



Stichting NIOC

Stichting NIOC en de NIOC kennisbank

Stichting NIOC (www.nioc.nl) stelt zich conform zijn statuten tot doel: het realiseren van congressen over informatica onderwijs en voorts al hetgeen met een en ander rechtstreeks of zijdelings verband houdt of daartoe bevorderlijk kan zijn, alles in de ruimste zin des woords.

De stichting NIOC neemt de archivering van de resultaten van de congressen voor zijn rekening. De website www.nioc.nl ontsluit onder "Eerdere congressen" de gearchiveerde websites van eerdere congressen. De vele afzonderlijke congresbijdragen zijn opgenomen in een kennisbank die via dezelfde website onder "NIOC kennisbank" ontsloten wordt.

Op dit moment bevat de NIOC kennisbank alle bijdragen, incl. die van het laatste congres (NIOC2025, gehouden op donderdag 27 maart 2025 jl. en georganiseerd door Hogeschool Windesheim). Bij elkaar zo'n 1500 bijdragen!

We roepen je op, na het lezen van het document dat door jou is gedownload, de auteur(s) feedback te geven. Dit kan door je te registreren als gebruiker van de NIOC kennisbank. Na registratie krijg je bericht hoe in te loggen op de NIOC kennisbank.

Het eerstvolgende NIOC vindt plaats op 18 maart 2027 in Arnhem en wordt georganiseerd door HAN University of Applied Sciences.

Reacties over de NIOC kennisbank en de inhoud daarvan kun je richten aan de beheerder:

R. Smedinga kennisbank@nioc.nl.

Vermeld bij reacties jouw naam en telefoonnummer voor nader contact.



Givaphity

IS-ontwikkeltools

NIOC 2013

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Research Group Model Based Information Systems



Presentation

- Introduction M-BIS
 - FCO-IM history
 - Meta & meta - meta
 - Graphical representation
 - Requirements of graphical meta-meta tool
 - FCO – IMAGine tool using Graphity
 - Integrated tool
 - Future developments
-

Introduction MBIS

- HAN University of Applied Sciences
- Information & Communication Academy
- Lecturers bachelor & master:
 - Information modeling
 - Databases
 - Web technology
- Research group: Model Based Information Systems
 - Education: ER/FCO-IM, Business Intelligence (DV, Anchor)
 - Tools: modeling & application generation
 - Projects: faculty information systems



FCO-IM history

- NIAM = Nijssen Information Analysis Method
 - Sjir Nijssen, Eckart Falkenberg, Robert Meersman & others, 1975 until 1989
 - www.pnagroup.nl
- ORM = Object Role Modeling
 - Terry Halpin, 1989 – now
 - www.orm.net
- FCO-IM = Fully Communication Oriented Information Modeling
 - Guido Bakema, Jan Pieter Zwart, Harm Van der Lek, 1991-now
 - www.fco-im.nl
- SBVR = Semantics of Business Vocabulary And Business Rules,
 - OMG, 2008 - now
 - <http://www.omg.org/spec/SBVR/1.0/>

FCO-IM basics

FLOOR	#EXITS	ROOM	#SEATS	EQUIPMENT
1	2	1.1	20	BB BM
.	.	1.2	30	-
2	0	2.1	20	BB
3	2	3.2a	-	-

BB blackboard, BM beamer, PC personal computer

- Example document with concrete example data

Verbalization

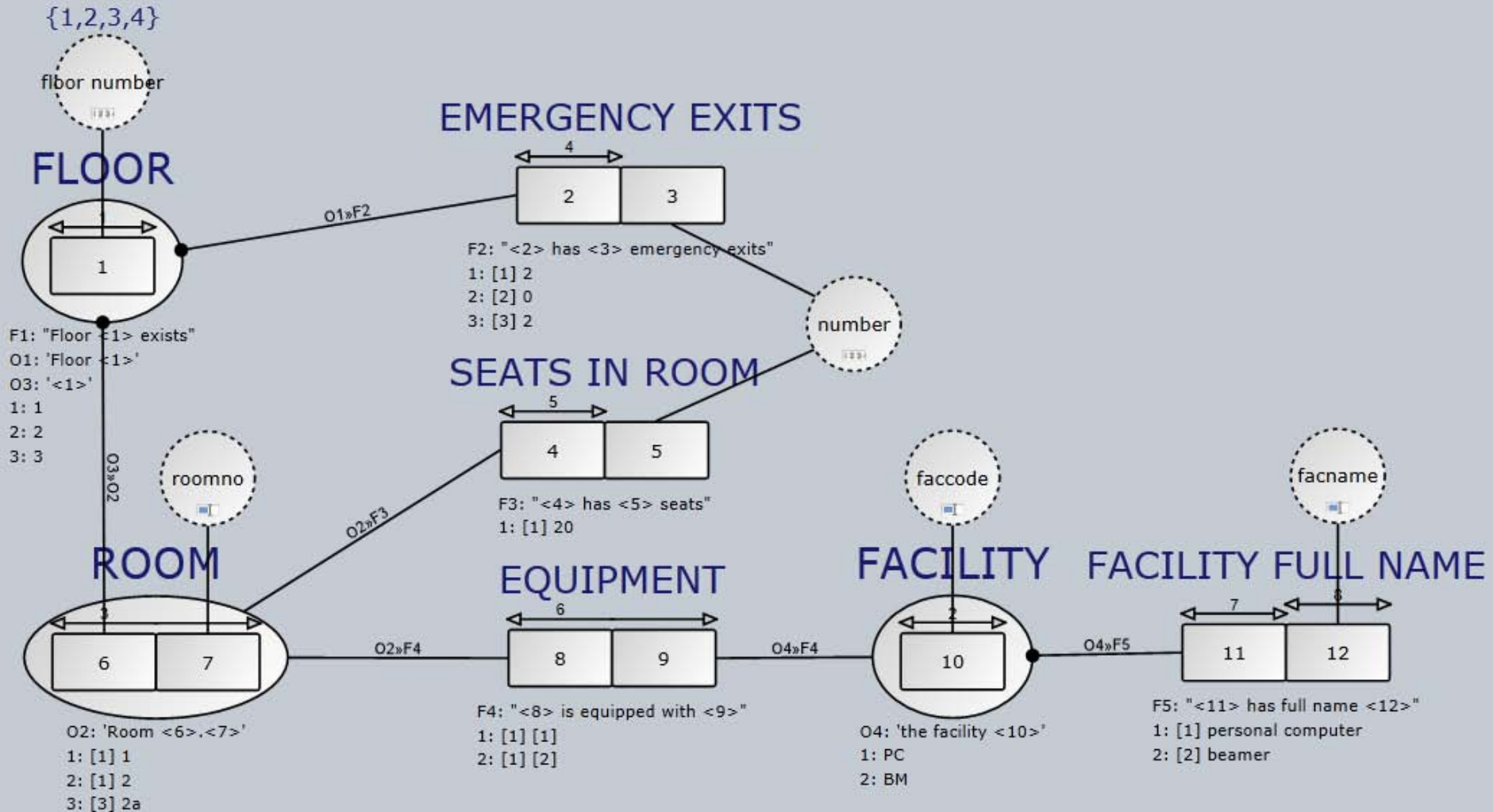
“Floor 1 exists.”

“Floor 1 has 2 emergency exits.”

“Room 1.1 has 20 seats.”

