



# Database Systems

## Introduction of DB Design Support Tool





# *Outline*

- Introduction
- Getting started with ER-win
- Choose model type and target database
- Basic screen configuration
- Choose data model diagram notation
- Choose data modeling phase
- Logical data modeling with ER-win (Company DB)
- Supplement

# Introduction

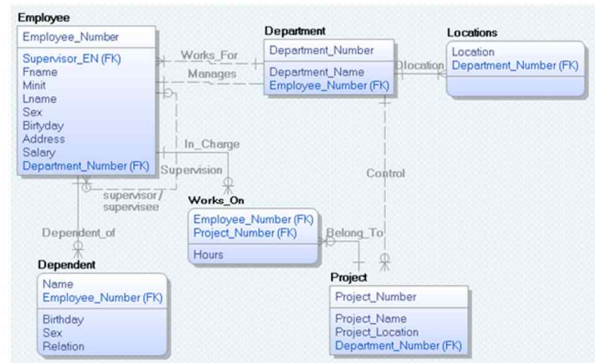
- ER-win
  - Data modeling tool
    - One of most popular CASE tool for database design
    - It can support not only to conceptual design with ER diagram but also to convert the conceptual schema to logical schema and even for forward/backward engineering.

Figure 8.1  
The ER conceptual schema diagram for the COMPANY database.



Example of conceptual diagram

convert

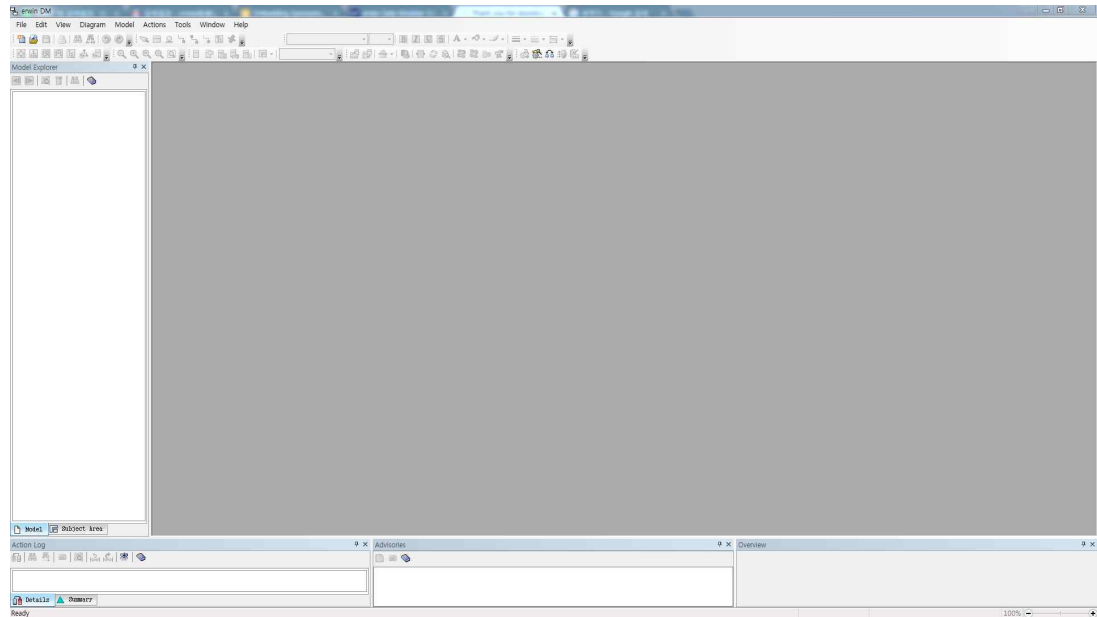


Example of logical diagram

# *Getting started with ER-win*

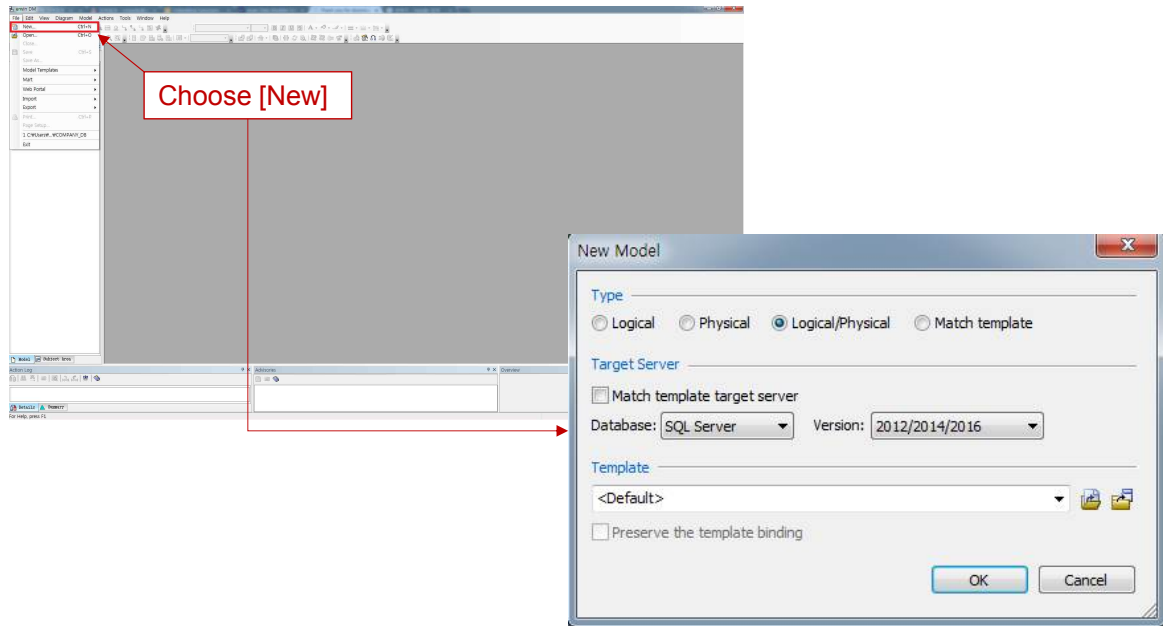
- Program execution

- [start button] → [program] → [erwin] → [AllFusion] → [Erwin Data Modeler r9.7] → Execute [Erwin Data Modeler r9.7]



## *Choose model type and target database (cont'd.)*

- Choose **[File]** in menu → choose **[New]** to open '**New Model**' dialog box.

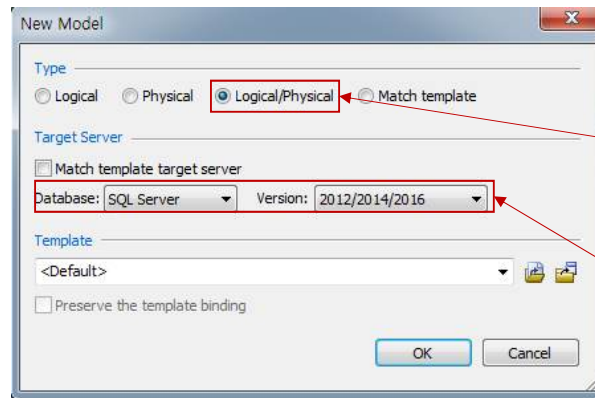


## *Choose model type and target database (cont'd.)*

- Choose model type.
  - **‘Logical’** model
    - For designing conceptual schema which contains the detailed information of entity types and relationship type such as attribute, primary key etc.
    - Not support to specify and design target DBMS and version, trigger, stored procedures etc.
  - **‘Physical’** model
    - For designing physical schema which contains the features related with specified DBMS
- The **‘logical/physical’** model type usually is used for normal and full design procedure.

## *Choose model type and target database (cont'd.)*

- Choose model type and target DBMS.
  - In this class, we will use “**SQL Server 201X**”.

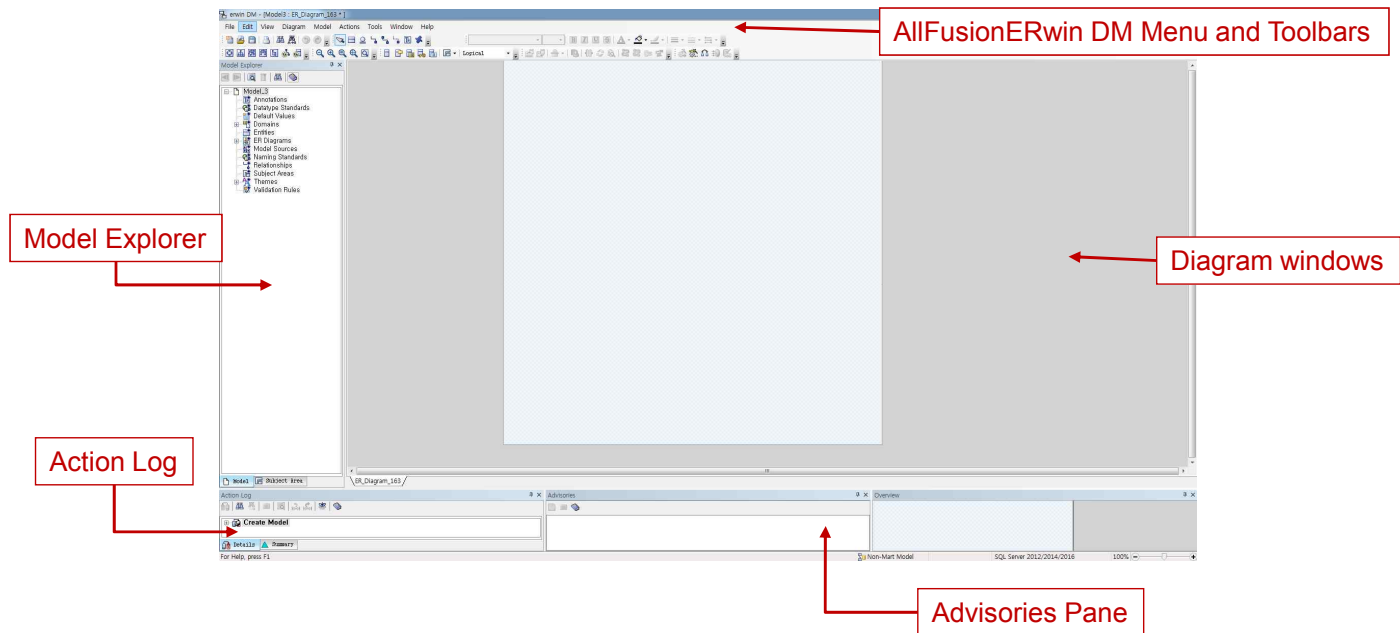


Click [Logical/Physical] type

Choose [SQL Server] database.  
Choose [2012/2014/2016] version

# *Basic screen configuration*

- It consists of one menu bar for user friendly interface and four sub windows for displaying different contents.





