Introduction to HOPEX Information Architecture

HOPEX Information Architecture is used to build the global architecture, from business data definition to database design. It ensures the traceability of data between three different levels: conceptual, logical and physical.

The Scope Covered by HOPEX IA

The **HOPEX Information Architecture** solution covers the three levels of data modeling for an organization:

- Business (conceptual) level: integration with is used to define the business function architecture concepts. These concepts can be implemented by objects at the logical level and be described by data models.
  See "HOPEX Information Architecture - Business Layer", page 5.
- Logical level: intended for clients seeking to develop general business-oriented models. Here it consists of modeling data of a domain, application or business process. It represents what we wish to do and where we want to go, irrespective of technical questions related to implementation. Data is represented in a data model or a class diagram.
  See: "HOPEX Information Architecture - Logical Layer".
- Physical level: consists of defining models intended to persist in a DBMS. It comprises detailed specifications for production of the physical diagram of the repository. It is represented by the relational diagram. The physical level also defines the way in which data is stored and how it can be accessed. It enables use of data by DBMSs.
  See "HOPEX Information Architecture - Physical Layer".

Modeling level	Details
Business function	Definition of the business vocabulary Realization of concepts
Logical	Modeling of logical data Realization of concepts by entities and classes
Physical	Modeling/generating of physical data Synchronization of logical and physical models

NEW IN VERSION HOPEX IA V2R1

Part Synchronization

The new modeling standard based on the concept of “Part”, which replace associations to connect classes, is taken into account in the synchronization tool.

See "Logical formalism and synchronization", page 3.

THE INFORMATION ARCHITECTURE DESKTOP

Connecting to HOPEX Information Architecture

To connect to **HOPEX Information Architecture**, see HOPEX Common Features, "HOPEX Web Front-End Desktop".

☛ *For more details on using the Web platform for HOPEX solutions, see the* ***HOPEX Common Features*** *guide.*

The menus and commands available in **HOPEX Information Architecture** depend on the profile with which you are connected.

See "HOPEX Information Architecture Profiles", page 6.

Displaying the Working Environment of an Enterprise

A repository can be partitioned into *Enterprises*.

An enterprise is a purposeful undertaking, an effort conducted by one or more organizations, aiming at delivering goods and services, in accordance with the enterprise mission in its changing environment. The enterprise establishes the enterprise goals to be achieved as well as the strategic action plans used to achieve these goals. It comprises transformation stages in which the capacities or deliverables to be reached are defined.

When associated with a working environment, enterprises are entry points into IA; the environment provides privileged access to the objects held and used by the enterprise in question.

Creating an enterprise and its working environment

The creation of an enterprise and its working environment is performed by the IA functional administrator.

To create an enterprise in **HOPEX Information Architecture**:

1. Click the navigation menu, then **Environment**.
2. In the navigation pane click **Standard Navigation**.
3. In the edit area click the **TEnterprises** tile.
4. Click **New**.
5. In the creation wizard that appears, enter the enterprise name.
6. To create the enterprise environment at the same time, select the "Information Architecture” environment.
7. Click **OK**.

If no environment was created at the same time as the enterprise, you can create it later.

To assign a working environment to an existing enterprise in **HOPEX Information Architecture**:

1. Select the project or the enterprise concerned to display its properties.

   ☛ *Click the Properties button of the edit area if properties are not displayed.*
2. Select the **Working Environment Assignment** page.
3. Click **New**.
4. Rename if needed the new environment and select the "Information Architecture" type.
5. Click **OK**.

   ☛ *You can also create the working environment if an enterprise during the enterprise creation.*

Displaying the working environment of an enterprise

To display the working environment of a project or an enterprise:

1. Click the **Main Menu** and select **Change Work Environment**.
2. Select the project or enterprise on which you want to work.

The IA desktop displays the objects specific to the selected project or enterprise. For each type of object, for example concepts in the **Information métier** pane, the edit area shows the objects held by the enterprise or project as well as the imported objects, that is, used but not owned by the enterprise or project.

By default, the various steps of the working environment are visible to all users. You can more precisely define the project or enterprise participants.

See also "Using Enterprises":.

HOPEX Information Architecture Profiles

In **HOPEX Information Architecture**, there are default user profiles with which specific rights and accesses are associated.

The Business information architect

The **Business Information Architect** is a representative of the enterprise business. He is responsible for structuring enterprise business information to facilitate its management and access. The business information architect is responsible for designing the enterprise vocabulary by modeling the information, their details and relationships as well as the different subject areas.

The **Business information architect** is responsible for execution of the following tasks:

- Identification of subject areas,
- Creation and definition of business information areas,
- Creation, definition and classification of concepts and concept types,
- terms creation,
- Creation of information architecture diagrams,
- Creation of concept views,
- Creation of reports facilitating information access

☛ *For more details on the activities of the Business Information Architect, see "Describing Business Information Architecture", page 35..*

Data architect

The **Data Architect** is an Information System player with read and write access to the logical data of the company. The Data Architect is responsible for modeling all the logical data (classes, associations, attributes, etc.) as well as the data areas used to exploit this information in process or application mapping.

Responsible for execution of the following tasks:

- Definition of logical data,
- Creation of realizations connecting logical data to business concepts.

Database architect

The **Database architect** is responsible for designing databases. For each version of the target DBMS version, the database architect uses the logical data and produces the physical view via synchronization tools.

Database administrator

The **Database Administrator** can connect to the desktop to consult the databases that are assigned to them and generate the corresponding SQL files.

The IA functional administrator

The **IA functional administration** is responsible for managing all the product's administrative tasks. The IA Functional Administrator has rights to all objects.

- It manages user creation and their profile assignments.
- Prepares the work environment and creates elements required for information management.
- Can intervene in:
  - subject areas,
  - business information areas,
  - concepts, concept types and concept views,
  - information architecture diagrams,
  - Reports,
  - all repository components.

Business Roles of HOPEX Information Architecture

In **HOPEX Information Architecture**, objects can be assigned to persons with the following roles:

- **Data Designer**: specifies the person responsible for the object design (such as a package, a data area, a database, etc.).
- **Data Scientist**: is responsible for bringing together the data designer (business and logical data) and the managers of the processes who use this data.
- **Database Administrator**: can be assigned to databases.

☛ *For more details on assignments, see "Managing assignments", page 31.*

HOPEX Information Architecture

User Guide

HOPEX V2

HOPEX Information Architecture - Business Layer

HOPEX Information Architecture offers a solution for managing and sharing the vocabulary specific to your enterprise. This application enables inventory, definition, classification and organization of business concepts to establish a pertinent link with technical objects implemented at information system level.

At the business level, **HOPEX Information Architecture** offers business users simple tooling to describe the concepts they handle and the links that manage their organization. To do this, **MEGA** is based on widely used semantic Web principles, as well as ontological frameworks such as IDEAS or standard ISO 15926 (high level, life cycle and event type).

At the IS architecture level, **HOPEX Information Architecture** offers features to establish correspondence between application data, based on UML formalism, and informations described at the business level.

The following points are covered in **HOPEX Information Architecture** - Business Layer:

- "Business IA: Objects Used", page 9
- "Describing Business Information Architecture", page 27
- "Business data reports", page 81

For more details on the interface and functions of **HOPEX** in general, see:

- "The HOPEX Web Front-End desktop", page 31

Vocabulary Management Process

The approach embedded in **HOPEX Information Architecture** starts from basic concepts up to concept classification (concept categories: contact types, vehicle types) passing through time concepts such as events and life cycles.

`For example: order issued, order paid, order delivered.`

This incremental approach allows enterprises to progressively build comprehensive glossaries adapted to the context of their organizations.

So that business users and IS users share a common vocabulary, **HOPEX Information Architecture** is based on two major functions:

- The analysis and organization of business concepts,
- The relationship setting of business concepts with information system architecture elements.

Analysis and organization of business concepts

This is carried out by a business user. It consists of describing all business concepts, using a simple semantic model based on notions of concept, event and state.

- A concept, representing a business object, is characterized by:
  - its scope, that is, its relationships with other concepts

    `For example, a work is characterized by its author, its title, its publication date, etc.`
  - its inheritance links with other concepts

    `For example, a subscription is a book or media subscription.`
  - its occurrences,

    `For example, Alexandre Dumas is an occurrence of Author.`
- A State Concept enables identification of an evolution in time of a concept,

  `For example, a work is available or on loan.`
- An Event represents a significant fact modifying the state of one or several concepts.

  `For example, publication of a work.`

HOPEX Information Architecture offers the standard "Business Data Architect" role to ensure business concept analysis and organization work.

Concept realization

Business concepts are generally implemented in the IS using the UML method and formalism.

"Concept realization" work therefore consists of connecting data model elements with business concepts in order to:

- define more precisely objects handled at IS architecture level,
- assure improved vocabulary sharing and improved global communication between business users and IS users.

HOPEX Information Architecture offers the standard "Data Architect" profile to ensure the "concept realization" work.

About This Guide

This guide describes how to make best use of **HOPEX Information Architecture** to assure efficient management of your business information.

Guide Structure

The **HOPEX Information Architecture - Business Layer** guide contains the following chapters:

- "Business IA: Objects Used", page 9, presents the objects of the **HOPEX** Suite that support **HOPEX Information Architecture** and the associated specific diagrams.
- "Describing Business Information Architecture", page 27, presents functionalities proposed by **HOPEX Information Architecture** to data managers to connect application data to business concepts;
- "Business data reports", page 81, presents reports proposed by **HOPEX Information Architecture** to improve organization of enterprise information and its communication.

Additional Resources

This guide is supplemented by:

- the **HOPEX Common Features** guide, which describes features specific to MEGA solutions.

  ☛ *It can be useful to consult this guide for a general presentation of the interface.*
- the **HOPEX Administration - Supervisor** administration guide.
- the **HOPEX Logical Data** guide describes the management of the logical data and the functionalities offered by **HOPEX Information Architecture** to data managers to connect application data to business concepts.

Conventions Used in the Guide

Styles and formatting

Remark on the preceding points.

Definition of terms used.

A tip that may simplify things.

Compatibility with previous versions.

Things you must not do.

Very important remark to avoid errors during an operation.

Commands are presented as seen here: **File > Open**.

Names of products and technical modules are presented in bold as seen here: **HOPEX**.

BUSINESS IA: OBJECTS USED

HOPEX Information Architecture enables definition, structuring and organization of the business vocabulary of your enterprise. Using a basic semantic model, this application offers you menus, commands and diagrams simplifying the construction of your information architecture.

This chapter introduces basic notions used by **HOPEX Information Architecture** .

CONCEPTS

With **HOPEX Information Architecture**, you can create a dictionary that describes and defines elements of your business vocabulary.

The basic component of a glossary is the **Concept**.

A concept expresses the essential nature of a being, an object, or a word through its properties and characteristics or its specific qualities.

The word that is associated with a **Concept** and which depends on language is a **Term**.

A term is a word or word group, that is used for a specific meaning in a specific context.

A term is therefore specific to a language and cannot be translated. On the other hand, it enables creation and viewing of the concept in the language chosen by the user.

Concept and Term

The same term in different languages can represent different concepts.

```
Example: the term "car" in English refers to a private car,
while the same term in French represents a collective
transport vehicle.
```

The terms are not translatable, therefore several **Term** objects can carry the same name in different languages.

In contrast, in the same language, the same term can represent several concepts and the meaning that is given to this term depends on its context of use.

```
For example, the word "ring" in English refers to a bell as
well as a ring.
```

As a consequence, for the same language, the same **Term** can be connected to several concepts. Each concept gives a specific definition of a term in its subject area.

A business information area is a sub-set of elements of a subject area that reduces the scope of a field.

As a consequence, with **HOPEX**, a concept carries the name of its associated term in the language chosen by the user. To modify the name of a concept in a given language, you must change the name of the associated term.

For more details, see "Using the Glossary in a Multilingual Context", page 23.

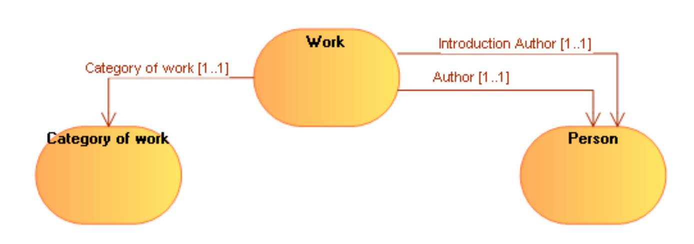
Links Between Concepts

To define semantics of a concept, you can draw several types of link between concepts: definition links or dependency links.

Definition links

Definition links enable characterization of a concept.

```
For example, a work is defined by its work category
(literary or musical), its author, the author of its
preface.
```



A definition link is described by a **Concept Structural Component**, which can be associated with a term.

A concept structural component enables representation of a dependency relationship between two concepts. This relationship is directional.

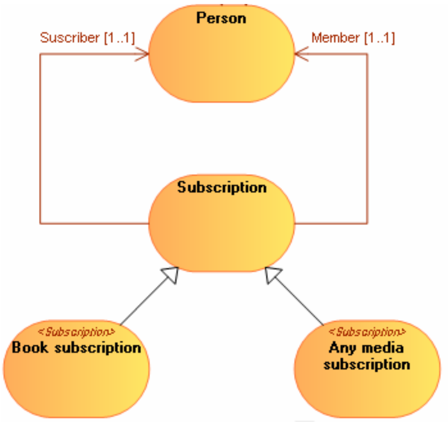
For more details, see "Describing Concept Structural Components", page 47.

Dependency links

Certain business concepts are versions of other concepts; they inherit the same structural components of concept.

```
For example, the "Subscription" concept is broken down into
"Book Subscription" and "Media Subscription". These two
```

subscription types inherit the links "Subscriber" and "Member" at the level of the "Subscription" concept.



This relationship is described by a **Variation**.

A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

☛ *For more details on variations, see the* ***HOPEX Common Features*** *guide, "Handling Repository Objects", "Object Variations".*

A **Variation** can also be created between two **Concept Structural Components**.

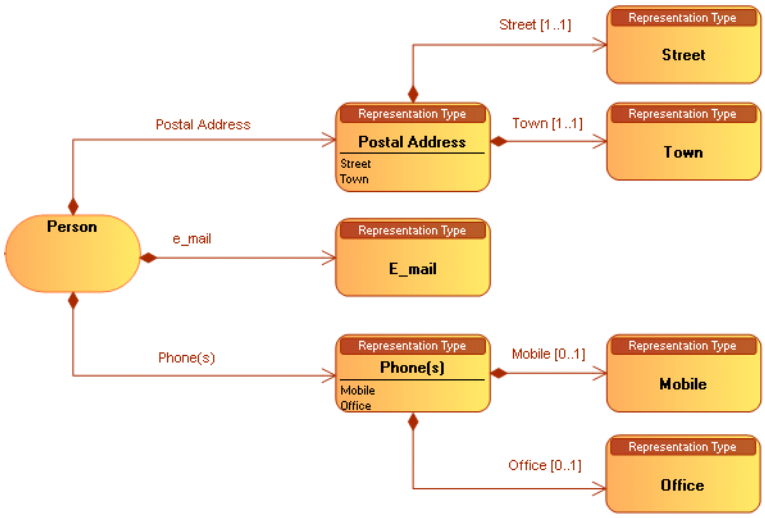
For example, the "Subscriber" is also a "Member".

☛ *For more details, see "Describing Concept Variations", page 50.*

Concept Properties: Representation types

To describe the characteristics associated with a concept, you can link a concept to representation types.

```
For example, a person is associated with a mandatory and
unique postal address, possibly an email address and one or
more telephone numbers.
```



The link between a concept and a representation type is described by a **Concept representation** that can, if necessary, be associated with a term.

A representation type component enables specification of the relationship between two representation types.

A concept representation is used to specify the relationship between a concept and a representation type.

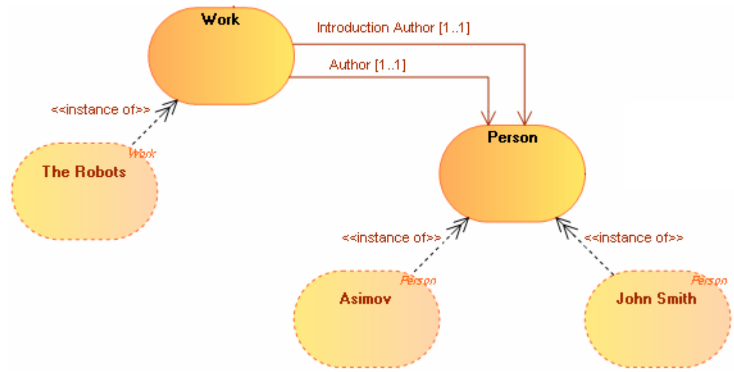
For more details, see "Using Representation Types", page 49.

Concept Instances: Individuals

To validate the semantic model created from concepts, **HOPEX Information Architecture** allows you to introduce concept instances, ie. real objects.

In this way you can create your semantic model using two approaches: either from real objects to deduce concepts, or from concepts to subsequently introduce real objects.

```
For example, "Asimov" is an instance of "Person" and "The
Robots" is an instance of "Work".
John Smith is also an instance of "Person", but in the
subscription holder category.
```



A concept occurrence is an **Individual**.

An individual represents the occurrence of a concept.

The relationship between a concept and its occurrences is described by an **Individual Classification**.

An individual classification is used to connect an individual to the concept that characterizes it.

You can also connect two individuals with a **Dictionary Entity Component** relationship type.

An entity component is used to connect an individual to a dictionary element.

```
It is then possible to specify that "Asimov" is the author
of the work "The Robots".
```

☛ *It is not possible to describe variations between individuals or between individuals' classifications.*

☛ *For more details, see "Describing individuals", page 55.*

The life cycle of a concept or Individual

To take account of evolution, in time and of business concepts, **HOPEX Information Architecture** has introduced two particular concepts:

- The **State Concept**, which enables identification of an evolution in time of a concept,

A state concept is a situation in a concept life cycle during which it satisfies certain conditions, executes a certain activity or waits for a concept event. A state concept represents a time interval of which limits *are two concept events. A state concept is a phase through which the concept passes during its life cycle.*

- The **Event Concept**, which represents a significant fact modifying the state of one or of several concepts.

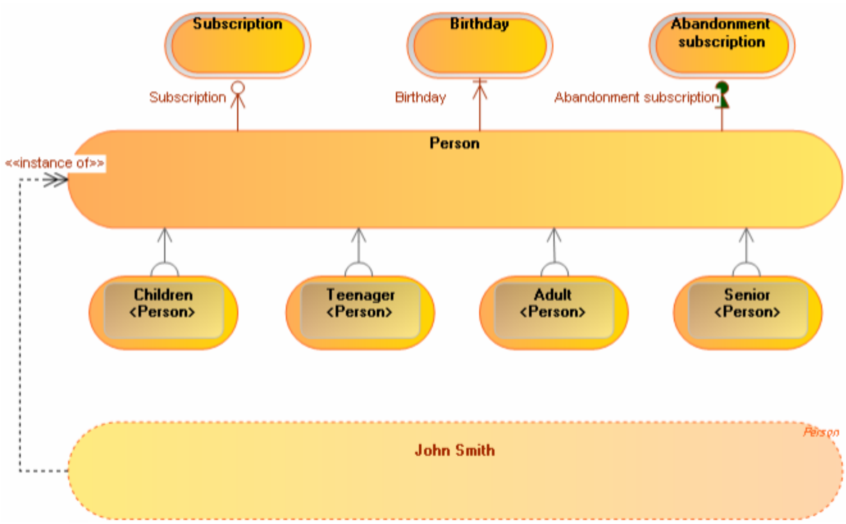
  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

State Concepts and **Event Concepts** can be described in the same way as any other concept.

Concept life cycle

The same business concept can take several states.

```
For example, the same subscription holder can pass from
"Child" state to "Adolescent" state, then to "Adult" state
and finally "Senior".
Passage from one state to another can be connected to a
event, a "Birthday" for example.
```



The relationship between a concept and its **State Concept** is described by a **Dictionary State Of**.

A dictionary state enables connection of a concept to a concept state, and specification of the state nature.

The relationship between a concept and its **Event Concept** is described by:

- a **Start Event**,
- an **End Event**,
- or an **Intermediate Event**.

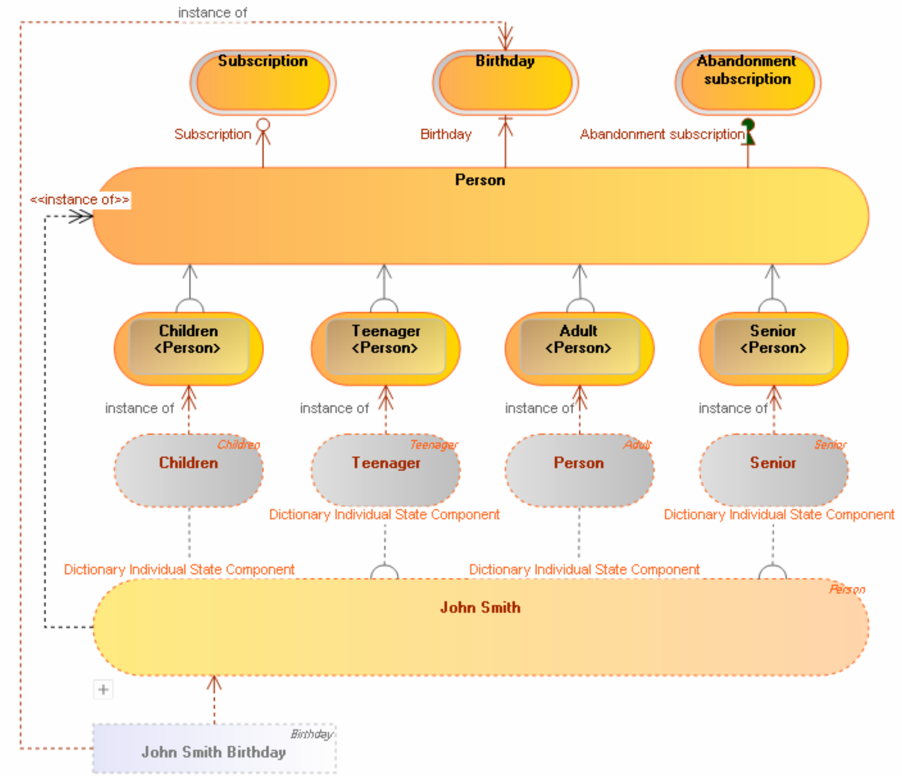
For more details, see "Describing Concept or Individual States", page 59.

Individual life cycle

☛ *For more details, see "Describing Individual States and Events", page 65.*

If a concept is associated with states and events, occurrences of this concept can also be associated with events and states.

```
For example, "John Smith" is a "Person" who can pass form
one state to another on his birthday.
```



To represent the individual state notion, **HOPEX Information Architecture** proposes the **Individual State**.

An individual state is an instance of a concept state to which the dictionary state is connected. It represents an individual state during its life cycle.

The relationship between an individual and its **Individual State** is described by an **Individual State Component**.

An individual state component is used to connect an individual to an individual state.

In addition, the switch from one individual state to another can be conditioned by an **Individual Event**.

An individual event represents an event occurring during the life of the individual. It is an instance of an event concept of the concept to which the individual is connected.

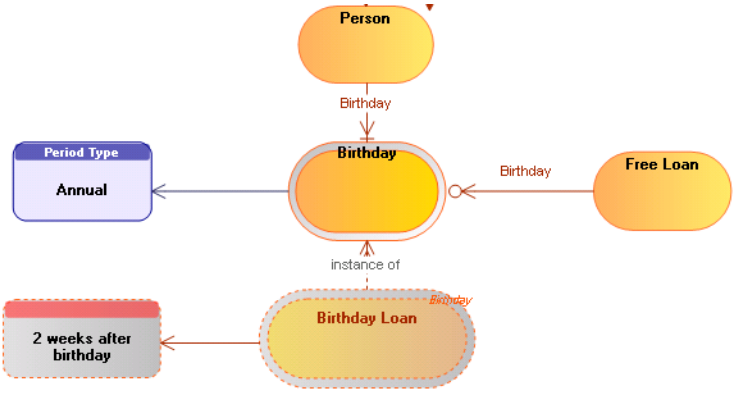
The relationship between an individual and its **Individual Event** is described by a **Entity Component**.

An entity component is used to connect an individual to a dictionary element.

Periods

Periods are used to add time-related information to events.

```
For example, a free loan may be offered to subscribers on
each anniversary. This annual loan is valid for a period of
two weeks.
```



A **Period type** is connected to an **Event concept**.

An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

The **Period** is connected to an **Individual event**.

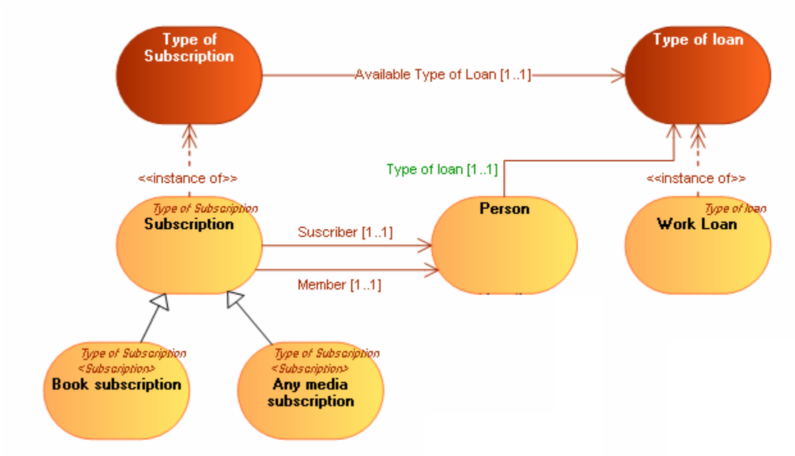
An individual event represents an event occurring during the life of the individual. It is an instance of an event concept of the concept to which the individual is connected.

☛ *For more details, see "Using periods", page 70.*

Classifying Concepts and the Concept Type Notion

A concept type enables classification of concepts. Relationships between concept types are represented by concept type components.

```
For example, "Subscriptions" can be classified by
"Subscription Type". A "Subscription Type" being
characterized by a "Loan Type".
```



HOPEX Information Architecture offers features to create the following relationships:

- the relationship between two **Concept Types** is described by a **Concept Type Component**.

  For example, a "Subscription Type" is characterized by an "Available Loan Type".

  A concept type component enables specification of the relationship between two concept types.

- The relationship between a **Concept Type** and a Concept Type is described by a **Concept Classification**.

  For example, all "Subscriptions" must correspond to a "Subscription Type".

  A concept classification enables connection of a concept to the concept that characterizes it.

- The relationship between a concept and a **Concept Type** is described by a **Concept Power Component**.

  For example, each member "Person" could be characterized by a "Loan Type".

  A concept power component enables connection of a concept to concept type to characterize a property of the concept.

The Concept View

To obtain a conceptualized preview of your business objects, **HOPEX Information Architecture** proposes the **Concept View** notion.

A concept view enables representation of the semantic scope covered by a business object. A concept view is based on the selection of several concepts specific to the view.

From a start concept linked to the business object you wish to describe, you browse the semantic links that define it. In this way you identify several concepts that define the described object in a particular context.

☛ *You can create different views for the same business object.*

☛ *For more details, see "Defining Concept Views", page 76.*

Dictionary Element Realization

To assure consistency between objects in your organizational and technical repository on the one hand, and elements in your dictionary on the other, **HOPEX Information Architecture**proposes the **Realization** notion.

A realization of concept connects a technical or organizational object of the repository to a dictionary element.

For more details on realizations, see the HOPEX IA - Logical Layer documentation.

For more details on generating the dictionary, see "Glossary Report", page 81.

Presentation of Concept Modeling Diagrams

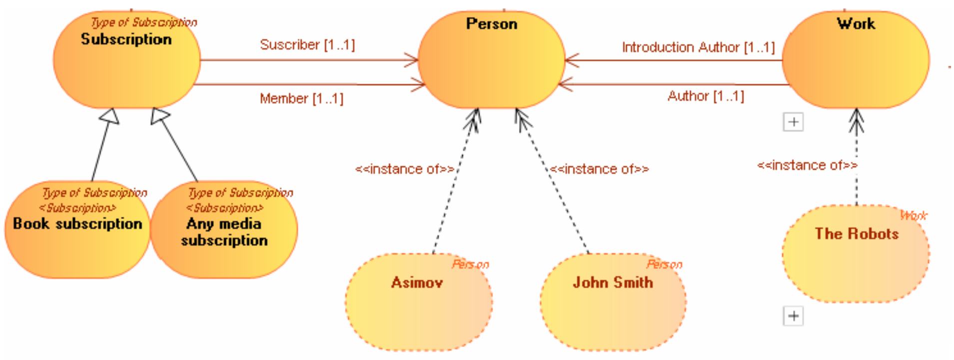
For business data definition, **HOPEX Information Architecture** provides different types of diagram.

Concept Diagram

A business information area provides a partial view of ontological models for the business information. It is described by a concept diagram presenting concepts, their components, super-types and links.

Link direction provides a natural mechanism of reading and deducing the scope defining the "business object".

```
The following business information area shows a partial
view of the "Media Library" subject area.
```

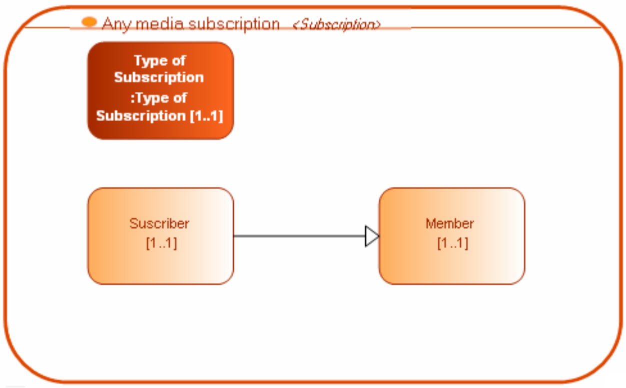


Example of a business information area with standard views

☛ *For more details, see "Building Concept Diagrams", page 32.*

Concept structure diagram

The content of business objects can be represented in a "Concept Structure Diagram", which can be initialized from concept graph elements.



Concept structure diagram example

☛ *For more details, see "Concept structure diagram", page 53.*

Concept type structure diagram

Concept types can be represented in a "Concept Type Structure Diagram", which can be initialized from concept graph elements.

☛ *For more details, see "The Concept Type Structure Diagram", page 75.*

State concept state structure diagram

State concept states can be represented in a "State Concept Structure Diagram", which can be initialized from concept graph elements.

☛ *For more details, see "State concept structure diagram", page 64.*

Individual structure diagram

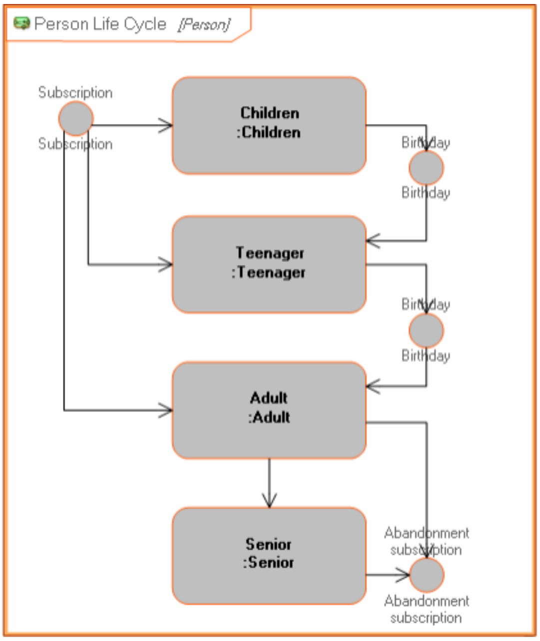
The individual structure diagram describes the internal structure of the concept instance and the links between all components. This diagram can be initialized from concept graph elements.

☛ *For more details, see "Individual structure diagram", page 57.*

The concept life cycle structure diagram

The concept life cycle structure diagram is used to describe the sequence of state concepts operating during the concept life cycle. Each state concept, which can be considered as point in time, is followed by other state concepts.

Passage from one state to another is modeled by a transition.



Example of a concept life cycle structure diagram

☛ *For more details, see "Concept life cycle structure diagram", page 67.*

GENERATING A GLOSSARY

HOPEX Information Architecture provides a ready-to-use glossary report to automatically build the business glossary of terms derived from a set of subject areas. For each term, the glossary displays a list of associated definitions with their text, synonyms and components list.

Launching a Glossary Report

See “Glossary Report”, page 81.

Using the Glossary in a Multilingual Context

For more details, see "Using HOPEX in a Multilanguage Context" in the HOPEX Common Features guide.

MANAGING ASSIGNMENTS OF BUSINESS DATA

During its creation, a **Subject area** or a **Business information area** is automatically assigned to a person. The other **HOPEX Information Architecture** object types can be assigned explicitly.

Assignable objects are:

- Subject areas
- Concepts
- Concept types
- State concepts
- Event concepts
- Concept life cycles
- Concept views
- Representation types

Accessing object assignments

To access information concerning the assignment of an object:

1. Click the navigation menu then **Business Information** to access the list of business objects.
2. In the edit area, click the object type, for example Concepts.
3. See the object concerned and in the **Action** column relating to it, click the **Properties** button.
4. In the Properties window, select the **Assignment** page.

☛ *Only assignable objects have an **Assignment** page.*

Automatic assignment of an object

During creation of a **Subject area** or **Business information area** object type, an assignment is automatically created. The object is assigned to the person who created it with the **Data designer** role.

☛ *The **Knowledge area** or **Business information area** object types appear in the **My knowledge areas** or **My business information areas** lists of the person who created them.*

If a **Concept**, **Concept Type** or **Concept View** is created using a **Knowledge area** or **Business information area** type object, the object created is assigned automatically to the person who created the **Knowledge area** or **Business information area**. The created object appears automatically in the **My concepts** (or **My concept types** or **My Concept Views**) lists of the person who created the **Knowledge area**, or **Business information area**.

Explicit assignment of an object

You can explicitly define the assignment of an object to an existing person.

To assign an object to a person:

1. Open the properties dialog box of the assignable object.
2. Select the **Assignments** page.
3. Click **New**.
   The **Create Assignment** dialog box opens.
4. Using the **Person or Person Group** field, click **Connect**.
   A **Connection** window opens.
5. Find and select the person that interests you and click **Connect**.
6. In the **Create an assignment** window, select the **Business role** of the person that you have just assigned.

   ☛ *For more details on the business roles used for assignments, see* *"Business Roles of HOPEX Information Architecture", page 8**.*
7. Click **OK**.
   A new assignment is added to the list of assignments associated with the object.

The **Concept**, **Concept Type** and **Concept View** type objects appear in the **My Concepts**, **My Concept Types** and **My Concept Views** lists of person to whom they were assigned.

DESCRIBING BUSINESS INFORMATION ARCHITECTURE

HOPEX Information Architecture is used to define the business information architecture of your enterprise using th procedure described in this chapter.

Defining Subject Areas

A business information area is a sub-set of elements of a subject area that reduces the scope of a field.

The subject area is the essential element in creating your information architecture.

Subject areas can be created with the **Business Information Architect** profile.

Subject Area Elements

HOPEX Information Architecture allows you to easily update your subject areas from already existing dictionary elements: *Term*, *Concept*, *State Concept*, *Event Concept* or *Concept View*.

> ☛ *The list of elements from a subject area is accessible from its properties dialog box in the **Characteristics**, **Scope** and **Scope instance** sections.*

A subject area is used to describe all the elements defining your information architecture:

- Concepts

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

  ☛ *For more details, see "Describing Concepts", page 41.*

- Concept variations

  A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

  ☛ *For more details, see "Describing Concept Structural Components", page 43.*

- Concept types

  A concept type enables classification of concepts. Relationships between concept types are represented by concept type components.

  ☛ *For more details, see "Describing Concept Types", page 67.*

- State concepts

  A state concept is a situation in a concept life cycle during which it satisfies certain conditions, executes a certain activity or waits for a concept event. A state concept represents a time interval of which limits are two concept events. A state concept is a phase through which the concept passes during its life cycle.

  ☛ *For more details, see "Describing Concept or Individual States", page 55.*

- Event concepts

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept *events can be distinguished as concept start events, end events and intermediate events.*

☛ *For more details, see "Describing Event Concepts", page 58.*

- Individuals

  An individual represents the occurrence of a concept.

  ☛ *For more details, see "Describing individuals", page 51.*

- Individual states

  An individual state is an instance of a concept state to which the dictionary state is connected. It represents an individual state during its life cycle.

  ☛ *For more details, see "Describing Concept or Individual States", page 55.*

A subject area can be completely or partially described by a concept diagram.

☛ *For more details on environment components, see "Defining a Business Information Area", page 32.*

Creating Subject Areas

To create a *subject area* with **HOPEX Web Front-End** :

1. Click the navigation menu then **Business Information**.
2. In the edit area, click **All Subject Areas**.
3. Click **New**.
   The **Create Subject Area** dialog box appears.
4. Enter the **Name** of your new subject area and click **OK**.
   The new subject area appears in the list.

☛ *To create a subject area with **HOPEX Windows Front-End**, in the **Information Architecture** desktop, click on the **IA Library** tab, then on the **Information Architecture** navigation pane and expand the **Subject areas** folder to obtain the list of existing subject areas in the repository.*

Accessing subject area concepts

To access subject area concepts in **HOPEX Web Front-End** :

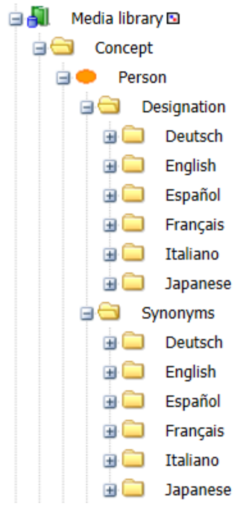
1. Click the navigation menu then **Business Information**.
2. In the **Business information** pane, click **Subject Areas** then **Architecture Information Hierarchy**.
   The list of existing subject areas in the repository appears.
3. Expand the folder that corresponds to the subject area that interests you.
4. Expand the **Concepts** folder.
   The list of subject area concepts appears.

☛ *Concepts carry the name of the term associated with the concept in the data language. For more details, see "Using the Glossary in a Multilingual Context", page 23.*

If you expand the folder associated with a concept, the terms and synonyms are accessible in all languages available in your environment **HOPEX**.

☛ *The number of languages proposed from folders depends on your **HOPEX** environment. To configure the list of languages, see the*

__HOPEX Power Supervisor__ guide, chapter "Managing Options", "Managing Languages", "Installing Additional Languages".



Accessing subject area terms

To access subject area terms:

1. Expand the folder that corresponds to the subject area that interests you.
2. Expand the **Terms** folder.
   All subject area terms appear without distinction of language.

Creating a Business Information Map

A business information map is a business information urbanization tool. It represents the business information areas of a subject area and their dependency links.

You can create a business information map from a project or an enterprise to target the scope studied.

To create the business information map for a subject area:

1. Click the navigation menu then **Business Information**.
2. In the navigation pane, select **Business Information Map**.
3. Display all the business information.
4. Click **New**.
5. In the window that opens, specify the name of the map and the owner subject area.
6. Click **OK**.

To create a business information map diagram:

1. Right-click on the business information map and select **New** > **Business Information Map**.
   The diagram appears in the edit area.

The components of a business information map

You can add internal and external components to a business information map.

Internal components are business information areas that are part of the scope of the business information map (whether or not they belong to the owner subject area).

External components are those used in the map but that are not part of the scope studied.

DEFINING A BUSINESS INFORMATION AREA

A business information area is a sub-set of elements of a subject area that reduces the scope of a field. A business information area is described in a concept diagram.

Business information areas can be created with the **Business Information Architect** profile.

Creating a business information area

To create a business information area in **HOPEX Information Architecture** :

1. Click the navigation menu then **Business Information**.
2. In the edit area, click **Business Information Area**.
3. Display all business information areas.
4. Click **New**.
   The creation window opens.
5. Enter the name of the business information area.
6. Find and connect the owner subject area.
7. Click **OK**.

Creating a Structure Diagram for a Business Information Area

A structure diagram defines the sub-areas of the business information area and their relationships.

To create the structure diagram of a business information area:

- Right-click on the business information area and select **New** > **Business Information Area Structure Diagram**.
  The structure diagram associated with the business information area opens in the edit window.

Building Concept Diagrams

A concept diagram is a graphical representation of the concepts used in the context of a business information area, as well as the links that exist between these concepts.

A business information area can be described by a number of concept diagrams.

A conceptual object belongs to a subject area from which it was created but can be used/referenced by a business information area of a different subject area.

See also "Defining a Business Information Area", page 32.

Creating a concept diagram of a business information area

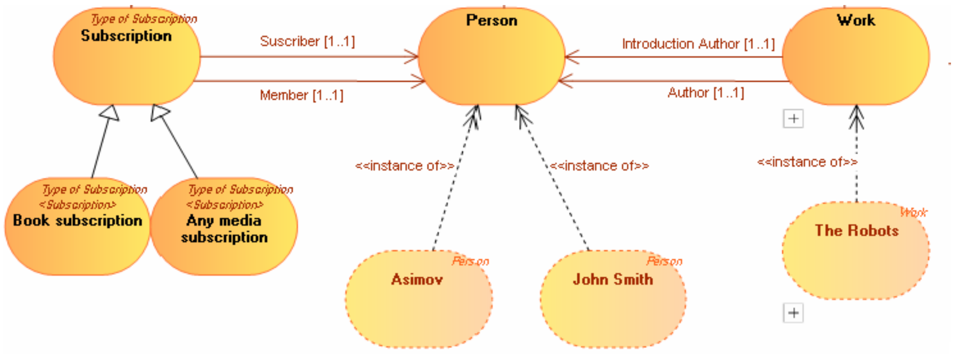
To create the concept diagram of a business information area:

- Right-click on the business information area and select **New** > **Concept Diagram of the Business Information Area**.
  The concept diagram opens in the Edit window.

The components of a concept diagram

A concept diagram describes the information architecture. By default, you see in the concept diagram concepts, variations and individuals only.

```
The following concept diagram partially describes the
"Media Library" subject area.
```



Concept graph diagram with standard views

Activating the views window

The **Views and Details** window presents an extended list of views (object types to be displayed).

To activate the **Views and Details** window:

1. In a diagram, click **Views and Details**.
   The list of views (object types to be displayed) appears.
2. Select or clear the views you wish to display or not.

The views available for a business information area are:

- Concepts,
- Concept types,
- State concepts,
- Event concepts,
- Individuals,
- Individual states,
- Individual events,
- Concept Views

A concept view enables representation of the semantic scope covered by a business object. A concept view is based on the selection of several concepts specific to the view.

For more details, see "Defining Concept Views", page 72.

Adding a concept diagram element

For example, to add an existing concept to a business information area:

1. In the concept diagram object toolbar, click **Concept**.
2. Click on the diagram.
   The add concept dialog box opens and asks you to select a concept.
3. Select the concept that interests you.
4. Click **Add**.
   The concept appears in the diagram.

For more details on concept creation, see "Describing Concepts", page 41.

Using the object insert toolbar

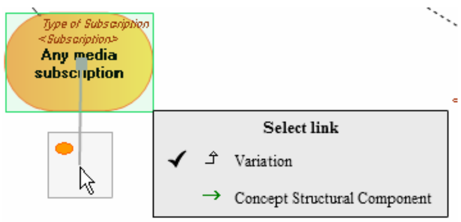
An insert toolbar available on each object simplifies object creation by proposing object selection help. It proposes only those objects that can be connected to the current object.

*This function is available in **HOPEX Web Front-End** only.*

To create, for example, a concept from a diagram concept:

1. Click on the concept of the diagram that interests you.
   The bar containing the objects you can insert at this stage appears.
2. Click the icon that represents the object you wish to create.

   For example: **Concept** .



The link selection dialog box appears.

3. In the link selection dialog box, select the desired link type.

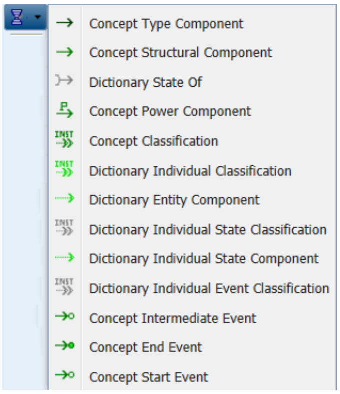
   For example: **Concept Structural Component**.

4. Click in the graph at the point where you wish to place the object.
   The object is created, with the link to the previous object.

Overview of links between objects

In each concept graph, relationships between concepts, concept types and concept individuals are represented by links.

The link direction provides a natural mechanism for reading and deducing the scope defining "the business object".



☛ *For more details on accessing the properties of concept graph links, see "Accessing link properties in a concept diagram", page 36.*

Link type	Definition and Comment
Concept type component	*A concept type component enables specification of the relationship between two concept types.*
Concept structural component	*A concept structural component enables representation of a dependency relationship between two concepts. This relationship is directional.*
Dictionary state of	*A dictionary state enables connection of a concept to a concept state, and specification of the state nature.* With "State concept" view.
Concept Power Component	*A concept power component enables connection of a concept to concept type to characterize a property of the concept.*
Concept classification	*A concept classification enables connection of a concept to the concept that characterizes it.*
Individual classification	*An individual classification is used to connect an individual to the concept that characterizes it.*

Link type	Definition and Comment
Dictionary entity component	*An entity component is used to connect an individual to a dictionary element.*
Individual state classification	*An individual state classification enables connection of an individual state to the state concept that characterizes it.* This link is available with "Individual State" view.
Individual state component	*An individual state component is used to connect an individual to an individual state.* This link is available with "Individual State" view.
Individual event classification	*An individual event classification is used to connect an individual to the event concept that characterizes it.* This link is available with "Individual State" view.
Concept intermediate event	*An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.* These links are available with "Event Concept" view.
Concept end event	
Concept start event	

Accessing link properties in a concept diagram

In a concept diagram, links are directional and access the properties of both the link and the link target object.

☛ *For more details on the list of links available in a business information area, see "Overview of links between objects", page 35.*

The pop-up menu of a **Concept Structural Component** link type for example presents:

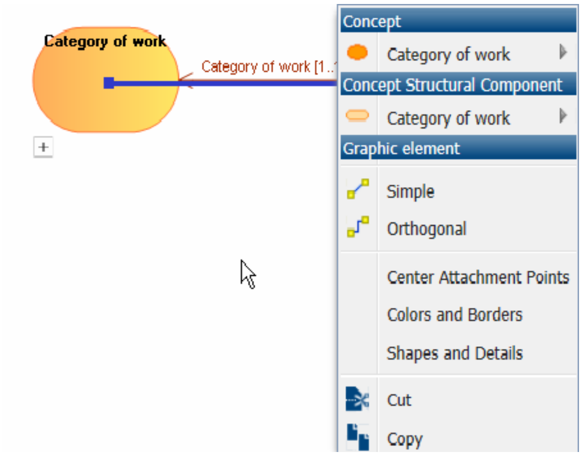
- commands specific to the object type used by the component

  `for example` **`Concept`**

- commands relating to the component itself

  `for example` **`Concept Structural Component`**

- commands relating to the graphics.



To access properties of a link of "component" type:

  `for example` **`Concept Structural Component`**

1. Right-click the link to open its pop-up menu.
2. Select the link and click **Properties**.
   The link properties dialog box opens.

In the **Characteristics** tab of link properties, provides several information.

- The **Local Name** of the link, which corresponds by default to the target dictionary element or term associated with the link.

  ☛ *For more details on association of a term with a link, see "Describing Concept Structural Components", page 43.*

- The **Composed Concept** targeted by the link.
- The **Owner** who is the dictionary element at the origin of the link.
- The **Minimum Multiplicity** is the number of origin elements that can access the same target elements.

  `For example, how many "Works" can belong to the same "Work Category".`

- The **Maximum Multiplicity** is the number of target elements that can be connected to the same origin elements.

  `For example, a "Work" can only belong to only one "Work Category".`

- The **Dictionary Abstract Type** check box, which enables specification of the concept or abstract character of a concept
- **Dictionary Scope Property** which can be one of the following:
  - "Referencing”: to indicate that the target concept is referenced by a link,
  - "Embedded": to indicate that the target concept exists in its own right, but is included in the concept that is the source of the link,
  - "Composite": to indicate that the target concept is a component of the concept that is the source of the link; if the target concept is destroyed, the composite is also destroyed.
- The **Designation** of the link and the **Definition Text** field enable association of a term and a definition to the link.

  ☛ *For more details on association of a term with a link, see "Describing Concept Structural Components", page 43.*

- **Super-types** that are used to access the properties of a linked inherited from a concept type.

  ☛ *For more details, see "Describing Concept Types", page 67.*

- The **Realization**, which is used to associate this dictionary element with others application architecture elements.

  ☛ *For more information, see **HOPEX Logical Data**.*

- **Synonyms**, which are used to specify a list of synonyms.

  ☛ *For more details, see "Describing Concept Structural Components", page 43 and "Concept and Term", page 10.*

For more details on defining concepts, see "Describing Concepts", page 41.

Managing the components of a business information area

HOPEX Information Architecture allows you to update your *Business subject areas* dictionary elements that already exist: *Term*, *Concept*, *State Concept*, *Event Concept* or *Concept View*.

The components of a business information area

The list of elements from a business information area that belong to the information area is accessible from the area properties window in the **Components** page.

Creating a business information area component

To specify that an existing concept is a business information area component:

1. Open the properties dialog box of the business information area.
2. Select the **Components** page.
3. Click **New**.
   The business information creation wizard appears.
4. Opposite the **Saved business information** field, click **Connect**.
   A connection window opens.
5. Select the concept that interests you and click **Connect**.
6. In the business information creation window, click **OK**.
   The concept is added to the list of business information area components.

Connecting or Deleting a component from a concept diagram (HOPEX Web Front-End)

To connect a dictionary element to a list of components for a business information area:

1. Open the concept diagram associated with the business information area.
2. Add the dictionary element that interests you in the diagram.
3. Right-click on this element to open its pop-up menu.
4. Select **Add to "Current business information area name"**.
   The element is added to the list of business information area elements, in the **Component** page of the area properties window. The shape changes in the diagram.

To delete a dictionary element from a business information area:

1. Right-click the dictionary element concerned to open its pop-up menu.
2. Select **Delete from "Current business information area name"**.
   The element is deleted from the list of business information area elements.

Define the CRUD for the components of a business information area

You can specify the access rights to each of the component types of a business information area. To do this, select or deselect the check boxes of each column associated with the actions: Create, Read, Update, Delete.

The content of the **Data access** column is calculated automatically according to the selected actions. This result appears in object form in the concept diagram associated with the business information area.

☛ *For more information on the components of a business information area, see "The components of a business information area", page 39.*

Describing Concepts

A concept expresses the essential nature of a being, an object, or a word through its properties and characteristics or its specific qualities.

A concept is the basic dictionary element offered by **HOPEX Information Architecture**.

Accessing the Concepts List

In Web Front-End

To access all concepts of your repository:

1. Click the navigation menu then **Business Information**.
2. In the **Business Information** pane, click **Concepts > Architecture Information**.
   The list of concepts appears.

   ☛ *For more details on use of the repository concepts list, see* *"Defining Subject Areas", page 28*.

In Windows Front-End

To access all concepts of your repository:

3. Select **IA Library > Dictionary Elements > Subject Area Management**.
   The list of dictionary elements appears in the left pane of the edit area and the subject areas tree appears in the right pane of the edit area.
4. In the left pane of the edit area, select the **Concept** tab.

Creating Concepts

To create a *concept* from a subject area:

1. In the **Business information** pane, click **Subject Areas > Architecture Information Hierarchy**.
   The tree for existing subject areas in the repository appears.
2. Right-click the subject area that interests you and select **New > Concept**.
   The concept type creation wizard opens.
3. Specify the **Local Name** and click **OK**.

4. In the **Term** section, the **Existing Terms** section lists terms with the same name as the new concept.

   A term is a word or word group, that is used for a specific meaning in a specific context.

   *If a term has already been created with the same name as the new concept, this term is automatically connected and appears automatically in the **Term** section.*

5. In the **Definition Text** field, enter the text of the concept definition and click **Finish**.
   The name of the new concept appears in the tree under the subject area.

   A new term with the same name as the concept is also created.

Concept Properties

Concept characteristics

The **Characteristics** tab of the concept properties window provides access to the main characteristics of the concept.

A concept is described by:

- the **Abstract Concept** check box, which enables specification of the concrete or abstract character of a concept,
- its **Designation**, which is represented by one or several terms,

  To modify the name of a concept in the corresponding language, you must access concept properties and modify the name of the term in the specific language. For more details, see *"Concept and Term", page 10.*

- the **Definition Text**,
- The **Synonyms** section enables specification of a list of synonym concepts,

  ```
  For example, in the Financial area, the term "Advance" is
  recognized as a synonym of "Down payment".
  ```

  A synonym is a term interchangeable with another term in the context of a concept of this term that has the same or almost the same meaning.

- The **Super-Type** section enables access to all concept types that classify the current concept,

  For more details, see "Describing Concept Types", page 67.

- The **Realization** section enables association of an application architecture element to the concept,

  *For more information, see **HOPEX Logical Data**.*

Links between a concept and other dictionary elements

In addition to terminology characteristics, a concept is characterized by its relationships with other dictionary elements.

- The **Variation** tab presents concepts whose properties are inherited by the described concept, for more details see "Describing Concept Variations", page 46
- The **Components** tab presents:
  - the list of concept structural components owned, for more details see "Describing Concept Structural Components", page 43.
  - the list of concept power components, for more details see "Describing Concept Power Components", page 44.

> ☛ *State concepts connected to a concept are not present in the properties dialog box, for more details see "Describing Concept or Individual States", page 55.*

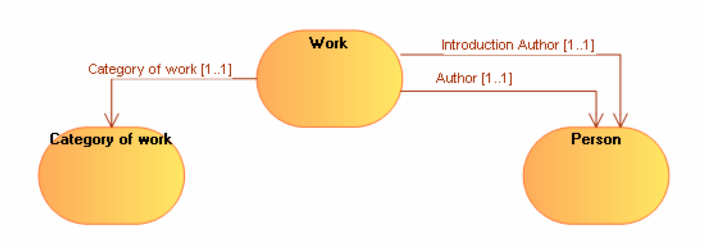
Describing Concept Structural Components

With **HOPEX Information Architecture**, a concept can be connected to another concept to characterize it.

```
For example, the "Work" concept is connected to the "Person"
concept to characterize the "Author" of a work.
```

This relationship is described by a **Concept Structural Component**, which can be associated with a term.

> *A concept structural component enables representation of a dependency relationship between two concepts. This relationship is directional.*



Accessing concept structural components

To access concept structural components:

1. Open the properties of a concept.
2. Select the **Components** tab.
3. Expand the **Structural Components** section.
   The list of structural components held appears.

> ☛ *You can also consult the list of structural components of a concept from its concept structure diagram. For more details, see "Concept structure diagram", page 49.*

Creating a concept structural component from a graph

```
The procedure for creating the "Author" concept structural
component between concepts "Work" and "Person" is described
as an example.
```

To create a concept structural component between two concepts of a business information area:

1. In the concept graph associated with the business information area, click on the concept that holds the link.

   ☛ *If you are in **HOPEX Windows Front-End**, roll the mouse over the concept that own the link and click [+].*

2. Select **Concept Structural Component**.
3. Click the target concept.
   The concept structural component creation wizard appears.
4. Specify the **Local Name**, for example "Author".
5. Given that the term "Author" must be created, select the "Creation with term" check box.
   In the section **Term** appears in the creation creation dialog box.

   A term is a word or word group, that is used for a specific meaning in a specific context.

6. In the **Definition Text** field, enter the text of the Concept Structural Component definition and click **OK**.
   The concept structural component appears in the graph.

   ☛ *A new term with the same name as the concept structural component is also created.*

You can also create a concept structural component in a concept structure diagram. In this case, you must specify the target concept in the concept structural component creation wizard

☛ *For more details, see "Concept structure diagram", page 49.*

Describing Concept Power Components

Just as a **Concept** can be characterized by a link to another concept, a concept can also be characterized by a link to a **Concept Type**.

A concept type enables classification of concepts. Relationships between concept types are represented by concept type components.

```
For example, each member "Person" could be characterized by
a "Loan Type".
```

☛ *For more details, see "Describing Concept Types", page 67.*

The relationship between a **Concept** and a **Concept Type** is described by a **Concept Power Component**.

A concept power component enables connection of a concept to concept type to characterize a property of the concept.

To create a **Concept Power Component** between a concept and a concept type in a business information area diagram:

1. In the insert toolbar, click the **Link** button.

2. Click the concept that owns the link.

   `For example, "Person"`

3. Click the target concept type.

   `For example, "Loan Type".`

   The Concept Power Component creation wizard opens.

4. Specify the **Local Name**.
5. If no term is to be created, select the "Creation without term" check box.
6. Click **OK**.
   The Concept Power Component appears in the diagram.

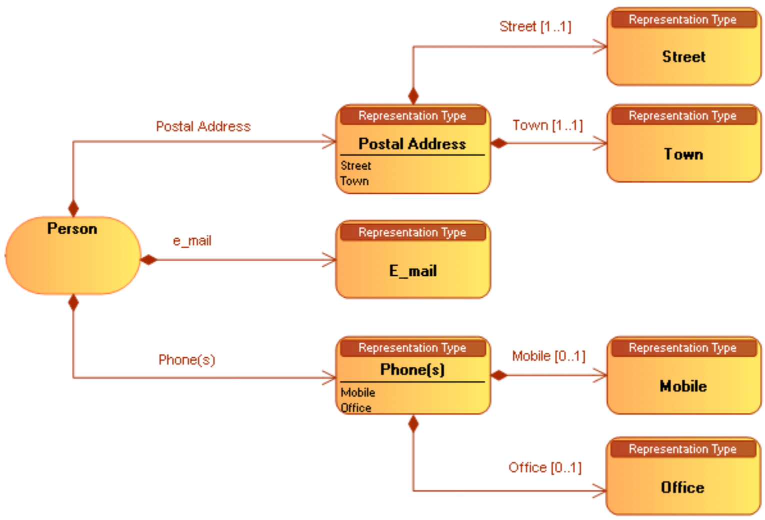
Using Representation Types

To describe the concrete elements attached to a concept, with **HOPEX Information Architecture** you can link a concept to **representation types**.

For example, a person is associated with a mandatory and unique postal address, possibly an email address and one or more telephone numbers.

A **representation type** can itself be connected to other representations types.

For example, the postal address is defined using the name of the street and the town.



Connecting a representation type to a concept

In **HOPEX Information Architecture**, the link between a concept and a representation type is described by a **Concept representation** that can, if necessary, be associated with a term.

A concept representation is used to specify the relationship between a concept and a representation type.

Connecting two representation types

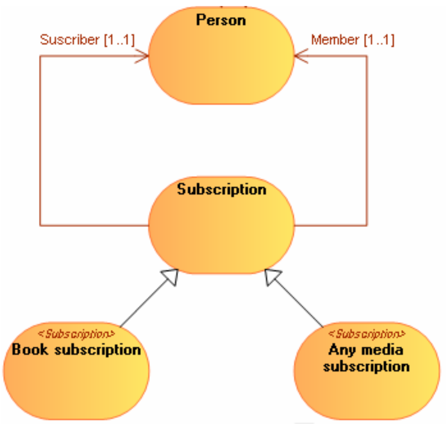
In **HOPEX Information Architecture**, the link between a concept and a representation type is described by a **representation type component** that can, if necessary, be associated with a term.

A representation type component enables specification of the relationship between two representation types.

Describing Concept Variations

Certain business concepts are versions of other concepts; they are characterized by the same concepts.

```
For example, "Subscription" concepts are broken down into
"Book Subscription" and "Media Subscription". These two
subscription types inherit the links "Subscriber" and
"Member" at the level of the "Subscription" concept.
```



This relationship is described by a **Variation**.

A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

☛ *For more details on variations and substitutions, see the **HOPEX Common Features** guide, "Handling Repository Objects", "Object Variations".*

Accessing concept variations

To access concept variations

1. Open the properties of a concept.
2. Select the **Variation** tab.
   The list of variations associated with the concept appears.

Creating a concept variation from a concept diagram

You can specify that a concept inherits characteristics defined for another concept.

```
For example, the "Book Subscription" concept inherits from
the "Subscription" concept.
```

To specify, based on a business information area, that a concept is a variation of another concept:

1. In the insert toolbar, click the **Link** button.
2. Click the object to be varied and drag the pointer to the new concept before releasing the mouse button.
3. Specify the **Name** and click **Add**.
   A directional link from the concept to be varied to the root concept appears.

   ☛ *The variation is represented by a link, but it is in fact a **HOPEX** object.*

   The variation creation wizard opens.

Creating a concept structural component variation

A **Variation** can also be created between two **Concept Structural Components**.

```
For example, the "Subscriber" is also a "Member".
```

To define a variation between two concept structural components, they should be connected to the same concepts, either directly or via variations.

To create a variation between two concept structural components:

1. Open the properties of the concept structural component to be varied.
2. Select the **Variation** tab.
3. Click the **New** button.
   The variation creation wizard opens.
4. Select the options:
   - "Initialization of attributes"
   - "Initialization of diagrams" so that the variation appears in diagrams.
5. Click **OK**.
   The variation is created.

   ☛ *A variation between **Concept Structural Components** is represented graphically in a concept structure diagram. For more details, see* *"Concept structure diagram", page 49**.*

Creating a concept structural component substitution

If, unlike a variation, a link is another definition of another link, you must create a **substitution**.

📖 *A substitution determines which element can be used to replace another, or is effectively replaced by an element existing in a given context (for example in the context of a variation). Unlike a variation, a substitution does not involve inheritance but a functional equivalence.*

☛ *For more details on variations and substitutions, see the **HOPEX Common Features** guide, "Handling Repository Objects", "Object Variations".*

To define a substitution between two concept structural components, they should be connected to the same concepts, either directly or via variations.

To create a substitution between two concept structural components from a concept structure diagram:

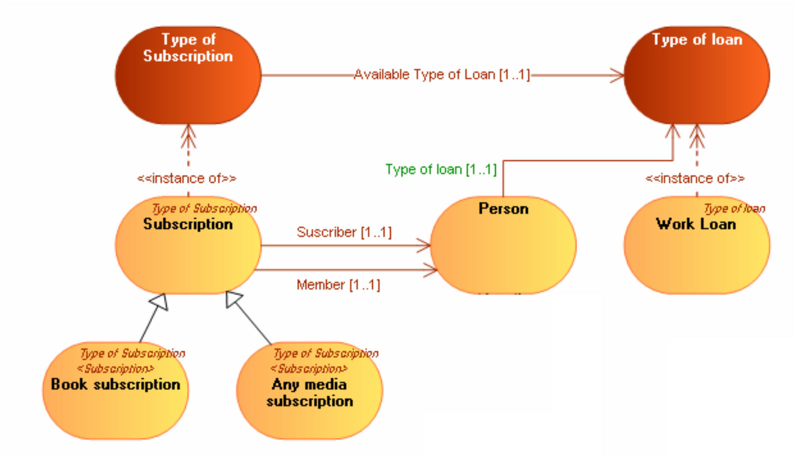
1. In the insert toolbar, click the **Substitution** button.
2. Click the structural components to be substituted and drag the pointer to the substituting structural components before releasing the mouse button.
3. Specify the **Name** and click **Add**.
   A dotted line directional link from the structural link to be substituted to the substituting structural component appears.

   ☛ *The substitution is represented by a link, but it is in fact a **HOPEX** object.*

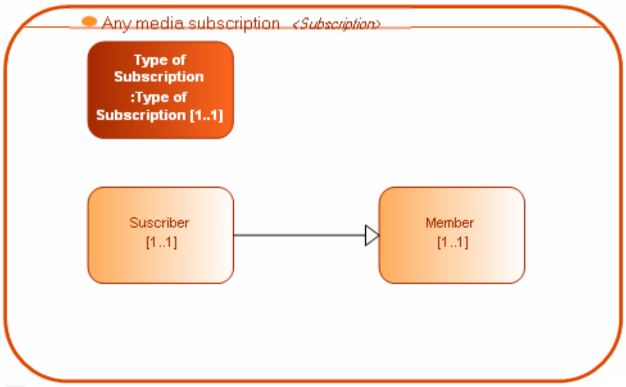
Concept structure diagram

In **HOPEX Information Architecture**, a concept structure diagram assembles all information relating to the concept. This diagram is initialized from concept graph elements.

For example, "Subscriptions" can be classified by "Subscription Type".



A "Subscription Type" is characterized by a "Loan Type".



The diagram includes:

- *variations* between components

  ```
  For example, "Subscriptions" can be classified by
  "Subscription Type". A "Subscription Type" being
  characterized by a "Loan Type".
  ```

  A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

  For more details, see "Creating a concept structural component variation", page 47.

- *Substitutions* between components

  A substitution determines which element can be used to replace another, or is effectively replaced by an element existing in a given context (for example in the context of a variation). Unlike a variation, a substitution does not involve inheritance but a functional equivalence.

  For more details, see "Creating a concept structural component substitution", page 47.

- *Concept structural components* describing the relationship between two **Concepts**

  ```
  For example, a "Subscription Type" is characterized by an
  "Available Loan Type".
  ```

  A concept structural component enables representation of a dependency relationship between two concepts. This relationship is directional.

  For more details, see "Describing Concept Structural Components", page 43.

- *Concept power components* enabling concept characterization from **Concept Types**

  ```
  For example, each member "Person" could be characterized by
  a "Loan Type".
  ```

  A concept power component enables connection of a concept to concept type to characterize a property of the concept.

  For more details, see "Describing Concept Type Variations", page 70.

- *start events*, *intermediate events* and *end events* enabling definition of events contributing to change of state of a concept,

  ```
  For example, the change of state of a member can be caused
  by a birthday.
  ```

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

  For more details, see "Describing State Concepts", page 55.

DESCRIBING INDIVIDUALS

HOPEX Information Architecture distinguishes a concept from the occurrences that characterize it.

An individual represents the occurrence of a concept.

The features used to manage individuals are described here:

Accessing the List of Individuals

To access all the individuals of your repository with **HOPEX Web Front-End** :

1. In the **Business information** pane, click **Subject Areas > Architecture Information Hierarchy**.
   The subject area tree appears.
   *To access individuals from a subject area with **HOPEX Windows Front-End**, in the **Information Architecture** desktop, select the **IA Library** tab, then the **Information Architecture** navigation pane.*
2. Expand the **Subject Areas** folder.
3. Expand the folder that corresponds to the subject area that interests you.
4. Expand the **Individuals** folder.
   The list of individuals appears.

Creating an Individual from a Subject Area

To create an individual from a subject area:

1. Right-click the subject area that interests you and select **New > Individual**.
   The individual creation wizard opens.
2. Specify the **Local Name** and click **OK**.
3. In the **Individual Classification** section, you can click **New** to specify the concept to which the dictionary individual is connected.
   For more details, see "Creating an Individual Classification", page 52.
4. Click **OK**.
   The name of the new individual appears in the tree under the subject area.

Individual Properties

The individual properties dialog box presents the following elements in the **Characteristics** tab:

- Its **Local Name**
- The individual classifications, which appear in the **Classification** section.

An individual classification is used to connect an individual to the concept that characterizes it.

☛ *For more details, see "Creating an Individual Classification", page 52.*

The other tabs in the dictionary individual properties dialog box are:

- The **Individual State** section, enabling presentation of the different states of an individual.

☛ *For more details, see "Describing Individual States and Events", page 61.*

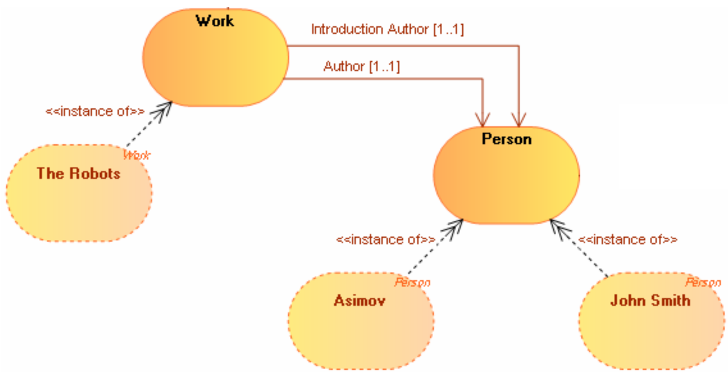
- The **Component** tab, presenting individuals connected to a described individual.

☛ *For more details, see "Creating a Dictionary Entity Component", page 53.*

Creating an Individual Classification

An individual classification is used to connect an individual to the concept that characterizes it.

```
For example, the individual "Asimov" is an instance of
"Person" and "The Robots" is an instance of "Work".
```



To create an individual classification:

1. Open the properties window of the individual carrying the relationship.

   ```
   For example, the "Asimov" individual.
   ```

2. Select the **Characteristics** tab.

3. In the **Classification** section, click the **New** button.
The individual classification creation wizard opens.
4. At the left of the **Characterizing Element** field, click the **Connect** button.
The query wizard opens.
5. Select the concept you want to connect.

    `For example, the "Person" concept.`
6. Click **OK**.
The individual classification into individuals is created.

Creating a Dictionary Entity Component

An entity component is used to connect an individual to a dictionary element.

HOPEX Information Architecture also enables connection of two individuals into individuals with a **Dictionary Entity Component** relationship type.

`For example, you can specify that "Asimov" is the author of the work "The Robots".`

To create a dictionary entity component between two individuals:

1. Open the properties window of the individual carrying the relationship.

    `For example, the "Asimov" individual.`
2. Select the **Components** tab.
3. Click the **New** button.
The dictionary entity component creation wizard opens.
4. At the left of the **Characterizing Element** field, click the **Connect** button.
The query wizard opens.
5. Select the individual you want to connect.

    `For example, the "The Robots" individual.`
6. Click **OK**.
The entity component is created. It appears in the individual structure diagram of the described object.

    ☛ *For more details, see "Individual structure diagram", page 53.*

Individual structure diagram

With **HOPEX Information Architecture**, the individual structure diagram describes the internal structure of the concept instance and the links between its components. This diagram is initialized from concept graph elements.

This diagram is composed of *dictionary entity components* used to connect two individuals.

```
It is then possible to specify that "Asimov" is the author
of the work "The Robots".
```

An entity component is used to connect an individual to a dictionary element.

☛ *For more details, see "Creating a Dictionary Entity Component", page 53.*

DESCRIBING CONCEPT OR INDIVIDUAL STATES

A business object can have a life cycle during which it takes different states according to events. If a concept is connected to a business object, other concepts can be connected to different states of the business object and to events at the causing changes of state. With **HOPEX Information Architecture**, it is possible to associate a life cycle with a concept, as well as state concepts and event concepts.

Individuals can also be connected to individual states and individual events that are instances of state concepts and event concepts.

The features offered by **HOPEX Information Architecture** to describe the evolution in time of a concept and individuals are described here:

Describing State Concepts

To represent the notion of a concept, **HOPEX Information Architecture** proposes the **State Concept**.

A state concept is a situation in a concept life cycle during which it satisfies certain conditions, executes a certain activity or waits for a concept event. A state concept represents a time interval of which limits are two concept events. A state concept is a phase through which the concept passes during its life cycle.

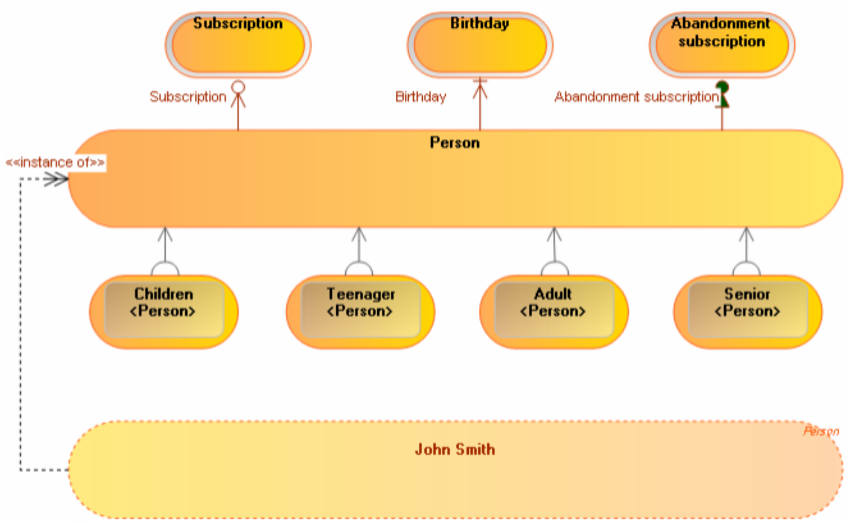
```
For example, the same subscription holder can pass from
"Child" state to "Adolescent" state, then to "Adult" state
and finally "Senior".
```

Passage from one state concept to another can be conditioned by an **Event Concept**.

An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept *events can be distinguished as concept start events, end events and intermediate events.*

```
For example, passage from one state to another can be
connected to a event, a "Birthday" for example.
```

☛ *For more details, see "Describing Event Concepts", page 58.*



Accessing the state concepts list

To access subject area state concepts:

1. In the **Information Architecture** pane, click **Subject Areas > Business Information Hierarchy**.
2. Expand the **Subject Areas** folder then the folder of the subject area that interests you.
3. Expand the **State Concepts** folder.
   The list of subject area state concepts appears.

Creating a state concept from a subject area

At creation of a state concept, **HOPEX Information Architecture** also creates a **Dictionary State of**, which represents the relationship between a state concept and its concept.

A dictionary state enables connection of a concept to a concept state, and specification of the state nature.

To create a state concept from a subject area:

1. Right-click the subject area that interests you and select **New > State Concept**.
   The event concept creation wizard opens.
2. Specify the **Local Name** and click **OK**.

3. In the **State Individual Type** field, specify to which concept the state concept you are creating is connected.

   ☛ *A* ***Dictionary State Of*** *is automatically created between the concept and the state concept.*

4. In the **Term** section, the **Existing Terms** section lists terms with the same name as the new state concept.

   A term is a word or word group, that is used for a specific meaning in a specific context.

   ☛ *If a term has already been created with the same name as the new state concept, this term is automatically connected and appears automatically in the* ***Term*** *section.*

5. In the **Definition Text** field, enter the text of the state concept definition and click **OK**.
   The name of the new state concept appears in the tree under the subject area.

   ☛ *You can also create a state concept in a business information area.*

State concept properties

State concept characteristics

The **Characteristics** tab of state concept properties enables access to its main characteristics.

With **HOPEX Information Architecture**, the state concept is described by:

- its **Designation**, which is represented by one or several terms,

  ☛ *To modify the name of a concept in the corresponding language, you must access concept properties and modify the name of the term in the specific language. For more details, see* *"Concept and Term", page 10**.*

- the **Definition Text**,
- The **Synonyms** section enables specification of a list of synonym concepts,

  A synonym is a term interchangeable with another term in the context of a concept of this term that has the same or almost the same meaning.

  ☛ *For more details, see* *"Concept and Term", page 10**.*

- The **Realization** section enables association of an application architecture element to the concept.

  ☛ *For more information, see* ***HOPEX Logical Data****.*

Links between a state concept and other dictionary elements

In addition to terminology characteristics, a state concept is characterized by its relationships with other dictionary elements.

- The **Super-Type** tab presents concepts whose properties are inherited by the described concept, for more details see "Describing Concept

Variations", page 46

- The **Components** tab presents:
  - the list of concept structural components owned, for more details see "Describing Concept Structural Components", page 43.
  - the list of concept power components, for more details see "Describing Concept Power Components", page 44.

☛ *Concepts connected to a state concept are not present in the properties dialog box.*

Describing Event Concepts

An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

Accessing the event concepts list

To access subject area event concepts:

1. In the **Information Architecture** pane, click **Subject Areas > Business Information Hierarchy**.
2. Expand the **Subject Areas** folder then the folder of the subject area that interests you.
3. Expand the **Event Concepts** folder.
   The list of subject area event concepts appears.

☛ *By expanding the folder of a concept, you can access event concepts attached to it.*

Creating an event concept from a subject area

To create an event concept from a subject area:

1. Right-click the subject area that interests you and select **New > Event Concept**.
   The event concept creation wizard appears.
2. Specify the **Local Name** and click **OK**.
3. In the **Term** section, the **Existing Terms** section lists terms with the same name as the new state concept.

   A term is a word or word group, that is used for a specific meaning in a specific context.

   ☛ *If a term has already been created with the same name as the new event concept, this term is automatically connected and appears in the* ***Term*** *section.*
4. In the **Definition Text** field, enter the text of the event concept definition and click **OK**.
   The name of the event concept appears in the tree under the subject area.

☛ *You can also create an event concept in a business information area.*

Event concept properties

The **Characteristics** tab of event concept properties enables access to its main characteristics.

With **HOPEX Information Architecture**, the event concept is described by:

- its **Designation**, which is represented by one or several terms,

  ☛ *To modify the name of a concept in the corresponding language, you must access concept properties and modify the name of the term in the specific language. For more details, see* *"Concept and Term", page 10.*

- the **Definition Text**,
- The **Synonyms** section enables specification of a list of synonym concepts,

  A synonym is a term interchangeable with another term in the context of a concept of this term that has the same or almost the same meaning.

  ☛ *For more details, see* *"Concept and Term", page 10.*

- The **Realization** section enables association of an application architecture element to the concept.

  ☛ *For more information, see **HOPEX Logical Data**.*

Connecting an event concept to its concept

The relationship between a concept and its event concept is described by:

- a **Start Event**,
- an **End Event**,
- or an **Intermediate Event**.

To connect an event concept to its concept in a graph associated with a business information area:

1. In the insert toolbar, click the **Link** button.
2. Click the concept to which the event concept is attached.

   `For example, "Person"`

3. Click the event concept to be connected.

   `For example, "Birthday".`

   A wizard proposes selection of an event type:

   - **Concept Start Event**
   - **Concept End Event**
   - **Concept Intermediate Event**

4. Select the event type and click **OK**.
   The creation wizard of the selected concept event type opens.
5. Specify the **Local Name**.
6. If no term is to be created, select the "Creation without term" check box.
7. Click **OK**.
   The link between the concept and the event concept appears in the diagram with an icon representing its type.