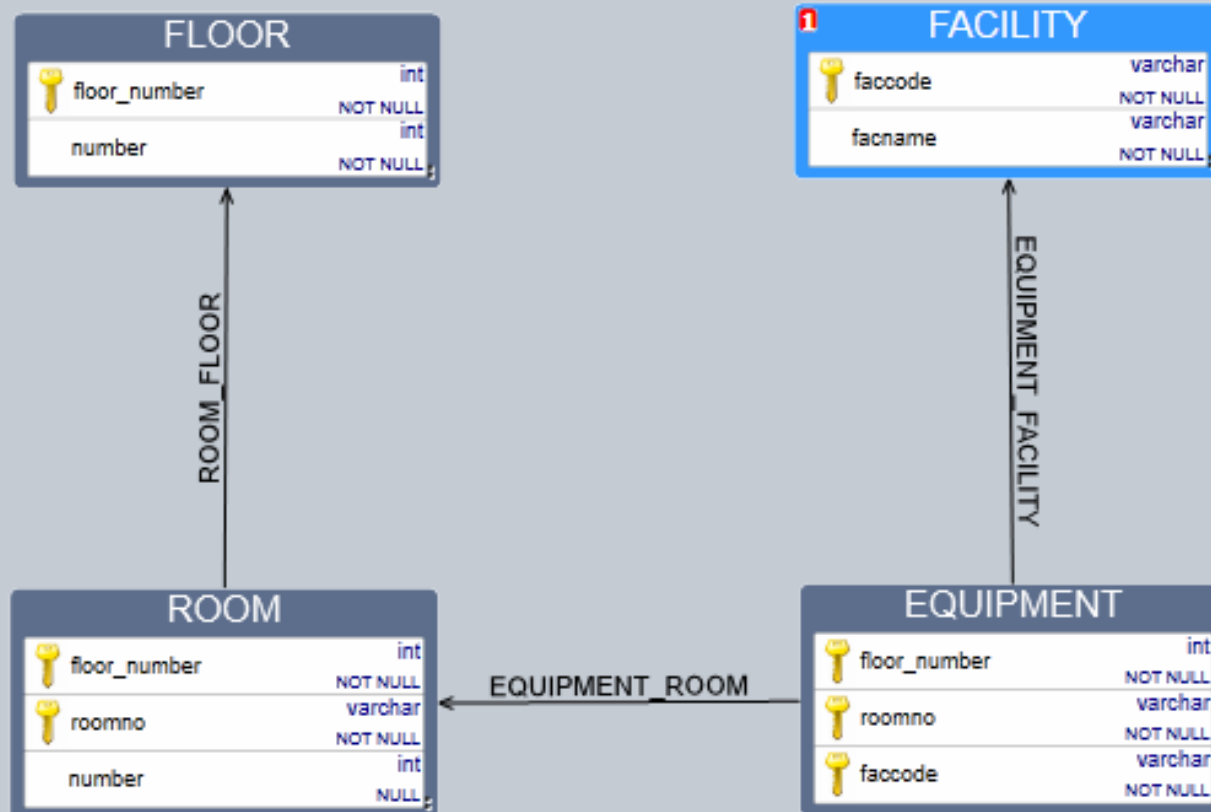
“Room 1.1 is equipped with PC.”

- Elementary fact expressions





Relational model



Output: CREATE script

```
CREATE TABLE [FLOOR] (  
  [floor_number] varchar(100) NOT NULL,  
  [number] varchar(100) NOT NULL,
```

```
  CONSTRAINT [PK_1] PRIMARY KEY ([floor_number])  
)
```

```
CREATE TABLE [ROOM] (  
  [floor_number] varchar(100) NOT NULL,  
  [roomno] varchar(100) NOT NULL,  
  [number] varchar(100) NULL,
```

```
  CONSTRAINT [PK_3] PRIMARY KEY ([floor_number],[roomno])  
)
```

 **SAS** 

Welcome test, you are a member of the role: "Administrator"

Forms

- Important Forms
- FACILITY
- FLOOR
- ROOM

Information

Since last login (unknown), following changes have been made:

1.0 Initial Deployment

Do not show information upto version 1.0 again

 **Forms** **ROOM of: FLOOR (1) (1/2)**

Start ► FLOOR ► ROOM

Insert Update Delete Search |

floor_number	roomno	number
1	1	20
	2	

Changed 2 minutes ago from :LSME-MACBOOK by:NT AUTHORITY\NETWORK SERVICE

EQUIPMENT (2)

Insert Options Close

faccode
BM-beamer
PC-personal computer

Insertform - EQUIPMENT

Ok Ok and again Cancel

Main information

Floor number* floor_number of EQUIPMENT 1	Roomno* roomno of EQUIPMENT 1	Faccode* faccode of EQUIPMENT BM-beamer BM-beamer PC-personal computer
--	--	---

Table or application level

Floor

Floor_number	number
1	2
3	2

Room

Floor_number	Roomno	Number
1	1	20
1	2	NULL
3	2a	NULL

Meta level

Tables

Table_name
Floor
Room

Columns

Table_name	Column_name	Datatype
Floor	Floorumber	int
Floor	Number	int
Room	Floornumber	int
Room	Roomnumber	varchar

Meta – meta level

Tables

Table_name
Tables
Columns

Columns

Table_name	Column_name	Datatype
Tables	Table_name	varchar
Columns	Table_name	varchar
Columns	Column_name	varchar
Columns	Datatype	varchar