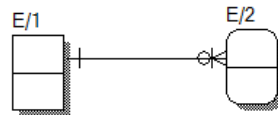
# *Basic screen configuration (cont'd.)*

Division	Function
Toolbars	<ul style="list-style-type: none"><li>➤ The buttons to help modeling works are gathered.</li><li>➤ It can be rearranged with that user wants.</li></ul>
Advisories Pane	<ul style="list-style-type: none"><li>➤ The certain amount of information about processed works by current user is shown.</li></ul>
Model Explorer	<ul style="list-style-type: none"><li>➤ It is explorer window in model.</li><li>➤ Each object shown in explorer has hierarchical structure.</li></ul>
Action Log	<ul style="list-style-type: none"><li>➤ Processed works by current user are recorded in real time.</li></ul>
Diagram Windows	<ul style="list-style-type: none"><li>➤ After model generation, the name of window is basically set as 'Display1', and user can progress modeling process on this area.</li></ul>

# *Choose data model diagram notation*

## • IE notation

- Information Engineering
- Notation uses the combination of line and circle looks like crow's foot.
- Widely used notation



## • IDEF1X notation

- Notation uses circle and diamond.
- Initial setup notation of ER-win

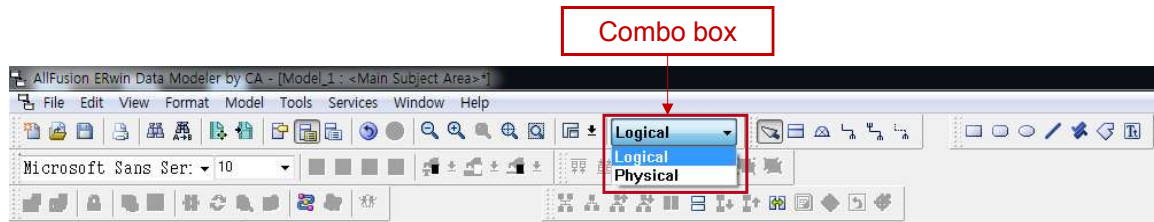


- **Change to IE from the initial IDEF1X notation.**



# *Choose data modeling phase*

- User can choose 'Logical' or 'physical' data modeling
  - If user choose 'Logical/Physical' type model when they started data modeling.
  - At combo box in toolbar
  - Refer to slide 6 for the details of each mode type.



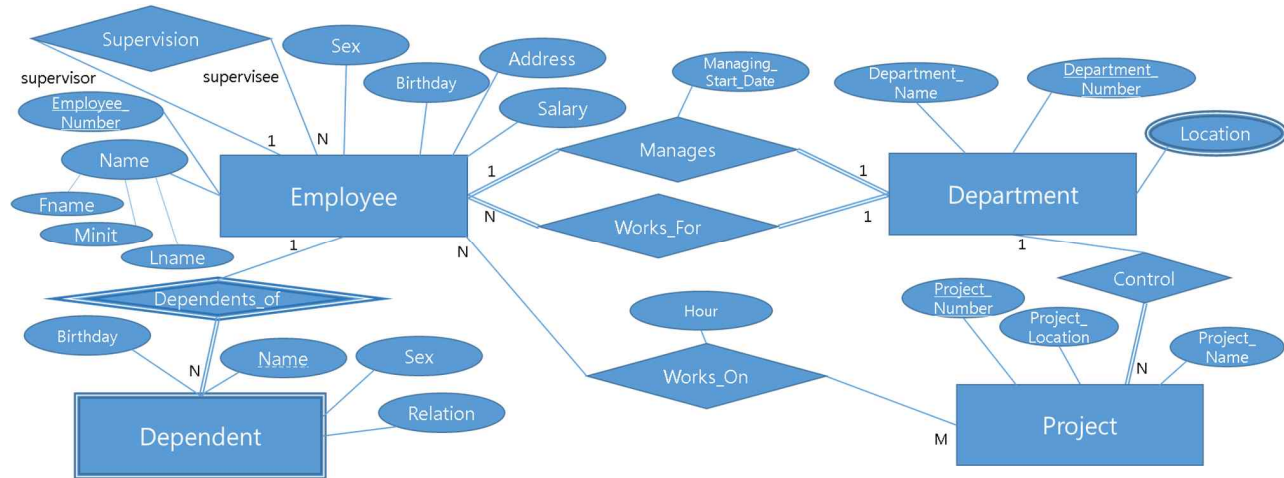


## *Logical data modeling with ER-win (Company DB)*

- Logical data modeling with ER-win is generally performed by the following 5 steps.
  - Step 1: Draw entity types
  - Step 2: Arrange entity types
  - Step 3: Set relationship type between entity types
  - Step 4: Naming relationship types
  - Step 5: Set the cardinality and optionality of each relationship type

# *Logical data modeling with ER-win (Company DB) (cont'd.)*

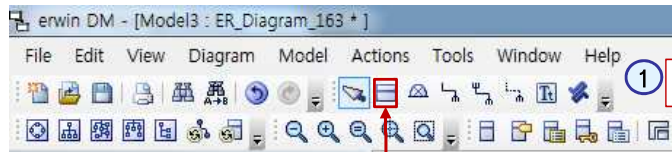
- This is conceptual diagram of company database as an example.



**Figure 2.** Conceptual diagram of company DB

# *Step 1: Draw entity types*

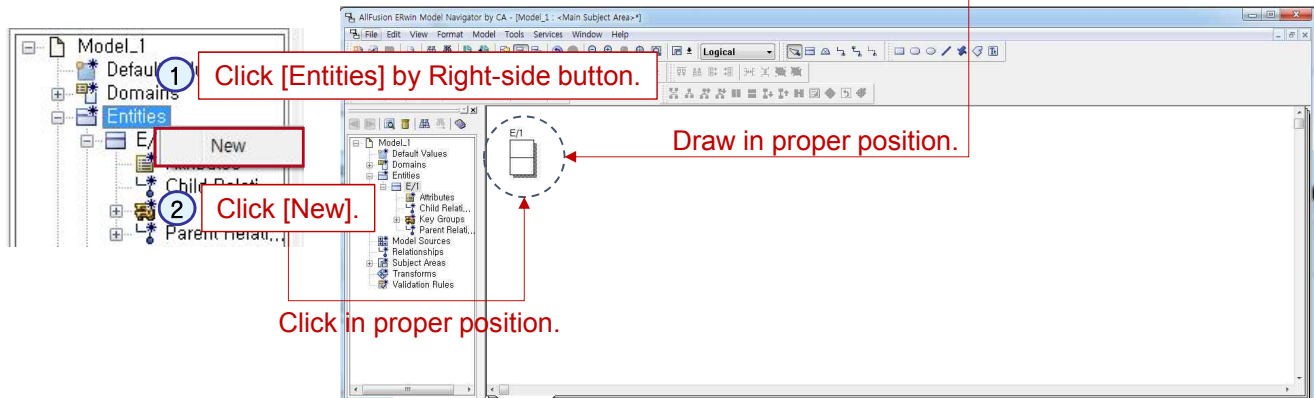
- Entity type can be created by either 'Method 1' or 'Method 2'.
- Method 1: Using toolbar**



Click [Entity] icon and draw in diagram windows.

Entity

- Method 2: Using model explorer**



Click [Entities] by Right-side button.

Click [New].

Draw in proper position.

Click in proper position.

# *Step 1: Draw entity types (cont'd.)*

- Entity type

The image consists of two screenshots of the erwin DM software interface, illustrating the process of creating an entity type.

**Left Screenshot:** Shows the 'erwin DM - [Model3 : ER\_Diagram\_163 \*]' window. The 'Model Explorer' on the left lists various model components. The main canvas displays a template entity symbol labeled 'E/1'. Three red callout boxes point to specific parts of the symbol:

- Entity Name:** Points to the top section of the entity symbol.
- Area for the primary key attribute:** Points to the middle section of the entity symbol.
- Area for normal attributes:** Points to the bottom section of the entity symbol.

A red dashed box contains the following instructions:

- How to fill in each area?
  - ① Click entity
  - ② Push 'Tab' key at keyboard to move to next area
  - ③ Write contents

A red arrow labeled 'Fill in' points from the instructions to the right screenshot.