State concept structure diagram

In **HOPEX Information Architecture**, a state concept structure diagram assembles all information relating to the state concept diagram described. This diagram is initialized from concept graph elements.

```
For example,
```

The diagram includes:

- *variations* between components

  ```
  For example, "Subscriptions" can be classified by
  "Subscription Type". A "Subscription Type" being
  characterized by a "Loan Type".
  ```

  A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

  ☛ *For more details, see "Creating a concept structural component variation", page 47.*

- *Substitutions* between components

  A substitution determines which element can be used to replace another, or is effectively replaced by an element existing in a given context (for example in the context of a variation). Unlike a variation, a substitution does not involve inheritance but a functional equivalence.

  ☛ *For more details, see "Creating a concept structural component substitution", page 47.*

- *Concept representation*,

  A concept representation is used to specify the relationship between a concept and a representation type.

  ☛ *For more details, see "Using Representation Types", page 45.*

- *Concept structural components* describing the relationship between two **Concepts**

  ```
  For example, a "Subscription Type" is characterized by an
  "Available Loan Type".
  ```

  A concept structural component enables representation of a dependency relationship between two concepts. This relationship is directional.

  ☛ *For more details, see "Describing Concept Structural Components", page 43.*

- *start events*, *intermediate events* and *end events* enabling definition of events contributing to change of state of a concept,

  ```
  For example, the change of state of a member can be caused
  by a birthday.
  ```

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

  ☛ *For more details, see "Describing State Concepts", page 55.*

Describing Individual States and Events

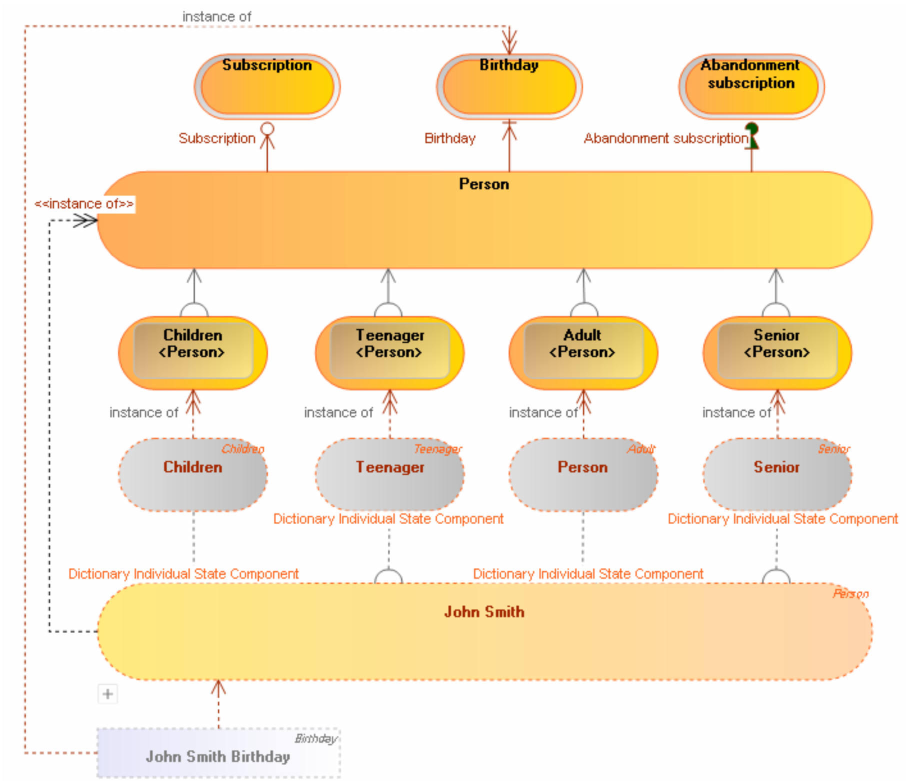
If a concept is associated with states, occurrences of this concept can also be associated with states. **HOPEX Information Architecture** therefore proposes the **Individual State**.

An individual state is an instance of a concept state to which the dictionary state is connected. It represents an individual state during its life cycle.

In addition, the switch from one individual state to another can be conditioned by an **Individual Event**.

An individual event represents an event occurring during the life of the individual. It is an instance of an event concept of the concept to which the individual is connected.

```
For example, "John Smith" is a "Person" who can pass form
one state to another on his birthday.
```



The relationship between an individual and its **Individual State** is described by an **Individual State Component**.

An individual state component is used to connect an individual to an individual state.

The relationship between an individual and its **Individual Event** is described by a **Dictionary Entity Component**.

An entity component is used to connect an individual to a dictionary element.

With **HOPEX Information Architecture**:

- an individual state is an instance of a state concept

  A state concept is a situation in a concept life cycle during which it satisfies certain conditions, executes a certain activity or waits for a concept event. A state concept represents a time interval of which limits are two concept events. A state concept is a phase through which the concept passes during its life cycle.

- an individual event is an instance of an event concept

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

Accessing the individual state and event list

To access the individual states of a subject area:

1. In the **Information Architecture** pane, click **Subject Areas > Business Information Hierarchy**.
2. Expand the **Subject Areas** folder.
3. From the subject area that interests you, expand the **Individual States** folder.
   The list of individual states of the subject area appears.
4. Expand the **Individual Events** folder.
   The list of individual events of the subject area appears.

Creating an Individual state from a business information area

The relationship between an individual and its **Individual State** is described by an **Individual State Component**.

An individual state component is used to connect an individual to an individual state.

If you create an individual state in a diagram, you can automatically create the individual state component of the associated individual.

To create an individual state from a concept graph:

1. In the diagram, roll the mouse over the individual who owns the individual state.

   ☛ *If you are in **HOPEX Windows Front-End**, roll the mouse over the individual who owns the individual state click* + *.*

2. Select **Individual state**.
3. Click on the diagram.
   The individual state creation wizard opens.
4. Specify the **Local Name** and click **Add**.
   The new individual state appears in the diagram.

   ☛ *You can also create an individual state from its subject area.*

Individual state properties

The individual state properties dialog box presents the following elements in the **Characteristics** tab:

- Its **Local Name**
- The individual classifications, which appear in the **Classification** section.

  An individual state component is used to connect an individual to an individual state.

  ☛ *For more details, see "Creating an Individual Classification", page 52.*
- The **Component** tab, presenting the individuals who define the described individual.

  ☛ *For more details, see "Creating a Dictionary Entity Component", page 53.*

Creating an Individual event from a business information area

To create an individual event from a business information area:

1. In the insert toolbar, click **Individual Event** and click in the diagram.
   The individual event creation wizard opens.
2. Specify the **Name** and click **Add**.
   The individual event appears in the diagram.

Connecting an individual event to an individual

The relationship between an individual and its **Individual Event** is described by a **Dictionary Entity Component**.

An entity component is used to connect an individual to a dictionary element.

To connect an event concept to its concept in the diagram:

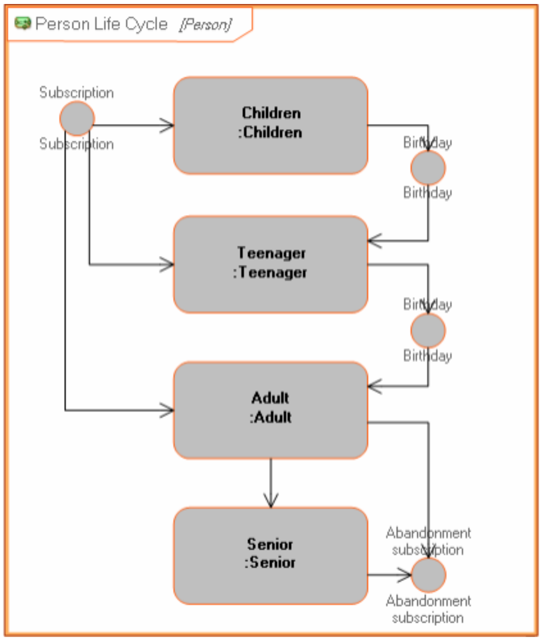
1. In the insert toolbar, click the **Link** button.
2. Click the individual event.
3. Click the event.
   The link appears in the diagram.

Concept life cycle structure diagram

The concept life cycle structure diagram is used to describe a concept life cycle.

```
For example, a "Person" becomes visible in a media library
after "Registration". It can be registered with state
"Child", "Adolescent", "Adult" or "Senior". Passage from
```

one state to another can be connected to a event, a "Birthday" for example.



A concept life cycle structure diagram includes the following elements:

- **Concept Life Cycle Phases**, which are connected to state concepts of the"Person" concept

  A state concept is a situation in a concept life cycle during which it satisfies certain conditions, executes a certain activity or waits for a concept event. A state concept represents a time interval of which limits are two concept events. A state concept is a phase through which the concept passes during its life cycle.

  For more details on state concepts, see "Describing State Concepts", page 55

- **Concept Life Cycle Events**, which are connected to event concepts of the"Person" concept

  An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

  For more details on event concepts, see "Describing Event Concepts", page 58

- **Concept Life Cycle Transitions**, which represent sequence flows between concept states and events.

Creating a concept life cycle

With **HOPEX Information Architecture**, to create a concept life cycle structure diagram, and to describe sequence flows of states defining the concept life cycle, you must first create the **Concept Life Cycle**.

To create a concept life cycle from a subject area:

1. Right-click the subject area that interests you, select **New > Subject Area Element > Concept Life Cycle** and click **OK**.
   The concept life cycle creation wizard appears.
2. Specify the **Local Name** and click **OK**.
3. In the **Life Cycle of**, specify the concept to which the life cycle relates.

   `For example, "Person"`
4. In the **Term** section, the **Existing Terms** section lists terms with the same name as the new object.

   ☛ *If a term has already been created with the same name as the now concept, this term is automatically connected to the concept and appears automatically in the* ***Term*** *section.*
5. In the **Definition Text** field, enter the text of the state concept definition and click **OK**.
   The name of the new concept life cycle appears in the tree under the subject area.

Creating a concept life cycle structure diagram

To create a concept life cycle structure diagram from a concept life cycle:

- Right-click the concept life cycle that interests you and select **New > Concept Life Cycle Structure Diagram**.
  The diagram opens in the edit area. State concepts associated with the described concept are positioned in the diagram via objects of **Concept Life Cycle Phases** type.

Adding a concept life cycle event

To add a concept life cycle event in the concept life cycle structure diagram:

```
For example, the concept life cycle event representing
"Registration".
```

1. In the diagram insert toolbar, click the **Concept Life Cycle Event** button.
2. Click in the frame of the concept life cycle frame.
   A concept life cycle event creation dialog box opens
3. In the **Composite Type** field, specify the name of the event concept to which the new object relates.

   `For example, "Registration".`

   ☛ *If a selection dialog box opens, select the object that interests you.*
4. Specify the **Local Name**.
5. If no term is to be created, select the "Creation without term" check box.
6. Click **OK**.
   The concept life cycle event event appears in the diagram.

Creating a concept life cycle transition

To represent sequence flow from a phase to a concept life cycle event, you must create a concept life cycle transition.

To create a concept life cycle transition:

1. In the diagram insert toolbar, click the **Concept Life Cycle Transition** button.
2. Click the triggering concept life cycle phase (or event), and, holding the mouse button down, drag the cursor to the triggered phase (or event).
3. Release the mouse button.
   The link appears in the diagram.

Using periods

A **Period** adds time-related information to an **individual event**.

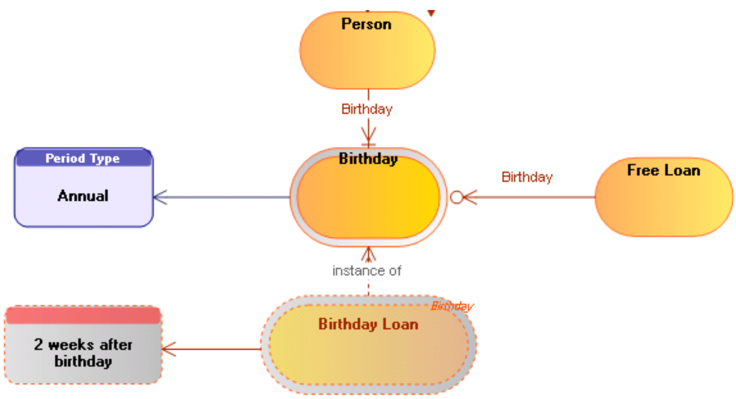
An individual event represents an event occurring during the life of the individual. It is an instance of an event concept of the concept to which the individual is connected.

```
For example, a free loan may be offered to subscribers on
each anniversary. This loan is valid for a period of two
weeks after the anniversary date.
```

A **period type** is used to specify an **event concept**.

An event concept represents an event occurring during concept life, for example a change of season. An event concept marks the impact on a concept of a phenomenon internal or external to the concept. Concept events can be distinguished as concept start events, end events and intermediate events.

```
For example, a free anniversary loan is offered every year.
```



The relationship between a **Period type** and an **Individual event** is described by an **Event type periodization**.

The relationship between a **Period** and an **Event concept** is described by an **Event periodization**.

DESCRIBING CONCEPT TYPES

A concept type enables classification of concepts. Relationships between concept types are represented by concept type components.

The features offered by **HOPEX Information Architecture** to use your concept types are described here:

Accessing the Concept Types List

To access all the concept types of your repository with **HOPEX Web Front-End** :

- In the **Business Information** pane, click **Concept Types > All concept types**.
  The list of concept types appears.

  *To access all the concept types that you have created with **HOPEX Web Front-End** : in the **Business Information** pane, click **Concept Types > My Concept types**.*

To access all the concept types of a subject area with **HOPEX Windows Front-End** :

1. In the **Information Architecture** desktop, select the **IA Library** tab, then the **Information Architecture** navigation tab.
2. Expand the **Subject Areas** folder.
3. Expand the folder that corresponds to the subject area that interests you.
4. Expand the **Concept Type** folder.
   The list of subject area event concepts appears.

To access the concept types you have created with **HOPEX Windows Front-End** :

1. In the **Information Architecture** desktop, select the **Home** tab, then **My Desktop** > **My Responsibilities**.
2. Expand the **My Concept Types** folder.
   The list of your concept types appears.

Creating a New Concept Type

To create a concept type from a subject area:

1. Right-click the subject area that interests you and select **New > Subject Area Element > Concept Type**.
   The concept type creation wizard appears.
2. Specify the **Local Name** and click **OK**.
3. In the **Term** section, the **Existing Terms** section lists terms with the same name as the new concept type.

   A term is a word or word group, that is used for a specific meaning in a specific context.

   ☛ *If a term has already been created with the same name as the new concept type, this term is automatically connected and appears in the **Term** section.*
4. In the **Definition Text** field, enter the text of the concept type definition and click **Finish**.
   The name of the new concept type appears in the tree under the subject area.

   ☛ *A new term with the same name as the concept type is also created.*

Concept Type Properties

Concept type characteristics

The **Characteristics** tab of concept type properties enables access to its main characteristics.

With **HOPEX Information Architecture**, the concept type is described by:

- its **Designation**, which is represented by one or several terms,

  ☛ *To modify the name of a concept in the corresponding language, you must access concept properties and modify the name of the term in the specific language. For more details, see "Concept and Term", page 10.*
- the **Definition Text**,
- The **Synonyms** section enables specification of a list of synonym concepts,

  A synonym is a term interchangeable with another term in the context of a concept of this term that has the same or almost the same meaning.

  ☛ *For more details, see "Concept and Term", page 10.*
- The **Realization** section enables association of an application architecture element to the concept.

  ☛ *For more information, see **HOPEX Logical Data**.*

Links between a concept and other dictionary elements

In addition to terminology characteristics, a concept is characterized by its relationships with other dictionary elements.

- The **Component** tab presents the list of owned concept type components , for more details see "Describing Concept Structural Components", page 43.
- The **Super-Type** tab presents concept types whose properties are inherited by the described concept type, for more details see "Describing Concept Type Variations", page 70

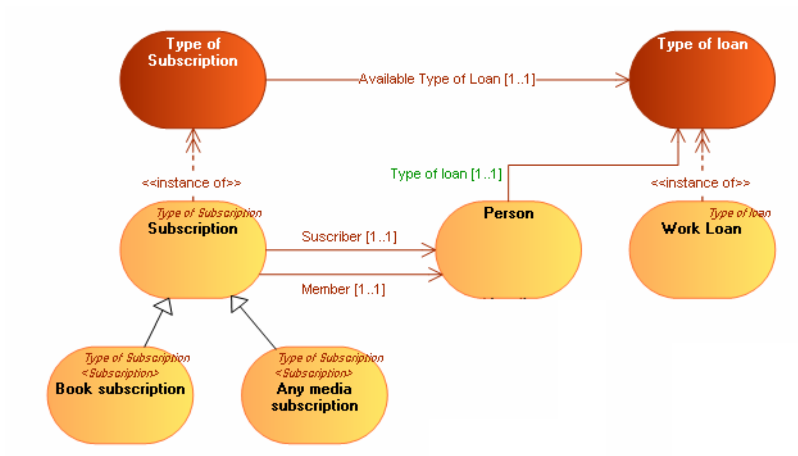
Describing Concept Type Components

With **HOPEX Information Architecture**, a concept type can be connected to another concept type to characterize it.

```
For example, a "Subscription Type" is characterized by a
"Loan Type".
```

This relationship is described by a **Concept Type Component**, which can be associated with a term.

A concept type component enables specification of the relationship between two concept types.



Accessing concept type components

To access concept type components of a concept type:

1. Open the concept type properties dialog box.
2. Select the **Components** tab.
   The list of concept type components associated with the concept appears.

You can also consult the list of structural components of a concept type from its concept life cycle diagram. For more details, see "The Concept Type Structure Diagram", page 71.

Creating a concept type component from a business information area

To create a concept type component between two concept types in a business information area diagram:

1. In the insert toolbar, click the **Link** button.
2. Click the concept type that owns the link.

   `For example, "Subscription Type".`
3. Click the target concept type.

   `For example, "Loan Type".`

   The concept type component creation wizard appears.
4. Specify the **Local Name**.
5. If no term is to be created, select the "Creation without term" check box.
6. Click **OK**.

   The Concept Type component appears in the diagram.

You can also create a concept type component in a concept type structure diagram. In this case, you must specify the target concept type in the concept type component creation wizard.

☛ *For more details, see "The Concept Type Structure Diagram", page 71.*

Describing Concept Type Variations

Certain concept types are versions of other concept types; they are characterized by the same concept type components.

With **HOPEX Information Architecture**, this relationship is described by a **Variation**.

A variation describes how a concept can be varied under another form. The variant is an object similar to the varied object, but with properties or relationships that may differ.

☛ *For more details on variations and substitutions, see the **HOPEX Common Features** guide, "Handling Repository Objects", "Object Variations".*

Accessing concept type variations

To access concept type variations

1. Open the concept type properties dialog box.
2. Select the **Super-Type** tab.

   The list of variations associated with the concept appears.

Creating a concept type variation from a business information area

To specify, from a business information area diagram, that a concept type inherits characteristics defined for another concept type:

1. In the insert toolbar, click the **Link** button.
2. Click the concept type to be varied and drag the cursor to the new concept before releasing the mouse button.

3. Specify the **Name** and click **Add**.
   A directional link from the concept type to be varied to the root concept type appears.

   ☛ *The variation is represented by a link, but it is in fact a* ***HOPEX*** *object.*

The Concept Type Structure Diagram

With **HOPEX Information Architecture**, a concept type structure diagram describes the internal structure of the concept type instance using relationships defined for other concept types it characterizes.

This diagram includes *concept type components* enabling characterization of the concept type by connecting it to other concept types.

```
For example, a "Subscription Type" is characterized by a
"Loan Type".
```

A concept type component enables specification of the relationship between two concept types.

☛ *For more details, see "Describing Concept Type Components", page 69.*

DEFINING CONCEPT VIEWS

A concept view enables representation of the semantic scope covered by a business object. A concept view is based on the selection of several concepts specific to the view.

HOPEX Information Architecture provides an editor used to create and display business views and their components.

☛ *On the same principle, the Data View can be used to navigate from Classes or Entities. For more details, see* *"Data views", page 13**.*

Creating a Concept View

To create a concept view with **HOPEX Web Front-End** :

1. Click the navigation menu then **Business Information**.
2. In the navigation pane, select **Concept Views**.
3. Display all concept views.

   ☛ *To create a concept view with **HOPEX Windows Front-End,** select the **IA Library > Dictionary Elements > Concept View** tab.*

4. Click **New**.
   The concept view creation wizard appears.
5. Enter the **Local Name**.
6. In the **Term** section, the **Existing Terms** table lists terms with the same name as the view.

   A term is a word or word group, that is used for a specific meaning in a specific context.

7. In the **Definition Text** space, enter the text of the definition of the view and click **Next**.
8. To specify the source concept of the concept view, click **New**.
9. In the dialog box that appears, specify:
   - the **MetaClass** concerned by the view (concept, state concept or event concept)
   - The reference concept of the data view
10. Click **Add**.
11. Click **OK** to close the concept view creation wizard.
    The new concept view appears in the list.

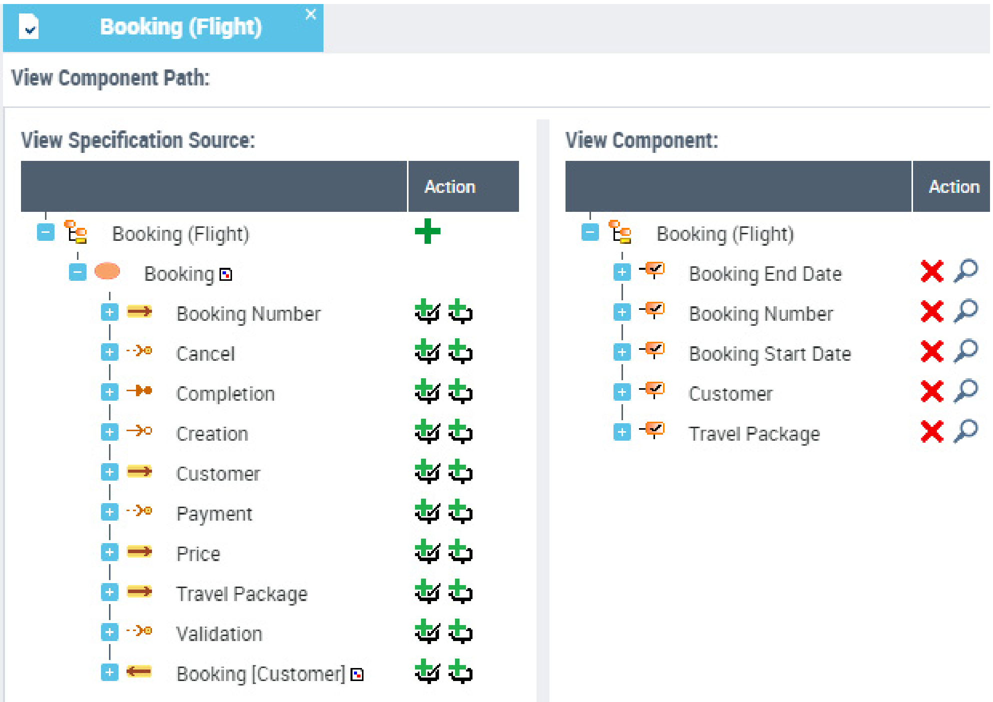
    ☛ *The new concept view is also accessible from the **My Concept View** menu.*

Defining the Concept View Content

Displaying objects in the view

The view editor is made up of a number of parts:

- the left part presents all the source concept components held by the view, as defined in the subject area
- the right part presents the concept components that will be kept for the concept view created
- the buttons in the **Action** column are used to add the components to the concept view.



Adding a source object to the concept view

To add a source object to a concept view:

1. Open the concept view.
2. On the source object side, under the **Action** column, click .
3. In the dialog box that appears, indicate:
   - the **MetaClass** concerned by the view (concept, state concept or event concept)
   - The reference concept of the data view
4. Click **Add**.

Once the source concept is defined, you can select the components of this concept - or the concept itself - to be added to the concept view.

Adding a component to the concept view

Using the source objects in the view, you can define embedded components and referenced components.

An embedded component is used to bring all the information making up the object into the view. A reference component references only the object in the view.

To add a component to the concept view:

1. In the tree on the left, select the component that you want to add to the view.
2. Click **Add a View Embedding Component**.
   The component added appears in the tree to the right.

   ☛ *You can* ***Add a referenced component*** *in the same way.*

A check mark appears in front of the objects embedded in the view, as opposed to referenced objects.

The views are then accessible in a report. For more details, see "DataSet Report", page 83.

The View Report

The view report provides a report on a concept view and its components.

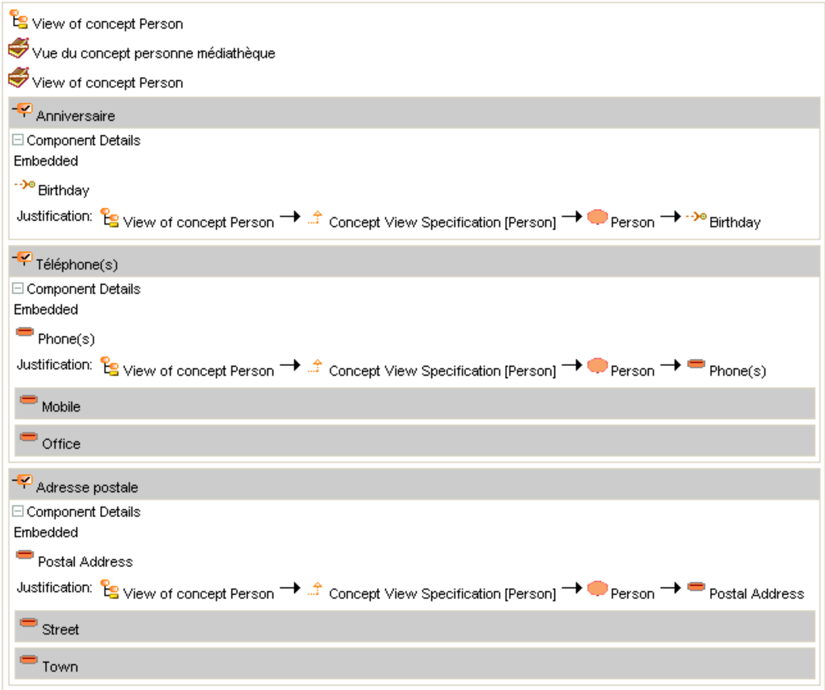
Report parameters

This consists of defining report input data.

Parameters	Parameter type	Constraints
View	View	Mandatory.
Sub-view	yes or no	Yes by default
Justification	yes or no	Yes by default
Depth level	Short	

Report example

The following example show the elements in the view based on the "Person" concept.


View of concept Person
Vue du concept personne médiathèque
View of concept Person

Anniversaire
Component Details
Embedded
Birthday
Justification: View of concept Person → Concept View Specification [Person] → Person → Birthday

Téléphone(s)
Component Details
Embedded
Phone(s)
Justification: View of concept Person → Concept View Specification [Person] → Person → Phone(s)
Mobile
Office

Adresse postale
Component Details
Embedded
Postal Address
Justification: View of concept Person → Concept View Specification [Person] → Person → Postal Address
Street
Town

BUSINESS DATA REPORTS

HOPEX Information Architecture offers different types of reports designed to analyze the business data defined in the repository.

☛ *For more details on operation of reports, see the HOPEX Common Features guide, "Generating Reports".*

☛ *Reports on the diagrams available in standard mode with **HOPEX** are also accessible with **HOPEX Information Architecture**.*

Accessing Reports

To access **HOPEX Information Architecture** reports:

1. Click the navigation menu, then **Reports**.

The View Report

See "The View Report", page 78.

Glossary Report

HOPEX Information Architecture provides a ready-to-use glossary report to automatically build the business glossary of terms derived from a set of subject areas. For each term, the glossary displays a list of associated definitions with their text, synonyms and components list.

The user can indicate if he/she wishes to display translation.

Report parameters

This consists of defining report input data.

Parameters	Parameter type	Constraints
List of libraries	Library	Displayed terms selection criterion Not mandatory.
List of subject areas	Subject area	Displayed terms selection criterion Domain mandatory if no library.
Glossary of translations	yes or no	
Example option		

Report example

```
The example below enables viewing of terms and their links
with contexts.
```

Media library	
Abandonment subscription	**Event** 1. **Component** 1. (Component of) Person Life Cycle
Adult	**State** 1. (Examples) Person (State of) Person (Through Component) Person
Annual	**Period Type** 1.
Any media subscription	**Concept** 1. (Hypernyms) Subscription (Component 1) Type of Subscription (Type) Type of Subscription (Presence) Always (Cardinality) 1
Author	**Component** 1. (Component of) Work
Available Type of Loan	**Component** 1. (Component of) Type of Subscription
Birthday	**Event** 1. (Examples) John Smith Birthday, Birthday Loan (Component 1) Périodisation d'évènement type (FR) (Type) Annual (Presence) Always (Cardinality) 1 **Component** 1. (Component of) Person Life Cycle

DataSet Report

A DataSet report is a data table created using repository objects, on which instant reports can be generated.

HOPEX Information Architecture provides the following DataSet reports:

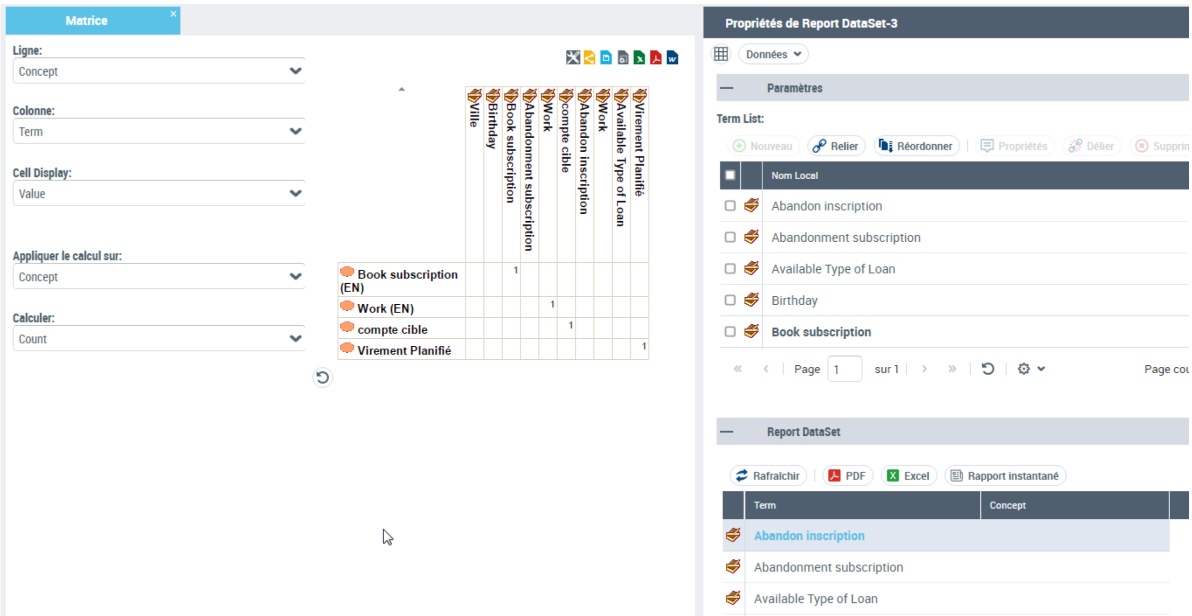
- "Definition of terms used.", page 83.
- "Knowledge area x Concept matrix", page 83.

Definition of terms used.

This report is used to identify the connections between the terms and the concepts.

Parameter	Parameter type	Constraints
Root objects	Term	Object list.

It is used for example to create a **Term/Concept** matrix that presents the list of concepts that use a term.

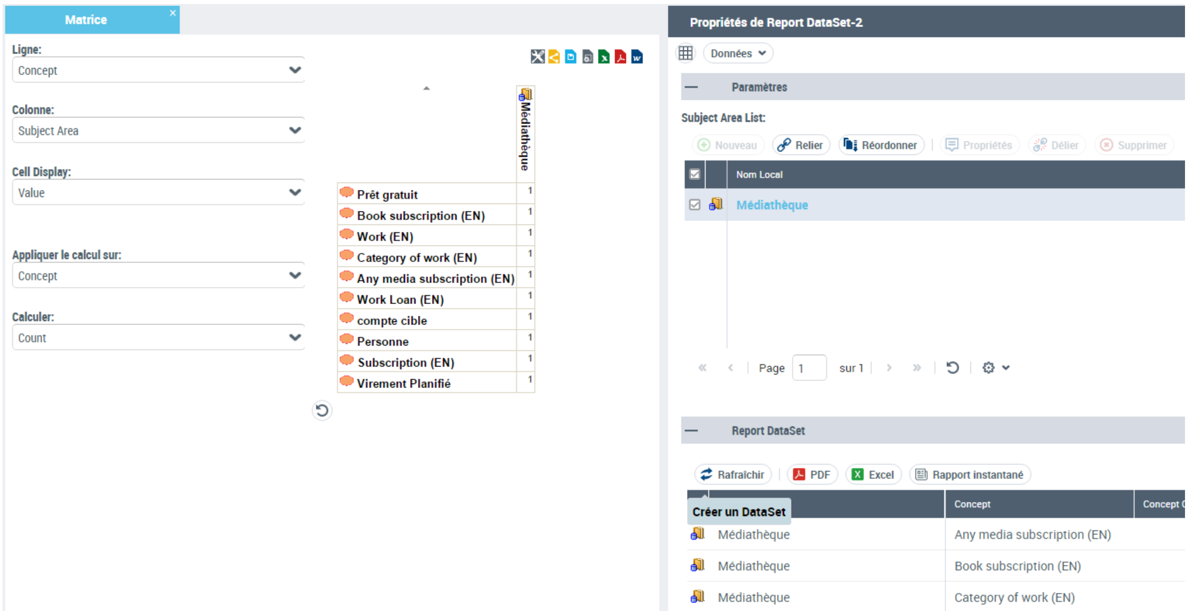


Knowledge area x Concept matrix

A concept can be referenced by one or more business information areas.

Parameter	Parameter type	Constraints
Root object	Subject area	Object list.

The data structure is used for example to create a **Capability area x Concept matrix**used to create the list of concepts referenced in a knowledge area.



HOPEX Business Data

User Guide

HOPEX V2R1

HOPEX INFORMATION ARCHITECTURE - LOGICAL LAYER

Company organizers and architects can describe operations using **HOPEX Information Architecture** by modeling data used when implementing business processes and applications. To this end, **HOPEX Information Architecture** makes available a number of notations.

Using logical data models, you can build corresponding physical models, that is, creates database tables, with its columns, indexes and keys as well as the relational diagram drawings.

Data Modeling Options

Formalisms

You can model logical data using two formalisms:

- the data package, to build class diagrams (UML notation)
- the data model, for data diagrams (standard notations, IDEF1X, I.E, Merise)

To display one of the formalisms:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Formalism**.
4. In the right part of the window pane select the formalism(s) that you want to display.
5. Click **OK**.
   The folders corresponding to the packages and data models appear in the **Logical data** navigation pane.

Notations

You have access to a standard data model notation, selected by default. To display another notation (DEF1X, I.E ou Merise) :

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Notation**.
4. In the right part of the window, select the notations that you want to display.
5. Click **OK**.

Repository access

To use the functionalities of **HOPEX Information Architecture**, you must have "Advanced" repository access:

1. Click **Main Menu** > **Settings** > **Options**.
2. In the left pane of the window, click the **Repository** folder.
3. In the right pane, check that access to the repository is in "Advanced" mode.

About This Guide

Guide Structure

The guide covers the following points:

Additional Resources

This guide is supplemented by:

- the **HOPEX Common Features Common Features** guide, which describes the Web interface and tools specific to HOPEX solutions.

  ☛ *It can be useful to consult this guide for a general presentation of the interface.*

- the **HOPEX Power Supervisor** administration guide.

Conventions used in the guide

Styles and formatting

☛ *Remark on the preceding points.*

Definition of terms used.

☺ *A tip that may simplify things.*

Compatibility with previous versions.

Things you must not do.

Very important remark to avoid errors during an operation.

Commands are presented as seen here: **File > Open**.

Names of products and technical modules are presented in bold as seen here: **HOPEX**.

LOGICAL DATA ARCHITECTURE

HOPEX Information Architecture provides a set of tools for modeling logical data in Class/ Association formalism.

You can define how the data of an organization will be used by the processes and the applications that it uses. Using the concepts of data area and data view, you can detail a logical data structure in a particular use context.

It is also possible to associate the entities and the classes with concepts created during the semantic analysis phase.

The following points are covered here:

ACCESSING LOGICAL DATA

In **HOPEX Information Architecture**, access to logical data in the repository is reserved for the **Data architect**.

Display the navigation pane of logical data

To access repository logical data:

1. On the **HOPEX Information Architecture** desktop, click the navigation menu, then **Logical data**.
   The navigation pane shows the corresponding object types:
   - Data packages
   - Data models (if the corresponding option is checked)
   - Data areas
   - Data views

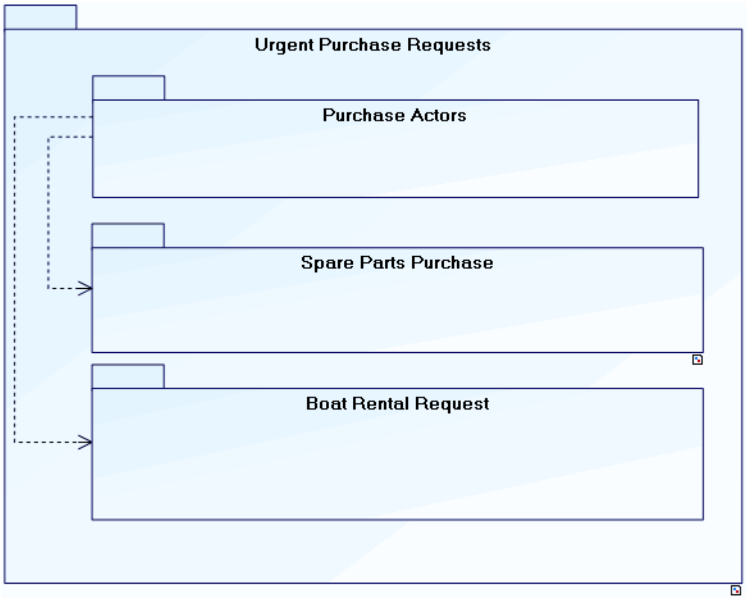
Basic Elements of the Logical View

UML package

A package is used to represent the static structure of a system, particularly the types of objects handled in the system, their internal structure, and the relationships between them.

The package is an owner element. It provides a namespace for the elements that it consolidates.

The package allows you to classify elements referenced in a project. You can create sub-packages in a package to classify objects in finer detail, for example actors of a project.




```
Urgent purchase requests are provided to process purchase
of spare parts and boat rental requests. In both of these
cases, users are actors of the purchasing domain.
```

☛ *For more details on the use of packages, see the **HOPEX UML** guide.*

Class diagrams are used to graphically represent elements in a **class diagram**.

See:

Data model

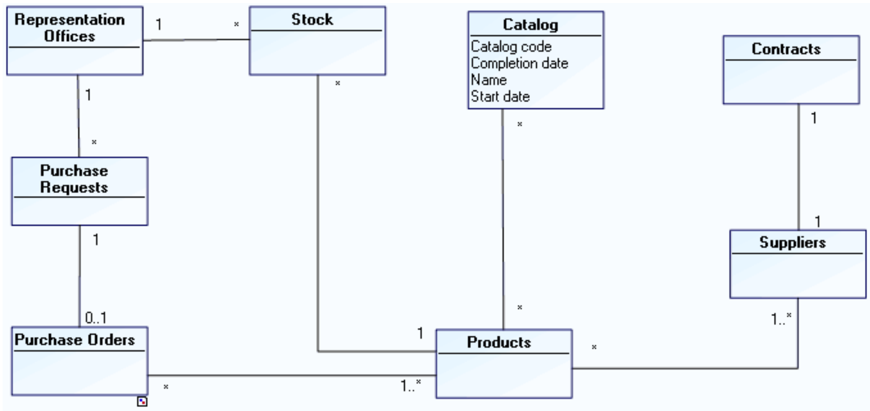
Like a package, a data model is used to represent the static structure of a system, particularly the types of objects handled in the system, their internal structure, and the relationships between them.

Data diagrams are used to graphically represent the elements in a **class diagram**.

For more details on creating and updating a data model, see "The data model", page 25.

Example

The data model of the "Purchase Request Automation" project is presented below.




```
The application manages purchase requests, orders and
product stock levels in each of the representation offices.

A centralized catalog of products and suppliers is
installed.

Contracts with referenced suppliers are also accessible
from the application.
```

☛ *For more details on creating and updating a data model, see "Modeling data".*

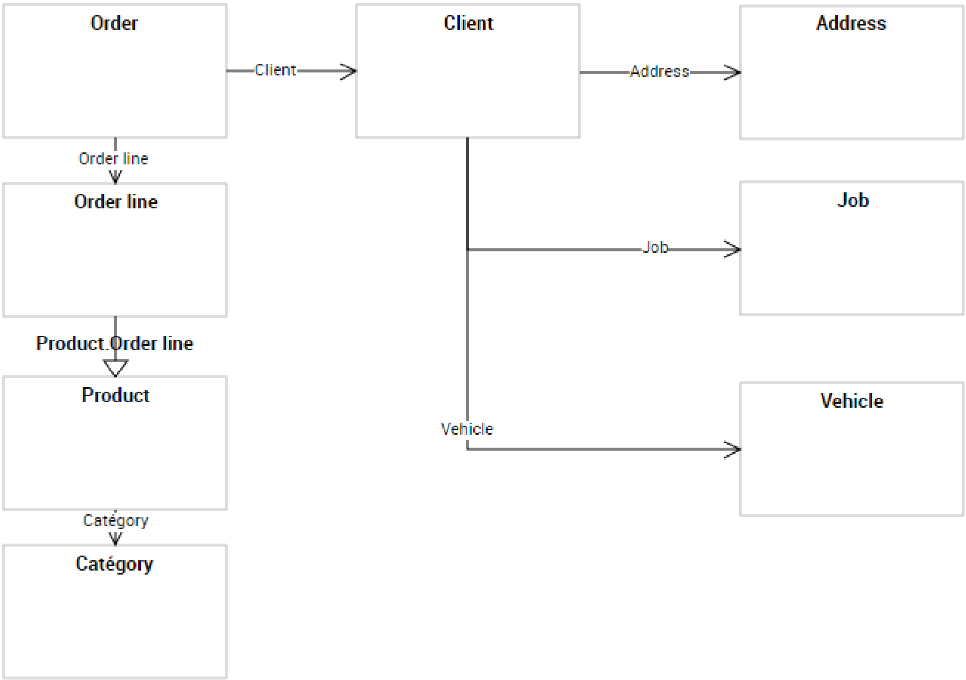
Data area

A data area represents a restricted data structure dedicated to the description of a software Data Store. It is made of classes and/or data views and can be described in a Data Area Diagram.

For more details, see "Logical data areas", page 10.

Example

The following data area diagram represents a data structure relating to Orders; it describes classes and their relationships in a Whole/Part formalism.



To address these specific use cases, you can create Data Views in which you can see and modify the scope covered by the classes.

See "Logical data areas", page 10.

Logical data view

A data view represents the scope covered by an element of a data model or a data area. A data view is based on the selection of several classes connected in the specific context of the view. See "Data views", page 13.

LOGICAL DATA AREAS

A logical data area is used to define a logical data structure made up of classes and data views.

A logical data area is owned by a package and can reference objects held in other packages.

You can define the access mode (creation, deletion, etc.) to the objects referenced by a data area by integrating them as components of the data area.

A corresponding physical structure can be defined via a physical data area. It is made up of tables and table views.

Creating a logical data area

To create a logical data area:

1. Click on the navigation menu, then on **Logical Data**.
2. In the navigation pane, click **All logical data areas**.
   The list of logical data areas appears.
3. Click the **New** button.
   The creation dialog box opens.
4. Enter the name of the data area.
5. If appropriate, enter the package owner.
6. Click **OK**.
   The data area appears in the list.

The Logical Data Map

A logical data map is an urbanization tool for logical information. It represents a set of data areas in a particular context.

To create a logical data map:

1. Click on the navigation menu, then on **Logical Data**.
2. In the navigation pane, click **Logical Data Map**.
3. Display all the logical data maps.
4. Click **New**.
   The map created appears.

To create a logical data map diagram:

1. Right-click on the data area and select **New** > **New Logical Map Diagram**.
   The diagram appears in the edit area.

The components of a logical data map

You can add internal and external components in a logical data map.

The internal components are data areas that are part of the map scope (whether they belong to the owner package or not).

The external components are those used in the map but that are not part of the scope analyzed.

The Logical Data Area Diagram

A logical data area can be described by a diagram.

A logical data area entity diagram is a structure diagram which defines classes and their relationships in a Whole/Part formalism in connection with the subject of the data area described.

You can connect one or more data area diagrams to a logical data area, according to what you want to describe.

Creating a Logical Data Area Diagram

To create a data area diagram from a logical data area:

- Right-click on the logical data area and select **New** > **Logical Data Area Entity Diagram**.

Adding an object to the diagram

In the data area diagram, you can add a new object or connect an existing object.

Adding a class

To add a new class to a diagram:

1. In the diagram insert toolbar, click **Class**, then click in the diagram.
   The **Add A Class** dialog box appears.
2. Enter the name of the class and click **Add**.

Add a data view

To add a new data view to a diagram:

1. In the diagram insert toolbar, click **Data View**, then click in the diagram.
   The **Add Data View** dialog box appears.
2. Enter the name of the data view and click **Add**.
3. The editor view appears. It is used to define the components of the view.
   See "Creating a data view", page 13.

Adding a component to a data area

You can connect objects to a data area through components. A component references an object (class or class view) and defines the type of access to the object in question (read-only, modification, deletion, etc.).

The data area is attached to the package; objects directly created from components are automatically connected to the package of the data area.

You can create a component from an object in the diagram or using the properties of the data area.

To create a component from an object of the data area diagram:

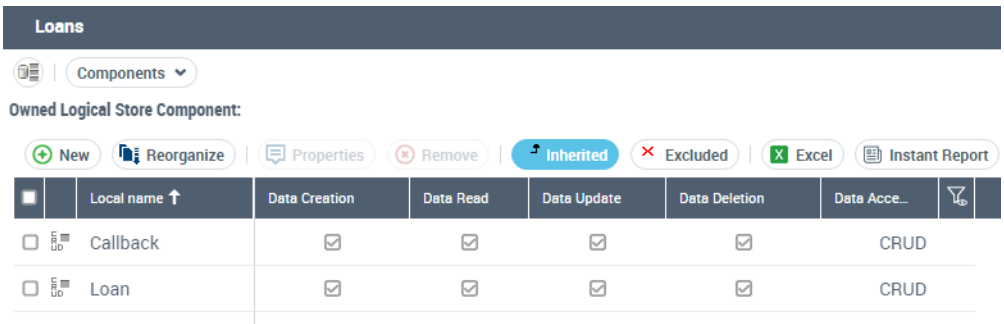
- In the diagram, right-click the object in question and select **Add to (name of the data area)**.
  The name of the component created appears in the properties of the data area. By default it has the name of the object that it references.

Defining the access mode to the referenced object

On the component, you can define the access mode to the object referenced (creation, read-only, deletion, etc.).

To define the access mode to the object in the data area:

1. Open the properties of the data area.
2. Click the drop-down list then **Components**.
   The list of components of the data area appears.
3. Select the component and select the check boxes that correspond to the types of access in question (Creation, Read-only, etc.).



DATA VIEWS

A data view enables representation of the scope covered by a data model element. A data view is based on the selection of several classes connected in the specific context of the view.

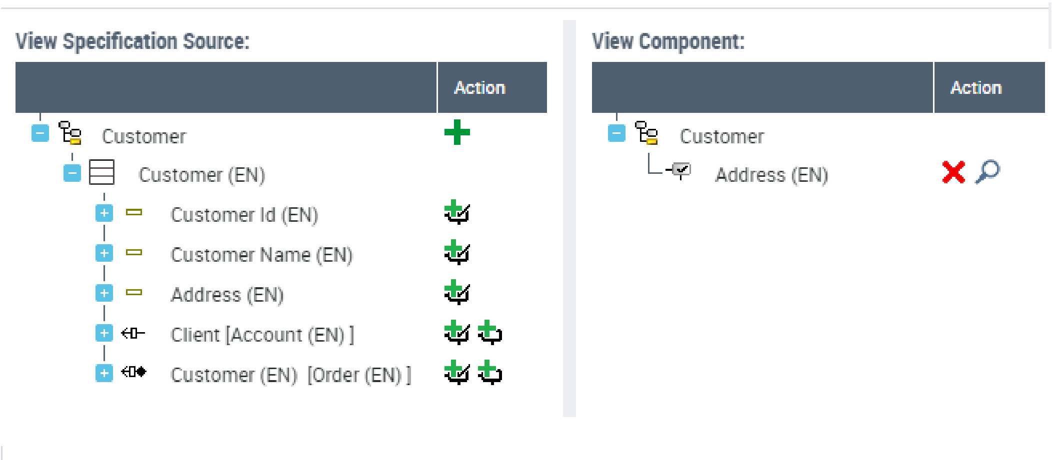
☛ *According to the same principle, the design view is used to view the semantic scope of a business object. For more details, see* *"Defining Concept Views", page 76**.*

Creating a data view

Creating a data view consists of:

- defining source objects concerning the view (a class or a data view)
- defining more precisely the properties of source objects to be taken into account in the view (attributes, parts)

```
For example, for order management, you must retrieve the
delivery address available for each client. To take into
account this information only, you will create a view on the
Client class that takes the "Address" attribute only,
without taking into account other attributes that can
contain the Client class.
```



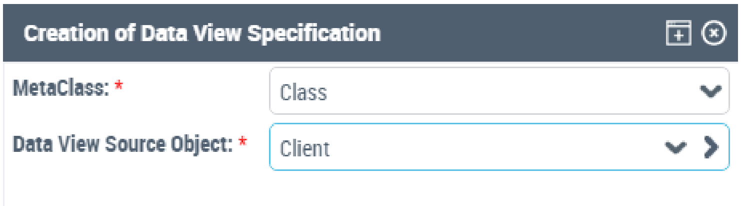
Using the source objects (left tree), you can define embedded components and referenced components in the view.

An embedded component specifies that all the information that comprises the source object is to be taken into account when using the view (for example, the parts and the attributes associated with a class). A referenced component references only the object in the view.

Creating a data view (from a list of views)

To create a data view with **HOPEX Web Front-End** :

1. Click on the navigation menu, then on **Logical Data**.
2. In the edit area, click **Data Views**.
3. Display all the data views.
4. Click **New**.
   the data view creation dialog box opens.
5. To specify the source object in the data view, click **New**.
6. In the dialog box that appears, enter:
   - the **MetaClass** concerned by the view.
   - The source object for the data view.



7. Click **Add**.
8. Repeat the procedure to add other source object if necessary.
9. Click **OK**.
   The new view appears in the list of data views.

Creating a data view directly from an object

You can define the source object of a view by creating the view directly on the object in question.

☛ *You can subsequently add another object to the view.*

To create a data view on an object:

1. Right-click the object concerned and select **New** > **Data view**.
   The data view creation wizard opens.
2. Enter the name of the view.
3. If appropriate, enter the name of the owner.
4. Click **OK**.
   The editor view appears.

Adding a Source Object to the Data View

The information that comprises a data view can come from different source objects.

You can define a source object when creating the data view (see "Creating a data view directly from an object", page 14). You can subsequently add new source objects.

To add a source object to the data view:

1. Open the data view.

2. On the source object side, under the **Action** column, click .
3. In the dialog box that appears, indicate:
   - the **MetaClass** concerned by the view.
   - The source object for the data view.
4. Click **Add**.

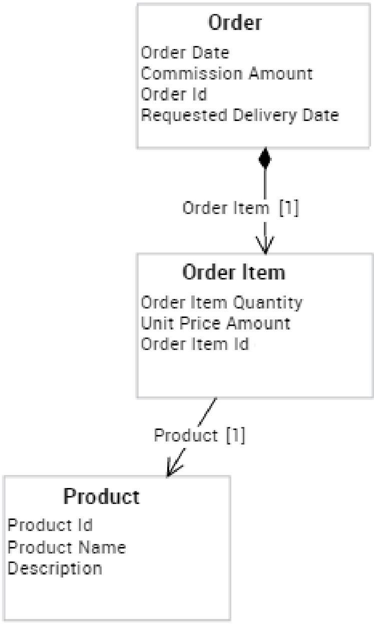
Once the source object is defined, you can select the components of this object to add to the data view.

Displaying source objects in the data view

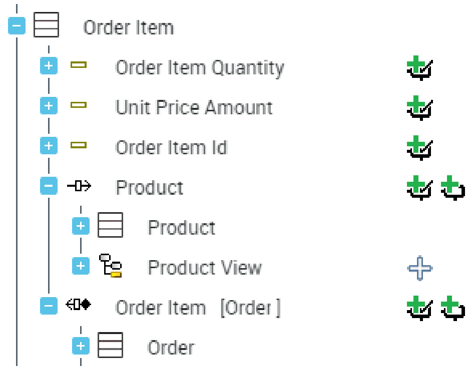
	**Class**
	Attribute
	**Part**
	Part (composing class)
	**Part (composed class)**

Example

Logical model



Logical data view



Defining the Data View Components.

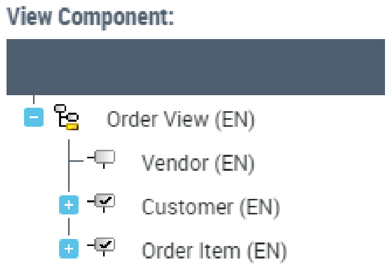
Embedded component

An embedded component brings all the information that makes up the object into the view (for example, the parts and the attributes associated with a class).

To add an embedded component to the view:

1. Open the data view.
2. On the source object side, select the element to add to the data view.

3. Under the **Action** column, click **Add a View Inclusion Component**.
   The object appears to the right of the view editor.



Referenced component

By referencing a component in the view, you can display the object in the view, without embedding all its properties.

You can reference the objects that contain a certain amount of information, such as classes, in the view. For attributes, only the inclusion button is available.

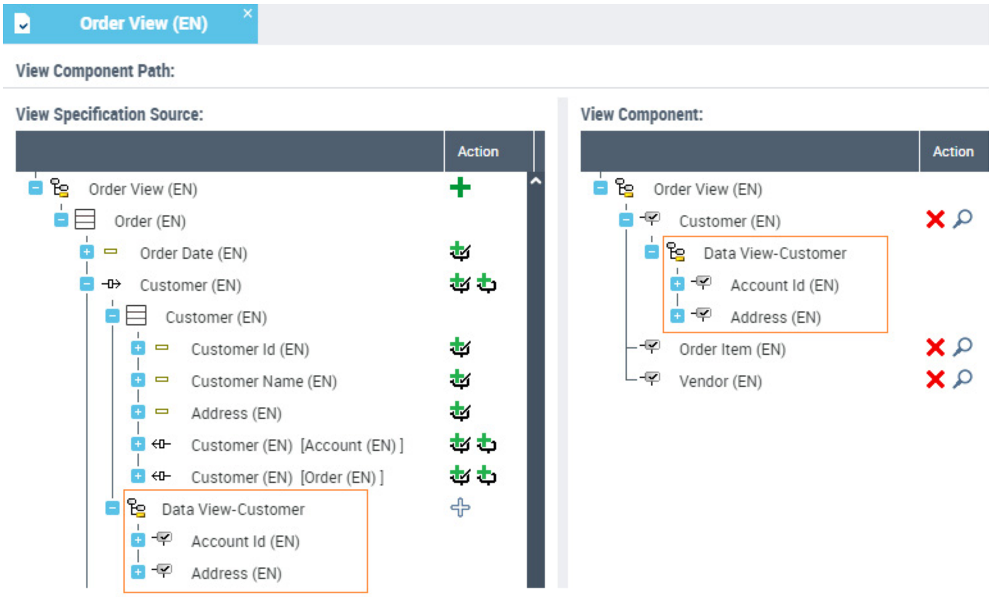
To reference an object in the view:

1. Open the data view.
2. On the source object side, select the element to add to the data view.
3. Under the **Action** column, click **Add a View Referencing Component**.
   The object appears to the right of the view editor.

Using a view in another view

When you embed a class in a data view, all the attributes of the class are added by default to the view. You can limit the list of attributes to those already defined in a view.

```
Below, only the attributes defined in the "Customer" view
(Account Id and Address) are added to the "Order" view.
```



To add a data view (source) to a data view (target) :

1. Open the target data.
2. On the left part, expand the class concerned by the source view to be added.

   ☛ *The source view has been previously embedded in the target view.*

3. Select the source view and under the **Action** column, click ✚ **Add a View**.
   The view associated with the class appears in the right part of the view editor, under the name of the class in question.

CONNECTING THE BUSINESS CONCEPTS TO THE LOGICAL DATA

The business concepts defined in **HOPEX Information Architecture** can be implemented in the IS using the UML method and formalism.

The "Concept realization" work therefore consists of connecting the data model elements with business concepts to:

- define more precisely objects handled at IS architecture level,
- assure improved vocabulary sharing and improved global communication between business users and IS users.

Realization of Concept

Using the "Realization" concept, you can connect logical view elements with dictionary elements.

Dictionary elements can be connected to the following logical elements:

- Classes
- Class attributes

Creating a concept realization

To associate a class with a concept, for example:

1. In the Information Architecture desktop, click on the navigation menu, then **Logical data**.
2. In the navigation pane, expand the "**Packages**" folder.
3. Click **Package Hierarchy**.
   The list of packages in the repository appears in the edit window.
4. Expand the package folder that interests you.
5. Select the class that you want to connect to a concept and open its properties.
6. Select the **Characteristics >Realization** page.
7. Click **New**.
   The **Choice of MetaClass** dialog box opens.
8. Select "Realization of Concept" and click **OK**.
   The creation of page opens.
9. In the **Dictionary Entity Realized** field, click **Connect**.
10. In the selection window, select "Concept" and click **Find**.
11. Select the concept that interests you and click **Connect**.
12. In the concept realization creation window, click **OK**.
    The concept realization appears in the properties window with the name of the concept selected.

Creating a concept component realization

In the same way, you can connect a class attribute to a concept component. You must first create a concept realization between the class that holds the attribute and the concept that holds the component.

To connect an attribute to a concept component:

1. Select the attribute concerned and display its properties.

   `For example, select the "Client code" attribute of the "Client" class.`

2. In the properties window, click the drop-down list and select **Characteristics** > **Realizations**.
3. In the **Component Realization** section, click **New**.
4. Select the MetaClass you want to create, that is "Concept component realization", and click **OK**.
   The concept realization creation window appears.
   To select the concept component to be connected to the attribute:
5. In **Concept Component Realization Context**, select the concept realization concerned in the drop-down list.
6. Click the arrow at the right of **Realized component** to see the list of components associated with the concept.
7. Select the concept component and click **OK**.

Realization report

You can use the realization report to view the realization (or implementation) coverage of dictionary elements with another architecture element.

To access the report:

1. Click the navigation menu, then **Reports**.
2. In the navigation pane, select **Realization report**.

Report parameters

This consists of defining report input data.

Parameters	Parameter type	Constraints
List of objects	Org-unit Application Library Capability Class Concept State concept Event concept Concept type Content Exchange contract Concept life cycle Exchange Entity (DM) functionality Business function System process Functional process Business process Organizational process IT service Data view Concept view	One object mandatory.
Responsibles dis-play mode	Show responsibles Show responsibles and percentages Hide responsibles	
Indicators dis-play mode	Boolean	

Report example

The example below enables viewing of the coverage rate of objects specified as parameters.

Note that realizations of structural components of concepts specified as parameters are also displayed.

Covered
Covered by multiple objects
Not Covered

Consultant	Consulting Organization	Training	Training certification	Training Session
Realizer Consultant 100%	**Realizer** Consulting Compagny 100% **Realizer** IT Subsidary 100%	**Realizer** Training 100%		
	Consultant Consultant		Certified consultant	Trainer
	Delivered certification		Granted training	Delivered training
	Proposed training Delivered training Mission			End
				Training occurrence (EN)

The Class Diagram

HOPEX Information Architecture provides two formalisms to describe logical data:

- the data package, to build class diagrams (UML notation)
- the data model, for data diagrams (standard notations, IDEF1X, I.E, Merise) See "The data model", page 25.

Data description in UML notation is carried out in a class diagram.

Creating a Package

A package partitions the domain and the associated work. It is designed to contain the modeled elements. Graphical representation of all or of certain of these elements is in a class diagram.

A database can be connected to a data model from the time of its creation. It is on this database that the different data processing tools can then be run (generation, synchronization etc.). The database package is the default owner of the classes and associations represented in the class diagram.

Creating a Package

To create a package with **HOPEX Information Architecture** :

1. On the desktop, click the navigation menu, then **Logical data**.
2. In the tree on the left, in the **Packages** folder, click **All Packages**.
   The list of packages appears in the edit area.
3. Click the **New** button.
   The dialog box for creating a package opens.
4. Enter the **Name** of the package.
5. If appropriate, enter the name of the **Owner**.
6. Click **OK**.
   The package created is added to the list of packages.

   ☛ *When the **OK** or **Create** buttons are grayed, this is because the requirements for the dialog box in which they appear have not been completed.*

Connecting a Package to a Database

To create a package from a database:

1. Click on the navigation menu, then on **Logical Data**.
2. In the tree to the left, in the **Database** folder, click **All Databases**.
3. Click the database icon and select **New** > **Data Package**.

To connect an existing package to a database:

- Right-click the database and select **New** > **Data Package**.

Creating a Class Diagram

A class diagram is used to represent the static structure of a system, in particular the types of objects manipulated in the system, their internal structure, and the relationships between them.

A class diagram includes:

- Classes, which represent the basic concepts (client, account, product, etc.).
- Parts, which define the relationships between the different classes.
- Attributes which define the characteristics of classes.
- Operations, which can be executed on objects of the class.

> ☛ *Operations are not taken into account by **HOPEX Information Architecture** tools (synchronization, generation etc.).*

To create the class diagram of a package in **HOPEX Information Architecture**:

1. On the desktop, click the navigation menu, then **Logical data**.
2. In the tree to the left, click in the packages list.
   The list of packages appears in the edit area.
3. Click the icon of the package concerned and select **New > Class Diagram**.

The new class diagram opens.

Note that when you create a package from a database, a class diagram is automatically created at the same time.

For more details on building a class diagram, see "The Class Diagram".

THE DATA MODEL

To help you describe logical data, **HOPEX Information Architecture** offers a simple notation to represent all current cases based on the data model.

A data model is used to represent the static structure of a system, particularly the types of objects handled in the system, their internal structure, and the relationships between them.

At the physical layer of **HOPEX Information Architecture**, data models can be mapped with physical models.

The following points are covered here:

Specific notations are also available:

- ✓
- ✓ The UML notation: see “The class diagram”. ->**Modifier lien pour l’impression**

DATA MODELING PRINCIPLES

Data modeling consists of identifying the entities representing the activity of the company, and defining the associations existing between them. The entities and associations in the data diagram associated with a sector of the company must be sufficient to provide a complete semantic description. In other words, one should be able to describe the activity of a company by using only these entities and associations.

This does not mean that each word or verb used in this explanation corresponds directly to an object in the data diagram. It means that one must be able to state what is to be expressed using these entities and associations.

Data model specification is often considered the most important element in modeling of an information system.

Summary of Concepts

Data model

A data model is used to represent the static structure of a system, particularly the types of objects manipulated in the system, their internal structure, and the relationships between them.

A data model is a set of entities with their attributes, the associations existing between these entities, the constraints bearing on these entities and associations, etc.

Data diagram

A data diagram is a graphical representation of a model or of part of a model.

A data diagram is represented by:

- *Entities*, which represent the basic concepts (customer, account, product, etc.).
- *Associations*, which define the relationships between the different entities.
- *Attributes*, which describe the characteristics of entities and, in certain cases, of associations.

The attribute or set of attributes that enables unique identification of an entity is called an identifier.

The data diagram also contains multiplicity definitions.

BUILDING A DATA MODEL

For the HOPEX Windows Front-End version, see the guide in .pdf format delivered on the Support site.

Creating a Data Model

Use of data models requires selection of an option. See "Data Modeling Options", page 1.

To create a data model:

1. On the desktop, click on the **Logical data** navigation pane.
2. Display the list of **Data Models**.
   The list of data models appears in the edit area.
3. In the edit area, click **New**.
   The data model mapping creation dialog box opens.
4. In the dialog box that appears, enter the name of the data model, and an owner if necessary.
5. Click **OK**.
   The data model created appears in the list of data models.

Creating a Data Diagram

A data diagram is a graphical representation of a model or of part of a model.

To create a data diagram:

- Right-click the data model and select **New > Data Diagram**.
  The data diagram opens.

Datatypes

A type is used to group characteristics shared by several attributes.

When you create a data model, the "Datatype Reference" datatype package is automatically connected with it by default. The list of *datatypes* it contains is available on each attribute of entities of the model. You can however assign to it another *datatype package*.

The reference datatype package of a data model is displayed in the properties dialog box of the model, in the **Characteristics** tab.

For more detailed information, see "Datatype Packages", page 100.

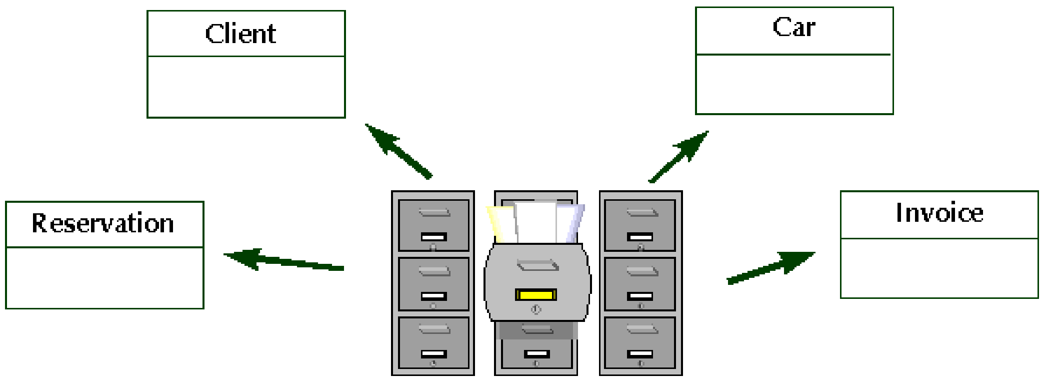
ENTITIES

An entity groups objects that share the same characteristics and have similar behavior. Entities are management elements considered useful for representing enterprise activity, and are therefore reserved for this purpose. They may, for example, have corresponding tables in a database.

An *entity* is described by a list of attributes.

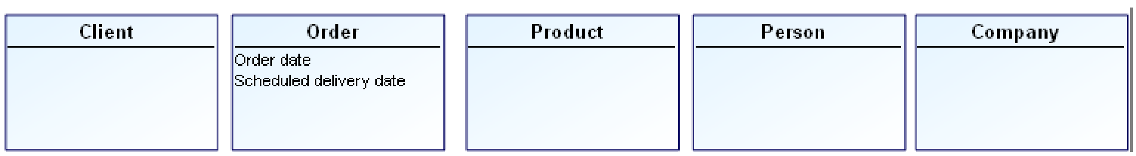
An entity is linked to other entities via associations. The set of entities and associations forms the core of a data model.

We can illustrate the entity concept by comparing entities to index cards filed in drawers.



Entities can represent management objects.

`Examples: Customer, Order, Product, Person, Company, etc.`



Entities can represent technical objects used in industry.

`Examples: Alarm, Sensor, Zone`

Creating an entity

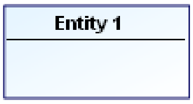
To create an entity:

1. In the data diagram insert toolbar, click the **Entity** button.

2. Click in the diagram.
   The **Add Entity (DM)** dialog box opens.
3. Enter the entity **Name**.

   ☛ *When the **OK** or **Create** buttons are grayed, this is because the requirements for the dialog box in which they appear have not been completed.*

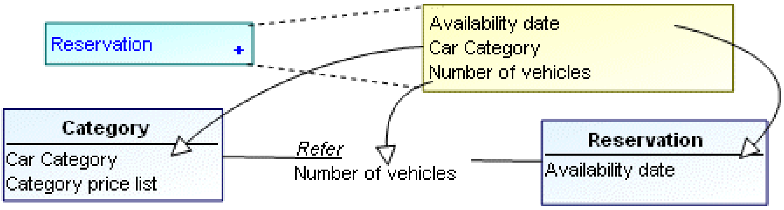
4. Click **Add**.
   The entity appears in the diagram.



☺ *You can create several entities successively without having to click the toolbar each time. To do this, double-click the **Entity** button. To return to normal mode, press <Esc>, or click on another button in the toolbar such as the arrow.*

Attributes

Entities and associations can be characterized by *attributes*.



These attributes can be found by studying the content of messages circulating within the enterprise.

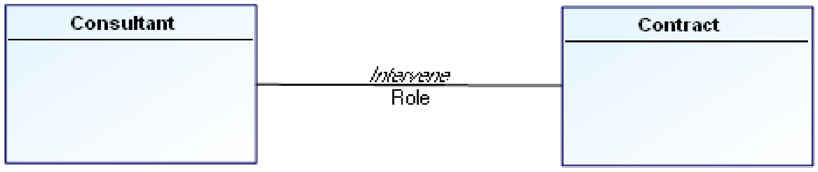
An attribute is the most basic data saved in the enterprise information system. An attribute is a property when it describes an entity or association, and an identifier when selected as a means of identification of each instance of an entity.

Examples:

- "Client Name" (property of the client entity).
- “Client No.” (identifier of the client entity).
- “Account Balance” (property of the account entity).

An attribute characterizes an association when the attribute depends on all the entities participating in the association.

In the diagram below, the role that a “Consultant” plays in a “Contract” depends on the consultant and on the contract, and therefore on the “Intervene” association.



Creating attributes

To create an attribute on an entity:

1. Right-click the entity and select **Properties**.
   The entity properties dialog box opens.
2. Click the drop-down list then **Attributes**.
   The Attributes page appears.
3. Click the **New** button.
   A default name is automatically proposed for the new attribute. You can modify this name.
4. Click **OK**.

You can specify its **Data type**.

`Example: Numeric value.`

☛ *See "Attribute Types", page 99 for more details on data types that can be assigned to an attribute.*

Inherited attributes

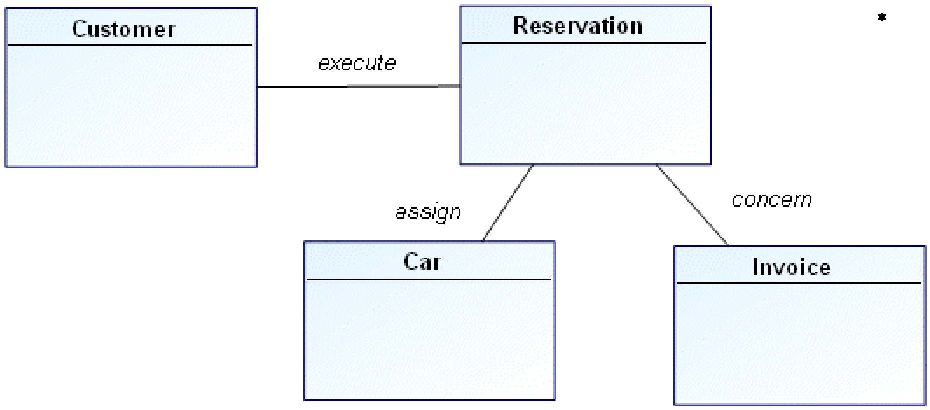
When a generalization exists between a general entity and a more specialized entity, the specialized entity inherits the attributes of the general entity.

See "Generalizations", page 44.

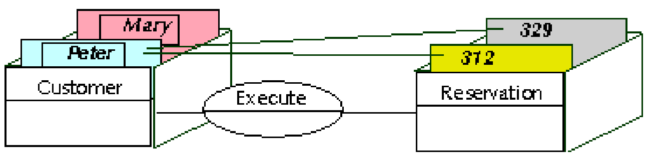
ASSOCIATIONS

An association is a relationship that exists between two or more entities. It can carry attributes that characterize the association between these entities

Associations can be compared to links between index cards.



The following drawing provides a three-dimensional view of the situations a data diagram can store.



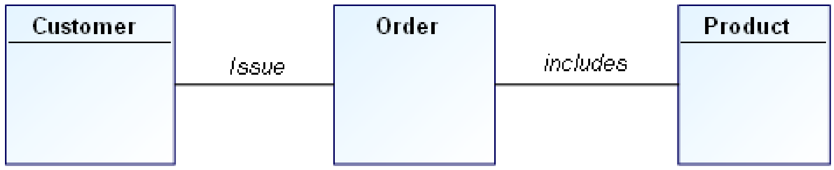
Peter and Mary are clients. Peter has made reservations numbers 312 and 329.

A data diagram should be able to store all situations in the context of the company, but these situations only.

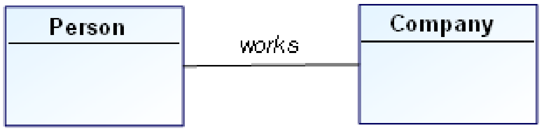
☛ *The diagram should not allow representing unrealistic or aberrant situations.*

Examples of associations:

- A client issues an order.
- An order includes several products.



- A person works for a company.



- An alarm is triggered by a sensor.
- A sensor covers a zone.
- A window displays a string of characters.

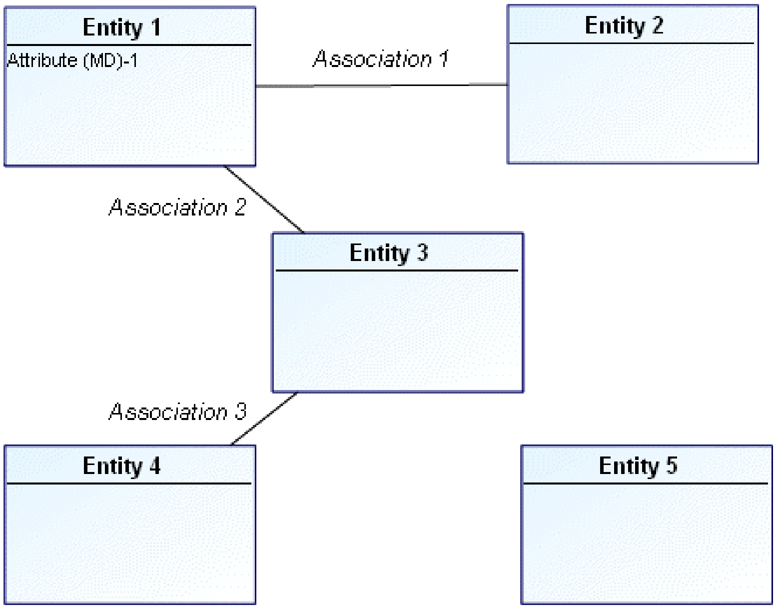
Creating an Association

To create an association:

1. In the data diagram objects toolbar, click the **Association** button.
2. Click one of the entities concerned, and holding the mouse button down, drag the mouse to the other entity, before releasing the button.
   A line appears in the diagram to indicate the association.
3. To specify the association name, right-click the association and select **Properties**.

   ☛ *Make sure you click on the line indicating the association and not one of the roles located at the ends of the association.*
4. In the **Characteristics** page, in the **Local Name** field, enter the association name.
5. Click **OK**.

Example



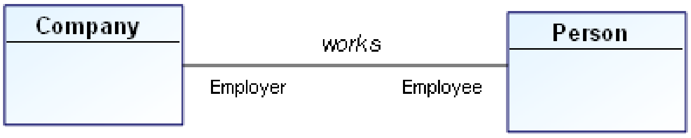
You can also delete an element or link you created in error by right-clicking it and selecting **Delete**.

Defining association roles (ends)

A role enables indication of one of the entities concerned by the association. Indication of roles is particularly important in the case of an association between an entity and itself.

Each end of an association specifies the role played by the entity in the association.

The role name is distinguished from the association name in the drawing by its position at the link end. In addition, the role name appears in a normal font, while the association name is italicized.



☺ *The status bar (located at the bottom of the window) also allows identification of the different zones: when you move your mouse along the association, it indicates if you are on an association or on a role.*

When two entities are linked by only one association, the names of the entities are often sufficient to describe the role. Role names are useful when several associations link the same two entities.

Multiplicities

Each role in an association has an indicated multiplicity to specify how many objects in the entity can be linked to an object in the other entity. Multiplicity is information related to the role and is specified as a completely bounded expression. This is indicated in particular for each role that entities play in an association.

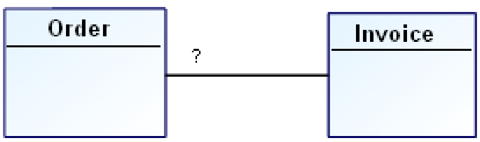
Multiplicity specifies the minimum and maximum number of instances of an entity that can be linked by the association to each instance of the other entity.

The usual multiplicities are "1", "0..1", "*" or "0..*", "1..*", and "M..N" where "M" and "N" are integers:

- The "1" multiplicity indicates that each object of the entity is linked by this association once and once only.
- The "0..1" multiplicity indicates that at most one instance of the entity can be linked by this association.
- The "*" or "0..*" multiplicity indicates that any number of instances of the entity can be linked by the association.
- The "1..*" multiplicity indicates that at least one instance of the entity is linked by the association.
- The "M..N" multiplicity indicates that at least M instances and at most N instances of the entity are linked by the association.