Meta – meta automodel

Tables

Table_name
Tables
Columns

Meta

Tables

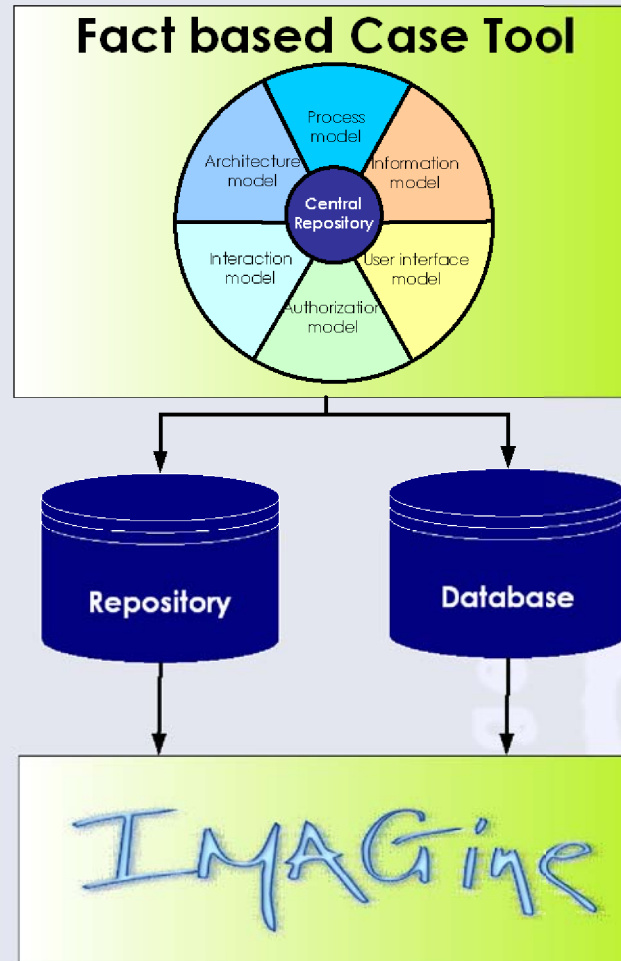
Table_name
Floor
Room

Table

Floor

Floor_number	number
1	2
3	2

Future: Integrated (fact based) modeling





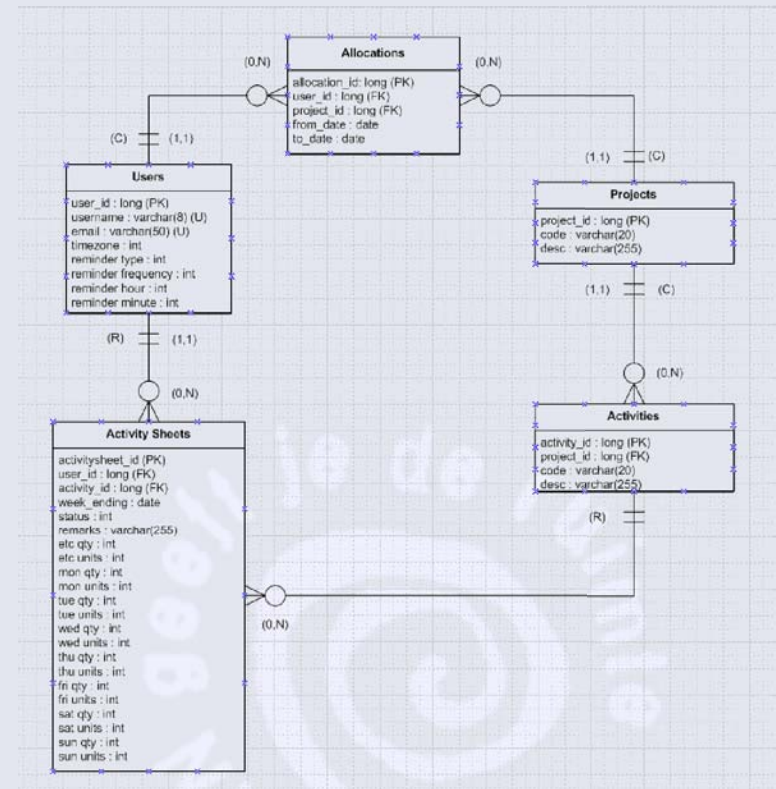
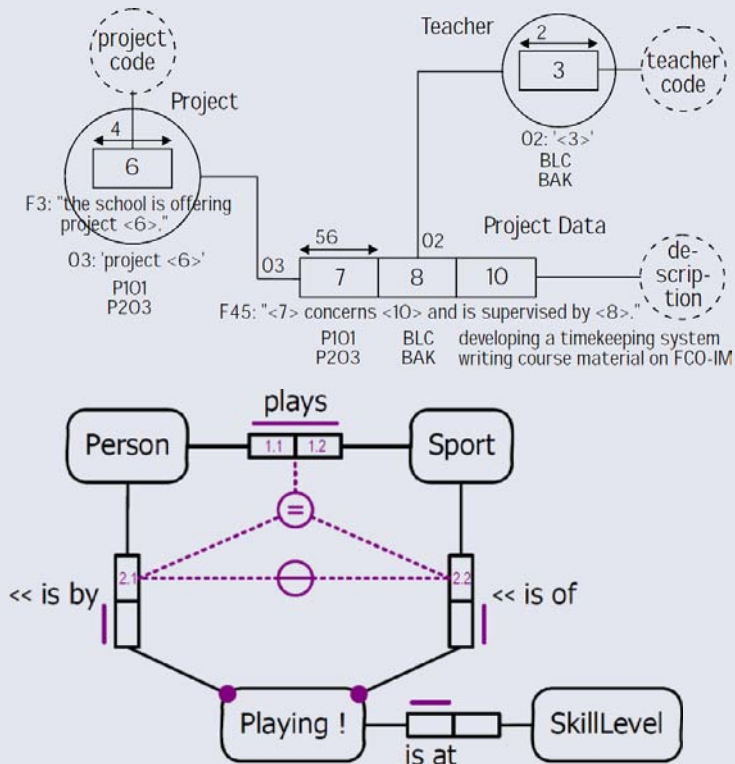
Graphical representation

- Why?
- Take a look at some examples
- Make an 'information analysis' of graphical models