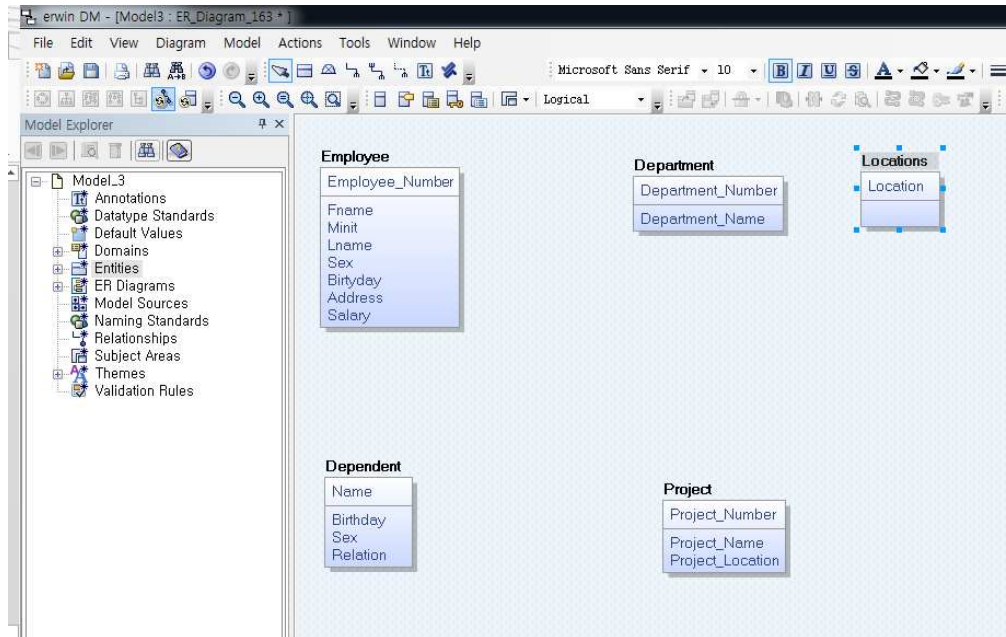
**Right Screenshot:** Shows the same software window, but the entity is now named 'Employee'. The 'Model Explorer' on the left is the same. The main canvas displays the 'Employee' entity symbol, which has been filled with the following attributes:

- Employee\_Number
- Fname
- Minit
- Lname
- Sex
- Birthday
- Address
- Salary



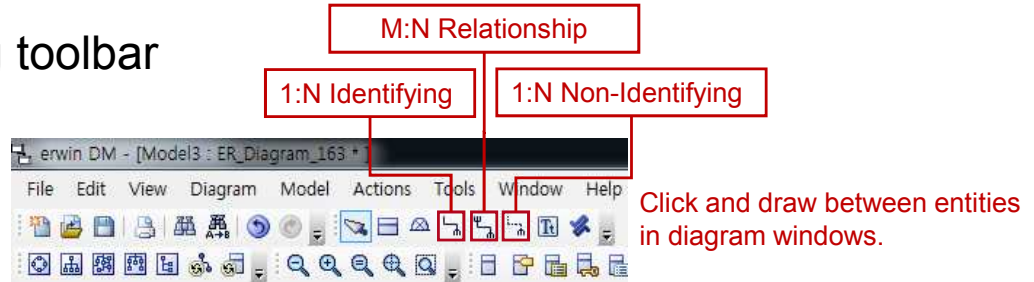
## *Step 2: Arrange entity types*

- Entity types are placed properly by rearranging.



# Step 3: Set relationship types

- **Method:** Using toolbar



- Relationship type

- **Identifying** for between weak entity type and its owner:
  - Primary key of the owner is used as part of the primary key of the weak entity type.
  - The weak entity is represented by rounded rectangle in ER-win.
- **Non-Identifying** for between strong entity types:
  - Primary key of the first entity type is used for normal attribute of the other.

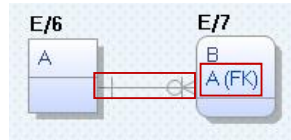


Figure 3. Example of identifying

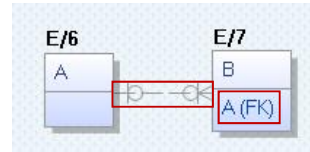
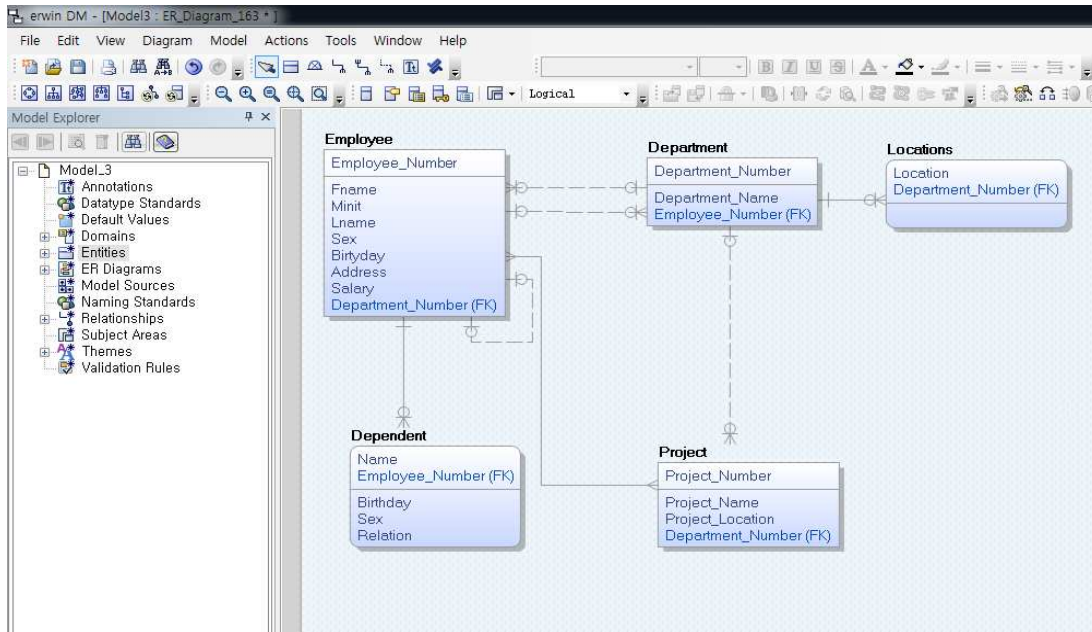


Figure 4. Example of non-identifying

## *Step 3: Set relationship type (cont'd.)*

- After creating the relationship types between entity types.



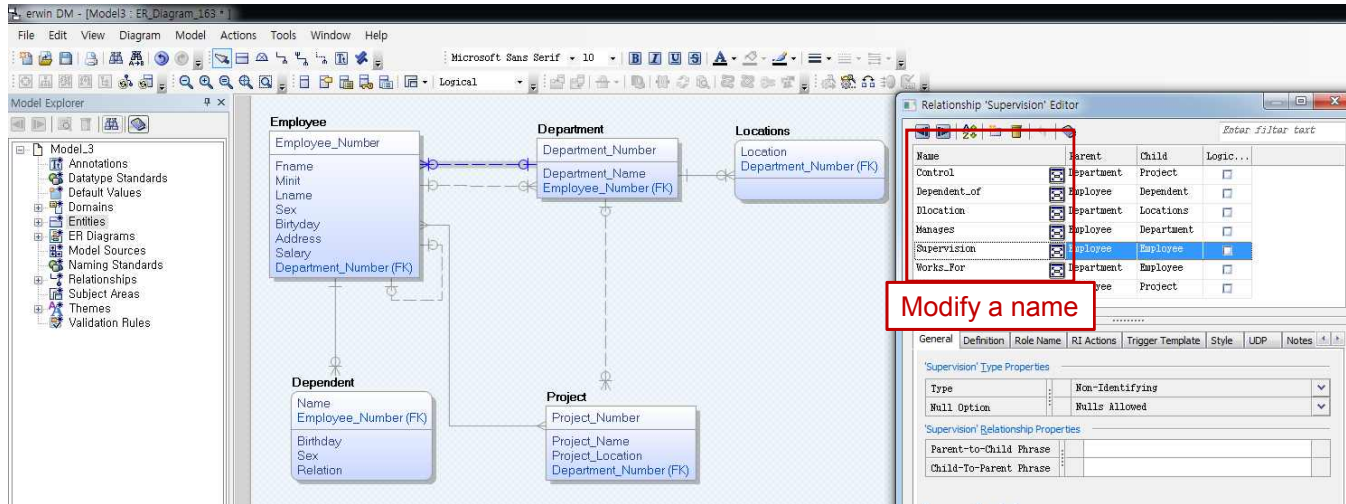
## Step 4: Naming relationship types

- **Method:** Using relationship property dialog box

The diagram illustrates the process of naming a relationship type in a database model. It consists of three main parts:

- Model Diagram:** A diagram showing two entity types, E/9 (A) and E/10 (B A (FK)), connected by a relationship line. A red arrow labeled '1' points from the relationship line to the context menu.
- Context Menu:** A menu that appears after a right-click on the relationship line. It contains several options, with 'Properties' highlighted. A red arrow labeled '2' points from 'Properties' to the 'Relationship 'R/12' Editor' dialog box.
- Relationship 'R/12' Editor:** A dialog box for editing the relationship type. It has a 'Name' tab selected, showing a list of relationship types. The relationship type 'R/12' is highlighted, and its name is shown in a red box labeled 'Relation Name'. The 'General' tab is also visible, showing the 'Type' as 'Identifying' and the 'Cardinality' as 'Zero, One or More'.