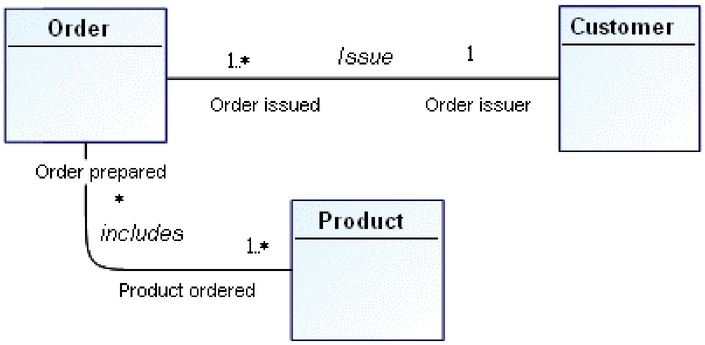
1	One and one only
0 / 1	Zero or one
M..N	From M to N (natural integer)
*	From zero to several
0..*	From zero to several
1..*	From one to several

Example:



0 / 1	An order corresponds to zero or at most one invoice.
*	No restriction is placed on the number of invoices corresponding to an order.
1	Each order has one and only one corresponding invoice.
1..*	Each order has one or more corresponding invoices.

Other examples of multiplicity:

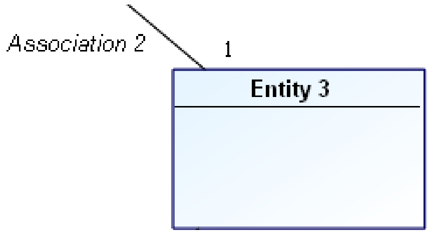


1..*	A client can issue one or more orders.
1	An order is issued by one and only one client.
1..*	An order contains one or more products.
*	A product can be contained in any number of orders, including no orders.
0 / 1	A person works for a company.
1..*	An alarm is triggered by one or more sensors.
1	A sensor covers one and only one zone.
1..*	A window displays one or more strings.

To specify role multiplicity:

1. In the data diagram, right-click the line between the association and the entity, to open the pop-up menu for the role.
2. Click **Properties**.
   The Properties dialog box of the role opens.
3. Click the drop-down list then **Characteristics**.
4. In the **Multiplicity** field, select the required multiplicity.

The representation of the association changes according to its new multiplicities.



☛ *In HOPEX Windows Front-End, multiplicity is also displayed in the role's pop-up menu. If the menu you see does not propose multiplicity, check that you clicked on that part of the line indicating the role and not the association.*

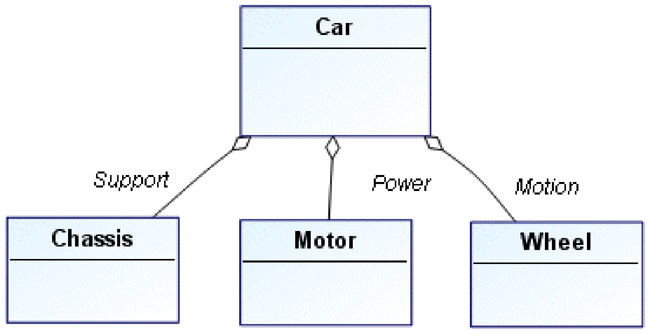
Other association characteristics

Aggregation

Aggregation is a special form of association, indicating that one of the entities contains the other.

Example of *aggregation*:

```
A car includes a chassis, an engine, and wheels.
```



To define the aggregation between the "Car" and "Motor" entities:

1. Right-click the role played by the "Car" entity in its association with the "Motor" entity and select **Properties**.
   Role properties appear.
2. Click **Characteristics**.
3. In the **Whole/Part** field, select "Aggregate".
   A diamond now appears on the role, representing the aggregation.

   ☺ *In HOPEX Windows Front-End you can specify aggregation directly from role's pop-up menu.*

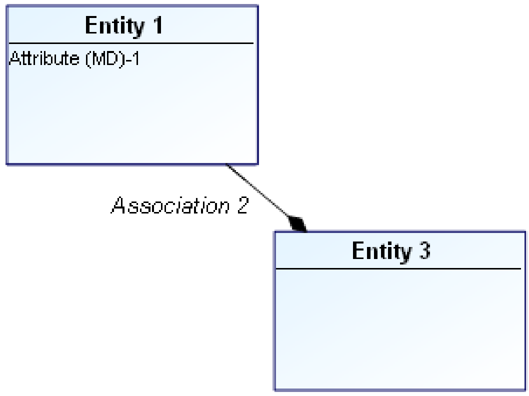
Composition

A composition is a strong aggregation where the lifetime of the components coincides with that of the composite. A composition is a fixed aggregation with a multiplicity of 1.

Example of *composition*:

```
An order consists of several order lines that will no longer
exist if the order is deleted.
```

Composition is indicated by a black diamond.



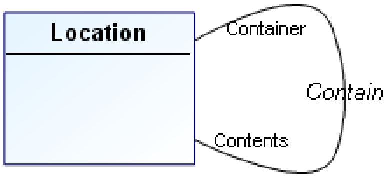
To specify composition of a role:

1. Right-click the role and select **Properties**.
   Role properties appear.
2. Click the drop-down list then **Characteristics**.
3. In the **Whole/Part** field, select "Composite".

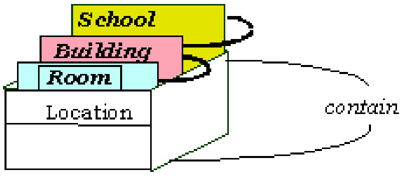
☺ *In HOPEX Windows Front-End you can specify composition directly from role's pop-up menu.*

Using reflexive associations

Certain associations use the same entity several times.



A classroom, a building, and a school are all locations.



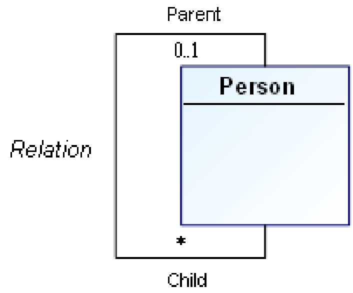
A classroom is contained in a building, which is contained in a school.

A reflexive association concerns the same entity at each end.

To create a reflexive association:

1. In the data diagram objects toolbar, click the **Association** button.
2. Select the entity concerned and drag the mouse outside the entity, then return inside it and release the mouse button.
   The reflexive association appears in the form of a half-circle in a broken line.

   ☛ *If there is association of an entity with itself, the roles need to be named in order to distinguish between the corresponding links in the drawing.*



Below, "Parent" and "Child" are the two *roles* played by the "Person" entity in the association.

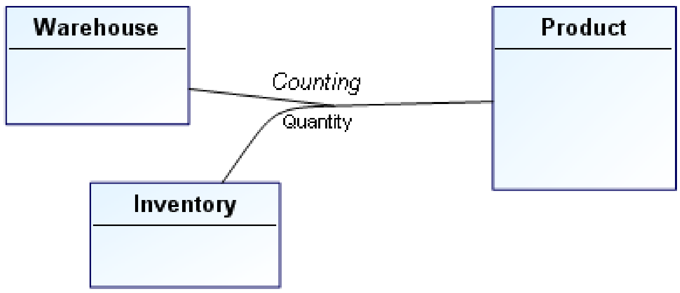
A role enables indication of one of the entities concerned by the association. Indication of roles is particularly important in the case of an association between an entity and itself.

You can segment a line by adding joints to modify its path. You can in particular segment a role to avoid an obstacle for example. You can also change the line to a curve.

Displaying an N-ary Association

Certain associations associate more than two entities. These associations are generally rare.

Example: When taking inventory, a certain quantity of product was counted in each warehouse.



To create a ternary association:

1. In the data diagram, create the association between two entities.
2. Click the **Association Role**  button and connect the third entity to the association.

CONSTRAINTS

A constraint is a declaration that establishes a restriction or business rule that must be applied on execution of processing.

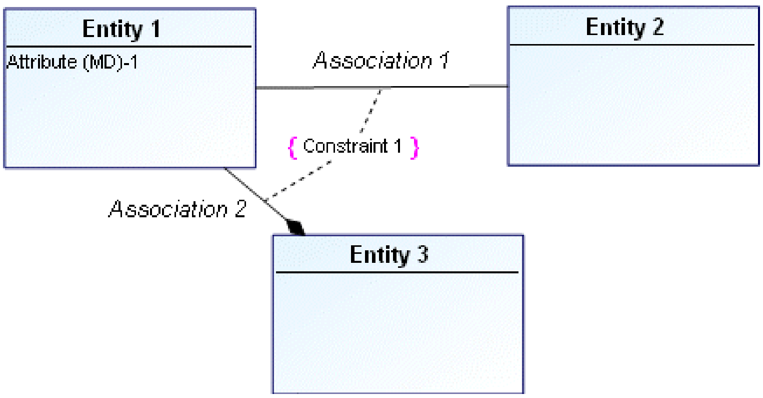
Most *constraints* involve associations between entities.

Examples of constraints:

```
The person in charge of a department must belong to the
department.

Any invoiced order must already have been delivered.

The delivery date must be later than the order date.

A sensor covering a zone can trigger an alarm for that zone
only.
```

To create a constraint:

1. In the diagram insert toolbar, click the **Constraint** button.
2. Then click one of the associations concerned by the constraint, and drag the mouse to the second association before releasing the mouse button.
   The **Add constraint** dialog box opens.
3. Enter the name of the constraint, then click **Add**.
   The constraint then appears in the drawing.



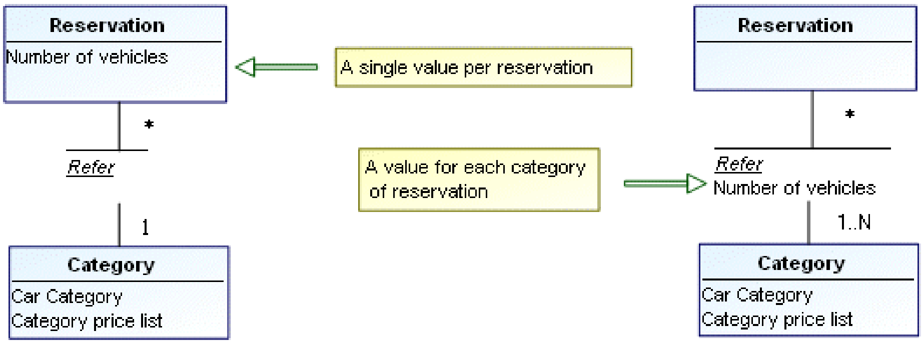
☺ *Save your work regularly using the **Save** button.*

Normalization Rules

Normal forms are rules that are designed to avoid modeling errors. Currently, there are six or seven normal forms. We will discuss the first three.

First Normal Form

Rule: The value of an attribute is uniquely set when the object(s) concerned are known.

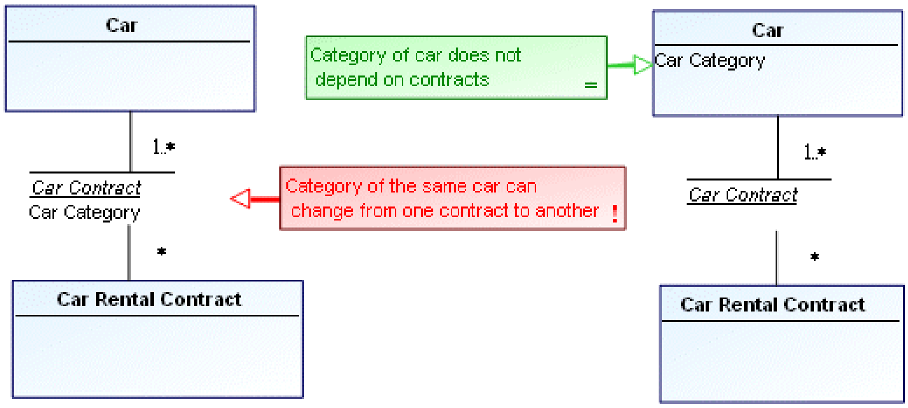


If the number of vehicles is an attribute of the "Reservation" entity, you can only indicate the total number of vehicles for a reservation. You must therefore make one reservation per category of rental vehicle (multiplicity of 1).

If the number of vehicles is an attribute of the association, you can specify the number of vehicles reserved for each category in the association. You can therefore make a single reservation for several categories of vehicles (multiplicity of 1..N).

Second Normal Form

Rule: The value of an association attribute is set only when all the entities concerned are known.

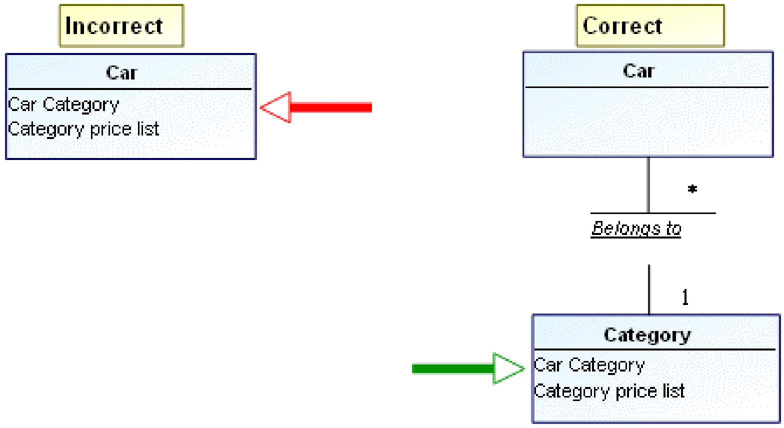


If the car category is an attribute of the "Car Contract" association, this assumes that the car category may change from one contract to the next, which would not be very honest.

If the car category is to be independent of the contract, it must be an attribute of the "Car" entity.

Third Normal Form

Rule: An attribute depends directly and uniquely on the entity it describes.



If the "Category Price List" is an attribute of the "Car" entity, this indicates that two cars in the same category can have a different "Category Price List".

To avoid this, we need to create a “Category” entity that contains the price list.

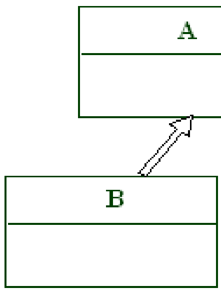
☺ *This rule is used to reveal concepts that were not found during the first draft of the data diagram.*

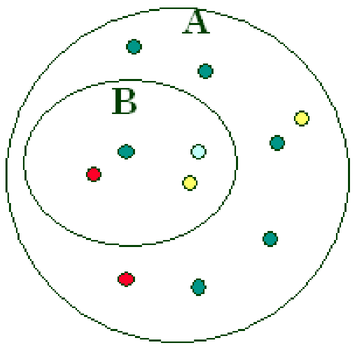
GENERALIZATIONS

See:

What is a generalization?

A generalization represents an inheritance relationship between a general entity and a more specific entity. The specific entity is fully consistent with the general entity and inherits its characteristics and behavior. It can however include additional attributes or associations. Any object of the specific entity is also a component of the general entity.





Entity A is a *generalization* of entity B. This implies that all objects in entity B are also objects in entity A. In other words, B is a subset of A. B is then the sub-entity, and A the super-entity.

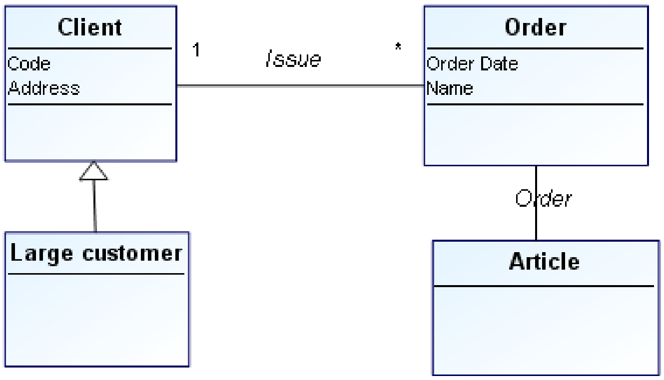
```
Example:
A: Person, B: Bostonian.
```

B being a subset of A, the instances of entity B "inherit" the characteristics of those in entity A.

It is therefore unnecessary to redescribe for entity B:

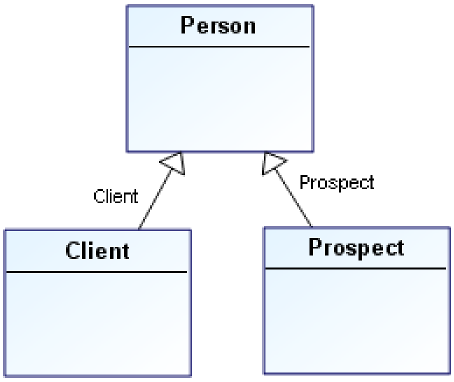
- Its attributes
- Its associations

```
Example:
The "Large Client" entity, representing clients with a 12-
month revenue exceeding $1 million, can be a specialization
of the Client entity (origin).
```



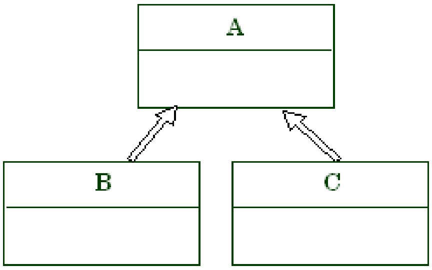
In the above example, the associations and attributes specified for “Client” are also valid for “Large client”.

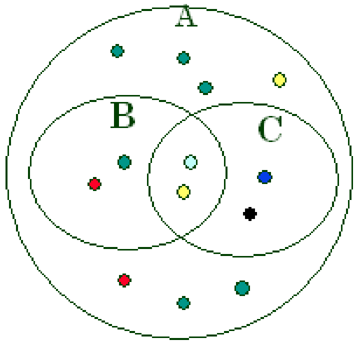
```
Other examples of generalizations:
"prospect" and "client" are two sub-entities of "person".
```




```
"export order" is a sub-entity of the "order" entity.
"Individual person" and "corporate person" are two sub-
entities of the "person" entity.
"polygon", "ellipse" and "circle" are sub-entities of the
"shape" entity.
"oak", "elm" and "birch" are sub-entities of the "tree"
entity.
"motor vehicle", "off-road vehicle" and "amphibious
vehicle" are sub-entities of the "vehicle" entity.
"truck" is a sub-entity of the "motor vehicle" entity.
```

Multiple sub-entities

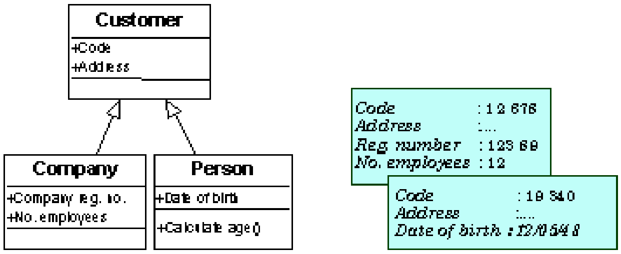




Several sub-entities of the same entity:

- are not necessarily exclusive.
- do not necessarily partition the set.

Advantages of sub-entities

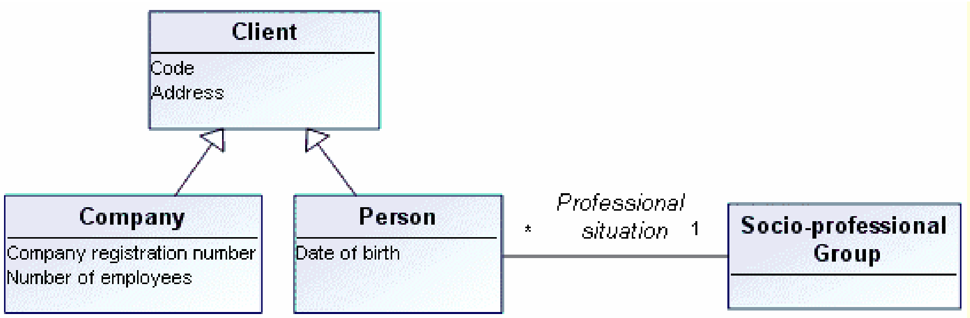


A sub-entity inherits all the attributes and associations of its super-entity, but can have attributes or associations that the super-entity does not have.

A sub-entity can also have specific attributes. These only have meaning for that particular sub-entity. In the above example:

- "Registry number" and "number of employees" only have meaning for a "company".
- "Date of birth" is a characteristic of a "person", not a "company".

A sub-entity can also have specific associations.



- A "person" falls into a "socio-professional group": “manager”, “employee”, “shopkeeper”, “grower”, etc. This classification makes no sense for a “company”. There is also a classification for companies, but this differs from the one for persons.

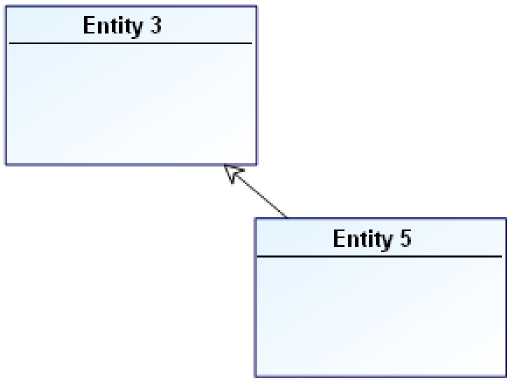
Multiple inheritance

It is sometimes useful to specify that an entity has several super-entities. The sub-entity inherits all the characteristics of both super-entities. This possibility should be used carefully.

Creating a generalization

To create a *generalization*:

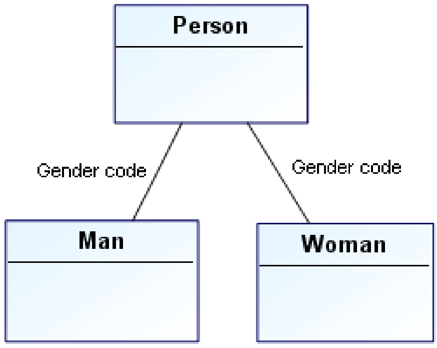
1. In the data diagram insert toolbar, click the **Generalization** button.
2. Click the sub-entity, in this example "Entity 5", and drag the mouse to the general entity, in this example "Entity 3", then release the button. The generalization is now indicated in the diagram by an arrow.



Discriminator

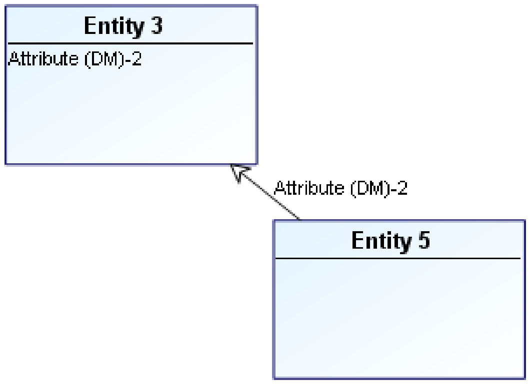
The discriminator is the general entity attribute whose value partitions the objects into the sub-entities associated with the generalization.

For example, the gender code attribute divides the objects in the person entity into the man and woman sub-entities.



To create a discriminator on a generalization:

1. Open properties of the generalization.
2. Click the drop-down list then **Characteristics**.
3. In the **Discriminator** field, click the arrow and select **Connect Attribute (DM)**.
4. Find ans select the discriminator among the super-entity attributes. Once selected, the discriminator is displayed on the generalization.



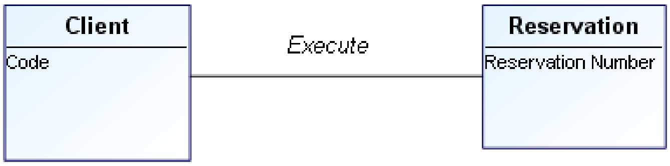
☛ *You can also indicate if the generalization is **Complete**: in this case all instances of the generic entity belong to at least one of the category entities of the generalization.*

IDENTIFIERS

Defining an Entity Identifier

Each object has an identity that characterizes its existence. The *identifier* provides an unambiguous way to distinguish any object in an entity. It is one way to distinguish between two objects with identical attribute values.

An identifier consists of one or several mandatory attributes or roles that enable unique identification of an entity.



Customer number 2718 executes Reservation number 314159.

Each entity has a unique identifier whose value can be used to find each of its instances.

By default, the identifier is implicit. In this case a primary key will be automatically generated from the entity name.

Identification by an attribute

It is also possible to select one of the attributes of the entity as its identifier. To do this:

1. Open properties of the entity.
2. Click the drop-down list then **Attributes**.
   The list of attributes appears.
3. For the chosen attribute, select "Yes" in the **Identifier** column.

*In HOPEX Windows Front-End, a candidate key comprising this attribute is then automatically created for this entity. The corresponding primary key will be created in the table generated for the entity at synchronization of the data model with the relational model using **HOPEX Database Builder**.*

Data Model Mapping

Data modeling reflects the activity of an enterprise and is based on the business function history. Differences observed between models are generally cultural or linked to conventions that vary from one person to another and over time. In addition, in expressing a business function requirement, the modeler must take account of what already exists and reconcile different views of the same reality.

Mapping of data models simplifies alignment of this heterogeneous inheritance on a common semantic base.

Functional Objectives

Distinguishing enterprise definitions and business function data

To ensure consistency of business function data, modelers can refer to enterprise definitions serving as the reference framework.

Data model mapping establishes a distinction between enterprise level definitions and business function data, while assuring traceability. The Dictionary tool supplements this approach, enabling compilation of business function vocabulary structured as a dictionary.

For more detailed information about dictionary, see HOPEX Common Features.

Integrating existing models

Existing models describing applications assets must be taken into account when creating new models or at the time of a revision project. Requirements vary according to use cases:

- "As-is to-be" type approach: development of a data model is progressive and is based on a stable reference state, which generally corresponds to data of the system in production.
- Software package installation: each software package (PGI, CRM, etc.) imposes its data model, encouraging a trend towards fragmentation and compartmentalization of the IS. Hence the need to have an independent model, linked to the different imposed models.

Mapping of data models is a means of bringing together the data models from different sources.

Use case

A typical case of data mapping occurs in the context of exchanges between applications, each with their own data models. When the number of applications becomes too high, you can install a reference pivot model that will serve as intermediary between the applications and thus avoid multiplication of mappings.

Running the mapping editor

The mapping editor tool is used to align two data models or to map the logical and physical view of a database. It comprises a mapping tree that juxtaposes the views of two models.

You can run the mapping editor from:

- The HOPEX **Main Menu**
- A data model
- A data package
- A database

To run the mapping editor from the **Main Menu**:

1. Select **Main Menu** >**Mapping Editor**.
   A dialog box appears:
2. Leave the **Create Mapping Tree** default option selected and click **Next**.
3. Indicate the name of the new mapping tree.
4. In the **Nature** list box, select the nature of the tree.
5. In the **Left Object** and **Right Object** frames, from the object types concerned, select the models you wish to align.
6. Click **OK**.
   The editor displays the mapping tree juxtaposing the two models.

When the mapping tree has been created, you can subsequently find it in the mapping editor.

Creating a Mapping

To create a mapping between two objects:

1. In the mapping editor, successively select the two objects concerned.
2. Click the **Create mapping item** button.

> ☛ *In Windows Front-End, you can also create the mapping from the pop-up menu of the last object selected, by clicking **Map**.*

The mapping is created from the last object selected.

Deleting a mapping

To delete a mapping on an object:

- Select the object in question and click the **Delete mapping item** button.

> ☛ *In Windows Front-End, you can also delete a mapping from the pop-up menu of the object selected, by clicking **Undo mapping**.*

Mapping Details

Objects with mappings are ticked green. When you select one of these objects in the mapping tree, its mapping appears in the details window, which by default is at the bottom of the mapping editor. It groups the names of connected objects, the object types and comments where applicable.

Validity state	Left object	Right object	Type	Comment Header
	Client ...	Agency Client ...	Entity - Entity	2007/10/02 11:58:50 (Mister Guide):

Mapping properties

To view mapping properties:

- In the editor details window, select the mapping item and click the **Properties** button.

Object status

Indicators enable indication of status of synchronized objects.

Object status can be characterized as:

Valid

Invalid (when an object has kept a mapping to an object that no longer exists)

No mapping

Mapping source

When you select an object in the tree of one of the models in the editor, you can find its mapping in the other model .

To display an object mapping:

1. Select the object in question.
   If there is a mapping item for the object, it is displayed at the bottom of the mapping editor.
2. Select the mapping item and click the **Locate** button.
   The mapped objects appear in bold in the editor.

Example of mapping between data models

Different modeling levels can cover distinct requirements. Take the example of two data models. A business function data model "Order Management (DM)" is at conceptual level. It describes at business function level how orders should be managed.

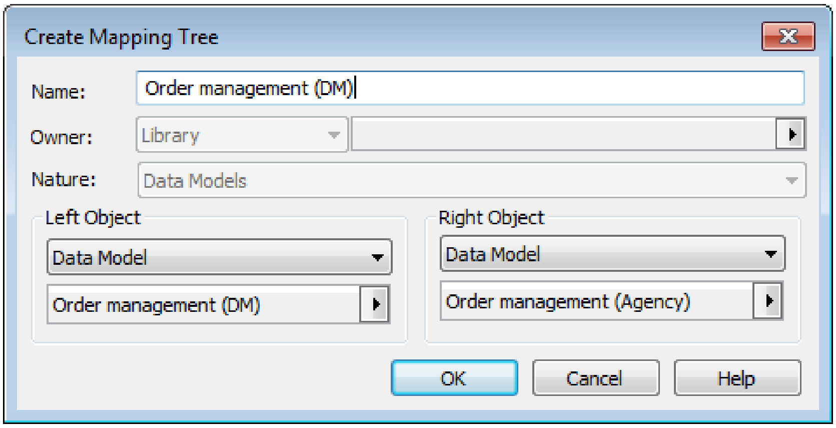
At logical level, the "Order Management (Agency)" data model presents an operational view of IS system data specific to each agency.

We find identical concepts in each of the models. These are however distinct objects.

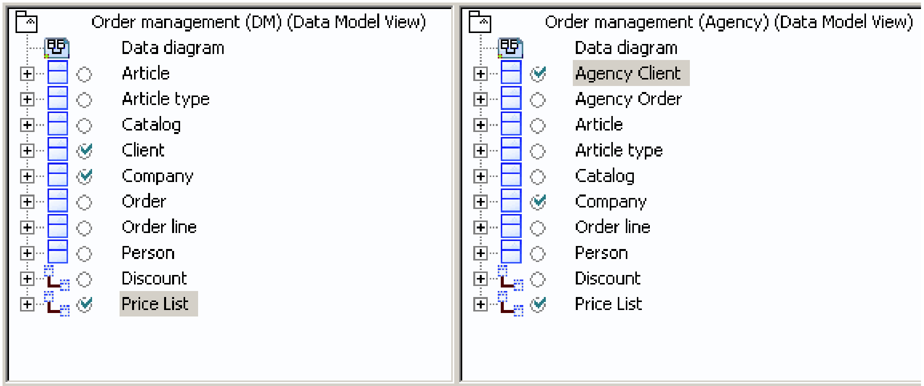
You can map the two data models to favor cohesion between the business function requirements and the systems that support them.

To do this:

1. Open the **Mapping Editor**.
2. Create a mapping tree.
3. Select the two models to be aligned.



4. Click **OK**.
   The editor displays the mapping tree juxtaposing the two models.
5. Create mappings between similar objects and then save.



When models have been mapped, you will know which logical objects is attached to business function objects. You can also analyze the impact of changes carried out at business function level on operational level and vice versa.

Other Notations Available with IA

This chapter presents the other notations available with **HOPEX Information Architecture.**

IDEF1X Notation

Prerequisite

To use the IDEF1X notation, you must select the corresponding option:

1. On the **HOPEX Information Architecture** desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Notation**.
4. In the right-hand side of the window, select the IDEF1X notation:
5. Click **OK**.

About Data Modeling with IDEF1X

Modeling data consists of identifying management objects (entities) and the associations or relationships between these objects, considered significant for representation of company activity.

IDEF1X is used to produce a graphical information model which represents the structure and semantics of information within an environment or system or an enterprise. Use of this standard permits the construction of semantic data models which may serve to support the management of data as a resource, the integration of information systems, and the building of computer databases.

A principal objective of IDEF1X is to support integration. The IDEF1X approach to integration focuses on the capture, management, and use of a single semantic definition of the data resource referred to as a "Conceptual Schema." The "conceptual schema" provides a single integrated definition of the data within an enterprise which is unbiased toward any single application of data and is independent of how the data is physically stored or accessed. The primary objective of this conceptual schema is to provide a consistent definition of the meanings and interrelationship of data which can be used to integrate, share, and manage the integrity of data. A conceptual schema must have three important characteristics:

- It must be consistent with the infrastructure of the business and be true across all application areas.
- It must be extendable, such that, new data can be defined without altering previously defined data.
- It must be transformable to both the required user views and to a variety of data storage and access structures.

The basic constructs of an IDEF1X model are:

- Things about which data is kept, eg., people, places, ideas, events, etc., represented by a box;
- Relationships between those things, represented by lines connecting the boxes; and
- Characteristics of those things represented by attribute names within the box.

Concept Synthesis

In **HOPEX Information Architecture**, a data model (IDEF1X) is represented by:

- Entities, which represent the basic concepts (client, account, product, etc.).
- Associations, which define relationships between the different entities.
- Attributes which define the characteristics of entities.

The attribute that enables unique identification of an entity is called an identifier.

The data model is completed by definition of multiplicities (or cardinalities).

Creating a Data Model (IDEF1X)

To create a data model:

1. In **HOPEX**, click the **Logical data** navigation pane.
2. In the navigation pane, click **All data models**.
3. In the edit area, click **New**.
   The data model mapping creation dialog box opens.
4. Enter the name of the model.
5. Click **OK**.
   The data model appears in the list of data models.

Data Diagram (IDEF1X)

A data diagram is a graphical representation of a model or of part of a model.

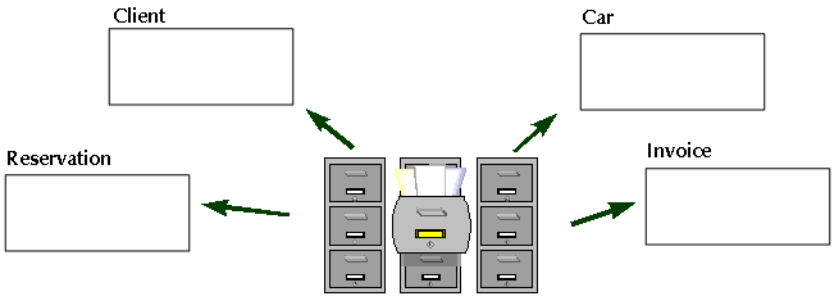
To create a data diagram:

- Right-click the data model and select **New > Data Diagram (IDEF1X)**.
  The data diagram opens.

Entities (IDEF1X)

An entity represents a set of real or abstract things (people, objects, places, events, ideas, combinations of things, etc.) which have common attributes or characteristics An individual member of the set is referred to as an "entity instance."

You can compare the *entity* concept to sheets in files for example.



An entity represents a particular object class, of which all instances can be described in the same way.

An entity is "independent" if each instance of the entity can be uniquely identified without determining its relationship to another entity. An entity is "dependent" if the unique identification of an instance of the entity depends upon its relationship to another entity.

An entity is represented as a box. If the entity is identifier-dependent, then the corners of the box are rounded.

Creating an entity

To create an entity:

1. Click the **Entity** button in the diagram objects toolbar.
2. Click in the diagram.
   The **Add Entity (DM)** dialog box opens.
3. Enter the entity name.
4. Click **Create** (Windows Front-End) or **Add**(Web Front-End).
   The entity appears in the diagram.

Attributes

An attribute represents a type of characteristic or property associated with a set of real or abstract things. An instance of an entity will usually have a single specific value for each associated attribute. An attribute or a combination of attributes can be an identifier when selected as a means of identification of each instance of an entity.

Examples of *attributes*:

- "Client Name" (property of the client entity).
- "Client No." (identifier of the client entity).
- "Account Balance" (property of the account entity).

Defining attributes

To create an attribute:

1. Right-click the entity and select **Properties**.
   The entity properties dialog box opens.
2. Select the **Attributes** tab.
3. To add a new attribute to the entity, click button ⊕ .
   A default name is automatically proposed for the new attribute. You can modify this name.

You can specify its **Data type**.

`Example: Numeric value.`

A datatype is used to group characteristics shared by several attributes. Data types are implemented as classes.

☛ *See "Attribute Types", page 99 for more details on data types that can be assigned to an attribute.*

Inherited attributes

When a categorization relationship (generalization) exists between a general entity and a more specialized entity, the specialized entity inherits the attributes of the general entity.

See "Categorization Relationships (Generalizations) - (IDEF1X)", page 67.

Specifying the entity identifier

To specify the entity identifier:

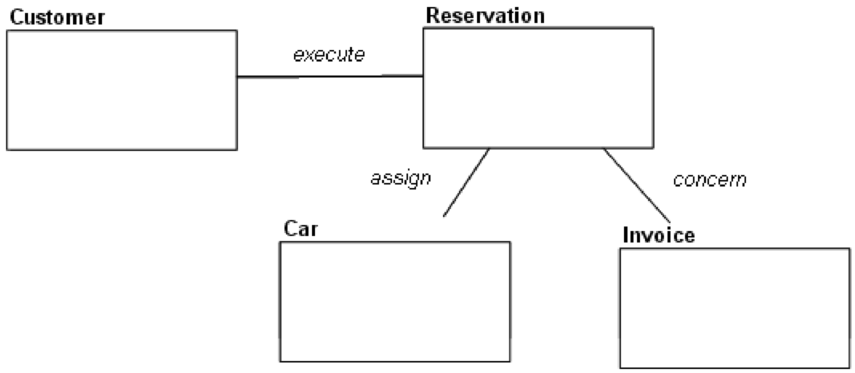
1. Open the properties dialog box of the entity.
2. Select the **Attributes** tab.
3. For the chosen attribute, select "Yes" in the **Identifier** column.

☛ *For more details, see "Defining an Entity Identifier", page 50.*

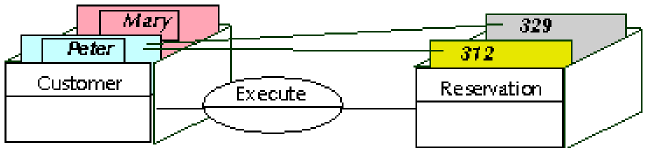
Associations (IDEF1X)

An association is a relationship that exists between two or more entities. It can carry attributes that characterize the association between these entities

Associations can be compared to links between index cards.



The following drawing provides a three-dimensional view of the situations a data diagram can store.



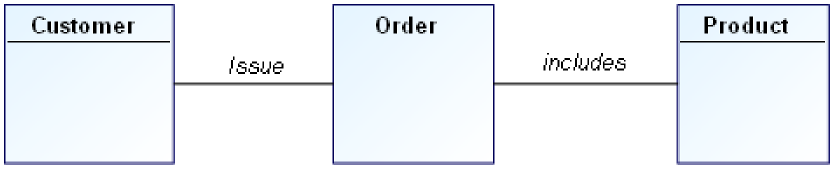
Peter and Mary are clients. Peter has made reservations numbers 312 and 329.

A data diagram should be able to store all situations in the context of the company, but these situations only.

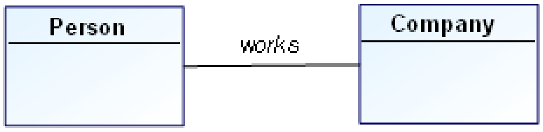
☛ *The diagram should not allow representing unrealistic or aberrant situations.*

Examples of associations:

- A client issues an order.
- An order includes several products.



- A person works for a company.



- An alarm is triggered by a sensor.
- A sensor covers a zone.
- A window displays a string of characters.

Mandatory identifying relationship

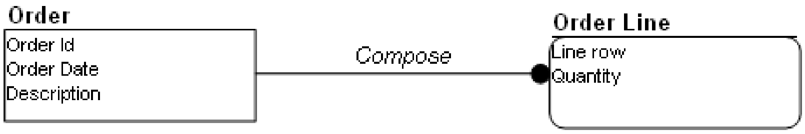
A mandatory identifying relationship is an association between entities in which each instance of one entity is associated with zero, one or more instances of the second entity and each instance of the second entity is associated with one instance of the first entity and identified by this association. The second entity is always an identifier-dependant entity represented by a rounded corner box. The identifying relationship is represented by a solid line with a dot at the dependant entity end of the line.

If an instance of the entity is identified by its association with another entity, then the relationship is referred to as an “identifying relationship”, and each instance of this entity must be associated with exactly one instance of the other entity. For example, if one or more tasks are associated with each project and tasks are only uniquely identified within a project, then an identifying relationship would exist between the entities "Project" and "Task". That is, the associated project must be known in order to uniquely identify one task from all other tasks . The child in an identifying relationship is always existence-dependent on the parent, i.e., an instance of the child entity can exist only if it is related to an instance of the parent entity.

To create an *identifying relationship*:

1. In the diagram objects toolbar, click the **Mandatory identifying relationship** button
2. Click the parent entity, and holding the mouse button down, drag the mouse to the child entity before releasing the button.

The association appears in the diagram. It is represented by a solid line with a dot at the dependent entity end of the line. The shape of the dependent entity is automatically changed to a rounded corner box.



Mandatory Identifying Relationship

In the above example, an order is composed of order lines, and each order line is identified through its association with the order. The order line is a dependent entity represented by a rounded corner box.

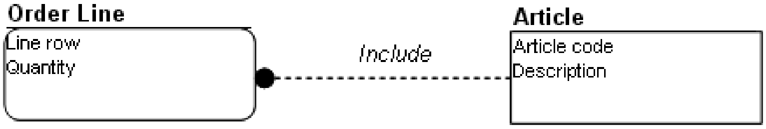
Mandatory non-identifying relationship

A mandatory non-identifying relationship is an association between entities in which each instance of one entity is associated with zero, one or more instances of the second entity and each instance of the second entity is associated with one instance of the first entity but not identified by this association. It is represented by a dashed line with a dot at the dependant entity end of the line.

If every instance of an entity can be uniquely identified without knowing the associated instance of the other entity, then the relationship is referred to as a "non-identifying relationship." For example, although an existence-dependency relationship may exist between the entities "Buyer" and "Purchase Order", purchase orders may be uniquely identified by a purchase order number without identifying the associated buyer.

To create a *non-identifying relationship*:

1. In the diagram objects toolbar, click the **Mandatory non-identifying relationship** button
2. Click the parent entity, and holding the mouse button down, drag the mouse to the child entity before releasing the button.
   The association appears in the diagram.



Mandatory Non-Identifying Relationship

In the above example, an order include one article, but is not identified through its association with the article.

Mandatory Non-Identifying Relationship

An optional relationship is an association between entities in which each instance of one entity is associated with zero, one or more instances of the second entity and each instance of the second entity is associated with zero or one instance of the first entity. It is represented by a dashed line with a dot at the second entity end of the line and a small diamond at the other end.

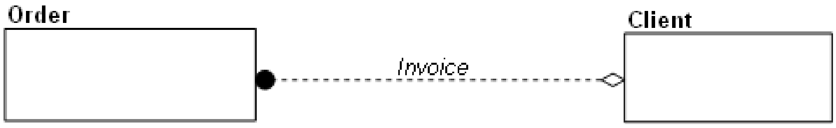
In an *optional non-identifying relationship*, each instance of the child entity is related to zero or one instances of the parent entity.

An optional non-identifying relationship represents a conditional existence dependency. A dashed line with a small diamond at the parent end depicts an optional non-identifying relationship between the parent and child entities.

An instance of the child in which each foreign key attribute for the relationship has a value must have an associated parent instance in which the primary key attributes of the parent are equal in value to the foreign key attributes of the child.

To create an optional non-identifying relationship:

1. In the diagram insert toolbar, click the **Optional relationship** button .
2. Click the parent entity, and holding the mouse button down, drag the mouse to the child entity before releasing the button.
   The association appears in the diagram.



Optional relationship

In the above example, an order should be invoiced to a client, but it is not mandatory (delivery problems, etc.).

non-specific relationship

A non-specific relationship is an association between entities in which each instance of the first entity is associated with zero, one or many instances of the second entity and each instance of the second entity is associated with zero, one or many instance of the first entity. It is depicted as a line drawn between the two associated entities with a dot at each end of the line.

Non-specific relationships are used in high-level Entity-Relationship views to represent many-to-many associations between entities.

In the initial development of a model, it is often helpful to identify "non-specific relationships" between entities. These non-specific relationships are refined in later development phases of the model.

A non-specific relationship, also referred to as a "many-to-many relationship," is an association between two entities in which each instance of the first entity is associated with zero, one, or many instances of the second entity and each instance of the second entity is associated with zero, one, or many instances of the first entity. For example, if an employee can be assigned to many projects and a project can have many employees assigned, then the connection between the entities "Employee" and "Project" can be expressed as a non-specific relationship. This non-specific relationship can be replaced with specific relationships later in the model development by introducing a third entity, such as "Project Assignment", which is a common child entity in specific connection relationships with the "Employee" and "Project" entities. The new relationships would specify that an employee has zero, one, or more project assignments. Each project assignment is for exactly one employee and exactly one project. Entities introduced to resolve non-specific relationships are sometimes called "intersection" or "associative" entities.

A non-specific relationship may be further defined by specifying the cardinality from both directions of the relationship.

To create a non-specific relationship:

1. In the diagram insert toolbar, click the **non-specific relationship** button .
2. Click the first entity, and holding the mouse button down, drag the mouse to the second entity before releasing the button.
   The association appears in the diagram.

non-specific relationship

In the above example, an article can appear in zero, one or several catalogs and a catalog can contain zero, one or several articles.

Associative entity

An associative entity is an entity that is introduced to resolve a non-specific relationship or to display attributes as properties of an association.

Non-specific relationships are used in high-level Entity-Relationship views to represent many-to-many associations between entities. In a keybased or fully-attributed view, all associations between entities must be expressed as specific relationships. However, in the initial development of a model, it is often helpful to identify "non-specific relationships" between entities. These non-specific relationships are refined in later development phases of the model.

Entities introduced to resolve non-specific relationships are sometimes called "intersection" or "associative" entities.

To create an *associative entity*:

1. In the diagram objects toolbar, click the **Entity** button
2. Click in the diagram.
   The **Add Entity (DM)** dialog box opens.
3. Enter the associative entity name.
4. Click **Create** (Windows Front-End) or **Add**(Web Front-End).
   The entity appears in the diagram.
5. Click the **Mandatory identifying relationship** button.
6. Click the first entity, and holding the mouse button down, drag the mouse to the associative entity before releasing the button.
   The association appears in the diagram. The shape of the associative entity changes for the a rounded corner box indicating that it is a dependent entity.
7. Create in the same way the second association by clicking the second entity, and holding the mouse button down, dragging the mouse to the associative entity before releasing the button.

You can add attributes to the associative entity.

Associative entity

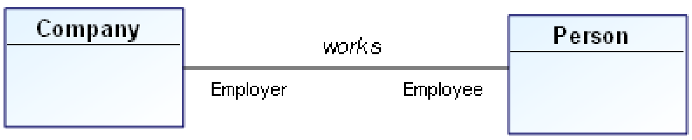
In the above example, an article can be discounted for zero, one or several clients and a client can have discounts for zero, one or several articles. In each case, the discount rate is indicated on the associative class.

Defining Association Roles

A role enables indication of one of the entities concerned by the association. Indication of roles is particularly important in the case of an association between an entity and itself.

Each end of an association specifies the role played by the entity in the association.

The role name is distinguished from the association name in the drawing by its position at the link end. In addition, the role name appears in a normal font, while the association name is italicized.

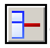


The status bar (located at the bottom of the window) also allows identification of the different zones: when you move your mouse along the association, it indicates if you are on an association or on a role.

When two entities are linked by only one association, the names of the entities are often sufficient to describe the role. Role names are useful when several associations link the same two entities.

Certain associations may associate more than two entities. These associations are generally rare.

To add a role to an association:

1. Click on the **Association Role** button  and connect the association to the entity.

Multiplicities

Each role in an association has an indicated multiplicity to specify how many objects in the entity can be linked to an object in the other entity. Multiplicity is information related to the role and is specified as a completely bounded expression. This is indicated in particular for each role that entities play in an association.

Multiplicity specifies the minimum and maximum number of instances of an entity that can be linked by the association to each instance of the other entity.

The usual multiplicities are "1", "0..1", "*" or "0..*", "1..*", and "M..N" where "M" and "N" are integers:

- The "1" multiplicity indicates that each object of the entity is linked by this association once and once only.
  It is represented as a mandatory relationship with a dot on the role and no dot on the opposite role.
- The "0..1" multiplicity indicates that at most one instance of the entity can be linked by this association.
  It is pictured by a "Z" (for zero) on the role.
- The "*" or "0..*" multiplicity indicates that any number of instances of the entity can be linked by the association.
  This is the default visibility.
- The "1..*" multiplicity indicates that at least one instance of the entity is linked by the association.
  It is pictured by a "P" (for positive) on the role.
- The "M..N" multiplicity indicates that at least M instances and at most N instances of the entity are linked by the association.

1	One and one only
0 / 1	Zero or one (Z)
M..N	From M to N (natural integer)
*	From zero to several
0..*	From zero to several
1..*	From one to several (P)

To specify role multiplicity:

1. Right-click the line between the association and the entity, to open the pop-up menu for the role.
2. Click **Properties**.
   The properties page of the role opens.
3. Click the **Characteristics** tab.
4. In the **Multiplicity** field, select the required multiplicity.

The representation of the association changes according to its new multiplicities.

☛ *In HOPEX Windows Front-End, multiplicity is also displayed in the role's pop-up menu. If the menu you see does not propose multiplicity, check that you clicked on that part of the line indicating the role and not the association.*

Categorization Relationships (Generalizations) - (IDEF1X)

A generalization represents an inheritance relationship between a general entity and a more specific entity. The specific entity is fully consistent with the general entity and inherits its characteristics and behavior. It can however include additional attributes or associations. Any object of the specific entity is also a component of the general entity.

What is a Categorization (Generalization)?

Categorization relationships are used to represent structures in which an entity is a “type” (category) of another entity.

Entities are used to represent the notion of “things about which we need information.” Since some real world things are categories of other real world things, some entities must, in some sense, be categories of other entities. For example, suppose employees are something about which information is needed.

Although there is some information needed about all employees, additional information may be needed about salaried employees which differs, from the additional information needed about hourly employees. Therefore, the entities "Salaried employee" and "Hourly employee" are categories of the entity "Employee". In the IDEF1X notation, they are related to one another through categorization relationships (*generalization*).

In another case, a category entity may be needed to express a relationship which is valid for only a specific category, or to document the relationship differences among the various categories of the entity. For example, a "Full-time employee" may qualify for a "Benefit", while a "Part-time employee" may not.

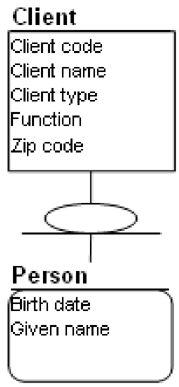
A “categorization relationship” or "generalization" is a relationship between one entity, referred to as the “generic entity”, and another entity, referred to as a “category entity” or "specialized entity". Cardinality is not specified for the category entity since it is always zero or one.

Category entities are also always identifier-dependent.

Creating a Categorization

To create a categorization relationship:

1. Click the **Generalization** button in the objects toolbar.
2. Click the category entity, drag the mouse to the generic entity, then release the button.
   The generalization is pictured in the diagram by an underlined circle. connected by a line to the generic entity and by another line to the category entity.

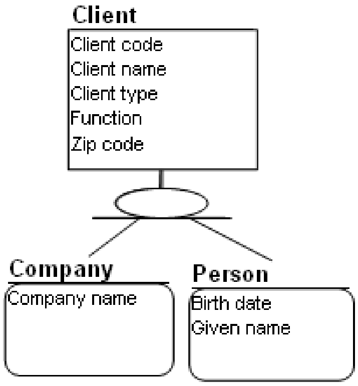


Categorization relationship

In the above example, attributes are interesting on persons that are of no avail for other categories of clients. Person is a dependent entity represented by a rounded corner box.

Multiple Categories

A "category cluster" is a set of one or more categorization relationships. An instance of the generic entity can be associated with an instance of only one of the category entities in the cluster, and each instance of a category entity is associated with exactly one instance of the generic entity. Each instance of the category entity represents the same real-world thing as its associated instance in the generic entity. From the example above, EMPLOYEE is the generic entity and SALARIED-EMPLOYEE and HOURLY-EMPLOYEE are the category entities. There are two categorization relationships in this cluster, one between "Employee" and "Salaried employee" and one between "Employee" and "Hourly employee".



Multiple Categories

In the above example, companies and persons are two categories of clients.

Multiple Category Clusters

Since an instance of the generic entity cannot be associated with an instance of more than one of the category entities in the cluster, the category entities are mutually exclusive. In the example, this implies that an employee cannot be both salaried and hourly. However, an entity can be the generic entity in more than one category cluster, and the category entities in one cluster are not mutually exclusive with those in others. For example, "Employee" could be the generic entity in a second category cluster with "Female employee" and "Male employee" as the category entities. An instance of "Employee" could be associated with an instance of either "Salaried employee" or "Hourly employee" and with an instance of either "Female employee" or "Male employee".

Complete Categorization

In a “complete category cluster”, every instance of the generic entity is associated with an instance of a category entity, ie., all the possible categories are present. For example, each employee is either male or female, so the second cluster is complete. In an “incomplete category cluster”, an instance of the generic entity can exist without being associated with an instance of any of the category entities, ie., some categories are omitted. For example, if some employees are paid commissions rather than an hourly wage or salary, the first category cluster would be incomplete.

It is possible to specify whether a categorization relationship is complete or not in the **Characteristics** tab of the generalization properties dialog box. If the value of the characteristic **Complete** is set to "Yes", then all instances of the generic entity belong to at least one of the category entities of the generalization.

Discriminator

An attribute in the generic entity, or in one of its ancestors, may be designated as the discriminator for a specific category cluster of that entity. The value of the discriminator determines the category of an instance of the generic. In the previous example, the discriminator for the cluster including the salaried and hourly categories might be named "Employee type". If a cluster has a discriminator, it must be distinct from all other discriminators.

To create a discriminator on a generalization:

1. Open properties of the generalization.
2. Click **Characteristics**.
3. In the **Discriminator** field, choose the discriminator among the super-entity attributes.
   Once selected, the discriminator is displayed on the generalization.

I.E. NOTATION

Prerequisite

To use the I.E. notation, you must select the corresponding option:

1. On the **HOPEX Information Architecture** desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Notation**.
4. In the right-hand side of the window, select the I.E. notation:
5. Click **OK**.

About Data Modeling with I.E.

"Information Engineering" was originally developed by Clive Finkelstein in Australia the late 1970's. He collaborated with James Martin to publicize it in the United States and Europe.

Information Engineering is an integrated and evolving set of tasks and techniques for business planning, data modeling, process modeling, systems design, and systems implementation. It enables an enterprise to maximize its resources - including capital, people and information systems - to support the achievement of its business vision.

Business-driven Information Engineering is one of the dominant systems development methodologies used world-wide, as organizations position themselves to compete in the turbulent 1990s and beyond.

Its focus is on data before process, which ensures that organizations identify "what" is required by the business before analysis of "how" it will be provided. IE provides a rich set of techniques for strategic business analysis not reflected in "process first" methodologies.

Information Engineering guides the organization through a series of defined steps that allow it to identify all information important to the enterprise and establish the relationships between those pieces of information. As a result, information needs are defined clearly based on management input, and can be translated directly into systems that support strategic plans.

Most information systems development during the past 25 years has been done from a "stovepipe" or application-specific perspective. The result is that many organizations have separate systems that are incapable of sharing data. In this situation, systems cannot begin to meet their potential and can actually become a burden on the business. IE clearly identifies data sharing requirements throughout the organization so that systems can be integrated accordingly.

Using IE, organizations have a stable yet flexible framework on which subsequent development activities can be based. This eliminates redundancy and leads to the reuse of program modules and the sharing of data required throughout the business, which helps alleviate the maintenance burden.

Modeling data consists of identifying management objects (entities) and the associations or relationships between these objects, considered significant for representation of company activity.

I.E. is used to produce a graphical information model which represents the structure and semantics of information within an environment or system or a company. Use of this standard permits the construction of semantic data models which may serve to support the management of data as a resource, the integration of information systems, and the building of computer databases.

The basic constructs of an Information Engineering data model are:

- Things about which data is kept, eg., people, places, ideas, events, etc., represented by a box;
- Relationships between those things, represented by lines connecting the boxes; and
- Characteristics of those things represented by attribute names within the box.

Concept Synthesis

In **HOPEX Logical Data**, a data model (I.E.) is represented by:

- Entities, which represent the basic concepts (client, account, product, etc.).
- Associations, which define relationships between the different entities.
- Attributes which define the characteristics of entities.

The attribute that enables unique identification of an entity is called an identifier.

The data model is completed by definition of multiplicities (or cardinalities).

Creating a Data Model (I.E)

An I.E. data diagram shows entity-types as square cornered boxes (an entity is any person or thing about which data is stored.) The entity types are associated with one another; for example, a "Product" entity is purchased by a "Customer" entity. Lines linking the boxes show these associations. The lines have cardinality (multiplicity) indicators.

To create a data model:

1. In **HOPEX**, click the **Logical data** navigation pane.
2. In the navigation pane, click **All data models**.

3. In the edit area, click **New**.
   The data model mapping creation dialog box opens.
4. Enter the name of the model.
5. Click **OK**.
   The data model appears in the list of data models.

Data Diagram (I.E.)

A data diagram is a graphical representation of a model or of part of a model. The creation of a diagram varies slightly depending on whether you are in Windows Front-End or Web Front-End.

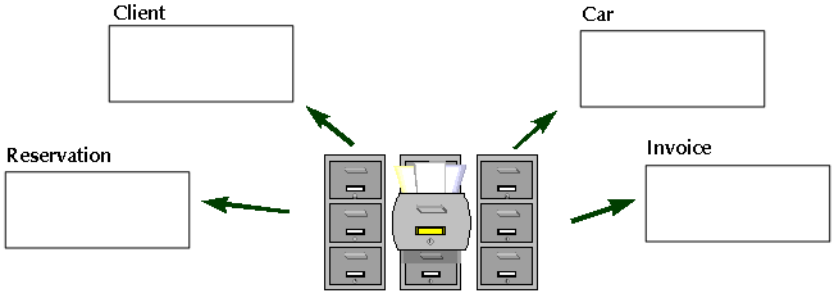
To create a data diagram:

- Right-click the data model and select **New > Data Diagram (I.E)**.
  The data diagram opens.

Entities (I.E.)

An entity represents a person, place, thing or concept that has characteristics of interest to the enterprise. An entity has various attributes that can be stored in the system. Example: Customer, Employee, Order, Invoice, etc.

You can compare the *entity* concept to sheets in files for example.



An entity represents a particular object class, of which all instances can be described in the same way. An entity is represented as a square cornered box.

Creating an entity

To create an entity:

1. Select the **Entity** button in the objects toolbar by clicking it with the left mouse button.
2. Click in the diagram.
   The **Add Entity (DM)** dialog box opens.
3. Enter the entity name.

4. Click **Create** (Windows Front-End) or **Add**(Web Front-End).
   The entity appears in the diagram.

Attributes

Examples of *attributes*:

- "Client Name" (property of the client entity).
- "Client No." (identifier of the client entity).
- "Account Balance" (property of the account entity).

An attribute represents a type of characteristic or property associated with a set of real or abstract things. An instance of an entity will usually have a single specific value for each associated attribute. An attribute or a combination of attributes can be an identifier when selected as a means of identification of each instance of an entity.

Defining attributes

To create an attribute:

1. Right-click the entity and select **Properties**.
   The entity properties dialog box opens.
2. Select the **Attributes** tab.
3. To add a new attribute to the entity, click button ⊕ .
   A default name is automatically proposed for the new attribute. You can modify this name.

You can specify its **Data type**.

```
Example: Numeric value.
```

A datatype is used to group characteristics shared by several attributes. Data types are implemented as classes.

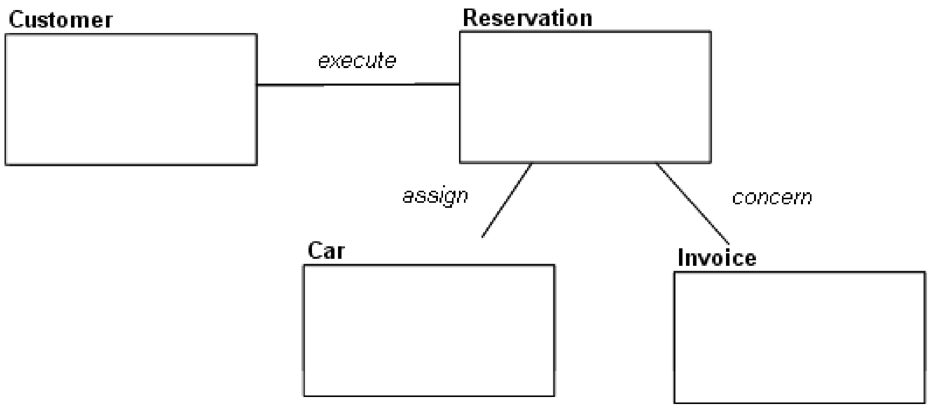
☛ *See "Attribute Types", page 99 for more details on data types that can be assigned to an attribute.*

Associations (I.E)

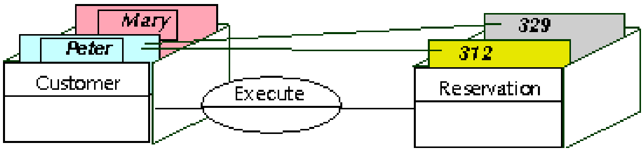
An association is a meaningful link between two objects. Associations are used to capture data about the relationship between two objects.

Overview

Associations can be compared to links between index cards.



The following drawing provides a three-dimensional view of the situations a data diagram can store.



Peter and Mary are clients. Peter has made reservations numbers 312 and 329.

Associations and their Multiplicities

Each role in an association has an indicated multiplicity to specify how many objects in the entity can be linked to an object in the other entity. Multiplicity is information related to the role and is specified as a completely bounded expression. This is indicated in particular for each role that entities play in an association.

To indicate that a role is optional, a circle "O" is placed at the other end of the line, signifying a minimum multiplicity of 0.

To indicate that a role is mandatory, a stroke "|" is placed at the other end of the line, signifying a minimum multiplicity of 1.

A crows-foot is used for a multiplicity of "many".

In conjunction with a multiplicity of 0 or 1, a stroke "|" is often used to indicate a maximum multiplicity of 1.

With this arrangement, the combination "O|" indicates "at most one" and the combination "| |" or just a single "|" indicates "exactly one".

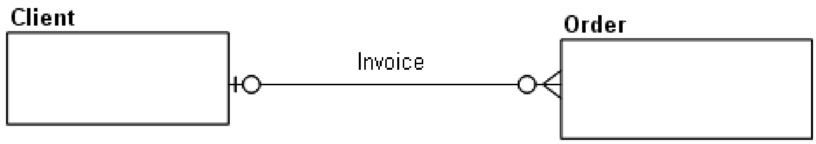
Mandatory relationship

A mandatory relationship means that each instance of the first entity is associated with exactly one instance of the second entity and that the second entity can be associated with zero, one or many instances of the first entity.

In the above example, a client can issue zero, one or many orders, but an order is always issued by one and only one client.

Optional relationship

An optional relationship means that each instance of the first entity is associated with zero or one instance of the second entity and that the second entity can be associated with zero, one or many instances of the first entity.



In the above example, a client can be invoiced for zero, one or many orders, and an order should be invoiced to a client, but it is not mandatory (delivery problems, etc.).

non-specific relationship

A non-specific relationship means that each instance of the first entity is associated with zero, one or many instances of the second entity and that the second entity can be associated with zero, one or many instances of the first entity.

In the above example, an article can appear in zero, one or several catalogs and a catalog can contain zero, one or several articles.

Creating an Association

To create an association:

1. Select the type of association by clicking the corresponding button , or in the objects toolbar.
2. Click one of the entities concerned, and holding the mouse button down, drag the mouse to the other entity, before releasing the button.
   The **Add Association** dialog box opens.
3. Enter the name of the association, then click **Create**.

The association appears in the diagram.

To modify role multiplicity:

1. Right-click the line between the association and the entity, to open the pop-up menu for the role.
2. Click **Properties**.
   The properties page of the role opens.
3. Click the **Characteristics** tab.
4. In the **Multiplicity** field, select the required multiplicity.

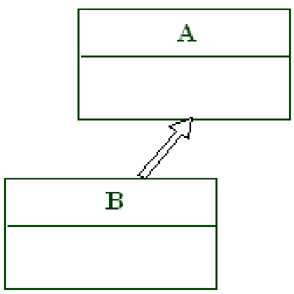
The representation of the association changes according to its new multiplicities.

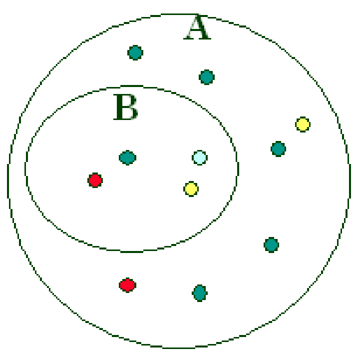
☛ *In HOPEX Windows Front-End, multiplicity is also displayed in the role's pop-up menu. If the menu you see does not propose multiplicity, check that you clicked on that part of the line indicating the role and not the association.*

Sub-types (I.E)

A generalization represents an inheritance relationship between a general entity and a more specific entity. The specific entity is fully consistent with the general entity and inherits its characteristics and behavior. It can however include additional attributes or associations. Any object of the specific entity is also a component of the general entity.

What is sub-type?





An entity B is a *subtype* of entity A. This assumes that all instances of entity B are also instances of entity A. In other words, B is a subset of A. B is then the subtype, and A the supertype.

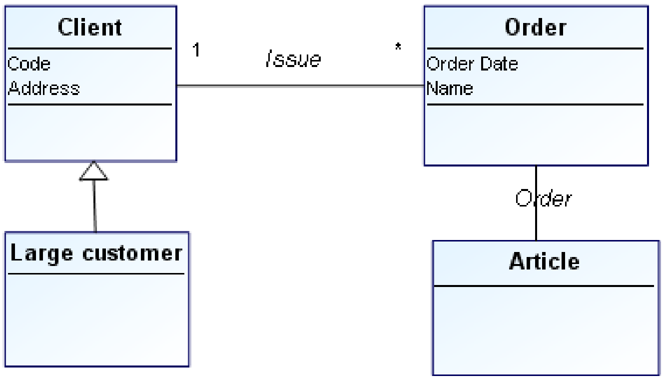
```
Example:

A: Person, B: Bostonian.
```

B being a subset of A, the instances of entity B "inherit" the characteristics of those in entity A.

It is therefore unnecessary to redescribe for entity B:

- Its attributes
- Its associations

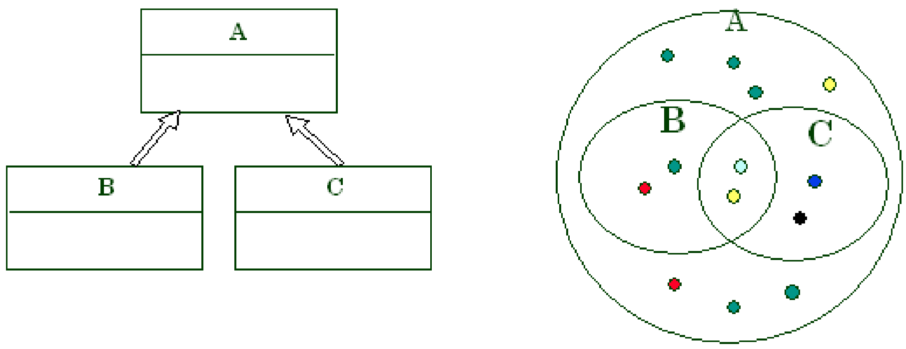
```
Example:

The "Large Client" entity, representing clients with a 12-month revenue exceeding $1 million, can be a subtype of the Client entity.
```



A subtype inherits all attributes, associations, roles and constraints of its supertype, but it can also have attributes, associations, roles or constraints that its supertype does not have.

In the above example, the attributes, associations, roles and constraints specified for "Client" are also valid for "Large Client".

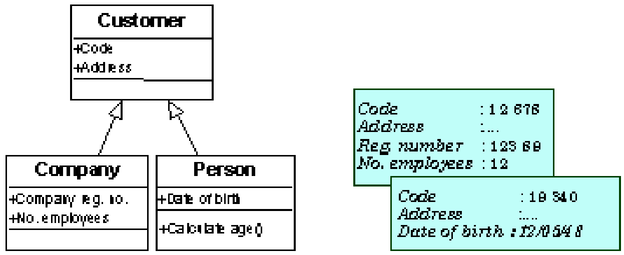
Multiple Subtypes



Several subtypes of the same entity:

- are not necessarily exclusive.
- do not necessarily partition the type.

Advantages of sub-types

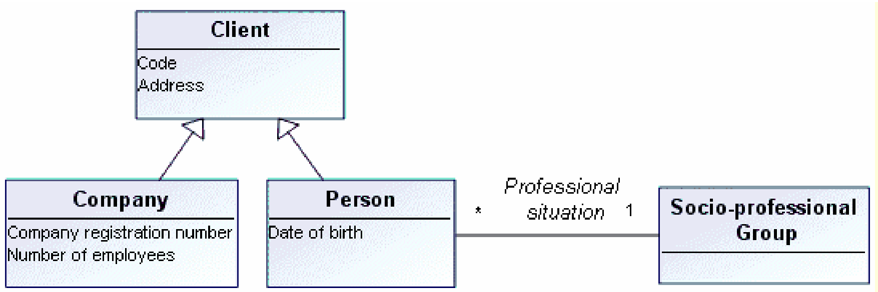


A subtype entity inherits all the attributes and associations of its supertype entity, but can have attributes or associations that the supertype entity does not have.

A subtype entity can also have specific attributes. These only have meaning for that particular sub-entity. In the above example:

- "Registry number" and "number of employees" only have meaning for a "company".
- "Date of birth" is a characteristic of a "person", not a "company".

A subtype entity can also have specific associations.



- A "person" falls into a "socio-professional group": "manager", "employee", "shopkeeper", "grower", etc. This classification makes no sense for a "company". There is also a classification for companies, but it differs from that for persons.

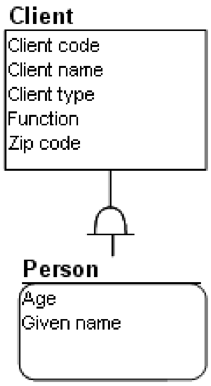
Multiple inheritance

It is sometimes useful to specify that an entity has several supertypes. The subtype inherits all the characteristics of both supertypes. This possibility should be used carefully.

Creating a sub-type

To create a subtype:

1. Click the **Generalization** button in the objects toolbar.
2. Click the subtype entity, drag the mouse to the supertype entity, then release the button.
   The generalization is now pictured in the diagram by an underlined semicircle connected by a line to the supertype entity and by another line to the subtype entity.



In the above example, attributes are interesting on persons that are of no avail for other categories of clients. The subtype entity is represented by a rounded corner box.

The Merise Notation

Prerequisite

To use the Merise notation, you must select the corresponding option:

1. On the **HOPEX Information Architecture** desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Notation**.
4. In the right-hand side of the window, select the Merise notation:
5. Click **OK**.

About Data Modeling

Modeling data consists of identifying management objects (entities) and the associations or relationships between these objects, considered significant for representation of company activity.

The entities, associations and properties that constitute the data model associated with a sector of the company must be sufficient to provide a complete semantic description.

In other words, one should be able to describe the activity of a company by using only the entities, associations and properties that have been selected.

This does not mean that there will be a direct equivalent in the data model for each word or verb in the explanation. It means one must be able to state what is to be expressed, using these entities, associations and properties.

Concept Synthesis

In **HOPEX Information Architecture**, a data model (Merise) is represented by:

- Entities, which represent the basic concepts (client, account, product, etc.).
- Associations, which define relationships between the different entities.
- Attributes (information or properties), which define the characteristics of entities and in certain cases, associations.

The attribute that enables unique identification of an entity is called an identifier.

The data model is completed by definition of cardinalities.

Creating a Data Model (Merise)

To create a data model:

1. In **HOPEX Information Architecture**, click the **Logical data** navigation pane.
2. In the navigation pane, click **All data models**.
3. In the edit area, click **New**.
   The data model mapping creation dialog box opens.
4. Enter the name of the model.
5. Click **OK**.
   The data model appears in the list of data models.

Data Diagram (Merise)

A data diagram is a graphical representation of a model or of part of a model. The creation of a diagram varies slightly depending on whether you are in Windows Front-End or Web Front-End.

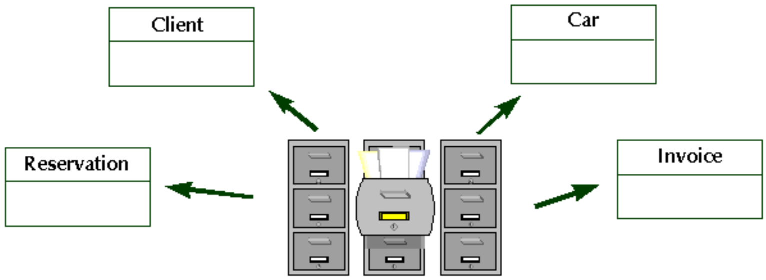
To create a data diagram:

- Right-click the data model and select **New > Data Diagram (Merise)**.
  The data diagram opens.

The entities (Merise)

An entity is a management object considered of interest in representing enterprise activity. An entity is described by a list of informations (properties) linked to the entity. An entity is linked to other entities via associations. The set of entities and associations forms the core of a data model.

You can compare the *entity* concept to sheets in files for example.

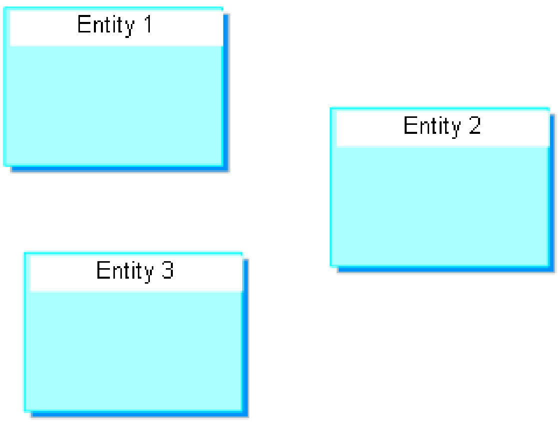


An entity represents a particular object class, of which all instances can be described in the same way.

Creating an entity

To create an entity:

1. Click the **Entity** button in the diagram objects toolbar.
2. Click in the diagram.
   The **Add Entity (DM)** dialog box opens.
3. Enter the entity name.
4. Click **Create** (Windows Front-End) or **Add**(Web Front-End).
   The entity appears in the diagram.



☛ *To continue creating org-units without having to keep clicking on the toolbar, double-click button To return to normal mode, press the Esc key or click on a different button in the toolbar, such as the arrow*

☛ *The objects you have created, and their characteristics and links, are saved automatically each time the pointer changes to the* *shape . The diagram drawing is not saved until you explicitly request this by clicking the **Save** button*

Specifying the entity identifier

To specify the entity identifier:

1. Open the properties dialog box of the entity.
2. Select the **Attributes** tab.
3. For the chosen attribute, select "Yes" in the **Identifier** column.

☛ *For more details, see "Defining an Entity Identifier", page 50.*

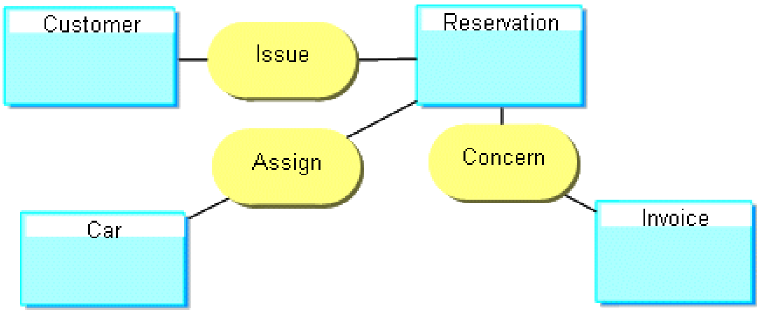
The associations (Merise)

An association is a relationship that exists between two or more entities. An association is said to be binary when it connects two entities, ternary when it connects three, etc. It can carry properties, ie. attributes that characterize association of the entities.

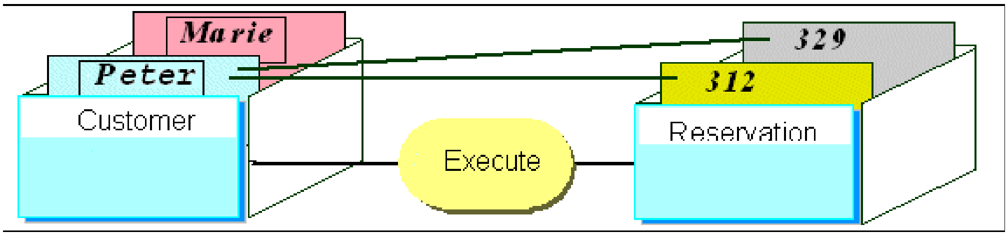
Examples of associations

To model that an "employee" is responsible for a "service" and to specify the "start date" of his or her functions, the following data model is created, where start date is a property of the association.

Other comparison: links between sheets.



The following drawing provides a three-dimensional view of the situations a data model can store.



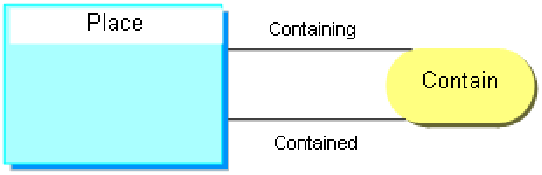
Peter and Mary are clients. Peter has made reservations numbers 312 and 329.

A data model should be able to store all situations in the context of the company, but only these situations.

☛ *The model should not allow representation of unrealistic or aberrant situations.*

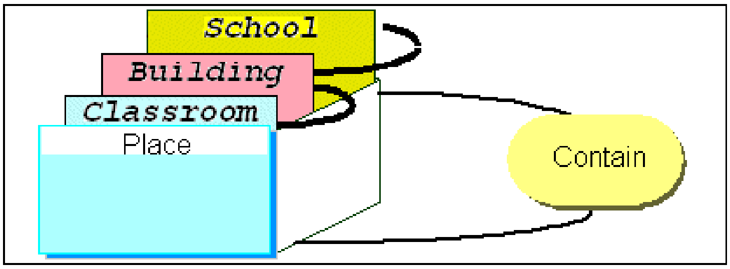
Reflexive relationships

Certain *associations* use the same entity.