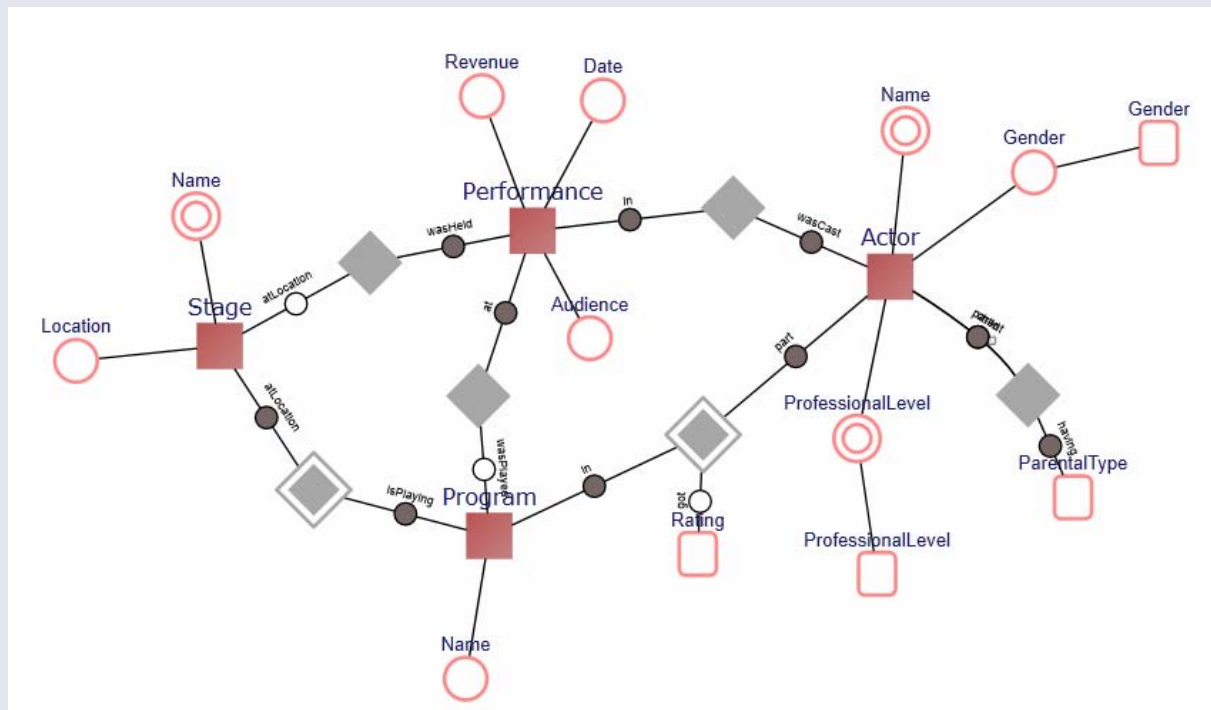
Tools for information modelling

- Objects
- Relations



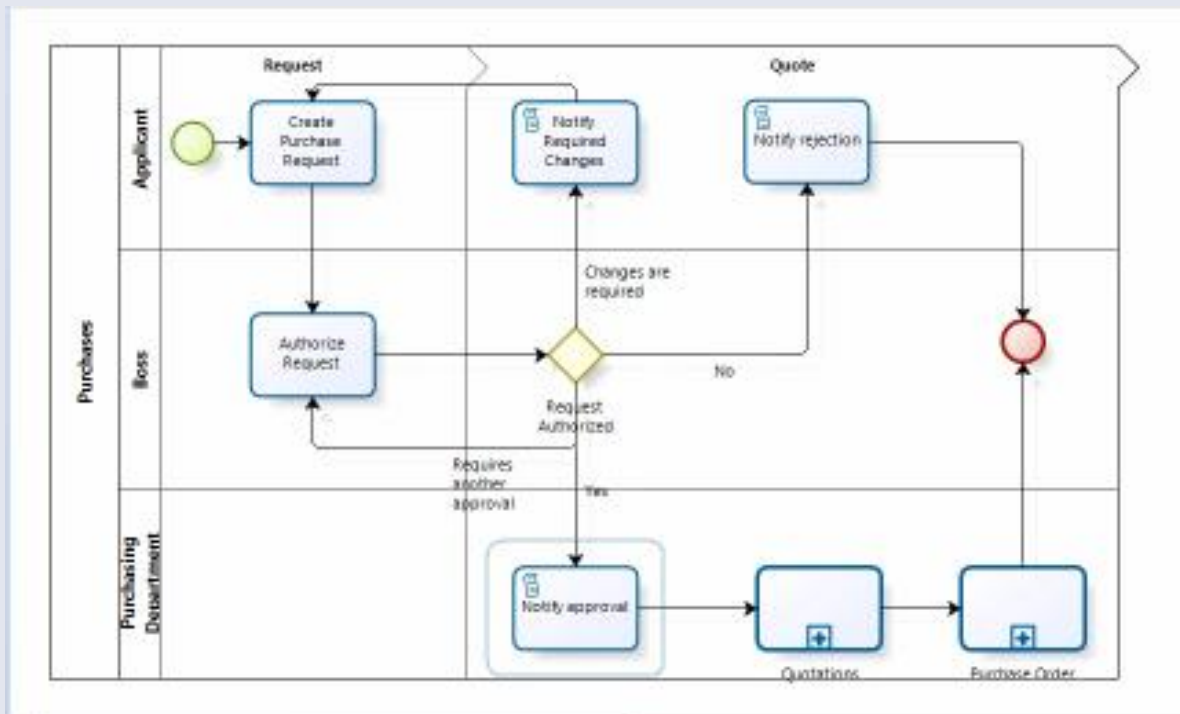
BI tools

- Anchor modeling



Process modeling tools

- BPMN

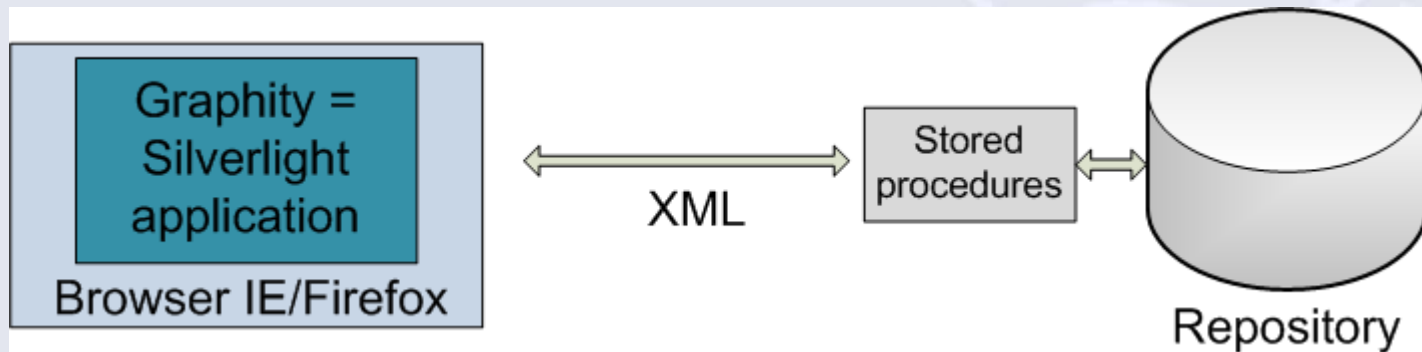


Requirements of graphical meta-meta tool

- Shapes: (rounded) rectangles, ellipses
 - Nested shapes
 - Connectors, configurable end points
 - Bound text
 - 'Rubber banding'
 - Web enabled
 - Menu actions
 - Repository independent
 - **SQL only**, but MSSQLServer 2005 or higher
 - No knowledge of C#, Ajax, ASP.NET, Silverlight, Webservices
-

Graphity

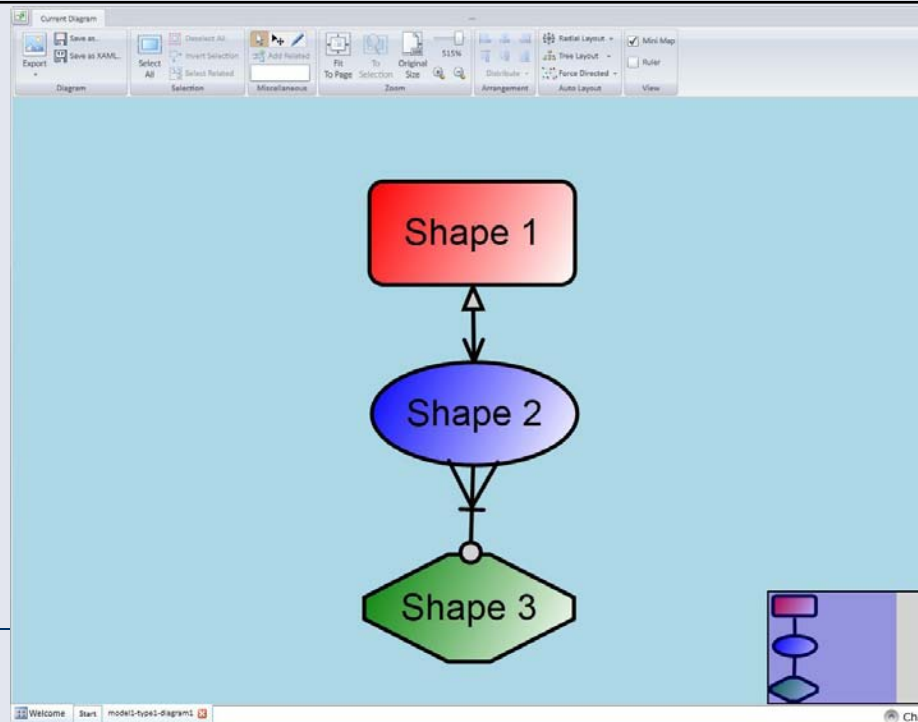
- Silverlight 5 MB
- Graphity = small Silverlight application, 1.5 MB
- Starts within browser
- Communicates through web services with database
- XML as interchange format





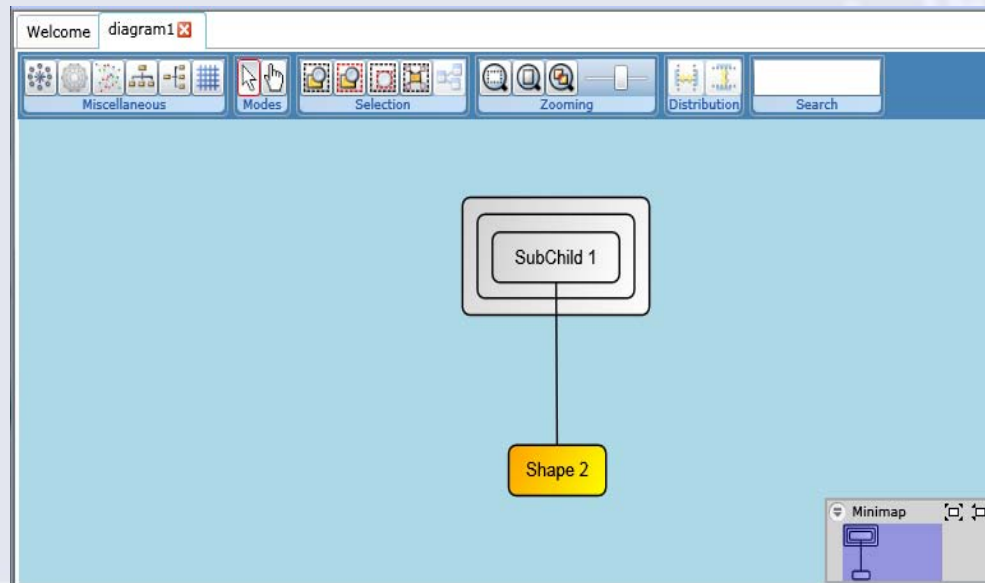
XML structure

```
<diagram name="diagram1" model="model1" type="type1">  
  <shape id="Shape1" innertext="Shape 1" fillcolor="red"/>  
  <shape id="Shape2" innertext="Shape 2" type="1" fillcolor="blue"/>  
  <shape id="Shape3" innertext="Shape 3" type="2" fillcolor="green"/>  
  <connector id="cnx1" from="Shape1" to="Shape2" headtype="1" tailtype="2"/>  
  <connector id="cnx2" from="Shape2" to="Shape3" headtype="3" tailtype="4"/>  
</diagram>
```