## Step 4: Naming relationship types (cont'd.)



# Step 4: Naming relationship types (cont'd.)

- To show name of relationship type in diagram
  - Using model property dialog box

The screenshot shows the erwin DM - [Model3: ER\_Diagram\_163] Editor. The main diagram displays entities: Employee (Employee\_Number, FName, MInit, LName, Sex, Birthday, Address, Salary, Department\_Number (FK)), Department (Department\_Number, Department\_Name, Employee\_Number (FK)), Locations (Location, Department\_Number (FK)), and Project (Project\_Number, Project\_Name, Project\_Location, Department\_Number (FK)).

Annotations and steps:

- 1 Click right-side button anywhere in diagram window area
- 2 Choose
- 3 Choose [relationship] tap.
- 4 Choose

The 'Properties...' dialog box is open, showing the 'Relationship' tab. The 'Display Logical Relationship Name' checkbox is checked.

ER Diagram 'ER\_Diagram\_163' Editor

Edit ER Diagrams in: Model\_3

Enter filter text

Name: ER\_Diagram\_163 View Mode: Logical Auto-populate: [checked]

Relationship

Relationship Display Options

Display Relationships: [checked]

Relationship Logical Display Options

Display Logical Relationship Name: [checked]

Display Logical Cardinality: [checked]

Display Logical Referential Integrity: [checked]

Display Subtype Discriminator: [checked]

Relationship Physical Display Options

Display Physical Relationship Name: [checked]

Display Physical Cardinality: [checked]

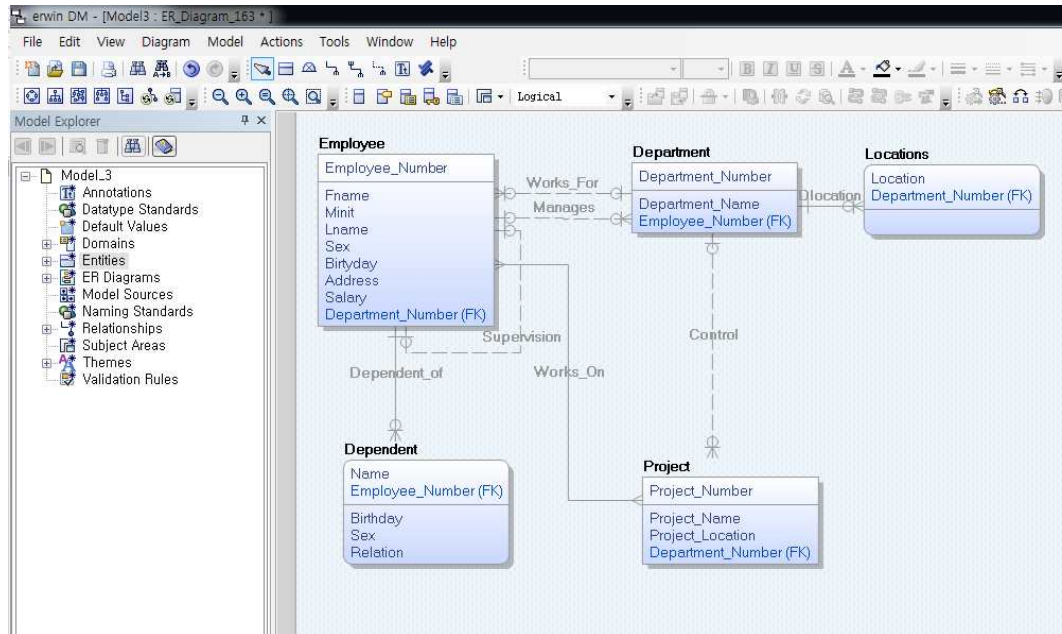
Physical Referential Integrity: [checked]

Generated Relationships: [checked]

Close Cancel

## *Step 4: Naming relationship types (cont'd.)*

- After naming relationship types



# Step 5: Set the cardinality and optionality

- **Method:** Using relationship property dialog box

The diagram illustrates the process of setting cardinality and optionality for a relationship. It consists of three main parts:

- Relationship Diagram:** A diagram showing two entities, E/9 (A) and E/10 (B A (FK)), connected by a relationship line. A red arrow labeled '1' points to the right-side button on the relationship line.
- Context Menu:** A context menu is shown with the 'Properties' option highlighted. A red arrow labeled '2' points to the 'Properties' option, with a red box labeled 'Choose' next to it.
- Relationship 'Control' Editor:** The 'Relationship 'Control' Editor' dialog box is shown. It has several tabs: General, Definition, Role Name, RI Actions, Trigger Template, Style, UDP, and Notes. The 'General' tab is selected. The dialog box contains three sections:
  - Control Type Properties:** Includes 'Type' (Non-Identifying) and 'Null Option' (Nulls Allowed).
  - Control Relationship Properties:** Includes 'Parent-to-Child Phrase' and 'Child-to-Parent Phrase'.
  - Control Cardinality Properties:** Includes 'Cardinality' (Zero, One or More) and 'Cardinality Value' (1).

Red arrows point from the red boxes to the corresponding fields in the dialog box:

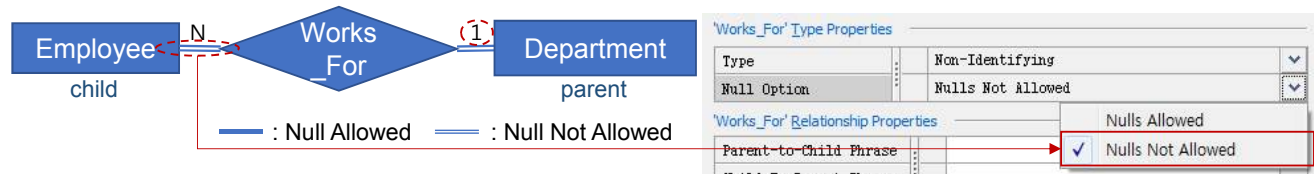
- From 'Type & Null option' to the 'Type' and 'Null Option' fields.
- From 'Phrase' to the 'Parent-to-Child Phrase' and 'Child-to-Parent Phrase' fields.
- From 'Cardinality' to the 'Cardinality' and 'Cardinality Value' fields.



# Step 5: Set the cardinality and optionality (cont'd.)

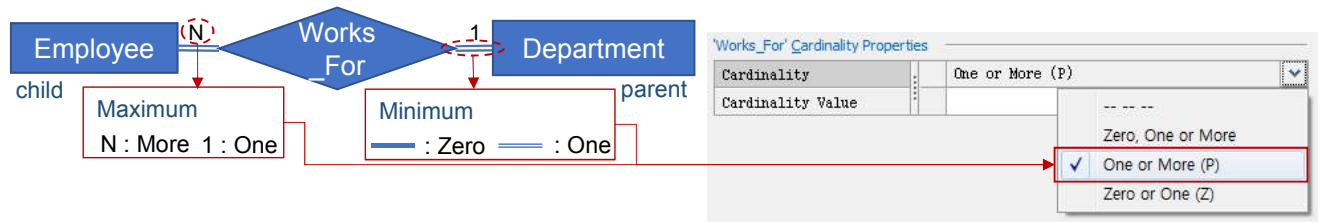
## • Null option

- Ascertain whether an instance at child entity type must have the relationship with the instance at parent entity type or not



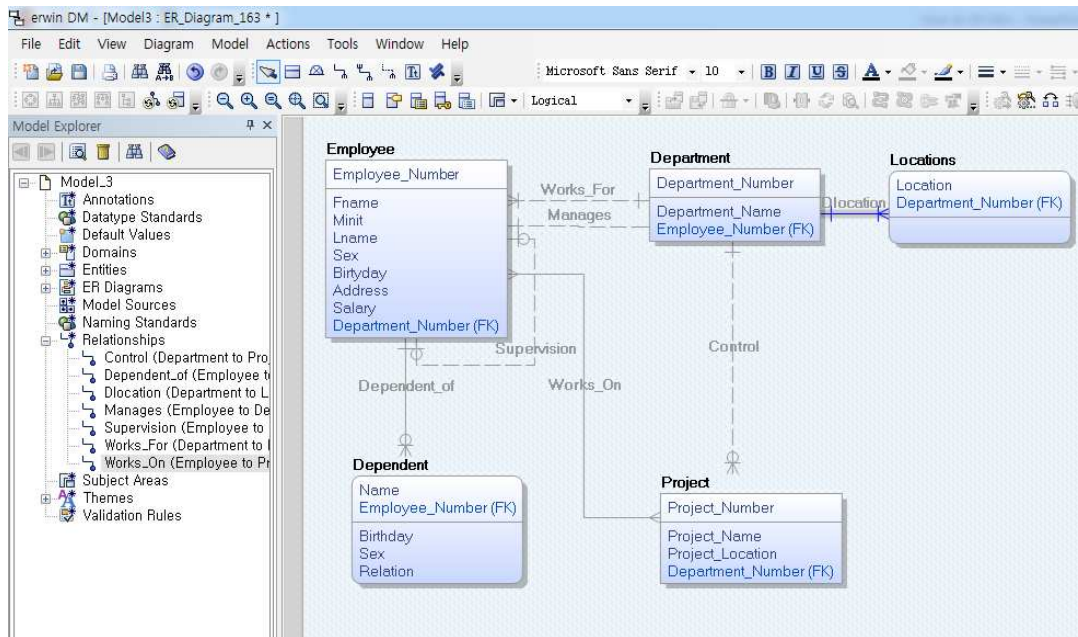
## • Cardinality

- The limit number of instances at child entity type which have the relationship with one instance at parent entity type