Example

A classroom, a building, and a school are all locations.



A classroom is contained in a building, which is contained in a school.

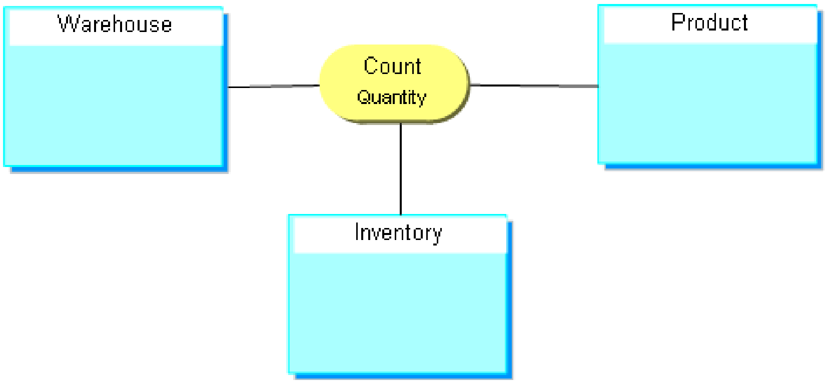
"n-ary" relationships

Certain associations associate more than two entities.

These associations are generally rare.

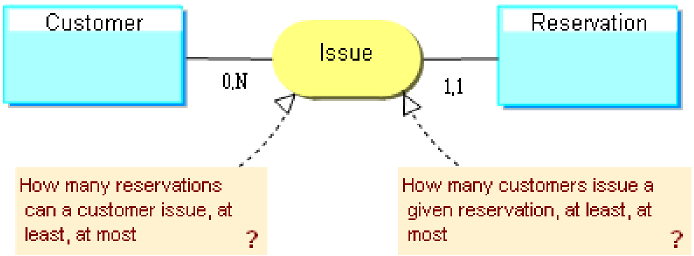
Example

When taking inventory, a certain quantity of product was counted in each warehouse.



Participations or cardinalities

Minimum and maximum cardinalities express the minimum and maximum number of participations of an instance of the entity in an association.

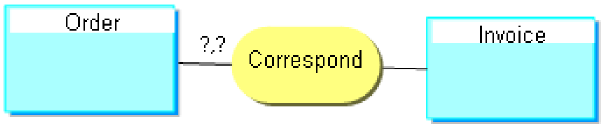


The most common participations or cardinalities are 0,1 1,1 0,N 1,N.

- Optional cardinality: minimum cardinality 0 indicates that the association is not necessarily specified.
- Mandatory participation Minimum cardinality 1 indicates that the association is necessarily specified.
- Unique participation : Maximum cardinality 1 indicates that the entity can be linked by the association once only at most.
- Not unique participation : Maximum cardinality N indicates that the entity can be linked by the association several times.

Example

The following example illustrates the significance of the different cardinalities or participations:



0.1 An order corresponds to zero or at most one invoice.

0,N No restriction is placed on the number of invoices corresponding to an order. This is the default visibility.

1.1 Each order has one and only one corresponding invoice.

1,N Each order has one or more corresponding invoices.

Creating an Association (Relationship)

To create an association:

1. Click the **Association** button in the objects toolbar.
2. Click one of the entities concerned and drag the mouse to the other entity before releasing the button.
   The **Add Association** dialog box appears.
   The arrow at the right of the **Name** box opens a menu that allows you to:
   - **Query** of existing associations, via the **Query** dialog box.
   - **List** associations in the repository.
   - **Create** an association.
3. Enter the name of the association, then click **Create** (Windows Front-End) or **Add**(Web Front-End)
   The association appears in the diagram.

☛ *In case of error, you can delete an object by right-clicking it and selecting the* ***Delete*** *command in its pop-up menu.*

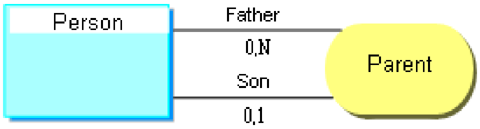
Reflexive relationships

If the creation request is made on an entity without moving the cursor, a reflexive association (also called "reflexive link") is automatically created on the entity.

If there is association of an entity with itself, the roles need to be named in order to distinguish between the corresponding links in the drawing.

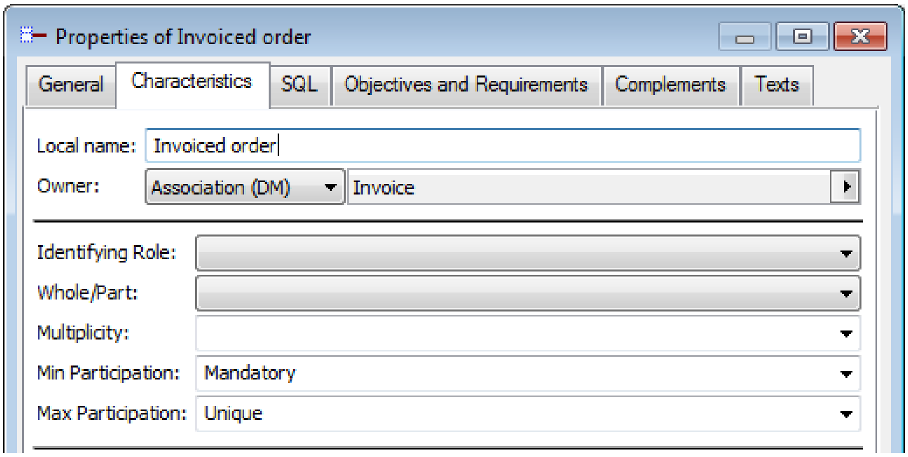
Example:

"Father" and "Son" are the two roles played by the "Person" entity in the "Parent" association.



Specifying participations

In the **Characteristics** tab of the property window of roles, you can indicate the minimum and maximum number of participations of each entity to the relationship (cardinalities).



Attributes (Information) - Merise

Properties

Entities and associations can be characterized by attributes:

These attributes can be found by studying the content of messages circulating within the company.

☛ *An attribute is the most basic data saved in the enterprise information system. An attribute is a property when it describes an entity or association, and an identifier when selected as a means of identification of each instance of an entity.*

A property characterizes an association when the property depends on all the classes participating in the association.

In the diagram below, the “Role” that a “Consultant” plays in a “Contract” depends on the consultant and on the contract, and therefore on the “Intervene” association.

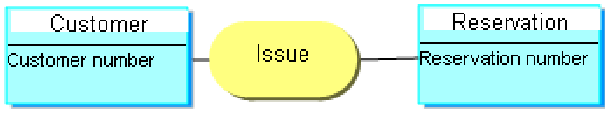
Examples of attributes:

"Client Name" (property of the client entity).

“Client No.” (identifier of the client entity).

“Account Balance” (property of the account entity).

Identifier



Customer number 2718 executes Reservation number 314159.

Each entity has a unique *identifier* whose value can be used to find each of its instances.

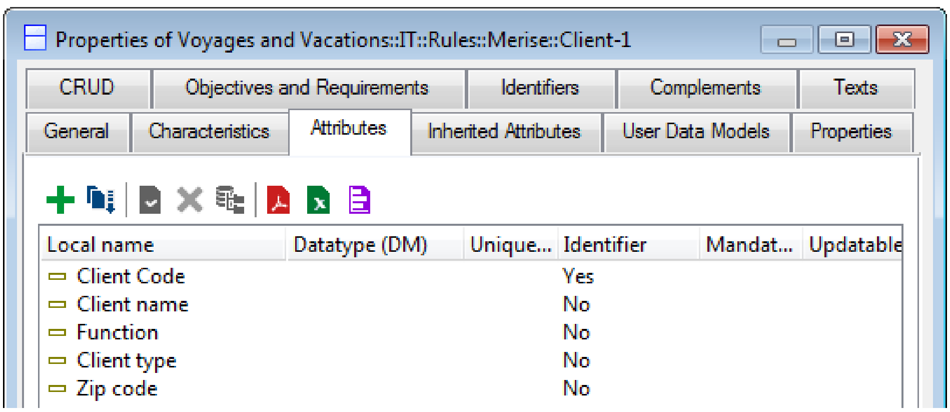
☛ *An identifier consists of one or several mandatory attributes or roles that enable unique identification of an entity.*

By default, associations do not have their own identifiers: an association is identified by the identifiers of the linked entities.

Creating Attributes

Attributes are created in the properties dialog boxes of associations and entities.

The **Attributes** tab of this dialog box shows attributes already linked to the entity or association.



To create an attribute:

› Click the New button and enter the name of the attribute.

You can specify its characteristics (see "Attribute Description", page 94 for further details).

> ☛ *You can specify its **Length**, if necessary complemented by the number of **Decimals**; it should be noted that the number of decimals is not added to the length; an information of length 5 with two decimals being presented in the form " 999.99 ".*

When you have completed this, close the properties dialog box.

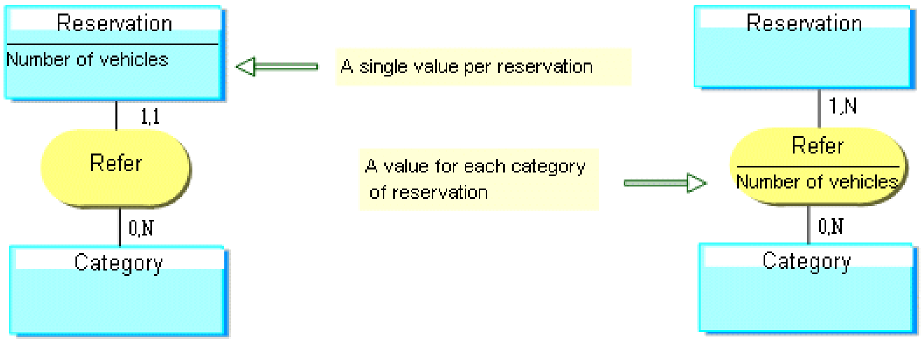
Normalization Rules (Merise)

Normal forms are rules that are designed to avoid modeling errors.

Currently, there are six or seven normal forms. We will discuss the first three.

First Normal Form

The value of an entity (or association) Property is fixed uniquely as soon as the entity concerned is known (concerned entities).

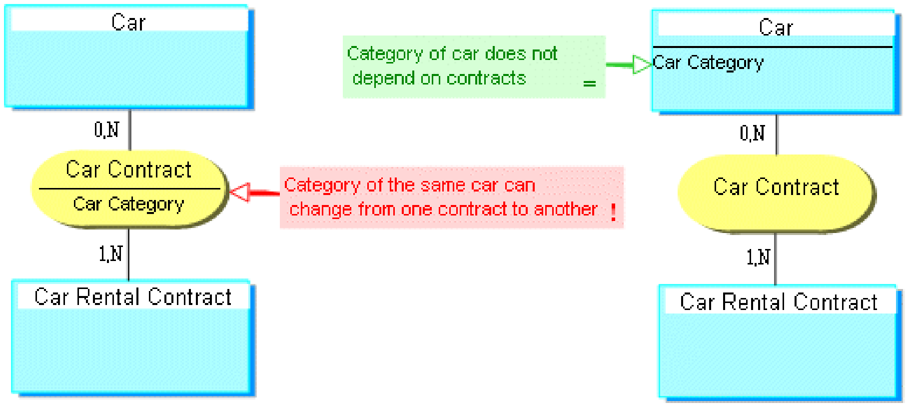


If the number of vehicles is an attribute of the "Reservation" entity, you can only indicate the total number of vehicles for a reservation. You must therefore make one reservation per category of rental vehicle (cardinalities1,1).

If the number of vehicles is an attribute of the association, you can specify the number of vehicles reserved for each category in the association. You can therefore make a single reservation for several categories of vehicle (cardinalities 1,N).

Second Normal Form

The value of an association Property is set only when all the entities concerned are known.

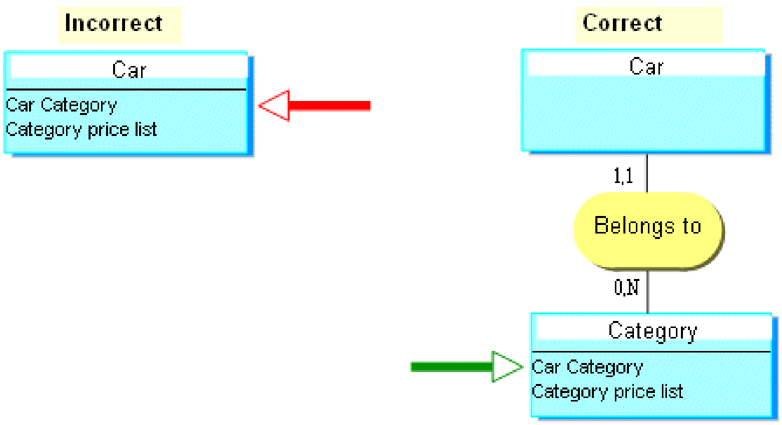


The fact that the car category is an attribute of the "Car Contract" association assumes that the car category may change from one contract to the next, which would not be very honest.

If the car category is to be independent of the contract, it must be an attribute of the "Car" entity.

Third Normal Form

A Property must directly and uniquely depend on the entity it describes.



If the "Category Price List" is an attribute of the "Car" entity, this indicates that two cars in the same category can have a different "Category Price List". To avoid this, we need to create a "Category" entity that contains the price list.

☛ *This rule is used to reveal concepts that were not found during the first draft of the data model.*

Refining Data Model Specification (Merise)

During specification, it is often necessary to complement the data model.

Complements to the specification consist of:

- Specifying Length and Decimal characteristics and documenting attributes.

In the data model, it is also possible to specify:

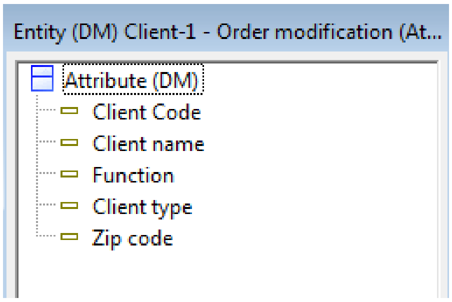
- Sub-type entities.
- Constraints that must be respected by data in documentary terms. These constraints are imposed by checks carried out during data update processing.

Ordering Attributes

The initial order of attributes is their order of creation (or of creation of the link with the entity or association).

To modify this order:

1. In the **Attributes** of the properties dialog box of the object, click the **Reorder**.
   The **Order Modification** dialog box appears.



To reorder attributes:

1. Select the attribute to be moved by clicking its name with the left mouse button.
2. Move the cursor to the desired position; it takes the following shape:
   The attribute is placed in the desired position, and the order of the link with the entity is modified.

This order will be used to generate the order of columns and tables. It will also be used in the document associated with the data model.

Attribute Description

Attributes can be described in two ways:

- By entering this description in the various fields of the list presented in the **Attributes** tab.
- In the properties dialog box of each attribute. This dialog box is opened by selecting **Properties** in the attribute pop-up menu.

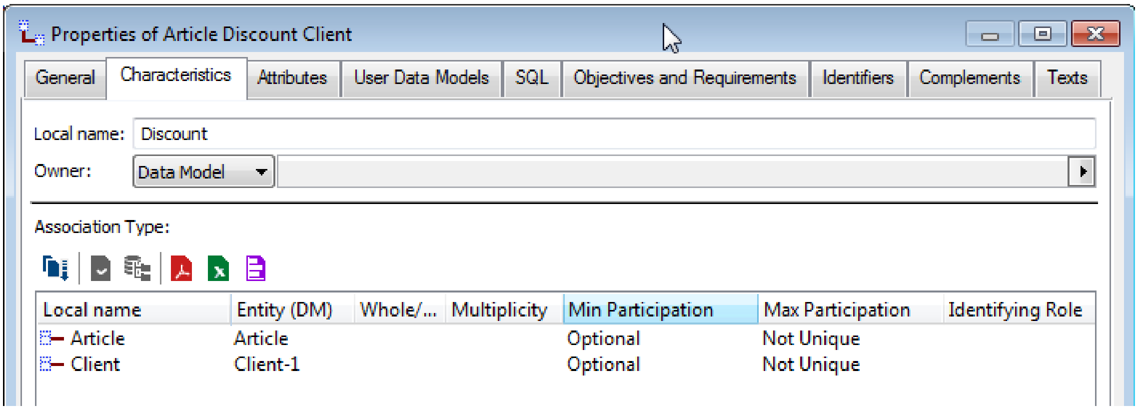
You can enter the attribute characteristics values in the corresponding fields.

- The **Data Type** which is the class used to specify the attribute type.
- The **Identifier** field indicates if the attribute forms part of the entity identifier.
- The **Mandatory** field enables indication of whether or not entry of a value for this attribute is mandatory.
- The **Uniqueness** field enables indication of whether or not two instances of this entity can have the same value for this attribute.
- The **Updatable** field enables indication of whether or not the value of this attribute can be modified after it has been entered.

Participations or cardinalities

To modify the participations or *cardinalities* of an association:

1. Open the properties dialog box of the association.
2. Click the **Characteristics** tab.
3. Enter participation (cardinality) values.



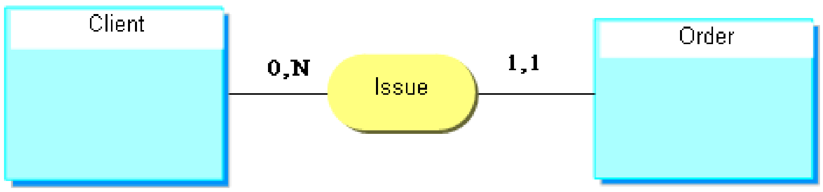
☛ *A cardinality is the minimum (or maximum) number of times an entity "participates" in an association (see also multiplicity).*

Cardinalities or participations most commonly used are:

- 0 or 1 for minimum cardinality (optional or mandatory minimum participation).
- 1 or N for maximum cardinality (unique or not unique maximum participation).
  Different values are permitted.
  When several roles, ie. several links, exist between an entity and an association, the cardinalities are defined for each role.
  Cardinality of an entity in an association can also be defined as follows:
- For a binary association, it is the minimum (or maximum) number of instances of the other entity in the association that can be linked to the initial entity.
- For a ternary association, it is the number of pairs of other entities in the association that can be linked to the initial entity.
- For a quaternary association, it is the number of triplets, etc.

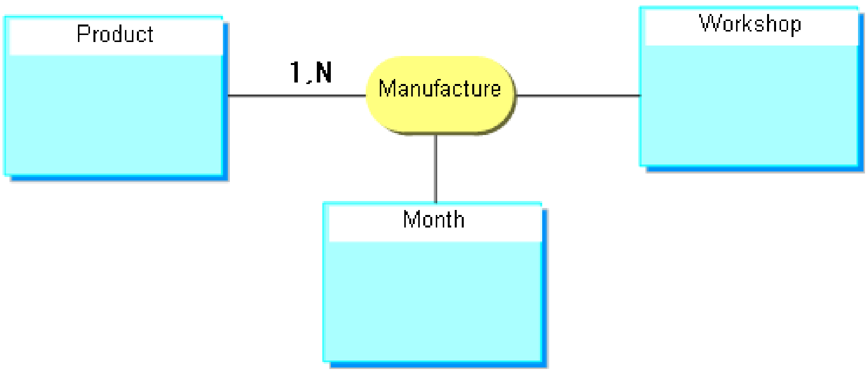
☛ *If expression of cardinalities is not sufficient to describe the link that exists between an entity and an association, for example when a cardinality depends on an organizational context, it is possible to use cardinality constraints, which enable more precise description.*

Examples



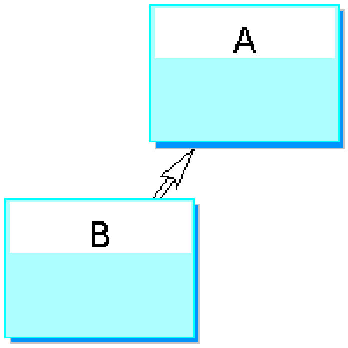
0,N : The client can issue no order, can issue a maximum of N orders (N indeterminate).

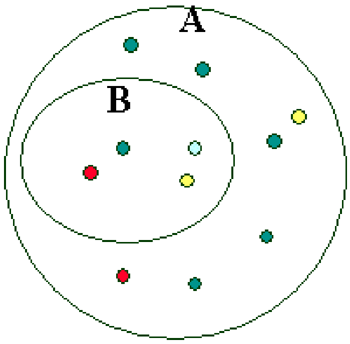
1.1, The order must be issued by one and only one client.



1,N : A product must be manufactured at minimum in 1 workshop over a period of 1 month. It can be manufactured in several workshops and/or over a period of several months (several workshop-month pairs).

Sub-typing (Merise)





What is sub-type?

An entity B is a sub-type of entity A. This assumes that all instances of entity B are also instances of entity A. In other words, B is a subset of A.

Example A: Person, B: Bostonian.

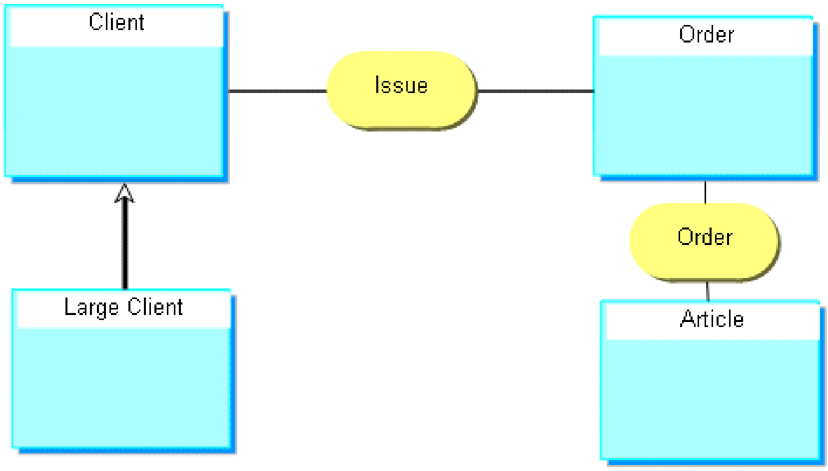
B being a subset of A, the instances of entity B "inherit" the characteristics of those in entity A.

It is therefore unnecessary to redescribe for entity B:

- its properties
- Its associations

Example

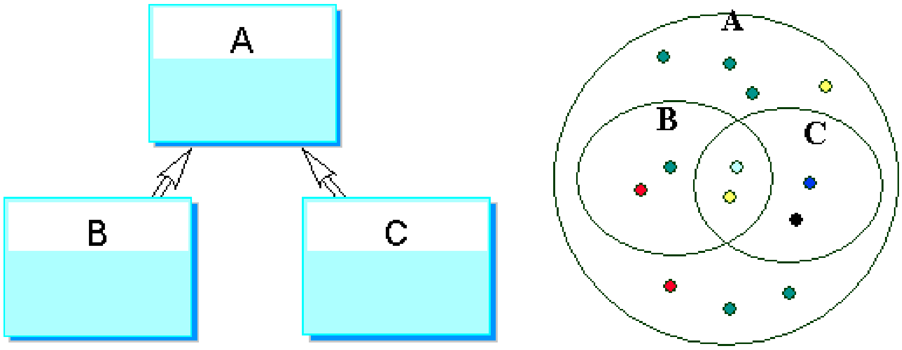
The "Large Client" entity, representing clients with a 12-month revenue exceeding $1 million, can be a subtype of the Client entity (origin).



A sub-type inherits all properties, associations, roles and constraints of its super-type, but it can also have properties, associations, roles or constraints that its super-type does not have.

In the above example, the properties, associations, roles and constraints specified for "Client" are also valid for "Large Client".

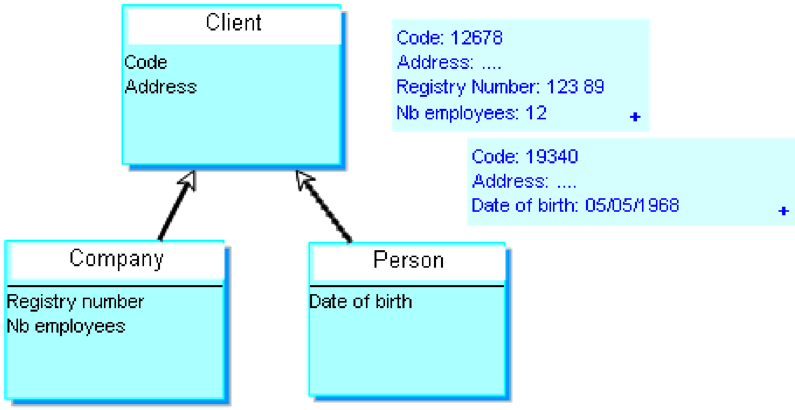
Multiple Subtypes



Several sub-types of the same entity

- are not necessarily exclusive.
- do not necessarily partition the type.

Advantages of sub-types



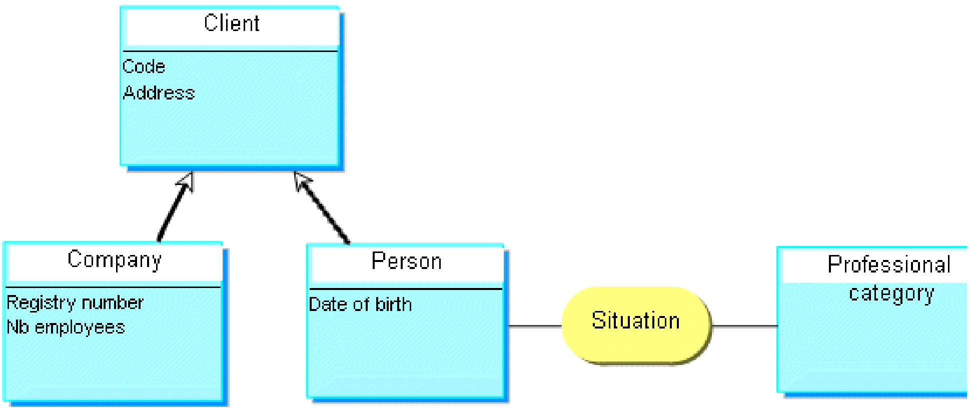
A sub-type entity can have specific properties. These only have meaning for that particular sub-type. In the above example:

- "Registry number" and "number of employees" only have meaning for a "company".
- "Date of birth" is a characteristic of a "person", not a "company".

An entity B is a sub-type of an entity A, if B represents a subset of A and the instances of entity B inherit the descriptions of those of entity A and if they have specific descriptive elements.

The Sub-Type link is represented graphically by a double arrow.

A subtype entity can also have specific associations.



A "person" falls into a "socio-professional group": “manager”, “employee”, “shopkeeper”, “grower”, etc. This classification makes no sense for a “company”. There is also a classification for companies, but this differs from the one for persons.

ATTRIBUTE TYPES

The following points are covered here:

DATATYPE PACKAGES

A data model is used to represent the static structure of a system, particularly the types of objects manipulated in the system, their internal structure, and the relationships between them. A data model is a set of entities with their attributes, the associations existing between these entities, the constraints bearing on these entities and associations, etc.

A datatype is used to group characteristics shared by several attributes. Data types are implemented as classes.

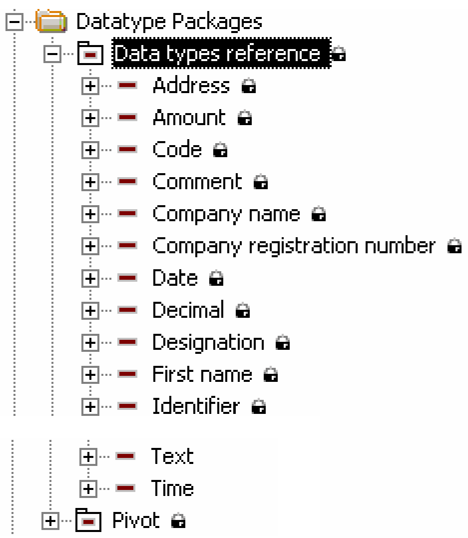
A datatype package is a reference package owning all or part of the datatypes used in the enterprise. All the other packages are declared as clients of the reference package of datatypes.

A datatype defines the type of values that a data can have. This can be simple (whole, character, text, Boolean, date, for example) or more elaborate and composite.

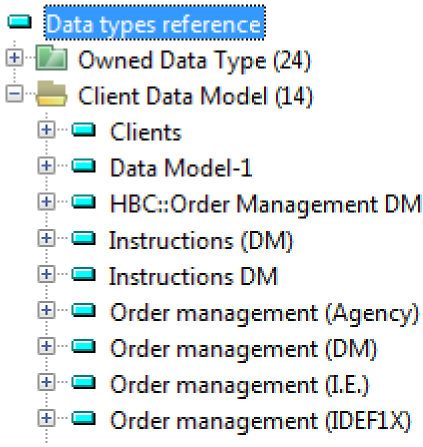
To type attributes of an entity, only datatypes defined for the data model that contains this entity are proposed.

When you create a data model, the "Datatype Reference" datatype package is automatically associated with it by default.

This "Datatype Reference" package owns datatypes "Address", "Code", "Date", etc.



Opening the explorer on this datatype package, you can see that is is referenced by several data models.



The attributes of entities of these models can therefore be typed using the datatypes “Address”, “Code”, “Date”, etc.

Creating a New Datatype Package

You can define a new reference datatype package owning the datatypes used by the enterprise.

To create your own datatype package:

1. On the **HOPEX Information Architecture** desktop, click on the **Logical data** navigation pane.
2. Display the list of **Data Model Packages**.
3. In the edit area, click **New**.
4. Enter the package name and click **OK**.

You can then add types to this package.

Creating a datatype

To create a datatype:

1. Right-click the package name and open its **Properties**.
   The package properties appear.
2. Click the drop-down list then **Data Types**.
3. Click **New**.
   The datatype creation dialog box opens.
4. Enter the name of the datatype and click **OK**.

Compound datatype

You can create compound datatypes by adding to them a list of attributes, for example an "Address" type comprising number, street postal code, city and country.

Literal value

You can allocate to a datatype literal values that define the values it can take. Attributes based on such a datatype can take only those values defined by the datatype.

When the new datatype package has been created, it should be referenced on the client data model.

Referencing Datatype Packages

To connect a datatype package to a data model:

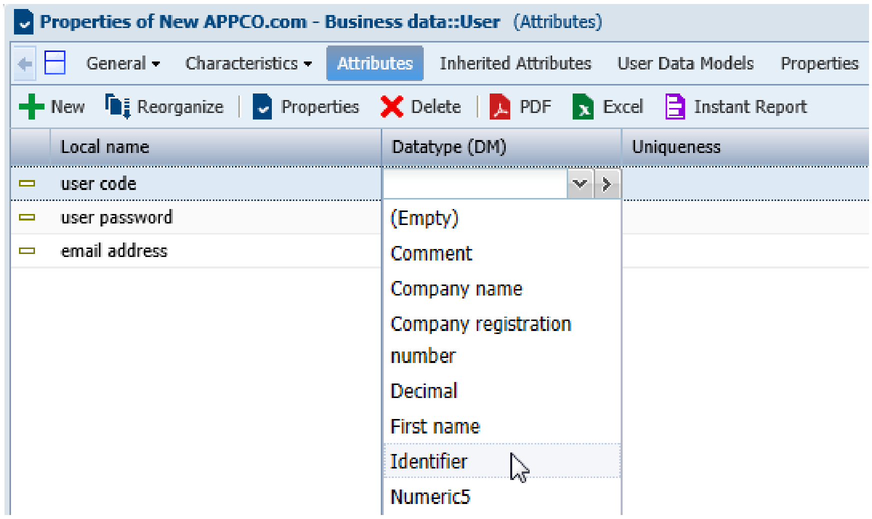
1. On the **HOPEX Information Architecture** desktop, click the navigation menu, then **Logical data**.
2. In the logical data navigation pane, click **All data models**.
   The list of data models appears in the edit area.
3. Right-click the model concerned and open its **Properties**.
4. Click the drop-down list then **Data Type Packages Used**.
5. Click **Connect**.
   The query dialog box appears.
6. Click **Find**.
   The list of datatype packages appears.
7. Select the desired package and click **Connect**.

Assigning Types to Attributes

When the datatype package has been referenced for the data model, the list of types it contains is available on each attribute of entities of the model. All that is required is to select the one that is suitable.

To define the type of an attribute:

1. Right-click the entity that contains the attribute.
2. Select **Properties**.
   The properties dialog box of the attribute opens.
3. Click the drop-down list then **Attributes**.
4. In the **Datatype (DM)** box corresponding to the attribute, select the desired type in the list.
5. Click **Apply**.



HOPEX Database Builder

User Guide

HOPEX V2R1

HOPEX Information Architecture - Physical Layer

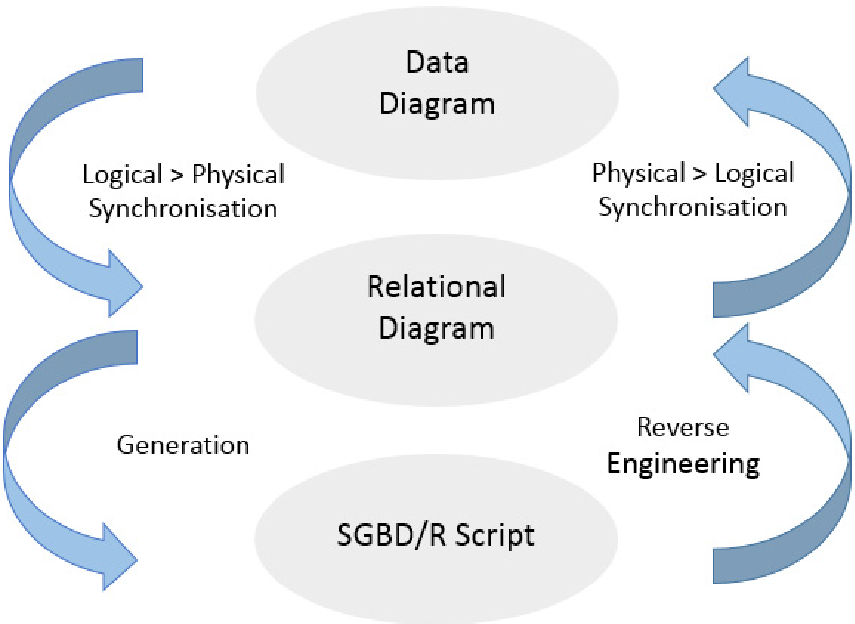
HOPEX Information Architecture is used to design and model databases.

A database describes organization of a system in the form of data stored in a structured way.

HOPEX Information Architecture integrates by default the logical and physical modeling levels and is used to switch from one model to another. You can therefore:

- Build a data diagram or a class diagram,
- From this diagram, create database tables and their columns, indexes, and keys, as well as the drawings for the corresponding relational diagrams.
- Optimize the resulting relational model and generate SQL commands to define the tables. **HOPEX Information Architecture** in particular takes account of evolutions of the conceptual model without losing optimizations made to the relational model.
- Reverse generate a database definition using the ODBC protocol to create the corresponding tables and columns in **HOPEX Information**

Architecture, and obtain the corresponding data diagram or class diagram.



Data Modeling Options

Formalisms

You can model logical data using two formalisms:

- the data package, to build class diagrams (UML notation) This formalism is selected by default.
- the data model, for data diagrams (standard notations, IDEF1X, I.E, Merise)

To display one of the formalisms:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Formalism**.
4. In the right part of the window pane select the formalism(s) that you want to display.
5. Click **OK**.
   The folders corresponding to the packages and data models appear in the **Logical data** navigation pane.

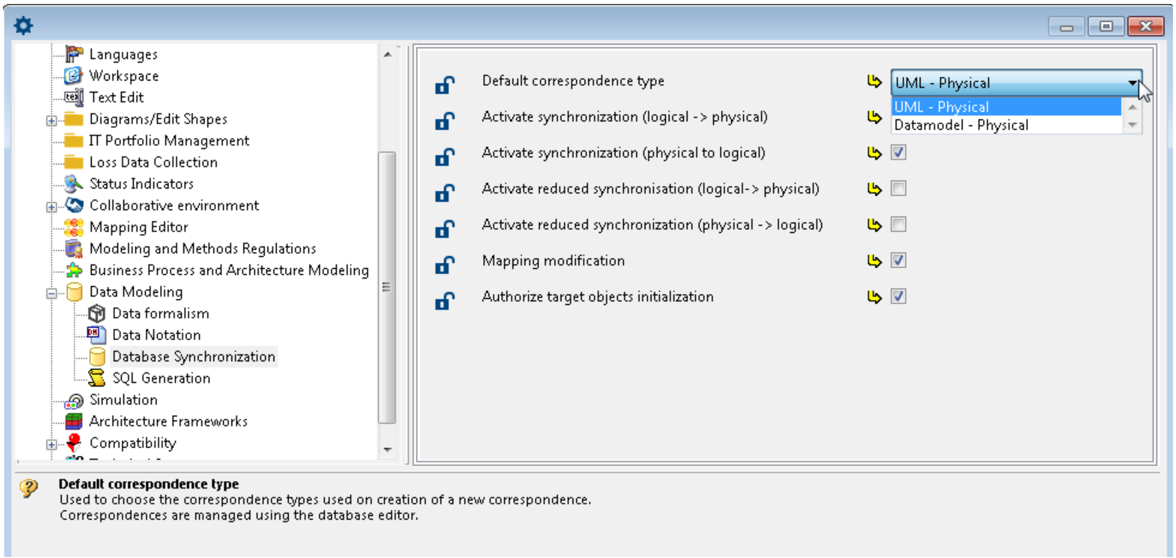
Logical formalism and synchronization

In **HOPEX Information Architecture** V2R1, the UML formalism is applied by default in the synchronization. It integrates handling of parts. Associations are no longer processed; when you synchronize a data model into a physical model, associations of the model are not taken into account in the synchronization.

For reason of compatibility, you can restore the former treatment, ie. UML formalism and data models, with the processing of associations instead of parts. You can change the formalism in the **HOPEX Administration** application.

To access the option:

1. Open the Administration tool.
2. Open the options of the environment concerned.
3. In the **Options** window, in the tree on the left, unfold the **Data Modeling** folder.
4. Click **Database synchronization**.
5. In the right pane of the window, in **Default correspondence type**, select the desired value.
   - UML - Physical: default option (with the processing of parts)
   - Datamodel - Physical: old option (with the processing of associations)



Notations

You have access to a standard data model notation, selected by default. To display another notation (DEF1X, I.E ou Merise):

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the navigation tree, expand the **Data Modeling** folder.
3. Click **Data Notation**.
4. In the right part of the window, select the notations that you want to display.
5. Click **OK**.

Repository access

To use the functionalities of **HOPEX Information Architecture**, you must have "Advanced" repository access:

1. Click **Main Menu** > **Settings** > **Options**.
2. In the left pane of the window, click the **Repository** folder.
3. In the right pane, check that access to the repository is in "Advanced" mode.

ABOUT THIS GUIDE

Guide Structure

The guide covers the following points:

- "Database and Physical Modeling", page 7 indicates how to create a database and its relational diagrams.
- "Synchronizing logical and physical models", page 25, describes how to automatically synchronize a conceptual data model with a database described in relational formalism, and vice versa.
- "Model Mapping", page 69, presents the application that enables mapping between different views of a database.
- "Denormalizing logical and physical models", page 79, explains how to modify models to suit specific requirements.
- "Attribute and Column Types", page 99, presents attribute datatypes and their mapping with column datatypes.
- "Generating SQL scripts", page 117, presents table definition SQL orders from specifications created with **HOPEX Information Architecture**.
- "Advanced SQL Options", page 133, describes the use of views, triggers and stored procedures, and adding physical properties to database objects.
- "Reverse engineer tables", page 149, presents how to create tables and columns in **HOPEX Information Architecture** from databases accessible via the ODBC, protocol, and then obtain the corresponding class diagram in UMLL.
- "ODBC Extraction Utility", page 155describes the utility used to access databases.
- "Glossary", page 217, presents definitions of objects handled in **HOPEX Information Architecture**.
- "Pivot Types and Datatypes Correspondence Tables", page 167, lists correspondence tables between pivot types and all DBMS datatypes.

Additional Resources

This guide is supplemented by:

- the **HOPEX Common Features Common Features** guide, which describes the Web interface and tools specific to MEGA solutions.

  ☛ *It can be useful to consult this guide for a general presentation of the interface.*

- the **HOPEX Power Supervisor** administration guide.

Conventions used in the guide

Styles and formatting

Remark on the preceding points.

Definition of terms used.

A tip that may simplify things.

Compatibility with previous versions.

Things you must not do.

Very important remark to avoid errors during an operation.

Commands are presented as seen here: **File > Open**.

Names of products and technical modules are presented in bold as seen here: **HOPEX**.

DATABASE AND PHYSICAL MODELING

The data model enables representation of the static structure of data at business level. A database is the object that enables storage and organization of data for use by programs corresponding to distinct applications, to facilitate the independent evolution of the data and the application programs.

You can connect a data model and associated diagram to a database. You can then create the corresponding relational diagram.

The points covered here are:

DATABASE

On a database, and depending on the target DBMS, control parameters of the various data processing tools (synchronization, generation, reverse generation etc.) will be defined.

Creating Databases

A database enables specification of data physical storage structure.

To create a *database* in **HOPEX Information Architecture**:

1. Click the navigation menu, then **Physical Data**.
2. In the navigation pane, select **Databases**.
   The list of databases appears in the edit area.
3. Click the **New** button.
   The database created appears in the list of databases. You can modify its name.

Database Properties

To access the properties of a database:

1. Click on the navigation menu, then on **Physical Data**.
2. In the navigation pane click **Databases**.
   The list of databases appears in the edit area.
3. Select the database and click the **Properties**  button.
   The properties window of the database appears.
4. Click on the drop-down list to access the different properties pages.

Properties pages are used to:

- Access the **Components** of the database (tables, physical views, data groups, etc.).
- Modify the **Characteristics** of the database (name, target DBMS, etc.).
- Define **Responsibilities**.
- Define the **Risks** associated, the **Standards** used, the **Objectives and Requirements**.
- To define the **Options** linked to:
  - the generation of tables. See "Configuring Database Generation", page 124.
  - synchronization. See "Configuring Synchronization", page 58.

Associating a Package with a Database

You can create a data package from the database or connect an existing package to it. The package enables representation of the structure of the database, the classes it contains and their parts.

The database package is the default owner of the objects represented in the class diagram. However it is possible to use objects held in other packages.

> ☛ *In the same way, you can connect a data model to a database, if the corresponding formalism has been selected. See* *"Formalisms", page 2**.*

To create a package from a database:

- Click the database icon and select **New** > **Package**. This command creates a new package as well as its associated class diagram.

To connect an package to a database:

1. Click the database icon and select **Connect** > **Data Package**.
   The query dialog box appears.
2. Click **Find**.
3. Select the desired package and click **Connect**.

You can see the name of the packages associated with a database in the database properties, in the **Characteristics** page.

Importing a DBMS Version

At creation of a new repository, only the **SQL ANSI/ISO 9075:1992** DBMS version is installed. If you choose another target DBMS for a database, you must import the solution pack for SQL datatypes that is compressed in the **DBMS SQL Type.exe** file.

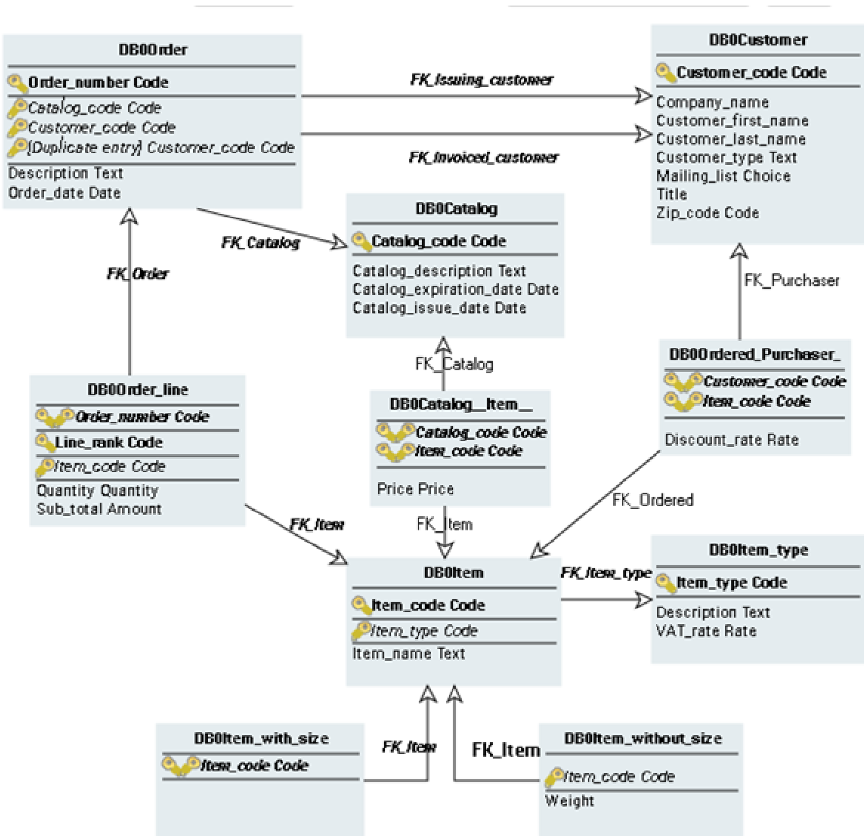
The **DBMS SQL Type.exe** file is available in the Utilities\Solution Pack of your HOPEX installation directory.

Once the solution pack is imported in **HOPEX Information Architecture**, you can select the appropriate DBMS in the database properties windows.

See also "Configuring Synchronization", page 58.

Relational Diagram

The Relational Diagram (RD) describes a database: it represents the physical data structures used by application programs.



Description in **HOPEX Information Architecture** of relational diagrams makes it possible to interface with the selected DBMS, guaranteeing semantic consistency between design data and production data.

Creating the Relational Diagram

The relational diagram is generally built in two phases:

1. Automated synchronization of the data diagram or diagrams produces the “raw“ diagram.
   See "Synchronizing logical and physical models", page 25.

2. Optimizing the diagram, or denormalization, to take into account the data access requirements of the application and to fine-tune the database performance.
   See "Denormalizing logical and physical models", page 79.

The key concept in a relational diagram is the table, which is derived from an entity or association.

> *Logical structure of data, used as the reference for the switch to production, the table is the central element of the database. A table is accessible by means of a primary key, and if necessary foreign keys; it is described by an ordered sequence of columns. A table is generally derived from an entity or association.*

A *table* is accessible by one or several keys, whose type indicates whether they are primary or foreign keys. It is possible to define indexes for a table, specifying their sort order (ascending or descending) and whether they are unique. Keys and indexes are connected to the columns that they contain.

Creating objects in the diagram

To create a key or an index in the relational diagram:

1. Click the table concerned.
   The list of commands associated with the table appears.
2. Click **Key** or **Index**

> *Check that the columns used by the key or index already exist in the table.*

You can also use the **Components** page in the properties dialog box of the database to create these objects. See "Creating a Key", page 17 and "Creating an Index", page 18.

To create a foreign key:

1. Select the **Key** button, click the first table, and then hold the button down while dragging the mouse to the second table.
   The creation dialog box opens.
2. Specify the name of the key and click **Add**.
   A second window asks you if you want to automatically create the columns of the foreign key from those of the primary key.
3. Click **Yes** to validate or **No** to create.

Configuring display of relational diagrams

As for data diagrams, you can specify which elements are to appear in the diagram:

- Either by using the **Views and Details** button to indicate globally the types of objects to be displayed in the diagram.
- Or by using display options that enable definition of which object characteristics should be presented.

To configure the display for a selected object:

- Right-click the object and select **Shapes and Details**.

  ☛ *When configuring the display of an object, the **Display** dialog box first shows the shapes that can be used to represent the object. Selecting an element in the tree causes its content to appear.*

PHYSICAL MODELING

A database is a set of data organized for use by distinct applications, to facilitate the independent evolution of the data and the application programs.

A database consists of tables, columns, keys and indexes:

- A ***table*** is the logical entity where columns are stored.
- A ***column*** is contained in a table.
- Just as an identifier uniquely identifies a class, the ***primary key*** for the table uniquely identifies a row in the table.
- A ***foreign key*** accesses another table, and imposes consistency between the corresponding columns in the tables concerned.
- An ***index*** accelerates access to data. It can be unique or not, and may be ascending or descending.

Database Tables

Database tables can be viewed or updated in two ways:

- In its relational diagram, that is the diagram of the tables in the database.
- In its properties, in the **Components** page.
  The components page displays the database tables.
  The name of the associated **Data Group** is indicated if applicable.

Creating a table

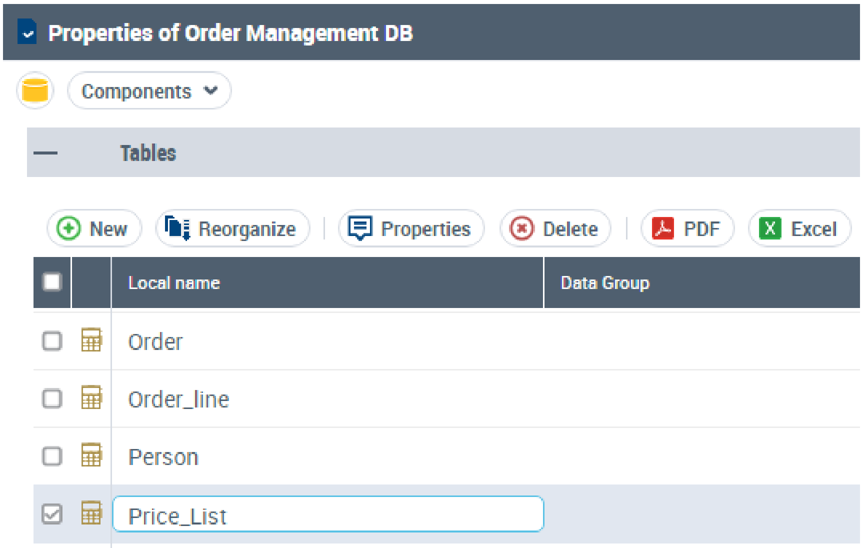
See previously: "Database Properties", page 8.

To create a table from the properties of the database:

1. Open the database properties window.
2. Click the drop-down list then **Components**.
3. In the **Tables** section, click **New**.
   The new table appears. It is named "Table 1" by default.

To rename it:

- Double-click the name of the table and enter the new name.



Deleting a table

To delete a table and its columns, keys and indexes:

- Right-click the table and select **Delete** ✕ .
  A message requests confirmation.

  ☛ *The deleted table will not be automatically recreated at a new synchronization. To recreate a table, at the synchronization results validation step validate the creation action proposed for this table (select the corresponding check box). See* *"Step 4: Validating results", page 37**.*

Table Columns

Viewing columns

See previously: "Database Properties", page 8.

To view the columns of a table:

1. Open the database properties dialog box.

2. Click the drop-down list then **Components**.
   The component page displays the **Columns** section.
   Presented for each column are:
   - Its **Local Name**
   - Its **Datatype**

     ☛ *The administrator can add to the list of datatypes (see "Creating New Datatypes", page 112).*
   - Its length **Ln** and its number of decimals **Dcml** where appropriate.
   - The value of its **NotNull** attribute.
   - Its **default value**: on generation of the table, the default value taken is that of the attribute from which it originated. If no initial value is specified for the attribute, or if you want to modify the value of a column, enter a value in this field.
   - The fact that the column is connected or not connected to a primary key (PK) or foreign key (FK). This is indicated by **Y** ("Yes") or **N** ("No").

You can modify the **Local Name** for a column by clicking its name and then entering the new name. This local name will be used in the script generated for the table.

An **SQL Name** can be specified directly in the **SQL** page of the properties of an attribute in the data diagram. Then all columns created from this attribute will have the same local name. In addition, the name will be reused during successive synchronizations, including total or partial reinitializations.

It is also possible to modify the value of other column characteristics.

☛ *These modifications will be retained in subsequent synchronizations.*

It is possible to create columns not derived from attributes in the data diagram whether in a table generated or created by the user.

Creating a column

See previously: "Database Properties", page 8.

To create a column:

1. Open the properties of the table concerned.
2. In the **Components** tab, **Columns** section, click **New**.

☛ *When creation of a column is not carried out from the* ***Properties*** *of a table, but for example from the explorer, it is necessary to previously select the table that will contain it, otherwise a message will indicate that creation is impossible.*

Deleting a column

To delete a column:

- Right-click the column and select **Delete**.

☛ *The deleted column will not be automatically recreated at a new synchronization. To recreate a column, at the synchronization results validation step validate the creation action proposed for this column (select the corresponding check box). See "Step 4: Validating results", page 37.*

The **Reorder** button accesses the Modify Order dialog box.

Modifying Keys and Indexes

The automatic creation of primary and foreign keys, and of indexes on these keys, is indicated in the synchronization configuration.

When these creations are requested:

- The primary keys use the columns corresponding to the identifiers.
- The foreign keys use the columns that are included in the tables because of a constraint association.

An index is created for each key.

It is possible to add to, modify, or delete the keys and indexes proposed during generation. To do this:

1. Right-click the table concerned and select **Properties**.
2. Click the drop-down list then **Components**.
3. The page presents the **Keys** and **Index** of the table.

The following is specified in the **Keys** section:

- The type of key (**Key-Type**): Foreign or Primary.
- In the case of a foreign key:
  - The table referenced.
  - Management of repository integrity on update (**On Update**) and on deletion (**On Delete**);consult the target DBMS documentation for the order types managed.

> ☛ *When a "migratory" column is created in a table to reflect a constraint association, you can instruct the DBMS to verify the updated value in this column. The DBMS then verifies that this value still exists in the original table (database integrity).*

When an update (**On Update**) or delete (**On Delete**) command is applied to the original table, the DBMS may:

- Update the values in the tables concerned, with the **Cascade** option.
- Do nothing, with the **NoAction** option.
- Prohibit updates or deletes, with the **Restrict** option.
- Reset to the default value in the tables concerned, with the **Set Default** option.
- Set the value to **Null** in the tables concerned, with the **Set Null** option.

The following is specified in the **Index** section:

- Its **Type**: Bitmap, Standard, Unique, Unique where not null.
- Its **Sort Order** (**Ascending** or **Descending**).
- If a grouped index **Clustered**.

> ☛ *Creation of a column from a key or index is not possible. A column must first be created in the table, then connected to the key or index.*

Creating a Key

See previously: "Database Tables", page 13.

To create a key:

1. Right-click the table concerned and select **Properties**.
2. Click the drop-down list then **Components**.
3. In the **Keys** section, click **New**.
   The key creation dialog box appears.
4. Select the type of key to be created: "foreign" or "primary". Creation of the key varies according to the type selected.

Primary key

When you select "Primary" type, the key appears in the properties of the table.

To define the properties of the key:

- Right-click the key and select **Properties**.
  In the **Columns** page, you can specify the columns concerned by the key.

It is also possible to specify the primary key of a table in the **Identifiers** page of the properties dialog box of the entity to which the table belongs. See "Defining an Entity Identifier", page 42.

It is also possible to manually specify the primary key by relating it to elements that can be attributes of the entity or the primary key of another table connected by a constraint association (multiplicity 1).

In all cases, the key specified will be created in the table on synchronization.

Foreign key

When the key created is a foreign key, a list of database tables is presented.

1. Select the reference table to which the foreign key relates.
   If the table you select includes a primary key, a dialog box opens.

2. Select **Yes**.
   the key appears in the properties of the table.

You can modify the **Local Name** of the key (the full name of the key is composed of the name of the database to which it belongs, followed by the name of the table then the local name: in the above example, "Exchange DB::Concern::Key1").

For a foreign key, as when editing a key, it is possible to specify repository integrity management on update (**On Update**) and on deletion (**On Delete**).

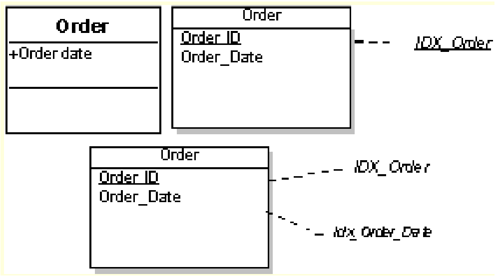
Creating an Index

See previously: "Database Tables", page 13.

Indexes are created automatically for primary and foreign keys. It is possible to add to the generated indexes columns used frequently in search criteria.

☺ *It is also possible to specify an index in the* ***Identifiers*** *page of the properties dialog box of the entity to which the table belongs. An index specified in this way will be created in the table during synchronization.*

Examples of indexes:



To create an index:

1. Right-click the table concerned and select **Properties**.
   The properties window appears.
2. Click the drop-down list then **Components**.
3. In the **Index** section, click **New**.
   The **Create Index** page appears.
4. Specify the **Local Name** and click **OK**.

Depending on the possibilities offered by the DBMS, you can specify the index **Type**, index **Sort direction** ("Ascending" or "Descending"), and if it is a grouped index (**Clustered**).

It is then possible to select the columns of the key (or index) in the **Columns** page of the properties dialog box of the index.

Adding a Column to a Key or Index

See previously: "Database Tables", page 13.

To add a column to a key (or to an index):

1. Right-click the table concerned and select **Properties**.
   The table properties dialog box opens.
2. Click the drop-down list then **Components**.
3. In the **Index** section, right-click on the index and select **Properties**.
   The properties dialog box of the index appears.
4. Click the drop-down list then **Columns**.

5. Click the **Connect** button.
   The query dialog box appears.
6. Find and select the column to be added to the key (index).

It is possible to indicate the sort order of the key or index, which can be “Ascending” or “Descending“.

Specifying Primary and Foreign Keys

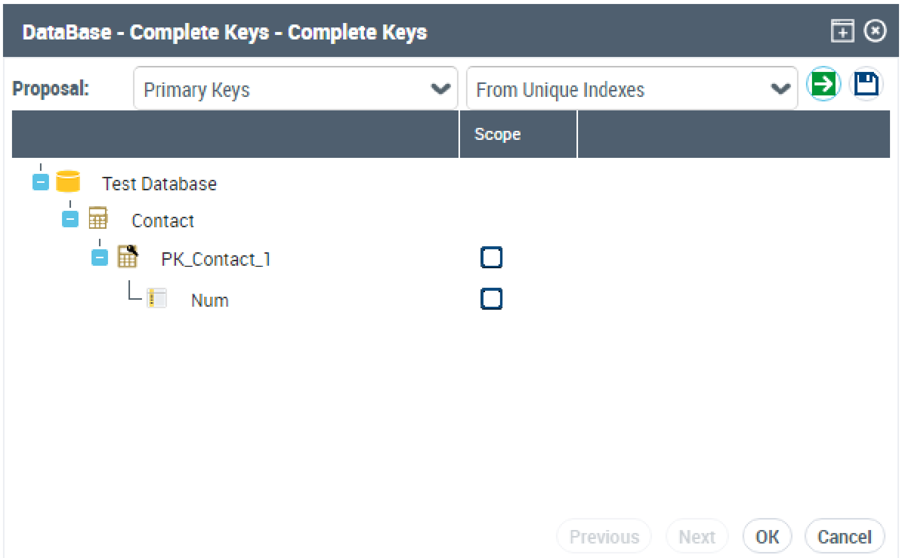
When the keys of a database are not completely specified, you must **Complete** them.

Specifying Primary Keys

To specify the primary keys of the database:

- Right-click the database and select **Complete the table keys**.
  The **Complete the keys** window appears.

  ☛ *When database specification is completed, the dialog box presents an empty list: no additional specification is required.*



The **Proposition** list is used to complete the keys:

- **From unique indexes**: the columns that belong to a unique index are proposed as components of the primary key.
- **From mandatory columns**: these columns are proposed as components of a key.
- **Through name comparison**: if the same column name is found in several tables, the column is proposed as primary key.

Each key is proposed under the table to which it belongs.

To validate a primary key:

1. Select the check box of the **Scope** column corresponding to the key.
   The associated columns are automatically selected by default. You can eliminate those that correspond to search criteria but are not components of the key.
2. Click the **Apply** button.
   The **Apply** button removes from the list the propositions of keys explicitly accepted or rejected.

For foreign keys, two keys including the same column on the same table are incompatible: acceptance of one automatically results in rejection of the other.

It is not possible to select several primary keys on the same table: acceptance of one results in rejection of the others.

> ☺ *You can complete the specification of keys in several stages. This allows you to consult the contents of the database while making your selections. To do this:*
>
> - *Click the **Apply** button to save your modifications.*
> - *Click the **Cancel** button to exit this dialog box without starting processing.*

Specifying Foreign Keys

To specify the foreign keys of the database:

- Right-click the database and select **Complete the table keys**.
  The **Complete the keys** window appears.

> ☛ *When database specification is completed, the dialog box presents an empty list: no additional specification is required.*

The **Proposition** list is used to complete the foreign keys:

- **From indexes**
- **From name comparison**

If the proposition is made from indexes, it is based on non-unique indexes of the table. The reference table is indicated after the name of the key.

To validate a foreign key:

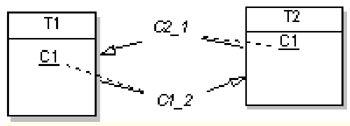
1. Select the check box of the **Scope** column corresponding to the key.
2. Click the **Apply** button.
   The **Apply** button removes from the list the propositions of keys explicitly accepted or rejected.

If no reference table is specified, the wizard automatically proposes the selection of possible tables. Keys that do not have a reference table cannot be accepted.

On proposition of keys, several tables may be found with an identical primary key. This could for example be the case for tables corresponding to different sub-types of the same entity.

Column Primary Key of Two Tables

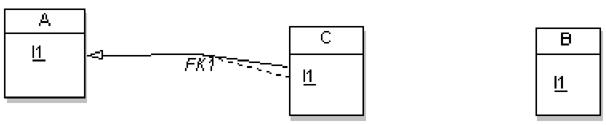
When the same column is the primary key of two tables, the foreign key proposition permits creation of each of these two keys.



A choice is then made of which of the two keys should effectively be taken into account.

Column Primary Key of Three Tables

When the same column is the primary key of three tables, the foreign key proposition permits creation of one foreign key from a column of a table.



The key proposition permits creation of only one foreign key from table C. The other should be added in data entry of tables in the database.

DATABASE MODELING RULES

HOPEX Information Architecture provides rules that enable database modeling checks. The physical regulation contains the rules relating to the database relational diagram. It is used to check the corresponding relational diagram in a DBMS.

The physical regulation contains rules relating to technical specifications of the database DBMS. It is used to check consistency of physical parameters of the relational diagram specific to the DBMS.

Checking a database

You can run a check on the database or on a database object.

To check a database:

1. Right-click the name of the database.
2. Select **Administer** >**Check** > **Regulation with Propagation**.
   When several regulations can apply to the check object, a dialog box asks you to select the required regulation.

The check applies to the database as well as the objects it owns.

Results appear in an HTML report.

For more details, see the **HOPEX Common Features** user guide, "Exploring the repository", "Tools for Checking Objects".

SYNCHRONIZING LOGICAL AND PHYSICAL MODELS

Synchronization is a process that translates a class diagram expressed in classes/parts formalism to a physical model expressed in relational formalism, and vice-versa. It therefore ensures correspondence of objects in the two models.

A compatibility option enables to synchronize a data model (entities/associations) and a physical model. See *"Logical formalism and synchronization", page 3**.*

The procedure should be carried out periodically. Throughout the modeling project, these models are each subject to their particular changes. Synchronization intervenes when we wish to compare the two models and automatically restore canonical mappings that connect them.

The synchronization functionality is available with "Advanced" access to the **HOPEX** repository.

Synchronization of models of a database can be in one direction or another - either in physical > logical direction or in logical > physical direction, but not both at the same time. When synchronization direction has been determined, synchronization should not be reversed. Mapping justification between the logical and physical levels is not guaranteed if this rule is not followed.

See also "Model Mapping", page 69.

Synchronization Display Options

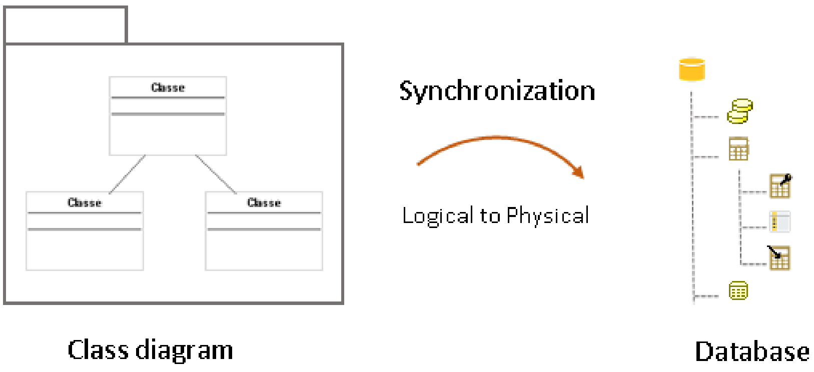
Certain synchronization options are filtered by default. To display these:

1. Click **Main Menu** > **Settings** > **Options**.
2. In the **Options** tree in the left pane, unfold the **Data Modeling** folder, then click the **Database synchronization** sub-folder.
3. In the right pane, check the desired synchronization options:
   - Synchronization (Logical to Physical)
   - Synchronization (Physical to Logical)
   - Reduced synchronization (Logical to Physical)
   - Reduced synchronization (Physical to Logical)

Note that the UML notation is applied by default in the synchronization. See "Formalisms", page 2.

"LOGICAL TO PHYSICAL" SYNCHRONIZATION RULES

The following rules are applied for transforming class diagrams into relational formalism.



See also "Configuring Name Generation", page 60 and "Attribute and Column Types", page 99.

Logical to Physical Synchronization: the Entities (or Classes)

In Logical to Physical mode, classes and entities are processed in the same way by the synchronization tool.

By default, the synchronization tool applies the class diagram logical formalism. See "Logical formalism and synchronization", page 3.

General rule

- Any non-abstract entity of the model becomes a table.
- The entity identifier becomes the primary key for the table. If the identifier is implicit, a column is automatically created. See "Configuring Name Generation", page 60.
- Entity attributes become columns in the table.
- Mapping rules are applied to determine the column datatypes from the datatype (DM) of each attribute. The possible configurations depend on the DBMS.

For more detailed information, see "Attribute and Column Types", page 99.

Sub-entity

- The foreign key reflecting dependency between the sub-entity and its super-entity is created.

Abstract entity

An abstract entity does not produce a table at synchronization.

If constraint associations point to an abstract entity, the corresponding foreign keys are not created, but columns corresponding to the foreign keys are created to respect table integrity.

When a sub-entity is abstract, all columns and foreign keys of the corresponding table are taken by the table corresponding to the super-entity.

Conversely, when a super-entity is abstract, all columns and foreign keys of the corresponding table are taken by the table corresponding to the sub-entity.

To define an abstract entity:

1. Open the properties dialog box of the entity.
2. Click the **Characteristics** tab.
3. In the **Abstract** box, select "Yes".

Realized entity

An entity is said to be realized if it produces creation of a table at synchronization.

A "not realized" entity is treated as an abstract entity.

Unlike the "abstract" property which characterizes the entity in all use cases, the "realized" concept applies only in the context of database synchronization. See "Realized mode", page 40.

Logical to Physical Synchronization: the Associations

Synchronization of associations is available with the former UML formalism which takes into account associations but not parts. See "Data Modeling Options", page 2.

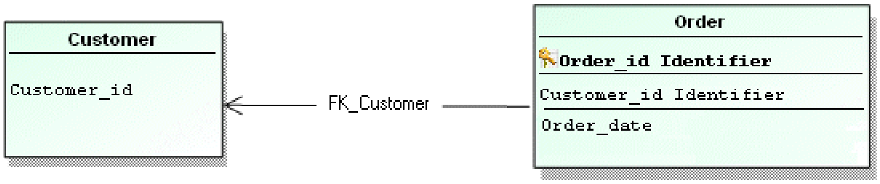
Constraint associations (multiplicities: 0,1 or 1,1)

A constraint association is a binary association one role of which has maximum multiplicity 1 In this case, it is not necessary to create a table corresponding to the association. Simply add a column to the table that corresponds to the entity.

A constraint association (one of its maximum multiplicities is 1) does not result in a table. In the following example, an order has only one customer.

Synchronization of this data diagram produces one of the two following results:

The association does not result in a table.



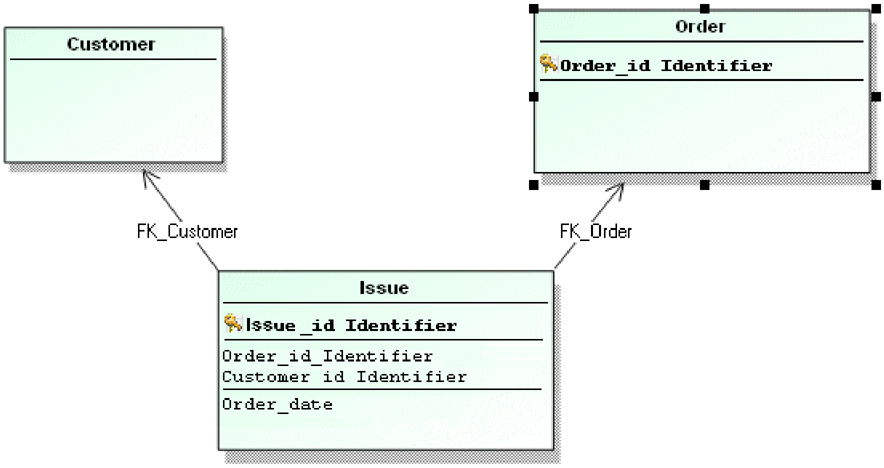
- A column corresponding to the key for the "Customer" entity is created in the "Order" table.
- A column is also created for each attribute of the association.
- A foreign key "FK_Customer" is added to check the "Customer_ID" column in the "Order" table. It indicates that the possible values for the "Customer_ID" column in the "Order" table are the values that already exist in the "Customer ID" column of the "Customer" table.

The foreign key is created from the entity identifier.

The association is transformed to a table

For the association to be transformed into a table:

1. Open the properties dialog box of the association.
2. Click the **Characteristics** tab.
3. In the **Potential Mapping** field, select "Table".

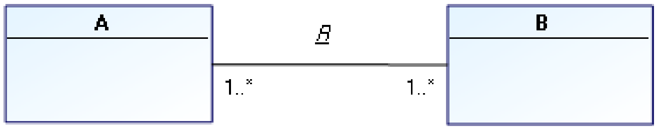


Constraint associations (multiplicities: 0,1 and 0,1)

In this particular case, the combination of multiplicities is ambiguous. There is nothing that can be used to decide which table should contain the column corresponding to the attribute.

Synchronization proposes a column in each table.

Deadlocks



The multiplicities 1..X, 1..X indicate that each of the two objects must be connected to at least one object of the other type in order for it to exist.

This poses problems when creating the first object of each type. In fact:

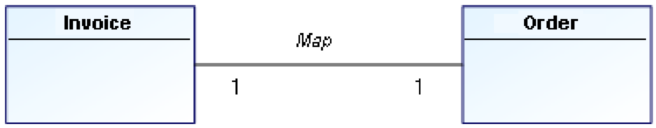
- An object of type A must exist in order to create an object of type B and then connect them.
- Conversely, an object of type B must exist in order to create an object of type A and then connect them.

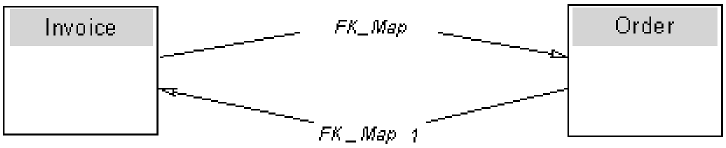
This is the case for the following multiplicity combinations:

- Multiplicities of 1..*, 1..*
- Multiplicities of 1, 1..*

However, it is not physically impossible to resolve such cases, because the problem is limited to creating the first object of each type. In addition, no foreign key is generated for verifying data integrity in the first case, and only one in the second case, so there is no resulting deadlock situation.

Multiplicities 1, 1 generate several obligatory foreign keys that will become deadlocked:





This situation results in complete deadlock, because in order to meet the constraints, several tables must be created at the same time.

Certain DBMSs prohibit creation of tables of this type.

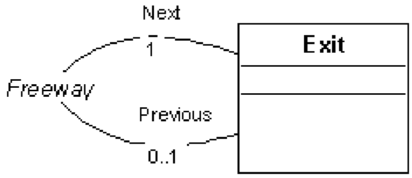
For correct synchronization, situations such as this should be avoided.

Select one of the foreign keys and assign it a multiplicity of 1, then assign 0..1 to the other. You can also pull the foreign key from the table after synchronization , but this is less convenient.

You can still impose the minimum multiplicity of 1 by adding a constraint as shown below. This constraint will not be taken into account in the synchronization.

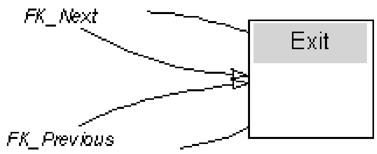
See "Constraints", page 37 for further information.

Here is another example using a reflexive link: Reflexive link 1, 1 or 0..1, 1



We want to show that each exit from a freeway comes before an exit and comes after an exit.

When modeled this way, all exits must be created at the same time, because each exit must have a previous exit already created.



To avoid this, set the multiplicities to 0..1 and 0..1.

Non-constraint association

An association where maximum multiplicities are not 1 will have a corresponding table:

- A column is created for each attribute of connected entities identifiers.
- The primary key for the table uses all these columns.
- A foreign key is also built for each connected entity.
- An additional column is created for each attribute of the association.

Before starting synchronization it is advisable to check validity of the data diagram and check that synchronization configuration is correct. See "Data Modeling Rules", page 48 and "Preparing Synchronization", page 58.

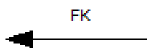
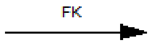
Association class

Associations connecting associative classes are not included in synchronization.

Logical to Physical Synchronization: the Parts (UML)

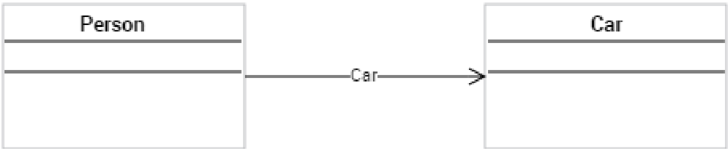
Synchronization of parts is available by default with the new UML formalism.

The result of the synchronization is determined by the combination of the **Whole/Part** link (None, Aggregation, Composition) and the **Multiplicity** defined on the part.

Multiplicity	**Whole/Part link**	
	Aggregation **Composition**	**None**
None (*) 2 / 6 1..*	The part gives rise to a foreign key to the owner class 	The part gives rise to a table between the two classes 
1 0 / 1	The part gives rise to a foreign key to the referenced class  and gives rise to a foreign key to the owner class 	The part gives rise to a foreign key to the referenced class 

Example 1: None / *

In the following example, the "Person" class references the "Car" class, without multiplicity constraint.

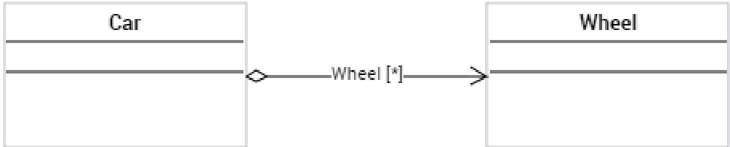


After synchronization, the "Car" part gives rise to a table:

- A column is created for each attribute of connected entities identifiers.
- The primary key for the table uses all these columns.
- A foreign key is also built for each connected entity.

Example 2: Aggregation / *

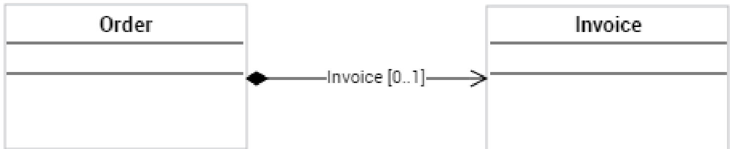
A car can have one or several wheels.



After synchronization, the part gives rise to a foreign key to the “Car” class.

Example 3: Composition / 0..1

An order contains an invoice.



After synchronization:

- A foreign key references the “Invoice” table in the “Order” table.
- A foreign key references the “Order” table in the “Invoice” table.

From the Logical Model to the Physical Model

This section explains how to synchronize the logical model of a database (represented by a data diagram) with the corresponding physical (relational) model.

Although synchronization of the relational model from the data diagram essentially concerns entities, it can also be carried out more generally from classes of a class diagram.

Synchronization in the reverse direction, from a physical model to a logical model, is also possible but not on the same database. When synchronization direction has been selected for an object, synchronization in the other direction will no longer be possible.

See "From the Physical Model to the Logical Model", page 52.

The points that follow present synchronization of a database. You can also run reduced synchronization, in other words on a specific object of the database. See "Reduced Synchronization (Logical to physical mode)", page 43.

Running Synchronization

Logical to Physical synchronization consists of building the physical model from the logical model, in other words of creating tables and columns corresponding to data diagram entities and attributes:

The synchronization tool is available in the **Logical data** navigation pane. You can also open the synchronization tool directly from the database concerned.

