Tutorial: DB-Main 9.1.1 (based on DB-Main help)

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- Este tutorial foi originalmente criado para a versão 9.1.1 do Db-main.
- Contudo, o produto gerado é compatível à versão 9.1.6 e a forma de trabalho na ferramenta não foi alterada (pelo menos não para as funcionalidades usadas na construção do .lun deste tutorial).
- Se você encontrar algum problema no tutorial, por favor, escreva para sarajane@usp.br, e coloque no assunto da mensagem: [Tutorial DBMain] – Problema encontrado.

DB-Main 9.1.1 – General Information

- General Purpose Modeling Tool For Database Applications Engineering
  - supporting toolset for system engineering;
  - modeling tool development environment – Computer Aided Software Engineering (CASE) tool.
- A product of the Laboratory of Database Application Engineering University of Namur.
- Developed and distributed by: REVER S.A. (Belgium)
- Web Site: www.db-main.eu Support: dbm@rever.eu Basic file extension: .lun
- Release 9.1.1 – February, 2012.

Modelling funcionalities (examples)

- This tool offers support for some forward and reverse engineering activities.

- Foward engineering

  - A generic, wide-spectrum representation model for conceptual, logical and physical objects;
  - A graphical representation of ERA Schemas, UML Class, Activity and Use Case Diagrams;
  - A generic model that describes procedural components of information systems at various abstraction levels as well as their relations;
  - Semantic and technical semi-formal annotations attached to each specification object;

Modelling funcionalities (examples)

- Reverse engineering
  - Code parsers extracting physical schemas from SQL, COBOL, CODASYL, IMS, XML DTD and RPG source programs;
  - Interactive and programmable source text analyzers that can be used, a.o., to detect complex programming patterns or *clichés* in source texts, and to build data flow diagrams through program variables;

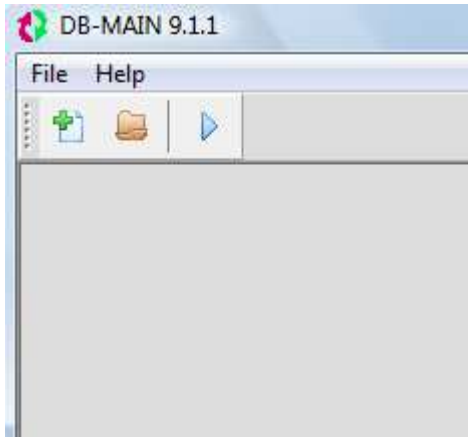
Modelling funcionalities (examples)

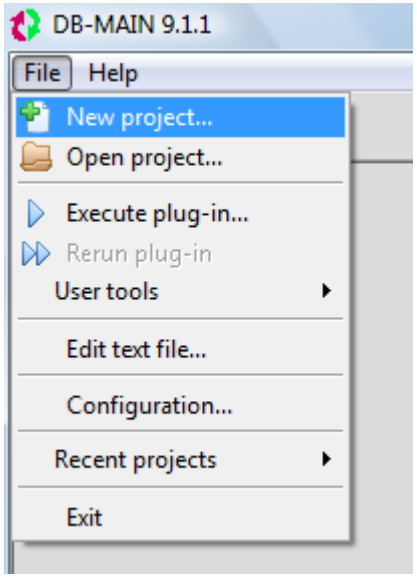
- CASE - Typical features
  - A toolbox of semantics-preserving transformational operators intended to carry out in a systematic way such activities as conceptual normalization, development of optimized logical and physical schemas from conceptual ones, and conversely (i.e. reverse engineering);
  - A set of assistants. An assistant is a kind of expert in a specific kind of tasks, or in a class of problems. It is intended to help the analyst to carry out frequent, tedious or complex tasks.

Modelling funcionalities (examples)

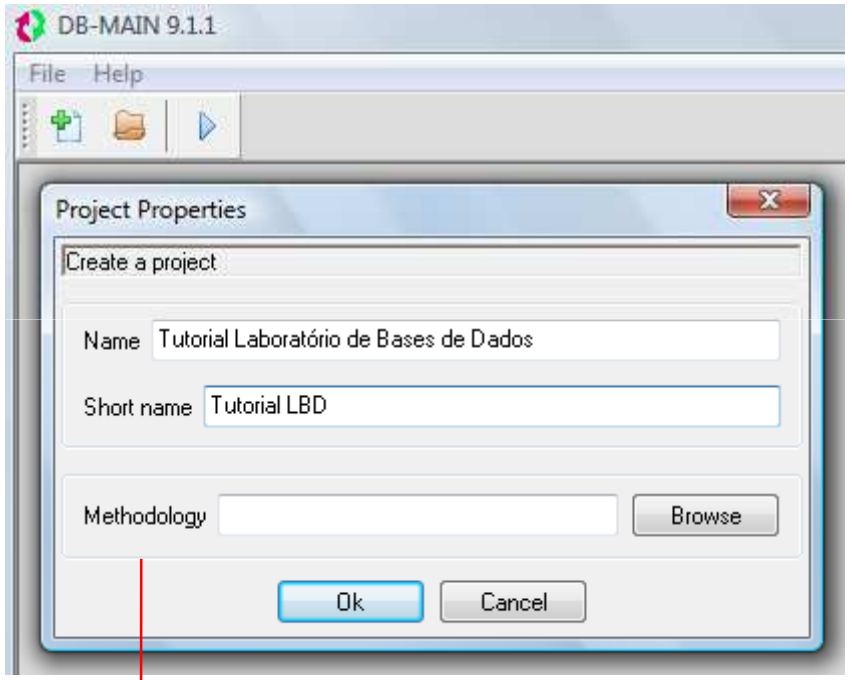
- Meta level functions
  - *Java Interface for DB-MAIN (JIDBM)* language and the *Voyager 2* allow the engineer (analyst or method engineer) to develop new functions that can be seamlessly incorporated into the tool;
  - Extension of the repository : new properties can be dynamically added and managed through plug-ins;
  - Methodological customization: the tool is methodologically neutral and can assist the analyst in following a large spectrum of methodologies.

Basic Interface Views



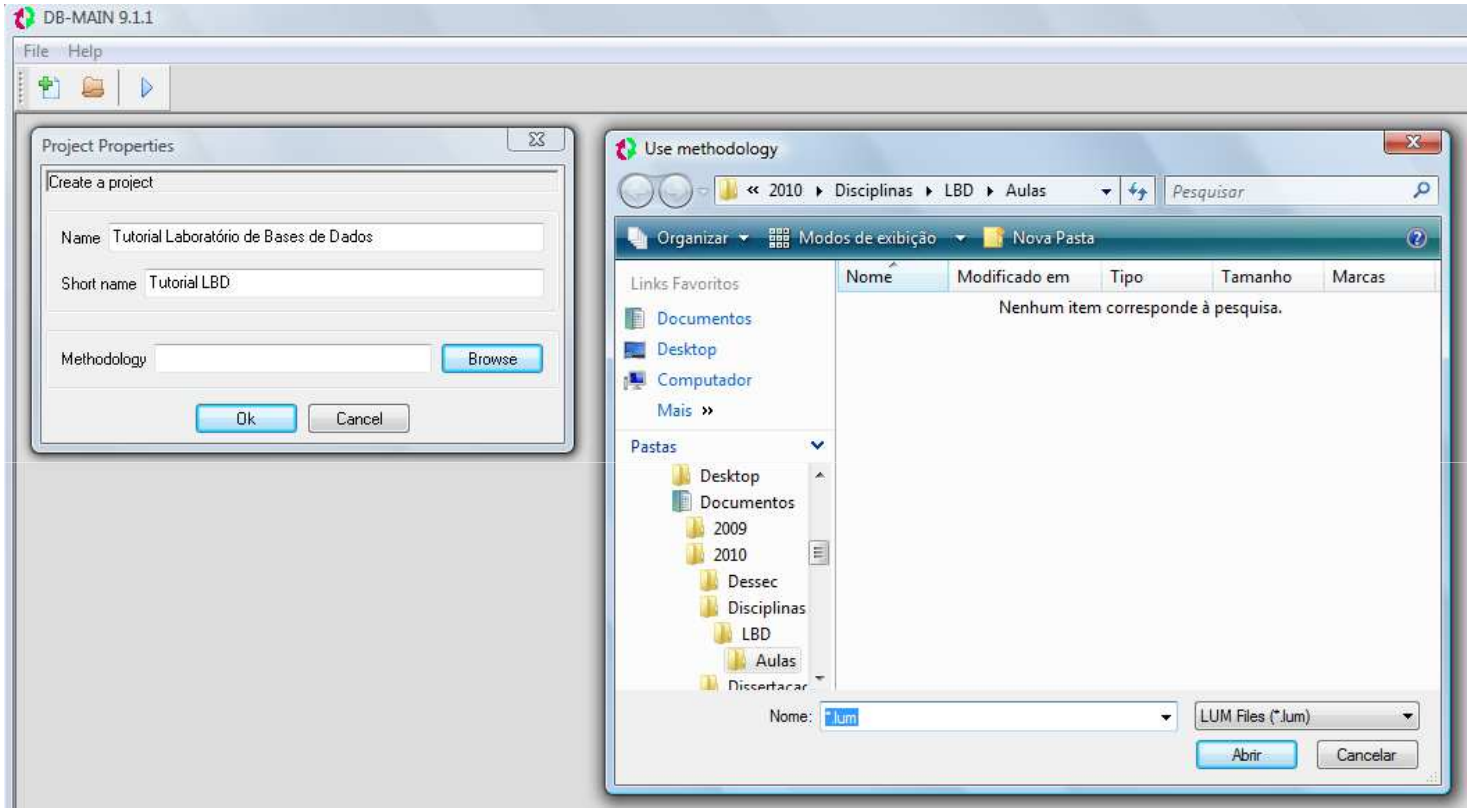


Our project



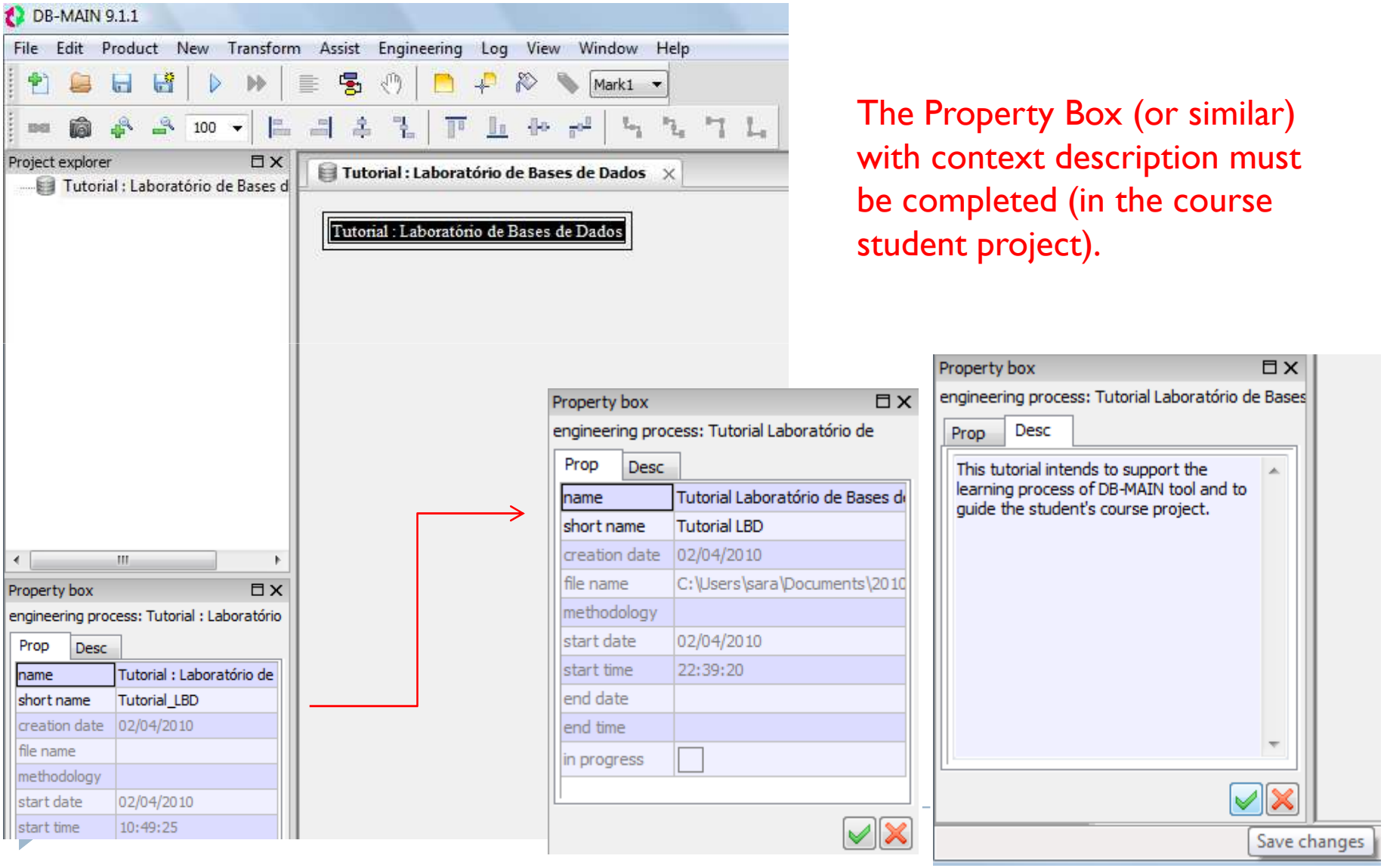
to choose a *.LUM file containing a method to be followed during the project

Basic Interface Views



Engineering methods must be written in MDL (Method Description Language) and compiled with the external MDL compiler to produce a *.LUM file. This file can be associated to the project at creation time (**File/New project** menu item). If no method is specified, the default one allows to do anything.

Basic Interface Views



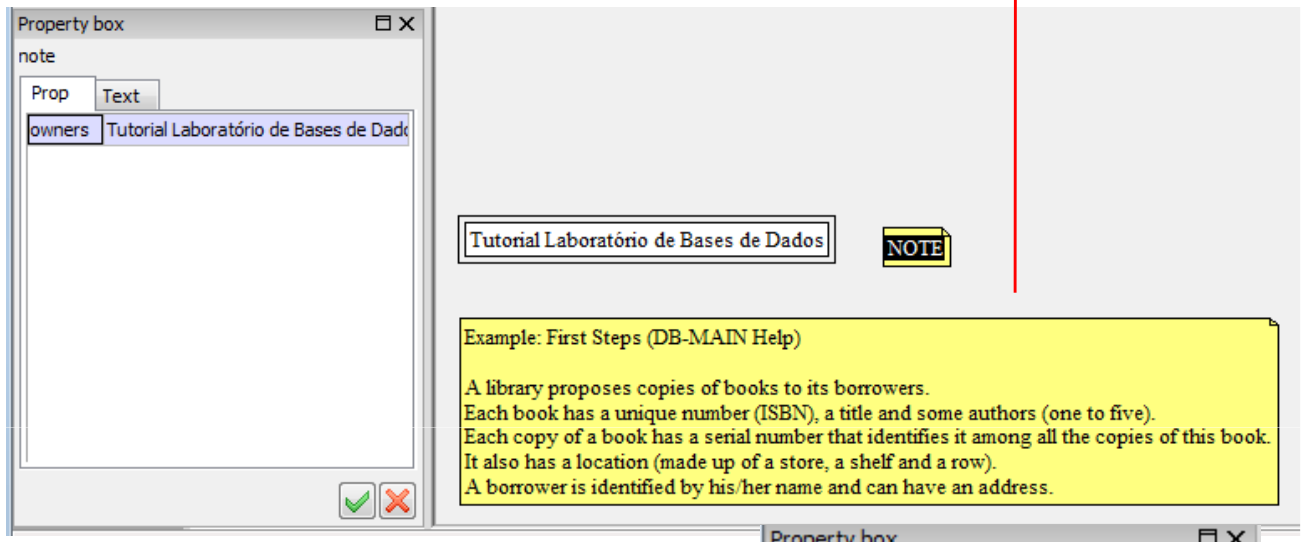
The Property Box (or similar) with context description must be completed (in the course student project).