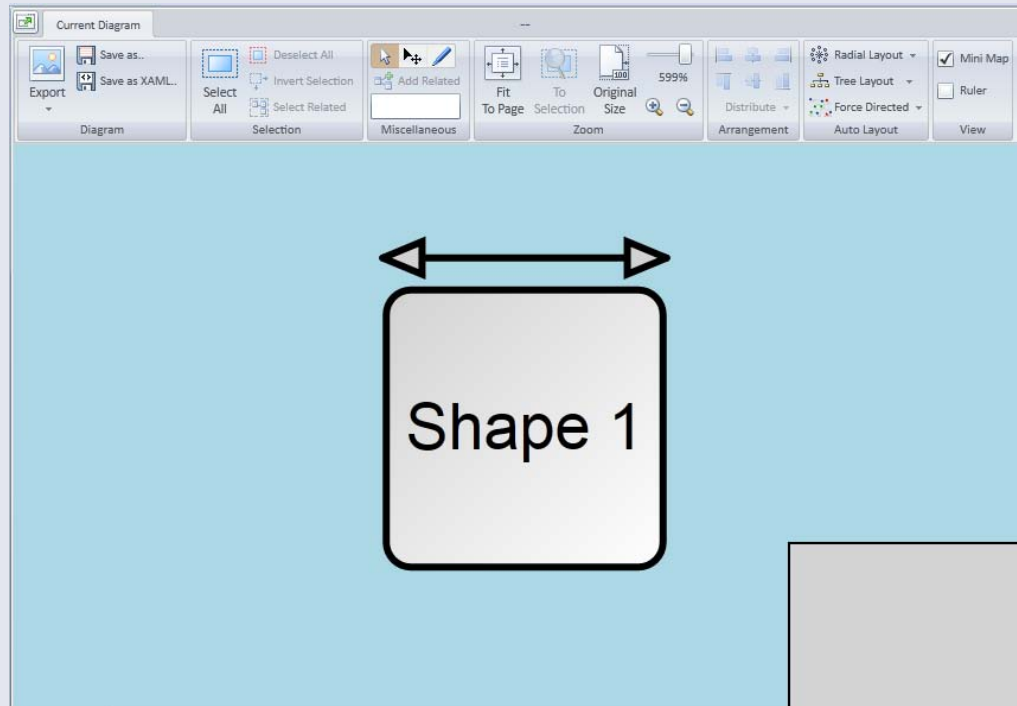
XML structure 2

```
<diagram name="diagram1" model="model1" type="type1">
  <shape id="Shape1" innertext="Shape 1" >
    <shape id="Child1" innertext="Child 1" >
      <shape id="SubChild1" innertext="SubChild 1" >
        </shape>
      </shape>
    </shape>
  <shape id="Shape2" innertext="Shape 2"/>
  <connector id="cnx1" from="Shape2" to="SubChild1" />
</diagram>
```



XML structure 3

```
<diagram name="diagram1" model="model1" type="type1">  
  <shape id="Shape1" innertext="Shape 1" arrowdistance="4" h="40" w="40">  
    <arrow id="Arrow1" headtype="2" tailtype="2"/>  
  </shape>  
</diagram>
```

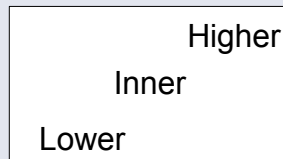


Shape/connector attributes

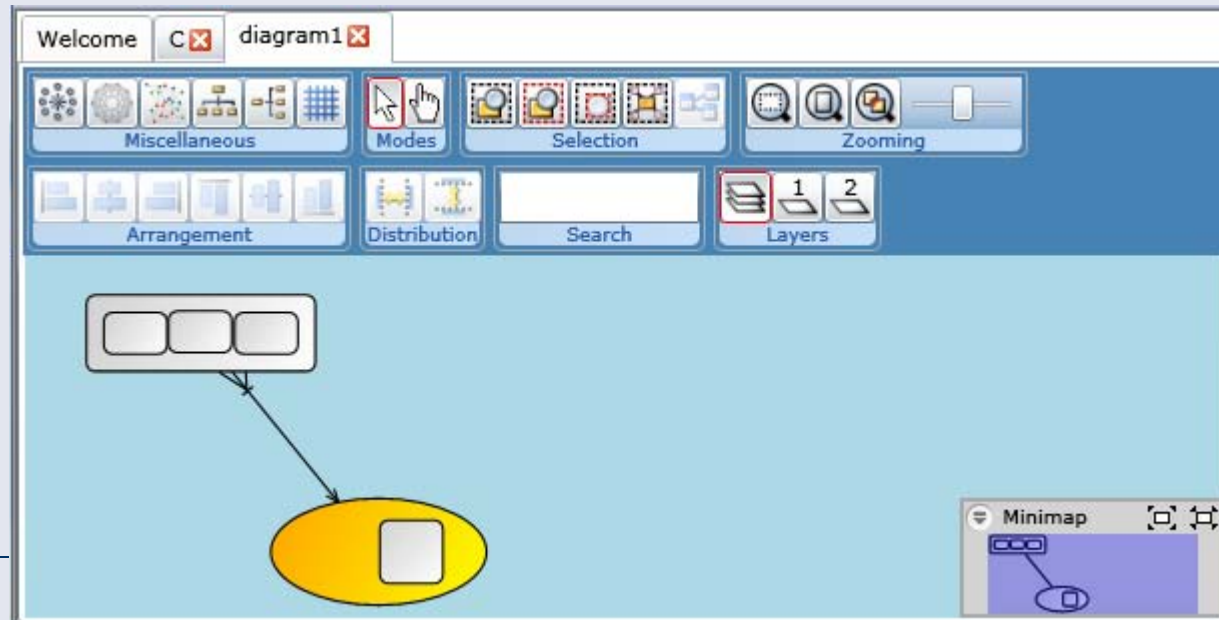
- Appearance, size, color, text, dash, positions, endpoints



Upper



Under



Graphity: Standard functions

- Mini map
- Zooming
- Selections
- Alignment
- Searching
- Property slider
- Object slider
- Auto layout
- Menu actions



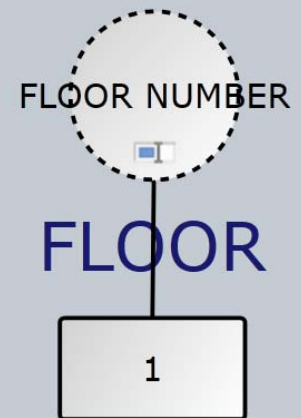
Develop a tool

- Make meta model using e.g. FCO-IM
- Create database
- Create XML queries to show model graphically
- Create menu actions
- Create transformations