To run a Logical to Physical synchronization on a database:

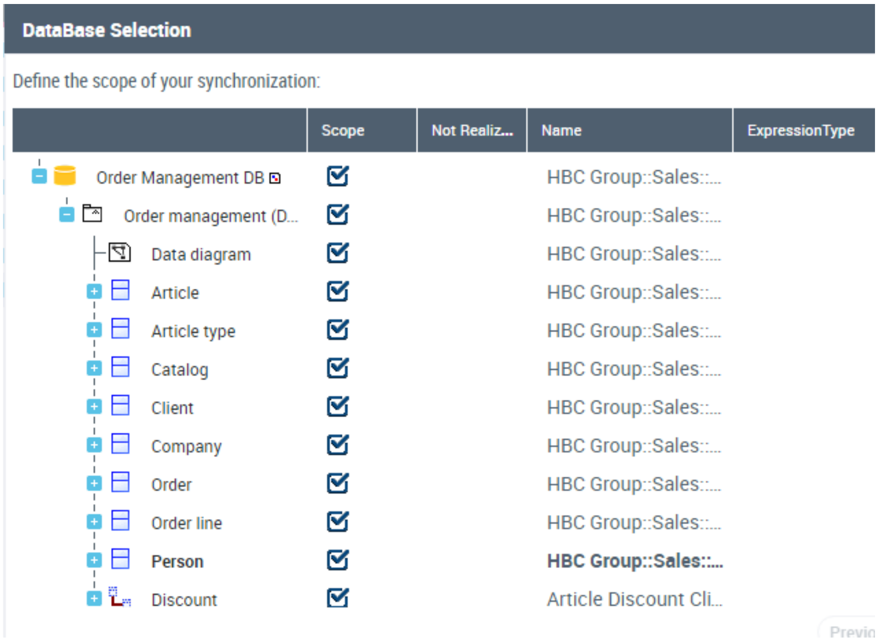
1. Click on the navigation menu, then on **Logical Data**.
2. In the navigation pane, click **All databases**.
   The list of repository databases appears in the edit window.
3. Right-click the database and select **Synchronization (logical to physical**.
   The synchronization wizard opens.

Step 1: Selecting the source objects to be synchronized

To define synchronization scope:

1. In the logical view tree, expand the list of objects contained in the database.

2. By default, all objects are selected and therefore included in synchronization. To exclude an object from thesynchronization, clear it from the **Scope** column. When an object is excluded, its mapping is also excluded.



3. By default, all the objects are "realized", in other words, they give way to the creation of an object during synchronization. To specify that an object is "not realized", select it in the **Not realized** column. For more detailed information, see "Realized mode", page 40.
4. When the list of objects has been defined, click the **Next** in the wizard.

Step 2: Synchronization options

From the synchronization options, you can:

- in a case where objects of the logical view have already been synchronized, synchronization will start from zero and will delete existing target objects.

  When models have already been synchronized, so that mappings are taken into account at a new synchronization, make sure the "Target object reinitialization" option is cleared.

- Recalculate target object names: names of physical objects are recalculated as a function of those of the source objects. This means that any manual modification of physical object names is canceled.
- Take account of optimizations: all optimizations - including those not selected in the validation step (see step 4) are proposed.
- Take account of deletions: entities, associations and diagrams that have been deleted are included in the scope. Consequently, deletion of corresponding target objects and links is proposed.
  See "Using Options", page 38.

Other options concern target object properties update. By default, synchronization updates all properties of each object concerned.

Scheduling

You can run synchronization:

- Immediately
- As soon as possible (after publication of updates)
- At a predefined date and time

› When options have been specified, click **Next**.

Step 3: Protecting objects

Synchronization can impact all objects in an existing database.

› To keep an object intact, select it in the **Frozen**.
› Click **Next** to continue.

See "Protecting Objects", page 40.

Step 4: Validating results

The wizard displays the results that will produce synchronization validation.

Objects that will be automatically modified are indicated by a tick.

Icons preceding object names indicate actions that will be executed on the objects.

Actions can be creation, deletion or update.

An arrow preceding an object indicates that synchronization has an impact on sub-objects of the object in question.

- Expand the object to view the modifications concerned.

Validating optimizations

Optimizations are customizations on objects thus removed from automatic synchronization processing.

> Optimization examples:
>
> A tick indicates objects that will be modified. If you do not wish to validate modifications relating to certain objects, you must clear the corresponding boxes. This optimization is kept at subsequent synchronizations.

In addition, **HOPEX** deduces optimizations following actions you may have carried out manually. If you have added a table in the physical view without having created the corresponding object in the logical view, synchronization does not select deletion of this table. 

So that the object will be deleted, you must select the corresponding box.

- When actions on target objects have been defined, you can click **Next**.

A report shows actions carried out.

You can close the wizard and view the results in the editor.

Using Options

The combination of the "Take account of optimizations" and "Take account of deletions" options varies depending on the scope of objects you wish to update.

Take account of optimizations

When this option is selected, synchronization proposes all creations, deletions and modifications, including optimizations not selected by default at the validation step.

When the option is cleared, only the modifications selected by default are proposed at the validation step.

This option enables filtering of the synchronization result to present only those modifications that have a real impact on target data.

Take account of deletions

When this option is selected, synchronization includes entities, associations and diagrams that have been deleted. Consequently, deletion of corresponding target objects and links is proposed.

When this option is cleared, the entities, associations and diagrams that have been deleted are not included. Consequently, the corresponding target objects are not modified.

This option only applies to entities, associations and diagrams. For other deleted object types (attributes, identifiers, etc.), the impact on target objects and links is conditioned not by this option, but by the object that contains them.

This option enables limitation of impact of a synchronization strictly to the source scope defined by the user, excluding any object not explicitly declared in the scope. This option can be associated with synchronization scope for use case types.

Possible option combinations

1. "Take account of deletions" option selected and complete synchronization scope

This is a use case that favors complete synchronization between source and target. In this case, all objects have a valid mapping on completion of each synchronization wizard operation. This mode should be used when source and target should be totally consistent.

2. "Take account of deletions" option selected and partial synchronization scope

This use case enables working on the selected scope, while including impact of deleted objects. In particular it enables confirmation of deletions of target objects following the deletion of source objects of entity, association or diagram types: as these source objects have been deleted, it is theoretically not possible to include them in the synchronization scope. Selecting this option makes this choice possible. This mode should be favored when the scope is wide, and the few objects excluded from the scope are only excluded temporarily (for example, new objects for which we wish to delay the impact on the target).

3. "Take account of deletions" option selected and empty synchronization scope

This is a special mode enabling "cleanup" of target objects whose mapping is no longer valid, with no other impact.

4. "Take account of deletions" option not selected and partial synchronization scope

This use case enables working strictly on the selected scope, excluding any impact outside this scope. In particular it avoids deletions of target objects following the deletion of source objects of entity, association or diagram types: as these source objects have been deleted, it is theoretically not possible to exclude them in the synchronization scope. Clearing this option makes this choice possible. This mode should be favored for a specific synchronization on a restricted scope, which does not include total consistency of source and target. In addition, it is the fastest mode.

5. "Take account of deletions" option not selected and complete synchronization scope

This combination is in principle an infrequent use case. It corresponds to a work mode in which deletion of source objects has no effect on the target; in other words no target object created is ever deleted when this mode is activated.

6. "Take account of deletions" option not selected and empty synchronization scope

This combination has no effect.

Protecting Objects

You can protect an object so that synchronization will have no impact on it. This excludes the object from synchronization without it disappearing.

There are two object protection modes; one upstream and the other downstream.

Frozen mode

"Frozen" mode concerns the target object, that which results from synchronization.

When you freeze a relational model table, you also freeze all child objects of this table: no child object is created, modified or deleted by synchronization.

You can freeze objects:

- Before running synchronization, in the database editor.
- When running synchronization, in the options presented in the wizard. See "Step 3: Protecting objects", page 37.

Realized mode

"Realized" mode concerns the source object of synchronization.

An object is said to be realized if it produces object creation at synchronization.

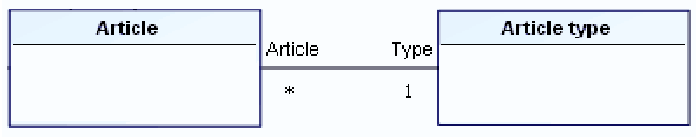
An object not realized does not produce object creation at synchronization but is treated as an abstract object. See "Abstract entity", page 28.

By default, all objects are realized.

You can exclude a source object from synchronization selecting the "Not realized" column on the object in question in the synchronization wizard. This action is available on entities, attributes and associations. The "realized" or "not realized" action is propagated to child objects.

Not realized entity example

The "Article" entity has an association to the "Article Type" entity.



The "Article Type" entity is said to be "not realized".

At synchronization, the "Article Type" entity does not produce creation of a table. In the"Article" table, the foreign key to "ArticleType" is not created; however the "Code_Type_Article" column is created.

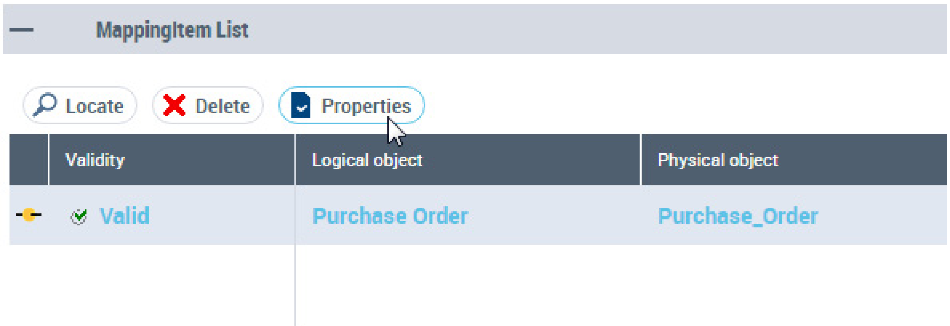
Synchronization Results: Correspondences

When synchronization is completed, the tables, columns, keys, and indexes of the physical diagram have been synchronized with the data diagram. They can now be viewed and the desired optimizations made.

Mapping characteristics

For more details on mapping:

- In the mapping editor, select the object mapping element and click **Properties**.
- In the window that opens, click the drop down list and select



Characteristics.

Synchronization scope

By default, all objects in synchronized models are included in the synchronization. You can however exclude an object from the synchronization.

See "Step 1: Selecting the source objects to be synchronized", page 35.

Synchronization state

You can protect an object so that it will not be modified at synchronization by specifying that it is "Frozen".

See also "Protecting Objects", page 40.

Synchronization direction

The synchronization direction of a mapping indicates which object is updated related to the other.

In certain cases, synchronization is possible in both directions (for example, when two objects that can be synchronized do not yet have a mapping). In other cases, it is only possible in one direction (for example, if one of the two objects is already synchronized) or impossible in both (because each object already has a mapping or because the object types concerned cannot be subject to synchronization). This indication is given in the **Synchronization** box.

Summing up:

- **Bidirectional: synchronization in both directions.**
- **From left to right**: synchronization is from left to right (the object on the right is synchronized with the object on the left).
- **From right to left: synchronization is from right to left.**
- **Never : no mapping is possible between the two objects.**

For more details on mapping, see "The Database Editor", page 70.

Reduced Synchronization (Logical to physical mode)

The synchronization function enables synchronization of a logical model and a physical model in the database. In design phase, it is often useful to synchronize part of the current model without having to consider the complete database which can be extremely large. **HOPEX Information Architecture** enables limitation of synchronization scope to a set of objects, thus reducing synchronization processing time.

The points that follow detail "Reduced synchronization" mode in direction Logical > Physical directions, but it is also available in Physical > Logical direction.

Reduced Synchronization Source Objects

Reduced synchronization is synchronization applied to an object other than to the database. Reduced synchronization applies only to an object of which the database has already been synchronized.

Objects on which you can run reduced synchronization are:

- Class
- Association
- Package
- Table
- Table file
- Entity (DM)
- Association (DM)
- Data model

Reduced synchronization scope is determined by the object on which you run reduced synchronization.

The following cases illustrate reduced synchronization in the logical to physical direction.

Running from a data model

When you run a synchronization on a data model, by default all objects of the model are selected in the scope of the synchronization; they are all selected in the editor.

Running from a data model entity

When you run a synchronization from an entity (or another object) belonging to a data model, only those objects linked to this entity within the same model are selected by default.

Objects linked to the entity but belonging to another model are displayed in the editor (when they are connected to the target database) but not selected by default. You must select the associated check boxes to take them into account in the synchronization.

The data model of the synchronized entity is taken as scope only if the ownership link between data model and entity is clearly identified: this is the case when you select the entity in the navigation window, but not when you select it in a diagram.

Running on an entity outside context

When you run synchronization on an entity outside context, for example in an explorer window, all objects depending on the modified entity, whether or not included in different models (on condition that these models are connected to the target database) are selected by default in synchronization scope, since no particular model context is identified.

Reduced Synchronization Strategies

At synchronization from an object, the three strategies below can be applied.

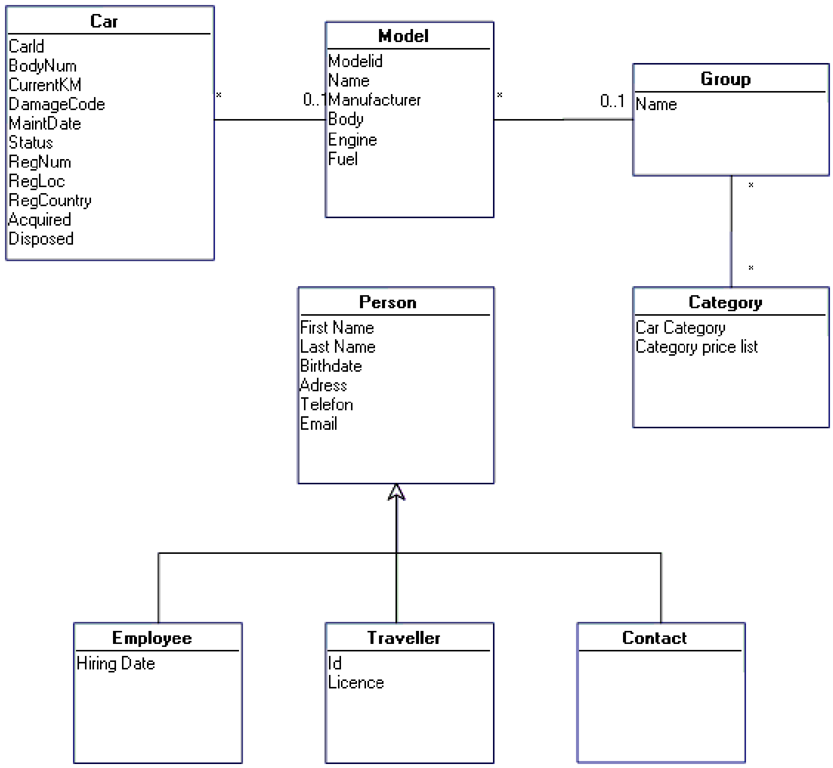
Impact of synchronized object on other objects

This strategy enables definition of synchronization scope from the source object, with the possibility of extending this to all objects dependent on the source object and likely to be affected by its modification.

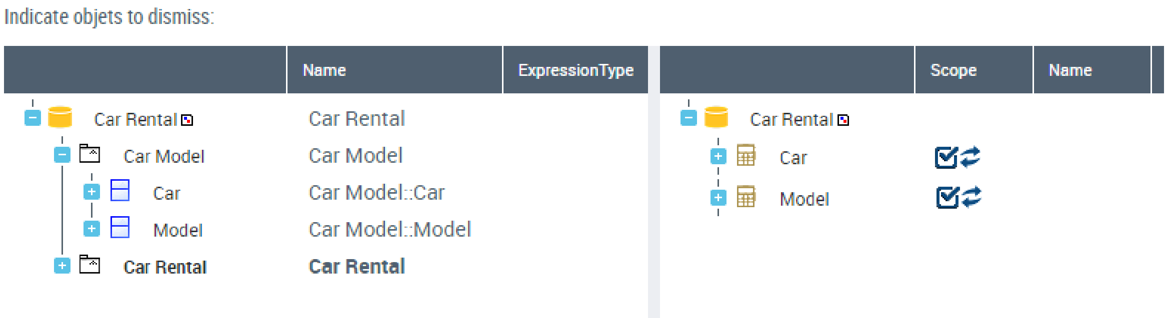
Example

With this strategy in the model below, reduced synchronization of the "Model" entity allows inclusion of the "Car" entity, which has a constraint association to the "Model" entity.

Logical model



Reduced synchronization results



Impact of other objects on synchronized object

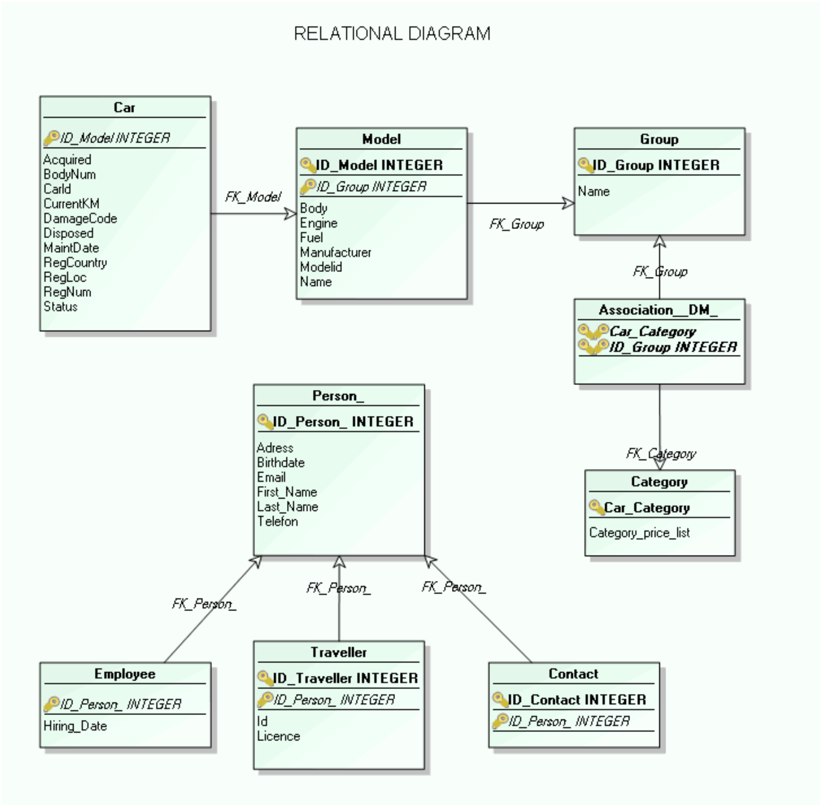
This strategy enables integration in reduced synchronization scope of objects on which the source object directly depends, for example all objects associated with the source entity which are necessary for update of the corresponding table.

Example

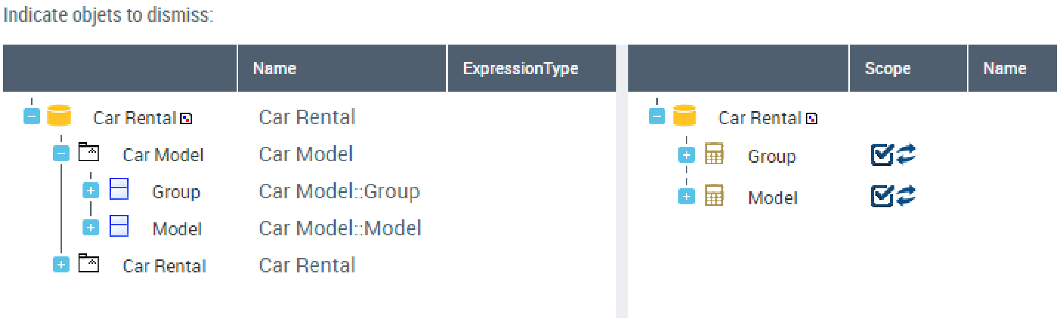
In the same example as before, taking the "Model" entity as source of reduced synchronization, the scope extends to the "Group" entity since tables corresponding to these two entities are linked by a foreign key: the "Group" entity can modify the "Model" table associated with the "Model" entity via the intermediary foreign key "FK_Group" (see diagram below).

The "Car" entity however is not taken into account in the scope since it cannot act on the "Model" table.

Physical model



Reduced synchronization results

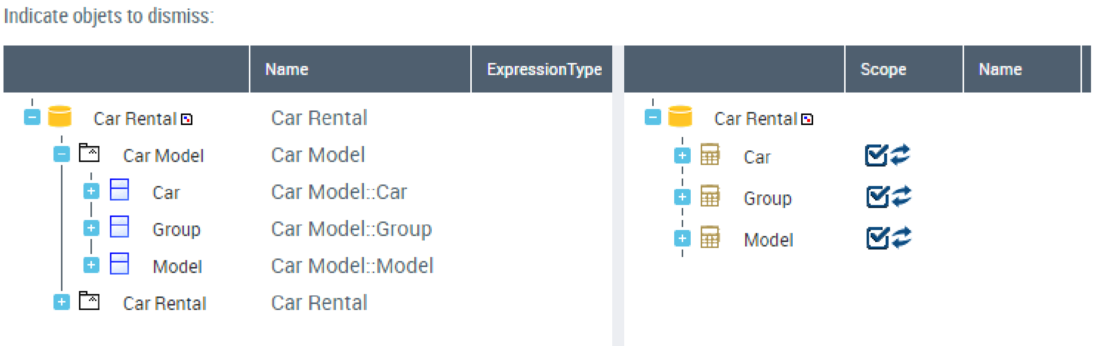


All impacts

This strategy allows a combination of the two strategies described above. Scope of reduced synchronization is extended to objects required by the source object, and to all objects likely to be affected.

Example

Reduced synchronization results



Running Reduced Synchronization

Before starting, check that option "Reduced synchronization (logical > physical)" is active:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
   The options window appears.
2. In the left pane of the window, expand the "Data Modeling" folder.
3. Click "Database Synchronization".
4. In the right pane of the window, select "Activate reduced synchronization (logical > physical)".

To start reduced synchronization:

1. Right-click the object to be synchronized.
2. Select **Synchronize (Logical to physical)**.
   The synchronization wizard opens.

   An entity can be used by several data models, therefore by several databases. When this is the case, you must select the database concerned.
3. Select the **Strategy**.
4. Click **Next**.
5. Select the objects to be synchronized
   The scope selected by default depends on the context in which you select the object to be synchronized: if reduced synchronization is initialized from an entity in a diagram, the diagram model in question is selected. If the entity is selected outside its context, all models in which it appears are displayed in the editor.

   ☛ *Selected objects are not memorized and at a new synchronization default scope is again displayed.*
6. Click **Next**.
7. Define the **Synchronization Options**. All standard synchronization options are available with the exception of the "Reinitialize target objects" option.
8. Click **Next**.
   The target objects protection option is displayed, you can view frozen objects. Protection of objects cannot be modified.
9. Validate results by clicking **Next**.
   The synchronization report appears.
10. Click **OK** to close the synchronization wizard.
    The mapping editor appears (unless the mapping option was cleared from the synchronization wizard).

Reduced synchronization options

Reduced synchronization presents the same options as total synchronization, with the exception of:

- Reinitialization of target objects
- Order

The reduced scope of reduced synchronization does not give a valid result for these two options

Running Synchronization After Modifications

When a database has been synchronized and then manually modified, any additional specifications made directly in the database are retained, unless:

- Reinitialization is requested.
- Changes made in the data diagrams prevent this (addition or deletion of objects or links).

These changes include:

- Creation of entities, associations, attributes in the data diagram
- Deletion of entities, associations, attributes in the data diagram
- Modifying the characteristics of an attribute
- Modifying the name of an attribute, entity, or association
- Modifying the maximum multiplicity of an association
- Modifying the links of an association

Additional specifications made to the relational diagram may include:

- Deleting objects created by the synchronization
- Creating objects
- Modifying object characteristics created by the synchronization
- Modifying the order of columns in the tables, keys, or indexes

Synchronization after Modification of the Data Diagram

Newly created entities, associations, and attributes in the data diagram

The corresponding elements are created in the relational diagram, according to the rules used in the first synchronization.

Entities, associations, or attributes deleted from the data diagram

The corresponding elements are deleted in the database. For example, when an attribute is deleted in the data diagram, the corresponding column(s) are also deleted.

Modified attribute characteristics

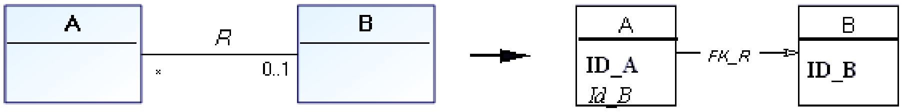
Modifications made to the characteristics of an attribute (type, length, decimal places, etc.) are reflected in the corresponding column in the relational diagram.

If the value of a characteristic of a column has been changed directly in the relational diagram, it will be preserved.

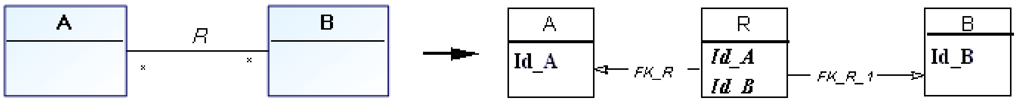
Modified name of an attribute, entity, or association

Modifications made to the name of an attribute, entity, or association are not reflected in the corresponding object in the relational diagram.

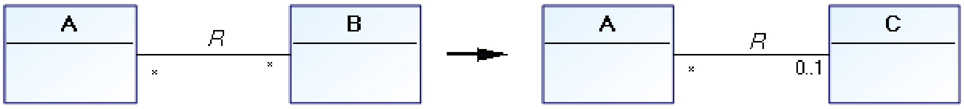
Modified maximum multiplicity of an association



If the maximum multiplicity of an association was 1, resulting in the creation of a migratory column, and has been changed to N, the migratory column is deleted and the table mapped by the maximum multiplicity of N is created.



Modified association links



Association R no longer concerns entity B, but does concern entity C.

In this case, the migratory column for B in A is no longer mapped.

- It is deleted.
- A migratory column from C is created.

Synchronization after Modifications to the Physical Diagram

Deleted table or column

If you delete objects from the database that were created by the synchronization (table, column, key, index...), these deletions are memorized and retained.

As long as the entity, association, or attribute that maps the table or column exists, the table or column is no longer recreated.

To recreate a column created by the synchronization and subsequently deleted:

1. Run database synchronization
2. At the results validation step, confirm the creation action (select the corresponding check box) proposed for this column.

Created objects

Objects (table, column, key, index) created in the relational diagram are retained.

However, deleting the objects they depend on may result in their deletion.

For example, a column is created in a table mapped by an entity. If the entity is then configured as "No table" or if the entity is disconnected from the datamodel, the corresponding table will disappear and the column with it.

☛ *Objects created in the relational diagram can be mapped manually. Objects created at synchronization are mapped automatically.*

Modified characteristics of objects created by synchronization

Modifications to the characteristics (SQL name, length, not null, datatypes) of objects created by synchronization are retained.

Modified order

Concerning modifications of order, processing depends on options defined in the synchronization wizard (see "Step 2: Synchronization options", page 55).

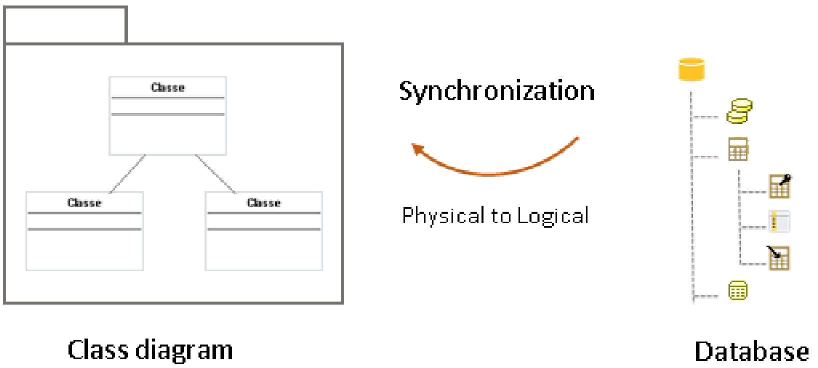
From the Physical Model to the Logical Model

This section describes how to synchronize the physical model model of a database with the corresponding conceptual model.

"Physical to Logical" Synchronization Rules

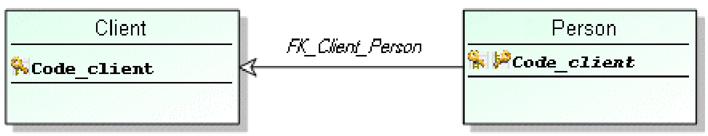
Synchronizing the logical model from the physical model enables creation of the database data diagram from its tables.

Rules used for this transformation are:



- A table of which the primary key is composed of a foreign key relating to the same columns becomes an entity. A generalization is created between this entity and the entity corresponding to the table to which the foreign key is pointed.

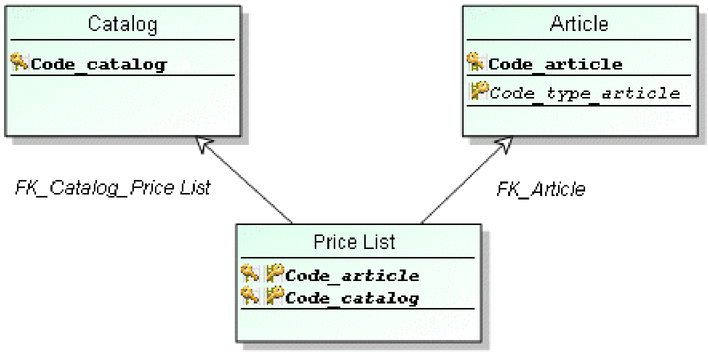
```
Physical level example:
```



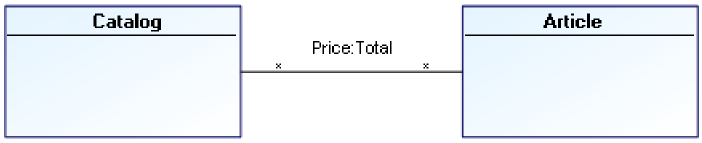

```
Result at the logical level:
```

- A table of which the primary key is composed of foreign keys only becomes an association of multiplicities (*..*). If columns do not belong to the primary key, an attribute connected to the association will be created for each of these columns.

Physical level example:



Result at the logical level:

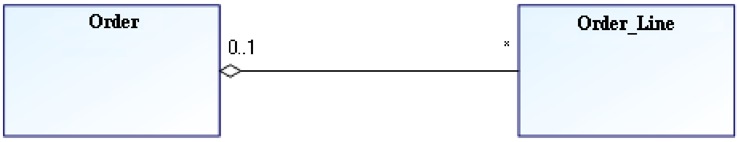


- A table of which the primary key contains foreign keys and at least one column that is not a foreign key becomes an entity. An aggregated association is created between this entity and the entity corresponding to the table to which each of the foreign keys is pointed.

The candidate key of the entity is composed of the roles of aggregated associations and of the attribute(s) corresponding to the other columns of the primary key of the table.

Physical level example:

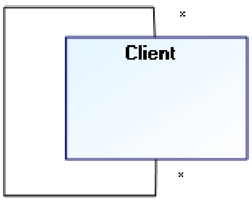
Logical level result:



- A table of which the primary key is composed of foreign keys only pointing to the same table becomes a reflexive association of multiplicities (*..*).

Physical level example:

Logical level result:



- In other cases, each table becomes an entity and its columns the attributes of the entity.

- A foreign key becomes an association (0..1, *). If all the columns of the key are mandatory, its cardinalities become (1, *).

- Types of attributes are recalculated with the help of the conversion table specific to the target DBMS (see "Attribute and Column Types", page 99).

Running Synchronization

To start the synchronization:

1. Select the database concerned (in the list of databases or in a diagram for example).
2. Right-click the database and select **Synchronization (Physical to Logical)**.
   The synchronization wizard opens.

Step 1: Selecting objects to be synchronized

To define synchronization scope:

Scroll the list of objects contained in the database.

1. By default, all objects are selected and therefore included in synchronization. To exclude an object from thesynchronization, clear it from the **Scope** column. When an object is excluded, its mapping is also excluded.
2. By default, all the objects are "realized", in other words, they give way to the creation of an object during synchronization. To specify that an object is "not realized", select it in the **Not realized** column. For more detailed information, see "Realized mode", page 40.
3. When the list of objects has been defined, click the **Next** in the wizard.

Step 2: Synchronization options

From the synchronization options, you can:

- Reinitialize target objects: synchronization starts from zero and deletes existing target objects.
- Recalculate target object names: names of data diagram objects are recalculated as a function of those of the relational diagram. This means that any manual modification of the data diagram is canceled.
- Take account of optimizations: all optimizations - including those not selected in the validation step (see "Validating optimizations", page 38) are proposed.
- Take account of deletions: entities, associations and diagrams that have been deleted are included in the scope. Consequently, deletion of corresponding target objects and links is proposed.
  See "Using Options", page 38.

You must also indicate the data model that will own the set of objects created by the synchronization.

Other options concern target object properties update. By default, synchronization updates all properties of each object concerned.

Scheduling

You can run synchronization:

- Immediately
- As soon as possible (after publication of updates)
- At a predefined date and time

› When options have been specified, click **Next**.

Step 3: Protecting objects

Synchronization can impact all target objects.

› To keep an object intact, select it in the **Frozen**.
› Click **Next** to continue.

See "Protecting Objects", page 40.

Step 4: Validating results

The wizard displays the results that will produce synchronization validation.

› To validate these results, click **Next**.

A report presents a list of processes that have been carried out.

Reduced synchronization

The above synchronization applies to a database but you can also run a Physical > Logical synchronization on a specific object of the database to reduce synchronization scope and processing time. See "Reduced Synchronization (Logical to physical mode)", page 43.

"Physical to Logical" Synchronization Results

Owner data model

A default data model owning the entities is created at the time of the Physical to Logical synchronization. Synchronized classes and associations are automatically connected to it. You can then distribute these entities and associations between the various data models of your study.

Data diagrams

A data diagram is created for each of the relational diagrams of the database. Classes and associations resulting from the tables of the corresponding relational diagram are connected to it.

Mappings

See "At synchronization, the "Article Type" entity does not produce creation of a table. In the"Article" table, the foreign key to "ArticleType" is not created; however the "Code_Type_Article" column is created. Synchronization Results: Correspondences", page 41.

Configuring Synchronization

This section describes the default options and parameters taken into account at synchronization.

Preparing Synchronization

To prepare synchronization:

1. Right-click the database and select **Properties**.
   The properties window appears.
2. Click the drop-down list then **Options** > **Standard**.
3. If you want the physical database name used at SQL script generation to be different from the database name, specify the target database name in the **SQL Name** text box.
4. If required, indicate a **Prefix** for the SQL Tables. This prefix will be added to the beginning of the name for each table generated.

   ☛ *Additional parameters for configuration of synchronization and generation can be indicated in* ***Options****. These parameters vary as a function of the DBMS selected.*
5. Click again on the scroll-down list of the properties window and click **Characteristics**.
6. Select the **Target DBMS** and its version.

   ☛ *The type of the target DBMS determines:*
   - *For synchronization, the generation of column datatypes based on the type and length of attributes (see* *"Determining Column Datatypes from Attribute Types", page 103**).*
   - *In generation, the syntax of the generated SQL commands.*
7. Click **OK** to close the dialog box, saving the modifications.

Creation Options

On a database

It is possible to configure synchronization for each database in order to modify:

- Its creation options
- Processing of repository integrity (keys OnDelete or OnUpdate as a function of the possibilities offered by the DBMS target)

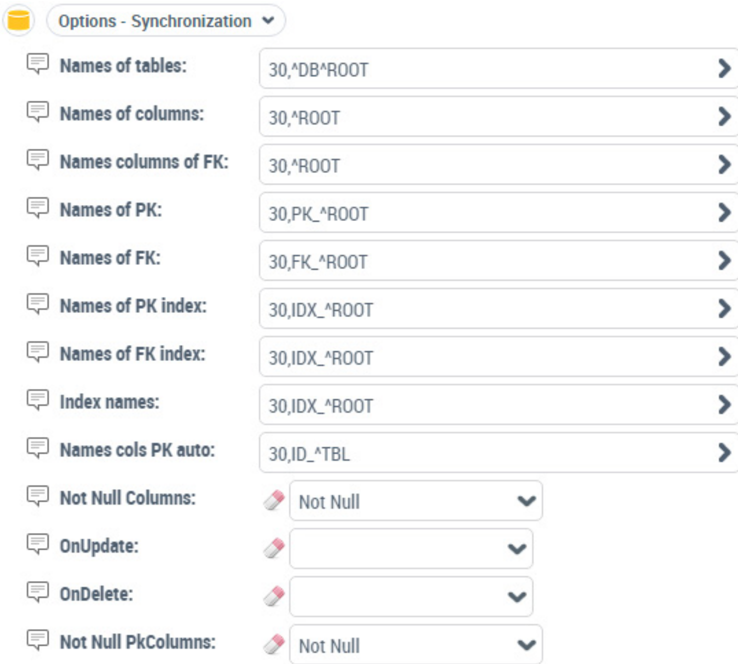
This configuration also concerns processing of the Not Null columns and the automatic creation of indexes on primary keys.

To configure the creation options for the database:

1. Right-click the database and select **Properties**.
   The properties window appears.

2. Click the drop-down list then **Options** > **Synchronization**.
   The corresponding options appear.

You can specify the following parameters:



- **Columns Not Null** activates/deactivates the WITH DEFAULT option for Not Null columns.
- **OnDelete**: key deletion default strategy. Possible values are:
  - **Restrict**: deletion is refused.
  - **Cascade**: deletion of a column is reflected in dependent tables.
  - **Set Null**: indicates "Null".
  - **Set Default**: gives the default value if this is specified. If no default value is specified, nothing occurs ("No action").
  - **No Action**: nothing occurs.
- **OnUpdate**: key update default strategy.
- **Names cols PK auto**: columns derived from the implicit identifier. See "General rule", page 27.

Parameters whose names begin with **Names of** indicate rules applied in name generation (see "Configuring Name Generation", page 60).

On the DBMS

The default values for database synchronization and generation parameters are accessible in the properties dialog box of the DBMS used.

To display DBMS synchronization parameters:

1. In the **HOPEX** toolbar, click the **Utilities** navigation window.
2. Right-click the target DBMS name and open its **Properties** dialog box.
3. Click the drop-down list then **Options** > **Synchronization**.

By default, the parameters specified at the DBMS levels are valid for all new databases. When you modify synchronization parameters on a database, this database no longer takes account of DBMS parameters.

☛ *For more information on synchronization configuration, see also* *"Running Synchronization", page 35.*

Configuring Name Generation

Naming rules

The names of physical objects created at "logical to physical" synchronization are deduced from the **Local Name** of the logical objects from which they are derived.

As logical object names are not subject to any particular restrictions, transformation rules apply by default at their synchronization. These rules are accessible locally in the **Options** > **Standard** page of synchronized database properties, or globally in the target DBMS properties:

- **Identifier size**: maximum size of SQL identifier for this target DBMS
- **First character**: character set authorized for first character of SQL identifier
- **Authorized characters**: character set authorized for SQL identifier characters
- **Replacement character**: replacement character for unauthorized characters
- **Converted characters**: SQL identifier character set to be converted
- **Conversion characters** character set corresponding to characters to be converted
- **Upper-case conversion**: conversion to upper-case of SQL identifiers

It is possible to indicate another name for each synchronized object using its **SQL Name**. The **SQL Name** replaces the **Local Name** at synchronization, while taking account of default transformation rules.

The **SQL Name** of logical objects is accessible in the **Generation** > **SQL** page (or **SQL** page) of their properties.

You can give a different name depending on the database and DBMS.

When fields **SQL Name (Database)** and **SQL Name (DBMS)** indicate different names, the name defined at database level takes precedence at synchronization.

By default, names of relational objects are generated according to the following masks:

Table	Database prefix + name* of entity or association
Column	name* of attribute
Primary key	"PK_" + name* of entity or association
Foreign key	"FK_" + name* of target entity or role if specified
Primary key index	"IDX_" + name* of entity or association
Foreign key index	"IDX_" + name* of target entity or role if specified

**Name calculated according to previously explained naming rules.*

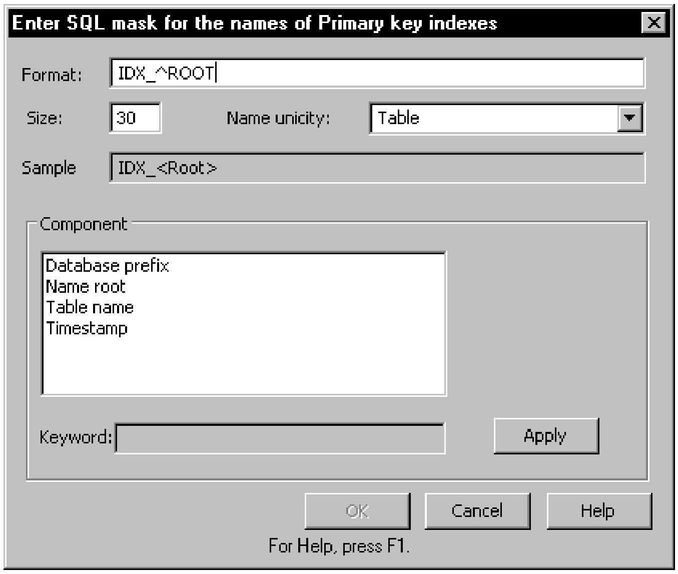
These masks can be modified locally in each database, or globally for a given target DBMS.

Modifying a naming rule

To modify the mask of a naming rule:

1. Right-click the database and select **Properties**.
2. Click the drop-down list then **Options** > **Synchronization**.
3. In the field of the rule in question, click the arrow.

4. Click **Modify**.
   The **Enter SQL Mask** window opens.



Entering the SQL mask

SQL masks define relational object naming rules at synchronization.

```
Example: In the DB_EMPLOYEES database, which has the prefix
EMP, the mask ^DB_^ROOT generates the following for the
table derived from the Customer entity: EMP_CUSTOMER
```

In the SQL mask entry dialog box, you can directly enter the **Mask** using syntax indicated below, but you can also use entry help proposed in the Component frame.

- In the list in the **Component** box, select the elements that are to prefix the names. These elements are:

^ROOT	• For a table: name* of the entity or association from which it is derived. • For a column: name* of the attribute. • For a primary key: "PK_" + name* of entity or association • For a foreign key: "FK_" + name* of target entity or role if specified • For an FK column: name* of the attribute. • For an auto PK column: name* of the entity identifier. • For an index on primary key: "PK_" + name* of entity or association • For an index on foreign key: "FK_" + name* of target entity or role if specified • For an index: name* of the attribute.
^DB	Database prefix
^TBL	Table name
^TBR	Reference table name
^KEY	Key name
^CPT	Timestamp

Name calculated according to previously explained naming rules.

Size indicates total length limit of the generated name. It also applies to each of the elements used, which will be shortened to the number of characters indicated between brackets alongside the element concerned.

Definition of a Timestamp ("^CPT") enables automatic generation of an order number and indication of its length, (for example, ^CPT[^1^] will generate "1", "2", "3"; ^CPT[^3^] will generate "001", "002", "003").

The **Always** option indicates that timestamping begins from the first occurrence (CLI00, CLI01, etc., instead of CLI, CLI01).

You can also specify characters used as prefix and suffix of this timestamp.

Using the **Name Unicity** option ensures that the name of an object is not repeated in the database, repository or table in which this object appears. As such, if you apply the Name unicity option to a table, different objects of this table cannot have the same name.

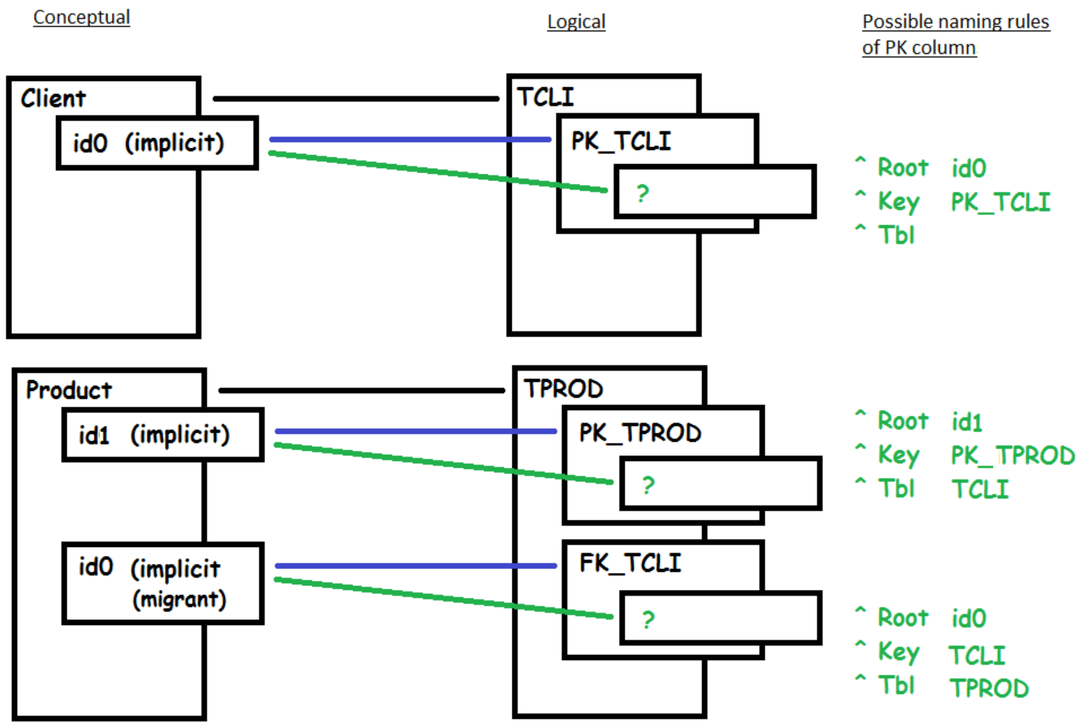
Configuring PK column names (implicit identifier)

At synchronization in Logical > Physical mode, the entity identifier becomes the primary key of the table. If the identifier is implicit, a column is automatically created. For more details, see ""Logical to Physical" Synchronization Rules", page 27.

By default, the name of a column derived from an implicit identifier is built using the ^TBL keyword which corresponds:

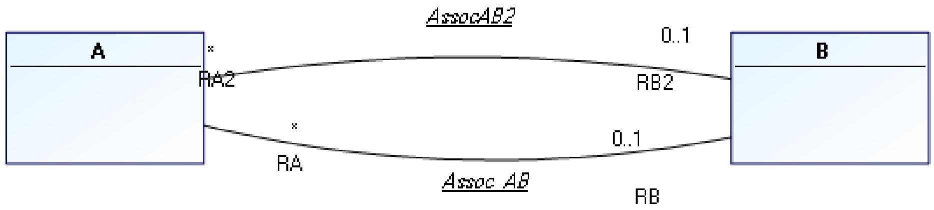
- to the name of the migrating table (in other words derived from a foreign key) if the identifier is migrating
- to the name of the table if the identifier is not migrating

You can modify construction rules and build the name of these columns with the ^KEY keyword corresponding to the name of the foreign key (without " FK_ ") if the identifier is migrating, as well as with the ^ROOT keyword corresponding to the name of the identifier (ID). See "Modifying a naming rule", page 61.

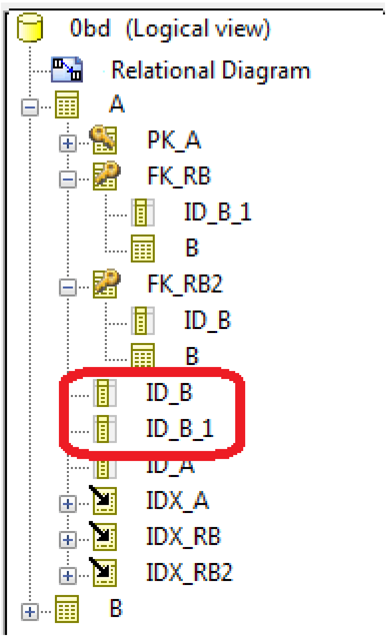


Example

When there are two constraint associations between two entities as below:



By default after synchronization, you obtain two columns with identical names, differentiated only by prefix "1".



You can modify the naming rule and build the name of these columns with the ^KEY keyword corresponding to the name of the foreign key (without " FK_ ").

The name of the foreign key being calculated on the name of the Role when it is specified, the names obtained for these two columns will be different.

In our example, if you replace "ID^TBL" par "ID^KEY" after synchronization you obtain:

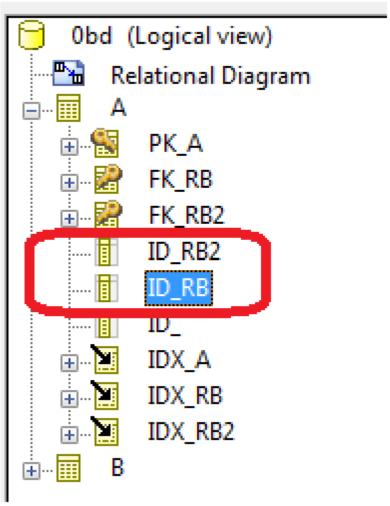


DIAGRAM SYNCHRONIZATION

Synchronization enables translation of a logical data model to a physical model, and vice versa. Before running synchronization, source diagrams (data diagrams and physical diagrams) must be saved and closed.

A first synchronization automatically creates the target model diagram. A new synchronization on previously synchronized models does not include automatic update of diagrams, in other words of graphical representation of models. Depending on the changes you have made, the synchronization wizard may propose update of the target diagram.

Case of Diagram Update at Synchronization

The synchronization wizard proposes diagram update in the following cases.

After source diagram modification

When you run synchronization after source diagram modification, by default the wizard activates target diagram update. Updating is indicated by display of two small blue arrows.

Below, at synchronization in logical to physical mode, modification of the logical diagram automatically produces a physical diagram update.

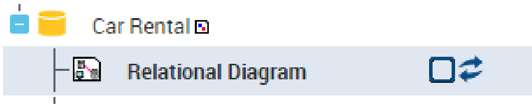
After target diagram modification

If you have modified the target diagram, for example the physical diagram, by default the synchronization does not propose update of this target diagram.

To display the case of target diagram update, you must select the synchronization option "Take account of optimizations". So that the update will be activated, you must select the check box in question.

After modification of both diagrams

If both diagrams - logical and physical - have been modified, target diagram update is proposed but not selected by default.



No modification detected

If neither of the two diagrams has been modified, the wizard does not propose update. It should be noted that any diagram modification must be saved before closing the diagram so that it will be taken into account by the synchronization wizard.

Particular case: an entity mapping with two tables.

When an entity of the logical model is associated with two tables in the physical model (following merging of entities for example), the updated physical model displays only one of the tables.

MODEL MAPPING

In many modeling projects the problem arises of communication between teams of analysts and architects and the database development teams.

HOPEX Information Architecture offers two modeling levels:

- ✓ The logical level which describes data modeling in terms of entities and relationships and is intended for analysts and developers.
- ✓ The physical (or relational) level, which describes the database in terms of tables and interfaces with the DBMS. This level is intended for the designer and the database administrator.

By enabling change from one data model to another, the database editor favors consistency between the architecture of data and its support systems.

The following points are covered:

The Database Editor

The database editor allows you to synchronize the different views of a database manually; the logical model and the physical (or relational) model.

The synchronization wizard automatically maps the the two views. See "Synchronizing logical and physical models", page 25.

After synchronization, you can create or modify mappings in the editor manually, but this method no longer guarantees consistency of the two models. The denormalization wizard maintains this consistency. See "Denormalizing logical and physical models", page 79.

Run the editor on a database

To open the editor on a database:

- Click the database icon and select **Mapping Editor**.
  The mapping editor juxtaposes the logical view and the physical view of the database. When a mapping tree exists, it is automatically displayed. When a tree has not been created for the database, a window prompts you to create it.

Creating a Logical/Physical Mapping Tree

To create a mapping tree:

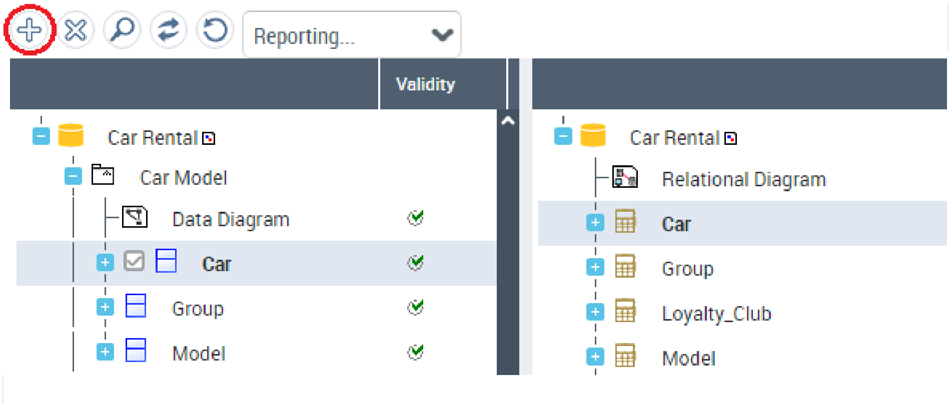
1. In the creation dialog box that opens, indicate the name of the new mapping tree.
2. In the **Nature** list box, select the nature of the tree: "Logical/Physical".
3. In the **Left Object** and **Right Object** frames, select the logical and physical models that you wish to align.
4. Click **OK**.
   The editor displays the mapping tree juxtaposing the two models.

Creating a Mapping

To create a mapping between an entity and a table:

1. In the database editor, select the entity then the table.

2. Click **Create mapping item**.

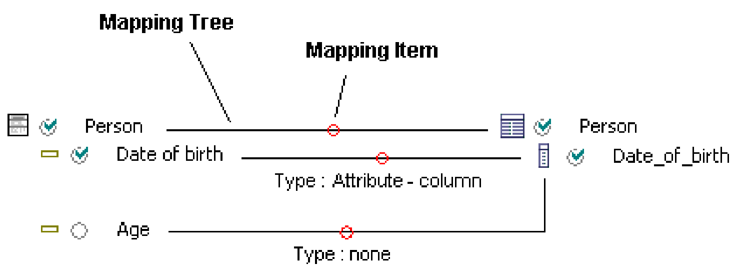


The mapping is created from the last object selected. Therefore, in order to create a mapping from the logical model to physical, in other words to define an object of the physical model from an object of the logical model, you must select the logical model object then the physical model object and create the mapping from the latter. If a mapping cannot be created, an error message appears (see "Synchronization direction", page 42).

New mapping example

Consider the "Person" entity that contains the "Birth Date" attribute. In physical formalism it has as mapping the "Person" table which contains the "Birth_Date" column.

Suppose we add the "Age" attribute on the entity. This can be calculated from the birth date. So as not to create a column corresponding to this new attribute at synchronization, you can directly connect it to the "Birth_Date" column.



To create a mapping between the "Age" attribute and the "Birth_Date" column:

1. In the editor, on one side select the "Birth_Date" column, and on the other the "Age" attribute.
2. Click **Create mapping item**.

When the mapping has been created, a tick appears in front of the "Age" attribute.

Deleting a mapping

To delete a mapping on an object:

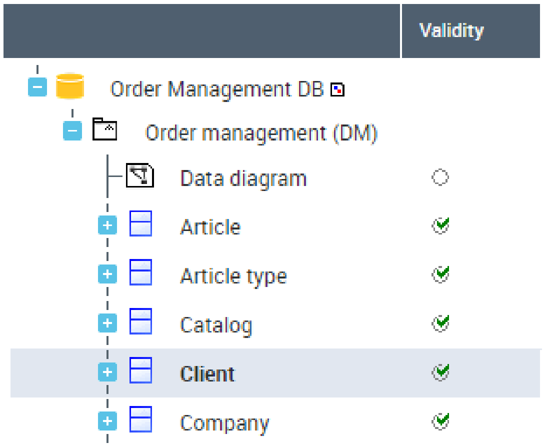
- Select the object in question and click the **Delete mapping item** button.

MAPPING DETAILS

Objects with mappings are ticked green. When you select one of these objects, its mapping appears in the mapping properties dialog box located by default at the bottom of the database editor. It groups the names of objects connected in the two formalisms, the object types and comments where applicable.

Mapping example

The "Customer" table is selected in the logical view tree:



The mapping displays the following objects:

Validity	Logical object	Physical object	Type
Valid	Client	Client	Entity - Table

This means that the "Customer" table is derived from the entity of the same name.

Mapping Properties

To view mapping properties:

1. In the mapping editor, select the mapping item and click **Properties**.
2. In the window that opens, click the drop down list and select **Characteristics**.

See also "Mapping characteristics", page 41.

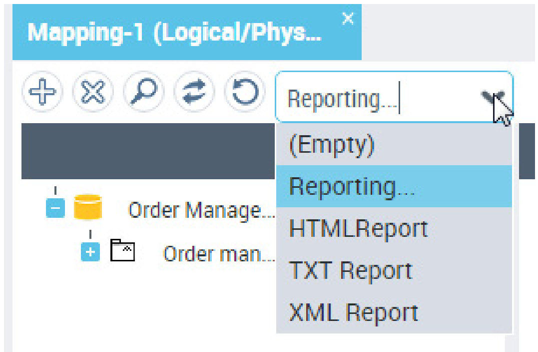
Mapping Report

In a document you can generate detail of mappings between the two database models. This can be an HTML, text or XML file.

Generating an HTML report

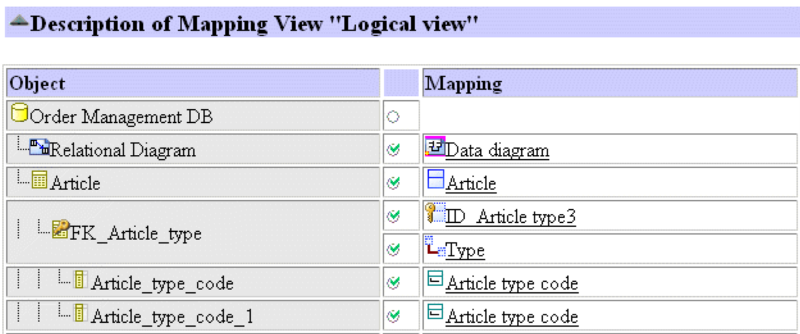
To generate the HTML report of a mapping tree:

- In the database editor toolbar, click the drop-down list and select **HTML Report**.



The corresponding file opens. It presents detail of mappings of the physical view and the logical view in the form of a table.

Each row of the table presents an object of the model and its equivalent in the other model. In the middle of each row appears the status of the mapping between the two objects.



Description of Mapping View "Logical view"

Object		Mapping
Order Management DB		
Relational Diagram		Data diagram
Article		Article
FK_Article_type		ID_Article type3
		Type
Article_type_code		Article type code
Article_type_code_1		Article type code

At the end of the document, you will also find a list of invalid mappings.

Object status

Indicators enable indication of status of synchronized objects. A filter bar allows you to show all or only certain of these indicators. This bar is available by selecting **View** > **Toolbar** in the editor.

Object status can be characterized as:

Valid

Invalid (when an object has kept a mapping to an object that no longer exists)

No mapping

Frozen (Protected)

Standard

Saving display of editor indicators

An option allows you to save the status of indicators in the mapping editor. It is specific to the user and the current mapping tree. A user who has selected the indicators display option will automatically find the status of objects in the previously created mapping tree.

The indicators display option of the editor is cleared by default. To activate it:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the left pane of the options window, select **Mapping Editor**.
3. In the right pane, select option **Save display of editor indicators**.
4. Click **OK**.

Mapping Source

When you select an object in the editor in one of the formalisms, you can display its mapping in the other formalism.

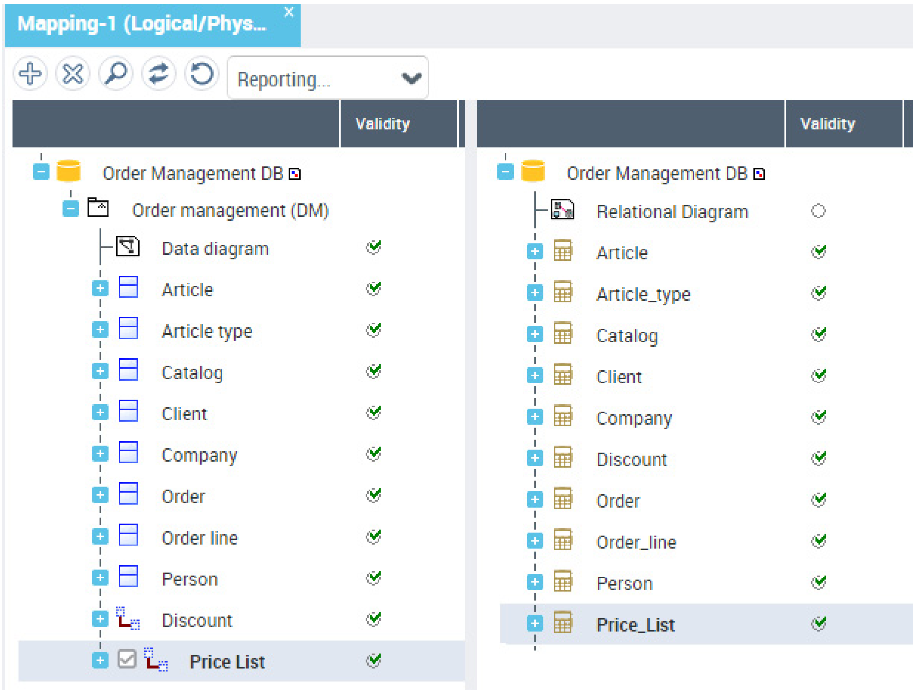
To display an object mapping:

- In the mapping editor, select the object concerned and click **Find**.

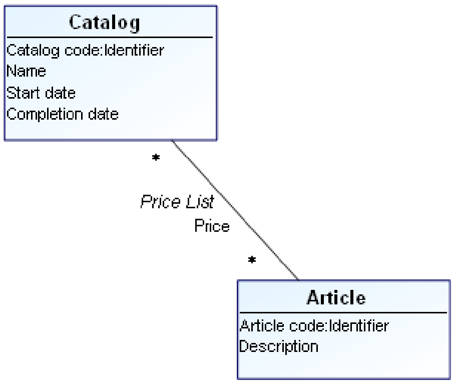
The editor displays the source object.

Mapping example

Consider the "Price List" table created in the logical model. In the pop-up menu of the table, select **Locate**. You will see that it corresponds to an association.



Opening the logical model diagram, you can see that this is the "Price List" association that connects the "Catalog" and "Article" entities.



At synchronization, this non-constraint association produces a table in which:

- A column is created for each connected entity.
- The primary key for the table uses all these columns.
- A foreign key is also built for each connected entity.

For more information on synchronization of associations, see "Logical to Physical Synchronization: the Associations", page 28.

Mapping Drawing

To view the mapping drawing:

- In the mapping tree, select the objects concerned.

A window appears at the bottom of the editor showing a drawing of objects and their connecting links.

DENORMALIZING LOGICAL AND PHYSICAL MODELS

After having synchronized a data model and a physical model, you can develop them by modification in their diagrams. This method does not however guarantee consistency between the two models.

Denormalization wizards have been created to ensure such consistency. They allow you to modify definition of one model while maintaining consistency with the other.

The wizards also allow you to quickly carry out duplication or merging operations without mapping transfer and/or without source object deletion when you wish to transfer modifications in the relational model.

In HOPEX Information Architecture V2R1, the denormalization functionality is only available for data models, it does not apply to packages (UML notation).

The following points are covered here:

DENORMALIZATION PRINCIPLES

Denormalization enables transformation or detailing of models as a function of specific requirements: choice of modeling, performance optimization, physical implementation level, redundancies, etc.

The denormalization tool is presented in the form of wizards enabling execution of these transformations.

A wizard applies to an object or group of objects. Depending on optimization type requested, denormalization creates new objects in a model starting from initial objects (source objects).

Denormalization: consistency of models

Denormalization changes the object of a model. When this model has been mapped with another (see "Synchronizing logical and physical models", page 25), you can manage impact of this change on the other model.

At denormalization, you can therefore:

- Transfer or not transfer mappings with synchronized objects.

- Delete or keep source objects.

Transferring mappings

Transfer of mappings guarantees stability and consistency between two models. When denormalization creates a new object at the logical level, mapping with the physical object is transferred to the new logical object. When you clear this option, mappings with new objects are not created and the two models must therefore be resynchronized.

So that synchronization can validate changes resulting from denormalization, make sure the "Reinitialize target objects" option is cleared.

Deleting source objects

Source objects are deleted by default. Non-deletion of source objects allows you to keep initial objects after denormalization.

Synchronization and Denormalization

In data modeling, synchronization and denormalization are often combined to respond to particular use cases.

Example

A PAYMENT entity that you wish to represent in the database by three tables TRANSFER, CHECK and OTHER. To produce this modeling:

1. Create the PAYMENT entity.
2. Run synchronization (logical to physical) to obtain the PAYMENT table.
3. Run the physical wizard to horizontally partition the PAYMENT table.
4. Rename the three duplicates TRANSFER, CHECK and OTHER.

The three tables obtained in this way are now connected to the PAYMENT entity and will follow the developments of future synchronizations.

Combining denormalization and synchronization options

Impact of a denormalization on two synchronized models varies depending on the options selected.

Consider the example of a logical denormalization. Possible combinations are:

- Deletion of source objects + transfer of mappings: logical model source objects are deleted. The physical level is unchanged; mapping with logical objects resulting from denormalization is assured.
- Deletion of source objects + non-transfer of mappings: physical objects corresponding to logical objects resulting from denormalization are created. The physical objects corresponding to deleted logical objects are deleted.
- Non-deletion of source objects + transfer of mappings: logical model source objects are kept. The physical level is unchanged; mapping with objects resulting from denormalization is assured.
- Non-deletion of source objects + non-transfer of mappings: physical objects corresponding to objects resulting from denormalization are created. Existing physical objects are kept.

Particular cases: ascending and descending merges:
In the case of an ascending merge, the supertype entity plays a particular role. Denormalization keeps its mapping in all cases. Similarly, in the case of a descending merge, subtype entities play a particular role; their mapping is kept in all cases.

Denormalization: Use Case

Combination of denormalization options varies depending on design mode of your models.

1. Maintaining stability at the physical level when a modification is applied at the logical level.

Context: a synchronization has already been established between the logical and physical levels. The physical level is in production. A modification must be applied at the logical level, without impact on the physical level.

Recommended denormalization options: transfer of mappings, deletion of source objects.

This use case corresponds to a preventive maintenance-oriented work mode: modifications are carried out by anticipation on the logical level, knowing that the physical level must not be modified until further notice.

Result: after denormalization, mappings are re-established between target logical objects and physical objects. After synchronization, nothing changes at the physical level.

2. Developing the physical level when denormalization is applied at the logical level.

Context: a synchronization has already been established between the logical and physical levels. The physical level is not frozen and must develop as a function of the logical level.

Recommended denormalization options: non-transfer of mappings, deletion of source objects.

This use case favors developments at conceptual level, ignoring impact at the physical level.

Result: after denormalization, target logical objects are without mappings and physical objects corresponding to source logical objects are no longer synchronized. After synchronization, the physical level is updated: the physical objects corresponding to source logical objects (objects existing before denormalization are deleted; new physical objects corresponding to target logical objects (objects created by denormalization) are created.

3. Simplifying logical level development during the development phase.

Context: a synchronization has already been established between the logical and physical levels, or the new physical level has not yet been implemented.

Recommended denormalization options: non-transfer of mappings, non-deletion of source objects.

This use case corresponds to an "incremental" work mode: logical level source objects are unchanged. The model is supplemented by target objects resulting from denormalization. These target objects produce a new section at the physical level and the existing physical section remains stable.

Result: after denormalization, mappings are unchanged. After synchronization, new physical objects corresponding to new logical objects are created; physical objects corresponding to source logical objects are unchanged.

4. Favoring installation of multiple scenarios in development phase.

Context: a synchronization has already been established between the logical and physical levels, several modeling options temporarily coexist for a single physical level.

Recommended denormalization options: transfer of mappings, non-deletion of source objects.

This use case, to be used with care, enables keeping two modeling options at conceptual level that produce a common result at the physical level.

Result: after denormalization, physical objects remain connected to source logical objects and are also connected to target logical objects. After synchronization, objects at the physical level are unchanged.

LOGICAL DENORMALIZATION

Logical denormalization applies to data model entities (or classes) and attributes.

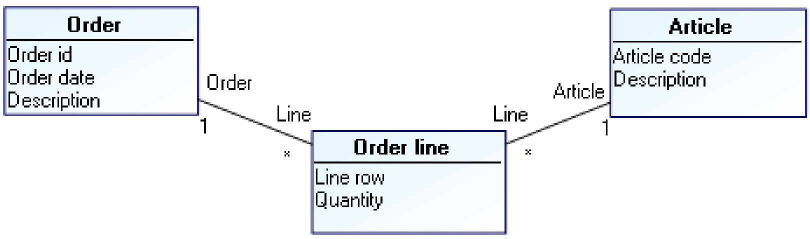
Running Logical Denormalization

To denormalize logical formalism:

1. Right-click the database with which the data model is associated and select **Logical denormalization**..
   A wizard opens.
2. In the **Select denormalization** field, select the type of denormalization concerned and follow the instructions of the wizard. See "Logical Denormalization Wizards", page 86.

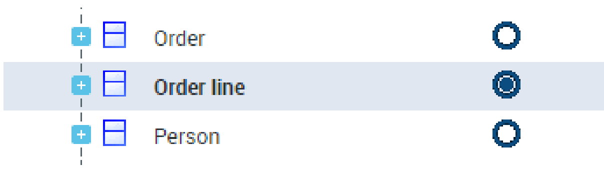
Logical denormalization example

Suppose that you wish to transform the "Order line" entity to an association.



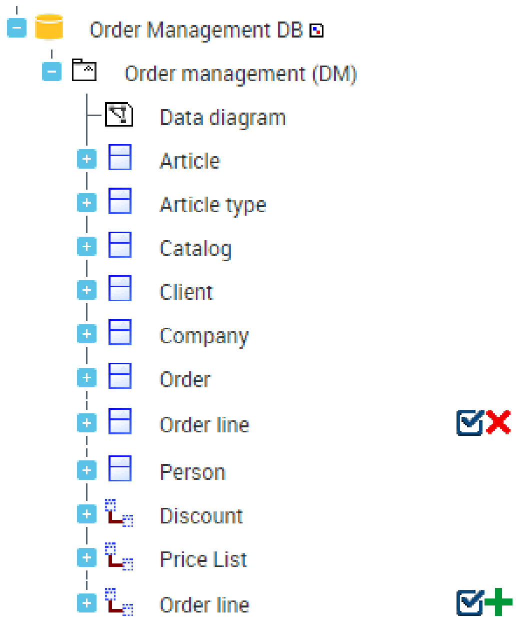
To transform this entity to an association:

1. Right-click the "Order management" database which contains this entity and select **Logical denormalization** .
   A wizard opens.
2. In the **Select the denormalization type field**, select "Transform an entity to an association".
3. Click **Next**.
4. In the editor tree, select the **Scope** column opposite the "Order line" entity check box.



☛ *You can select several entities at denormalization.*

5. Click **Next**.
Denormalization options appear. Mapping transfer and source object deletion are activated by default. This means that the "Order line" entity will be deleted and the mapping link with the "Order line" table will be transferred to the association which replaces it.
6. Click **Next**.
The editor displays changes produced by this denormalization. You can see that the "Order line" entity will be deleted and the "Order line" association will be created.



☛ *When a selected entity cannot be transformed, the editor will indicate the reason.*

You can refuse a modification by clearing the corresponding box.

7. Validate results by clicking **Next**.
This transformation is definitive and will be taken into account by the next synchronization.
On completion of denormalization, you can see that the "Order line" association that replaces the entity is now mapped with the "Order line" table.

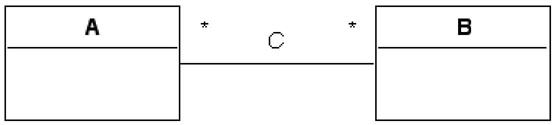
☛ *If an object is protected, it is not possible to select it during denormalization.*

Logical Denormalization Wizards

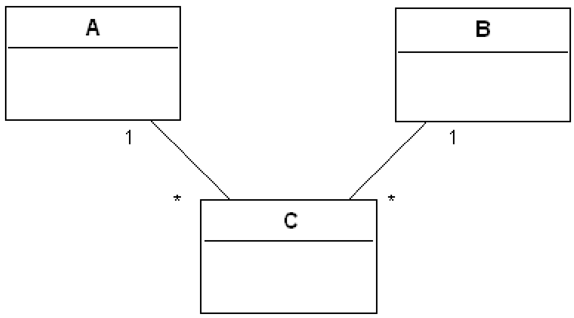
Transform association to entity

This denormalization enables transformation of an n-ary association, whatever its multiplicities, to an entity. An association of multiplicity '*,1' is created between this entity and the entities of the association.

Before



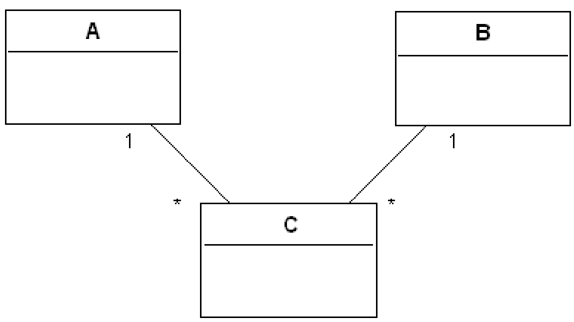
After



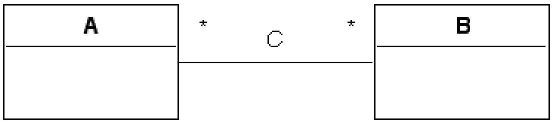
Transform entity to association

This denormalization enables transformation of an entity with n binary associations, of which opposite roles are of multiplicity '1', to an association. A new n-ary association of multiplicity * is created between these entities.

Before



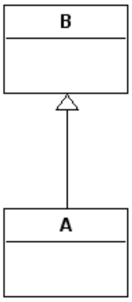
After



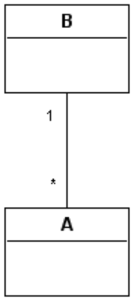
Transform generalization to association

This denormalization enables transformation of a generalization between two entities to an association. An association of multiplicity *,1 is created between the two entities and the generalization is deleted.

Before



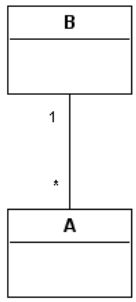
After



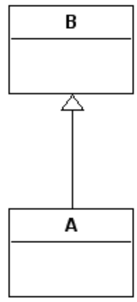
Transform association to generalization

This denormalization enables transformation of an association 1,* to a generalization. A generalization is created between the two entities and the association is deleted.

Before



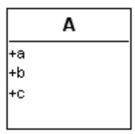
After



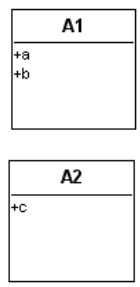
Vertical partition of an entity

This denormalization enables division of an entity into several entities. The attributes, associations and generalizations are shared between the entities.

Before



After



Horizontal partition of an entity

This denormalization enables duplication of an entity.

Before **After**

Horizontal partition and synchronization in Logical > Physical mode

Consider a "Catalog" entity. After horizontal partition, this entity gives two entities "Catalog-1" and "Catalog-2".

After synchronization of the Logical > Physical mode, the two entities have a table as mapping.

If you display properties of mappings, you will note that both are bidirectional, meaning that entities and table are updated in both directions of synchronization.

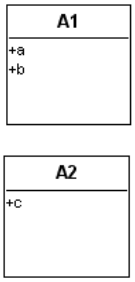
If you carry out logical modifications on these entities and then re-run synchronization, the editor displays a signal on the target table; it does not know which entity to take to carry out updates.

When you select an entity, this is kept as reference entity (for example Catalog-1). The other entity will be kept in one direction only, in other words Catalog-2 could be updated in the logical model but will have no impact on the table.

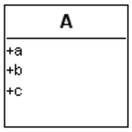
Merging of entities

This denormalization enables merging of entities.

Before



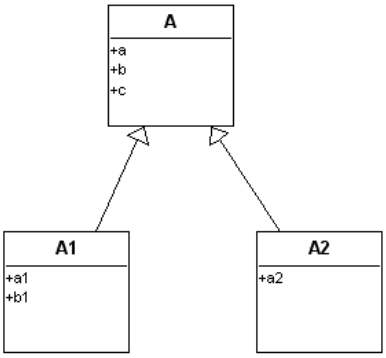
After



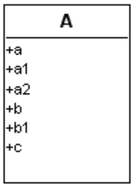
Merging of ascending entities

This denormalization enables merging of an entity with its parent entity: all attributes and links are transferred to the parent entity and the child entity is deleted.

Before



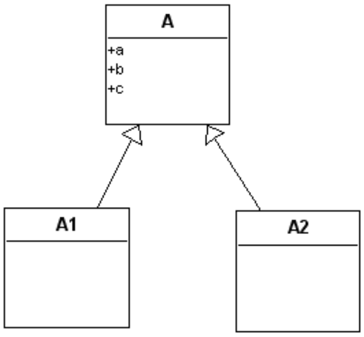
After



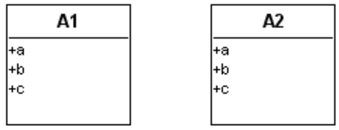
Merging of descending entities

This denormalization enables merging of an entity with its child entity: all attributes and links are transferred to the child entity and the parent entity is deleted.

Before



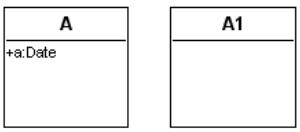
After



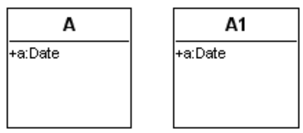
Copy/paste of attributes

This denormalization enables transfer of attributes of an entity or association to other entities or associations.

Before



After



PHYSICAL DENORMALIZATION

Physical denormalization applies to database objects represented by tables, columns, keys and indexes.

Running Physical Denormalization

To denormalize the physical formalism:

1. Right-click the database and select **Physical denormalization**.

A wizard presents all customizations possible on database objects.

Physical denormalization example

It is possible to arrange that a table is partitioned into two separate tables, either to separate columns of the two tables (vertical partition), or to duplicate information in a table in two others (horizontal partition).