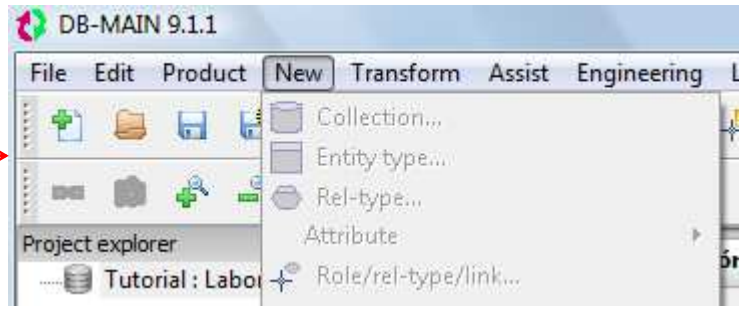
Object: Notes

Simplified requirements system.

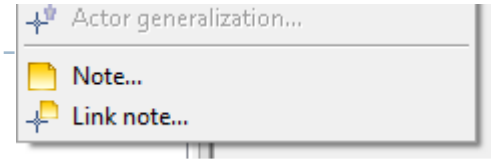
A note is a kind of post-it that can be inserted in a schema or attached to some objects of a schema.

The links between a note and its owners are represented by dotted lines, except for those associated to schemas.

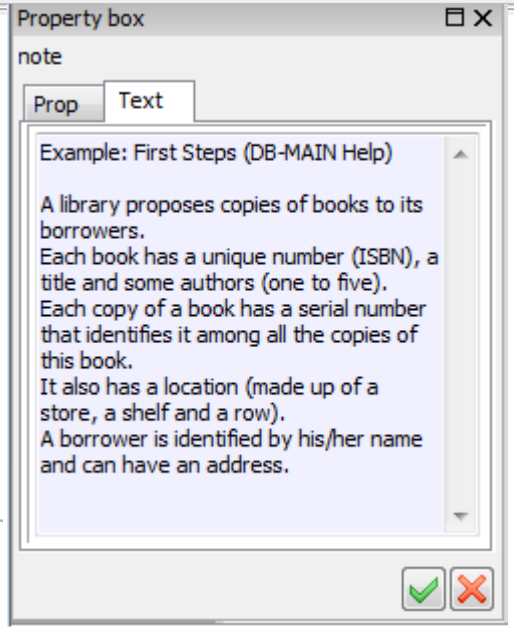




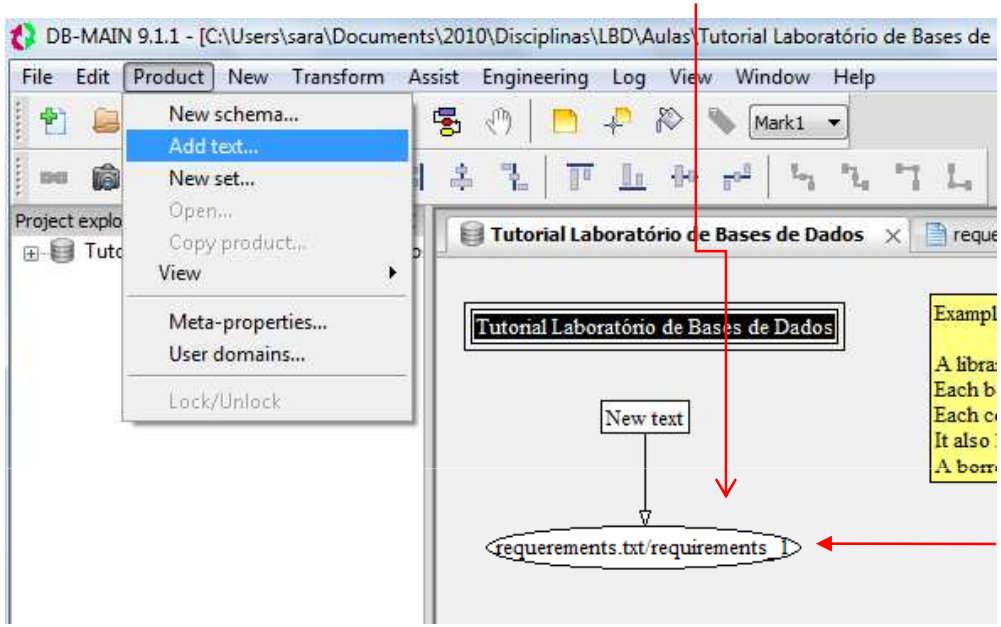
No menu NEW.



Use in your project in order to improve the specification legibility !!

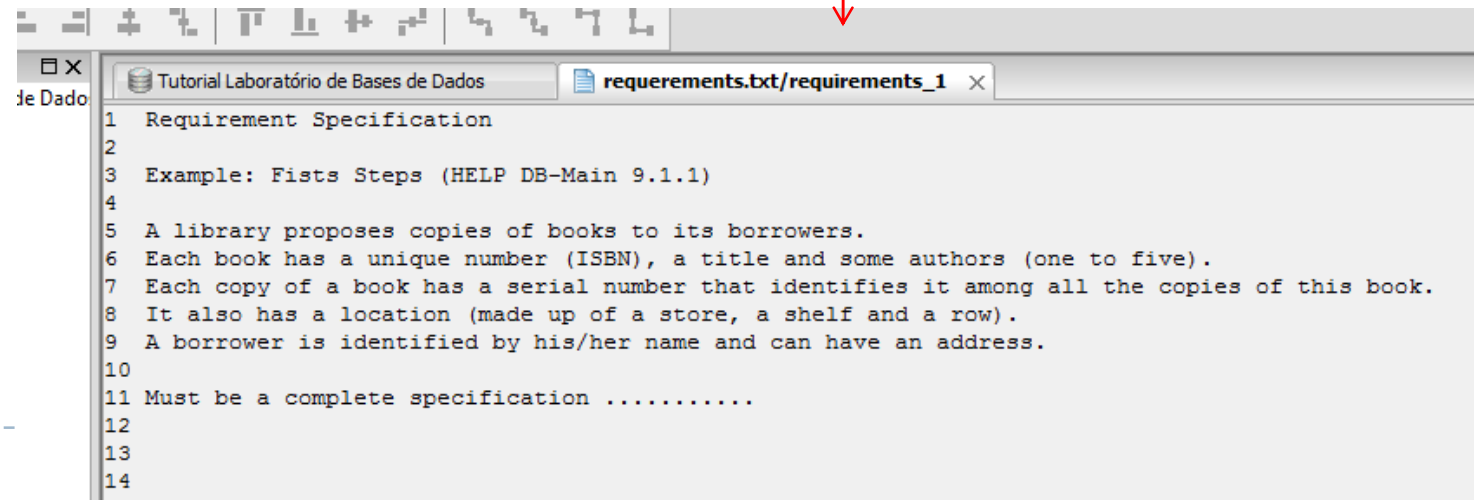


Inserting Text Information

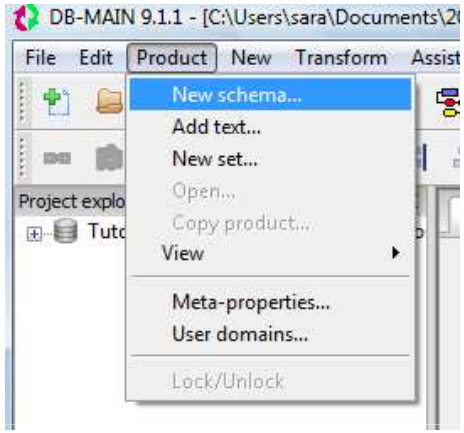


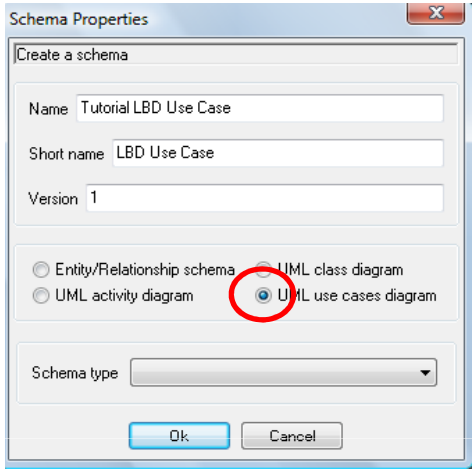
System documentation!!

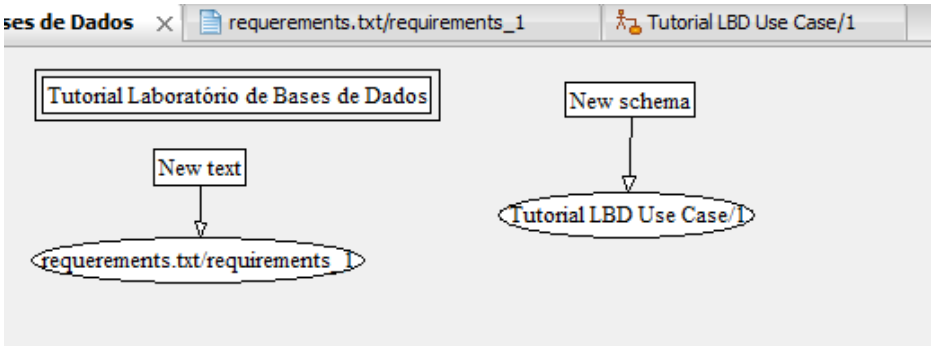
Double Click!