## *Step 5: Set the cardinality and optionality (cont'd.)*

- After specifying the proper cardinality and optionality for relationship types (compared with the figure in slide 23)

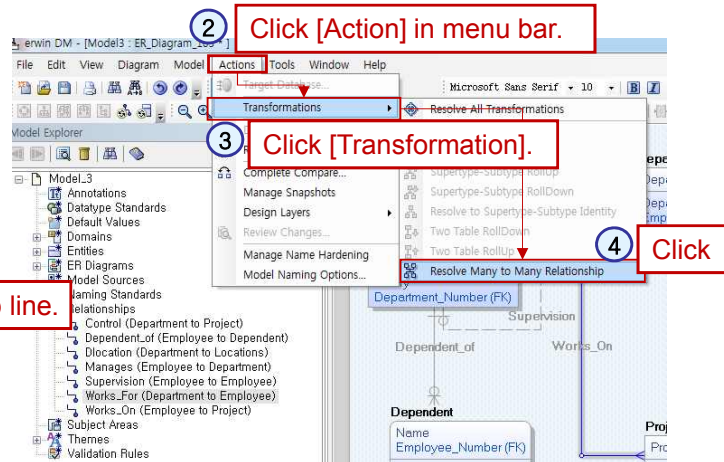
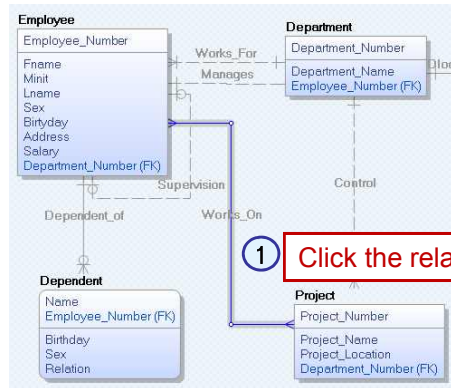


# Step 5: Set the cardinality and optionality (cont'd.)

- For M:N relationship
  - Method: Transformation

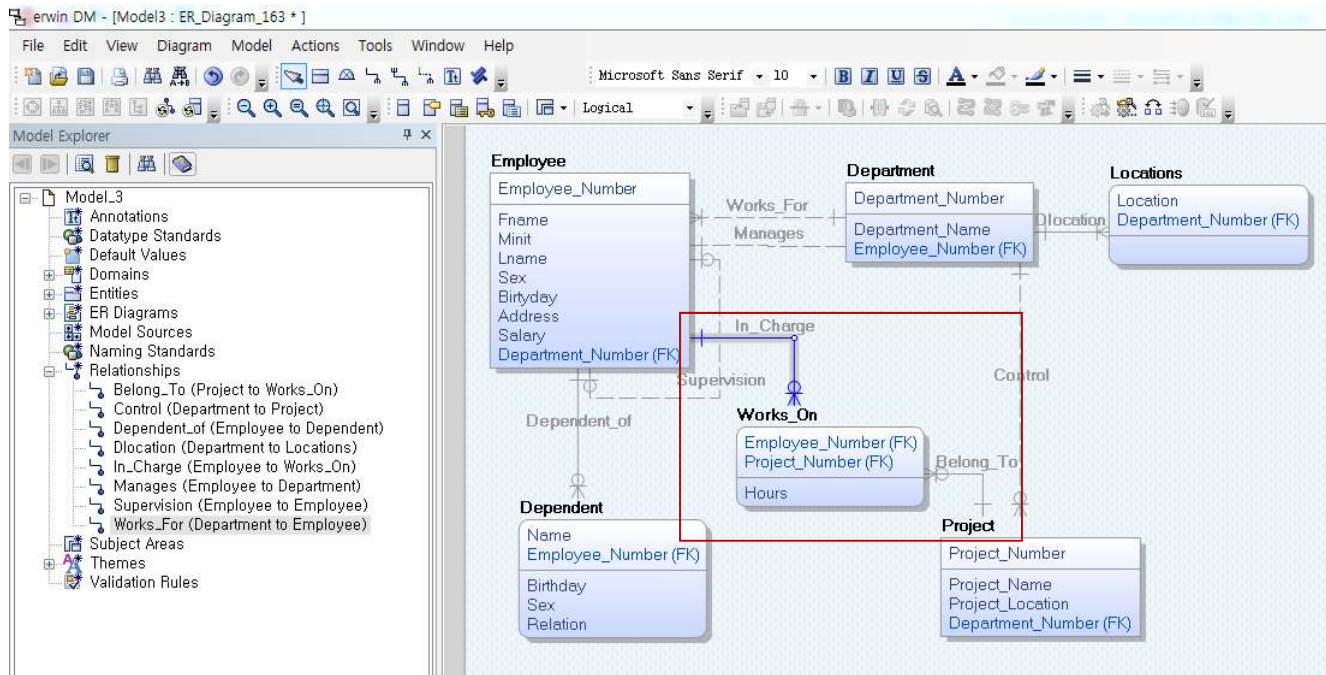


M:N relationship type



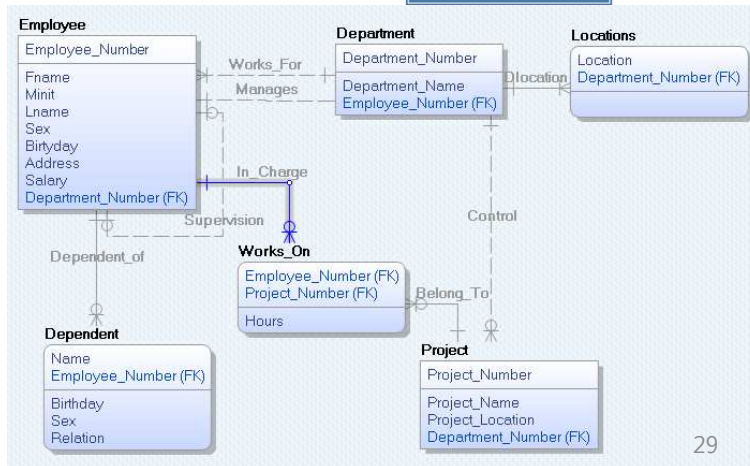
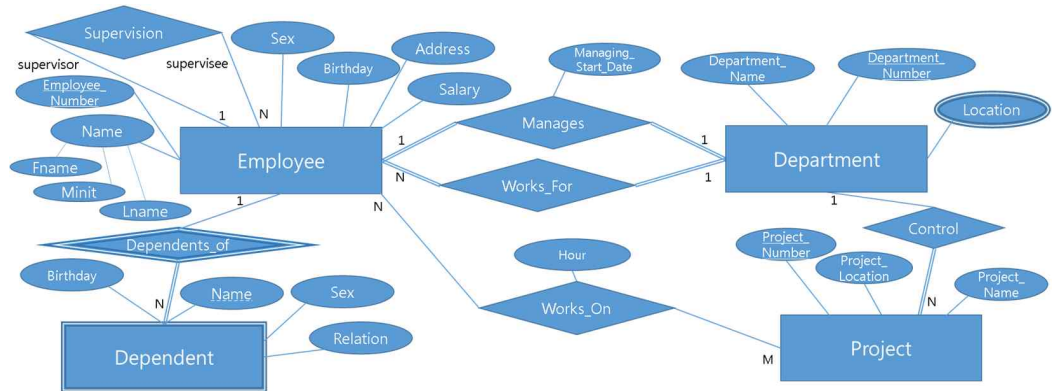
# *Step 5: Set the cardinality and optionality (cont'd.)*

- After transformation and naming M:N relationship type



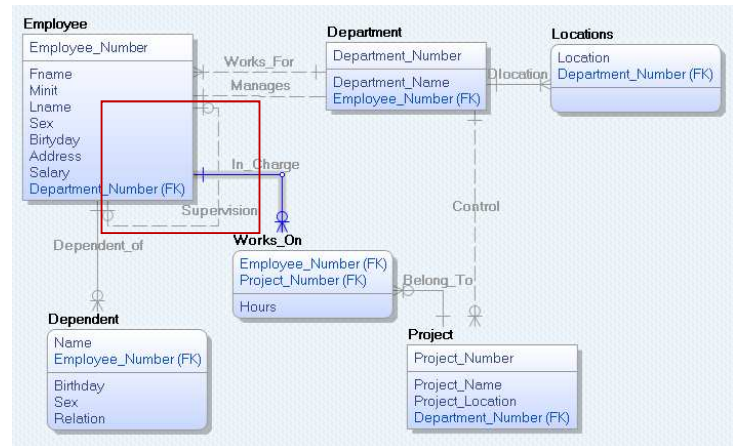
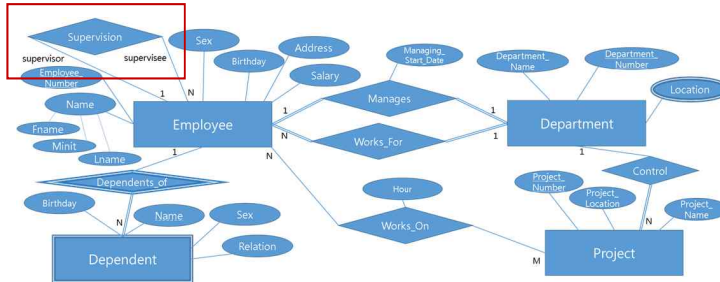
# Step 5: Set the cardinality and optionality (cont'd.)