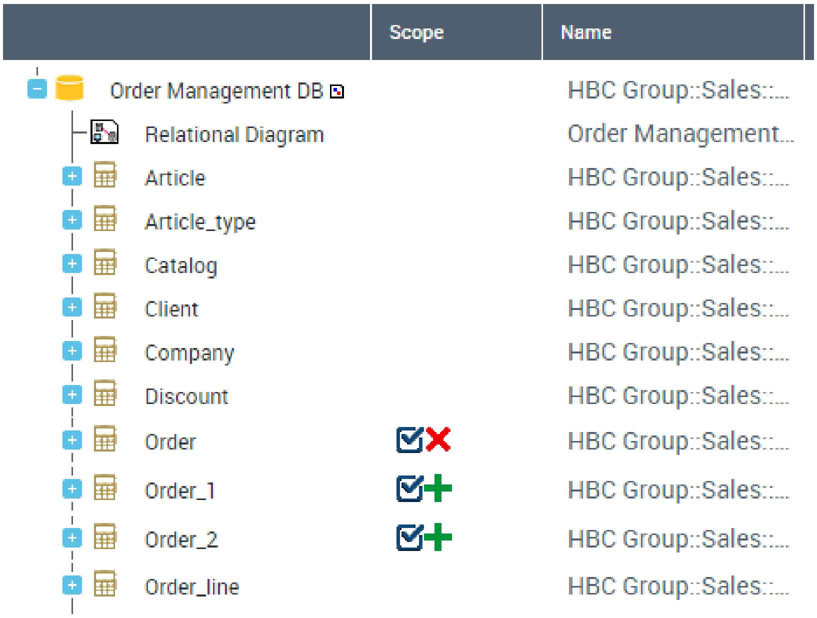
Consider the example of an order entry. This order entry is represented by an entity at the logical level, and gives a table at the physical level. Suppose that order entry has to be managed differently at technical level, depending on whether it is a telephone or Internet order. This change can be integrated in the physical model without having to modify the logical model in parallel. To do this, we arrange that the entity representing order entry is partitioned into two tables; one for telephone orders, the other for Internet orders. By integrating this modification from the wizard, the partition becomes automatic at each synchronization, and the two models remain consistent.

To create a horizontal partition such as that described above:

1. Right-click the "Order management" database that contains this entity and select **Physical denormalization**.
   A wizard opens.
2. In the **Select the denormalization type field**, select "Horizontal partition of table".
3. Click **Next**.
4. In the editor tree, select the table you wish to duplicate, in this case "Order".
5. Click **Next**.
   Denormalization options appear. Mapping transfer and source object deletion are activated by default. This means that the "Order" table will be deleted and the link with the "Order" entity will be transferred to the two tables.

   Specify the number of partitions, in other words the number of tables created. The tool creates two tables by default.

6. Click **Next**.
The editor displays changes produced by this denormalization. You can see that the "Order" table will be deleted and that two new tables will be created.



7. Validate results by clicking **Next**.
This transformation is definitive and will be taken into account by the next synchronization.
On completion of denormalization, you can see that the two new tables are now mapped with the "Order" entity.

Denormalization here applies to the physical model. The synchronization that will take this customization into account must therefore be run in the same direction, in other words from logical model to the physical. It is not valid in the other direction.

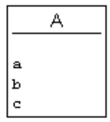
List of Physical Denormalization Wizards

Vertical partition of a table

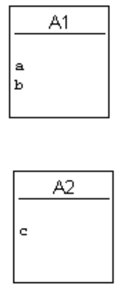
This denormalization enables division of a table into several tables. Columns are shared between the tables obtained.

Only columns that are not part of a key can be distributed between tables.

Before



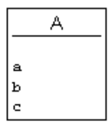
After



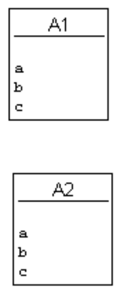
Horizontal partition of a table

This denormalization enables duplication of a table. The two tables obtained contain all columns of the original table.

Before



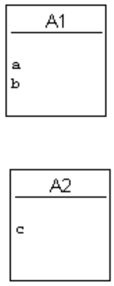
After

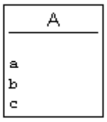


Merging of tables

This denormalization enables merging of tables.

Before **After**



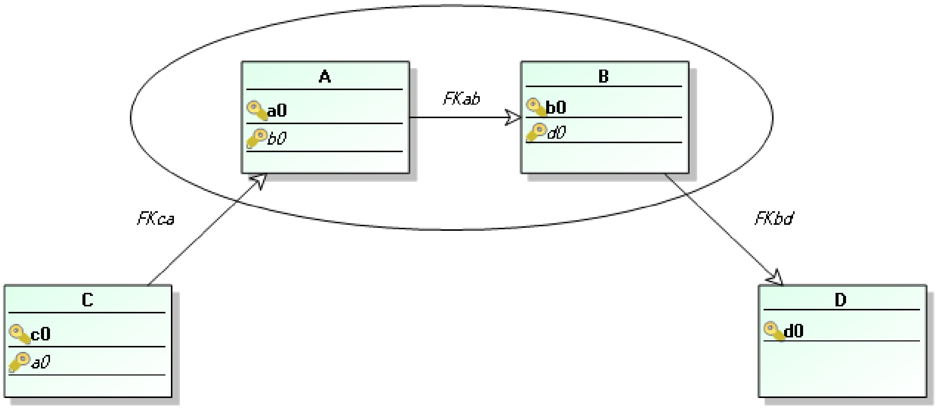


Primary keys option

When you run merging of tables, an option allows you to determine the primary key of the merge table: you can select one of the primary keys of the source tables or merge all primary keys of the source tables.

When you select a primary key for the merge table, only those foreign keys that reference this primary key are transferred. Foreign keys that reference primary keys that are not transferred are not taken into account.

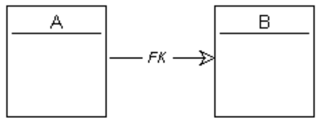
Therefore in the following example, if you merge tables A and B and keep the primary key of table A, the primary key of B disappears at merge. Nor is foreign key FKab transferred since it references primary key B. The other foreign keys, FKca and FKbd, are transferred in the relational diagram.



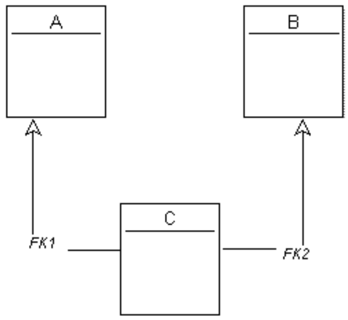
Transform foreign key to table

This denormalization enables transformation of a foreign key to a table. A new table and two new foreign keys are created. The original foreign key is deleted.

Before



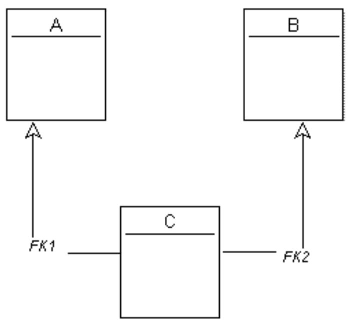
After



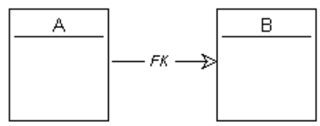
Transform table to foreign key

This denormalization enables transformation of a table to a foreign key. The table and its two foreign keys are deleted and a new foreign key is created.

Before



After



Copy/paste of columns

This denormalization enables transfer of columns of one table to another.

Before **After**

ATTRIBUTE AND COLUMN TYPES

Not all data has the same value type. Datatype determination enables indication of format and therefore facilitates handling by the different data processing tools.

HOPEXmanages datatypes at different modeling levels, assuring correspondence of datatypes at the logical level with datatypes handled by the different supported DBMSs.

The following points are covered here:

ATTRIBUTE DATATYPES

A type is used to group characteristics shared by several attributes.

To type attributes of an entity, only those datatypes defined for the *data model* that contains this entity are proposed.

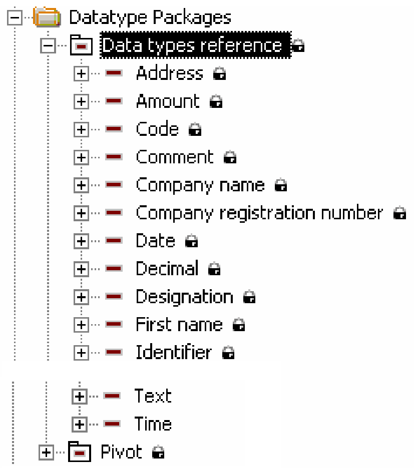
A data model is used to represent the static structure of a system, particularly the types of objects manipulated in the system, their internal structure, and the relationships between them. A data model is a set of entities with their attributes, the associations existing between these entities, the constraints bearing on these entities and associations, etc.

Datatype Packages

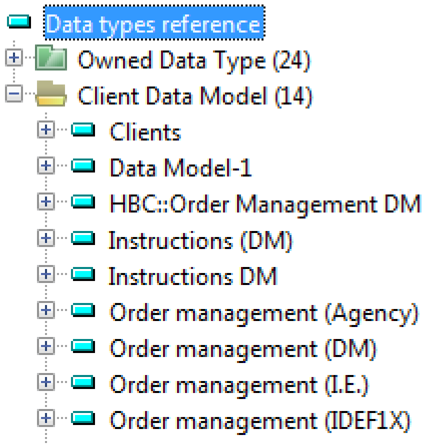
A datatype package is a reference package owning all or a proportion of the datatypes used in the enterprise. All the other packages are declared as clients of the reference package of datatypes.

When you create a data model, the "Datatype Reference" *datatype package* is automatically associated with it by default.

This "Datatype Reference" package owns standard datatypes "Address", "Code", "Date", etc.



Opening the explorer on this datatype package, you can see that is is referenced by several data models.



The attributes of entities of these models can therefore be typed using the datatypes "Address", "Code", "Date", etc.

Creating a New Datatype Package

You can define a new reference datatype package owning the datatypes used by the enterprise.

To create your own datatype package:

1. On the desktop, click the navigation menu, then **Logical data**.
2. In the navigation pane, click the **Datatype packages**.
   The list of datatype packages in the repository appears in the edit window.
3. Click **New**.
   The datatype package creation dialog box opens.
4. Enter its name and an owner if appropriate.
5. Click **OK**.

You can then add types to this package.

Creating a datatype

To create a datatype:

1. Right-click the datatype package and select **Properties**.
   The properties dialog box of the package appears.
2. Click the drop-down list then **Data Types**.
3. Click **New**.
   The datatype creation dialog box opens.
4. Enter the name of the datatype and click **OK**.

Compound datatype

You can create compound datatypes by adding to them a list of attributes, for example an "Address" type comprising number, street postal code, city and country.

Literal value

You can allocate to a datatype literal values that define the values it can take. Attributes based on such a datatype can take only those values defined by the datatype.

When the new datatype package has been created, it should be referenced on the client data model.

Referencing Datatype Packages

When you define a new datatype package, you must connect it to the data model concerned.

To connect a datatype package to a data model:

1. On the desktop, click the navigation menu, then **Logical data**.
2. In the navigation pane, click the **All data models** folder.
   The list of data models appears in the edit area.
3. Right-click the data model concerned and select **Properties**.
   The data model properties dialog box appears.
4. Click the drop-down list then **Characteristics**.
5. In the **Reference** field, click the arrow and select **Connect Package**.
   The query dialog box appears.
6. Click **Find**.
   The list of datatype packages appears.
7. Select the desired package and click **OK**.

Assigning Types to Attributes

When the datatype package has been referenced for the data model, the list of types it contains is available on each attribute of entities of the model. All that is required is to select the one that is suitable.

To define the type of an attribute:

1. Right-click the entity that contains the attribute and select **Properties**.
   The properties dialog box of the entity appears.
2. Click the drop-down list then **Attributes**.
3. In the **Datatype (DM)** column that corresponds to the attribute, select the desired type in the list.
4. Click **Apply**.

Determining Column Datatypes from Attribute Types

Datatypes defined at the logical level level are not always comprehensible for the target DBMS. In this case, they need to be converted to datatypes corresponding to the target DBMS.

This conversion intervenes notably at synchronization. Datatypes of attributes defined in the logical model are translated to datatypes for the generated columns.

Conversion is assured by an equivalence link with pivot types. The pivot types are an intermediary between logical datatypes and generated datatypes.

Pivot Types

Pivot types are datatypes defined independently of the target DBMS, which you can use when you do not yet know the system in which the database will be hosted, or when several systems may be used.

Pivot types have an equivalent datatype in each supported DBMS. They therefore enable you to define the attribute types just once, then to reinterpret them later as a function of the target DBMS.

To use the datatypes of a DBMS, you must import the corresponding solution pack. See "Importing a DBMS Version", page 9.

List of pivot types

Once imported, the pivot types are available in the **Logical data** navigation pane, in the "Pivot" datatype package.

Alphanumeric types		**Other Information**
P-String	Alphanumeric character chain	
P-Text	Alphanumeric character chain	
P-Character	Alphanumeric string of fixed length	Length
P-Varchar	Alphanumeric string of variable length	
Numeric types		
P-Decimal	Decimal	
P-Double		
P-Float		

P-Integer	Short	
P-Long Integer		
P-Long Real		
P-Real		
P-Smallint		
P-Tinyint		
P-Numeric	Number	Length, decimal places
P-Currency	Amount expressed as currency	Length, decimal places
Date types		
P-Date	Date	
P-Time	Time	
P-DateTime	Date and time	
Binary types		
P-Binary	Binary string	
P-Byte	Binary string	
P-Timestamp	Identification automatically generated from the date and time, expressed in thousandths of seconds since January 1, 1970	
P-Boolean	Boolean, equals 0 or 1	
P-Multimedia	Binary string	
P-Varbinary	Binary string	

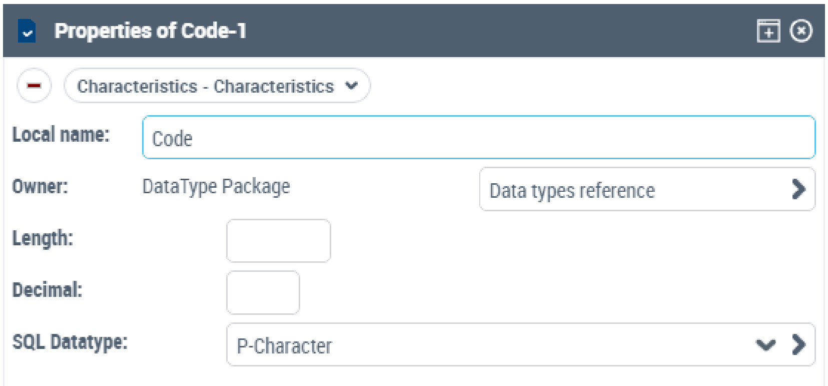
Connecting a Datatype to a Pivot Type

Datatypes contained in the "Datatypes Reference" package and associated by default with all new data models are connected to these pivot types. Therefore when you create new datatypes, these must be connected to the corresponding pivot types so that they can subsequently be used at physical level.

To connect a datatype to a pivot type:

1. Right-click the datatype and select **Properties**.
   The properties dialog box of the datatype properties dialog box appears.
2. Click the drop-down list then **Characteristics**.
3. In the **SQL Datatype** field, select the pivot type.

Take the "Code" datatype. Open its properties dialog box and click the **Characteristics** page. In the **SQL Datatype** field, you can see that it is connected to the "P-Character" pivot type .



At synchronization of a logical model to a physical model, this pivot type "P-Character" will give a datatype CHAR, VARCHAR, LONG or TEXT depending on the DBMS concerned by synchronization. You can modify the target DBMS without having to modify the datatype, **HOPEX** assuring automatic conversion. See "Mappings Between Pivot Types and Datatypes", page 109.

Connecting a Datatype to a Pivot Type in UML Notation

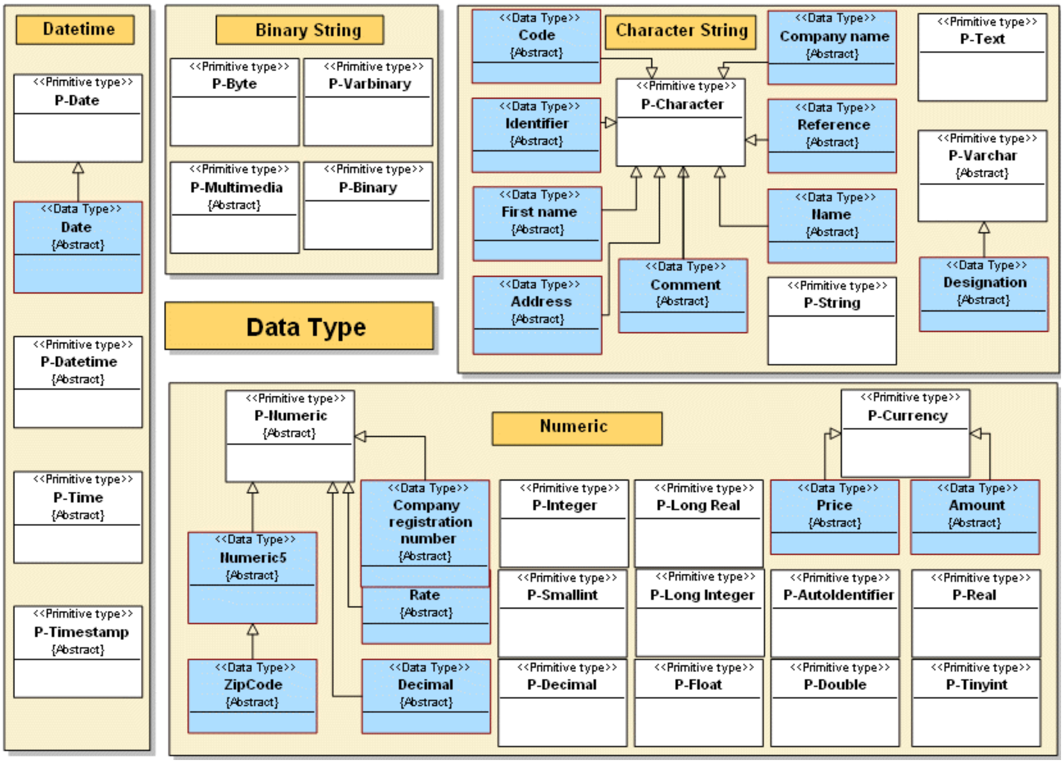
If you use UML notation and class diagrams to modify your data - and for reasons of compatibility with earlier versions of **HOPEX Database Builder** - other methods of referencing pivot types are possible.

You can create new datatypes and connect them to pivot types:

- By inheritance
- By a correspondence link
- By an equivalence link
- By creating a compound datatype

By inheritance

You can define your own datatypes by declaring them as subclasses of the pivot types, as shown in the example below.



The datatypes defined as subclasses will automatically inherit the characteristics of their superclass. In particular, the datatype conversion rule for the superclass is applied to the subclass.

It is possible to specify a length and a number of decimal places for the subclass. These will be taken into account when generating the data types if they were not already defined for the superclass.

By a correspondence link

To create this link:

1. Open the properties dialog box of the class.
2. Click the drop-down list then **Generation** > **SQL**.
3. Indicate the **SQL Type** associated with the class.

    ☛ *Only pivot types of the Standard::Types::Pivot package are proposed in the list.*

4. You can also indicate the length and the number of decimal places to be applied.

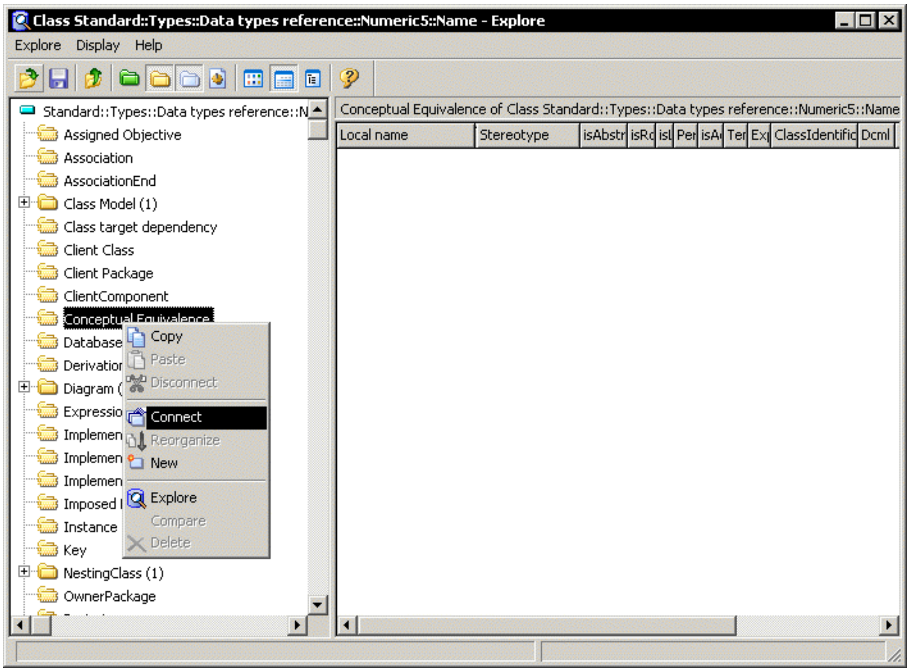
By an equivalence link

It is possible to define a new datatype by creating an equivalence link with a pivot type. To do this:

1. Create a new datatype
2. Right-click the type and select **Explorer**.
3. In the dialog box that appears, click the **Empty Collections** button.

   ☛ *If necessary, click*  *to display the hidden commands.*

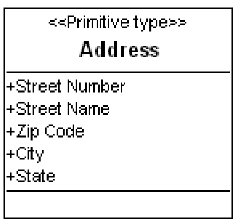
4. Right-click the "Conceptual Equivalence" folder and select **Connect**.



5. In the standard query dialog box, select the pivot type you wish to connect to your type.

By creating a compound datatype

You can define a compound datatype by assigning to it a list of attributes.

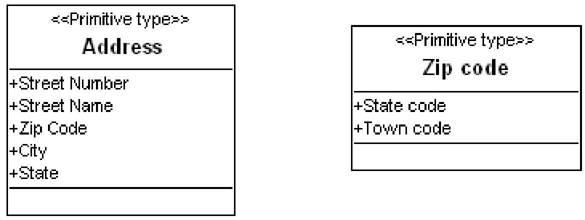


Here the "Address" type is composed of the number, street, zip code, city, and country.

The derivation of the "Address" attribute will produce these five columns.

It is possible to have several levels of compound types by assigning a compound type to an attribute of a compound type.

For example, the zip code can be broken down into the main five digits and the four-digit extension:



Mappings Between Pivot Types and Datatypes

Pivot types establish correspondence between the logical datatypes to which they are connected and the datatypes for which they have an equivalent in each target DBMS.

The equivalence links carry conditions that enable them to be distinguished one from the other.

To visualize correspondences between pivot types and the different DBMS datatypes, see "Pivot Types and Datatypes Correspondence Tables", page 167.

Example of correspondence between pivot types and Oracle 8 datatypes

Pivot to Datatype

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Binary		RAW(@L)
P-Boolean	L=2 or L ø	RAW(1)
	L>1	RAW(@L)
P-Byte		RAW(1)
P-Character	L=256 or L ø	CHAR(@L)
	L>2000	LONG
	255<L<2001	VARCHAR2(@L)
P-Currency		NUMBER(@L,@D)
P-Date		DATE
P-Datetime		DATE
P-Decimal		NUMBER(@L,@D)
P-Double		NUMBER(@L,@D)
P-Float		NUMBER(@L,@D)
P-Integer		NUMBER(@L)
P-Long Integer		NUMBER(@L)
P-Long Real		NUMBER(@L,@D)

Pivot	Condition	Datatype
P-Multimedia		LONG RAW
P-Numeric	L=0 or L ø	NUMBER
	L>0 and D ø	NUMBER(@L)
	L>0 and D not ø	NUMBER(@L,@D)
P-Real		NUMBER(@L,@D)
P-Smallint		NUMBER(@L)
P-String		LONG
P-Text		VARCHAR2(@L)
P-Time		DATE
P-Timestamp		ROWID
P-Tinyint		NUMBER(@L)
P-Varbinary		LONG RAW
P-Varchar	L>2000 or L=0 or L ø	LONG
	0<L<2001	VARCHAR2(@L)

Datatype to Pivot

Datatype	Condition	Pivot
CHAR(L)		P-Character
DATE		P-Date
LONG		P-String
LONG RAW		P-Multimedia
NUMBER		P-Numeric
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric
RAW(1)		P-Boolean
RAW(L)		P-Boolean
ROWID		P-Timestamp
VARCHAR2(L)		P-Varchar

In this table, we can see that the "P-Numeric" type has three correspondences for type classes using three different conditions on the equivalence links.

if P_Numeric is assigned to an attribute and the length of this attribute is 10, then the column justified by this attribute via the synchronization will give Number(10).

The condition is written in VB Script language. The main elements of the condition are:

- **Sub ConditionInvoke (Column, ByRef bValid)**: the first line constitutes the signature of the function.
- **Column**: the column is given as an input parameter.
- **bValid** : is the return parameter. Its value is "True" if the condition is verified, "False" if not.

Example:

```
Sub ConditionInvoke (Column, ByRef bValid)
   bValid = False
   If (IsNumeric(Column.Length)) Then bValid = True
End  Sub
```

The following can be specified in the condition:

- Presence of a number
- Presence of a decimal
- Range concerned (example: between 0 and 150 inclusive)

Creating New Datatypes

Each datatype is implemented in the form of a class; it is specific to a DBMS version. It is possible to use masks with datatypes.

Example for Oracle 10

Objective

In the ORACLE scripts, create a numeric datatype called Data8 with a length and a specified number of decimal places.

Steps

Steps are as follows:

1. Create a new datatype in **HOPEX**. If necessary, you can create a mask.
2. Connect the datatype to the target DBMS (in this case Oracle 10).
3. Connect the datatype to the corresponding type in the "Pivot" package.
4. Configure the conditions on each link in both directions (from datatype to pivot type and vice-versa).

   ☛ *For more information on equivalence links and conditions, see* *"Determining Column Datatypes from Attribute Types", page 103 .*

Prerequisite Conditions

To see packages containing DBMS datatypes, you must import the corresponding solution pack. See "Importing a DBMS Version", page 9.

☛ *You can connect the datatype to a generation target that you created. To create a generation target, see* *"", page 124 and "", page 124.*

It is recommended that a datatype be defined in only one DBMS version.

In addition, certain data is protected in **HOPEX**. To be able to modify objects contained in DBMS packages:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.
2. In the tree on the left, click **Repository**.
   The list of options linked to the repository appears in the right pane of the window.
3. In the "Authorize MEGA data modification" box, select "Authorize".
4. Click **OK**.

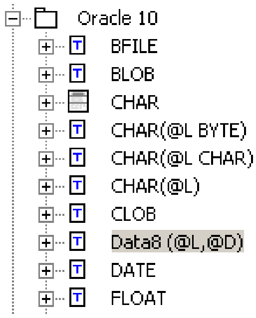
Creating a new datatype

To create a new datatype:

1. On the desktop, click the navigation menu, then **Logical data**.

2. Select the **All Packages** folder.
3. Right-click the "Oracle 10" folder and select **New > Class**. The **Creation of Class** dialog box opens.
4. Name your class "Data8 (@L,@D)".
5. Open the properties dialog box of this new class.
6. In the **Characteristics** page, select "Expression" in the **Stereotype** drop-down list, then click **Apply**.
7. The **Expression Type** field appears. In this field, select "Data8 (@L,@D)". Also delete the quotation marks around this value.

You will see in the navigator that a new class "Data 8" has been automatically created.



☛ *This new class is automatically created for UML operating requirements..*

Connecting the datatype to the pivot type

If you wish to obtain this datatype after synchronization, you must give it an equivalence at the logical level.

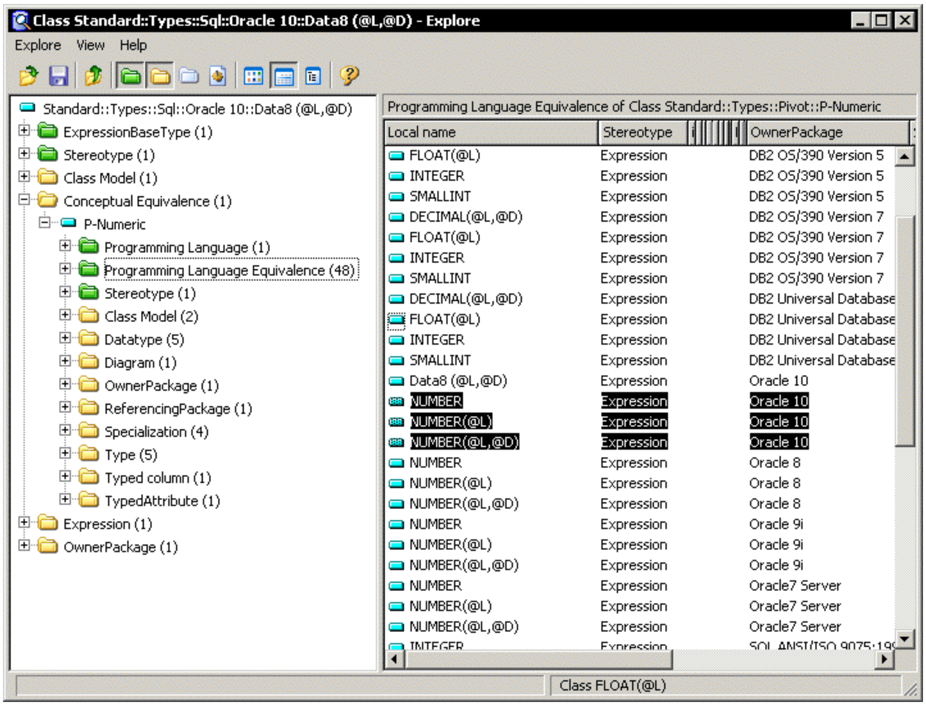
1. Open the properties dialog box of datatype "DATA8 (@L,@D)".
2. Click the drop-down list then click **Complements**.
3. Right-click the "Conceptual Equivalence" folder and select **Connect**.
4. In the query dialog box, select the class "P-Numeric".

Configuring conditions on links

To configure a condition on links:

1. Right-click the "Data8" class and select **Explorer**.
2. Expand the "Conceptual Equivalence" folder.

3. Select the green folder "Programming Language Equivalence".
   You will see that there are three other cases of correspondence for Oracle 10.



Conditions on these correspondences must therefore be modified so that they will be coherent with the conditions placed on the new datatype.

4. Open the properties dialog box of datatype "NUMBER(@L,@D)".
5. In the **Texts** page, select "Language equivalence condition", and modify the text as follows:

```
Sub ConditionInvoke (Column, ByRef bValid)
   bValid = False
   Dim IsNumericLength
   IsNumericLength = IsNumeric(Column.Length)
   Dim IsNumericDecimal
   IsNumericDecimal = IsNumeric(Column.Decimal)
   If (IsNumericLength and IsNumericDecimal) Then
      If (Column.Length <> 8) Then
         bValid = True
      End If
   End If
End  Sub
```

6. In the same way, add the following text in the properties dialog box of new datatype "Data8".

```
Sub ConditionInvoke (Column, ByRef bValid)
   bValid = False
   Dim IsNumericLength
   IsNumericLength = IsNumeric(Column.Length)
   Dim IsNumericDecimal
   IsNumericDecimal = IsNumeric(Column.Decimal)
   If (IsNumericLength and IsNumericDecimal) Then
      If (Column.Length = 8) Then
         bValid = True
      End If
   End If
End  Sub
```

Verifying datatypes

To verify datatypes:

1. Right-click a **HOPEX Information Architecture** navigator database and select **Tables**.
2. Display the properties of a column concerned by conditions placed on the datatype.
3. Verify that the mask displayed in the **Datatype** column is "Data8 (%l, %d)" for this column.

Example for SQL Server 7

Objective

Reread SQL Server 7 columns containing a non-standard datatype.

Manipulations are the same as for Oracle (see "Example for Oracle 10", page 112). On this occasion we shall not create a mask.

Creating a new datatype

To create a new datatype:

1. On the desktop, click the navigation menu, then **Logical data**.
2. Select the **All Packages** folder.
3. Right-click the “SQL Server 7" package and select **New > Class**.
   The **Creation of Class** dialog box opens.
4. Name your class "TLongName".
5. Open the properties dialog box of this new class.
6. In the **Characteristics** page, select "Expression" in the **Stereotype** drop-down list, then click **OK**.

Connecting the datatype to the pivot type

To connect the datatype to the primitive type:

1. Open the properties dialog box of the "TLibelleLong" datatype.
2. Select the **Complements** page.
3. Right-click the "Conceptual Equivalence" folder and select **Connect**.
4. In the query dialog box, select the "P-Text" class.

Configuring conditions on links

To configure a condition on links:

1. Right-click the "TLibelleLong" class and select **Explorer**.
2. Select the green folder "Programming Language Equivalence".
   You will see that there is another correspondence for SQL Server 7.
3. Open the properties dialog box of datatype "text".
4. In the **Texts** page, select "Language equivalence condition", and modify the text as follows:

```
Sub ConditionInvoke (Column, ByRef bValid)
   bValid = False
   Dim IsNumericLength
   IsNumericLength = IsNumeric(Column.Length)
   If (IsNumericLength) Then
      If (Column.Length > 255) Then
         bValid = True
      End If
   End If
End  Sub
```

5. In the same way, add the following text in the properties dialog box of new datatype "TLongName".

```
Sub ConditionInvoke (Column, ByRef bValid)
   bValid = False
   Dim IsNumericLength
   IsNumericLength = IsNumeric(Column.Length)
   If (IsNumericLength) Then
      If (Column.Length <= 255) Then
         bValid = True
      End If
   End If
End  Sub
```

GENERATING SQL SCRIPTS

The SQL generation function produces SQL script files, which, from logical objects of your **HOPEX** repository (database, table, column, etc.) allow you to create, modify or update the corresponding objects in the target DBMS of your choice.

Generation takes into account parameters inherited from the target DBMS (specified for the database), parameters that you can customize at a global level (see "Configuring Database Generation", page 124) or at a more detailed level, on a column or primary key for example.

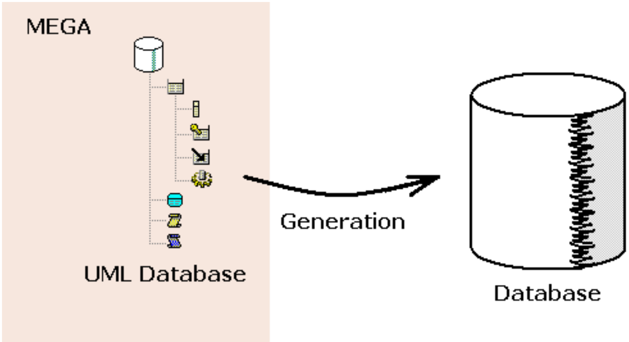
For the main target DBMSs on the market, the database editor makes accessible a "physical view" that allows you to optimize the SQL grammar of generated scripts in order to integrate technical options specific to the selected DBMS, such as partitioning. See "Adding Physical Properties to Database Objects", page 142.

Finally, logical level can be completed by generation of physical objects specific to each database for a DBMS, such as logical views, stored procedures and triggers. See "Advanced SQL Options", page 133.

The different generation modes presented below take into account the constraints linked to database administration under different systems with maximum flexibility.

The points covered here are:

Running SQL Generation



SQL Generation Objects

Objects taken into account in generation are:

- Table
- Column
- Primary key
- Foreign key
- Indexes
- Data group
- Logical view
- Material view
- Trigger
- Stored procedure
- Job Title
- Synonym
- Sequence
- Cluster
- Partition

Scripts generated by **HOPEX** manage only the structure of relational objects, their content is not covered.

Starting the generation wizard

Display of certain generation targets can be filtered. Before starting generation, check that the selected generation target is activated:

1. On the desktop, click **Main Menu** > **Settings** > **Options**.

2. In the left pane of the options window, expand the **Data Modeling** folder then double-click the **SQL Generation** folder.
   This folder contains all supported SQL generators.
3. In the right part of the window pane select those that you want to display in **HOPEX Information Architecture**

For generation targets, see "Supported DBMS versions", page 123.

To start an SQL generation:

1. On the desktop, click the navigation menu, then **Physical data**.
2. In the navigation pane, select **SQL Code Generation**.
   A wizard opens.
3. Define the **Generation scope**:
   - database for a complete generation
   - another SQL object for a partial generation.
4. Select the database concerned and click **Next**.
5.
6. Select the **Generation Mode**.
   Four generation modes are possible:
   - "Creation": generates creation orders for all objects.
   - "Deletion": generates object deletion orders only.
   - "Replacement": starts deletion of objects, then recreation (to avoid creation of duplicates for example). Supposes that the target DBMS supports this generation mode.
   - "Modification": modifications only are taken into account. Unlike the other modes that act without taking account of what possibly exists, this mode enables connection to the DBMS server to obtain read-only access to the database already created. The wizard compares the **HOPEX** data file and the database information. After analysis of the two structures, the wizard generates the corresponding modification SQL orders. See "Incremental Generation", page 120.

     ☛ *This mode is only available for the main DBMSs. See "Supported DBMS versions", page 123.*
7. Click **Next**.
   A dialog box then presents the objects generated.
8. Click **Next**.
   Generation starts. A dialog box presents progress of the operation indicating the file(s) containing the result.
   Click **Open** to see the list of the files generated.

When the extension used for the generated files is recognized by Windows, you need only double-click the file name to view it using the editor associated with the extension.

INCREMENTAL GENERATION

When a database has already been generated, you can subsequently reflect only changes to the database using "Modification" mode of SQL generation.

For a database, incremental generation allows you to:

- consult in an HTML report the differences between the database and its representation in **HOPEX**.
- produce SQL scripts enabling update of the target database from its description in **HOPEX**.

Incremental Generation Objects

Objects managed by incremental generation are the same as those of generation in "Creation" mode: table, column, primary key, foreign key, index, data group, logical view, material view, trigger, stored procedure, function, synonym, cluster, partition.

Scripts generated by **HOPEX** manage only the structure of relational objects, their content is not covered. Incremental generation options enable isolation of SQL orders that require particular precautions or additional processing.

Running Incremental Generation

Generation options

Incremental generation is done in a global file; it is carried out from the database and not from a particular modified object.

Before starting generation:

1. Right-click the database and select **Properties**.
   The properties window of the database appears.
2. Click the drop-down list then **Options** > **Generation**.
3. In **Script Distribution**, select "A global file".
4. Click **OK**.

In options, you must also indicate incremental generation mode, which authorizes object deletion or not.

For more details on generation options, see "Configuring Database Generation", page 124.

Start the generation wizard

To run incremental generation:

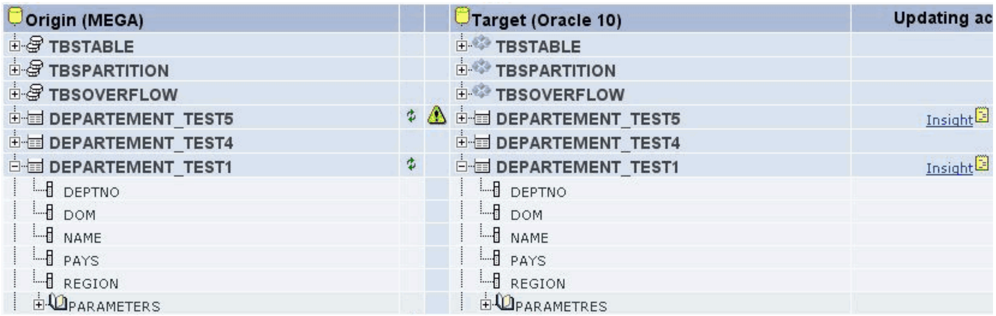
1. Right-click the database and select **Generate the code**.

2. In the **Generation mode** field, select "Modification".

   ☛ *This "Modification" command is only available for the main DBMSs. See "Supported DBMS versions", page 123.*

3. Select the **Data source**. Incremental generation can be carried out:
   - From an ODBC connection.
   - From an extraction file See "ODBC Extraction Utility", page 155.
4. Click **Next**.
5. When connected to the target DBMS, enter the name of the owner. This will enable you to filter the tables to be taken into account in the generation.
6. Click **Next**.

The result window presents two files, the SQL file and a "Report.htm" file. The latter file is a report of the generation. It is a dynamic file that presents initial content of the database and modifications carried out.



Each row of the list describes:

- The **HOPEX** object. This can be empty if it has been deleted from the **HOPEX** repository.
- The DBMS update reference as compared to **HOPEX**. The various actions possible on objects are:
  - Creation
  - Modification
  - Deletion
  - Replacement
- A warning symbol when the update of a DBMS object is not complete, or when this must be handled with care. When this icon is present, a block in the generated script details what cannot be updated.
- Object on DBMS side. This can be empty in the context of creation on the **HOPEX** side.
- The link to the object update script.

From each object you can access all its sub-objects by expanding the corresponding tree. You can also view the physical parameters. In a context of object modification, only the modified physical parameters are displayed.

There is also a report of the generation (.txt) in the properties dialog box of the generated database.

Configuring SQL generation

Configuring the DBMS Version

Supported DBMS versions

This list is given as a guide only. It is not intended to be an exhaustive list, and may change as new DBMS versions are released.

Product	Editor	Supported Versions
SQL ANSI	ISO 9075	1992
DB2	IBM	OS 390 V5 / OS 390 V7 / OS 390 V8 UDB V5 / UDB V7 / UDB V8
Ingres II	Computer Associates	2.0
Dynamic Server	Informix	7.3
Oracle	Oracle	8 / 9i / 10 / 11
SQL Server	Microsoft	7 / 2000 / 2005 / 2008
Adaptative Server	Sybase	11 / 12.5
Teradata Database	Teradata	14
PostgreSQL	PostgreSQL Global Development Group	9.3

Modifying DBMS version properties

Generation configuration is carried out to check the size of the identifiers generated, the characters authorized, etc.

You can access a DBMS from a database linked to this DBMS.

To configure generation options of a DBMS version:

1. Right-click the database concerned and select **Properties**.
   The properties window of the database appears.
2. Click the drop-down list then **Characteristics**.
3. In the **Target DBMS** field, click the arrow at the extreme right to access the properties of the DBMS.
4. In the properties window of the DBMS, click the drop down list and select **Options** > **Generation**.

5. Modify the parameters you wish to change.

☛ *The parameters available vary as a function of the target DBMS. If the* ***Generation*** *subtab does not appear, select* ***Tools*** *>* ***Options*** *in the HOPEX bar, expand "Data Modeling SQL Generation" and check that the generation option linked to the DBMS concerned is selected.*

Configuring Database Generation

To configure generation of a database:

1. Open the database properties dialog box.
2. Click the drop-down list then **Options** > **Generation**.

As for configuration of a target, the parameters proposed vary as a function of the DBMS and an explanatory message indicates the use of each parameter.

You can specify the following parameters:

- The **Trigger Name** parameters define the names of three types of trigger.
- **Error Ref Value**: user error number for the current DBMS.
- **Val. Default Value**: activates/deactivates generation of DEFAULT orders for columns.
- **Quoted Identifier**: activates/deactivates generation of quotes around SQL identifiers (SQL name).
- **Qualifier** : **enables prefix of object names.See** **"Prefixing Object Names", page 126**.
- **Mode Generation Inc**: this parameter applies to incremental generation and can take values "Alter" and "Drop/Create".
  - "Alter" does not authorize deletion of objects (tables, indexes, etc.) at the level of generated scripts. Only those instructions that can be executed using the ALTER command are generated. For physical parameters, deletion is still authorized (this is the case notably for partitions).
  - "Drop/Create" authorizes object deletion. If an update cannot execute via the ALTER command, the object is deleted then recreated.

  By default, the parameter takes value "Alter".
- **Script Distribution**: indicates if the result of generation should be created in a unique file or in one file per object or in one file per object type.
- **SQL Script**: name of the file generated when this is a unique file. By default, this sub-folder is called REFEXT. You can customize at DBMS

level. The arrow at extreme right of the field allows you to reinitialize the parameter.

You can also reinitialize all parameters of the object concerned. This action should be carried out with care.

- **Script Directory**: relative generation folder.
- The various **Ext** parameters allow you to specify extensions of each file generated for tables, datagroups, views, etc.
- **Conversion**: format of generated files (ANSI Windows or ASCII MS-DOS).
- **CREATE CLUSTER**: activates/deactivates generation of CREATE CLUSTER orders.
- **CREATE TABLE**: activates/deactivates generation of CREATE TABLE orders.
- **CREATE TABLESPACE**: activates/deactivates generation of CREATE TABLESPACE orders.
- **PRIMARY KEY**: activates/deactivates generation of PRIMARY KEY orders.
- **FOREIGN KEY**: activates/deactivates generation of FOREIGN KEY orders.
- **CREATE INDEX**: activates/deactivates generation of CREATE INDEX orders.
- **CREATE PROCEDURE**: activates/deactivates generation of stored procedures.
- **CREATE INDEX PK**: activates/deactivates generation of CREATE INDEX orders for primary key indexes.
- **CREATE INDEX[UNIQUE]**: activates/deactivates generation of CREATE INDEX orders for unique indexes.
- **CREATE VIEW**: activates/deactivates generation of logical views.
- **CREATE SEQUENCE**: activates/deactivates generation of CREATE SEQUENCE orders.
- **CREATE SYNONYM**: activates/deactivates generation of CREATE SYNONYM orders.
- **CREATE TRIGGER**: activates/deactivates generation of triggers.
- **Comments**: activates/deactivates generation of **HOPEX** comments in SQL script.
- **UNIQUE**: activates/deactivates generation of UNIQUE orders.
- **UNIQUE[PK]**: activates/deactivates generation of UNIQUE orders for primary keys.
- **PRIMARY KEY syntax**: PRIMARY KEY orders are generated in CREATE TABLE order or in an ALTER TABLE order.
- **Position FOREIGN KEY**: generation of FOREIGN KEY orders after each CREATE TABLE or grouped at end of script.
- **COMMENT ON TABLE**: comments on tables (0:no comment, 1:one line, Total:all text)
- **COMMENT ON COLUMN**: comments on columns (0:no comment, 1:one line, Total:all text)

☛ *Generation of comments is only possible for target systems that accept these (Oracle, DB2,...).*

- The various **Add-Ons** parameters activate/deactivate generation of add-ons on tables, datagroups, etc.
- **Tbspace of Tables**: by default, tables are generated in the SYSTEM tablespace.
- **Tbspace of Indexes**: by default, tables are generated in the SYSTEM tablespace.

Prefixing Object Names

There is a schema concept for most DBMSs, which enables definition of a logical grouping for objects.

Therefore at creation of a table for example, it can be automatically stored in a schema, and if this is not specified, a default schema can be automatically assigned.

In **HOPEX** there is not a schema concept, but a specific concept - the Qualifier - which enables prefix of database object names at generation. If for example you want objects to have names prefixed "MEGA", you must enter this value in the Qualifier field of the objects in question.

Inheritance

The Qualifier property can be defined at database level and on all other object types. There is an Inheritance system: if the Qualifier is not specified at the level of a table, by default it is the value entered on the database that is taken into account.

To prefix the name of an object at generation:

1. Open the properties dialog box of the object in question.
2. Click the drop-down list then **Options** > **Generation**.
3. In the **Qualifier** field, enter the value that will prefix the name of the object.

DBMSs concerned

The Qualifier is available for the following DBMSs:

- Oracle
- SQL Server
- DB2
- MySQL

Supported Syntax

CREATE TABLE Instruction

The CREATE TABLE instruction defines a table. The definition includes:

- Table name
- The names and attributes of its columns.
- The attributes of the table such as its primary and foreign keys.

The syntax is as follows:

```
CREATE TABLE table-name (col1-name col1-type [NOT NULL]
...
name-coln type-coln [NOT NULL])
```

For DB2, the syntax is as follows:

```
CREATE TABLE table-name (col1-name col1-type [NOT NULL]
...
name-coln type-coln [NOT NULL])
[in Tablespace <Name>]
```

For Oracle, the syntax is as follows:

```
CREATE TABLE table-name (col1-name col1-type [NOT NULL]
...
name-coln type-coln [NOT NULL])
[Tablespace <Name>]
```

- ***table name*** : “SQL” value for the table, or else defaults to the name of the table; unrecognized characters are replaced by "_"
- ***col-name***: Value of the SQL Name attribute for the column, or by default the name of the column; unrecognized characters are replaced by “_”
- ***col-type***
- ***NOT NULL***: See "Managing NOT NULL", page 127.
- ***Tablespace***: DB2 and Oracle: Name of the target tablespace for the tables

The PRIMARY KEY clause is generated within the CREATE TABLE command (see "PRIMARY KEY clause", page 128).

Managing NOT NULL

Clauses NULL, NOT NULL and NOT NULL WITH DEFAULT are generated automatically on the columns of primary keys and on columns derived from obligatory attributes at time of synchronization.

These values can be initialized as "Null", "Not Null" or "Not Null with Default" as a function of configuration defined in the database Properties dialog box for **Not Null Columns**, in the **Synchronization** subtab of the **Options** tab.

The values proposed can then be modified on each column.

PRIMARY KEY clause

Defining a primary key

One or more of the columns in a table can be used to uniquely identify each row in the table. Values in these columns must be specified. They act as the primary key for the table.

A table must have only one primary key or none.

Each column name must identify a column in the table, and the column cannot be identified more than once.

Processing and generating SQL commands

After declaring the names of the columns in the table, if the **PRIMARY KEY** option is enabled, the name(s) of the columns in the primary key are declared as follows:

```
PRIMARY KEY (list of columns in the primary key)
```

The PRIMARY KEY clause is generated within the **CREATE TABLE** command.

Example 1	**Example 2**
The primary key "PK" has only one column, "PK-col". CREATE TABLE table-name (PK-col CHAR(9) NOT NULL, info1 CHAR(7), info2 CHAR(7), PRIMARY KEY (PK-col)	The primary key "PK1" has columns "PK11" and "PK12". CREATE TABLE table-name PK11 CHAR(9) NOT NULL, PK12 CHAR(9) NOT NULL, info1 CHAR(7), info2 CHAR(7), PRIMARY KEY (PK11, PK12)

For Oracle, the complete PRIMARY KEY clause is as follows:

```
CONSTRAINT PK_<key name> (list of columns in the primary
key)
```

FOREIGN KEY clause

Database integrity can be ensured either by FOREIGN KEY clauses or by generated triggers, depending on the target DBMS. (In Oracle, it is ensured either with triggers, or with FOREIGN KEY clauses, depending on the database configuration.)

One or more columns in a table can refer to a primary key in this table or in another table. These columns form the foreign key. These columns do not need to have a value in each row.

The table containing the referenced primary key is a parent table. The table containing the foreign key is a dependent table.

Each column name must identify a single column in the table, and the same column cannot be identified more than once. If the same list of column names is specified in more than one FOREIGN KEY clause, these clauses cannot identify the same table.

The table name specified in the FOREIGN KEY clause must identify a parent table. A foreign key in a dependent table must have the same number of columns as the primary key for the parent table.

The number of foreign keys is unlimited.

Processing and generating SQL commands

After declaring the primary keys (PRIMARY KEY), the column name(s) for the foreign key(s) are declared for a table using FOREIGN KEY:

```
FOREIGN KEY (list of columns in the foreign key) REFERENCES
<Parent table name> [ON DELETE <Action>] [ON UPDATE
<Action>]
```

or:

```
ALTER TABLE tablename [ADD] FOREIGN KEY (list of columns for
the foreign key) REFERENCES <Parent table name > [ON DELETE
<Action>] [ON UPDATE <Action>]
```

For Oracle, the syntax is as follows:

```
CONSTRAINT FK_<name of the foreign key> (list if columns for
the foreign key)  REFERENCES <Parent table name > [ON DELETE
<Action>] [ON UPDATE <Action>]
```

or:

```
ALTER TABLE...
```

Examples

The table "table1-name" has two foreign keys. These keys have no components.

```
CREATE TABLE table1-name
pk1 CHAR(9) NOT NULL,
pk2-rel12 CHAR(7) NOT NULL,
pk3-rel13 CHAR(7) NOT NULL,
info1 CHAR(7),
info2 CHAR(7),
PRIMARY KEY (pk1))
ALTER TABLE table1-name ADD FOREIGN KEY(cp2-rel12)
REFERENCES table2-name
ALTER TABLE table2-name ADD FOREIGN KEY(cp3-rel13)
REFERENCES table3-name
```

The table "table1-name" has a foreign key "fk2" which has two components, "fk21" and "fk22". The foreign key "fk2" has no reference (it is therefore a component of the primary key of another table).

```
CREATE TABLE table1-name
pk1 CHAR(9) NOT NULL,
fk21 CHAR(7) NOT NULL,
fk22 CHAR(7) NOT NULL,
info1 CHAR(7),
PRIMARY KEY (pk1))
ALTER TABLE table1-name ADD FOREIGN KEY (fk21, fk22)
REFERENCES table2-name
```

The table "table1-name" has a foreign key, "fk2". The foreign key "fk2" is equivalent to the primary key "pk2" which has two components, "pk21" and "pk22". The columns identified by "pk21" and "pk22" are "NOT NULL".

```
CREATE TABLE table1-name
pk1 CHAR(9) NOT NULL,
pk21 CHAR(7) NOT NULL,
pk22 CHAR(7) NOT NULL,
info1 CHAR(7),
info2 (CHAR7),
PRIMARY KEY (pk1))
ALTER TABLE table1-name ADD FOREIGN KEY (pk21, pk22)
REFERENCES table2-name
```

UNIQUE clause

A UNIQUE clause is generated for each unique index in the table, unless this index corresponds to the primary key.

Processing and generating SQL commands

For each unique index, the following clause is generated:

```
UNIQUE (col1,...,coln)
```

(col1,...n,coln) represent the columns used by the index.

CREATE INDEX Instruction (Oracle, Sybase, SQL Server)

Definition of an index

An index is a set of columns in a table for which a direct access is defined.

For Sybase and SQL Server, the value of the index-type attribute for the index determines what type of index is generated: UNIQUE, CLUSTERED, or UNIQUE CLUSTERED.

Processing and generating SQL commands

For each index a clause is generated as a function of the target DBMS.

For Oracle:

```
CREATE INDEX (column1,..., columnN) [TABLESPACE
(TbSpaceName)
```

(column1, ..., columnN) represent the columns in the index; TbSpaceName is the name of the tablespace for the indexes (see "Configuring SQL generation", page 123).

For Sybase and SQL Server:

```
CREATE [UNIQUE] [CLUSTERED] INDEX (IndexName) (TableName)
(column1,..., columnN)
```

(column1, ..., columnN) represent the columns in the index; TbSpaceName is the name of the tablespace for the indexes (see "Configuring SQL generation", page 123).

CREATE VIEW Clause

A view is defined for a database. It can include one or more tables.

```
CREATE VIEW view-name

AS

SELECT

(column-name,column-name,...)
```

You can enhance this definition in the view specification (see "Defining Database Views", page 134).

ADVANCED SQL OPTIONS

You can supplement relational object definition with definitions of technical objects such as views, triggers and stored procedures, specifications of which are specific to each target DBMS and can be generated separately or in the SQL file of the database.

You can therefore:

- ✓ "Defining Database Views", page 134
- ✓ "Defining Triggers for a Database", page 137
- ✓ "Using Stored Procedures", page 140
- ✓ "Adding Physical Properties to Database Objects", page 142

Tools presented in the pages that follow are available with "Advanced" access to the repository.

Defining Database Views

A physical view is a virtual table, of which structure and content are deduced from one or several other tables with an SQL query.

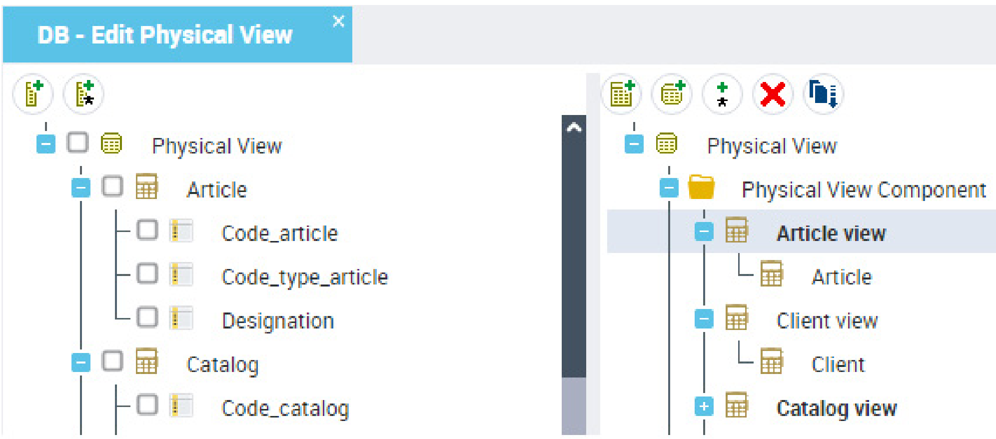
Database *views* are created in a tree format, which automatically generates part of the view definition. The user can then add to it as desired.

Creating Database Views

To create a physical view from a database:

1. On the desktop, click the navigation menu, then **Physical data**.
2. In the navigation pane, select **Physical views**.
   The list of physical views appears in the edit area.
3. Click **New**.
   The view creation wizard opens.
4. In the **Owner** field, select the database concerned.
5. In the **Physical View Component** field, click **New**.
6. Select the tables concerned by the view
7. Click **OK**.
   The physical view editor appears.

The left tree displays tables to which the physical view relates, with their columns. The right tree displays the tables and columns that constitutes the view. By default these ones have the same names as the source tables and columns. You can rename them.



Add a table or a column to a view

To add a table to a view:

1. In the right-hand part of the editor, right-click the **Table** folder and select **Table view**.

Select the desired table and click **OK**.

To add a column to a view:

1. In the right-hand part of the editor, right-click the **Column** folder and select **Column view**.
2. Select the desired column and click **OK**.

SQL Definition

The right side of the dialog box, labeled **SQL Definition**, shows the SQL code that would be generated to define the view. The code is initially calculated based on the definition indicated in the tree.

You can modify this code, in particular by using joints. You can also directly enter modifications in the SQL frame.

View joints

By default, the edition of logical views window proposes the foreign keys of the selected tables where these exist.

It is thus possible to complete specification of a view by associating with it foreign keys, potential sources of joints.

To associate a foreign key with the view:

- Select the foreign key in the tree on the left and drag it into the SQL definition field.

User mode

You can modify the view code by typing directly in the SQL definition field:

- Click the **Save** button so that the **SQL Definition** will be saved in the repository as is.

After you have modified the definition, you can restore the definition as determined by the tree:

- Click the **Initialize the SQL definition** button.
  A message warns you that the previously saved definition will be reinitialized. %In other words, any user additions made to the definition will be lost.
- Click **OK** to confirm.

Fields

Field categories correspond to object types used in the declarative tree: table, view, column and foreign key column. Fields displayed in the SQL definition correspond to elements declared in the tree.

The foreign key type does not produce a field category: usable fields are derived from key columns and not from the keys themselves.

The **Field properties** button displays properties of the object corresponding to the selected field.

If an object is added to the tree, a corresponding field becomes available for insertion.

If an object is renamed in the tree or in the repository, its references remain valid and the fields are displayed in the text with the new name.

If an object is deleted in the tree or in the repository, its references become invalid and are indicated as such in the fields.

Defining a Data Group

A data group - or tablespace - is a group, in the same physical pages of the database, of the rows of several tables to optimize queries, joints in particular. Example: Tablespace in DB2, Cluster in Oracle etc.

To define *data groups* in the database:

1. Open the database properties dialog box.
2. Click the drop-down list then **Components**.
3. The **Data groups** section displays the list of data groups
4. Click the **New** button.
5. In the dialog box that opens, indicate the **Name** of the data group.
6. Click **OK**.

Then open the properties window of the data group to define the tables and indexes that it includes.

To specify the tables and indexes included in the data group:

1. Select the data group and click **Properties**.
   The data group properties dialog box appears.
2. Click the drop-down list then **Tables**.
3. Click the **Connect** button.
4. In the list of database tables presented, select the tables to be included.

   ☛ *Click **Disconnect** to remove a table from the list in the case of error.*

5. Carry out the same operations for the indexes of the data group.
6. Click **OK**.

DEFINING TRIGGERS FOR A DATABASE

A trigger is processing recorded in a database, which automatically triggers on updating a table.

Creating Triggers

Triggers are defined at the level of database tables.

☛ *It should be noted that triggers are defined as a function of the target DBMS; this is why it is important to check that the target DBMS is correct before creating triggers.*

If the target DBMS is later modified, triggers created for the DBMS are not deleted but deactivated.

To create a trigger:

1. On the desktop, click the navigation menu, then **Physical data**.
2. In the navigation pane, in the **Database** folder, click **Database hierarchy**.
   The list of databases appears in the edit area.
3. Expand the folder of the database then the table concerned.
4. Right-click the **Trigger** folder and select **New** > **Trigger**.
   The dialog box for creating a trigger opens.
5. Specify the name of the trigger and actions triggered. See "Trigger triggering", page 137.

Trigger triggering

Triggering can occur following one of the three following actions:

- At **Creation** of a row in the table.
- At **Deletion** of a row.
- At **Modification** of the table or of a particular column.

In addition, you can choose to run it **Before** or **After** these actions, on the entire table, or on each row concerned.

References

The "Reference of old rows" and "Reference of new rows" fields create in the trigger code references to lines inserted, deleted or updated.

The name indicated in the "Reference of old rows" field corresponds to the line that existed before the update.

The name in the "Reference of new rows" field indicates the line after the update.

In the case of insertion, only the new line is valid.

In the case of deletion, only the old line is valid.

SQL Definition

The **SQL Definition** option in the properties window of the trigger presents the trigger code.

To access this option you must have "Expert" access to the metamodel.

To display Expert mode:

1. On the **HOPEX** desktop, click **Main Menu** > **Settings** > **Options**.
2. In the left pane of the window, click the **Repository** folder.
3. In the right pane of the window, for **Repository Access** select "Expert" mode.

To display the trigger code:

1. Right-click the trigger and select **Properties**.
   The properties window of the trigger appears.
2. Click the drop-down list then click **Texts**.
3. Select the **SQL Definition** tab.

Repository Integrity

Repository integrity is managed by creation of foreign keys on a database.

It groups all constraints allowing a check of the impact of modification of a table in tables connected to it.

It could be that the existence of keys in certain DBMSs does not involve a systematic check. It could also be that you wish to customize constraints to be applied on a particular table.

This is why you can generate in triggers the code that corresponds to repository integrity management.

To generate repository integrity of a table:

1. Right-click the database and select **Generate triggers**.
   The trigger generation dialog box opens.
2. Select one of the options offered:
   - Generate Trigger by type
   - Generate Trigger by repository integrity
3. Select the tables of the database.
4. Click **Next**.
   Triggers are automatically created for the selected tables.

   When generation has been completed, the triggers appear under the **Trigger** folder available under each table. There are three trigger types:
   - An update trigger (U_followed by table name), which enables specification of the action to be carried out in case of modification of a line of the table that is part of the foreign key.
   - A delete trigger (D_), which specifies the action to be carried out in case of deletion.
   - An insert trigger (I_), which specifies the action to be carried out in case of insertion.

These triggers are only valid for a target DBMS. When you change DBMS, you must regenerate the triggers.

USING STORED PROCEDURES

HOPEX Information Architecture allows you to create *stored procedures*.

A stored procedure combines a procedural language and SQL requests within a program. It enables execution of a particular task on a database. It is recorded in a database and can be called from a program external to the database of from a trigger.

A stored procedure can be implemented in two ways; either as a procedure or as a function.

A procedure is a set of instructions executing a sub-program.

A function is a procedure returning a value on completion of execution.

To create a procedure stored on a database:

1. Open the database properties dialog box.
2. Click the drop-down list then **Components**.
   The **Stored Procedures** section displays the list of stored procedures.
3. Click the **New** button.
4. In the window that opens, specify the name of the procedure and its nature (Procedure or Function).
5. Click **OK**.
   The stored procedure appears. Open its properties to define its code.

Example of stored procedure for Oracle

This is an example of a stored procedure updating the unit price of a part as a function of the part identifier:

```
CREATE PROCEDURE update_part_unitprice (part_id IN INTEGER,
new_price IN NUMBER)
IS
 Invalid_part EXCEPTION;
BEGIN
-- HERE'S AN UPDATE STATEMENT TO UPDATE A DATABASE RECORD
 UPDATE sales.parts
   SET unit_price = new_price
   WHERE id = part-id;
-- HERE'S AN ERROR-CHECKING STATEMENT
 If SQL%NOTFOUND THEN
   RAISE invalid_part;
 END IF;
EXCEPTION
-- HERE'S AN ERROR-HANDLING ROUTINE
 WHEN invalid_part THEN
   raise_application_error(-20000, 'Invalid Part ID');
```

```
END update_part_unitprice;
```

Adding Physical Properties to Database Objects

When your database has been defined in a relational diagram, you can generate the corresponding SQL scripts for the different DBMSs.

The physical data navigation pane allows you to complete database physical modeling by specifying parameters specific to each DBMS and therefore to produce complete SQL scripts.

In **HOPEX**, you can also import physical parameters defined on reverse engineered objects. See: "Physical Properties Reverse Engineering", page 152.

You can adapt the same logical model to several DBMSs. It is not necessary to duplicate objects.

Target DBMSs

To define a target DBMS on a database:

1. Open the properties dialog box of the database concerned.
2. Click the **Characteristics** page.
3. Specify the **target DBMS** field in the corresponding field.

See also "Importing a DBMS Version", page 9.

Creating Physical Properties

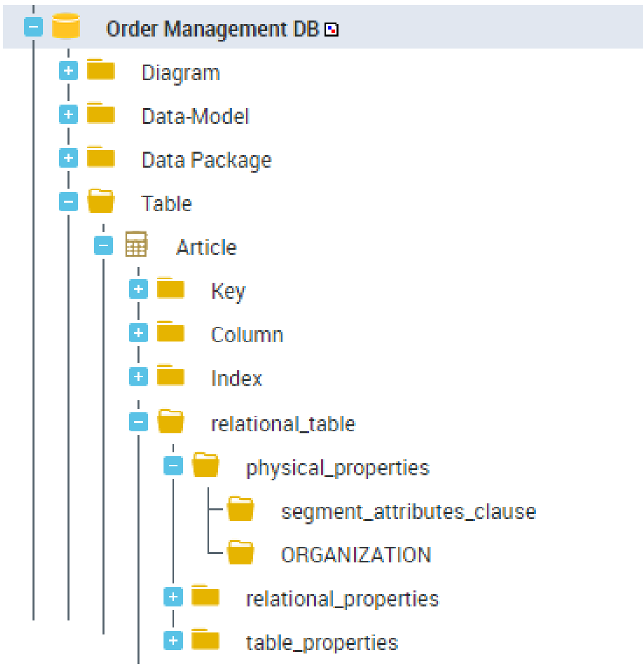
To create physical properties on objects of a database:

1. On the desktop, click the navigation menu, then **Physical data**.
2. Expand the **Database** folder and click **Database hierarchy**.
   The list of repository databases appears in the edit area.
3. Expand the folder and the sub-folders of the databases concerned.

Parameters are presented in tree form, conforming to SQL grammar of the DBMS considered (refer to DBMS SQL documentation).

Two folder types are presented in the tree:

- Navigation folders.
- Parameter groups that you must instance.



Each parameter group, represented by an "SQL clause" object, has a properties page enabling value definition.

SQL clauses defined in this way are accessible just like repository standard objects. For example it is possible to query SQL objects that have a given parameter value.

By default, clauses cannot be reused from one object to another. It is however possible to define a clause for one object and connect it to other objects. In this case, any modification of the clause affects all objects that use it.

Objects containing physical parameters

Not all objects in **HOPEX** support physical parameters. These concern only:

- Data groups
- Tables
- Indexes
- Clusters

Creating a new clause

To define object parameters:

1. Right-click the corresponding parameter group and select **New** > **SQL clause**.

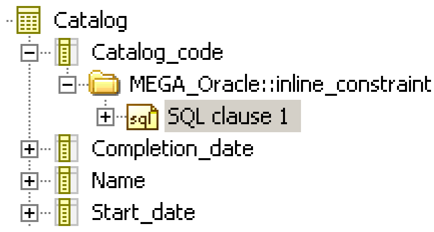
2. Open the properties window of the clause and specify the value of the parameter to be defined.

Connecting a clause

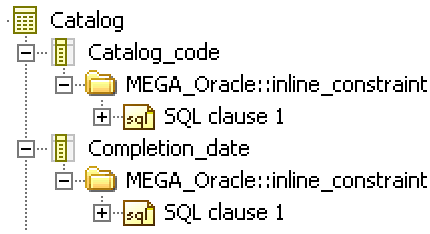
You can assign the same clause to several objects, on condition that you connect the correct clause type.

Consider the "Order Management" database with Oracle 9i as DBMS.

On the column "Code_catalogue", create "Clause 1" of type "inline_constraint".



You can connect "Clause 1" to another column. Being the same type of clause, this is copied on the new column with no problem.



On the other hand, if you connect "Clause 1" to an object of type different from that initially defined on "Clause 1" - for example "Storage_clause" - then "Clause 1" changes type to take that of the last element connected. In other words, "Clause 1" that was type "inline_constraint" takes type "storage_clause". This change is reflected on the start columns to which "Clause 1" was connected.

Naming clauses

Standard case

By default, the clause takes the name of the clause type to which it is attached. When you attach a clause to another type, the name automatically adapts.

Specific naming

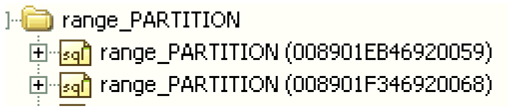
A specific name can be given to a clause. In this case, the clause name becomes static and will not be modified at change of clause type.

☛ *You can return to dynamic mode by overloading the name empty.*

Specific naming is essential when a clause is used in different contexts (generic clause).

Multiple clauses

For a given level, several clauses can be attached to the same clause type. To distinguish different clauses, the clause name comprises the name of the clause type followed by its hexaIdAbs.



Naming from a property

It is possible to modify standard behavior by defining an automatic naming rule for an SQL clause type. This configuration is carried out at the clause type _settings property level. In the example below, the configuration on clause type "range_PARTITION" for Oracle 9i indicates that the name of SQL clauses of this type will be built from the value of the PARTITION property.

```
[NameIdentification]
AttrForNameIdentification=A3F2DE8C417E06C9
```

When the parameter has been executed, names of SQL clauses are automatically calculated from values of the PARTITION property.

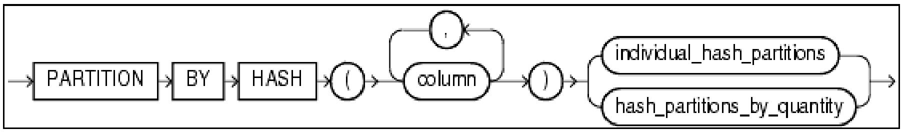
Property	Value
Key compression	
PARTITION	P1
Value list	

The name of SQL clauses is not taken into account in SQL generation. In the example provided, it is the value of the PARTITION property that feeds the generated SQL scripts.

Physical Model Customization Example

You can partition a table to simplify data access or to manage the information blocks differently.

Suppose you wish to partition the "Order Line" table of the "Order Management" database using the Oracle by hash method. This method enables dynamic calculation of table partitioning.



Hash partitioning instruction syntax

Check that the database has Oracle 9i as target DBMS.

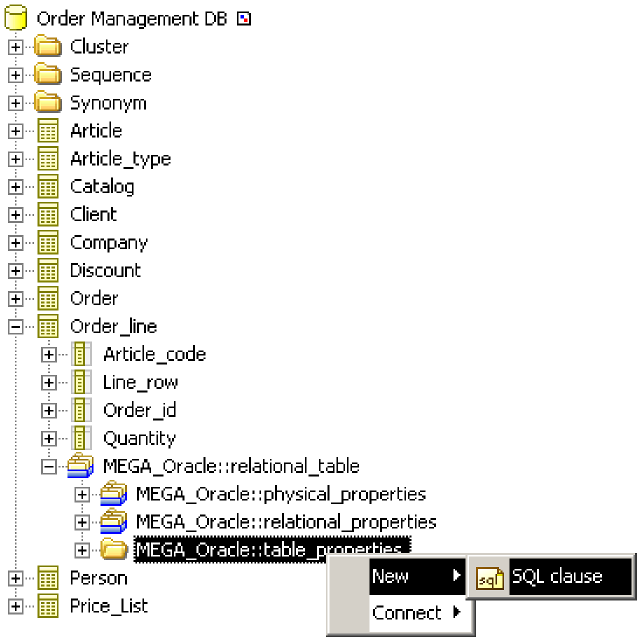
- Open its properties dialog box and click the **Characteristics** page. The DBMS name is indicated in the **Target DBMS** box.

Display the physical properties of the "Order Management" database:

1. On the desktop, click the navigation menu, then **Physical data**.
2. Expand the **Database** folder and click **Database hierarchy**. The list of repository databases appears in the edit area.
3. Expand the folder and the sub-folders of the "Order Management" database to display the parameters linked to the Oracle grammar.

To partition the "Order line" table:

1. Expand the "Order_line" table.
2. Expand the "MEGA_Oracle::relational_table" parameter group.
3. Right-click the "MEGA_Oracle::table_properties" clause type and select **New** > **SQL clause**.



4. Name the clause "Order_line/Table_properties".
   It appears in the navigation tree.
5. Under this clause, expand the "MEGA_Oracle::table_partitioning_clauses" parameter group. It contains the different partitioning types that can be produced in Oracle.
6. On the "MEGA_Oracle::hash_partitioning" folder, create the clause "Order_line/hash_partitioning".
7. Open its properties page.
8. In the **PARTITION BY HASH** page, indicate the columns on which breakdown applies. To do this, connect the columns concerned by partitioning.
9. Close the properties dialog box.
10. Under the clause "Order_line/hash_partitioning" two clause types are available:
    - **individual_hash_partitions**: enables naming of each partition.
    - **hash_partitions_by_quantity**: enables definition of the number of partitions you wish to create.
11. Create the clause "Order_line/Hash_partition_by_quantity".
12. Open its properties page.
13. Select the **PARTITIONS** page.
14. In the **Hash partition quantity** field, indicate the number of partitions. These partitions are represented by data groups.
15. In the **STORE IN** field, connect the data groups.

To obtain the script corresponding to this partitioning, right-click the "Order line" table and select **Generate the code**.

```
SPOOL \_MEGASQL.LST;
PROMPT -------------------------------------------------- ;
PROMPT  Compte-Rendu de génération ;
PROMPT -------------------------------------------------- ;
/* ------------------------------------------------------------------------------------------
/* Begin of generation Oracle 9i for database Order_Management_DB the June 14, 2006 at 14: 0:49 */
/* ------------------------------------------------------------------------------------------
CREATE TABLE "Order_line"
(
  "Article_code" CHAR(6),
  "Line_row" NUMBER(7),
  "Order_id" CHAR(5),
  "Quantity" NUMBER(7),
  CONSTRAINT "PK_Order_line" PRIMARY KEY
  (
    "Line_row",
    "Order_id"
  )
)
PARTITION BY HASH ("Line_row","No_commande")
PARTITIONS 5 STORE IN ("tbs_1","tbs_2","tbs_3","tbs_4") TABLESPACE "SYSTEM";
/* ------------------------------------------------------------------------------------------
/* Foreign Key FK_Order */
/* ------------------------------------------------------------------------------------------
ALTER TABLE "Order_line"
ADD CONSTRAINT "FK_Order" FOREIGN KEY
(
  "Order_id"
) REFERENCES "Order";
/* ------------------------------------------------------------------------------------------
/* Foreign Key FK_Order_line_ */
/* ------------------------------------------------------------------------------------------
ALTER TABLE "Order_line"
ADD CONSTRAINT "FK_Order_line_" FOREIGN KEY
(
  "Article_code"
) REFERENCES "Article";
SPOOL OFF;
DEFINE _EDITOR = "notepad.exe";
EDIT \_MEGASQL.LST
EXIT;
/* ------------------------------------------------------------------------------------------
/* End of generation Oracle 9i for database Order_Management_DB the June 14, 2006 at 14: 0:51 */
/* ------------------------------------------------------------------------------------------
```

Generating the SQL File

When object customization has been completed, you can generate the corresponding script file to consult the results, without having to regenerate the entire database.

For example, to generate the SQL file of an index:

- Right-click the index and select **Generate the code**.

See also "Generating SQL scripts", page 117.

REVERSE ENGINEER TABLES

Reverse engineering enables you to take existing databases and create the corresponding tables and columns in the **HOPEX** repository.

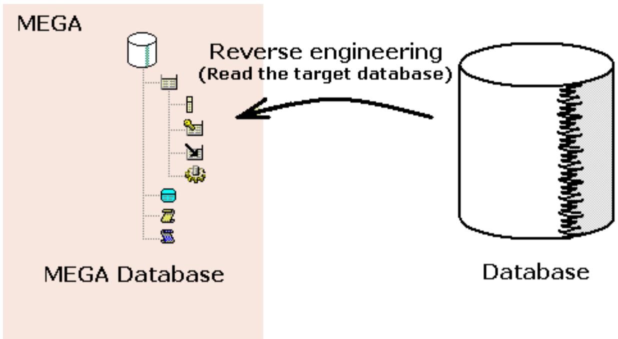
Reverse engineering can be done from a previous database extraction. See "ODBC Extraction Utility", page 155.

The tables and columns are integrated in a database where they can be easily maintained and documented.