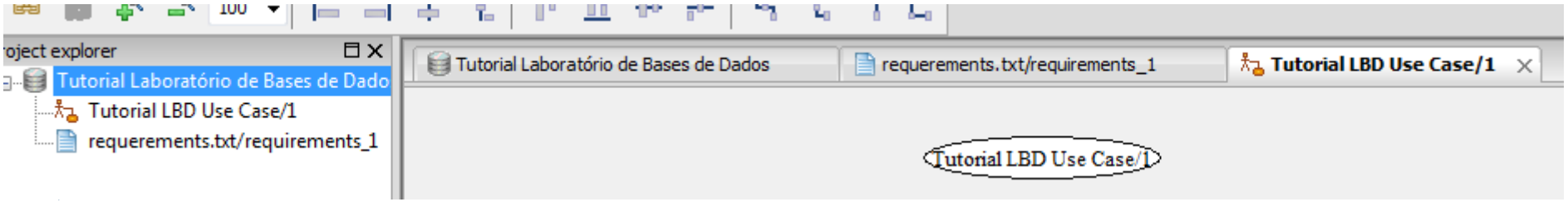


Building a Use Case Diagram

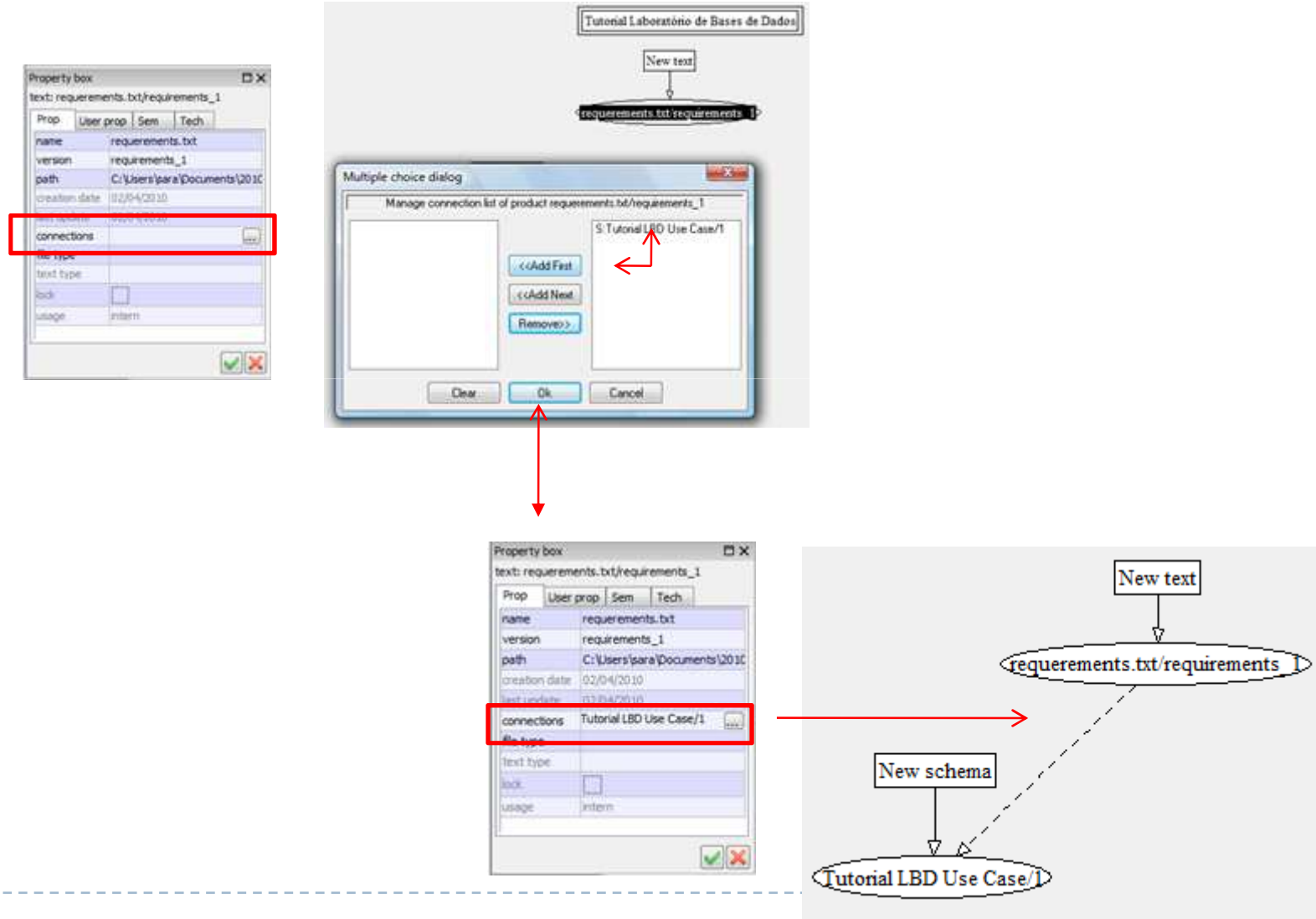




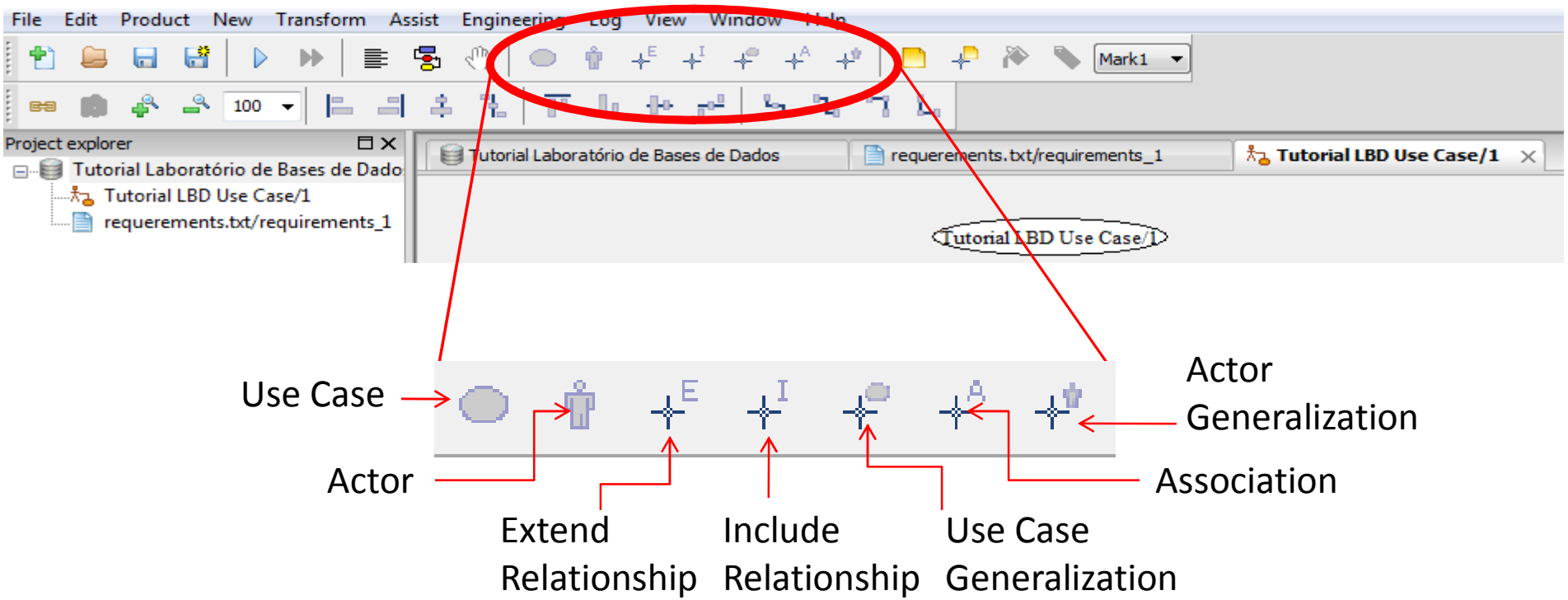




Linking the new schema to other object



Use Case – Toolbar



Use Case - Definitions

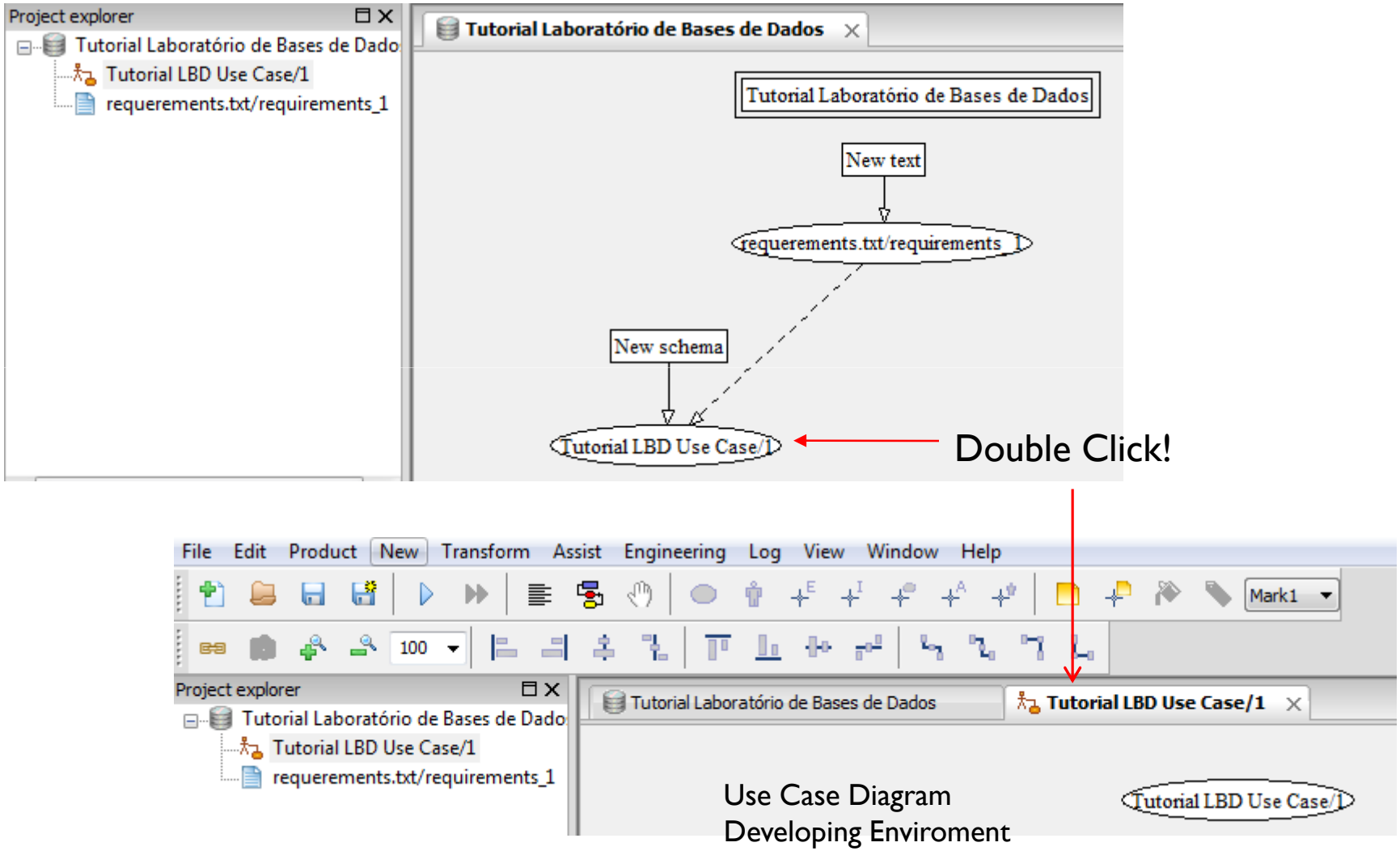
- *Use Case*: A use case is a kind of classifier representing a coherent unit of functionality provided by a system, a subsystem, or a class.
  - a *use case generalization* from a use case *A* to a use case *B* indicates that *A* is a specialization of *B* (is a kind of *relation*).

- *Actor*: an actor represents a coherent set of roles that users can play when interacting with a system. An actor materializes any resource (man, machine, ...) that can be associated with an action.
  - an *actor generalization* from an actor *A* to an actor *B* indicates that an instance of *A* can communicate with the same kinds of use-case instances as can do an instance of *B* (is a kind of *relation*).

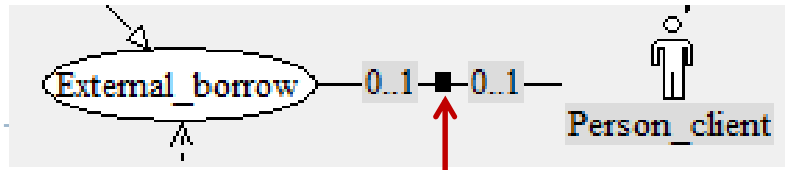
Use Case - Definitions

- These are also kinds of relations:
  - an *extend relationship* from a use case *A* to a use case *B* indicates that an instance of *B* may be augmented by the behavior specified by *A*;
  - an *include relationship* from a use case *A* to a use case *B* indicates that an instance of *A* will also contain the behavior specified by *B*;
  - an *association* between a use case and an actor indicates the participation of an actor in a use case.

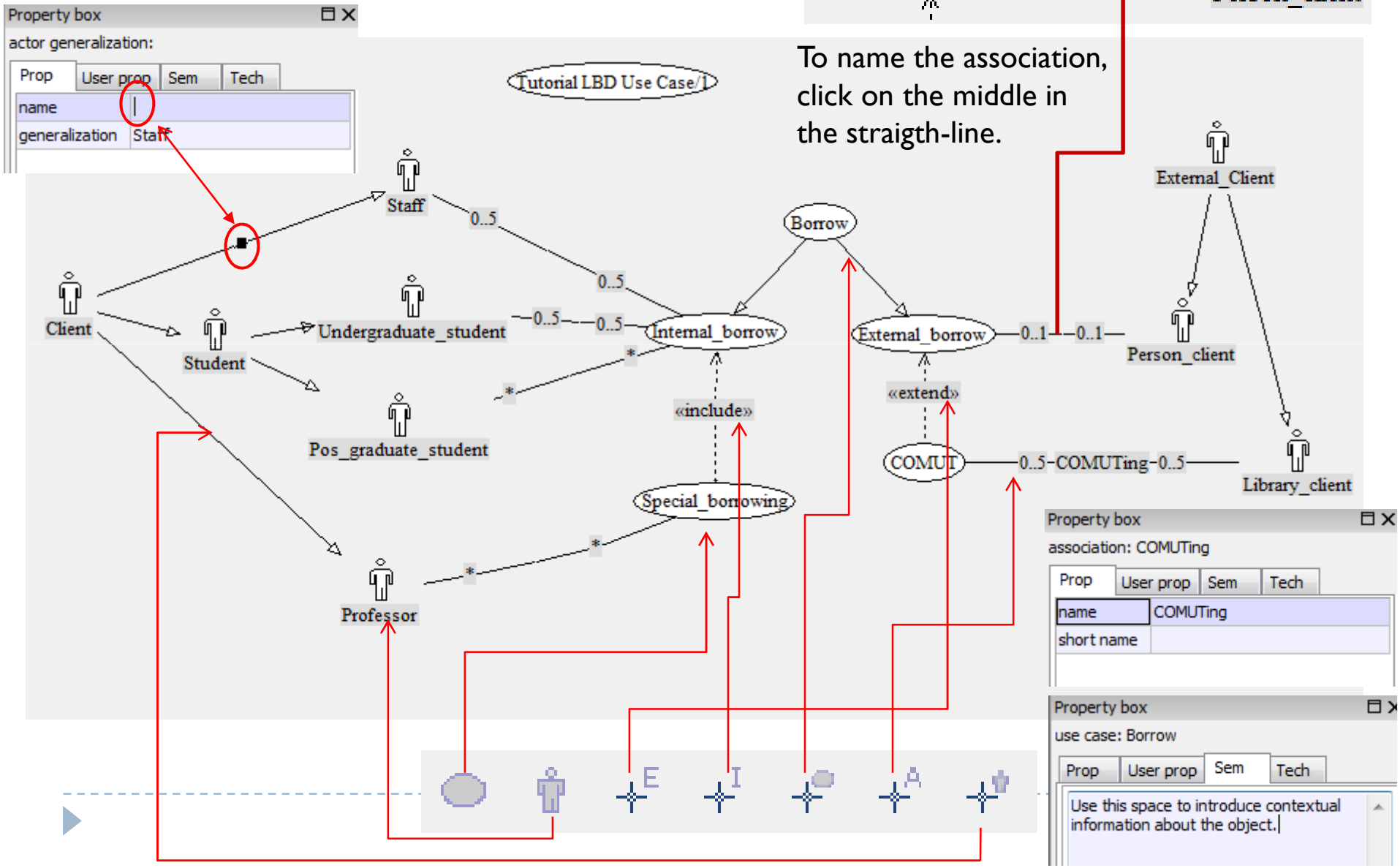
Use Case – building the diagram



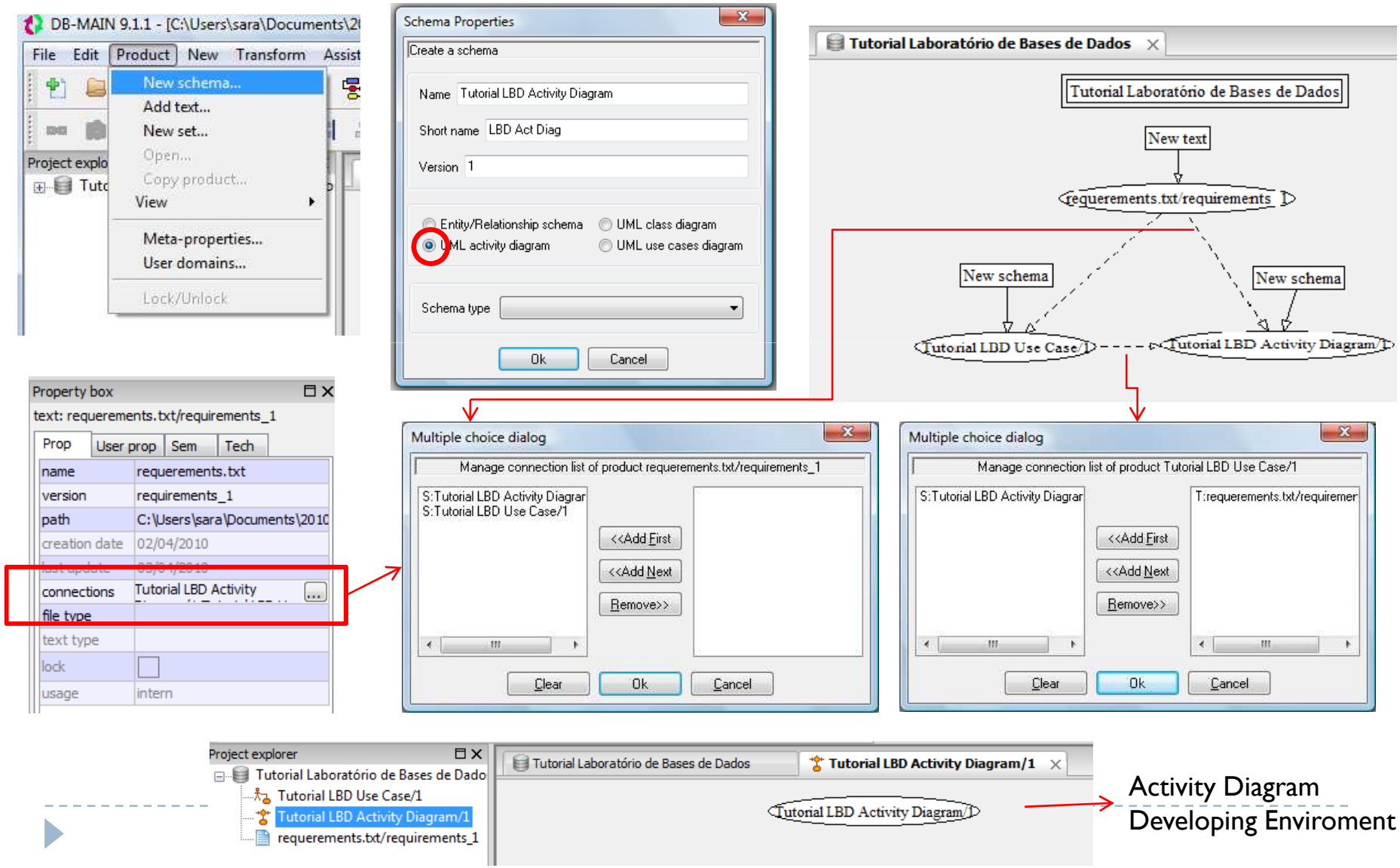
Use Case - elements



To name the association, click on the middle in the straigth-line.