- Final result



# Supplement

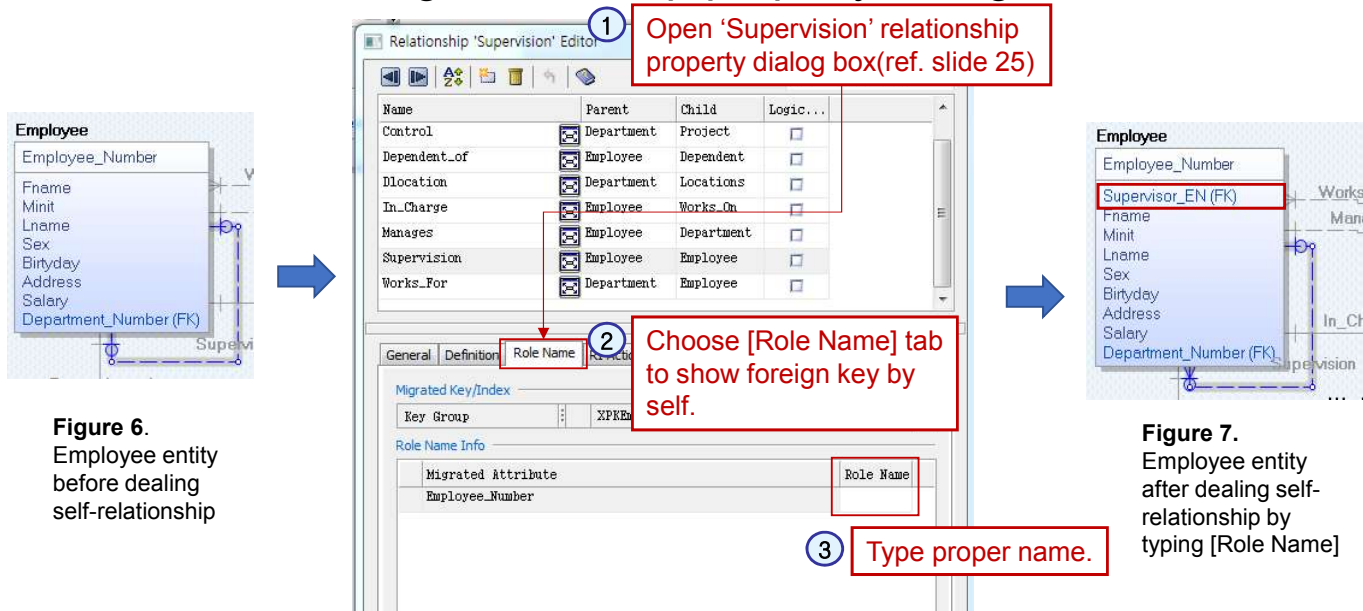
## 1. How to show **self-relationship**



# Supplement (cont'd.)

## 1. How to show **self-relationship**

– **Method:** Using relationship property dialog box





# Supplement (cont'd.)

## 1. How to show **self-relationship**

– **Method:** Using relationship property dialog box



**Figure 6.**  
Employee entity  
before dealing  
self-relationship

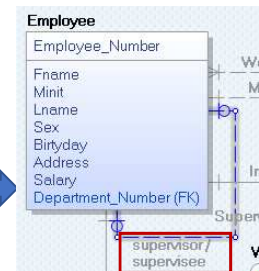
Figure 7 shows the 'Relationship 'Supervision' Editor' dialog box. It has a 'General' tab selected. The 'Parent' and 'Child' columns are both set to 'Employee'. The 'Supervision' relationship is highlighted in blue. The 'Parent-to-Child Phrase' is 'supervisor' and the 'Child-to-Parent Phrase' is 'supervisee'. The 'Type' is 'Non-Identifying' and 'Nulls Allowed' is checked.

Name	Parent	Child	Logic...
Control	Department	Project	<input type="checkbox"/>
Dependent_of	Employee	Dependent	<input type="checkbox"/>
Dlocation	Department	Locations	<input type="checkbox"/>
In_Charge	Employee	Works_On	<input type="checkbox"/>
Manages	Employee	Department	<input type="checkbox"/>
<b>Supervision</b>	<b>Employee</b>	<b>Employee</b>	<input type="checkbox"/>
Works_For	Department	Employee	<input type="checkbox"/>

1 Open 'Supervision' relationship property dialog box(ref. slide 25)

2 Choose [General] tab to show role name of parent and child

3 Type proper name.



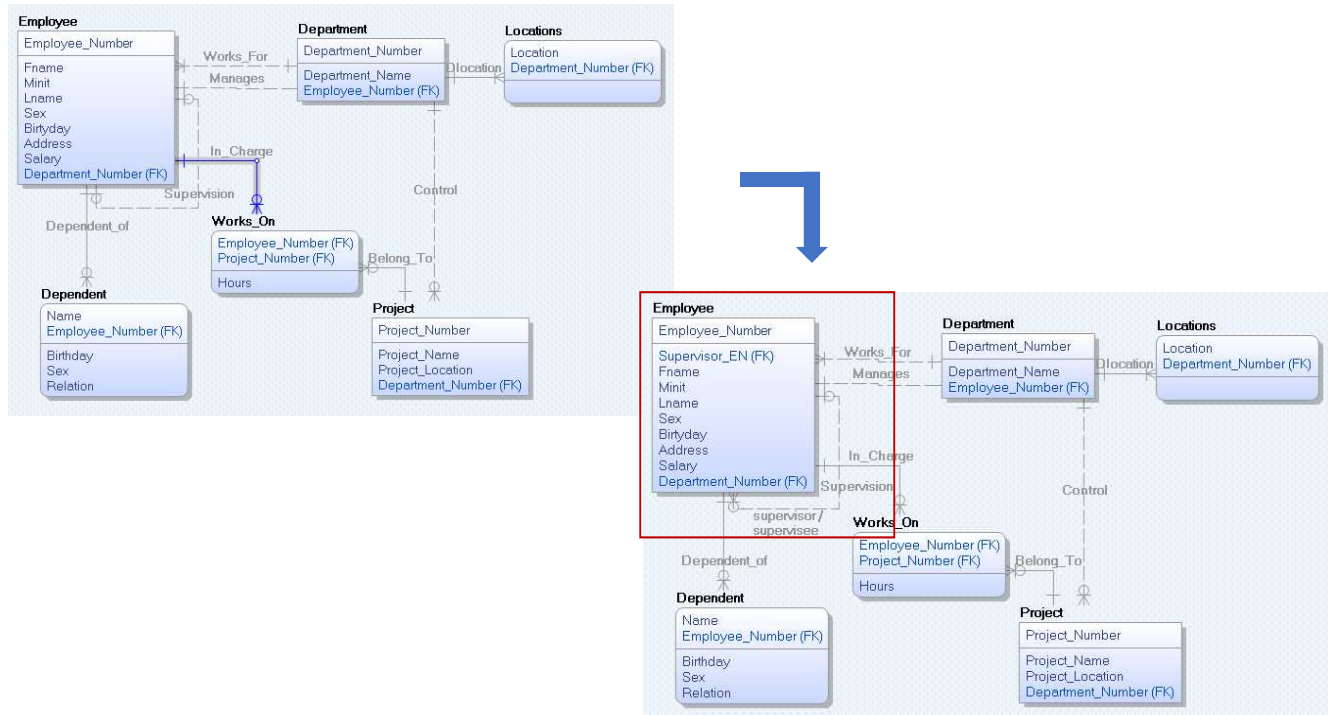
**Figure 8.**  
Employee entity  
after dealing  
self-relationship  
by typing name  
of between  
parent and child



# *Supplement (cont'd.)*

## 1. How to show **self-relationship**

– Result



# Supplement (cont'd.)

## 2. [Physical] modeling mode

- The modeling mode to design physical schema for the specified DBMS
- ER-Win helps to design physical data model.
- How choose?