The following points are covered here:

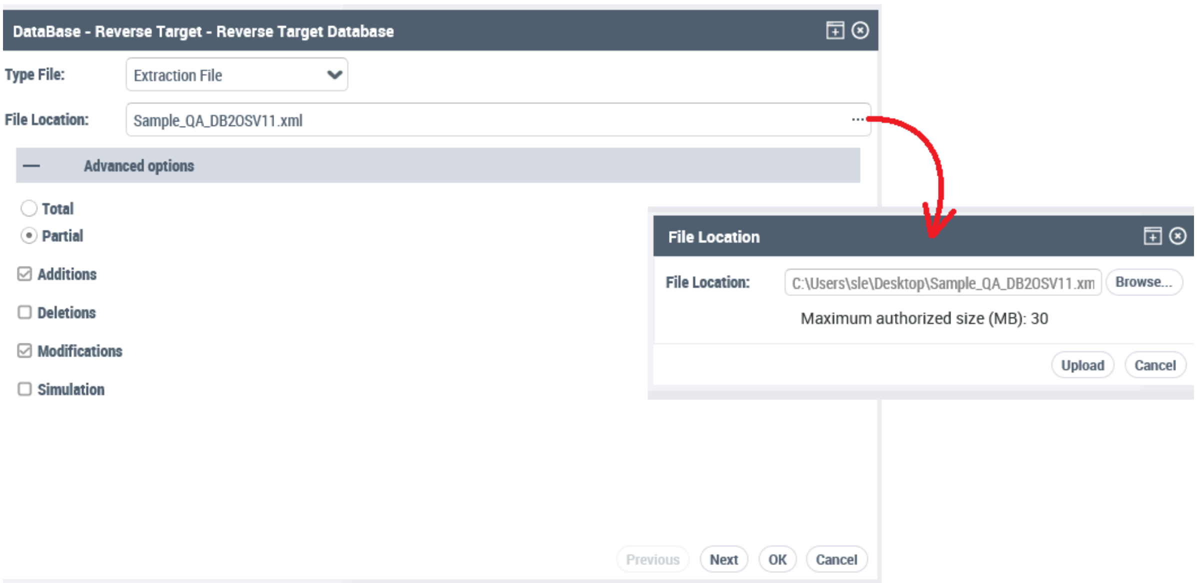
Tools presented in the pages that follow are available with "Advanced" access to the repository.

Running Reverse Engineering



To run reverse engineering:

1. Right-click the database and select **Reverse target database**.
   The **Reverse a target database** dialog box opens.
2. Select the **Type** of data source: Extraction file obtained using the data extraction utility (see "ODBC Extraction Utility", page 155).
3. Indicate the location of the file.



4. Define the **Options**:
   If the database has already been reverse engineered, it is possible to specify the extent of the **Reinitialization**, which can be:
   - **Total**: all existing tables are deleted.
   - **Partial** concerns only **Additions**, **Deletions** or **Modifications**.

   The **Simulation** option is provided so you can simulate the operation and generate a report indicating the impact on the repository.
5. Click the **Next** button to run reverse engineering.
   Messages inform you of progress.
6. On completion of processing, a report displays the details of the execution.
   At the end of reverse engineering, the database tables and columns are created. However, the relational diagram must be created in order to view the database in a graphical model.

   ☺ *If non-standard datatypes were created in the DBMS, they must be added to the configuration if they are to be recognized by **HOPEX**..*

Physical Properties Reverse Engineering

Reverse engineering also enables creation in **HOPEX** of physical properties on objects of a database.

Physical properties are parameters enabling expression, for a relational object (table, index, etc.), of the way in which information will be stored within a database. These parameters are specific to each DBMS and can evolve depending on versions of the same DBMS.

See also "Adding Physical Properties to Database Objects", page 142.

Default Values

Certain DBMS properties are automatically reversed in **HOPEX** even if they have not been explicitly specified.

So as not to recover these values by default, **HOPEX** provides for each DBMS and for each DBMS version a generic clause that contains the list of these default values and treating them specifically.

At reverse engineering, DBMS properties with values equal to values defined in the generic clause are not imported.

You can activate the generic clause by importing into **HOPEX** the .mol file associated with each DBMS in the Mega_Std folder of your installation.

Eliminating Redundant and Transverse Values

At reverse engineering of objects in **HOPEX**, certain physical properties that have not been clearly determined are automatically regenerated by the DBMS via an inheritance mechanism.

With Oracle for example, the value of property PCTFREE in a table, if it has not been specified, is directly inherited from that of its attached tablespace. Such a value is called transverse, since it is derived from an inheritance between two distinct object types. A value is said to be redundant if inheritance is derived from objects of the same type.

At reverse engineering, **HOPEX** does not recover transverse and redundant values.

Only the management of redundant values can be customized.

Specific Cases

Physical properties of tablespaces

In certain cases, reverse engineering of object physical properties requires an ODBC connection with DBMS Administrator rights. For example with Oracle, reverse engineering of the physical properties of tablespaces requires that you use a "System" account.

Clusters Reverse Engineering

Reverse engineering of a cluster in Oracle is carried out correctly if the connecting user verifies one of the two following conditions:

- The user is owner of the cluster
- The user has Administrator profile

If the cluster is not accessible, it is not reversed.

When the user sees the cluster but is neither owner nor administrator, the cluster is reversed, but the link between columns of the cluster and columns of the attached tables is not reversed in **HOPEX**.

☛ *From a technical viewpoint, for an administrator user, reverse engineering depends on the view oracle sys.all_clu_columns (relationship between cluster columns and table columns). This view enables reversing only of information relating to objects of which the user is owner.*

ODBC EXTRACTION UTILITY

The ODBC extraction utility is used to extract the description of a database accessed with the ODBC protocol. This description, obtained in structured format, can then be used for reverse engineering purposes in **HOPEX** or for generation in modification mode.

The following points are covered here:

EXTRACTING THE DESCRIPTION OF A DATABASE

The extraction utility is designed to run on a workstation that does not have **HOPEX** installed. You can then transfer the results to a **HOPEX** workstation for reverse engineering. It can also be used for generation in modification mode.

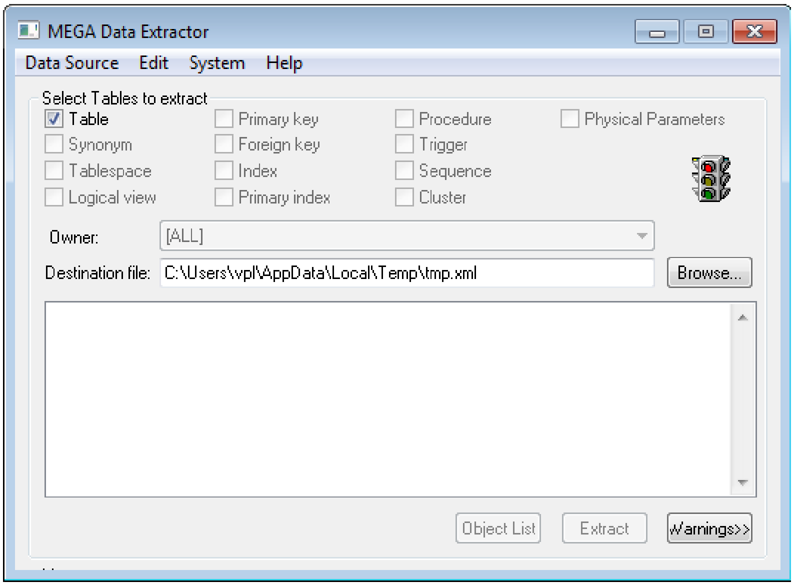
In order to extract the data, the workstation must be connected to the database using ODBC protocol (see the installation documentation for this product). The database driver must have a conformance level of 1 or higher.

To install this utility, simply copy to a directory the files mgwdbx32.exe and mg_dbex.dll. If it does not exist, the file ODWDBEX.INI must be created.

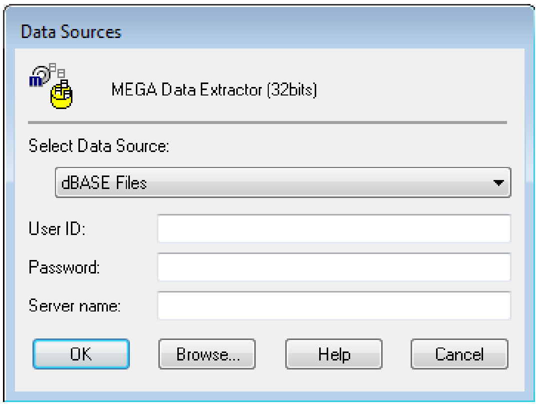
The extraction utility can be installed independently of **HOPEX Information Architecture**.

To extract the description of a database:

1. In the **HOPEX** installation folder, under the "Utilities\MEGA Data Extractor" folder, run the mgwdbx32.exe extraction utility.



2. Connect to a data source by clicking **Data Source > Connect**.
The **Data Sources** dialog box opens.



The drop-down list shows the ODBC connections.

(The list is empty if these connections are not defined or could not be established.)

3. Use the **Browse** button to access the ODBC manager to define a new data source or install a new driver.

4. Depending on the connection, you may need to specify a **User ID**, a **Password**, and a **Server Name**. If other parameters are required by the ODBC manager, you will be prompted for them when the connection is established.

5. Confirm the information entered by clicking **OK**.
A green light indicates that the connection has been established. Otherwise a message appears if the connection has not been correctly established. In this case, check the data source definition.

Once the connection has been established, select the desired extraction options.

If some of the options remain disabled, this is because the driver does not support them.

*To obtain information on the ODBC protocol used, select ODBC information in the **System** menu.*

6. Select the elements to be extracted in addition to the tables and columns. By default, all of these elements are selected.
All the accessible tables are displayed, whether or not you are the owner. *Synonym* tables can also appear if you select the corresponding check box.

A synonym is an alternative name given to an object (table, view, stored procedure, synonym and sequence). A synonym can be defined to indicate an object in another database.

To view only those tables belonging to a specific **Owner**, select the appropriate owner from the drop-down list. It may take a few seconds for the list of owners and their tables to appear. Table extraction takes a few minutes.

The following elements are included in the extraction:

- Primary keys (**Primary keys**).
- Foreign keys (**Foreign keys**).
- Index (**Index**): these are indexes that do not use primary keys.
- Primary index (**Primary index**): these are indexes that do not use primary keys.

Not all drivers support the ODBC primitives used to extract these elements; if this is your case, a message will indicate this in the report file. In addition, some DBMS do not handle the corresponding concepts, which are then ignored.

The **Destination file** field specifies the name and path of the extraction file; use the **Browse** button to specify its location.

7. After selecting the extraction options, click the **Extract** button to begin the extraction.
   A message reports the number of tables extracted. You can select the **Warnings** button to view the report file.

   ☺ *During the extraction, the **Extract** button becomes **Cancel** and can be used to stop the extraction.*

   You can view the list of accessible tables by clicking the **List Tables** button, and then select specific tables from the list for extraction (all tables are selected by default).
8. On completion of extraction, select **Edit > Report file** to consult the report, or **Edit > Extraction file** to consult the result.

The results file can then be transferred to a workstation that has **HOPEX Database Builder** where reverse engineering can be performed (see "Reverse engineer tables", page 149). It contains a database description in the form of **HOPEX** objects.

When the extraction operation has been completed:

- Select **Disconnect** in the **Data Source** menu to disconnect from the data source.
- Reconnect to another data source if needed, or exit the dialog box by selecting **Exit** in the **Data Source** menu.

Extraction Report File

The file that reports on the table extraction is created by the ODBC extraction utility. It is called <FIC>_CRD.TXT where <FIC> represents the first three characters of the name of the results file.

It contains a list of the tables that were reread.

Example:

```
=====================================================
 Data Source Extracting: DATASOURCE
=====================================================
Table: OWNER.TABLENAME1
Table: OWNER.TABLENAME2
 (cont.)
=====================================================
End of extraction
=====================================================
```

Extraction Results File

The extraction results file contains the description of the tables and columns that results from the read. This file has extension ".xml".

Example of extraction file:


```
<?xml version="1.0" encoding="ISO-8859-1" ?>
- <XMDB Name="Xmdb" Version="2.0">
 - <DATABASE Name="Database">
  - <TABLE Name="TABLE.AURORA036IIOP036SYSTEM036PROPERTIES" DBBName="AURORA$IIOP$SYSTEM$PROPERTIES">
   - <TBLCOL Name="TBLCOL.AURORA036IIOP036SYSTEM036PROPERTIES.KEY" Order="1" DBBName="KEY" Decimale="0"
      Length="200" NotNull="N">
      <COLDATATYPE Name="COLDATATYPE.AURORA036IIOP036SYSTEM036PROPERTIES.KEY"
        DataType="SQL_VARCHAR" TypeTech="SQL_Oracle8VARCHAR2" />
     </TBLCOL>
   - <TBLCOL Name="TBLCOL.AURORA036IIOP036SYSTEM036PROPERTIES.VALUE" Order="2" DBBName="VALUE"
      Decimale="0" Length="1024" NotNull="N">
      <COLDATATYPE Name="COLDATATYPE.AURORA036IIOP036SYSTEM036PROPERTIES.VALUE"
        DataType="SQL_VARCHAR" TypeTech="SQL_Oracle8VARCHAR2" />
     </TBLCOL>
   - <INDEX Name="INDEX.AURORA036IIOP036SYSTEM036PROPERTIES.KEY095C" DBBName="KEY_C" Type="U">
      <IDXCOL Name="IDXCOL.AURORA036IIOP036SYSTEM036PROPERTIES.KEY095C.KEY"
        Reference="TBLCOL.AURORA036IIOP036SYSTEM036PROPERTIES.KEY" />
     </INDEX>
    </TABLE>
  - <TABLE Name="TABLE.JAVA036HTTP036DEPLOYMENT036DIGEST036"
     DBBName="JAVA$HTTP$DEPLOYMENT$DIGEST$">
   - <TBLCOL Name="TBLCOL.JAVA036HTTP036DEPLOYMENT036DIGEST036.USERNAME" Order="1"
      DBBName="USERNAME" Decimale="0" Length="30" NotNull="M">
      <COLDATATYPE Name="COLDATATYPE.JAVA036HTTP036DEPLOYMENT036DIGEST036.USERNAME"
        DataType="SQL_VARCHAR" TypeTech="SQL_Oracle8VARCHAR2" />
     </TBLCOL>
   - <TBLCOL Name="TBLCOL.JAVA036HTTP036DEPLOYMENT036DIGEST036.IS095DOC095ROOT" Order="4"
      DBBName="IS_DOC_ROOT" Decimale="0" Length="1" NotNull="N">
      <COLDATATYPE Name="COLDATATYPE.JAVA036HTTP036DEPLOYMENT036DIGEST036.IS095DOC095ROOT"
        DataType="SQL_DECIMAL" TypeTech="SQL_Oracle8DECIMAL" />
     </TBLCOL>
    </TABLE>
   </DATABASE>
  </XMDB>
```

CUSTOMIZING ODBC EXTRACTION

When the extraction is incomplete or does not correspond to your needs, you can customize the extraction with the Odwdbex.ini file. This configuration depends on the ODBC driver you are using.

You can customize the extraction in a number of different ways by using:

- ODBC standard APIs available for the main concepts (Table, Column, Key, Index, etc.)
- **HOPEX** queries delivered as a replacement for ODBC standard APIs
- customized queries.

By default, ODBC standard APIs are used for the main concepts and **HOPEX** queries for the other concepts. For some ODBC drivers, **HOPEX** queries are used for the main concepts as the result obtained by the ODBC standard is incomplete.

Using the Odwdbex.ini file and customized queries

To customize extraction:

1. Contact your data administrator to obtain the customized queries corresponding to your ODBC driver used to select objects (Eg: primary keys, foreign keys, sequences, etc).
2. In the "All users" folder in Windows, create a file named Odwdbex.ini (example: C:\Documents and Settings\All Users\ApplicationData\Mega\Odwdbex.ini).
3. Edit the file and add the queries for the concepts whose behavior you want to manage. The concepts that are not cited here remain unchanged.
   [<DBMS Name>]
   PRIMARY KEYS="Custom query"
   FOREIGN KEYS="Custom query"
   TBLCOLUMNS="Custom query"
   ...

The <DBMS Name> value depends on the ODBC utility. To obtain the appropriate value:

1. Run the **HOPEX** extraction tool (mgwdbx32.exe).
2. In the **Data Source** menu, select the data source.
3. Then click **System** > **ODBC Information**.
4. Read the "DBMS Name".

You can edit the Odwdbex.ini file by selecting **System** > **Edit Odwdbex.ini** in the **HOPEX** extraction tool. Check that the file is archived.

For more the format of queries, see "Select Clause Formats", page 162.

Using ODBC standard APIs

To force the use of ODBC APIs:

1. Edit the Odwdbex.ini file.
2. At the level of each concept concerned, modify the extraction strategy using the keyword: USE_DRIVER_ODBC.

```
Example in the ODWDBEX.INI file:
[<DBMS Name>]
INDEXES=USE_DRIVER_ODBC
```

SELECT CLAUSE FORMATS

It is important to use the indicated syntax and in particular not to omit any of the "1"s. Note that the clauses must fit on a single line in the ODWDBEX.INI file.

Primary Keys

```
SELECT
1,
TABLE_OWNER,
TABLE_NAME,
COLUMN_NAME,
KEY_SEQUENCE,
PK_NAME
FROM ...
WHERE ...
```

- TABLE_OWNER: owner of the primary key table
- TABLE_NAME: name of the primary key table
- COLUMN_NAME: name of the primary key column
- KEY_SEQUENCE: Number of the column in the key sequence (starts at 1)
- PK_NAME: Name of the primary key; “1” if this name is not supported by the DBMS.

Foreign Keys

```
SELECT
1,
PKTABLE_OWNER,
PKTABLE_NAME,
1,
1,
FKTABLE_OWNER,
FKTABLE_NAME,
FKCOLUMN_NAME,
KEY_SEQ,
UPDATE_RULE,
DELETE_RULE,
FK_NAME
FROM ...
WHERE ...
```

- PKTABLE_OWNER: name of the owner of the primary key table (reference table)
- PKTABLE_NAME: name of the primary key table
- FKTABLE_OWNER: name of the owner of the foreign key table
- FKTABLE_NAME: name of the foreign key table
- FKCOLUMN_NAME: name of the foreign key column
- KEY_SEQ: number of the column in the key sequence (starts at 1)
- UPDATE_RULE : R: Restrict, C: Cascade
- DELETE_RULE : R: Restrict, C: Cascade
- FK_NAME: name of the foreign key; “1” if this name is not supported by the DBMS.

Indexes

```
SELECT
1,
TABLE_OWNER,
TABLE_NAME,
NON_UNIQUE,
1,
INDEX_NAME,
TYPE,
SEQ_IN_INDEX,
COLUMN_NAME,
COLLATION
FROM ...
WHERE ...
```

- TABLE_OWNER: name of the owner of the table concerned by the statistic or the index
- TABLE_NAME: name of the index table
- NON_UNIQUE: the indexes must have a unique value
- INDEX_NAME: name of the index
- TYPE : Index type
- SEQ_IN_INDEX: number of the column in the key sequence (starts at 1)
- COLUMN_NAME: name of the column
- COLLATION: column sort; "A" increasing order, "D" decreasing order

Columns

```
SELECT
1,
COLUMN_OWNER,
TABLE_NAME,
COLUMN_NAME,
DataType ODBC,
DataType Name,
Detail,
Length,
Scale,
1,
NULLABLE,
COMMENT,
DEFAULT_VALUE,
1,
1,
1,
Order
WHERE [Joint between <MEGA:OWNER><MEGA:OBJECT_NAME>]
```

- <MEGA:OWNER> is replaced by the user, the Schema or "".
- <MEGA:OBJECT_NAME>] is replaced by the name of the table.
- COLUMN_OWNER: name of the column, string with 128 characters.
- TABLE_NAME: name of the table, string with 128 characters.
- DataType ODBC: data type in the form of an integer. This value is the value of ODBC data types therefore comprised of the following:

```
# -1 (SQL_LONGVARCHAR)
# -2 (SQL_BINARY
# -3 (SQL_VARBINARY)
# -4 (SQL_LONGVARBINARY)
# -5 (SQL_BIGINT)
# -6 (SQL_TINYINT)
# -7 (SQL_BIT)
# 0 (SQL_UNKNOWN_TYPE)
# 1 (SQL_CHAR)
# 2 (SQL_NUMERIC)
# 3 (SQL_DECIMAL)
# 4 (SQL_INTEGER)
```

```
# 5 (SQL_SMALLINT)
# 6 (SQL_FLOAT)
# 7 (SQL_REAL)
# 8 (SQL_DOUBLE)
# 9 (SQL_DATE)
# 10 (SQL_TIME)
# 11 (SQL_TIMESTAMP)
# 12 (SQL_VARCHAR)
```

- DataType Name: name of the data type, string of 128 characters. It is built as follows: "SQL_<DbmsName><String>"
- Precision: length in MEGA if "Length" is empty.
- Length: length in MEGA if greater than 0.
- Scale: integer
- NULLABLE: integer specifying if the column can be NULL. ODBC values possible: 0 (SQL_NO_NULLS), 1 (SQL_NULLABLE) or 3 (SQL_NULL_WITH_DEFAULT).
- COMMENT: column comments, string with 1257 characters.
- DEFAULT_VALUE: default value of the column, string with 1257 characters.

Pivot Types and Datatypes Correspondence Tables

The following tables show correspondence between pivot types and the different supported DBMSs and their versions.

DB2 OS/390 Version 5

Pivot --> Datatype (DB2 OS/390 Version 5)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<256	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>255	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and D not ø	DECIMAL(@L,@D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		REAL

Pivot --> Datatype (DB2 OS/390 Version 5)

Pivot	Condition	Datatype
P-Multimedia		LONG VARCHAR FOR BIT DATA
P-Numeric	L not ø and D not ø	DECIMAL(@L,@D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	L=5 or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 OS/390 Version 5)

Datatype	Condition	Pivot
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
DATE		P-Date
DECIMAL		P-Decimal

Datatype --> Pivot (DB2 OS/390 Version 5)

Datatype	Condition	Pivot
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
LONG VARCHAR FOR BIT DATA		P-Multimedia
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Timestamp
VARCHAR		P-Varchar
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 OS/390 VERSION 7

Pivot --> Datatype (DB2 OS/390 Version 7)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<256	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>255	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L, @D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and D not ø	DECIMAL(@L, @D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		REAL

Pivot --> Datatype (DB2 OS/390 Version 7)

Pivot	Condition	Datatype
P-Multimedia		LONG VARCHAR FOR BIT DATA
P-Numeric	L not ø and D not ø	DECIMAL(@L, @D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	(L<5 and D ø) or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 OS/390 Version 7)

Datatype	Condition	Pivot
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
DATE		P-Date
DECIMAL		P-Decimal

Datatype --> Pivot (DB2 OS/390 Version 7)

Datatype	Condition	Pivot
DECIMAL(L)		P-Decimal
DECIMAL(L, D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
LONG VARCHAR FOR BIT DATA		P-Multimedia
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Datetime
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 FOR Z/OS VERSION 8

Pivot --> Datatype (DB2 for z/OS Version 8)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<256	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>255	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L, @D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and D not ø	DECIMAL(@L, @D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		REAL

Pivot --> Datatype (DB2 for z/OS Version 8)

Pivot	Condition	Datatype
P-Multimedia		LONG VARCHAR FOR BIT DATA
P-Numeric	L not ø and D not ø	DECIMAL(@L, @D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	(L<5 and D ø) or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 for z/OS Version 8)

Datatype	Condition	Pivot
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
DATE		P-Date
DECIMAL		P-Decimal

Datatype --> Pivot (DB2 for z/OS Version 8)

Datatype	Condition	Pivot
DECIMAL(L)		P-Decimal
DECIMAL(L, D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
LONG VARCHAR FOR BIT DATA		P-Multimedia
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Datetime
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 UNIVERSAL DATABASE VERSION 5

Pivot --> Datatype (DB2 Universal Database Version 5)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<255	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>254	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and D not ø	DECIMAL(@L,@D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		BIGINT
P-Long Real		REAL

Pivot --> Datatype (DB2 Universal Database Version 5)

Pivot	Condition	Datatype
P-Multimedia		BLOB(@L)
P-Numeric	L not ø and D not ø	DECIMAL(@L,@D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	(L<5 and D not ø) or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 Universal Database Version 5)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BLOB(L)		P-Multimedia
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
DATE		P-Date

Datatype --> Pivot (DB2 Universal Database Version 5)

Datatype	Condition	Pivot
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Timestamp
VARCHAR		P-Varchar
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 UNIVERSAL DATABASE VERSION 7

Pivot --> Datatype (DB2 Universal Database Version 7)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<255	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>254	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and L not ø	DECIMAL(@L,@D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		BIGINT
P-Long Real		REAL

Pivot --> Datatype (DB2 Universal Database Version 7)

Pivot	Condition	Datatype
P-Multimedia		BLOB(@L)
P-Numeric	L not ø and D not ø	DECIMAL(@L,@D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	L=5 or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 Universal Database Version 7)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BLOB(L)		P-Multimedia
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
DATE		P-Date

Datatype --> Pivot (DB2 Universal Database Version 7)

Datatype	Condition	Pivot
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Timestamp
VARCHAR		P-Varchar
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 Universal Database Version 8

Pivot --> Datatype (DB2 Universal Database Version 8)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<255	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>254	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and L not ø	DECIMAL(@L,@D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		BIGINT
P-Long Real		REAL

Pivot --> Datatype (DB2 Universal Database Version 8)

Pivot	Condition	Datatype
P-Numeric	L not ø and D not ø	DECIMAL(@L,@D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	L=5 or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 Universal Database Version 8)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
DATE		P-Date
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal

Datatype --> Pivot (DB2 Universal Database Version 8)

Datatype	Condition	Pivot
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
REAL		P-Real
SMALLINT		P-Smallint
SMALLINT		P-Tinyint
TIME		P-Time
TIMESTAMP		P-Timestamp
VARCHAR		P-Varchar
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 Universal Database Version 9

Pivot --> Datatype (DB2 Universal Database Version 9)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<255	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>254	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and L not ø	DECIMAL(@L,@D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		BIGINT
P-Long Real		REAL

Pivot --> Datatype (DB2 Universal Database Version 9)

Pivot	Condition	Datatype
P-Multimedia		BLOB(@L)
P-Numeric	L not ø and D not ø	DECIMAL(@L,@D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	L=5 or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary		VARCHAR(@L) FOR BIT DATA
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 Universal Database Version 9)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BLOB(L)		P-Multimedia
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
CLOB(L)		CLOB

Datatype --> Pivot (DB2 Universal Database Version 9)

Datatype	Condition	Pivot
DATE		P-Date
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
REAL		P-Real
SMALLINT		P-Smallint
SMALLINT		P-Tinyint
TIME		P-Time
TIMESTAMP		P-Timestamp
VARCHAR		P-Varchar
VARCHAR(L)		P-Varchar
VARCHAR(L) FOR BIT DATA		P-Varbinary

DB2 Version 9 For OS

Pivot --> Datatype (DB2 Version 9 For OS)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		CHAR(@L) FOR BIT DATA
P-Boolean		CHAR(@L) FOR BIT DATA
P-Byte		CHAR (1) FOR BIT DATA
P-Character	Not Unicode and (L=0 or L ø)	CHAR
	Not Unicode and 0<L<256	CHAR(@L)
	Not Unicode and (L=256 or L ø)	GRAPHIC(@L)
	Not Unicode and L>255	VARCHAR(@L)
	Not Unicode and L>255	VARGRAPHIC(@L)
P-Currency		DECIMAL(@L, @D)
P-Date		DATE
P-Datetime		TIMESTAMP
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL(@L)
	L>0 and D not ø	DECIMAL(@L, @D)
P-Double		DOUBLE
P-Float	L=0 or L ø	FLOAT
	L<>0	FLOAT(@L)
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		REAL

Pivot --> Datatype (DB2 Version 9 For OS)

Pivot	Condition	Datatype
P-Multimedia		BLOB
		BLOB(@L)
		CLOB
		CLOB FOR MIXED DATA
		CLOB(@L)
		CLOB(@L) FOR MIXED DATA
		LONG VARCHAR FOR BIT DATA
P-Numeric	L not ø and D not ø	DECIMAL(@L, @D)
	L>9 and D ø	FLOAT(@L)
	4<L<10 and D ø	INTEGER
	(L<5 and D ø) or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		LONG VARCHAR
P-Text		LONG VARCHAR
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyint		SMALLINT
P-Varbinary	L <=1024	VARCHAR(@L) FOR BIT DATA
	L>1024	XML
P-Varchar	Not Unicode and (L=0 or L ø)	VARCHAR
	Not Unicode and L<>0	VARCHAR(@L)
	Unicode	VARGRAPHIC(@L)

Datatype --> Pivot (DB2 Version 9 For OS)

Datatype	Condition	Pivot
BLOB		P-Multimedia
BLOB(L)		P-Multimedia
CHAR		P-Character
CHAR (1) FOR BIT DATA		P-Byte
CHAR(L)		P-Character
CHAR(L) FOR BIT DATA		P-Boolean
CLOB		P-Multimedia
CLOB FOR MIXED DATA		P-Multimedia
CLOB(L)		P-Multimedia
CLOB(L) FOR MIXED DATA		P-Multimedia
DATE		P-Date
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
DECIMAL(L, D)		P-Decimal
DOUBLE		P-Double
FLOAT		P-Float
FLOAT(L)		P-Float
INTEGER		P-Integer
LONG VARCHAR		P-Text
LONG VARCHAR FOR BIT DATA		P-Multimedia
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
TIMESTAMP		P-Datetime
VARCHAR(L)		P-Varchar

Datatype --> Pivot (DB2 Version 9 For OS)

Datatype	Condition	Pivot
VARCHAR(L) FOR BIT DATA		P-Varbinary
XML		P-Varbinary

INFORMIX DYNAMIC SERVER 7.3

Pivot --> Datatype (Informix Dynamic Server 7.3)

Pivot	Condition	Datatype
P-AutoIdentifier		SERIAL
P-Binary		BYTE
P-Boolean		SMALLINT
P-Byte		BYTE
P-Character		CHAR(@L)
P-Currency		MONEY(@L,@D)
P-Date		DATE
P-Datetime		DATETIME
P-Decimal	D ø	DECIMAL(@L)
	D not ø	DECIMAL(@L,@D)
P-Double		FLOAT
P-Float	L=0 or L ø	FLOAT
	L<>0	SMALLFLOAT(@L)
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		FLOAT
P-Multimedia		BYTE
P-Numeric	L>9	DECIMAL(@L)
	4<L<10	INTEGER
	L=5 or L ø	SMALLINT
P-Real		FLOAT
P-Smallint		SMALLINT
P-String		VARCHAR(@L)
P-Text		VARCHAR(@L)

Pivot --> Datatype (Informix Dynamic Server 7.3)

Pivot	Condition	Datatype
P-Time		DATETIME
P-Timestamp		SERIAL
P-Tinyint		SMALLINT
P-Varchar	D ø	VARCHAR(@L)
	D not ø	VARCHAR(@L,@D)

Datatype --> Pivot (Informix Dynamic Server 7.3)

Datatype	Condition	Pivot
BYTE		P-Multimedia
CHAR(L)		P-Character
DATE		P-Date
DATETIME		P-Datetime
DECIMAL(L)		P-Decimal
DECIMAL(L,D)		P-Decimal
FLOAT		P-Float
INTEGER		P-Integer
MONEY(L,D)		P-Currency
SERIAL		P-Timestamp
SMALLFLOAT(L)		P-Float
SMALLINT		P-Boolean
VARCHAR(L)		P-Varchar
VARCHAR(L,D)		P-Varchar

INGRES II 2.0

Pivot --> Datatype (Ingres II 2.0)

Pivot	Condition	Datatype
P-AutoIdentifier		integer
P-Binary		long byte(@L)
P-Boolean		integer1
P-Byte		byte(@L)
P-Character		char(@L)
P-Currency		money(@L,@D)
P-Date		date
P-Datetime		date
P-Decimal		decimal(@L,@D)
P-Double		integer1
P-Float		float4
P-Integer		integer
P-Long Integer		integer
P-Long Real		float
P-Multimedia	L=2001 or L ø	byte(@L)
	L>2000	long byte(@L)
P-Numeric	L>9	float
	4<L<10	integer
	L=3 or L ø	integer1
	2<L<5	smallint
P-Real		float
P-Smallint		smallint
P-String		long varchar(@L)
P-Text		text(@L)

Pivot --> Datatype (Ingres II 2.0)

Pivot	Condition	Datatype
P-Time		date
P-Timestamp		date
P-Tinyint		integer1
P-Varbinary		byte varying(@L)
P-Varchar		varchar(@L)

Datatype --> Pivot (Ingres II 2.0)

Datatype	Condition	Pivot
byte varying(L)		P-Varbinary
byte(L)		P-Multimedia
char(L)		P-Character
date		P-Datetime
decimal(L,D)		P-Decimal
float		P-Real
float4		P-Float
integer		P-Integer
integer1		P-Tinyint
long byte(L)		P-Binary
long varchar(L)		P-String
money(L,D)		P-Currency
smallint		P-Smallint
text(L)		P-Text
varchar(L)		P-Varchar

MySQL 4.1

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
	L>0 and D not ø	REAL (@L,@D) UNSIGNED
	L=0 or L ø	REAL UNSIGNED
	L>0 and D not ø	REAL (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	REAL UNSIGNED ZEROFILL
P-AutoIdentifier		INTEGER
P-Binary	L ø or L<=0	BINARY
	L is numeric and L<>0	BINARY (@L)
P-Boolean		BOOLEAN
P-Byte	L ø or L<=0	BIT
	L is numeric and L<>0	BIT (@L)
P-Character	Not Unicode and L=0	CHAR
	Not Unicode and L<>0	CHAR (@L)
	Unicode and L<>0	CHAR (@L) UNICODE
	Unicode and L=0	CHAR UNICODE
P-Character Ascii	L ø or L<=0	CHAR ASCII
	L is numeric and L<>0	CHAR(@L) ASCII
P-Character Binary	Not Unicode and L<>0	CHAR (@L) BINARY
	Unicode and L<>0	CHAR (@L) UNICODE BINARY
	Not Unicode and L=0	CHAR BINARY
	Unicode and L=0	CHAR UNICODE BINARY

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
P-Character Unicode	L is numeric and L<>0	CHAR (@L) UNICODE
	L ø or L<=0	CHAR UNICODE
P-Character Unicode Binary	L is numeric and L<>0	CHAR (@L) UNICODE BINARY
	L ø or L<=0	CHAR UNICODE BINARY
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		DATETIME
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL (@L)
	L>0 and D not ø	DECIMAL(@L,@D)
P-Decimal Unsigned	L>0 and D ø	DECIMAL (@L) UNSIGNED
	L>0 and D not ø	DECIMAL (@L,@D) UNSIGNED
	L=0 or L ø	DECIMAL UNSIGNED
P-Decimal Unsigned Zerofill	L>0 and D ø	DECIMAL (@L) UNSIGNED ZEROFILL
	L>0 and D not ø	DECIMAL (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	DECIMAL UNSIGNED ZEROFILL
P-Double	L ø or L<=0	DOUBLE PRECISION
	L<>0 or D<>0	DOUBLE PRECISION (@L,@D)
P-Double Unsigned	L>0 and D not ø	DOUBLE PRECISION (@L,@D) UNSIGNED
	L=0 or L ø	DOUBLE PRECISION UNSIGNED

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
P-Double Unsigned Zero-fill	L>0 and D not ø	DOUBLE PRECISION (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	DOUBLE PRECISION UNSIGNED ZEROFILL
P-Float	L=0 or L ø	FLOAT
	L>0 and D ø	FLOAT (@L)
	L>0 and D not ø	FLOAT (@L,@D)
P-Float Unsigned	L>0 and D ø	FLOAT (@L) UNSIGNED
	L>0 and D not ø	FLOAT (@L,@D) UN-SIGNED
	L=0 or L ø	FLOAT UNSIGNED
P-Float Unsigned Zerofill	L>0 and D ø	FLOAT (@L) UNSIGNED ZEROFILL
	L>0 and D not ø	FLOAT (@L,@D) UN-SIGNED ZEROFILL
	L=0 or L ø	FLOAT UNSIGNED ZER-OFILL
P-Integer	L ø or L<=0	INTEGER
	L is numeric and L<>0	INTEGER (@L)
P-Integer Unsigned	L is numeric and L<>0	INTEGER (@L) UN-SIGNED
	L ø or L<=0	INTEGER UNSIGNED
P-Integer Unsigned Zerofill	L is numeric and L<>0	INTEGER (@L) UN-SIGNED ZEROFILL
	L ø or L<=0	INTEGER UNSIGNED ZEROFILL
P-Long Integer	L ø or L<=0	BIGINT
	L is numeric and L<>0	BIGINT (@L)

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
P-Long Integer Unsigned	L is numeric and L<>0	BIGINT (@L) UNSIGNED
	L ø or L<=0	BIGINT UNSIGNED
P-Long Integer Unsigned Zerofill	L is numeric and L<>0	BIGINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	BIGINT UNSIGNED ZEROFILL
P-Longblob		LONGBLOB
P-Longtext		LONGTEXT
P-Mediumblob		MEDIUMBLOB
P-Mediumint	L ø or L<=0	MEDIUMINT
	L is numeric and L<>0	MEDIUMINT (@L)
P-Mediumint Unsigned	L is numeric and L<>0	MEDIUMINT (@L) UNSIGNED
	L ø or L<=0	MEDIUMINT UNSIGNED
P-Mediumint Unsigned Zerofill	L is numeric and L<>0	MEDIUMINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	MEDIUMINT UNSIGNED ZEROFILL
P-Mediumtext		MEDIUMTEXT
P-Multimedia		BLOB
P-National Varchar	L ø or L<0	NATIONAL VARCHAR
	L is numeric and L>=0	NATIONAL VARCHAR (@L)
P-National Varchar Binary	L is numeric and L>=0	NATIONAL VARCHAR (@L) BINARY
	L ø or L<0	NATIONAL VARCHAR BINARY

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
P-Numeric	L=0 or L ø	NUMERIC
	L>0 and D ø	NUMERIC (@L)
	L>0 and D not ø	NUMERIC (@L,@D)
P-Real	L ø or L<=0	REAL
	L>0 and D not ø	REAL (@L,@D)
P-Smallint		SMALLINT
	L is numeric and L<>0	SMALLINT (@L)
P-Smallint Unsigned	L is numeric and L<>0	SMALLINT (@L) UNSIGNED
	L ø or L<=0	SMALLINT UNSIGNED
P-Smallint Unsigned Zerofill	L is numeric and L<>0	SMALLINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	SMALLINT UNSIGNED ZEROFILL
P-String		VARCHAR(@L)
P-Text		TEXT
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyblob		TINYBLOB
P-Tinyint	L ø or L<=0	TINYINT
	L is numeric and L<>0	TINYINT (@L)
P-Tinyint Unsigned	L is numeric and L<>0	TINYINT (@L) UNSIGNED
	L ø or L<=0	TINYINT UNSIGNED
P-Tinyint Unsigned Zerofill	L is numeric and L<>0	TINYINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	TINYINT UNSIGNED ZEROFILL
P-Tinytext		TINYTEXT

Pivot --> Datatype (MySQL 4.1)

Pivot	Condition	Datatype
P-Varbinary	L ø or L<0	VARBINARY
	L is numeric and L>=0	VARBINARY (@L)
P-Varchar	L ø or L<0	VARCHAR
	L is numeric and L>=0	VARCHAR(@L)
P-Varchar Binary	L is numeric and L>=0	VARCHAR (@L) BINARY
	L ø or L<0	VARCHAR BINARY
P-Wide Character	L ø or L<=0	NATIONAL CHAR
	L is numeric and L<>0	NATIONAL CHAR (@L)
P-Wide Character Binary	L is numeric and L<>0	NATIONAL CHAR (@L) BINARY
	L ø or L<=0	NATIONAL CHAR BINARY
P-Year	L ø or L<=0	YEAR
	L is numeric and L<>0	YEAR (@L)

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BIGINT (L)		P-Long Integer
BIGINT (L) UNSIGNED		P-Long Integer Unsigned
BIGINT (L) UNSIGNED ZEROFILL		P-Long Integer Unsigned Zerofill
BIGINT UNSIGNED		P-Long Integer Unsigned
BIGINT UNSIGNED ZEROFILL		P-Long Integer Unsigned Zerofill
BINARY		P-Binary
BINARY (L)		P-Binary
BLOB		P-Multimedia

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
BOOLEAN		P-Boolean
CHAR (L)		P-Character
CHAR (L) BINARY		P-Character Binary
CHAR (L) UNICODE		P-Character Unicode
CHAR (L) UNICODE BINARY		P-Character Unicode Binary
CHAR ASCII		P-Character Ascii
CHAR BINARY		P-Character Binary
CHAR UNICODE		P-Character Unicode
CHAR UNICODE BINARY		P-Character Unicode Binary
CHAR(L) ASCII		P-Character Ascii
DATE		P-Date
DATETIME		P-Datetime
DECIMAL (L)		P-Decimal
DECIMAL (L) UNSIGNED		P-Decimal Unsigned
DECIMAL (L) UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill
DECIMAL (L,D) UNSIGNED		P-Decimal Unsigned
DECIMAL (L,D) UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill
DECIMAL UNSIGNED		P-Decimal Unsigned
DECIMAL UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill
DOUBLE PRECISION		P-Double
DOUBLE PRECISION (L,D)		P-Double

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
DOUBLE PRECISION (L,D) UNSIGNED		P-Double Unsigned
DOUBLE PRECISION (L,D) UNSIGNED ZERO-FILL		P-Double Unsigned Zero-fill
DOUBLE PRECISION UNSIGNED		P-Double Unsigned
DOUBLE PRECISION UNSIGNED ZEROFILL		P-Double Unsigned Zero-fill
FLOAT		P-Float
FLOAT (L)		P-Float
FLOAT (L) UNSIGNED		P-Float Unsigned
FLOAT (L) UNSIGNED ZEROFILL		P-Float Unsigned Zerofill
FLOAT (L,D)		P-Float
FLOAT (L,D) UNSIGNED		P-Float Unsigned
FLOAT (L,D) UNSIGNED ZEROFILL		P-Float Unsigned Zerofill
FLOAT UNSIGNED		P-Float Unsigned
FLOAT UNSIGNED ZER-OFILL		P-Float Unsigned Zerofill
INTEGER		P-Integer
INTEGER (L)		P-Integer
INTEGER (L) UN-SIGNED		P-Integer Unsigned
INTEGER (L) UN-SIGNED ZEROFILL		P-Integer Unsigned Zerofill
INTEGER UNSIGNED		P-Integer Unsigned
INTEGER UNSIGNED ZEROFILL		P-Integer Unsigned Zerofill
LONGBLOB		P-Longblob

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
LONGTEXT		P-Longtext
MEDIUMBLOB		P-Mediumblob
MEDIUMINT		P-Mediumint
MEDIUMINT (L)		P-Mediumint
MEDIUMINT (L) UNSIGNED		P-Mediumint Unsigned
MEDIUMINT (L) UNSIGNED ZEROFILL		P-Mediumint Unsigned Zerofill
MEDIUMINT UNSIGNED		P-Mediumint Unsigned
MEDIUMINT UNSIGNED ZEROFILL		P-Mediumint Unsigned Zerofill
MEDIUMTEXT		P-Mediumtext
NATIONAL CHAR		P-Wide Character
NATIONAL CHAR (L)		P-Wide Character
NATIONAL CHAR (L) BINARY		P-Wide Character Binary
NATIONAL CHAR BINARY		P-Wide Character Binary
NATIONAL VARCHAR		P-National Varchar
NATIONAL VARCHAR (L)		P-National Varchar
NATIONAL VARCHAR (L) BINARY		P-National Varchar Binary
NATIONAL VARCHAR BINARY		P-National Varchar Binary
NUMERIC		P-Numeric
NUMERIC (L)		P-Numeric
NUMERIC (L,D)		P-Numeric
REAL		P-Real

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
REAL (L,D)		P-Real
REAL (L,D) UNSIGNED		
REAL (L,D) UNSIGNED ZEROFILL		
REAL UNSIGNED		
REAL UNSIGNED ZEROFILL		
SMALLINT		P-Smallint
SMALLINT (L)		P-Smallint
SMALLINT (L) UNSIGNED		P-Smallint Unsigned
SMALLINT (L) UNSIGNED ZEROFILL		P-Smallint Unsigned Zerofill
SMALLINT UNSIGNED		P-Smallint Unsigned
SMALLINT UNSIGNED ZEROFILL		P-Smallint Unsigned Zerofill
TEXT		P-Text
TIME		P-Time
TIMESTAMP		P-Timestamp
TINYBLOB		P-Tinyblob
TINYINT		P-Tinyint
TINYINT (L)		P-Tinyint
TINYINT (L) UNSIGNED		P-Tinyint Unsigned
TINYINT (L) UNSIGNED ZEROFILL		P-Tinyint Unsigned Zerofill
TINYINT UNSIGNED		P-Tinyint Unsigned
TINYINT UNSIGNED ZEROFILL		P-Tinyint Unsigned Zerofill
TINYTEXT		P-Tinytext
VARBINARY		P-Varbinary

Datatype --> Pivot (MySQL 4.1)

Datatype	Condition	Pivot
VARBINARY (L)		P-Varbinary
VARCHAR		P-Varchar
VARCHAR (L) BINARY		P-Varchar Binary
VARCHAR BINARY		P-Varchar Binary
VARCHAR(L)		P-Varchar
YEAR		P-Year
YEAR (L)		P-Year

MYSQL 5.0

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
	L>0 and D not ø	REAL (@L,@D) UNSIGNED
	L=0 or L ø	REAL UNSIGNED
	L>0 and D not ø	REAL (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	REAL UNSIGNED ZEROFILL
P-AutoIdentifier		INTEGER
P-Binary	L ø or L<=0	BINARY
	L is numeric and L<>0	BINARY (@L)
P-Boolean		BOOLEAN
P-Byte	L ø or L<=0	BIT
	L is numeric and L<>0	BIT (@L)
P-Character	Not Unicode and L=0	CHAR
	Unicode and L<>0	CHAR (@L) UNICODE
	Unicode and L=0	CHAR UNICODE
	Not Unicode and L<>0	CHAR(@L)
P-Character Ascii	L ø or L<=0	CHAR ASCII
	L is numeric and L<>0	CHAR(@L) ASCII
P-Character Binary	Not Unicode and L<>0	CHAR (@L) BINARY
	Unicode and L<>0	CHAR (@L) UNICODE BINARY
	Not Unicode and L=0	CHAR BINARY
	Unicode and L=0	CHAR UNICODE BINARY

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
P-Character Unicode	L is numeric and L<>0	CHAR (@L) UNICODE
	L ø or L<=0	CHAR UNICODE
P-Character Unicode Binary	L is numeric and L<>0	CHAR (@L) UNICODE BINARY
	L ø or L<=0	CHAR UNICODE BINARY
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		DATETIME
P-Decimal	L=0 or L ø	DECIMAL
	L>0 and D ø	DECIMAL (@L)
	L>0 and D not ø	DECIMAL(@L,@D)
P-Decimal Unsigned	L>0 and D ø	DECIMAL (@L) UNSIGNED
	L>0 and D not ø	DECIMAL (@L,@D) UNSIGNED
	L=0 or L ø	DECIMAL UNSIGNED
P-Decimal Unsigned Zerofill	L>0 and D ø	DECIMAL (@L) UNSIGNED ZEROFILL
	L>0 and D not ø	DECIMAL (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	DECIMAL UNSIGNED ZEROFILL
P-Double	L=0 or L ø	DOUBLE PRECISION
	L>0 and D not ø	DOUBLE PRECISION (@L,@D)
P-Double Unsigned	L>0 and D not ø	DOUBLE PRECISION (@L,@D) UNSIGNED
	L=0 or L ø	DOUBLE PRECISION UNSIGNED

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
P-Double Unsigned Zero-fill	L>0 and D not ø	DOUBLE PRECISION (@L,@D) UNSIGNED ZEROFILL
	L=0 or L ø	DOUBLE PRECISION UNSIGNED ZEROFILL
P-Float	L=0 or L ø	FLOAT
	L>0 and D ø	FLOAT (@L)
	L>0 and D not ø	FLOAT (@L,@D)
P-Float Unsigned	L>0 and D ø	FLOAT (@L) UNSIGNED
	L>0 and D not ø	FLOAT (@L,@D) UN-SIGNED
	L=0 or L ø	FLOAT UNSIGNED
P-Float Unsigned Zerofill	L>0 and D ø	FLOAT (@L) UNSIGNED ZEROFILL
	L>0 and D not ø	FLOAT (@L,@D) UN-SIGNED ZEROFILL
	L=0 or L ø	FLOAT UNSIGNED ZER-OFILL
P-Integer	L ø or L<=0	INTEGER
	L is numeric and L<>0	INTEGER (@L)
P-Integer Unsigned	L is numeric and L<>0	INTEGER (@L) UN-SIGNED
	L ø or L<=0	INTEGER UNSIGNED
P-Integer Unsigned Zerofill	L is numeric and L<>0	INTEGER (@L) UN-SIGNED ZEROFILL
	L ø or L<=0	INTEGER UNSIGNED ZEROFILL
P-Long Integer	L ø or L<=0	BIGINT
	L is numeric and L<>0	BIGINT (@L)

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
P-Long Integer Unsigned	L is numeric and L<>0	BIGINT (@L) UNSIGNED
	L ø or L<=0	BIGINT UNSIGNED
P-Long Integer Unsigned Zerofill	L is numeric and L<>0	BIGINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	BIGINT UNSIGNED ZEROFILL
P-Longblob		LONGBLOB
P-Longtext		LONGTEXT
P-Mediumblob		MEDIUMBLOB
P-Mediumint	L ø or L<=0	MEDIUMINT
	L is numeric and L<>0	MEDIUMINT (@L)
P-Mediumint Unsigned	L is numeric and L<>0	MEDIUMINT (@L) UNSIGNED
	L ø or L<=0	MEDIUMINT UNSIGNED
P-Mediumint Unsigned Zerofill	L is numeric and L<>0	MEDIUMINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	MEDIUMINT UNSIGNED ZEROFILL
P-Mediumtext		MEDIUMTEXT
P-Multimedia		BLOB
P-National Varchar	L ø or L<0	NATIONAL VARCHAR
	L is numeric and L<>0	NATIONAL VARCHAR (@L)
P-National Varchar Binary	L is numeric and L<>0	NATIONAL VARCHAR (@L) BINARY
	L ø or L<0	NATIONAL VARCHAR BINARY

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
P-Numeric	L=0 or L ø	NUMERIC
	L>0 and D ø	NUMERIC (@L)
	L>0 and D not ø	NUMERIC (@L,@D)
P-Real	L=0 or L ø	REAL
	L>0 and D not ø	REAL (@L,@D)
P-Smallint	L ø or L<=0	SMALLINT
	L is numeric and L<>0	SMALLINT (@L)
P-Smallint Unsigned	L is numeric and L<>0	SMALLINT (@L) UNSIGNED
	L ø or L<=0	SMALLINT UNSIGNED
P-Smallint Unsigned Zerofill	L is numeric and L<>0	SMALLINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	SMALLINT UNSIGNED ZEROFILL
P-String		VARCHAR(@L)
P-Text		TEXT
P-Time		TIME
P-Timestamp		TIMESTAMP
P-Tinyblob		TINYBLOB
P-Tinyint	L ø or L<=0	TINYINT
	L is numeric and L<>0	TINYINT (@L)
P-Tinyint Unsigned	L is numeric and L<>0	TINYINT (@L) UNSIGNED
	L ø or L<=0	TINYINT UNSIGNED
P-Tinyint Unsigned Zerofill	L is numeric and L<>0	TINYINT (@L) UNSIGNED ZEROFILL
	L ø or L<=0	TINYINT UNSIGNED ZEROFILL
P-Tinytext		TINYTEXT

Pivot --> Datatype (MySQL 5.0)

Pivot	Condition	Datatype
P-Varbinary	L ø or L<0	VARBINARY
	L is numeric and L>=0	VARBINARY (@L)
P-Varchar	L ø or L<=0	VARCHAR
	L is numeric and L=0	VARCHAR(@L)
P-Varchar Binary	L is numeric and L<>0	VARCHAR (@L) BINARY
	L ø or L<0	VARCHAR BINARY
P-Wide Character	L ø or L<=0	NATIONAL CHAR
	L is numeric and L<>0	NATIONAL CHAR (@L)
P-Wide Character Binary	L is numeric and L<>0	NATIONAL CHAR (@L) BINARY
	L ø or L<=0	NATIONAL CHAR BINARY
P-Year	L ø or L<=0	YEAR
	L is numeric and L<>0	YEAR(@L)

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BIGINT (L)		P-Long Integer
BIGINT (L) UNSIGNED		P-Long Integer Unsigned
BIGINT (L) UNSIGNED ZEROFILL		P-Long Integer Unsigned Zerofill
BIGINT UNSIGNED		P-Long Integer Unsigned
BIGINT UNSIGNED ZEROFILL		P-Long Integer Unsigned Zerofill
BINARY		P-Binary
BINARY (L)		P-Binary
BIT		P-Byte

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
BIT (L)		P-Byte
BLOB		P-Multimedia
BOOLEAN		P-Boolean
CHAR		P-Character
CHAR (L) BINARY		P-Character Binary
CHAR (L) UNICODE		P-Character Unicode
CHAR (L) UNICODE BINARY		P-Character Unicode Binary
CHAR ASCII		P-Character Ascii
CHAR BINARY		P-Character Binary
CHAR UNICODE		P-Character Unicode
CHAR UNICODE BINARY		P-Character Unicode Binary
CHAR(L)		P-Character
CHAR(L) ASCII		P-Character Ascii
DATE		P-Date
DATETIME		P-Datetime
DECIMAL		P-Decimal
DECIMAL (L)		P-Decimal
DECIMAL (L) UNSIGNED		P-Decimal Unsigned
DECIMAL (L) UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill
DECIMAL (L,D) UNSIGNED		P-Decimal Unsigned
DECIMAL (L,D) UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill
DECIMAL UNSIGNED		P-Decimal Unsigned
DECIMAL UNSIGNED ZEROFILL		P-Decimal Unsigned Zerofill

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
DECIMAL(L,D)		P-Decimal
DOUBLE PRECISION		P-Double
DOUBLE PRECISION (L,D)		P-Double
DOUBLE PRECISION (L,D) UNSIGNED		P-Double Unsigned
DOUBLE PRECISION (L,D) UNSIGNED ZERO-FILL		P-Double Unsigned Zero-fill
DOUBLE PRECISION UNSIGNED		P-Double Unsigned
DOUBLE PRECISION UNSIGNED ZEROFILL		P-Double Unsigned Zero-fill
FLOAT		P-Float
FLOAT (L)		P-Float
FLOAT (L) UNSIGNED		P-Float Unsigned
FLOAT (L) UNSIGNED ZEROFILL		P-Float Unsigned Zerofill
FLOAT (L,D)		P-Float
FLOAT (L,D) UNSIGNED		P-Float Unsigned
FLOAT (L,D) UNSIGNED ZEROFILL		P-Float Unsigned Zerofill
FLOAT UNSIGNED		P-Float Unsigned
FLOAT UNSIGNED ZER-OFILL		P-Float Unsigned Zerofill
INTEGER		P-Integer
INTEGER (L)		P-Integer
INTEGER (L) UN-SIGNED		P-Integer Unsigned
INTEGER (L) UN-SIGNED ZEROFILL		P-Integer Unsigned Zerofill

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
INTEGER UNSIGNED		P-Integer Unsigned
INTEGER UNSIGNED ZEROFILL		P-Integer Unsigned Zerofill
LONGBLOB		P-Longblob
LONGTEXT		P-Longtext
MEDIUMBLOB		P-Mediumblob
MEDIUMINT		P-Mediumint
MEDIUMINT (L)		P-Mediumint
MEDIUMINT (L) UN-SIGNED		P-Mediumint Unsigned
MEDIUMINT (L) UN-SIGNED ZEROFILL		P-Mediumint Unsigned Ze-rofill
MEDIUMINT UN-SIGNED		P-Mediumint Unsigned
MEDIUMINT UN-SIGNED ZEROFILL		P-Mediumint Unsigned Ze-rofill
MEDIUMTEXT		P-Mediumtext
NATIONAL CHAR		P-Wide Character
NATIONAL CHAR (L)		P-Wide Character
NATIONAL CHAR (L) BINARY		P-Wide Character Binary
NATIONAL CHAR BI-NARY		P-Wide Character Binary
NATIONAL VARCHAR		P-National Varchar
NATIONAL VARCHAR (L)		P-National Varchar
NATIONAL VARCHAR (L) BINARY		P-National Varchar Binary
NATIONAL VARCHAR BINARY		P-National Varchar Binary
NUMERIC		P-Numeric

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
NUMERIC (L)		P-Numeric
NUMERIC (L,D)		P-Numeric
REAL		P-Real
REAL (L,D)		P-Real
REAL (L,D) UNSIGNED		
REAL (L,D) UNSIGNED ZEROFILL		
REAL UNSIGNED		
REAL UNSIGNED ZEROFILL		
SMALLINT		P-Smallint
SMALLINT (L)		P-Smallint
SMALLINT (L) UNSIGNED		P-Smallint Unsigned
SMALLINT (L) UNSIGNED ZEROFILL		P-Smallint Unsigned Zerofill
SMALLINT UNSIGNED		P-Smallint Unsigned
SMALLINT UNSIGNED ZEROFILL		P-Smallint Unsigned Zerofill
TEXT		P-Text
TIME		P-Time
TIMESTAMP		P-Timestamp
TINYBLOB		P-Tinyblob
TINYINT		P-Tinyint
TINYINT (L)		P-Tinyint
TINYINT (L) UNSIGNED		P-Tinyint Unsigned
TINYINT (L) UNSIGNED ZEROFILL		P-Tinyint Unsigned Zerofill
TINYINT UNSIGNED		P-Tinyint Unsigned

Datatype --> Pivot (MySQL 5.0)

Datatype	Condition	Pivot
TINYINT UNSIGNED ZEROFILL		P-Tinyint Unsigned Zero-fill
TINYTEXT		P-Tinytext
VARBINARY		P-Varbinary
VARBINARY (L)		P-Varbinary
VARCHAR		P-Varchar
VARCHAR (L) BINARY		P-Varchar Binary
VARCHAR BINARY		P-Varchar Binary
VARCHAR(L)		P-Varchar
YEAR		P-Year
YEAR(L)		P-Year

ORACLE 10

Pivot --> Datatype (Oracle 10)

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Binary		RAW(@L)
P-Boolean	L=2 or L ø	RAW(1)
	L>1	RAW(@L)
P-Byte		RAW(1)
P-Character	Not Unicode and (L<2001 or L ø)	CHAR(@L)
	L>4000	LONG
	Not Unicode and (L=2001 or L ø)	NCHAR(@L)
	Unicode and 2000<L<4001	NVARCHAR2(@L)
	Not Unicode and 2000<L<4001	VARCHAR2(@L)
P-Currency		NUMBER(@L,@D)
P-Date		DATE
P-Datetime		DATE
P-Decimal		NUMBER(@L,@D)
P-Double		NUMBER(@L,@D)
P-Float	L=0 or L>126 or L ø	FLOAT
	0<L<127	FLOAT(@L)
P-Integer		NUMBER(@L)
P-Long Integer		NUMBER(@L)
P-Long Real		NUMBER(@L,@D)
P-Multimedia		LONG RAW

Pivot --> Datatype (Oracle 10)

Pivot	Condition	Datatype
P-Numeric	L=0 or L ø	NUMBER
	L>0 and D ø	NUMBER(@L)
	L>0 and D not ø	NUMBER(@L,@D)
P-Real		NUMBER(@L,@D)
P-Smallint		NUMBER(@L)
P-String		LONG
P-Text	Unicode	NVARCHAR2(@L)
	Not Unicode	VARCHAR2(@L)
P-Time		DATE
P-Timestamp	L>9 or L ø	TIMESTAMP
	L<10	TIMESTAMP(@L)
P-Tinyint		NUMBER(@L)
P-Varbinary		LONG RAW
P-Varchar	L>4000 or L=0 or L ø	LONG
	Unicode and 0<L<4001	NVARCHAR2(@L)
	Not Unicode and 0<L<4001	VARCHAR2(@L)

Datatype --> Pivot (Oracle 10)

Datatype	Condition	Pivot
CHAR(L)		P-Character
DATE		P-Date
FLOAT		P-Float
FLOAT(L)		P-Float
LONG		P-String
LONG RAW		P-Multimedia
NUMBER		P-Numeric

Datatype --> Pivot (Oracle 10)

Datatype	Condition	Pivot
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric
RAW(1)		P-Boolean
RAW(L)		P-Boolean
TIMESTAMP		P-Timestamp
TIMESTAMP(L)		P-Timestamp
VARCHAR2(L)		P-Varchar

ORACLE 11

Pivot --> Datatype (Oracle 11)

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Binary		RAW(@L)
P-Boolean	L=2 or L ø	RAW(1)
	L>1	RAW(@L)
P-Byte		RAW(1)
P-Character	Not Unicode and (L<2001 or L ø)	CHAR(@L)
	L>4000	LONG
	Not Unicode and (L=2001 or L ø)	NCHAR(@L)
	Unicode and 2000<L<4001	NVARCHAR2(@L)
	Not Unicode and 2000<L<4001	VARCHAR2(@L)
P-Currency		NUMBER(@L,@D)
P-Date		DATE
P-Datetime		DATE
P-Decimal		NUMBER(@L,@D)
P-Double		NUMBER(@L,@D)
P-Float	0<L<127	FLOAT(@L)
	L=0 or L>126 or L ø	FLOAT
P-Integer		NUMBER(@L)
P-Long Integer		NUMBER(@L)
P-Long Real		NUMBER(@L,@D)

Pivot --> Datatype (Oracle 11)

Pivot	Condition	Datatype
P-Numeric	L=0 or L ø	NUMBER
	L>0 and D ø	NUMBER(@L)
	L>0 and D not ø	NUMBER(@L,@D)
P-Real		NUMBER(@L,@D)
P-Smallint		NUMBER(@L)
P-String		LONG
P-Text	Unicode	NVARCHAR2(@L)
	Not Unicode	VARCHAR2(@L)
P-Time		DATE
P-Timestamp	L<10	TIMESTAMP(@L)
	L>9 or L ø	TIMESTAMP
P-Tinyint		NUMBER(@L)
P-Varchar	L>4000 or L=0 or L ø	LONG
	Unicode and 0<L<4001	NVARCHAR2(@L)
	Not Unicode and 0<L<4001	VARCHAR2(@L)

Datatype --> Pivot (Oracle 11)

Datatype	Condition	Pivot
CHAR(L)		P-Character
DATE		P-Date
FLOAT		P-Float
FLOAT(L)		P-Float
LONG		P-String
NUMBER		P-Numeric
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric

Datatype --> Pivot (Oracle 11)

Datatype	Condition	Pivot
RAW(1)		P-Boolean
RAW(L)		P-Boolean
TIMESTAMP		P-Timestamp
TIMESTAMP(L)		P-Timestamp
VARCHAR2(L)		P-Varchar

ORACLE 8

Pivot --> Datatype (Oracle 8)

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Binary		RAW(@L)
P-Boolean	L=2 or L ø	RAW(1)
	L>1	RAW(@L)
P-Byte		RAW(1)
P-Character	L=2001 or L ø	CHAR(@L)
	L>4000	LONG
	2000<L<4001	VARCHAR2(@L)
P-Currency		NUMBER(@L,@D)
P-Date		DATE
P-Datetime		DATE
P-Decimal		NUMBER(@L,@D)
P-Double		NUMBER(@L,@D)
P-Float		NUMBER(@L,@D)
P-Integer		NUMBER(@L)
P-Long Integer		NUMBER(@L)
P-Long Real		NUMBER(@L,@D)
P-Multimedia		LONG RAW
P-Numeric	L=0 or L ø	NUMBER
	L>0 and D ø	NUMBER(@L)
	L>0 and D not ø	NUMBER(@L,@D)
P-Real		NUMBER(@L,@D)
P-Smallint		NUMBER(@L)
P-String		LONG

Pivot --> Datatype (Oracle 8)

Pivot	Condition	Datatype
P-Text		VARCHAR2(@L)
P-Time		DATE
P-Timestamp		ROWID
P-Tinyint		NUMBER(@L)
P-Varbinary		LONG RAW
P-Varchar	L>4000 or L=0 or L ø	LONG
	0<L<4001	VARCHAR2(@L)

Datatype --> Pivot (Oracle 8)

Datatype	Condition	Pivot
CHAR(L)		P-Character
DATE		P-Date
LONG		P-String
LONG RAW		P-Multimedia
NUMBER		P-Numeric
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric
RAW(1)		P-Boolean
RAW(L)		P-Boolean
ROWID		P-Timestamp
VARCHAR2(L)		P-Varchar

Oracle 9i

Pivot --> Datatype (Oracle 9i)

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Binary		RAW(@L)
P-Boolean	L=2 or L ø	RAW(1)
	L>1	RAW(@L)
P-Byte		RAW(1)
P-Character	Not Unicode and (L<2001 or L ø)	CHAR(@L)
	L>4000	LONG
	Not Unicode and (L=2001 or L ø)	NCHAR(@L)
	Unicode and 2000<L<4001	NVARCHAR2(@L)
	Not Unicode and 2000<L<4001	VARCHAR2(@L)
P-Currency		NUMBER(@L,@D)
P-Date		DATE
P-Datetime		DATE
P-Decimal		NUMBER(@L,@D)
P-Double		NUMBER(@L,@D)
P-Float	L=0 or L>126 or L ø	FLOAT
	0<L<127	FLOAT(@L)
P-Integer		NUMBER(@L)
P-Long Integer		NUMBER(@L)
P-Long Real		NUMBER(@L,@D)
P-Multimedia		LONG RAW
P-Numeric	L=0 or L ø	NUMBER
	L>0 and D ø	NUMBER(@L)
	L>0 and D not ø	NUMBER(@L,@D)

Pivot --> Datatype (Oracle 9i)

Pivot	Condition	Datatype
P-Real		NUMBER(@L,@D)
P-Smallint		NUMBER(@L)
P-String		LONG
P-Text	Unicode	NVARCHAR2(@L)
	Not Unicode	VARCHAR2(@L)
P-Time		DATE
P-Timestamp	L>9 or L ø	TIMESTAMP
	L<10	TIMESTAMP(@L)
P-Tinyint		NUMBER(@L)
P-Varbinary		LONG RAW
P-Varchar	L>4000 or L=0 or L ø	LONG
	Unicode and 0<L<4001	NVARCHAR2(@L)
	Not Unicode and 0<L<4001	VARCHAR2(@L)

Datatype --> Pivot (Oracle 9i)

Datatype	Condition	Pivot
CHAR(L)		P-Character
DATE		P-Date
FLOAT		P-Float
FLOAT(L)		P-Float
LONG		P-String
LONG RAW		P-Multimedia
NUMBER		P-Numeric
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric
RAW(1)		P-Boolean
RAW(L)		P-Boolean

Datatype --> Pivot (Oracle 9i)

Datatype	Condition	Pivot
TIMESTAMP		P-Timestamp
VARCHAR2(L)		P-Varchar

POSTGRESQL9.3

Pivot --> Datatype (PostgreSQL9.3)

Pivot	Condition	Datatype
P-Boolean		boolean
P-Byte	L=0 or L ø	bit
	Valid	bit(@L)
P-Character	L=0 or L ø	char
	Valid	char(@L)
P-Currency		money
P-Date		date
P-Decimal	L=0 or L ø	decimal
	L>=1 and D ø	decimal(@L)
	L>=1	decimal(@L,@D)
P-Double		double precision
P-Integer		integer
P-Long Integer		bigint
P-Numeric	L=0 or L ø	numeric
	L>=1 and D ø	numeric(@L)
	L>=1	numeric(@L,@D)
P-Real		real
P-Smallint		smallint
P-Text		text
P-Time	L=0 or L ø	time
	Valid	time(@L)
P-Timestamp	L=0 or L ø	timestamp
	L <> 0	timestamp(@L)

Pivot --> Datatype (PostgreSQL9.3)

Pivot	Condition	Datatype
P-Varchar	L=0 or L ø	varchar
	Valid	varchar(@L)

Datatype --> Pivot (PostgreSQL9.3)

Datatype	Condition	Pivot
bigint		P-Long Integer
bit		P-Byte
bit(L)		P-Byte
boolean		P-Boolean
char		P-Character
char(L)		P-Character
date		P-Date
decimal		P-Decimal
decimal(L)		P-Decimal
decimal(L,D)		P-Decimal
double precision		P-Double
integer		P-Integer
money		P-Currency
numeric		P-Numeric
numeric(L)		P-Numeric
numeric(L,D)		P-Numeric
real		P-Real
smallint		P-Smallint
text		P-Text
time		P-Time
time(L)		P-Time
timestamp		P-Timestamp

Datatype --> Pivot (PostgreSQL9.3)

Datatype	Condition	Pivot
timestamp(L)		P-Timestamp
varchar		P-Varchar
varchar(L)		P-Varchar

SQL ANSI/ISO 9075:1992

Pivot --> Datatype (SQL ANSI/ISO 9075:1992)

Pivot	Condition	Datatype
P-AutoIdentifier		INTEGER
P-Binary		BIT VARYING(@L)
P-Boolean		BIT(@L)
P-Byte		BIT(@L)
P-Character		CHAR(@L)
P-Currency		DECIMAL(@L,@D)
P-Date		DATE
P-Datetime		DATETIME
P-Decimal		DECIMAL(@L,@D)
P-Double		DOUBLE PRECISION
P-Float		FLOAT
P-Integer		INTEGER
P-Long Integer		INTEGER
P-Long Real		REAL
P-Multimedia		BIT VARYING(@L)
P-Numeric	L>4	INTEGER
	L=5 or L ø	SMALLINT
P-Real		REAL
P-Smallint		SMALLINT
P-String		VARCHAR(@L)
P-Text		VARCHAR(@L)
P-Time		TIME
P-Timestamp		DATETIME
P-Tinyint		SMALLINT

Pivot --> Datatype (SQL ANSI/ISO 9075:1992)

Pivot	Condition	Datatype
P-Varbinary		BIT VARYING(@L)
P-Varchar		VARCHAR(@L)

Datatype --> Pivot (SQL ANSI/ISO 9075:1992)

Datatype	Condition	Pivot
BIT VARYING(L)		P-Multimedia
BIT(L)		P-Boolean
CHAR(L)		P-Character
DATE		P-Date
DATETIME		P-Datetime
DECIMAL(L,D)		P-Currency
DOUBLE PRECISION		P-Double
FLOAT		P-Float
INTEGER		P-Integer
REAL		P-Real
SMALLINT		P-Smallint
TIME		P-Time
VARCHAR(L)		P-Varchar

SQL SERVER 2000

Pivot --> Datatype (SQL Server 2000)

Pivot	Condition	Datatype
P-AutoIdentifier		uniqueidentifier
P-Binary		binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	Not Unicode and (L<8001 or L ø)	char(@L)
	Not Unicode and (L=8001 or L ø)	nchar(@L)
	Not Unicode and L>8000	ntext
	Not Unicode and L>8000	text
P-Currency		money
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal		decimal(@L,@D)
P-Double		numeric(@L,@D)
P-Float		float
P-Integer		int
P-Long Integer		bigint
P-Long Real		real
P-Multimedia		image
P-Numeric		numeric(@L,@D)
P-Real		real
P-Smallint		smallint

Pivot --> Datatype (SQL Server 2000)

Pivot	Condition	Datatype
P-String	Unicode	ntext
	Not Unicode	text
P-Text	Unicode	ntext
	Not Unicode	text
P-Time		datetime
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary		varbinary(@L)
P-Varchar	Not Unicode and L>8000	ntext
	Not Unicode and (L=8001 or L ø)	nvarchar(@L)
	Not Unicode and L>8000	text
	Not Unicode and (L<8001 or L ø)	varchar(@L)
P-Wide Character		nchar(@L)
P-Wide String		nvarchar(@L)

Datatype --> Pivot (SQL Server 2000)

Datatype	Condition	Pivot
bigint		P-Long Integer
binary(L)		P-Binary
bit		P-Boolean
char(L)		P-Character
datetime		P-Datetime
decimal(L,D)		P-Decimal
float		P-Float
image		P-Multimedia
int		P-Integer

Datatype --> Pivot (SQL Server 2000)

Datatype	Condition	Pivot
money		P-Currency
nchar(L)		P-Wide Character
numeric(L,D)		P-Numeric
nvarchar(L)		P-Wide String
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
text		P-Text
timestamp		P-Timestamp
tinyint		P-Tinyint
uniqueidentifier		P-AutoIdentifier
varbinary(L)		P-Varbinary
varchar(L)		P-Varchar

SQL Server 2005

Pivot --> Datatype (SQL Server 2005)

Pivot	Condition	Datatype
P-AutoIdentifier		uniqueidentifier
P-Binary		binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	Not Unicode and (L<8001 or L ø)	char(@L)
	Not Unicode and (L=8001 or L ø)	nchar(@L)
	Not Unicode and L>8000	ntext
	Not Unicode and L>8000	text
P-Currency		money
		smallmoney
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal		decimal(@L,@D)
P-Double		numeric(@L,@D)
P-Float		float
P-Integer		int
P-Long Integer		bigint
P-Long Real		real
P-Multimedia		image
P-Numeric		numeric(@L,@D)
P-Real		real
P-Smallint		smallint

Pivot --> Datatype (SQL Server 2005)

Pivot	Condition	Datatype
P-String	Unicode	ntext
	Not Unicode	text
P-Text	Unicode	ntext
	Not Unicode	text
P-Time		datetime
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary		varbinary(@L)
P-Varchar	Not Unicode and L>8000	ntext
	Not Unicode and (L=8001 or L ø)	nvarchar(@L)
	Not Unicode and L>8000	text
	Not Unicode and (L<8001 or L ø)	varchar(@L)
P-Wide Character		nchar(@L)
P-Wide String		nvarchar(@L)

Datatype --> Pivot (SQL Server 2005)

Datatype	Condition	Pivot
bigint		P-Long Integer
binary(L)		P-Binary
bit		P-Boolean
char(L)		P-Character
datetime		P-Datetime
decimal(L,D)		P-Decimal
float		P-Float
image		P-Multimedia
int		P-Integer

Datatype --> Pivot (SQL Server 2005)

Datatype	Condition	Pivot
money		P-Currency
nchar(L)		P-Wide Character
numeric(L,D)		P-Numeric
nvarchar(L)		P-Wide String
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
smallmoney		P-Currency
text		P-Text
timestamp		P-Timestamp
tinyint		P-Tinyint
uniqueidentifier		P-AutoIdentifier
varbinary(L)		P-Varbinary
varchar(L)		P-Varchar

SQL SERVER 2008

Pivot --> Datatype (SQL Server 2008)

Pivot	Condition	Datatype
P-AutoIdentifier		uniqueidentifier
P-Binary		binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	Not Unicode and (L<8001 or L ø)	char(@L)
	Not Unicode and (L=8001 or L ø)	nchar(@L)
	Not Unicode and L>8000	ntext
	Not Unicode and L>8000	text
P-Currency	L not empty or L > 10	money
	L empty or L < 11	smallmoney
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal		decimal(@L,@D)
P-Double		numeric(@L,@D)
P-Float	L empty	float
	L not empty	float(@L)
P-Integer		int
P-Long Integer		bigint
P-Long Real		real
P-Multimedia		image
P-Numeric		numeric(@L,@D)
P-Real		real

Pivot --> Datatype (SQL Server 2008)

Pivot	Condition	Datatype
P-Smallint		smallint
P-String	Unicode	ntext
	Not Unicode	text
P-Text	Unicode	ntext
	Not Unicode	text
P-Time		time
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary		varbinary(@L)
P-Varchar	Not Unicode and L>8000	ntext
	Not Unicode and (L=8001 or L ø)	nvarchar(@L)
	Not Unicode and L>8000	text
	Not Unicode and (L<8001 or L ø)	varchar(@L)
P-Wide Character		nchar(@L)
P-Wide String		nvarchar(@L)

Datatype --> Pivot (SQL Server 2008)

Datatype	Condition	Pivot
bigint		P-Long Integer
binary(L)		P-Binary
bit		P-Boolean
char(L)		P-Character
datetime		P-Datetime
decimal(L,D)		P-Decimal
float		P-Float
float(L)		P-Float

Datatype --> Pivot (SQL Server 2008)

Datatype	Condition	Pivot
image		P-Multimedia
int		P-Integer
money		P-Currency
nchar(L)		P-Wide Character
numeric(L,D)		P-Numeric
nvarchar(L)		P-Wide String
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
smallmoney		P-Currency
text		P-Text
time		P-Time
timestamp		P-Timestamp
tinyint		P-Tinyint
uniqueidentifier		P-AutoIdentifier
varbinary(L)		P-Varbinary
varchar(L)		P-Varchar

SQL Server 7

Pivot --> Datatype (SQL Server 7)

Pivot	Condition	Datatype
P-AutoIdentifier		timestamp
P-Binary		binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	0<L<251	char(@L)
	L>250 or L=0 or L ø	text
P-Currency		money
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal		decimal(@L,@D)
P-Double		numeric(@L,@D)
P-Float		float
P-Integer		int
P-Long Integer		int
P-Long Real		real
P-Multimedia		image
P-Numeric	L>9 and D ø	float
	4<L<10 and D ø	int
	L not ø and D not ø	numeric(@L,@D)
	2<L<5 and D ø	smallint
	(L<3 and D ø) or L ø	tinyint
P-Real		real
P-Smallint		smallint
P-String		char(@L)

Pivot --> Datatype (SQL Server 7)

Pivot	Condition	Datatype
P-Text		text
P-Time		datetime
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary		varbinary(@L)
P-Varchar		varchar(@L)

Datatype --> Pivot (SQL Server 7)

Datatype	Condition	Pivot
binary(L)		P-Binary
bit		P-Boolean
char(L)		P-String
datetime		P-Datetime
decimal(L,D)		P-Decimal
float		P-Float
image		P-Multimedia
int		P-Integer
money		P-Currency
numeric(L,D)		P-Double
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
text		P-Character
timestamp		P-Timestamp
tinyint		P-Tinyint
varbinary(L)		P-Varbinary
varchar(L)		P-Varchar

Sybase Adaptive Server 11

Pivot --> Datatype (Sybase Adaptive Server 11)

Pivot	Condition	Datatype
P-AutoIdentifier		timestamp
P-Binary		binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	Not Unicode and L<256	char(@L)
	Unicode and L<256	nChar(@L)
	L>255 or L ø	text
P-Currency		money
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal	0<L<39 and D not ø	decimal(@L,@D)
	(L>9 and D ø) or (1<L<38 and D not ø)	float
	4<L<10 and D ø	int
	2<L<5 and D ø	smallint
	(L<3 and D ø) or L ø	tinyint
P-Double		double precision
P-Float		float
P-Integer		int
P-Long Integer		int
P-Long Real		real
P-Multimedia		image

Pivot --> Datatype (Sybase Adaptive Server 11)

Pivot	Condition	Datatype
P-Numeric	(L>9 and D ø) or (1<L<38 and D not ø)	float
	4<L<10 and D ø	int
	0<L<39 and D not ø	numeric(@L,@D)
	2<L<5 and D ø	smallint
	(L<3 and D ø) or L ø	tinyint
P-Real		real
P-Smallint		smallint
P-String	Not Unicode	char(@L)
	Unicode	nChar(@L)
P-Text		text
P-Time		datetime
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary		varbinary(@L)
P-Varchar	Unicode	nVarChar(@L)
	Not Unicode	varchar(@L)

Datatype --> Pivot (Sybase Adaptive Server 11)

Datatype	Condition	Pivot
binary(L)		P-Binary
bit		P-Boolean
char(L)		P-String
datetime		P-Datetime
decimal(L,D)		P-Decimal
double precision		P-Double
float		P-Float

Datatype --> Pivot (Sybase Adaptive Server 11)

Datatype	Condition	Pivot
image		P-Multimedia
int		P-Integer
money		P-Currency
numeric(L,D)		P-Numeric
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
text		P-Character
timestamp		P-Timestamp
tinyint		P-Tinyint
varbinary(L)		P-Varbinary
varchar(L)		P-Varchar

Sybase Adaptive Server 12.5

Pivot --> Datatype (Sybase Adaptive Server 12.5)

Pivot	Condition	Datatype
P-AutoIdentifier		timestamp
P-Binary	L=0 or L ø	binary
	L > 0	binary(@L)
P-Boolean		bit
P-Byte		bit
P-Character	Not Unicode and (L=0 or L ø)	char
	Not Unicode and 0<L<256	char(@L)
	L>255	text
	Not Unicode and (L=256 or L ø)	unichar(@L)
P-Currency		money
P-Date		smalldatetime
P-Datetime		datetime
P-Decimal	0<L<39 and D not ø	decimal(@L,@D)
	(L>9 and D ø) or ((L<1 or L>38) and D not ø)	float
	4<L<10 and D ø	int
	2<L<5 and D ø	smallint
	L ø or (L<3 and D ø)	tinyint
P-Double		double precision
P-Float		float
P-Integer		int
P-Long Integer		int
P-Long Real		real

Pivot --> Datatype (Sybase Adaptive Server 12.5)

Pivot	Condition	Datatype
P-Multimedia		image
P-Numeric	(L>9 and D ø) or ((L<1 or L>38) and D not ø)	float
	4<L<10 and D ø	int
	0<L<39 and D not ø	numeric(@L,@D)
	2<L<5 and D ø	smallint
	L ø or (L<3 and D ø)	tinyint
P-Real		real
P-Smallint		smallint
P-String	Not Unicode and (L=0 or L ø)	char
	Not Unicode and (0<L<256)	char(@L)
	L>255	text
	Not Unicode and (L=256 or L ø)	unichar(@L)
P-Text		text
P-Time		datetime
P-Timestamp		timestamp
P-Tinyint		tinyint
P-Varbinary	L=0 or L ø	varbinary
	L > 0	varbinary(@L)
P-Varchar	L>255	text
	Not Unicode and (L=256 or L ø)	univarchar(@L)
	Not Unicode and (L=0 or L ø)	varchar
	Not Unicode and 0<L<256	varchar(@L)

Datatype --> Pivot (Sybase Adaptive Server 12.5)

Datatype	Condition	Pivot
binary		P-Binary
binary(L)		P-Binary
bit		P-Boolean
char		P-Character
char(L)		P-Character
datetime		P-Datetime
decimal(L,D)		P-Decimal
double precision		P-Double
float		P-Float
image		P-Multimedia
int		P-Integer
money		P-Currency
numeric(L,D)		P-Numeric
real		P-Real
smalldatetime		P-Date
smallint		P-Smallint
text		P-Text
timestamp		P-Timestamp
tinyint		P-Tinyint
varbinary		P-Varbinary
varbinary(L)		P-Varbinary
varchar		P-Varchar
varchar(L)		P-Varchar

TERADATA DATABASE

Pivot --> Datatype (Teradata Database 14)

Pivot	Condition	Datatype
P-AutoIdentifier		NUMBER
P-Boolean		BYTEINT
P-Byte	L=0 or L ø	BYTE
	L>0	BYTE(@L)
P-Character	L=0 or L ø	CHAR
	L>0	CHAR(@L)
P-Date		DATE
P-Datetime		DATE
P-Decimal	L=0 or L ø and D=0 Or D ø	DECIMAL
	L>0 and D=0 Or D ø	DECIMAL(@L)
P-Double		NUMBER(@L,@D)
P-Float		FLOAT
P-Integer		INTEGER
P-Long Integer		BIGINT
P-Long Real		FLOAT
P-Multimedia	L=0 or L ø	BLOB
	L>0	BLOB(@L)
P-Numeric	L=0 or L ø and D=0 Or D ø	NUMBER
	L ø and D > 0	NUMBER(*,@D)
	L>0 and D=0 Or D ø	NUMBER(@L)
	L>0 and D>0	NUMBER(@L,@D)
P-Real		FLOAT
P-Smallint		SMALLINT
P-String		VARCHAR(@L)

Pivot --> Datatype (Teradata Database 14)

Pivot	Condition	Datatype
P-Text		VARCHAR(@L)
P-Time		TIME
	D > 0	TIME(@D)
P-Timestamp		TIMESTAMP
	D > 0	TIMESTAMP(@D)
P-Tinyint		SMALLINT
P-Varbinary		VARBYTE(@L)
P-Varchar		VARCHAR(@L)

Datatype --> Pivot (Teradata Database 14)

Datatype	Condition	Pivot
BIGINT		P-Long Integer
BLOB		P-Multimedia
BLOB(L)		P-Multimedia
BYTE		P-Byte
BYTE(L)		P-Byte
BYTEINT		P-Boolean
CHAR		P-Character
CHAR(L)		P-Character
DATE		P-Date
DECIMAL		P-Decimal
DECIMAL(L)		P-Decimal
FLOAT		P-Real
INTEGER		P-Integer

Datatype --> Pivot (Teradata Database 14)

Datatype	Condition	Pivot
NUMBER		P-Numeric
NUMBER(*,D)		P-Numeric
NUMBER(L)		P-Numeric
NUMBER(L,D)		P-Numeric
SMALLINT		P-Smallint
TIME		P-Time
TIME(D)		P-Time
TIMESTAMP		P-Timestamp
TIMESTAMP(D)		P-Timestamp
VARBYTE(L)		P-Varbinary
VARCHAR(L)		P-Varchar

DB2 Version 10.5: Syntax supported by HOPEX

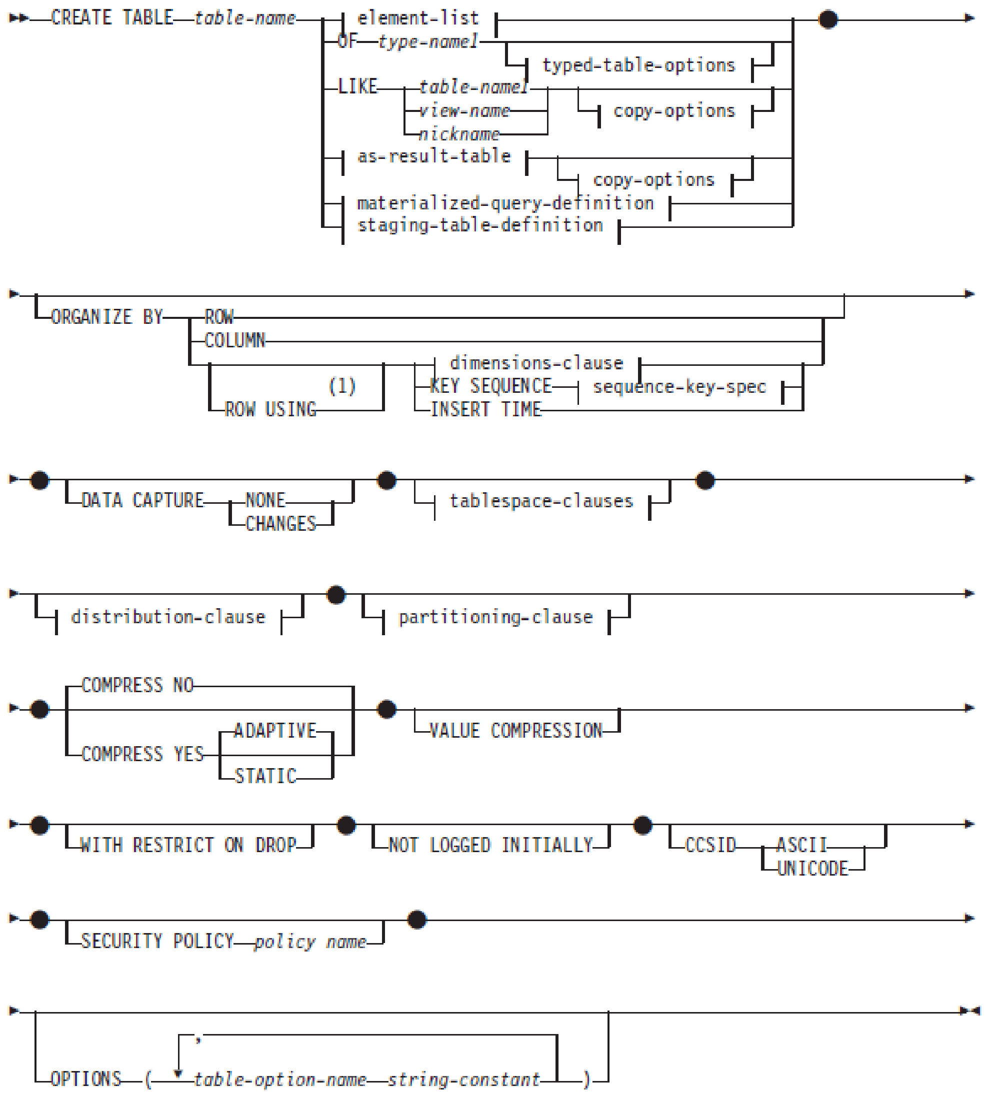
This document details concepts of DB2 V10.5 recognized by MEGA.