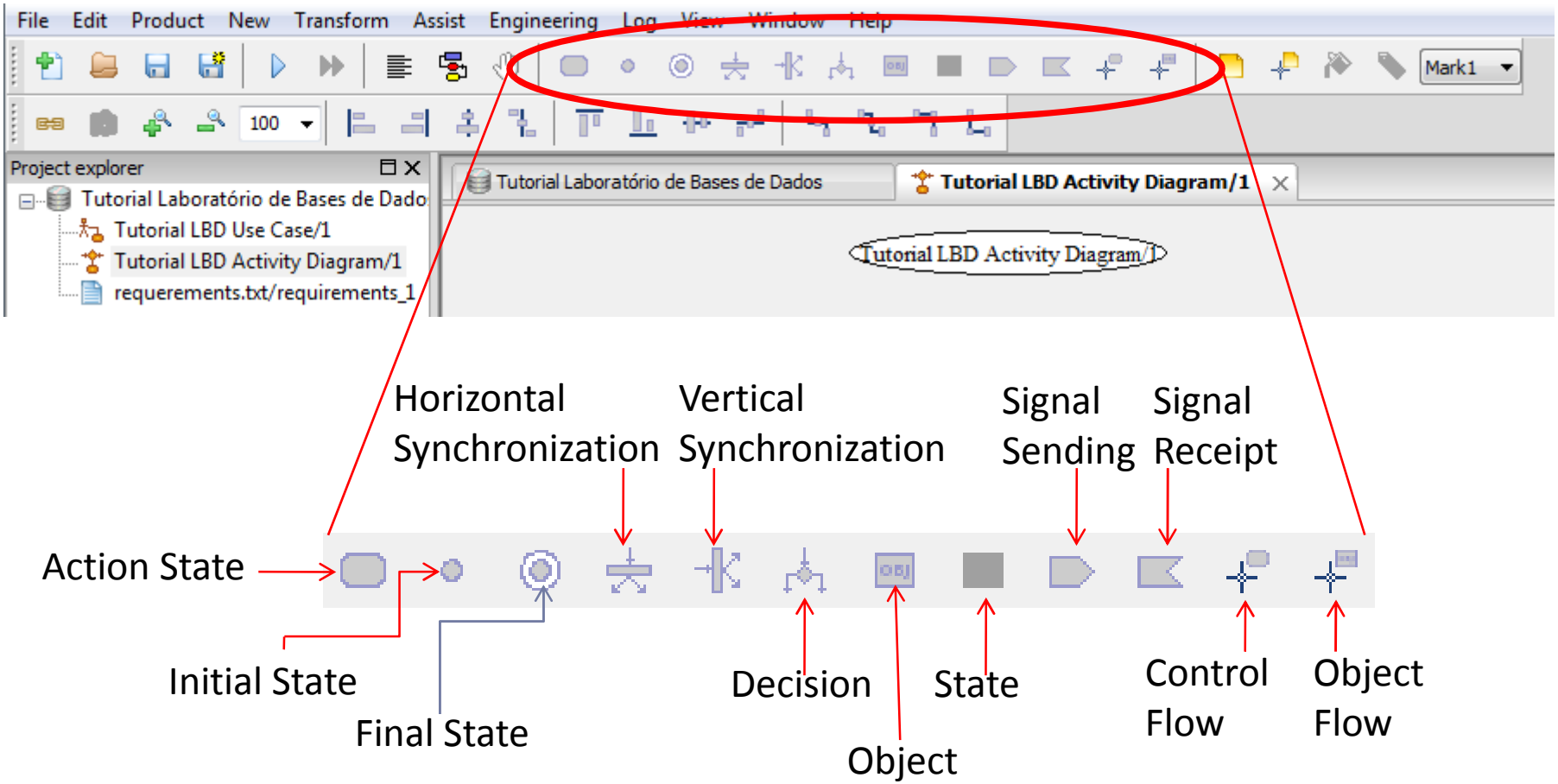


Building an Activity Diagram



Activity Diagram Developing Enviroment

Activity Diagram – Toolbar



Activity Diagram - definitions

- *Objects* are used as input or output of action states.
  - an *internal object* can be a data type, a variable, a constant or any object that is known by the action states of the schema but that is unknown outside;
  - an *external object* is defined in a data schema and used in a UML Activity Diagram. Such is the case of entity types, attributes, collections or rel-types.

- *State* (or object state) is a picture of an object at a precise time. In fact, an object that can be transformed during the process described by the activity diagram can be in a different state before and after one of the actions.
  - For instance, a glass can be empty before the action of filling it, and full after that action. Since only the empty glass can be put in a cupboard and only the full glass can be drunk, it is important, for other actions, to distinguish the various states of the object.

Activity Diagram - definitions

- *Action state* is a shorthand for a state with an entry action and at least one outgoing transition involving the implicit event of completing the entry action.

- *Initial state* is a special kind of action state that represents the beginning of an activity diagram.

- *Final state* is a special kind of action state that represents the completion of an activity diagram.

-

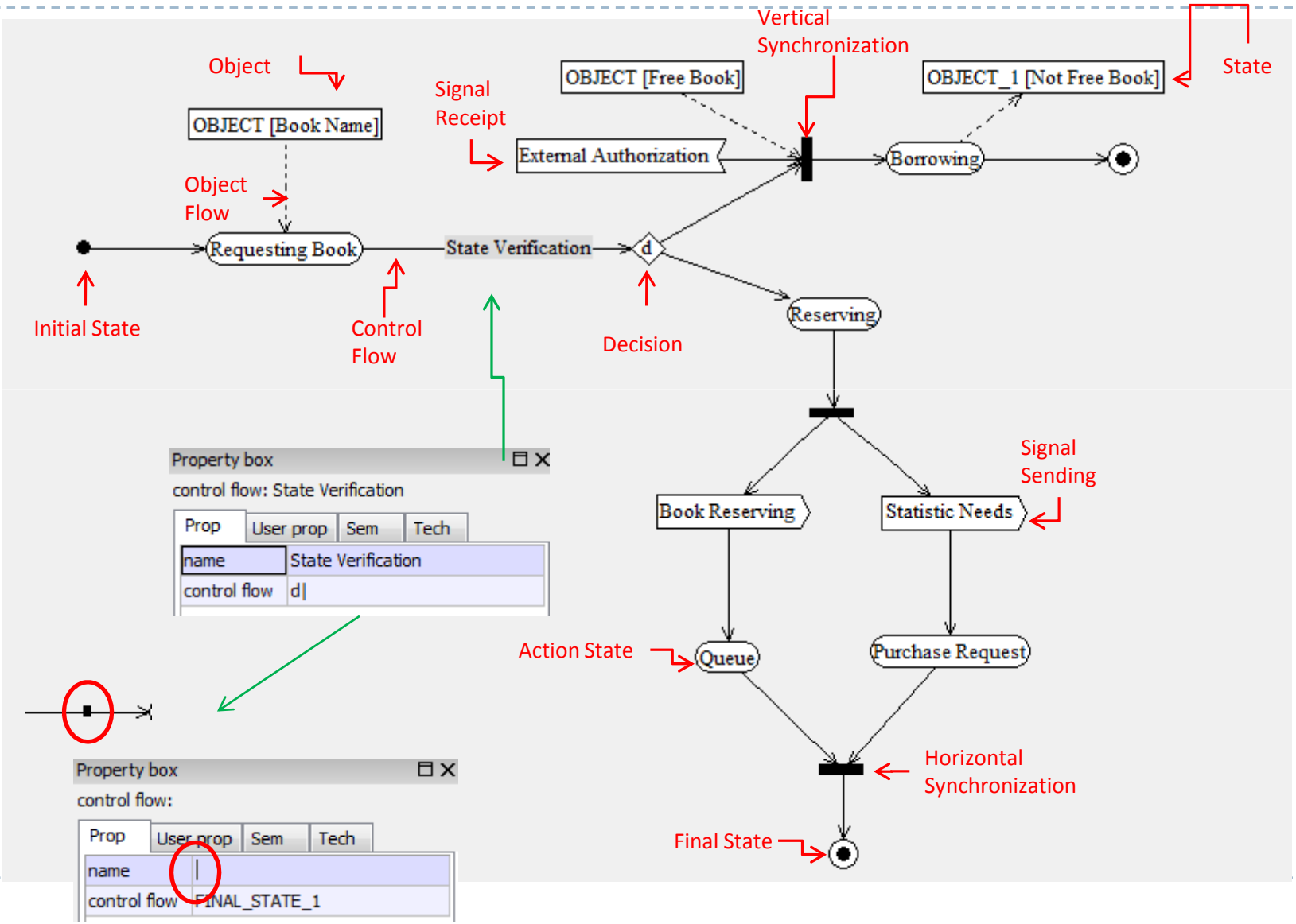
- *Synchronization state*, either horizontal or vertical allows to synchronize concurrent regions. It is used in conjunction with forks and joins to insure that one region leaves a particular state before another region can enter a particular state.

- *Decision state* is expressed when conditions are used to indicate various possible transitions that depend on boolean conditions.

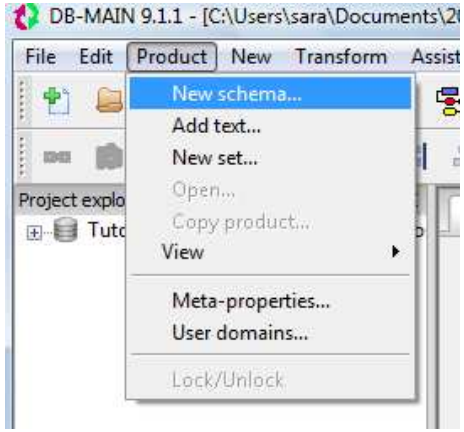
Activity Diagram - definitions

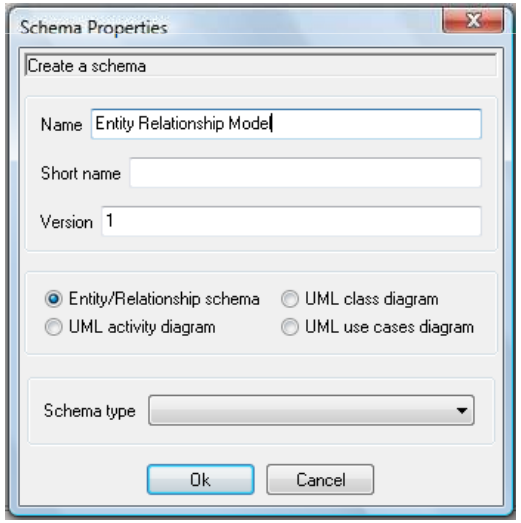
- S*ignal sending* shows a transition sending a signal.
- S*ignal receipt* shows a transition receiving a signal.
- *Control Flow:* to open a dialog box for selecting the action state(s) implied in a control flow;
  - a *control flow* indicates the order of execution of action states;
- *Object Flow:* to open a dialog box for selecting the object(s) implied in a object flow;
  - an *object flow* indicates input object states or output objects (internal or external) of an action state;

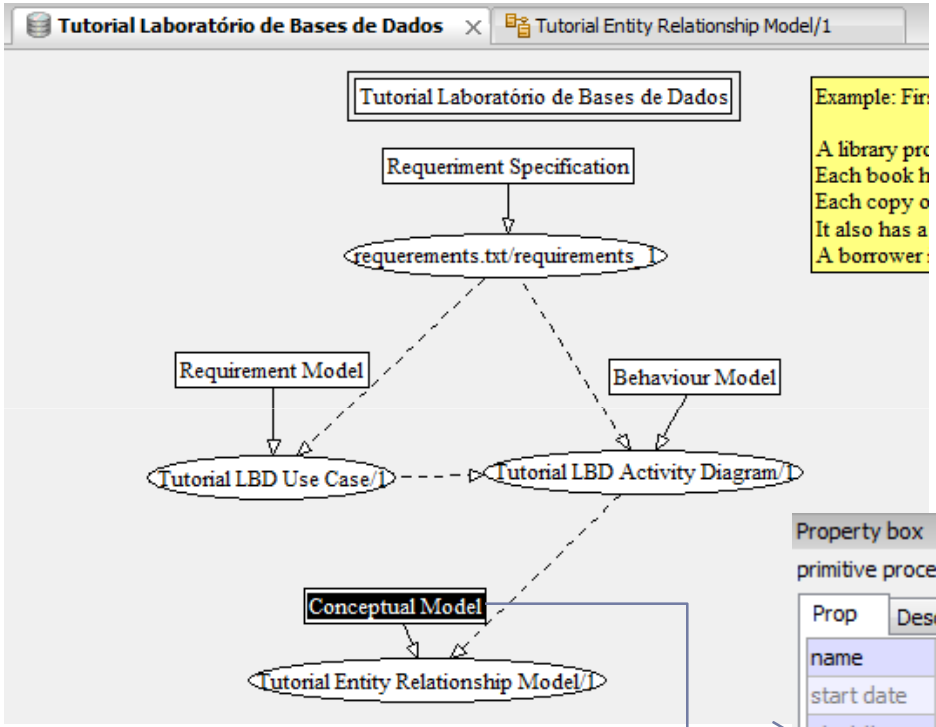
Activity Diagram - elements



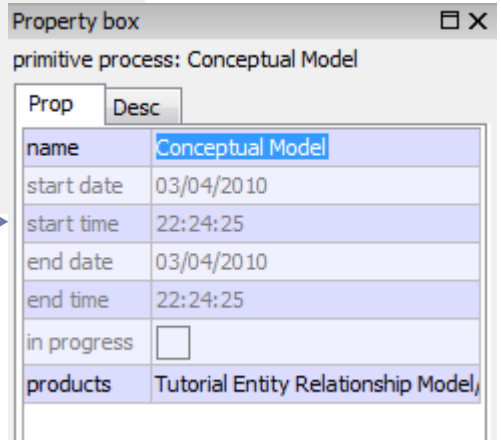
Building an Entity-Relationship Model

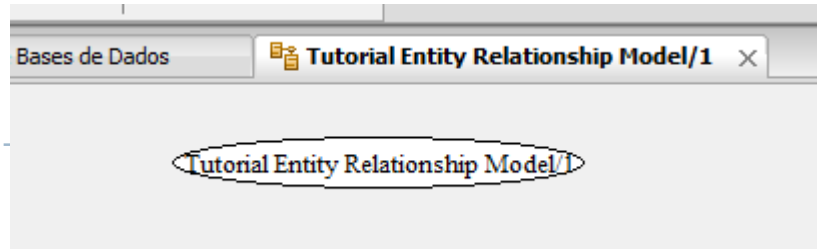




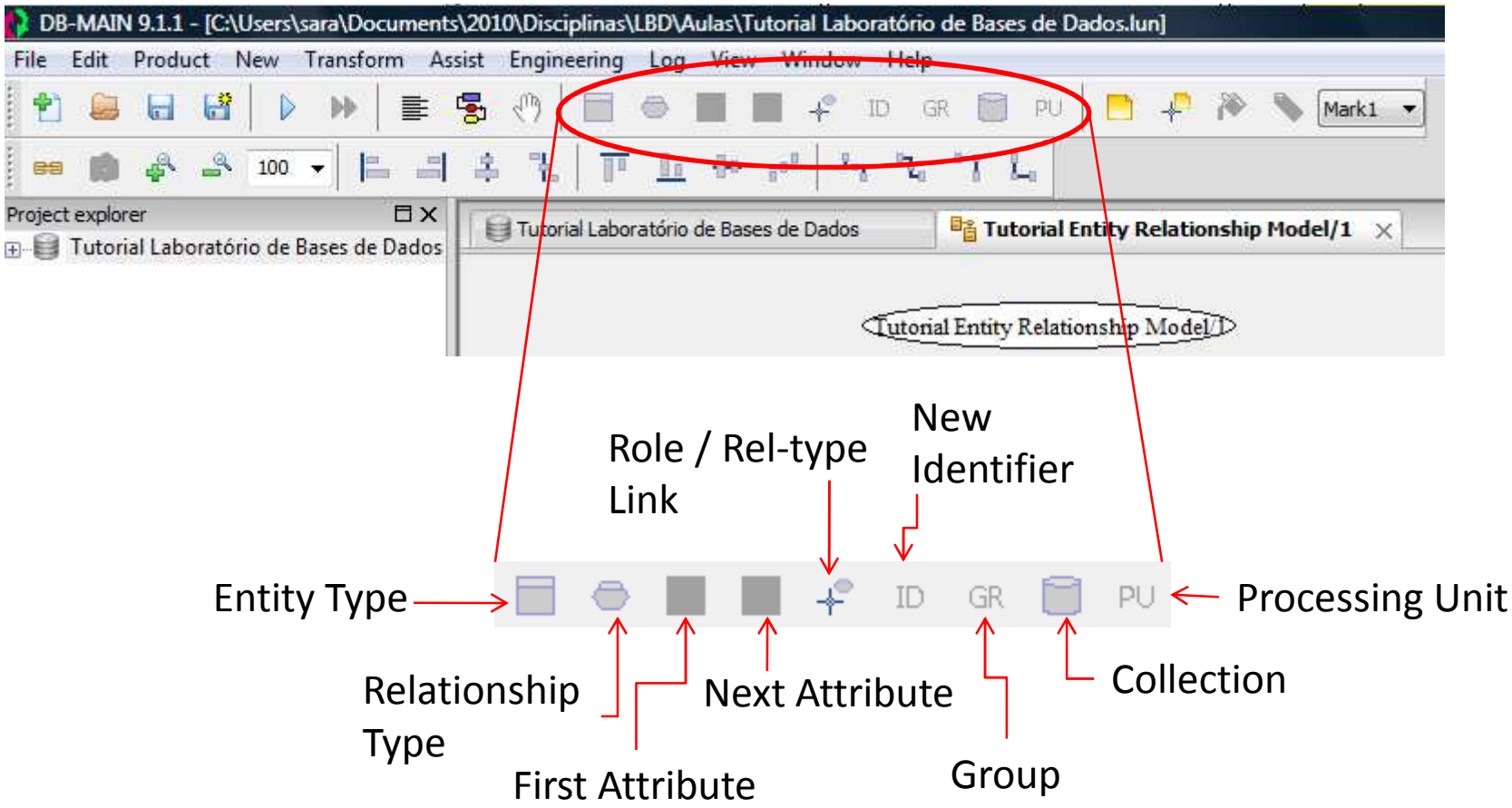


Labeling the schema





Entity Relationship Model – Toolbar



Entity Relationship Model - definitions

- *Entity type* materializes a class of entities that represent objects. These objects can be real world abstract or concrete entities. They can also be abstract or concrete data structures, such as records, tuples or segments. An entity type can have any number (including zero) of attributes.
  - An entity type can be a subtype of one or several other entity types.