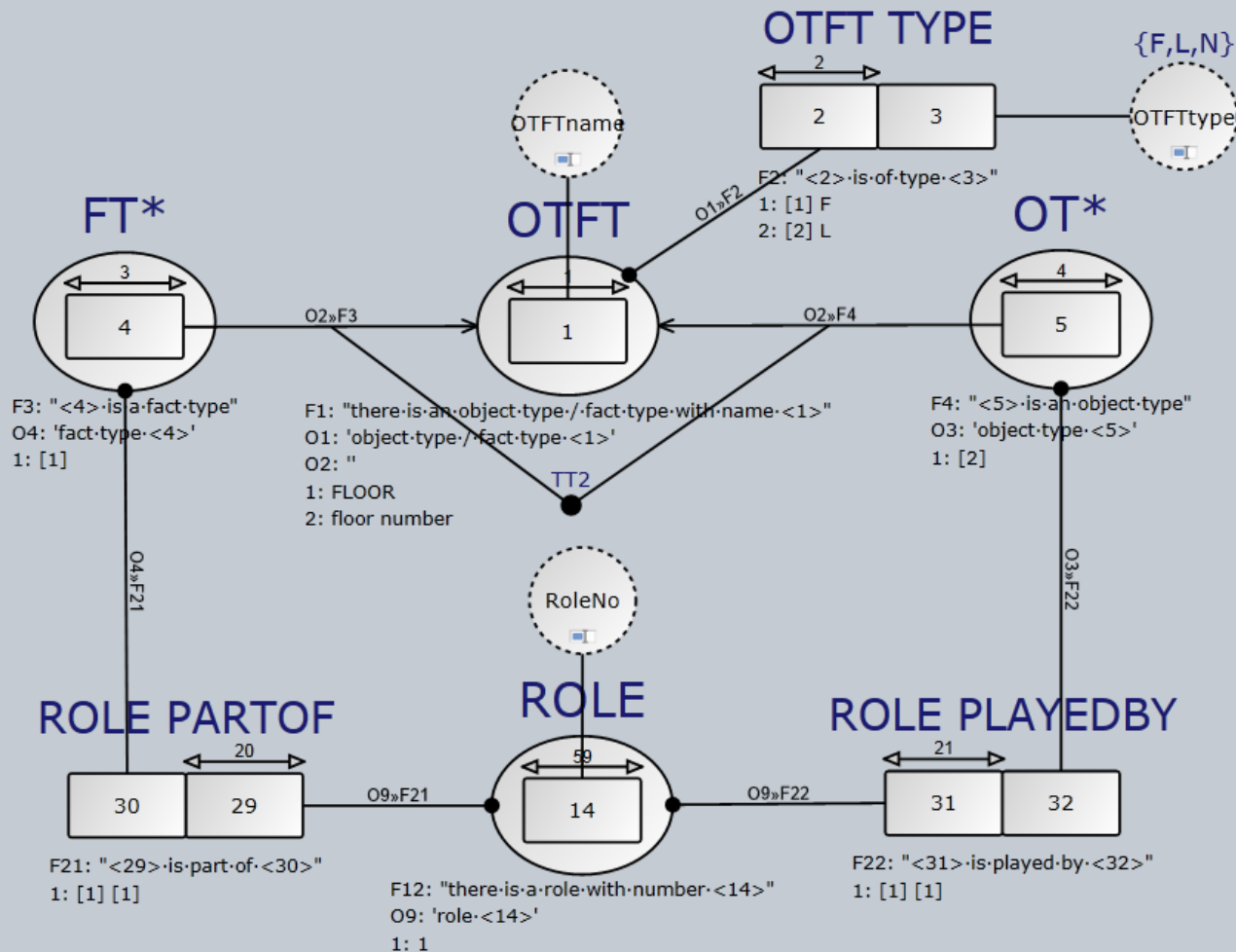
FCO – IM tool using Graphity

- FCO-IM repository
- How to create that?
- Apply FCO-IM on starting document e.g. IGD
- “Role ‘1’ is part of fact type ‘FLOOR’”.
- “Role ‘1’ is played by object type/label type ‘floor number’”.



F1: "Floor <1> exists"
1: 2

Small automodel

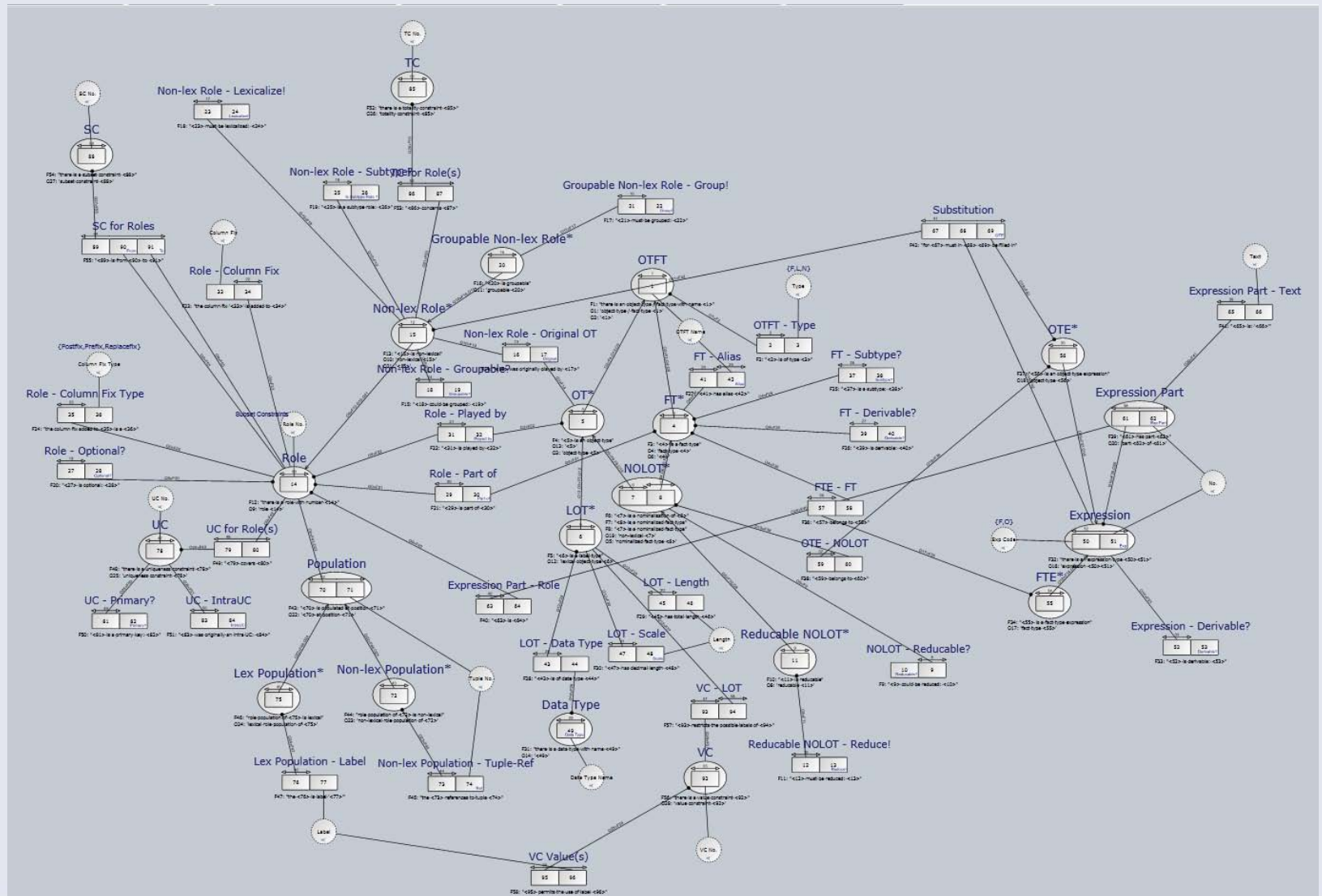


FLOOR



F1: "Floor <1> exists"
1: 2

Automodel FCO-IM

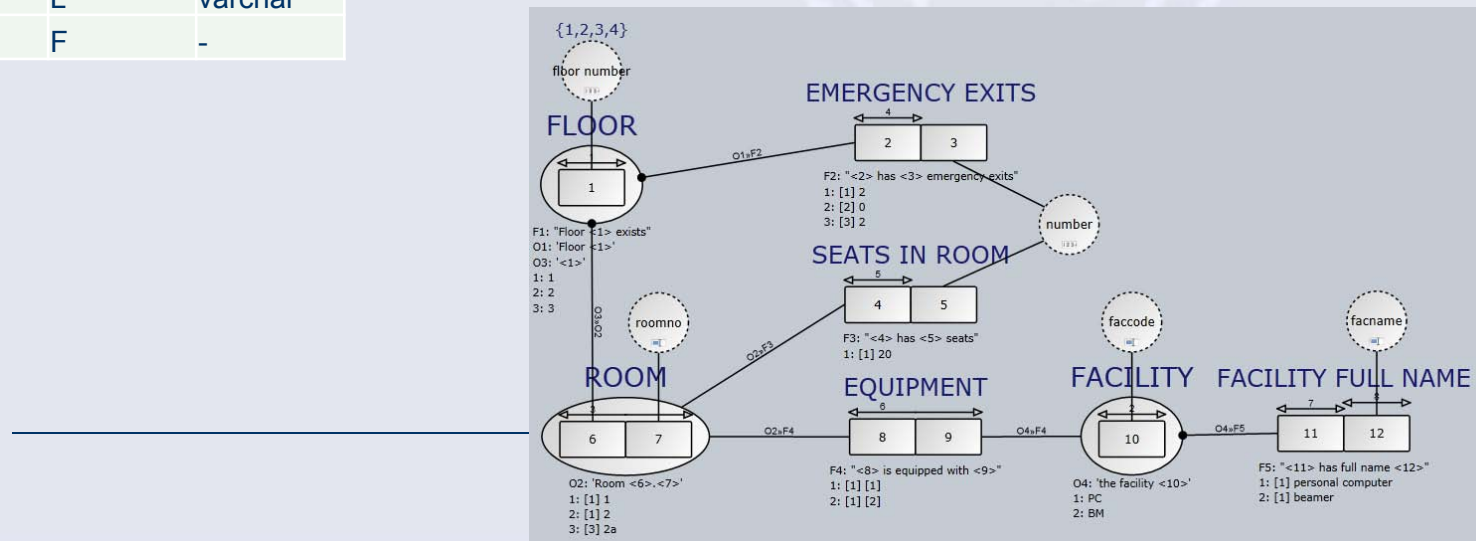


Example of populated FCO-IM repository

OTFT		
Name	Type	Data type
EMERGENCY EXISTS	F	-
EQUIPMENT	F	-
faccode	L	varchar
FACILITY	N	-
FACILITY FULL NAME	F	-
facname	L	varchar
FLOOR	N	-
floor number	L	varchar
number	L	varchar
ROOM	N	-
roomno	L	varchar
SEATS IN ROOM	F	-