Detail of Concepts Managed by DB2 V10.5

All SQL commands are available at the following address:

http://public.dhe.ibm.com/ps/products/db2/info/vr105/pdf/en_US/DB2SQLRefVol1-db2s1e1051.pdf

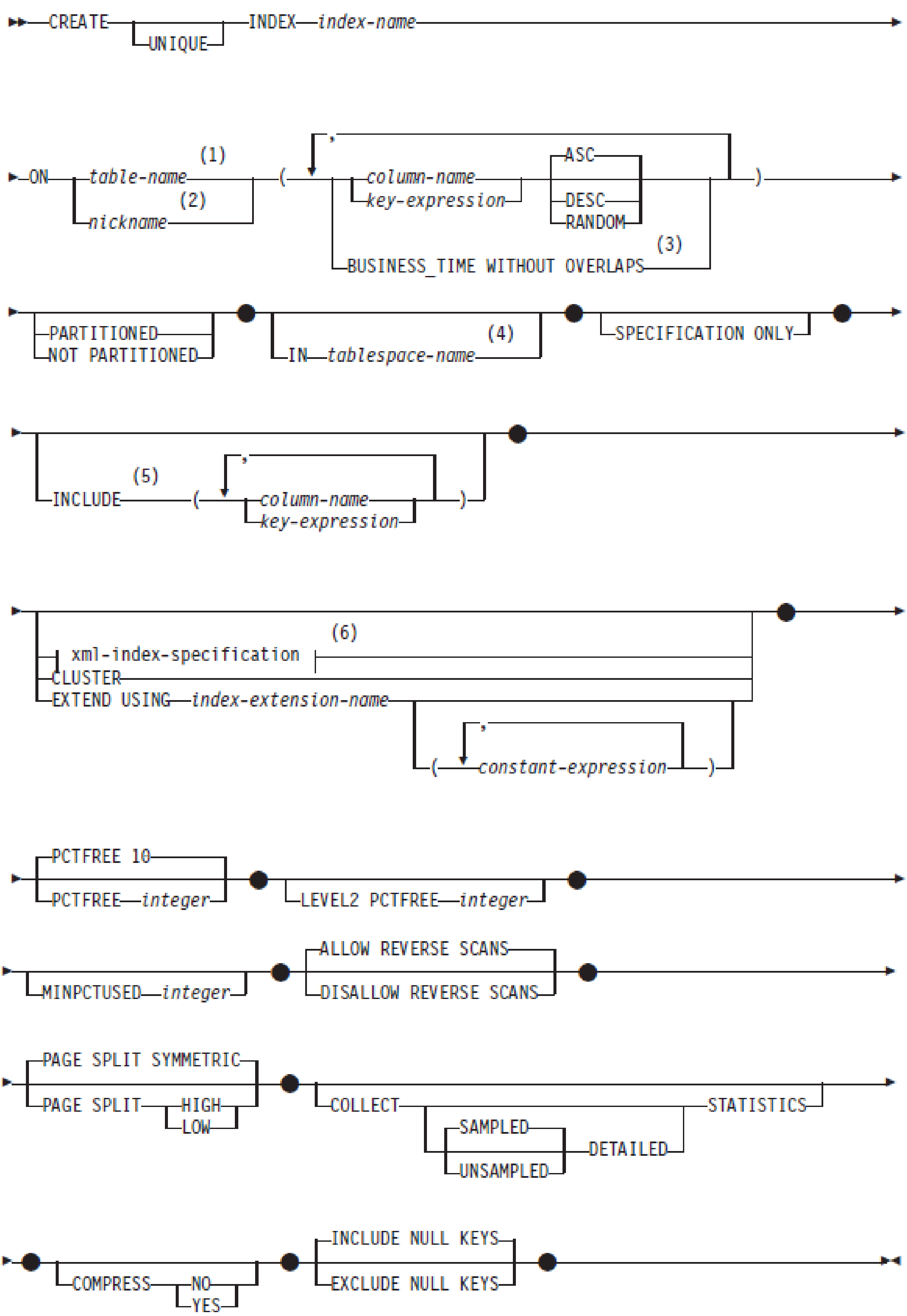
Tables



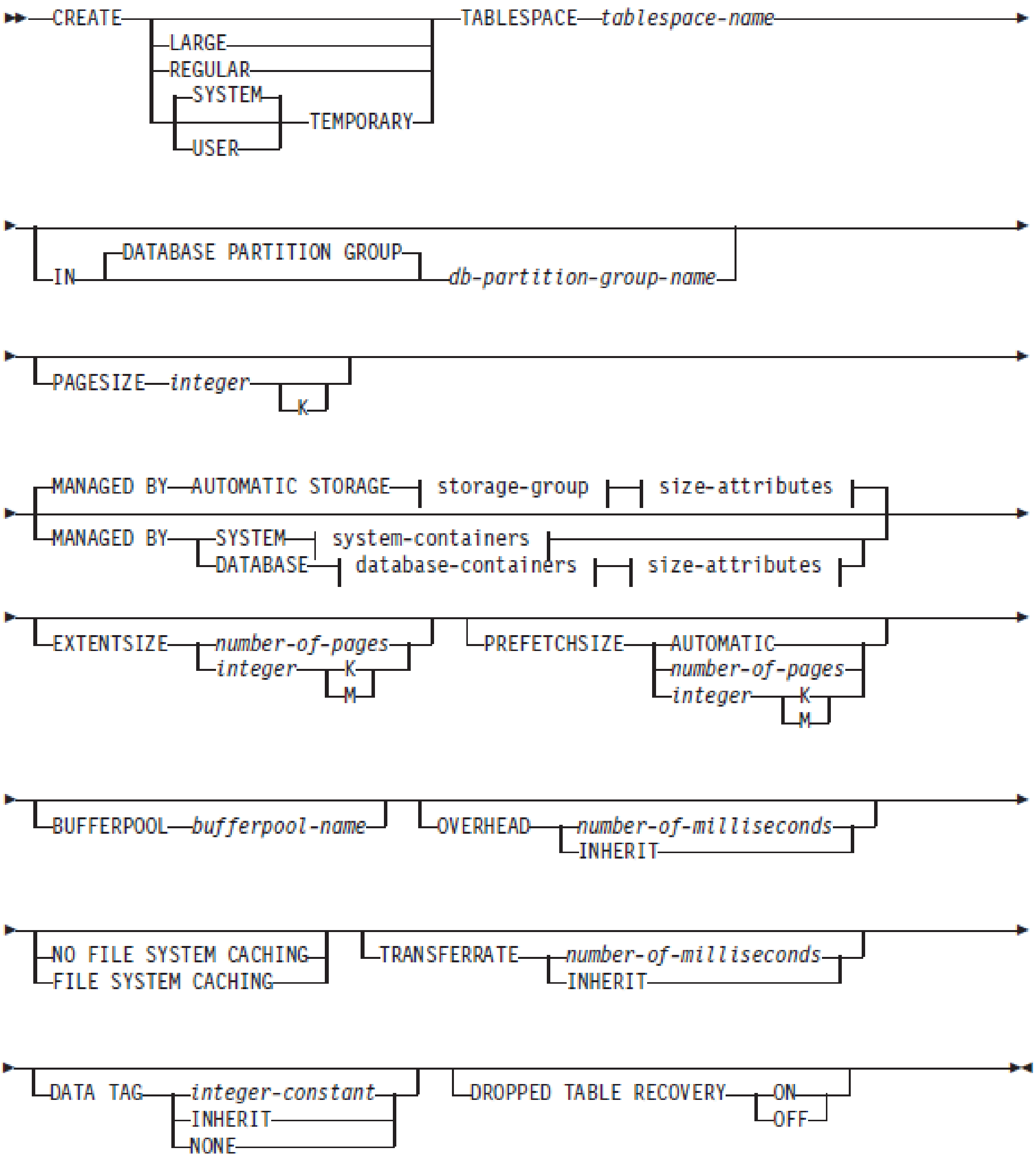
CREATE GLOBAL TEMPORARY TABLE

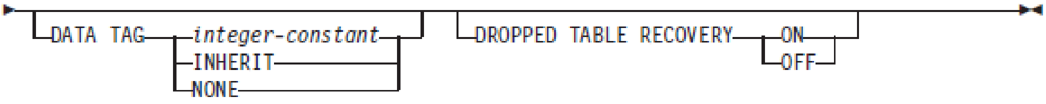
This new table type of DB2V10.5 is not supported by MEGA.

Indexes

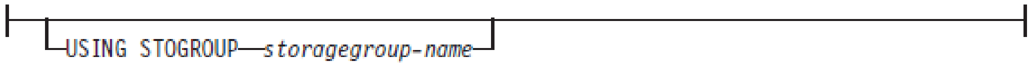

CREATE
UNIQUE
INDEX
index-name
ON
table-name
(1)
nickname
(2)
(
,
column-name
key-expression
ASC
DESC
RANDOM
BUSINESS_TIME WITHOUT OVERLAPS
(3)
)
PARTITIONED
NOT PARTITIONED
IN
tablespace-name
(4)
SPECIFICATION ONLY
INCLUDE
(5)
(
,
column-name
key-expression
)
xml-index-specification
(6)
CLUSTER
EXTEND USING
index-extension-name
(
,
constant-expression
)
PCTFREE 10
PCTFREE
integer
LEVEL2 PCTFREE
integer
MINPCTUSED
integer
ALLOW REVERSE SCANS
DISALLOW REVERSE SCANS
PAGE SPLIT SYMMETRIC
PAGE SPLIT
HIGH
LOW
COLLECT
SAMPLED
UNSAMPLED
DETAILED
STATISTICS
COMPRESS
NO
YES
INCLUDE NULL KEYS
EXCLUDE NULL KEYS

Tablespaces

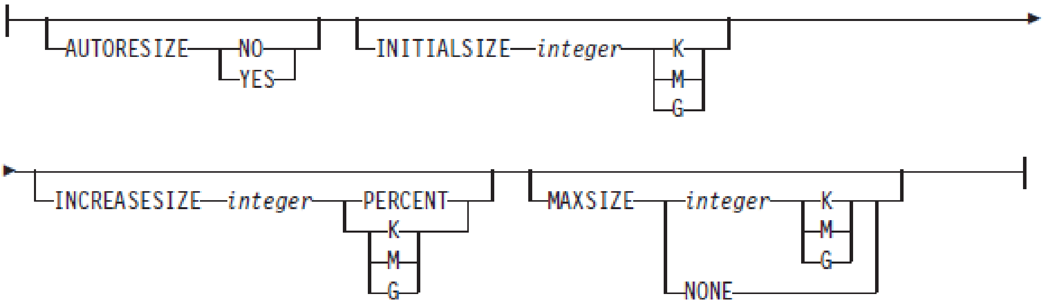




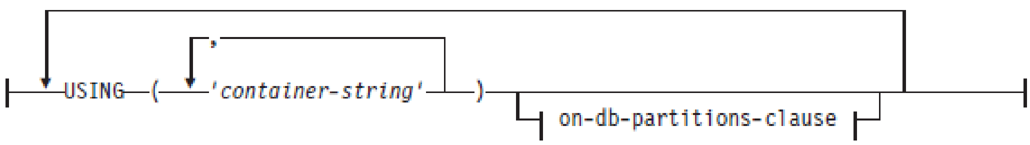
storage-group:



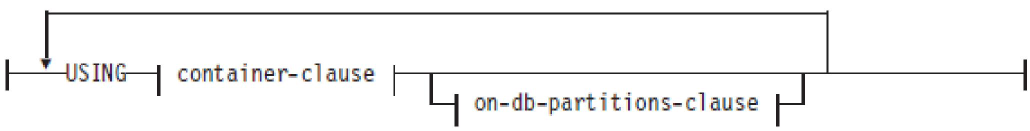
size-attributes:



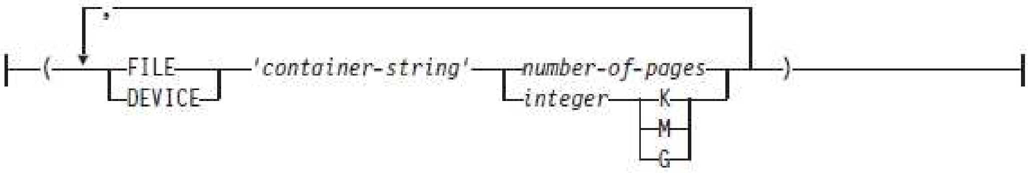
system-containers:



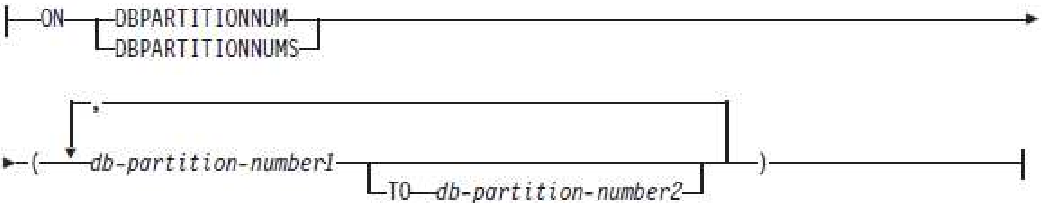
database-containers:



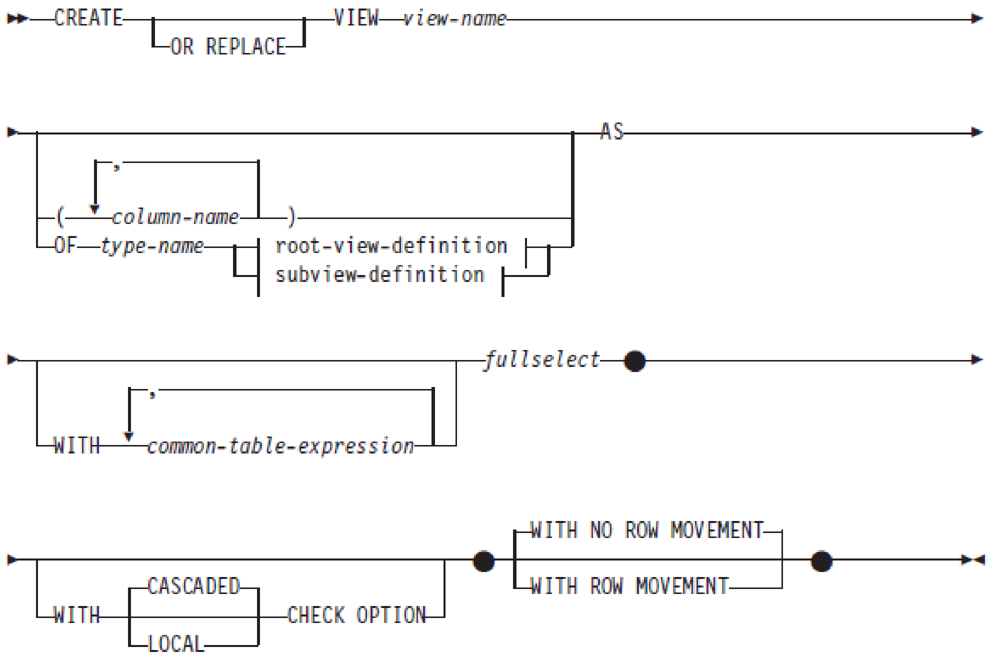
container-clause:



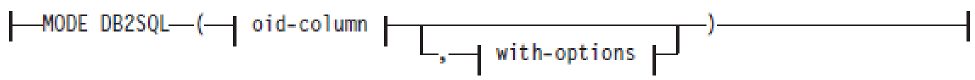
on-db-partitions-clause:



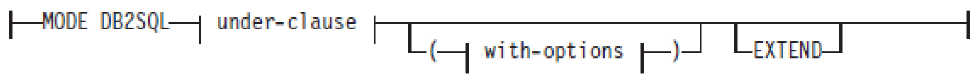
Views



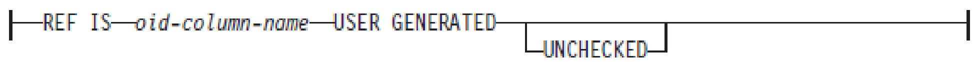
root-view-definition:



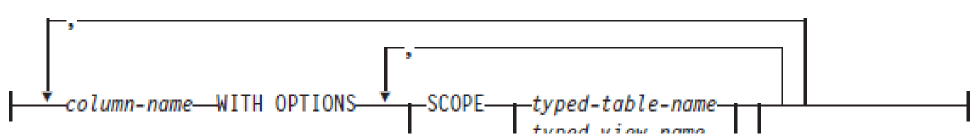
subview-definition:



oid-column:



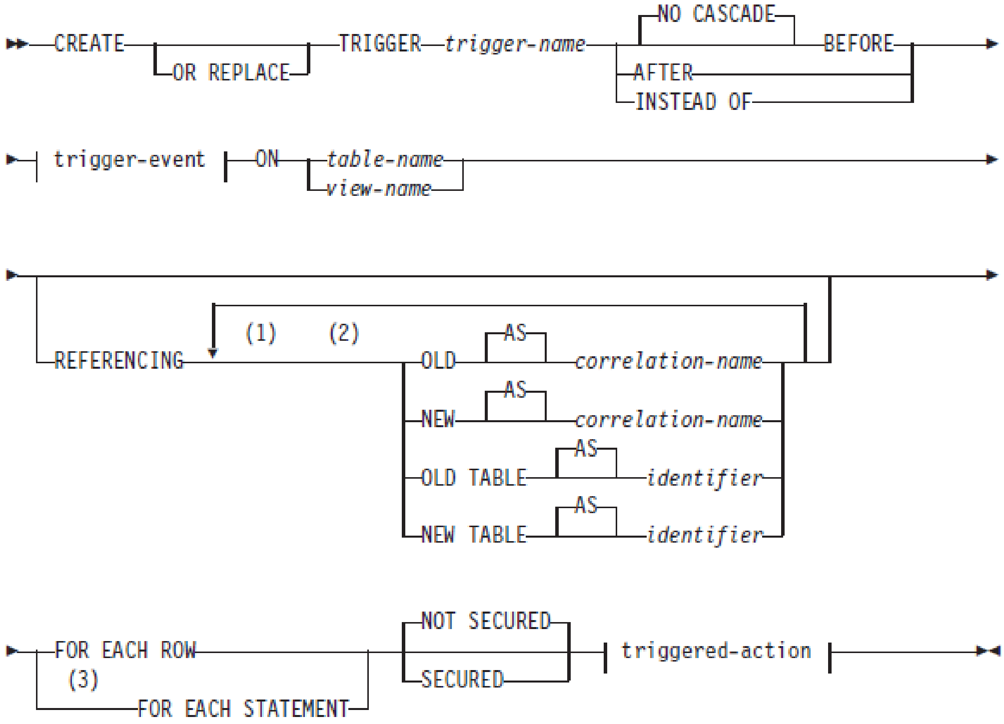
with-options:



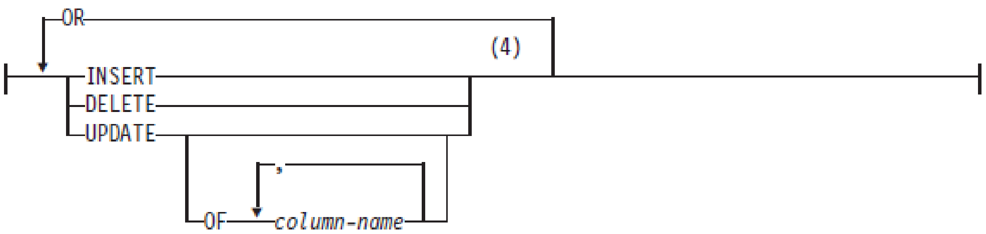
Example:

CREATE VIEW MA_PROJ
AS SELECTPROJNO, PROJNAME, RESPEMP
FROM PROJECT **WHERE SUBSTR(**PROJNO, 1, 2**)** = ' MA'

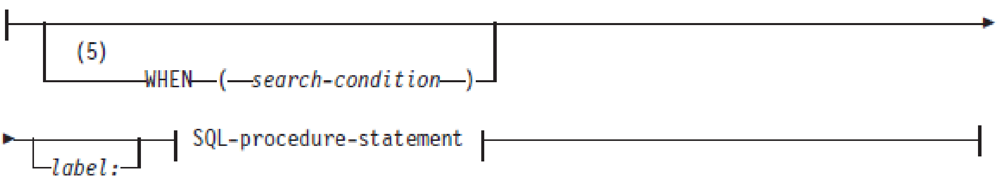
Triggers



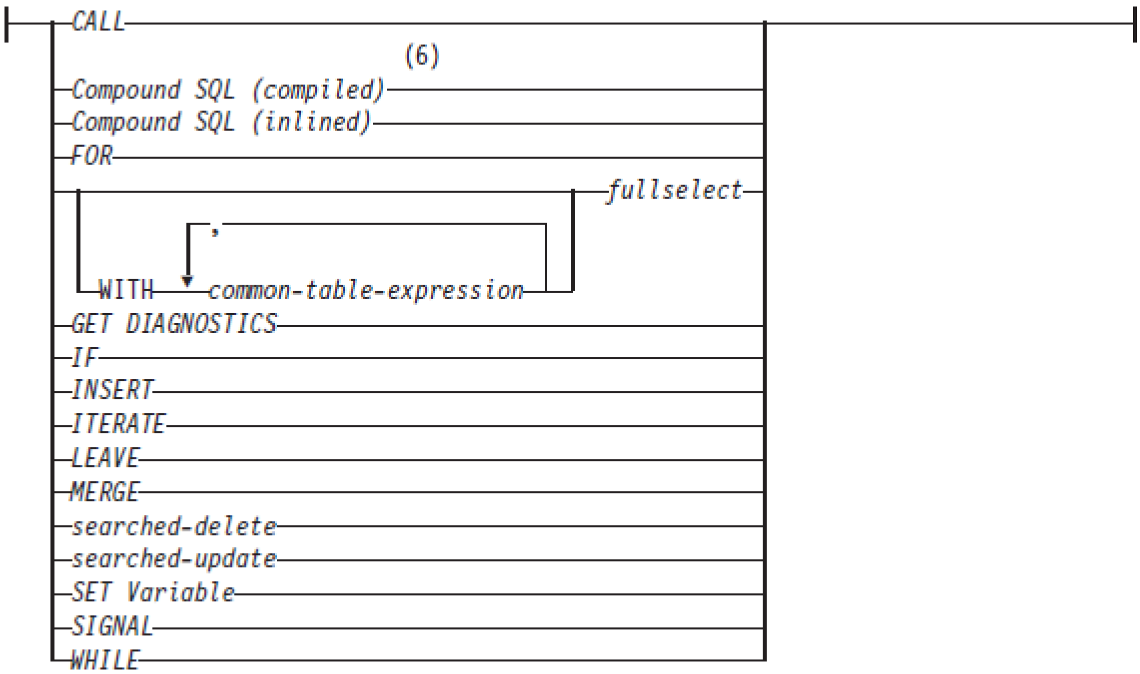
trigger-event:



triggered-action:



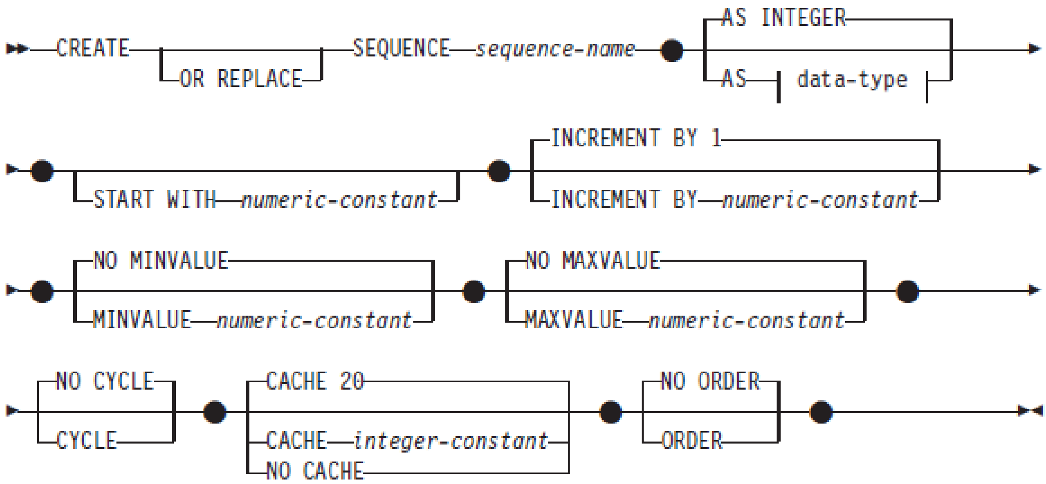
SQL-procedure-statement:



Example:

```
CREATE TRIGGER REORDER
AFTER UPDATE OF ON_HAND, MAX_STOCKED ON PARTS
REFERENCING NEW TABLE AS NTABLE
FOR EACH STATEMENT
BEGIN ATOMIC
SELECT ISSUE_SHIP_REQUEST(MAX_STOCKED - ON_HAND, PARTNO)
FROM NTABLE
WHERE (ON_HAND < 0.10 * MAX_STOCKED);END
```

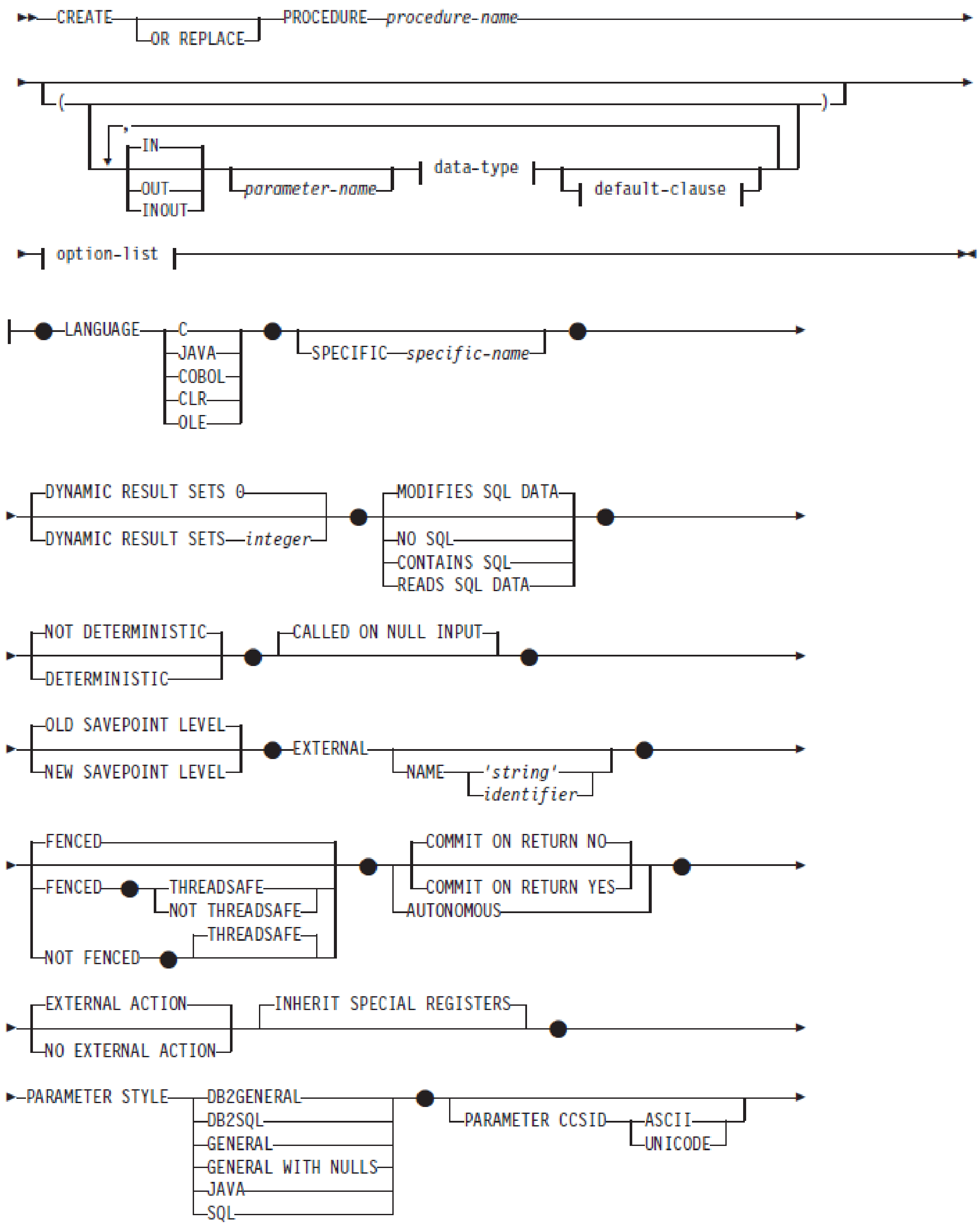
Sequences



Example:

CREATE SEQUENCE ORG_SEQ
START WITH 1
INCREMENT BY 1
NO MAXVALUE
NO CYCLE
CACHE 24

Procedures



Example:

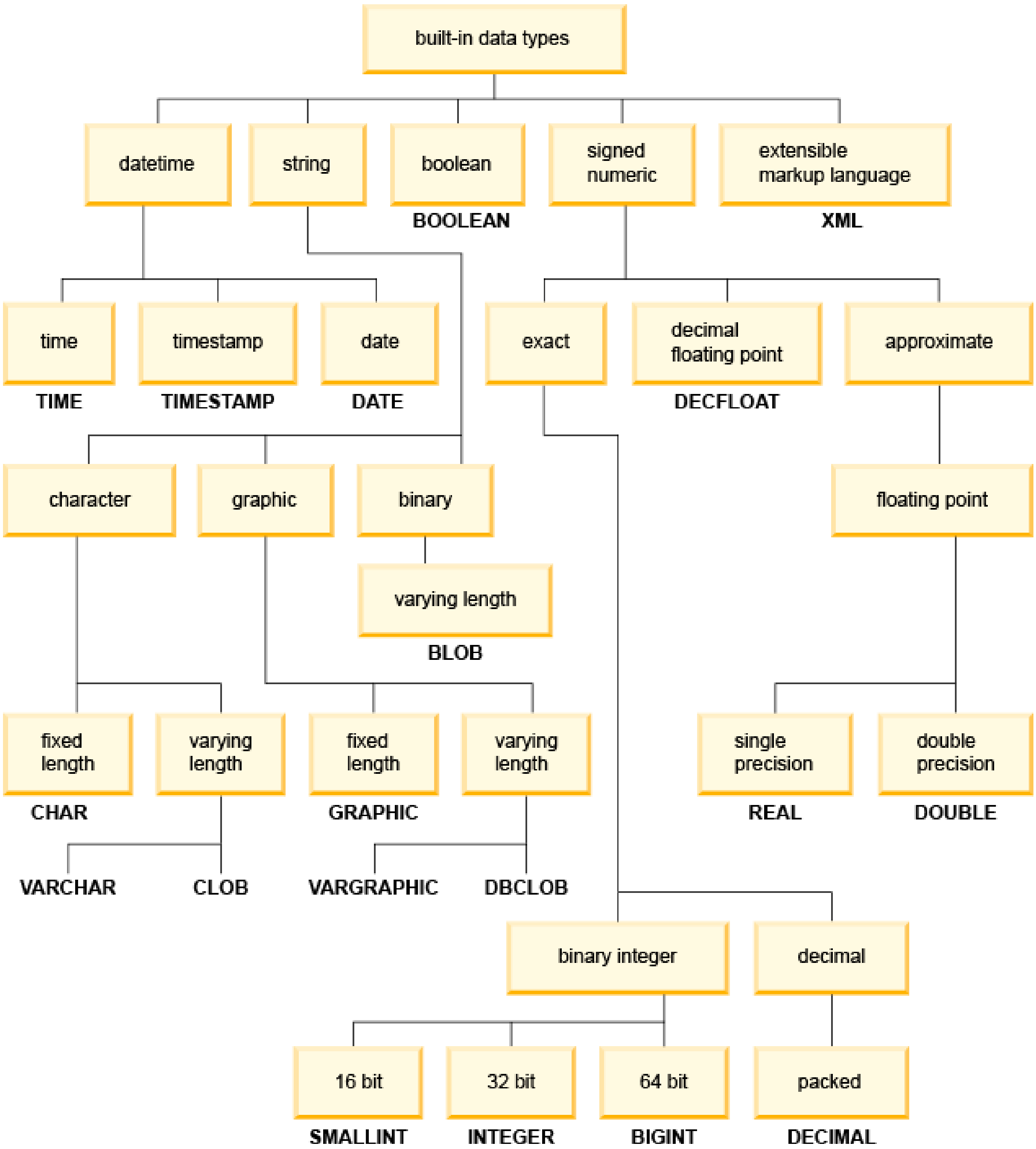
CREATE PROCEDURE PARTS_ON_HAND (**IN** PARTNUM **INTEGER,**
OUT COST **DECIMAL(7,2),**
OUT QUANTITY **INTEGER**)
EXTERNAL NAME ’ parts.onhand’
LANGUAGE JAVA PARAMETER STYLE JAVA

Creating Datatype Packages

DB2V10.5 Datatypes

A complete description of datatypes is accessible from the following link:

http://www-01.ibm.com/support/knowledgecenter/SSEPGG_10.5.0/com.ibm.db2.luw.sql.ref.doc/doc/r0008483.html?cp=SSEPGG_10.5.0%2F2-12-2-3&lang=fr



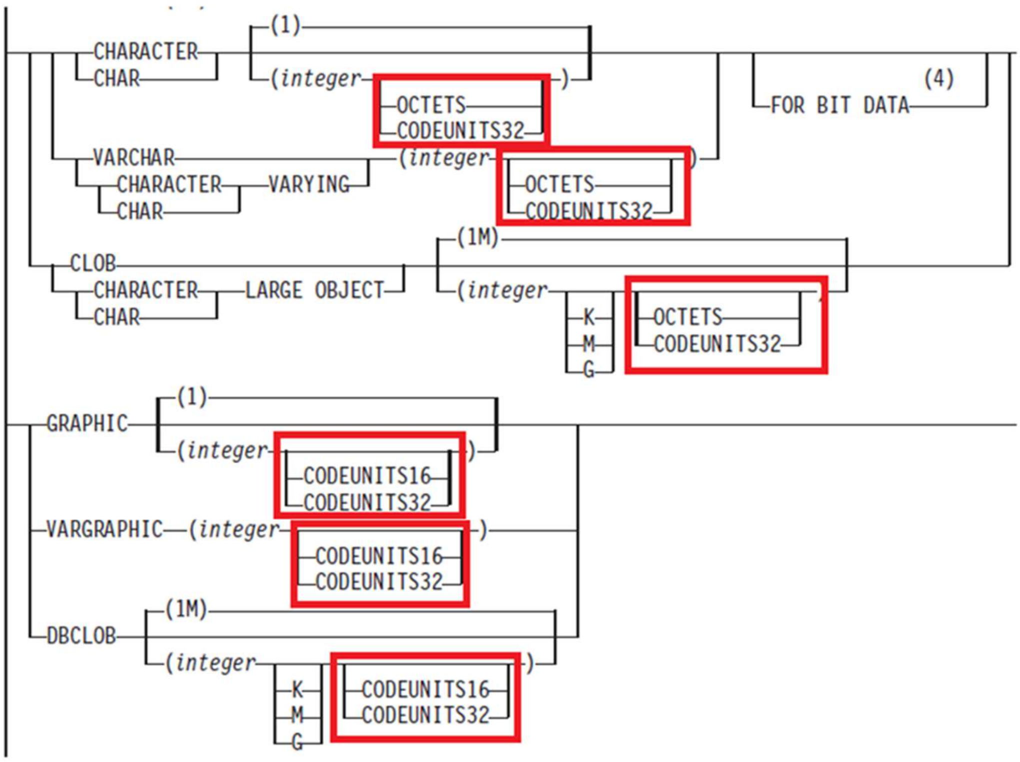
NCHAR, NVARCHAR, NCLOB

The NCHAR, NVARCHAR, NCLOB datatypes are not supported by MEGA.

OCTETS, CODEUNITS32, CODEUNITS16

OCTETS, CODEUNITS32 and CODEUNITS16 are units of length for the character string datatype.

They are not supported by MEGA.



LONG VARCHAR, LONG VARGHAPHIC

The LONG VARCHAR and LONG VARGRAPHIC datatypes are deprecated in version 10.5 but remain accepted in DB2 10.5 syntax.

Physical Parameters

Colors used:

Gray: parameters where reverse engineering is non-directional.

Red: parameters not processed.

Green: parameters reverse engineered.

Tables

- Clause type : table_check
    - CHECK NAME (String)
    - ENFORCED(Enumeration: ENFORCED,NOT ENFORCED,NOT ENFORCED TRUSTED, NOT ENFORCED NOT TRUSTED
- Clause type : table_block
    - DATA CAPTURE (Enumeration: CHANGES,NONE)
    - NOT LOGGED INITIALLY(Boolean)
    - WITH RESTRICT ON DROP
    - COMPRESSION MODE (Enumeration: COMPRESSION NO,COMPRESSION YES ADAPTIVE,COMPRESSION YES STATIC)
    - VALUE COMPRESSION (Boolean)
    - CCSID (UNICODE,ASCII)
    - SECURITY POLICY(String)
    - OPTIONS (VarChar)
    - AS ROW (Enumeration : BEGIN,END)
- Clause type : organize_clause
    - ORGANIZE BY (Enumeration :ROW,COLUMN,DIMENSIONS,KEY SEQUENCE,INSERT TIME)
    - ROW USING (Boolean)
    - ALLOW OVERFLOW(Boolean)
    - PCTFREE (Integer)
    - Not processed:
    -
- Clause type : organize_sequence_key_clause
    - COLUMN (Link)
    - STARTING_CONSTANT
    - ENDING_CONSTANT
- Clause type : distribution_clause
    - DISTRIBUTE BY (Enumeration :HASH,REPLICATION)
    - DISTRIBUTION COLUMNS(Link)
- Clause type : partitioning_clause
    - RANGE(Boolean)
- Clause type : partitioning_range_clause
    - PARTITION NAME(String)

- EVERY(String)
- Used Data Group(Link)

- Clause type: boundary_clause
  - BOUNDARY INCLUSIVE(INCLUSIVE,EXCLUSIVE)
  - BOUNDARY TYPE(STARTING,ENDING)
  - BOUNDARY VALUES(String)
- Clause type: tablespace_option
  - CYCLE(Boolean)
  - Used Data Group (link)
  - Used Data Group 2 (link)
  - Used Data Group 3 (link)

- Clause type : partition_expression
  - COLUMN(Link)
  - NULLS ORDER (Enumeration : FIRST,LAST)

- Clause type : table_period_defintion
  - PERIOD MODE (Enumeration : BUSINESS_TIME,SYSTEM_TIME)
  - BEGIN COLUMN(Link)
  - END COLUMN(Link)

Columns

- Clause type : column_block
  - COMPACT (Boolean)
  - COMPRESS (Boolean)
  - INLINE LENGTH (Boolean)
  - LOGGED (String)
  - IMPLICITLY HIDDEN (Enumeration : IMPLICITLY HIDDEN, NOT HIDDEN)
- Clause type : generated_column_spec
  - GENERATED (Enumeration : GENERATED ALWAYS, GENERATED DEFAULT)
  - GENERATION TYPE (Enumeration : AS GENERATED EXPRESSION,AS ROW CHANGE TIMESTAMP, AS ROW TRANSACTION TIMESTAMP, AS ROW TRANSACTION STARTD ID)
  - START WITH (String)
  - INCREMENT (String)
  - MAX VALUE (OPENED ENUMERATION : NO MAXVALUE)
  - MIN VALUE (OPENED ENUMERATION : NO MINVALUE)

- CACHE (OPENED ENUMERATION : NO CACHE)
- CYCLE (Boolean)
- ORDER (Boolean)
- GENERATE EXPRESSION (VarChar)

Indexes

- Clause type : index_block
  - BUSINESS_TIME WITHOUT OVERLAPS (Boolean)
  - PARTIONED (Enumeration : PARTITIONED ,NOT PARTITIONED)
  - Used Data Group (Link)
  - EXTEND USING (String)
  - VALUE LIST (VarChar)
  - PCTFREE (Percent)
  - LEVEL2 PCTFREE (Percent)
  - MINPCTUSED (String)
  - REVERSE SCANS (ALLOW,DISALLOW)
  - PAGE SPLIT (HIGHT,LOW,SYMMETRIC)
  - COLLECT(STATISTICS,DETAILED STATISTICS,SAMPLED DETAILED STATISTICS,UNSAMPLED DETAILED STATISTICS)
  - COMPRESS(YES,NO)
  - NULL KEYS (INCLUDE NULL KEYS, EXCLUDE NULL KEYS)
  - INCLUDE(Link)

Tablespaces

- Clause type : tablespace_block
  - STORE(LARGE,LOB,LONG,REGULAR,SYSTEM TEMPORARY,USER TEMPORARY)
  - NODEGROUP(Boolean)
  - NODEGROUP NAME(String)
  - PAGESIZE(String)
  - MANAGED(MANAGE BY AUTOMATIC STORAGE,MANAGED BY DATABASE,MANAGED BY SYSTEM)
  - EXTENTSIZE(String)
  - PREFETCHSIZE(String)
  - BUFFERPOOL(String)
  - OVERHEAD(String)
  - TRANSFERRATE(String)

- DROPPED TABLE RECOVERY(ON,OFF)
- AUTORESIZE(Boolean)
- INCREASESIZE(String)
- INITIALSIZE(String)
- MAXSIZE(String)
- FILE SYSTEM CACHING (FILE SYSTEM CACHING
- NO FILE SYSTEM CACHING (NO FILE SYSTEM CACHING,NO NO FILE SYSTEM CACHING)
- DATA TAG (String)

- Clause type : containers
  - Container-type(FILE,DEVICE)
  - Container-strings(VarChar)
  - Container –size (String)
  - container-numbers(String)

Unmanaged physical parameters

- AS

  Specifies that the columns of the table are based on the attributes of the structured type identified by type-name1. If type-name1 is specified without a schema name, the type name is resolved by searching the schemas on the SQLpath (defined by the FUNCPATH preprocessing option for static SQL and by the CURRENT PATH register for dynamic SQL). The type name must be the name of an existing user-defined type (SQLSTATE 42704) and it must be an instantiable structured type (SQLSTATE 428DP) with at least one attribute (SQLSTATE 42997).

- LIKE

  Specifies that the columns of the table have exactly the same name and description as the columns of the identified table (table-name1), view (view-name) or nickname (nickname). The name specified after LIKE must identify a table, view or nickname that exists in the catalog, or a declared temporary table. A typed table or typed view cannot be specified (SQLSTATE428EC).

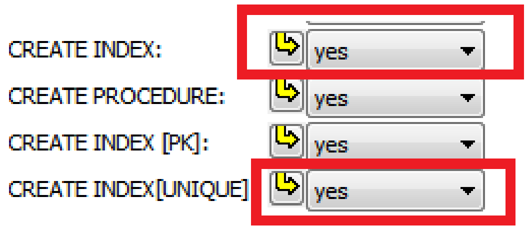
- TYPE_NAME

  Creates a typed table, which takes its structure from the specified composite type (name optionally schema-qualified). A typed table is tied to its type; for example the table will be dropped if the type is dropped (with DROP TYPE ... CASCADE). When a typed table is created, then the data types of the columns are determined by the underlying composite type and are not specified by the CREATE TABLE command. But the CREATE TABLE command can add defaults and constraints to the table and can specify storage parameters.

UNIQUE Constraint

Creating a UNIQUE constraint automatically creates a unique index of the same name. It is therefore recommended not to generate unique indexes.

In the generation options of a database, select one of the two options “Create Index” and “Create Index[Unique]”.

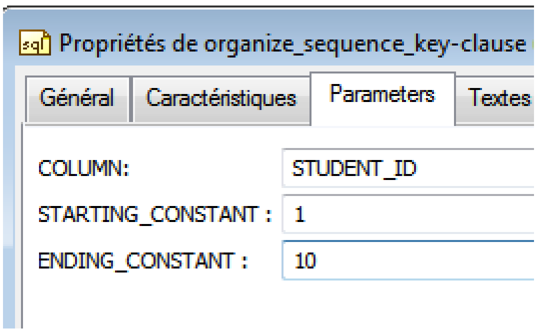


The same rule applies on PK constraints.

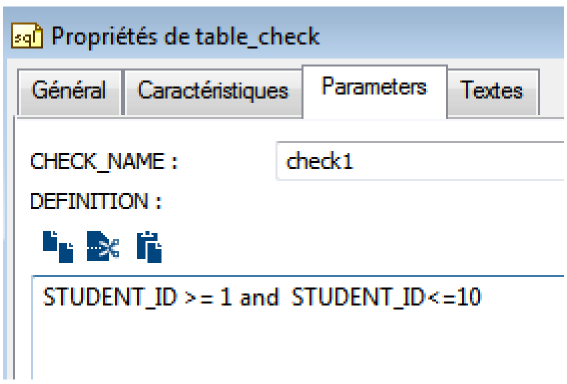
Organize_sequence_key-clause Clause

The “organize_sequence_key-clause” clause is reverse engineered into a check constraint.

For example:



Became:



A Unique index is also created on columns used in “organize_sequence_keyclause” clauses.

In DB2V10.5 reverse engineering of this clause is not supported.

‘EVERY \ DB2’ Properties

The “EVERY” property has no physical value in DB2 system tables. If this property is declared on a partition, it means that the partition is composed of several partitions.

For example:

CREATE TABLE PARTITION_range_4

(

ID INTEGER,

CONTENTS CLOB

)

PARTITION BY RANGE (ID) (STARTING 1 ENDING 100, STARTING 101 ENDING 400 **EVERY** 100)

Is equal to:

CREATE TABLE PARTITION_range_4

(

ID INTEGER,

CONTENTS CLOB

)

PARTITION BY RANGE (ID) (STARTING 1 ENDING 100, STARTING 101 ENDING 200, STARTING 201 ENDING 300, STARTING 301 ENDING 400)

PostgreSql 9.3: Syntax supported by HOPEX

This document details concepts of PostgreSQL 9.3 recognized by MEGA.

Detail of Concepts Managed by PostgreSQL

All SQL commands are available at the following address:

http://www.postgresql.org/docs/9.3/static/sql-commands.html

Tables

```
CREATE [ [ GLOBAL | LOCAL ] { TEMPORARY | TEMP } ] TABLE table_name ( [
  { column_name data_type [ DEFAULT default_expr ] [ column_constraint [ ... ] ]
    | table_constraint
    | LIKE parent_table [ like_option ... ] }
    [, ... ]
] )
[ INHERITS ( parent_table [, ... ] ) ]
[ WITH ( storage_parameter [= value] [, ... ] ) | WITH OIDS | WITHOUT OIDS ]
[ ON COMMIT { PRESERVE ROWS | DELETE ROWS | DROP } ]
[ TABLESPACE tablespace ]

CREATE [ [ GLOBAL | LOCAL ] { TEMPORARY | TEMP } ] TABLE table_name
    OF type_name [ (
  { column_name WITH OPTIONS [ DEFAULT default_expr ] [ column_constraint [ ... ] ]
    | table_constraint }
    [, ... ]
) ]
[ WITH ( storage_parameter [= value] [, ... ] ) | WITH OIDS | WITHOUT OIDS ]
[ ON COMMIT { PRESERVE ROWS | DELETE ROWS | DROP } ]
[ TABLESPACE tablespace ]
```

Indexes

```
CREATE [ UNIQUE ] INDEX [ CONCURRENTLY ] [ name ] ON table_name [ USING method ]
    ( { column_name | ( expression ) } [ COLLATE collation ] [ opclass ] [ ASC | DESC ] [ NULLS { FIRST | LAST } ] [, ...] )
    [ WITH ( storage_parameter = value [, ... ] ) ]
    [ TABLESPACE tablespace_name ]
    [ WHERE predicate ]
```

Tablespaces

```
CREATE TABLESPACE tablespace_name [ OWNER user_name ] LOCATION 'directory'
```

Views

```
CREATE [ OR REPLACE ] [ TEMP | TEMPORARY ] [ RECURSIVE ] VIEW name [ ( column_name [, ...] ) ]
    [ WITH ( view_option_name [= view_option_value] [, ... ] ) ]
    AS query
```

CREATE VIEW v_example_character_type AS
 SELECT col_char1, col_char2
  FROM example_character_type
 WHERE col_char1 = 'A';

Triggers

```
CREATE [ CONSTRAINT ] TRIGGER name { BEFORE | AFTER | INSTEAD OF } { event [ OR ... ] }
    ON table_name
    [ FROM referenced_table_name ]
    { NOT DEFERRABLE | [ DEFERRABLE ] { INITIALLY IMMEDIATE | INITIALLY DEFERRED } }
    [ FOR [ EACH ] { ROW | STATEMENT } ]
    [ WHEN ( condition ) ]
    EXECUTE PROCEDURE function_name ( arguments )

where event can be one of:

    INSERT
    UPDATE [ OF column_name [, ... ] ]
    DELETE
    TRUNCATE
```

Example:

```
CREATE OR REPLACE FUNCTION test() RETURNS trigger AS $$
    BEGIN
        RETURN 0;
    END IF;
$$ LANGUAGE plpgsql;
```

```
CREATE TRIGGER check_update
  BEFORE UPDATE ON example_character_type
  FOR EACH ROW
  EXECUTE PROCEDURE test();
```

Sequences

```
CREATE [ TEMPORARY | TEMP ] SEQUENCE name [ INCREMENT [ BY ] increment ]
    [ MINVALUE minvalue | NO MINVALUE ] [ MAXVALUE maxvalue | NO MAXVALUE ]
    [ START [ WITH ] start ] [ CACHE cache ] [ [ NO ] CYCLE ]
    [ OWNED BY { table_name.column_name | NONE } ]
```

Example:

CREATE SEQUENCE example_sequence
 INCREMENT 1
 MINVALUE 1
 START 101 ;

Functions

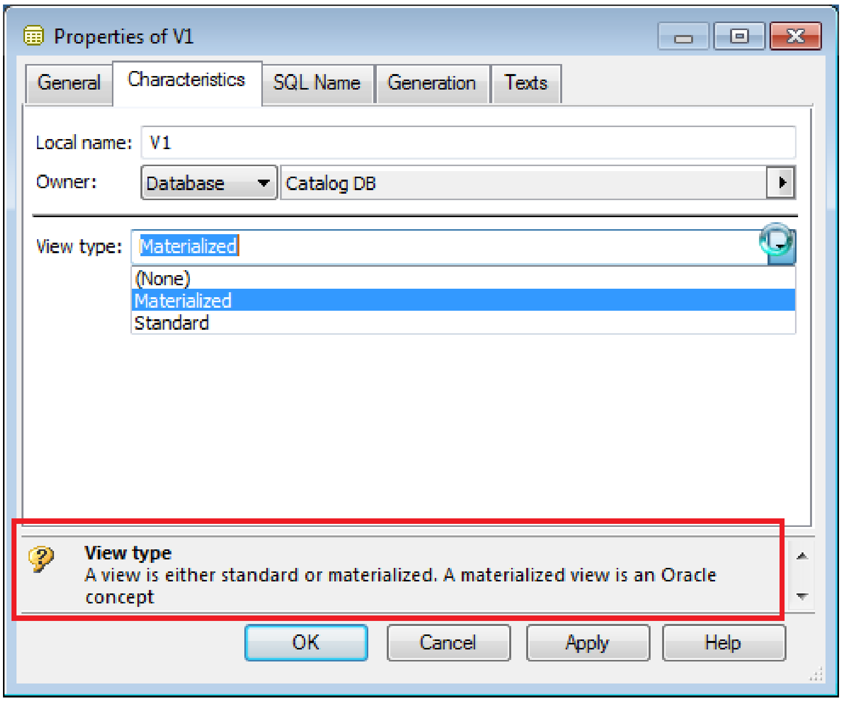
```
CREATE [ OR REPLACE ] FUNCTION
    name ( [ [ argmode ] [ argname ] argtype [ { DEFAULT | = } default_expr ] [, ...] ] )
    [ RETURNS rettype
      | RETURNS TABLE ( column_name column_type [, ...] ) ]
  { LANGUAGE lang_name
    | WINDOW
    | IMMUTABLE | STABLE | VOLATILE | [ NOT ] LEAKPROOF
    | CALLED ON NULL INPUT | RETURNS NULL ON NULL INPUT | STRICT
    | [ EXTERNAL ] SECURITY INVOKER | [ EXTERNAL ] SECURITY DEFINER
    | COST execution_cost
    | ROWS result_rows
    | SET configuration_parameter { TO value | = value | FROM CURRENT }
    | AS 'definition'
    | AS 'obj_file', 'link_symbol'
  } ...
    [ WITH ( attribute [, ...] ) ]
```

Example:

```
CREATE OR REPLACE FUNCTION test() RETURNS trigger AS $$
    BEGIN
        RETURN i + 1;
    END IF;
$$ LANGUAGE plpgsql;
```

Materialized views

This concept is managed in MEGA by specifying the appropriate type to a view.



However, MEGA presents two restrictions:

- It is not possible to specify a tablespace for storage of the view.
- More generally, it is not possible to specify physical parameters.

Domains and types

These are two concepts that enable management of structures of elementary datatypes. These concepts exist for other DBMSs.

These concepts are not initially managed. A detailed study is necessary.

"Trigger events"

This concept enables extension of the trigger concept to a database.

MEGA does not currently offer suitable management of this concept.

Creating Datatype Packages

PostgreSQL datatypes

A complete description of datatypes is accessible from the following link:

http://www.postgresql.org/docs/9.3/static/sql-commands.html

- Complete list

The following sections provide additional information.

Name	Aliases	Description
bigint	int8	signed eight-byte integer
bigserial	serial8	autoincrementing eight-byte integer
bit [(*n*)]		fixed-length bit string
bit varying [(*n*)]	varbit	variable-length bit string
boolean	bool	logical Boolean (true/false)
box		rectangular box on a plane
bytea		binary data ("byte array")
character [(*n*)]	char [(*n*)]	fixed-length character string
character varying [(*n*)]	varchar [(*n*)]	variable-length character string
cidr		IPv4 or IPv6 network address

Name	Aliases	Description
`circle`		circle on a plane
`date`		calendar date (year, month, day)
`double precision`	`float8`	double precision floating-point number (8 bytes)
`inet`		IPv4 or IPv6 host address
`integer`	`int`, `int4`	signed four-byte integer
`interval [` *`fields`* `] [ (`*`p`*`) ]`		time span
`json`		JSON data
`line`		infinite line on a plane
`lseg`		line segment on a plane
`macaddr`		MAC (Media Access Control) address
`money`		currency amount
`numeric [ (`*`p`*`,` *`s`*`) ]`	`decimal [ (`*`p`*`,` *`s`*`) ]`	exact numeric of selectable precision
`path`		geometric path on a plane
`point`		geometric point on a plane

Name	Aliases	Description
`polygon`		closed geometric path on a plane
`real`	`float4`	single precision floating-point number (4 bytes)
`smallint`	`int2`	signed two-byte integer
`smallserial`	`serial2`	autoincrementing two-byte integer
`serial`	`serial4`	autoincrementing four-byte integer
`text`		variable-length character string
`time [ (p) ] [ without time zone ]`		time of day (no time zone)
`time [ (p) ] with time zone`	`timetz`	time of day, including time zone
`timestamp [ (p) ] [ without time zone ]`		date and time (no time zone)
`timestamp [ (p) ] with time zone`	`timestamptz`	date and time, including time zone
`tsquery`		text search query
`tsvector`		text search document
`txid_snapshot`		user-level transaction ID snapshot

Name	Aliases	Description
uuid		universally unique identifier
xml		XML data

- Numeric types

Name	Storage Size	Description	Range
smallint	2 bytes	small-range integer	-32768 to +32767
integer	4 bytes	typical choice for integer	-2147483648 to +2147483647
bigint	8 bytes	large-range integer	-9223372036854775808 to +9223372036854775807
decimal	variable	user-specified precision, exact	up to 131072 digits before the decimal point; up to 16383 digits after the decimal point
numeric	variable	user-specified precision, exact	up to 131072 digits before the decimal point; up to 16383 digits after the decimal point
real	4 bytes	variable-precision, inexact	6 decimal digits precision
double precision	8 bytes	variable-precision, inexact	15 decimal digits precision
smallserial	2 bytes	small autoincrementing integer	1 to 32767
serial	4 bytes	autoincrementing integer	1 to 2147483647
bigserial	8 bytes	large autoincrementing integer	1 to 9223372036854775807

```
CREATE TABLE example_numeric_type
(
  col_bigint               bigint,
  col_decimal1             decimal,
  col_decimal2             decimal(8),
  col_decimal3             decimal(8,2),
  col_double_precision     double precision,
  col_integer              integer,
  col_numeric1             numeric,
  col_numeric2             numeric(8),
  col_numeric3             numeric(8,2),
  col_real                 real,
  col_serial               serial,
  col_bigserial            bigserial,
  col_smallserial          smallserial,
  col_smallint             smallint
);
```

- Monetary types

Name	Storage Size	Description	Range
money	8 bytes	currency amount	-92233720368547758.08 to +92233720368547758.07

```
CREATE TABLE example_monetary_type
(
  col_money      money
)
```

- Character strings

Name	Description
`character varying(n), varchar(n)`	variable-length with limit
`character(n), char(n)`	fixed-length, blank padded
`text`	variable unlimited length

```
CREATE TABLE example_character_type
(
  col_char1 char,
  col_char2 char(12),
  col_varchar1 varchar,
  col_varchar2 varchar(15),
  col_text text
)
```

- Binary types

Name	Storage Size	Description
`bytea`	1 or 4 bytes plus the actual binary string	variable-length binary string

```
CREATE TABLE example_binary_type
(
  col_bytea bytea
)
```

- Time types

Name	Storage Size	Description	Low Value	High Value	Resolution
`timestamp [ (p) ] [ without time zone ]`	8 bytes	both date and time (no time zone)	4713 BC	294276 AD	1 microsecond / 14 digits
`timestamp [ (p) ] with time zone`	8 bytes	both date and time, with time zone	4713 BC	294276 AD	1 microsecond / 14 digits
`date`	4 bytes	date (no time of day)	4713 BC	5874897 AD	1 day
`time [ (p) ] [ without time zone ]`	8 bytes	time of day (no date)	00:00:00	24:00:00	1 microsecond / 14 digits
`time [ (p) ] with time zone`	12 bytes	times of day only, with time zone	00:00:00+1459	24:00:00-1459	1 microsecond / 14 digits
`interval [ fields ] [ (p) ]`	12 bytes	time interval	-178000000 years	178000000 years	1 microsecond / 14 digits

```
CREATE TABLE example_datetime_type
(
  col_date          date,
  col_time1         time,
  col_time2         time(6),
```

```
  col_time3          time with time zone,
  col_time4          time(6) with time zone,
  col_timestamp1     timestamp,
  col_timestamp2     timestamp(6),
  col_timestamp3     timestamp with time zone,
  col_timestamp4     timestamp(6) with time zone,
  col_interval1      interval,
  col_interval2      interval(6),
  col_interval3      interval day,
  col_interval4      interval day(6)
)
```

- Boolean types

Name	Storage Size	Description
boolean	1 byte	state of true or false

```
CREATE TABLE example_boolean_type
(
  col_boolean boolean
)
```

- Geometric types

Name	Storage Size	Representation	Description
point	16 bytes	Point on a plane	(x,y)
line	32 bytes	Infinite line (not fully implemented)	((x1,y1),(x2,y2))
lseg	32 bytes	Finite line segment	((x1,y1),(x2,y2))
box	32 bytes	Rectangular box	((x1,y1),(x2,y2))
path	16+16n bytes	Closed path (similar to polygon)	((x1,y1),...)
path	16+16n bytes	Open path	[(x1,y1),...]
polygon	40+16n bytes	Polygon (similar to closed path)	((x1,y1),...)
circle	24 bytes	Circle	<(x,y),r> (center point and radius)

```
CREATE TABLE example_geometric_type
(
  col_point point,
  col_line line,
  col_lseg lseg,
  col_box box,
  col_path path,
  col_polygon polygon,
  col_circle circle
)
```

- Network types

Name	Storage Size	Description
cidr	7 or 19 bytes	IPv4 and IPv6 networks
inet	7 or 19 bytes	IPv4 and IPv6 hosts and networks
macaddr	6 bytes	MAC addresses

```
CREATE TABLE example_network_type
(
  col_cidr cidr,
  col_inet inet,
  col_macaddr macaddr
)
```

- Type : Bit String

Bit strings are strings of 1's and 0's. They can be used to store or visualize bit masks. There are two SQL bit types: `bit(n)` and `bit varying(n)`, where *n* is a positive integer. `bit` type data must match the length *n* exactly; it is an error to attempt to store shorter or longer bit strings. `bit varying` data is of variable length up to the maximum length *n*; longer strings will be rejected. Writing `bit` without a length is equivalent to `bit(1)`, while `bit varying` without a length specification means unlimited length.

```
CREATE TABLE example_bit_type
(
  col_bit1 bit,
  col_bit2 bit(3),
  col_bit_varying1 bit varying,
  col_bit_varying2 bit varying(5)
)
```

- Type : Other

```
CREATE TABLE example_other_type
(
  col_json json,
  col_uuid uuid,
  col_xml xml
)
```

Physical Parameters

Colors used:

Gray: parameters where reverse engineering is non-directional.

Red: parameters not processed.

Green: parameters reverse engineered.

Tables

- Clause type: table properties
  - POSTGRESQL_TBL_TEMPORARY (boolean)
  - *POSTGRESQL_ TBL_LOG (boolean)*
  - POSTGRESQL_ TBL_NOT_EXISTS (boolean)
  - POSTGRESQL_ TBL_COMMIT (PRESERVE ROWS, DELETE ROWS, DROP)
  - POSTGRESQL_ TBL_OIDS (yes, no)
  - Link to a data group
  - Link to a clause type storage parameter

Example:

CREATE TABLE example_with_storage_parameter (code char(5)) WITH (fillfactor=60, autovacuum_enabled);

- Clause type: table constraint
  - POSTGRESQL_CONSTRAINT_NAME (String)
  - POSTGRESQL_CONSTRAINT_TYPE (UNIQUE, PRIMARY KEY, EXCLUDE, FOREIGN KEY)
  - POSTGRESQL _EXPRESSION (String)
  - POSTGRESQL_DEFERRABLE (yes, no)
  - POSTGRESQL_DEFERRED (yes, no)
  - POSTGRESQL_MATCH_TYPE (Full, partial, simple)
  - POSTGRESQL_UPDATE_ACTION (String)
  - POSTGRESQL_DELETE_ACTION (String)
  - POSTGRESQL_CONDITION (String)
  - Link to a clause type storage parameter
  - Link to a clause type column option (multiple clause)
  - Link to a data group
  - Link to a table
  - Link to a column

```
CREATE TABLE table_with_constraint (
   did     integer CHECK (did > 100),
   name    varchar(40)
);
```

Columns

- Clause type: column properties

- POSTGRESQL_COLLATE (String)

Example:

CREATE TABLE table_with_collation (c1 serial, c2 text COLLATE "C");

- Clause type: column constraint
  - POSTGRESQL_CONSTRAINT_NAME (String)
  - POSTGRESQL_CONSTRAINT_TYPE (UNIQUE, PRIMARY KEY, FOREIGN KEY)
  - POSTGRESQL_CONSTRAINT_EXPRESSION (String)
  - POSTGRESQL_DEFERRABLE (yes, no)
  - POSTGRESQL_DEFERRED (yes, no)
  - POSTGRESQL_MATCH_TYPE (Full, partial, simple)
  - POSTGRESQL_ACTION (String)
  - Link to a clause type storage parameter
  - Link to a data group
  - Link to a table
  - Link to a column

Indexes

- Clause type: index properties
  - POSTGRESQL_IDX_CONCURRENTLY (boolean)
  - POSTGRESQL_IDX_METHOD (btree,hash,gist,spgist,gin)
  - POSTGRESQL_PREDICATE (String)
  - POSTGRESQL_EXPRESSION (String)
  - Link to a clause type storage parameter
  - Link to a data group
- Clause type: column option

Examples:

CREATE INDEX example_character_idx ON example_character_type USING btree (col_char2) WITH (fillfactor=60)

CREATE INDEX index_with_tbs ON example_character_type (col_varchar1) TABLESPACE dbspace;

Tablespaces

- Clause type: tablespace properties
  - POSTGRESQL_TBS_LOCATION (String)

CREATE TABLESPACE dbspace LOCATION 'C:\Travail\2014\Database\PostGreSql';

```
CREATE TABLE table_with_tablespace (
    id serial,
    name text,
    location text
) TABLESPACE dbspace;
```

Generic clause types

- Clause type: storage parameter
  - POSTGRESQL_ FILLFACTOR (integer)
  - POSTGRESQL_VACUUM (boolean)
  - POSTGRESQL_THRESHOLD (integer)
  - POSTGRESQL_SCALE_FACTOR (float)
  - POSTGRESQL_ANALYSE_THRESHOLD (integer)
  - POSTGRESQL_ANALYSE_SCALE_FACTOR (double)
  - POSTGRESQL_COST_DELAY (integer)
  - POSTGRESQL_COST_LIMIT (integer)
  - POSTGRESQL_FREEZE_MIN_AGE (integer)
  - POSTGRESQL_FREEZE_MAX_AGE (integer)
  - POSTGRESQL_FREEZE_TABLE_AGE (integer)
  - POSTGRESQL_MULTIXACT_FREEZE_MIN_AGE (integer)
  - POSTGRESQL_ MULTIXACT_FREEZE_MAX_AGE (integer)

- Clause type: column option
  - Link to a column
  - POSTGRESQL_EXPRESSION (String)
  - POSTGRESQL_COLLATE (String)
  - POSTGRESQL_CLASS (String)
  - POSTGRESQL_SORT (ASK, DESK)
  - POSTGRESQL_NULL (NULLS, NULLS FIRST, NULLS LAST)

Unmanaged physical parameters

- INHERITS

  The optional `INHERITS` clause specifies a list of tables from which the new table automatically inherits all columns. Use of `INHERITS` creates a persistent relationship between the new child table and its parent table(s). Schema modifications to the parent(s) normally propagate to children as well, and by default the data of the child table is included in scans of the parent(s).

- LIKE

  The `LIKE` clause specifies a table from which the new table automatically copies all column names, their data types, and their not-null constraints. Unlike `INHERITS`, the new table and original table are completely decoupled after creation is complete. Changes to the original table will not be applied to the new table, and it is not possible to include data of the new table in scans of the original table. Default expressions for the copied column definitions will only be copied if `INCLUDING DEFAULTS` is specified. The default behavior is to exclude default expressions, resulting in the copied columns in the new table having null defaults.

- TYPE_NAME

  Creates a *typed table*, which takes its structure from the specified composite type (name optionally schema-qualified). A typed table is tied to its type; for example the table will be dropped if the type is dropped (with `DROP TYPE ... CASCADE`). When a typed table is created, then the data types of the columns are determined by the underlying composite type and are not specified by the `CREATE TABLE` command. But the `CREATE TABLE` command can add defaults and constraints to the table and can specify storage parameters.

Properties pages

An Sql Clause contains the definition of all physical parameters of all DBMSs managed by MEGA. To display the correct properties page according to the DBMS and the clause type, a specific properties page must be generated for each DBMS version.

- Create a MetaAttributGroup "PostgreSQL_93_Parameters"

  This should be connected to the SQL Clause MetaClass

- Create a MetaPropertyPage "PostgreSQL_93_ Parameters"

  Setup as follows:

  ```
  [Page]
  Order=10
  [Filter]
  Condition = (ItemCount(~ISl(gRH(HTB8[IsClauseForPostgreSQL93])>0)
  [Template]
  ExtraParam=IncludeProfile(~ESI(CMH(HHX7[GeneratePropertyPageForPostgreSQL93]),Origin(Macro)
  ```

  Where IsClauseForPostgreSQL93 is a query and GeneratePropertyPageForPostgreSQL93 is a macro. We can use as models the query IsClauseForPostgre93 and the macro GeneratePropertyPageForPostgreSQL93.

- Clause type: table constraint