- *Rel-type* (relationship type) represents a class of associations between entities. It has two or more roles and any number (including zero) of attributes.
  - A role is the partner of an entity type.

Entity Relationship Model - definitions

- An attribute represents a property of entities or associations of the same type. It is either atomic or compound; an atomic attribute has a domain of values; each attribute is subject to a cardinality constraint [min-max]. This constraint allows to specify optional/mandatory (min = 0 or 1) attributes as well as single-valued/multivalued (max = 1 or > 1) attributes.
- The possible domains of values are listed below:
  - *boolean*; *char*; *compound*; *date*; *float; index*; *numeric; sequence*; *varchar; object type;*
  - *user-defined*: can be atomic or compound, it can be associated with several attributes (in the attribute properties dialog box, select user-defined type in the *type* combo-box and then the user-defined domain in the new combo-box). A user-defined domain is defined for the current project.

Entity Relationship Model - definitions

- A multivalued attribute has a collection type. The possible collection types are listed below:
  - *set*: the values of the attribute are distinct and there is no ordering relation between them.
  - *bag*: the values are not necessarily distinct and there is no ordering relation between them.
  - *unique list*: the values are distinct and ordered.
  - *list*: the values are not necessarily distinct but they are ordered.
  - *unique array*: the values are distinct and ordered. Each value is stored into a cell and a cell can be empty.
  - *array*: the values are not necessarily distinct but they are ordered. Each value is stored into a cell and a cell can be empty.

Entity Relationship Model - definitions

- *Role* is a place holder in a rel-type. It is played by one or several entity types (mono-ET role or multi-ET role) and is given a cardinality constraint that states the minimum and maximum number times connected entities can play this role.

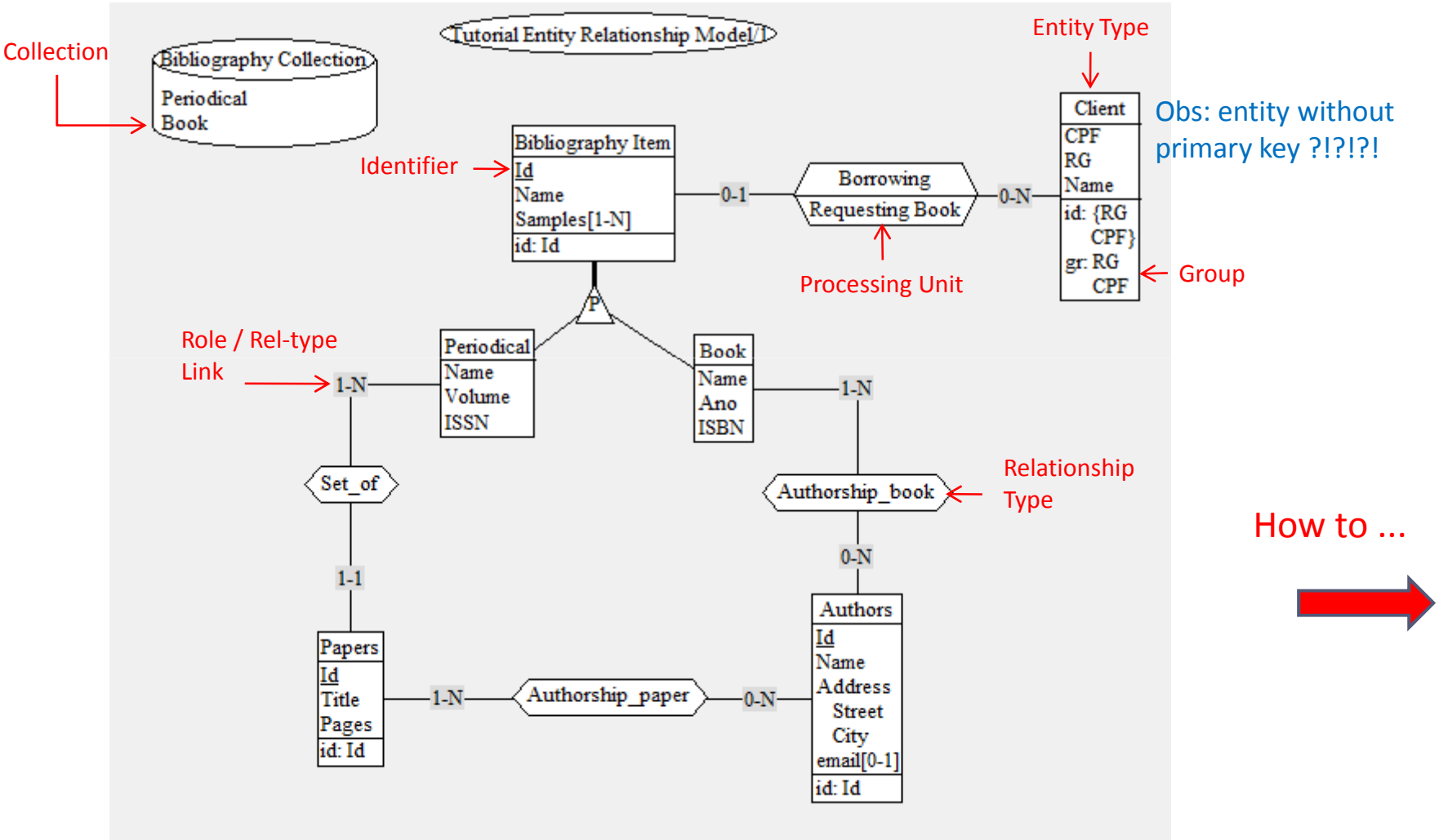
- *Group* is associated to a parent object (entity type, rel-type or multivalued compound attribute). A group is a set of attributes and/or roles and/or other groups that play some functions together for the parent object. The possible functions of a group include: identifier, coexistence, exclusive, at-least-one, user constraint and access key.

Entity Relationship Model - definitions

- *Collection* is a repository of entity types. In logical and physical schemas, collections can be used to represent files and the like.

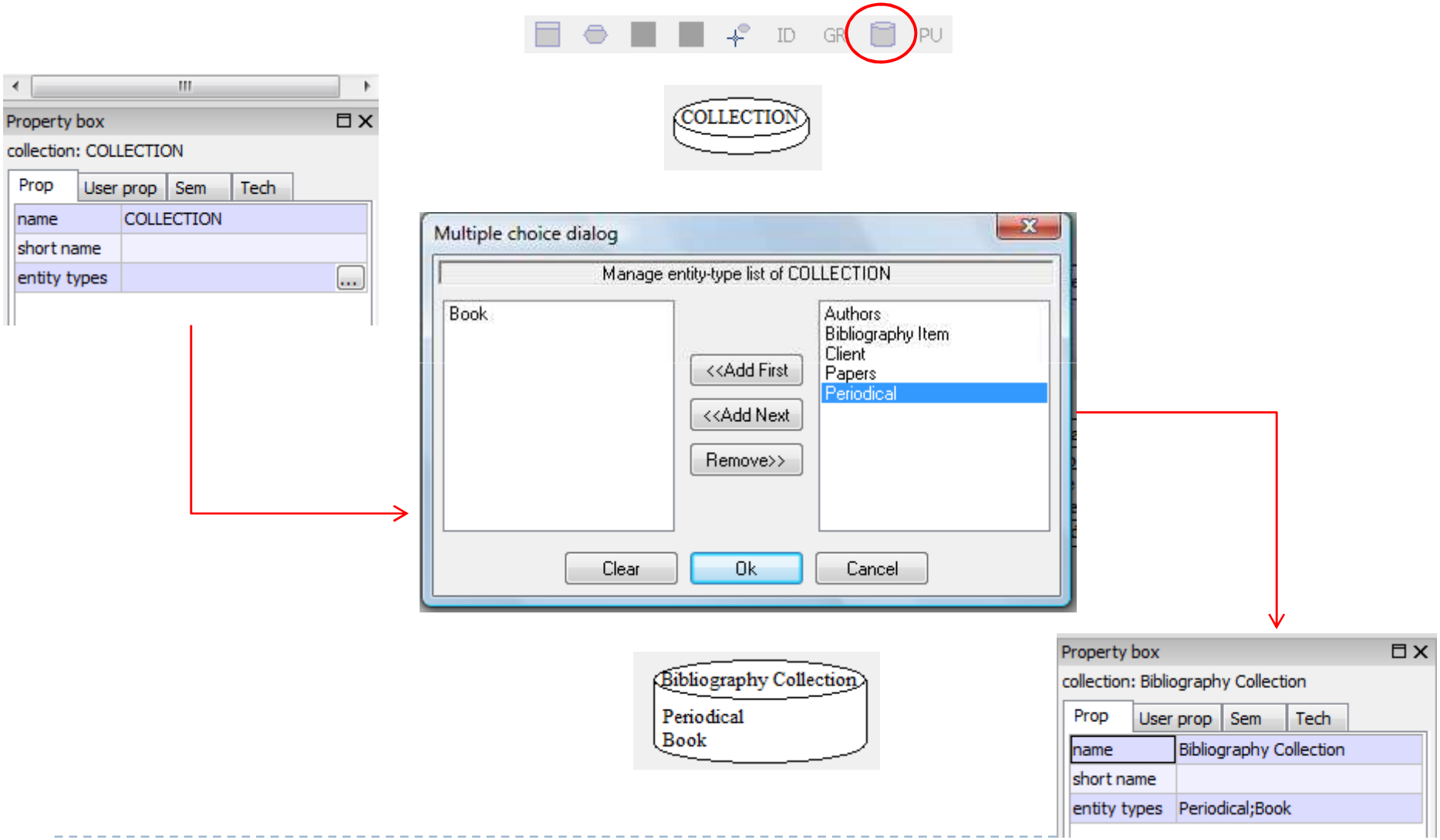
- In a data schema (ER or UML Class Diagram), an *anchored processing unit* is any dynamic or logical component of the described system that can be associated with a schema, an entity-type or a relationship type.

Entity Relationship Model - elements

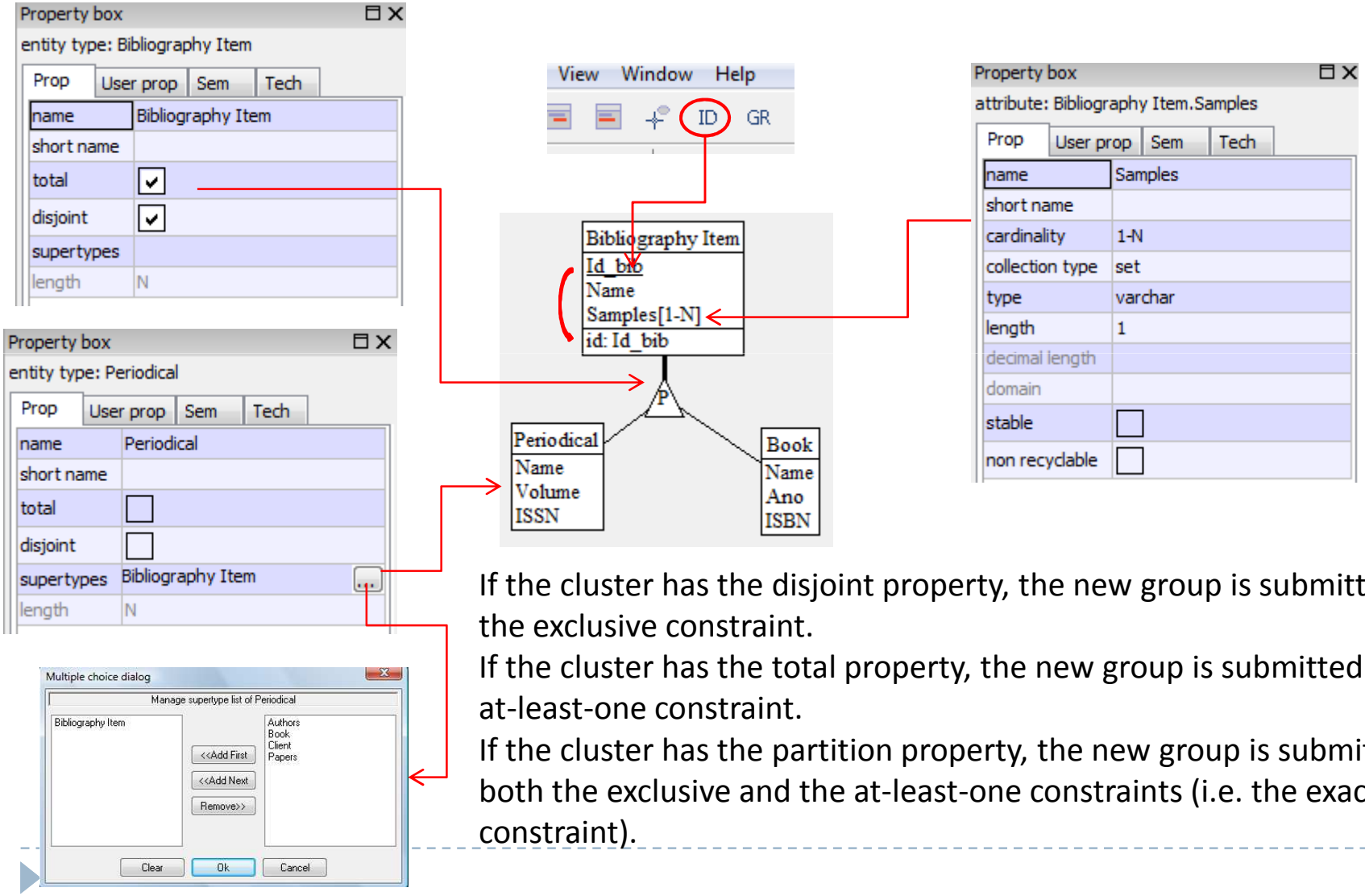


How to ...