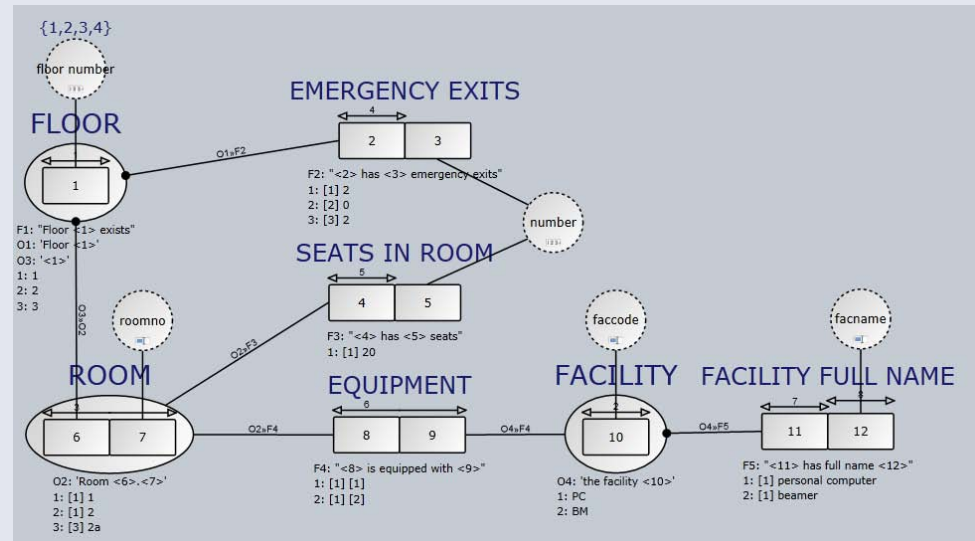
Roles	
Nr Part of OTFT	Played By OTFT
1 FLOOR	floor number
2 EMERGENCY EXISTS	FLOOR
3 EMERGENCY EXISTS	number
4 SEATS IN ROOM	ROOM
5 SEATS IN ROOM	number
6 ROOM	FLOOR
7 ROOM	roomno
8 EQUIPMENT	ROOM
9 EQUIPMENT	FACILITY
10 FACILITY	faccode
11 FACILITY FULL NAME	FACILITY
12 FACILITY FULL NAME	facname

Expressions		
Type	Code	OTFT
F	1 FLOOR	
F	2 EMERGENCY EXISTS	
F	3 SEATS IN ROOM	
F	4 EQUIPMENT	
F	5 FACILITY FULL NAME	
O	1 FLOOR	
O	2 ROOM	
O	3 FLOOR	
O	4 FACILITY	



Example part 2

Expression parts				
Expression	Code	Nr	Role	text
F	1	1	-	Floor
F	1	2	1	-
F	1	3	-	exists
F	2	1	2	-
F	2	2	-	has
F	2	3	3	-
F	2	4	-	emergency exists
F	3	1	4	-
F	3	2	-	has
F	3	3	5	-
F	3	4	-	seats
F	4	1	8	-
F	4	2	-	is equipped with
F	4	3	9	-
F	5	1	11	-
F	5	2	-	has full name
F	5	3	12	-
O	1	1	-	Floor
O	1	2	1	-
O	2	1	-	Room
O	2	2	6	-
O	2	3	-	.
O	2	4	7	-
O	3	1	1	-
O	4	1	-	the facility
O	4	2	10	-

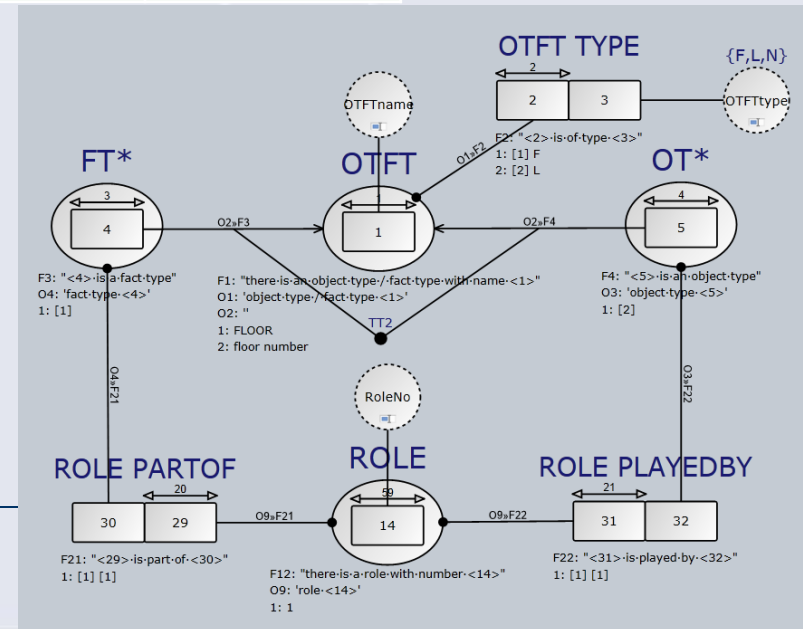


Population			
Role	Tupel	ReferenceTupelNumber	Label
1	1	-	1
1	2	-	2
1	3	-	3
2	1	1	-
2	2	2	-
2	3	3	-
3	1	-	2
3	2	-	0
3	3	-	2

Example of FCO-IM auto repository

OTFT		
Name	OTFTType	DataType
FT	N	NULL
OT	N	NULL
OTFT	N	NULL
OTFT TYPE	F	NULL
OTFTname	L	varchar
OTFTtype	L	varchar
ROLE	N	NULL
ROLE PARTOF	F	varchar
ROLE PLAYEDBY	F	varchar
RoleNo	L	varchar

Roles		
Number	PartOf	PlayedBy
1	OTFT	OTFTname
2	OTFT TYPE	OTFT
3	OTFT TYPE	OTFTtype
4	FT	OTFT
5	OT	OTFT
14	ROLE	RoleNo
29	ROLE PARTOF	ROLE
30	ROLE PARTOF	FT
31	ROLE PLAYEDBY	ROLE
32	ROLE PLAYEDBY	OT



Transformations of repository

- FCO-IM EL-IGD = XML structure for Graphity
- GLR = repository -> repository transformation
- SQL script = text transformation
- Research: all repository transformations
 - Entity Relationship Modeling
 - UML
 - Data vault
 - Anchor modelig
 - Stars & snowflakes for DWH

Example of XML generation

```
SELECT
'@id'                = REPLACE(otf_OTFTName,' ','_'),
'@innertext'         = otf_OTFTName
FROM tbIFCO_OTFT
WHERE otf_Modelname = 'Rooms and floors'
AND otf_ModelType = 'EL-IGD'
AND otf_OTFTType IN ('F','N')
FOR XML PATH('shape'), TYPE
```

```
<shape id="AVAILABLE_FACILITIES" innertext="AVAILABLE FACILITIES" />
<shape id="EMERGENCY_EXISTS" innertext="EMERGENCY EXISTS" />
<shape id="EQUIPMENT" innertext="EQUIPMENT" />
<shape id="FACILITY" innertext="FACILITY" />
<shape id="FACILITY_FULL_NAME" innertext="FACILITY FULL NAME" />
<shape id="FLOOR" innertext="FLOOR" />
<shape id="INSTALLED_FACILITIES" innertext="INSTALLED FACILITIES" />
<shape id="ROOM" innertext="ROOM" />
<shape id="SEATS_IN_ROOM" innertext="SEATS IN ROOM" />
```