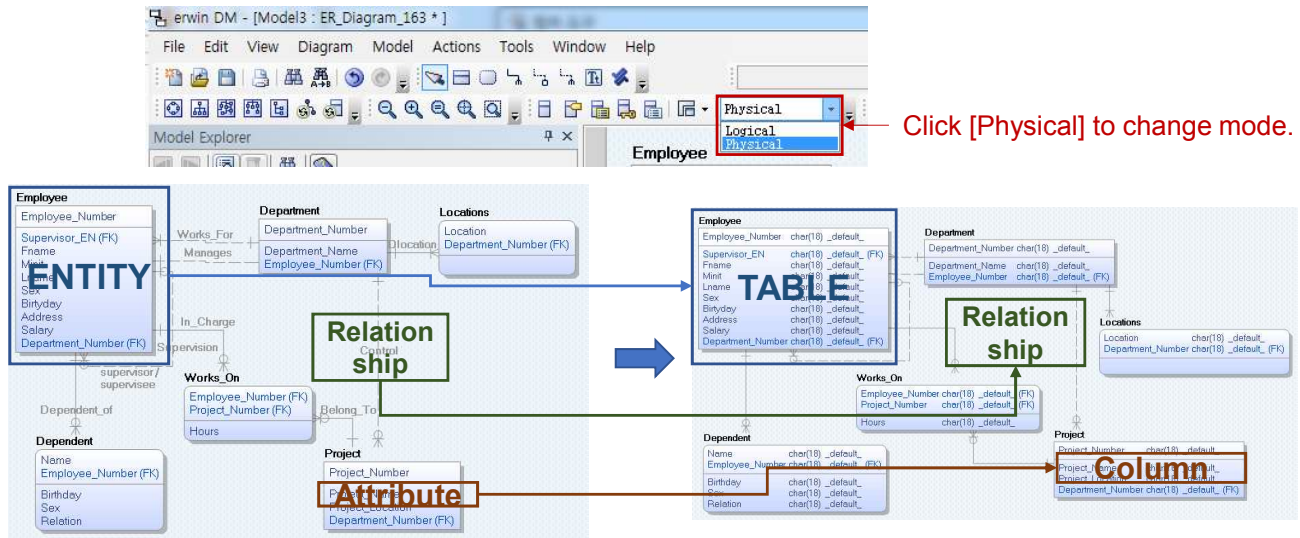


Figure . Logical diagram of company DB

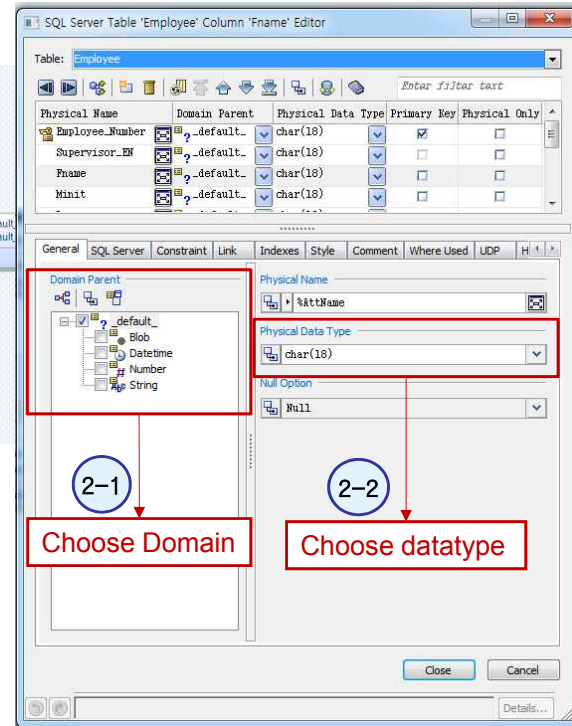
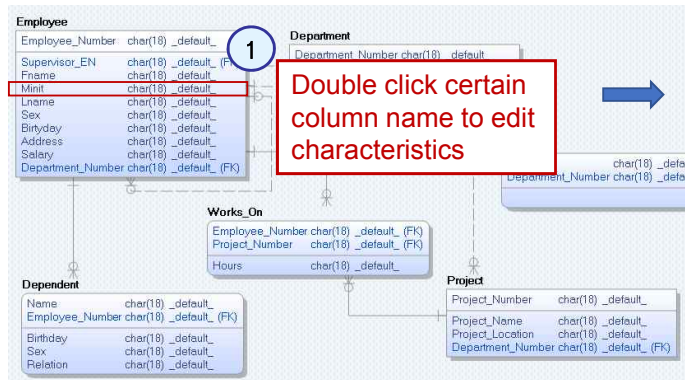
Figure . Physical diagram of company DB

# Supplement (cont'd.)

## 2.[Physical] modeling mode

– How to set domain or datatype for columns?

– **Method:** using column editor

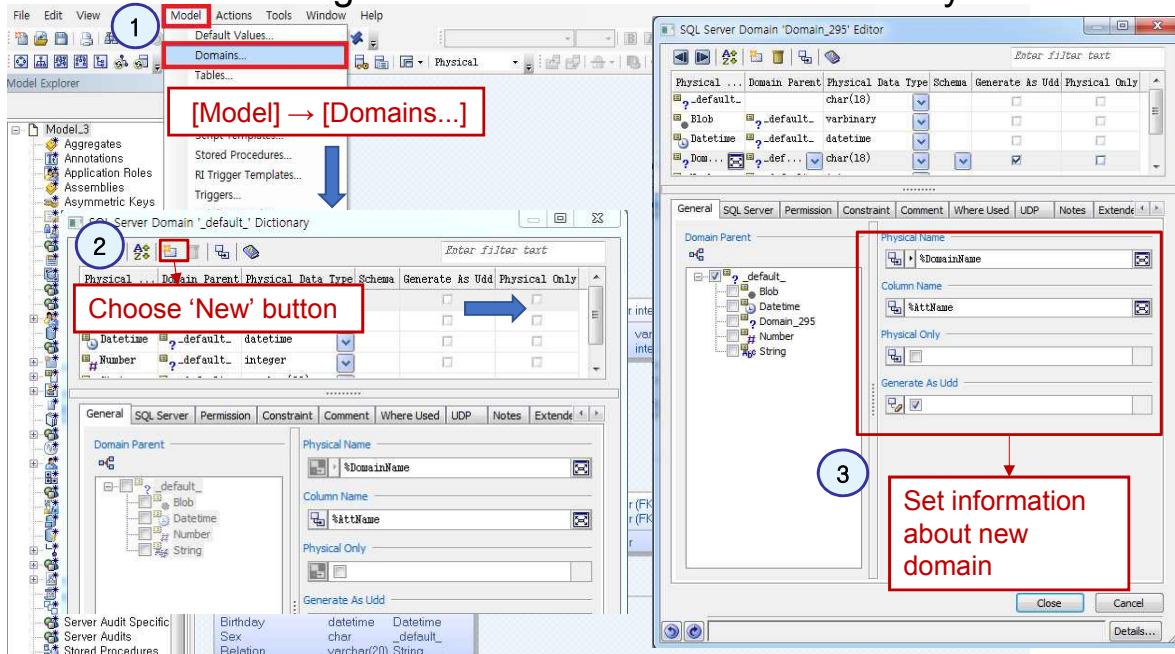


# Supplement (cont'd.)

## 2.[Physical] modeling mode

– How to make new domain for columns?

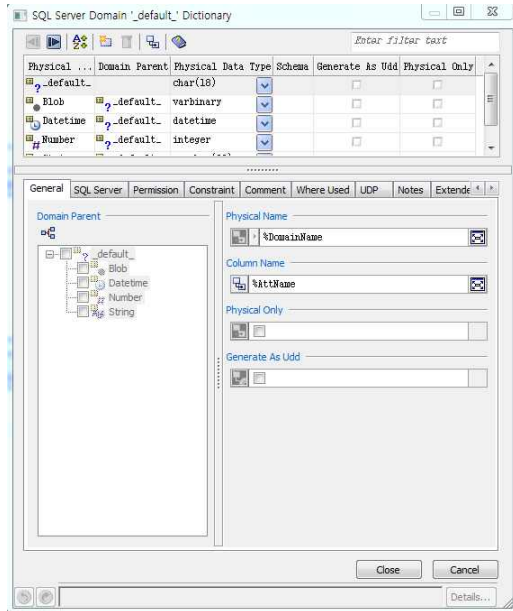
– **Method:** using Domain editor in domain dictionary



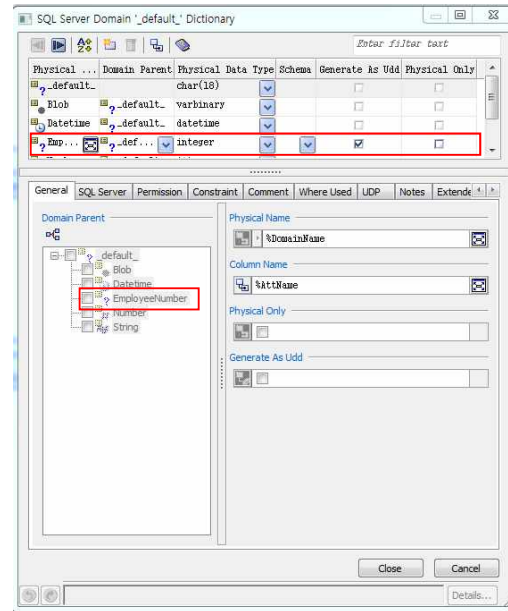
# Supplement (cont'd.)

## 2.[Physical] modeling mode

– How to make new domain for columns?