Entity Relationship Model – how to



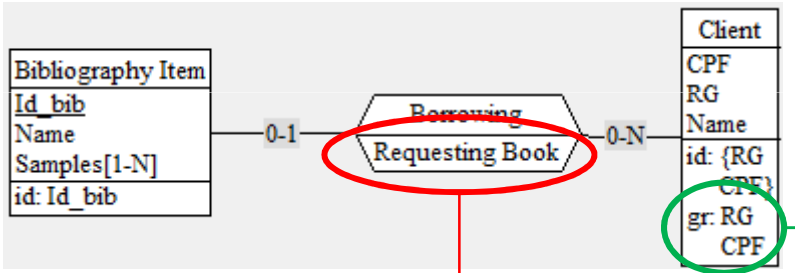
Entity Relationship Model – how to

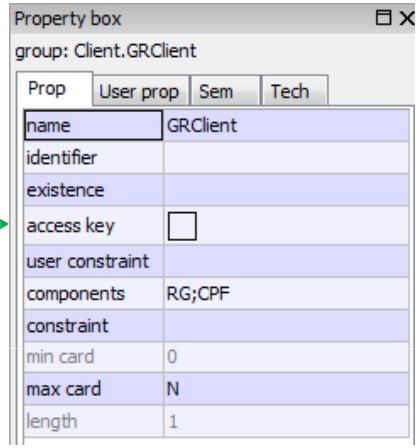


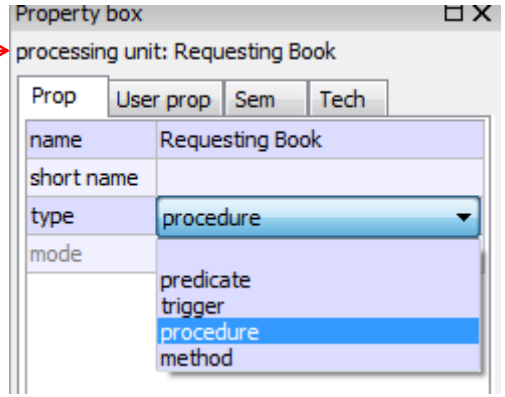
If the cluster has the disjoint property, the new group is submitted to the exclusive constraint.
If the cluster has the total property, the new group is submitted to the at-least-one constraint.
If the cluster has the partition property, the new group is submitted to both the exclusive and the at-least-one constraints (i.e. the exactly-one constraint).

Entity Relationship Model – how to

Choose an attribute or a relationship type and create the group.







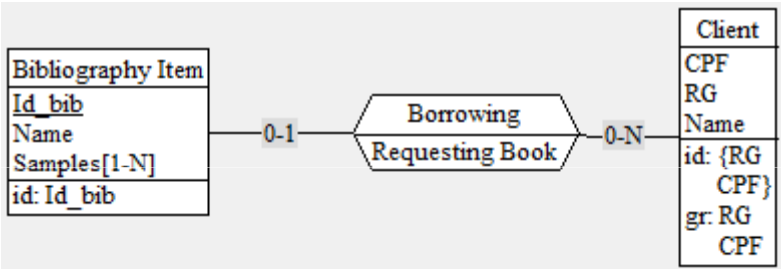
Choose an entity or a relationship type and associate the unit processing.

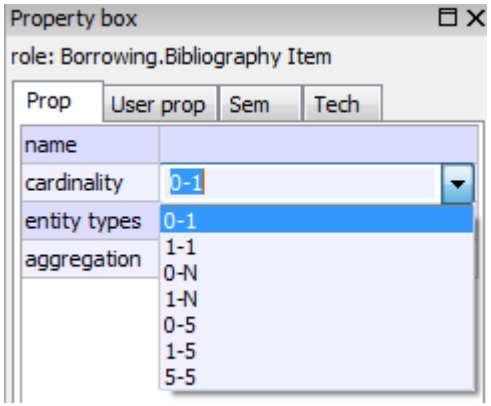
Os objetos que serão criados no SGBD como triggers, views, etc.

Entity Relationship Model – how to

Link/association between entity and relationship types.

ATENÇÃO!!!!!



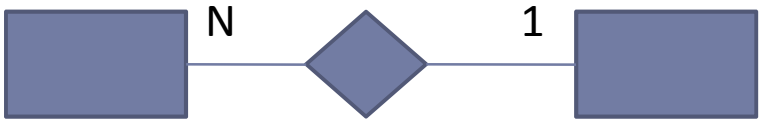


Reading:

A bibliography item can appears 0 ou 1 time in the borrow event (relationship), i.e., a bibliography item can be borrowed or not.

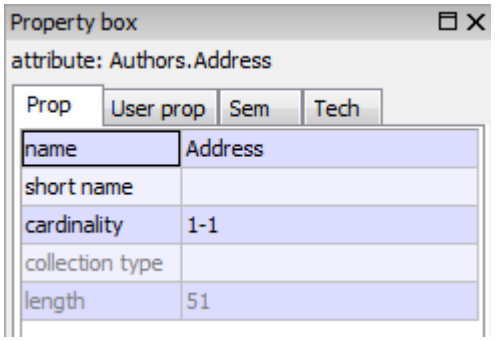
A client can appears 0 ou N times in the borrow event (relationship), i.e., a client can borrow some (or several) items or not.

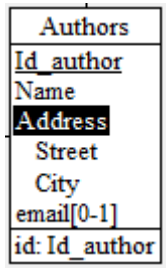
Classic view



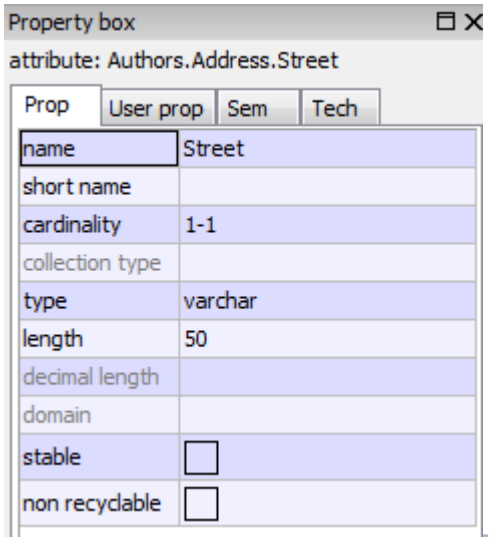
É a notação MIN-MAX – pg. 52 – Navathe!

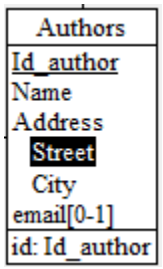
Entity Relationship Model – how to





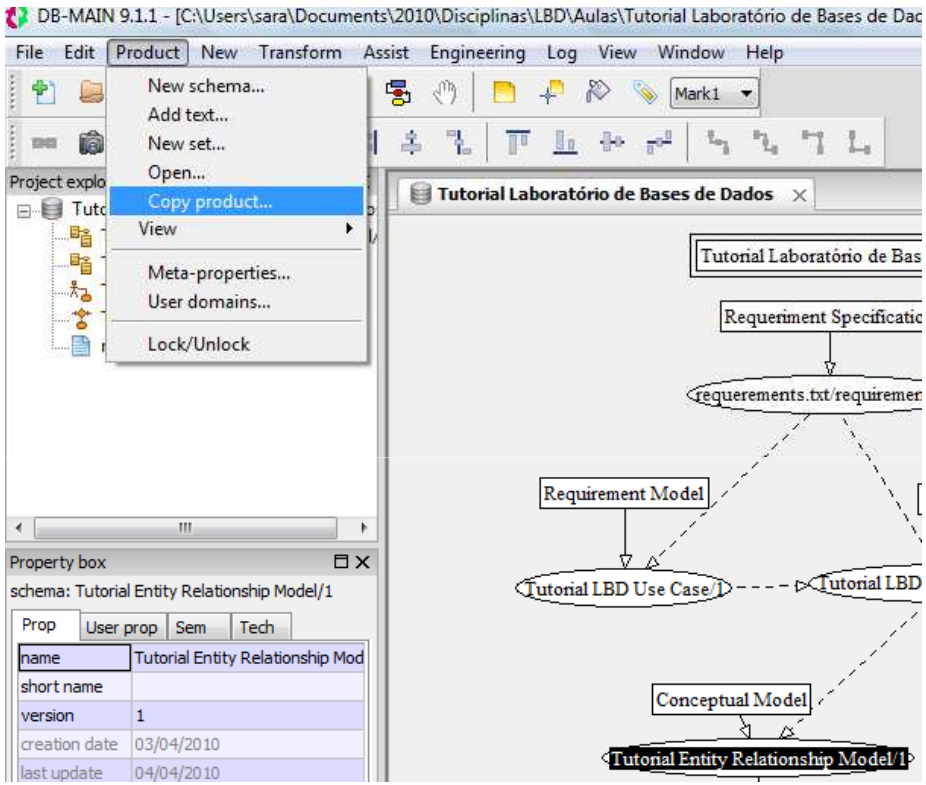
Mark the parent attribute and choose, in the toolbar, the option “First Attribute”.

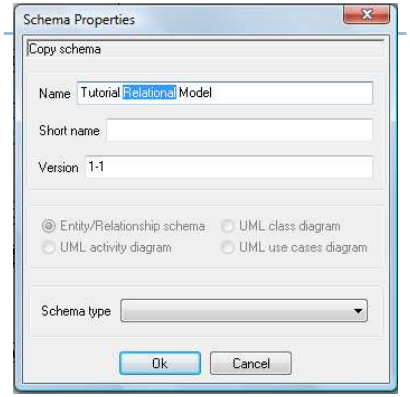


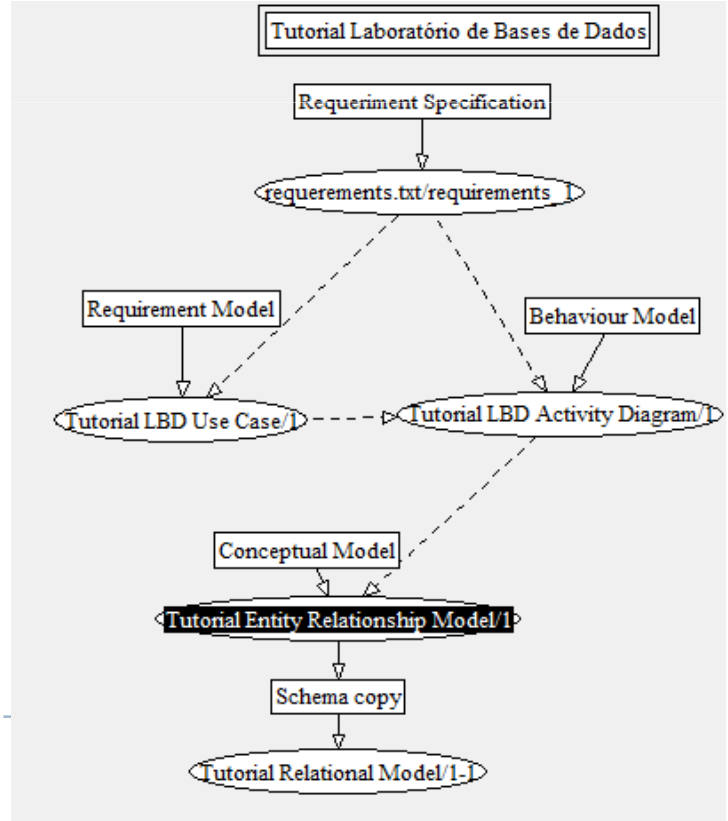


Mark the attribute and choose, in the toolbar, the option “Next Attribute”.

Building an Relation Model through an automatic mapping (1)



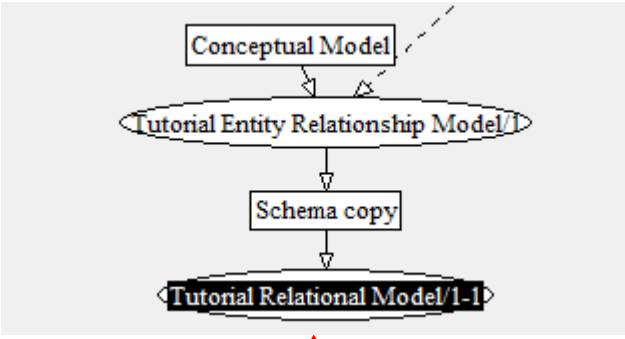




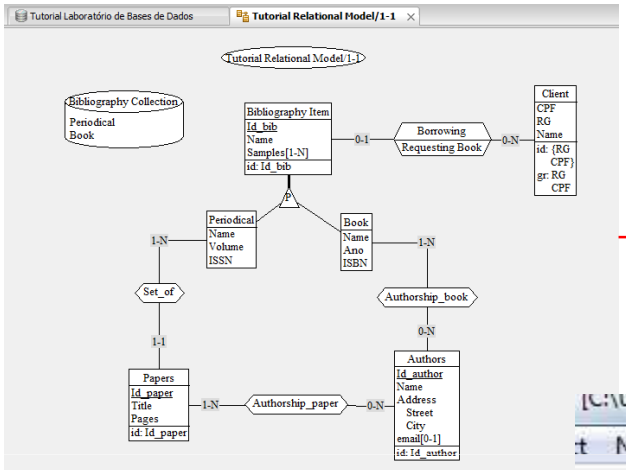
Do not execute the mapping with the original ER model. The mapping will replace the ER model by the relational model. **We cannot redo!!!!!!**

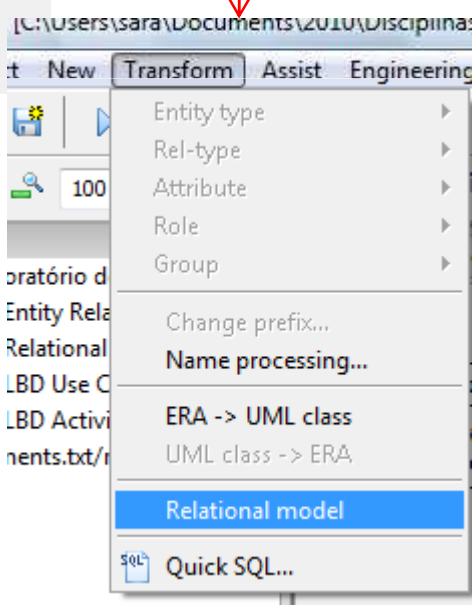
Create a schema copy!!!!!!!!!!!!!!!!!!!

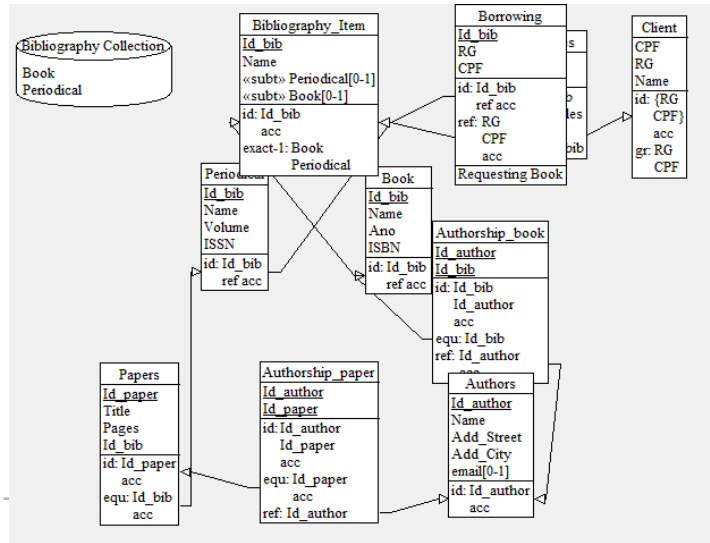
Building an Relation Model through an automatic mapping (2)



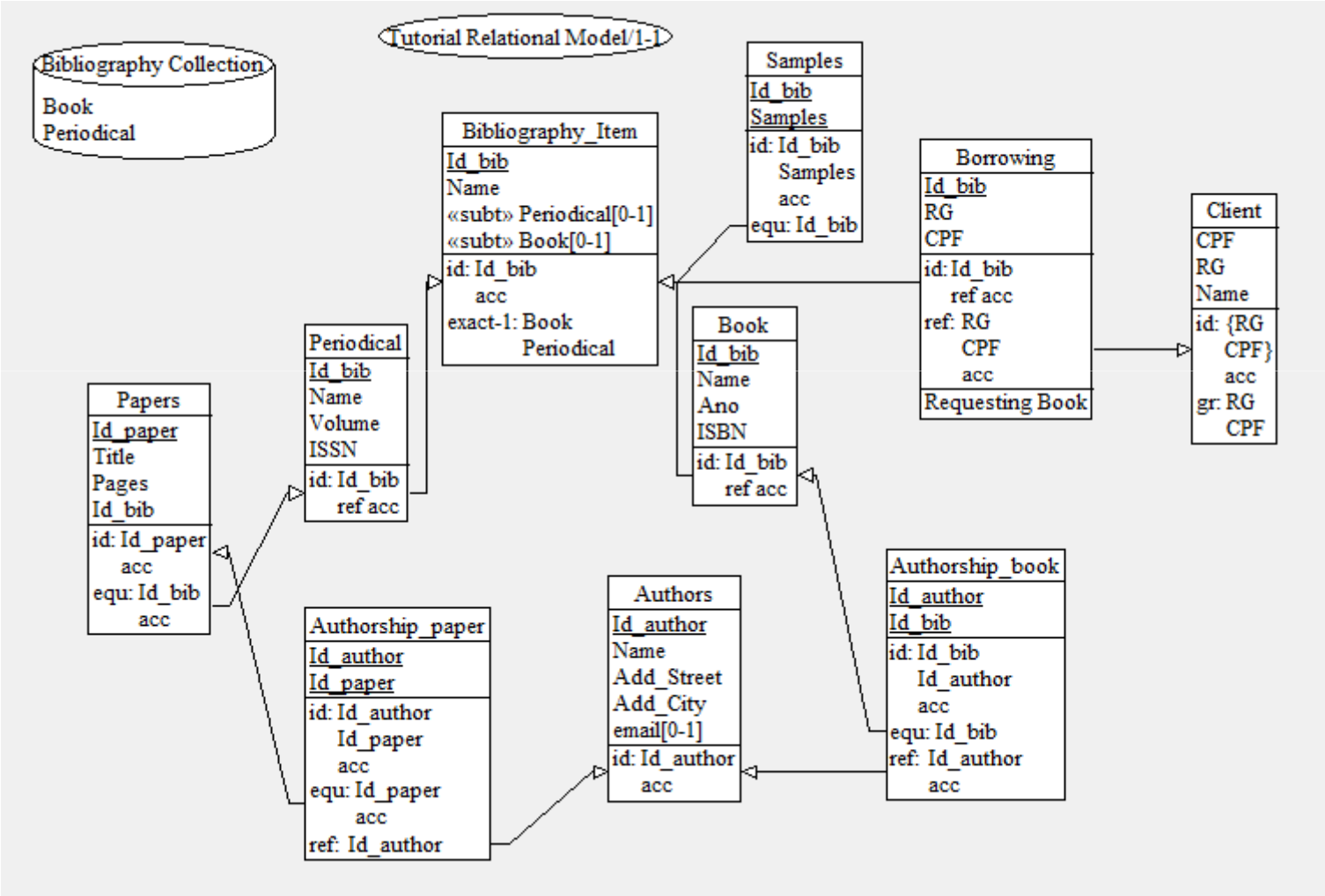
Double Click!







Building an Relation Model through an automatic mapping (3)



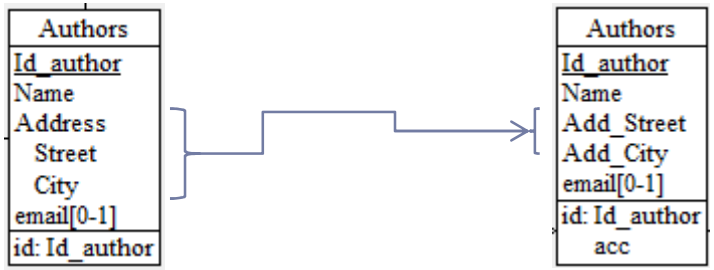
Analysing!!!!

Relation Model -automatic mapping – analysing …

ER Model

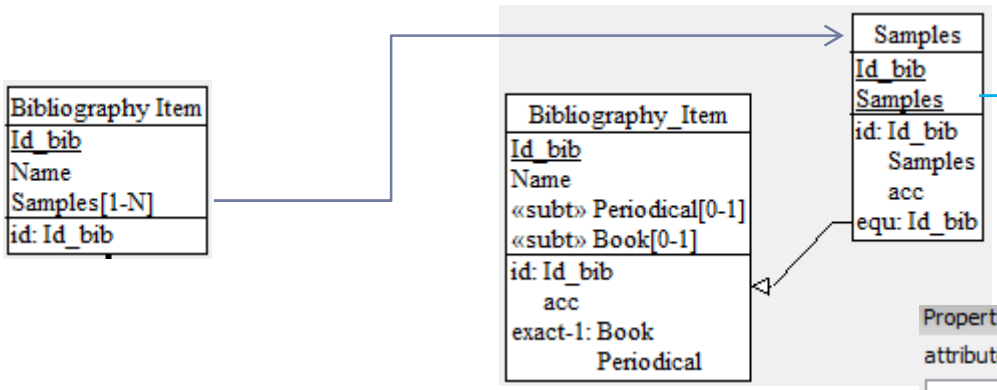
Relational Model

Compound Attribute



→ Primary key = index!

Multi-valored Attribute



Foreign key "equ" – total: All Bibliography items are associated to Samples.

attribute: Bibliography Item.Samples

Prop	User prop	Sem	Tech
name	Samples		
short name			
cardinality	1-N		
collection type	set		
type	varchar		
length	1		

Property box

attribute: Samples.Samples

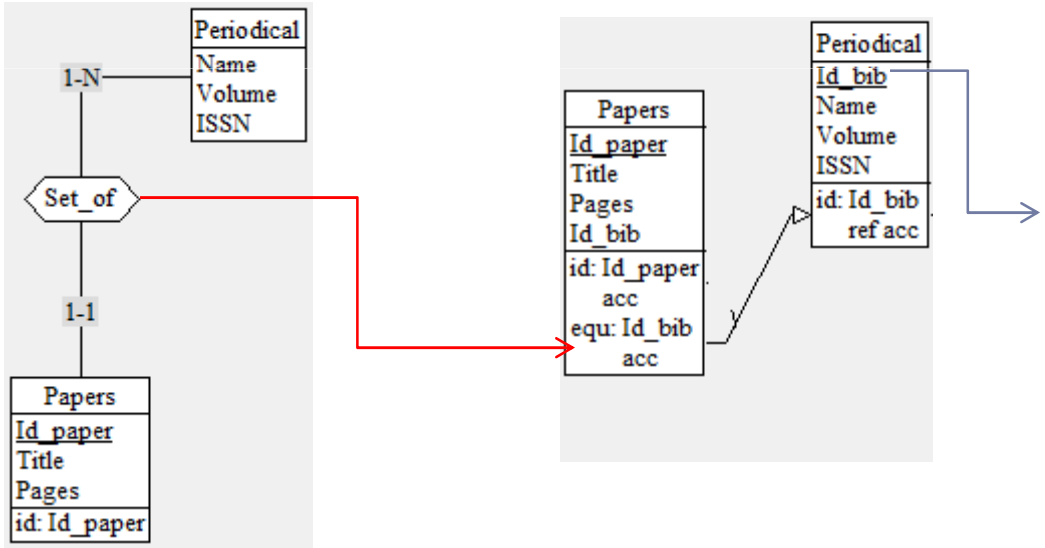
Prop	User prop	Sem	Tech
name	Samples		
short name			
cardinality	1-1		
collection type			
type	varchar		
length	1		

Relation Model -automatic mapping – analysing …

Relationship 1-N

ER Model

Relational Model

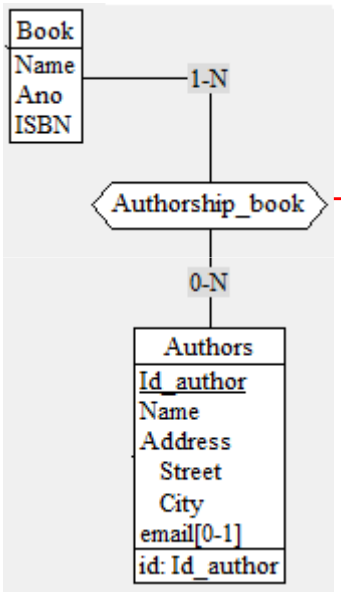


From Generalization Relationship.

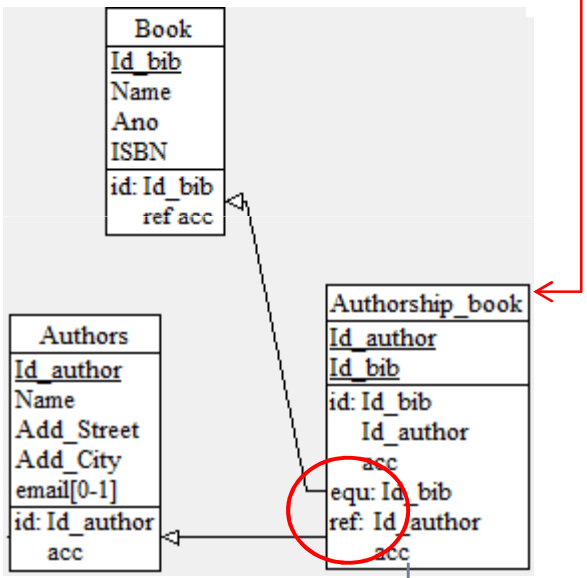
Relation Model -automatic mapping – analysing …

Relationship N-M

ER Model



Relational Model



equ → 1-N → the participation is required.

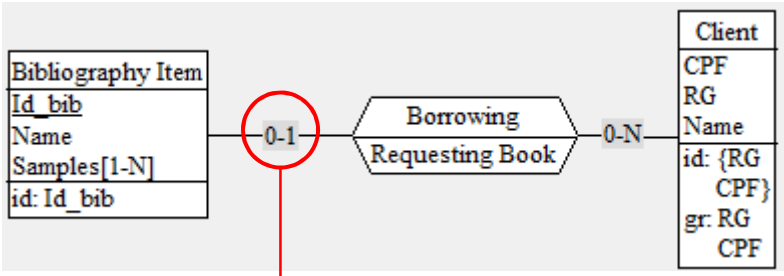
ref → 0-N → the participation is not required

The symbol **acc** (for *access key*) is associated with each identifier and each foreign key.

Relation Model -automatic mapping – analysing …

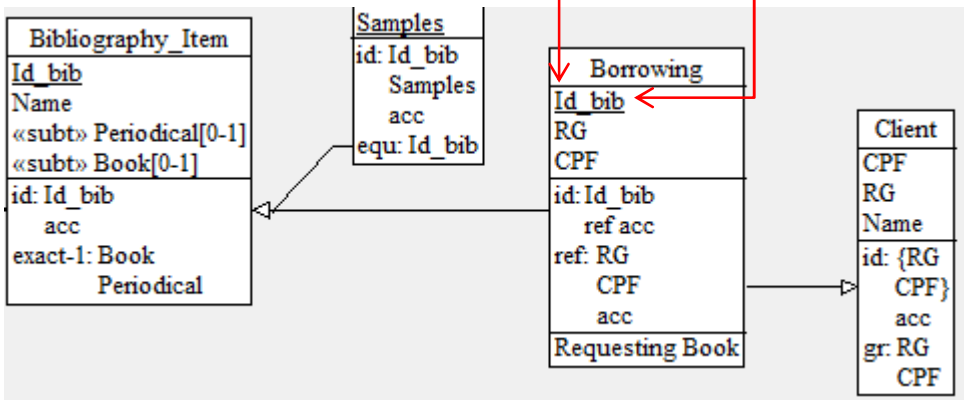
Relationship 1-N (0-N)
With specific feature – unit processing.

ER Model



The primary key is only one of the foreign keys.

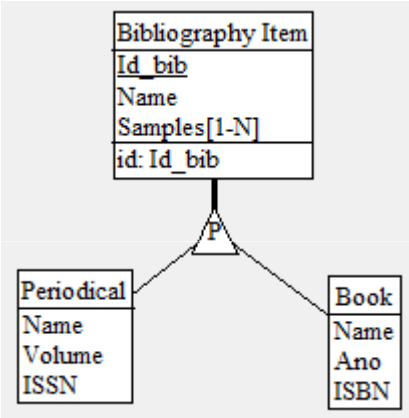
Relational Model



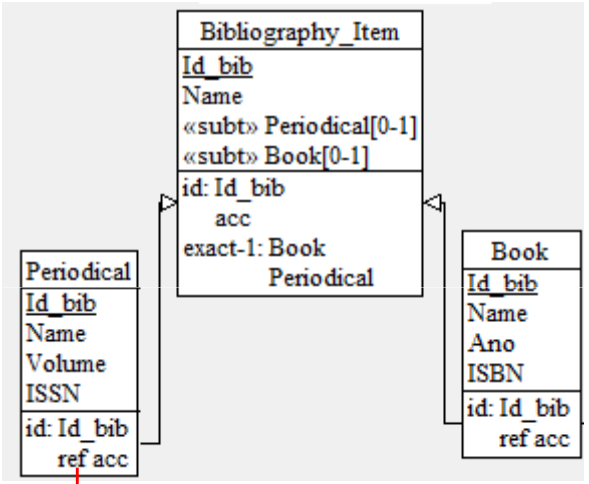
Relation Model -automatic mapping – analysing …

Generalization - Specialization.

ER Model



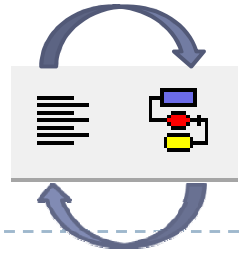
Relational Model



Ref: Foreign key – not total: Some Bibliography Items are Periodicals, others are Books.

If the cluster has the disjoint property, the new group is submitted to the exclusive constraint.
If the cluster has the total property, the new group is submitted to the at-least-one constraint.
If the cluster has the partition property, the new group is submitted to both the exclusive and the at-least-one constraints (i.e. the exactly-one constraint).