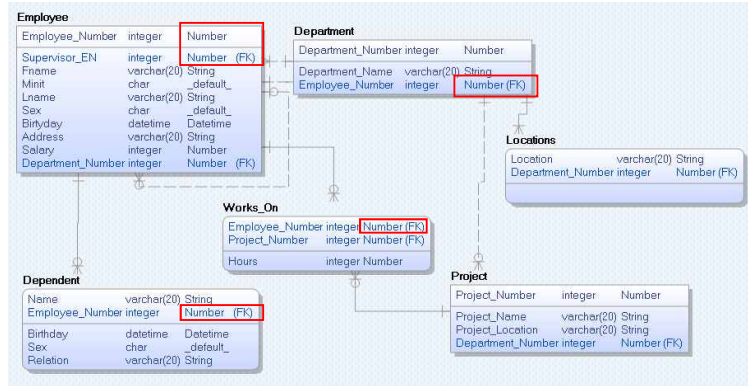


Domain dictionary before make new domain

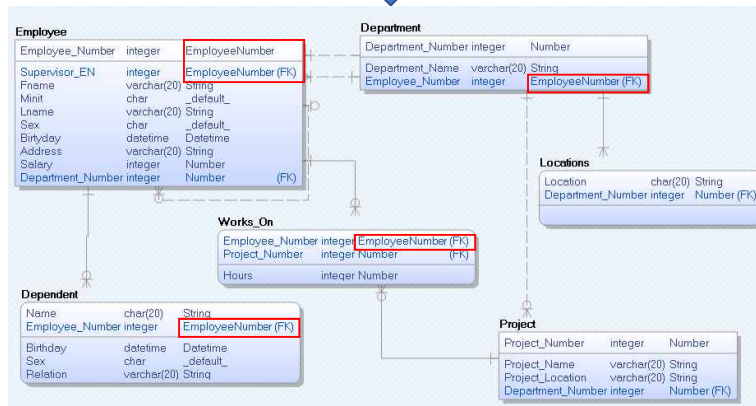


Domain dictionary after make new domain

# Supplement (cont'd.)



Physical diagram before setting new domain




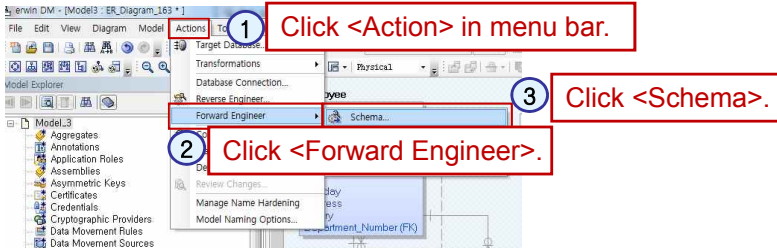
Physical diagram after setting new domain at appropriate position

# *Supplement (cont'd.)*

## 3. Forward engineering

- The process of building from a high-level model to the actual database within the specified DBMS
- ER-win can support the forward engineering.
- How?

1)  Click [Physical] to change mode.

2)  Click <Action> in menu bar.  
Click <Forward Engineer>.  
Click <Schema>.

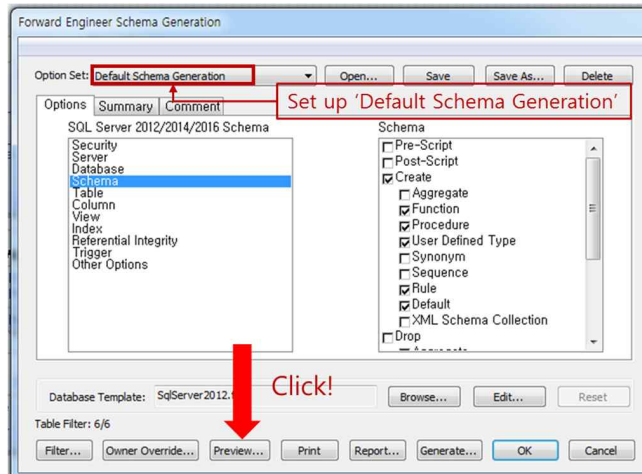


# *Supplement (cont'd.)*

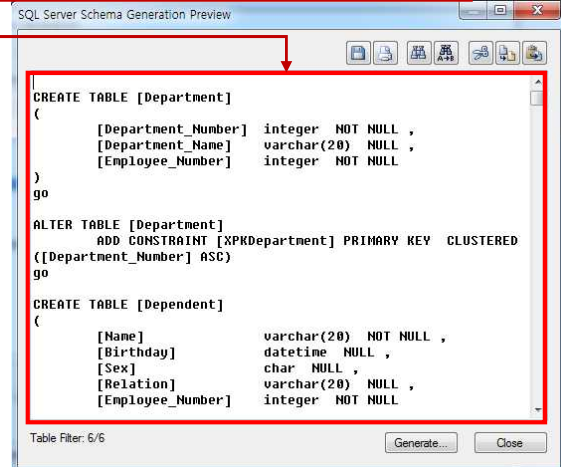
## 3. Forward engineering

– How?

### 3) DDL script previewing



Use DDL query to create database



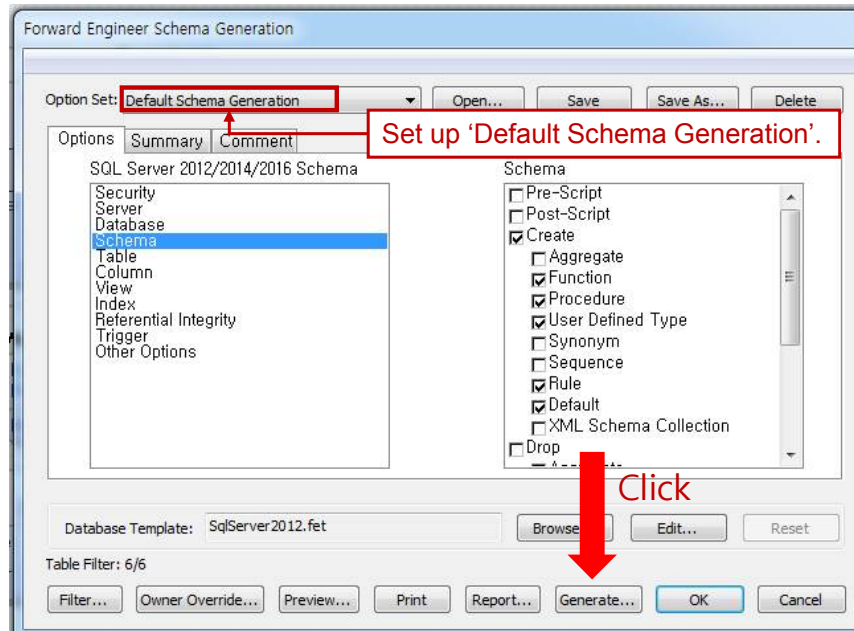


# *Supplement (cont'd.)*

## 3. Forward engineering

– How?

### 4) DB schema generation

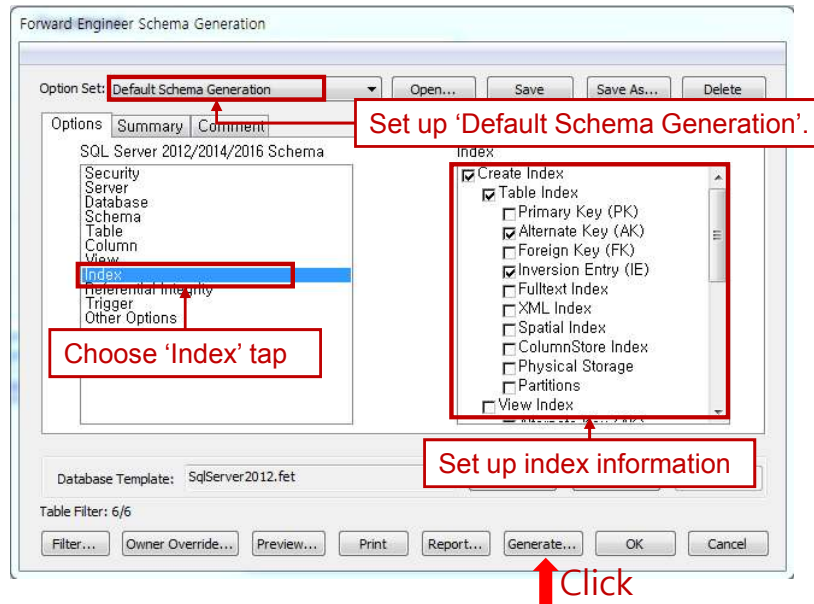


# *Supplement (cont'd.)*

## 3. Forward engineering

– How?

### 4) Index generation

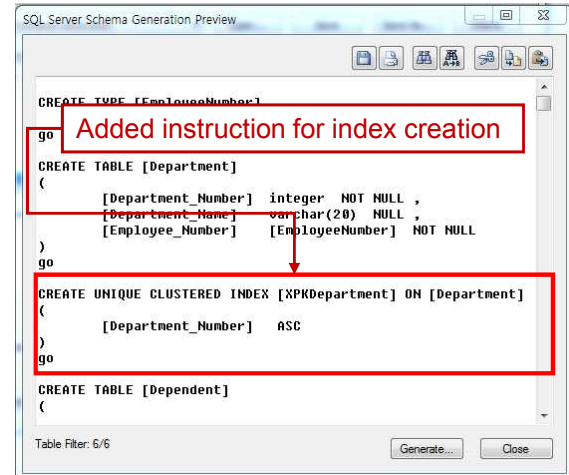
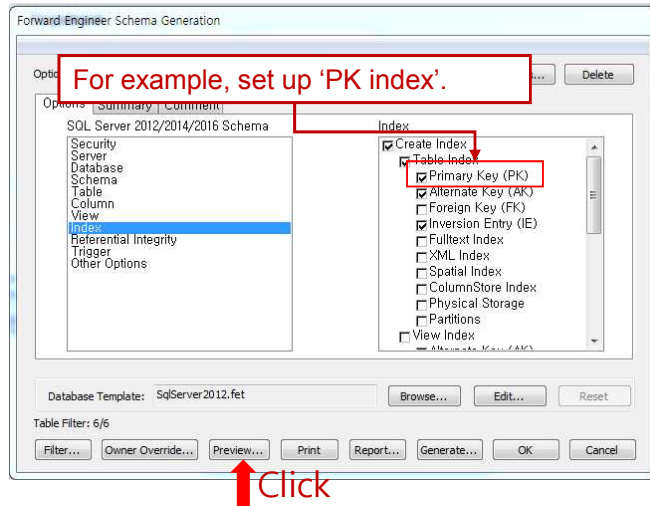


# Supplement (cont'd.)

## 3. Forward engineering

– How?

### 4) Index generation





# THANK YOU



인하대학교