Text Standard



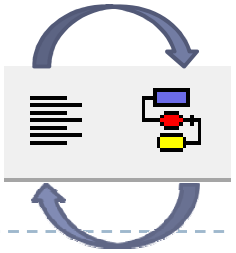
Schema Tutorial LBD Use Case/1

```
Borrow
    specialization of Internal_borrow
    specialization of External_borrow
External_borrow
Internal_borrow
COMUT
    extend to External_borrow
Special_borrowing
    include Internal_borrow

Client
    specialization of Staff
    specialization of Professor
    specialization of Student
External_Client
    specialization of Library_client
    specialization of Person_client
Library_client
Person_client
Pos_graduate_student
Professor
Staff
Student
    specialization of Undergraduate_student
    specialization of Pos_graduate_student
Undergraduate_student

COMUTing (
    [0..5]: COMUT
```

Schema Tutorial LBD Activity Diagram/1

```
INITIAL_STATE
    call Requesting Book
Requesting Book
    State Verification: call d
    in OBJECT [Book Name]
d
    call Reserving
    call SYNCHRONISATION_2
Borrowing
    call FINAL_STATE_1
    out OBJECT_1 [Not Free Book]
Reserving
    call SYNCHRONISATION
Book Reserving
    call Queue
Queue
    call SYNCHRONISATION_1
FINAL_STATE
SYNCHRONISATION
    call Book Reserving
    call Statistic Needs
Statistic Needs
    call Purchase Request
Purchase Request
    call SYNCHRONISATION_1
SYNCHRONISATION_1
    call FINAL_STATE
FINAL_STATE_1
External Authorization
    call SYNCHRONISATION_2
```

Text Standard

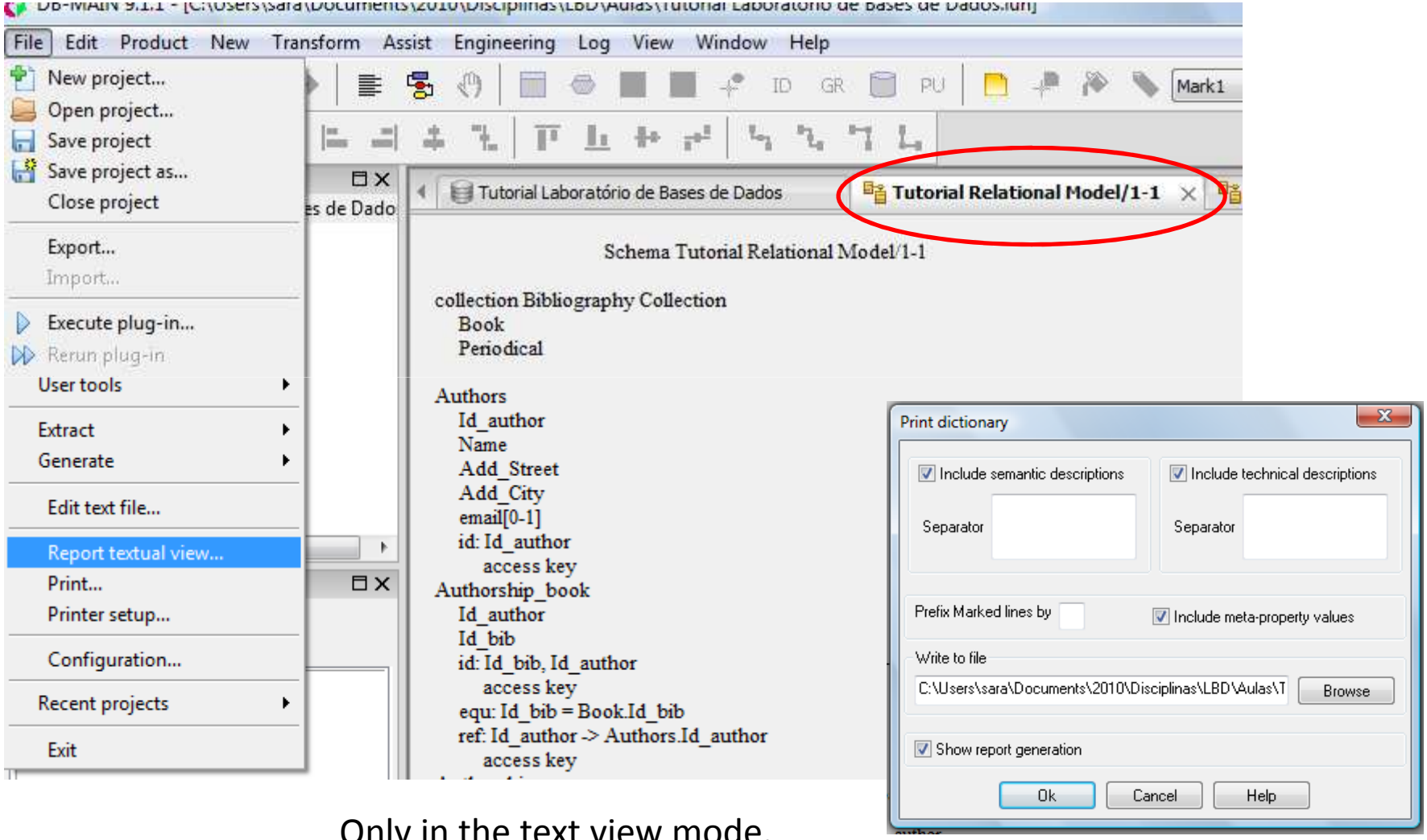


```
                    Schema Tutorial Entity Relationship Model/1

collection Bibliography Collection
    Periodical
    Book

Authors
    Id_author
    Name
    Address
        Street
        City
    email[0-1]
    id: Id_author
Bibliography Item
    Id_bib
    Name
    Samples[1-N]
    id: Id_bib
Book
    is-a Bibliography Item
    Name
    Ano
    ISBN
Client
    CPF
    RG
    Name
    id: {RG, CPF}
    group: RG, CPF
Papers
    Id_paper
    Title
    Pages
```

```
                    Schema Tutorial Relational Model/1-1

collection Bibliography Collection
    Book
    Periodical

Authors
    Id_author
    Name
    Add_Street
    Add_City
    email[0-1]
    id: Id_author
        access key
Authorship_book
    Id_author
    Id_bib
    id: Id_bib, Id_author
        access key
    equ: Id_bib = Book.Id_bib
    ref: Id_author -> Authors.Id_author
        access key
Authorship_paper
    Id_author
    Id_paper
    id: Id_author, Id_paper
        access key
    equ: Id_paper = Papers.Id_paper
        access key
    ref: Id_author -> Authors.Id_author
Bibliography_Item
    Id_bib
```

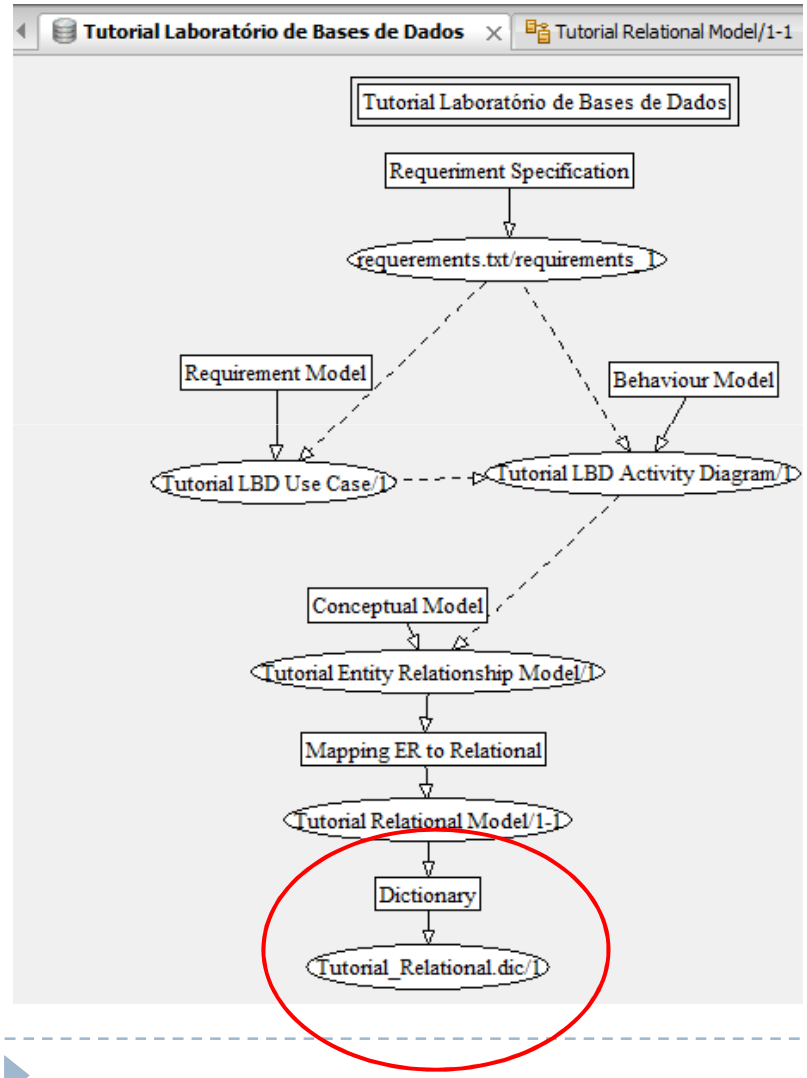
Index!

Data Dictionary



Only in the text view mode.

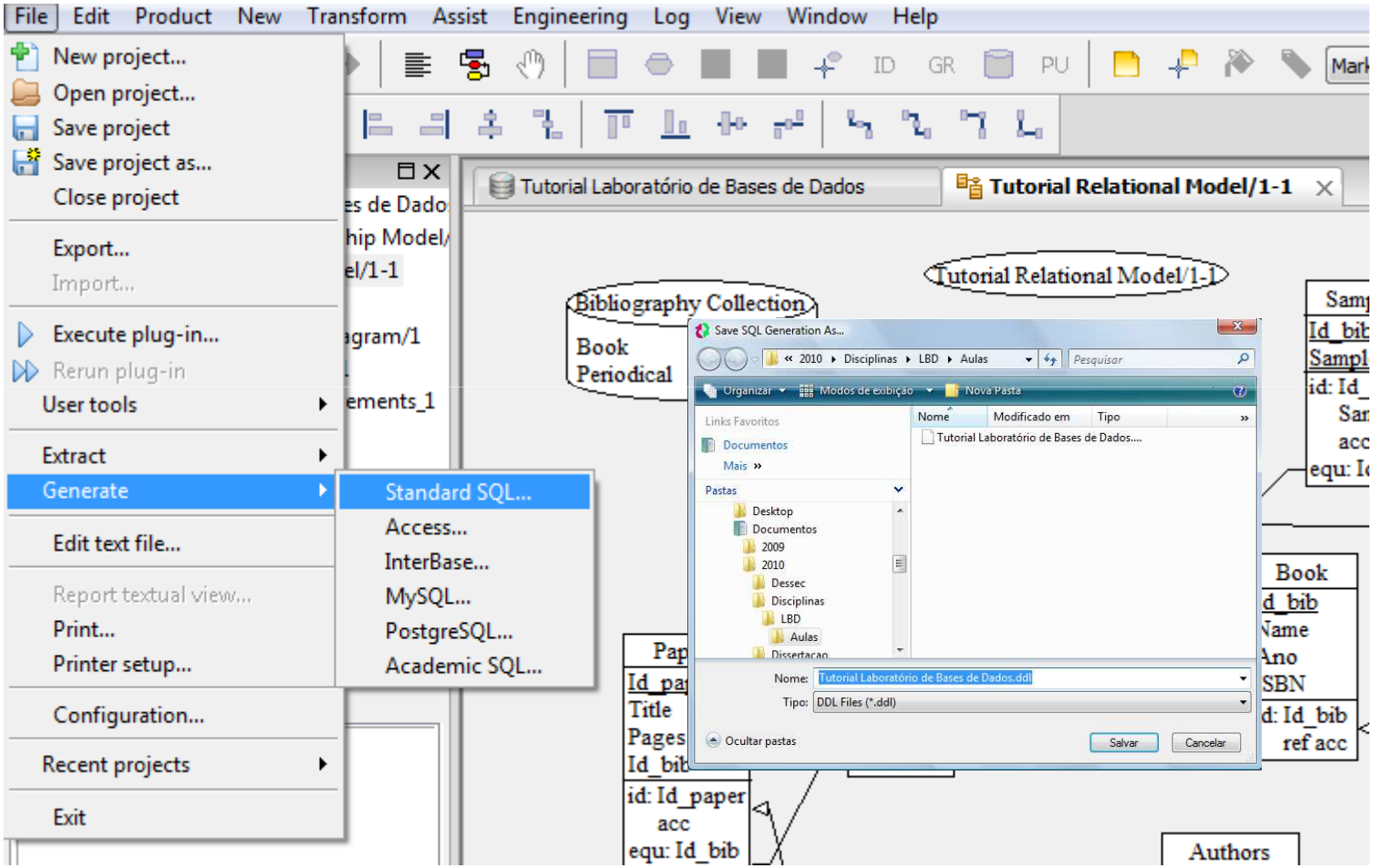
Data Dictionary



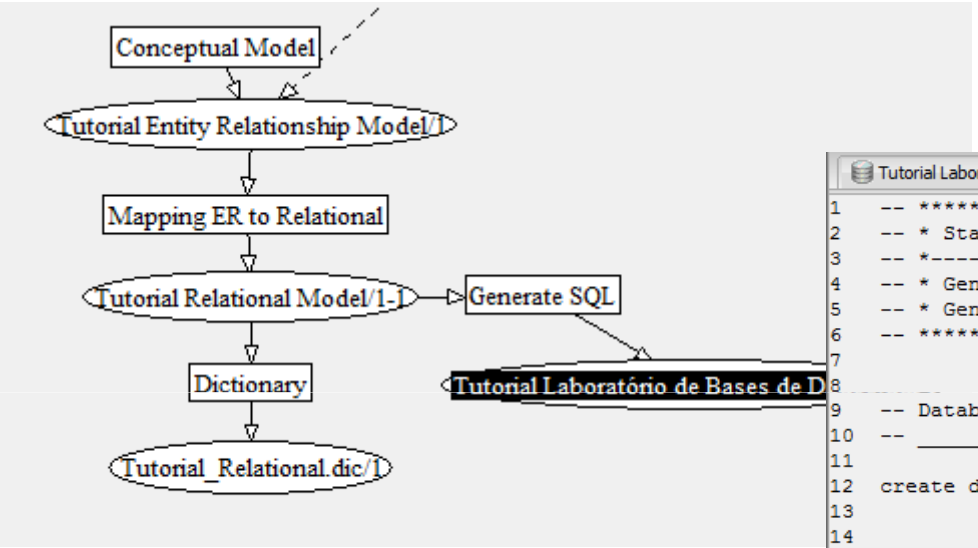

```
1   ____________________________________________________________
2
3          Dictionary report
4
5          Project              Tutorial Laboratório de Bases de Dados
6   ____________________________________________________________
7
8
9
10                        Schema Tutorial Relational Model/1-1
11
12     collection Bibliography Collection
13        Book
14           MappingOID: 525
15        Periodical
16           MappingOID: 523
17
18     Authors
19        MappingOID: 558
20        Id_author
21           MappingOID: 560
22        Name
23           MappingOID: 562
24        Add_Street
25           MappingOID: 574
26        Add_City
27           MappingOID: 578
28        email[0-1]
29           MappingOID: 592
30        id: Id_author
```

```
168              Supertype: Bibliography Item
169              MappingOID: 1093
170     Samples
171        MappingOID: 1143
172        Id_bib
173           MappingOID: 531
174        Samples
175           MappingOID: 600
176        id: Id_bib, Samples
177           MappingOID: 1150
178           access key
179              MappingOID: 1150
180        equ: Id_bib = Bibliography_Item.Id_bib
181           MappingOID: 1145
182
183
```

Generating the SQL Script



Generating the SQL Script



Tutorial Laboratório de Bases de Dados | Tutorial Laboratório de Bases de Dados.ddl/1

```
1   -- ********************************************
2   -- * Standard SQL generation                  *
3   -- *------------------------------------------*
4   -- * Generator date:  Feb 26 2010             *
5   -- * Generation date: Mon Apr 05 15:41:25 2010 *
6   -- ********************************************
7
8
9   -- Database Section
10  -- _________________
11
12  create database Tutorial Relational Model;
13
14
15  -- DBSpace Section
16  -- ________________
17
18  create dbspace Bibliography Collection;
19
20
21  -- Tables Section
22  -- ______________
23
24  create table Authors (
25       Id_author char(1) not null,
26       Name char(1) not null,
27       Add_Street -- Compound attribute -- not null,
28       Add_City char(1) not null,
29       email char(1),
30       constraint ID_Authors_ID primary key (Id_author));
31
```

FIM!!