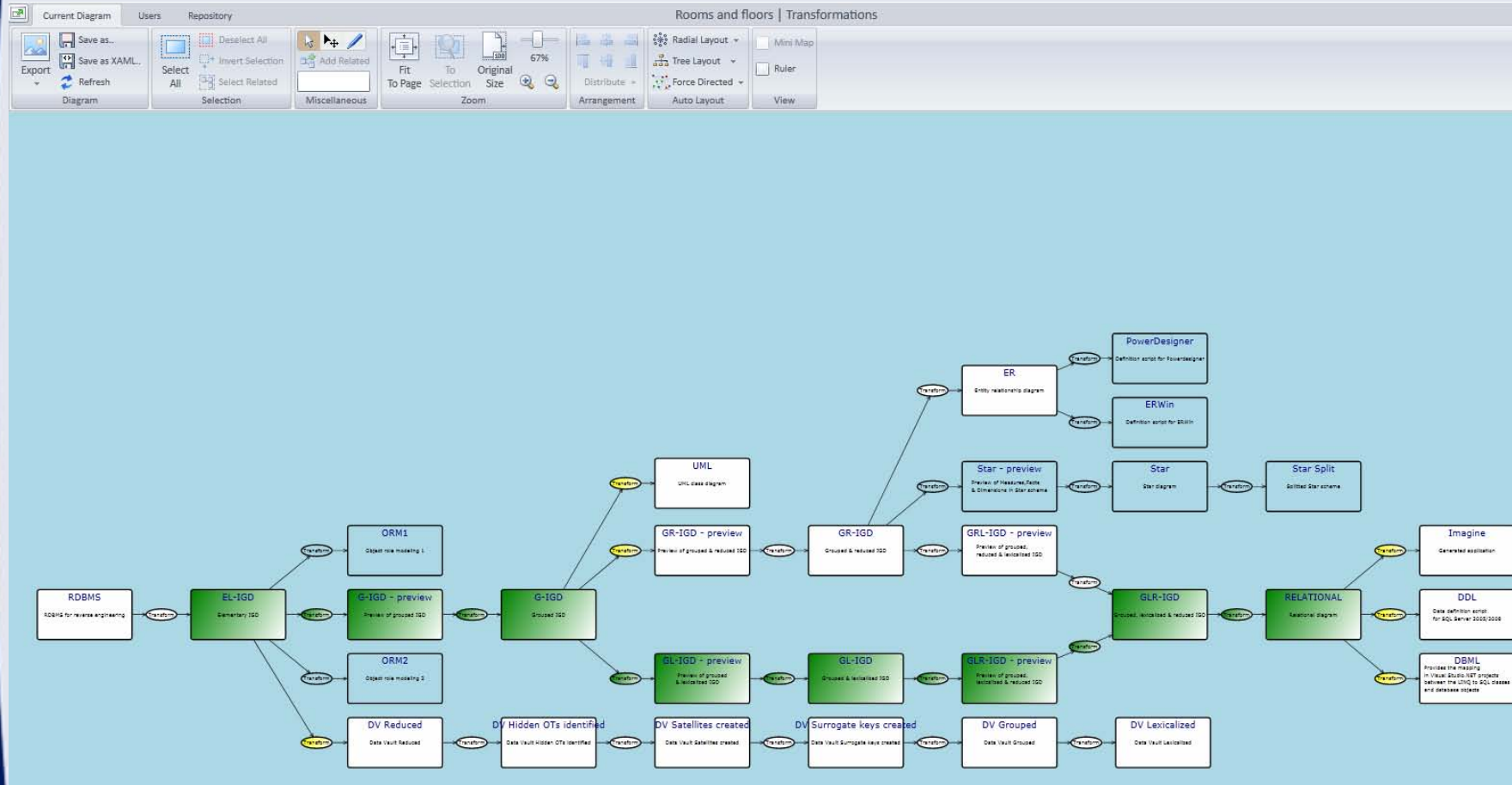
Example of SQL generation

```
SELECT 'CREATE TABLE ' + otf_OTFTName + '( )'  
FROM tbIFCO_OTFT  
WHERE otf_Modelname = 'Rooms and floors'  
AND otf_ModelType = 'EL-IGD'  
AND otf_OTFTType IN ('F','N')
```

```
CREATE TABLE EMERGENCY EXISTS ( )  
CREATE TABLE EQUIPMENT ( )  
CREATE TABLE FACILITY ( )  
CREATE TABLE FACILITY FULL NAME ( )  
CREATE TABLE FLOOR ( )  
CREATE TABLE ROOM ( )  
CREATE TABLE SEATS IN ROOM ( )
```



Integrated tool



'Programmed functions'

- Flipping

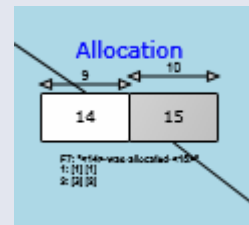
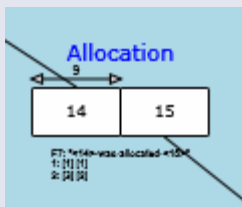


'Programmed functions'

- Totality constraints

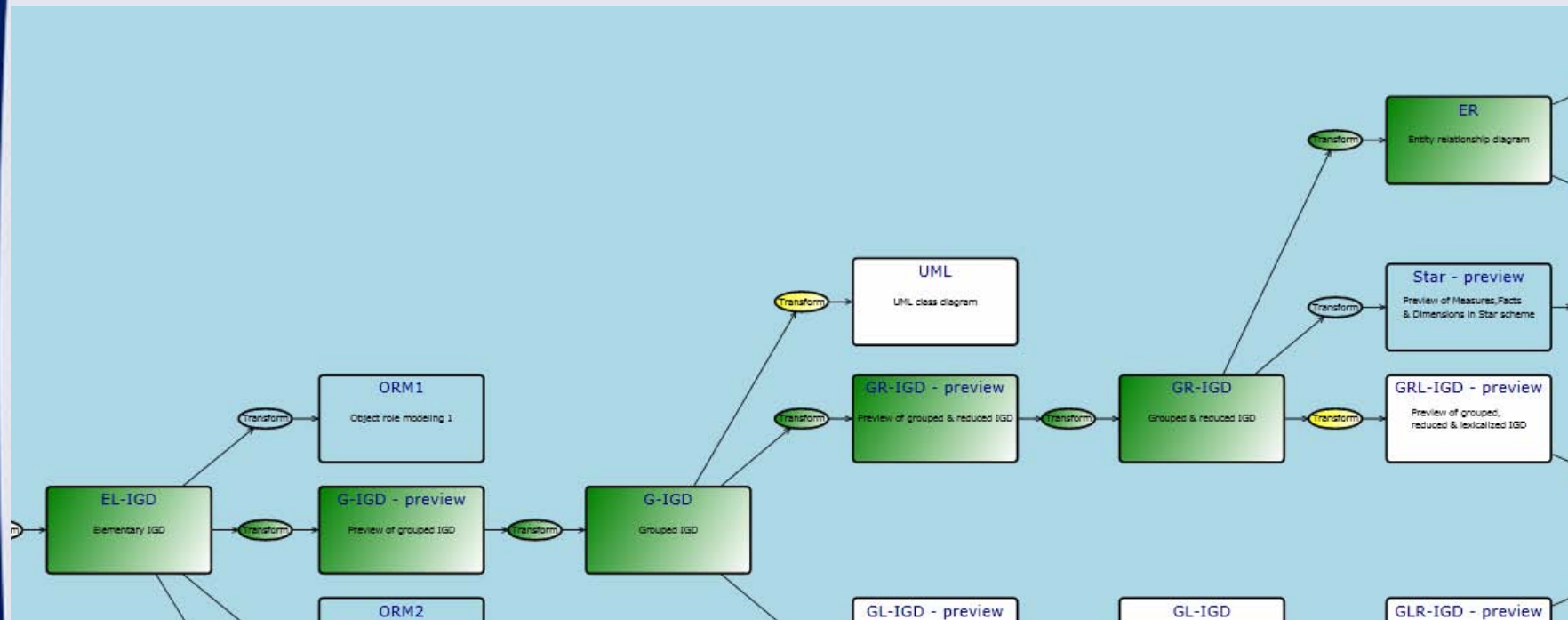


- Unicity constraints

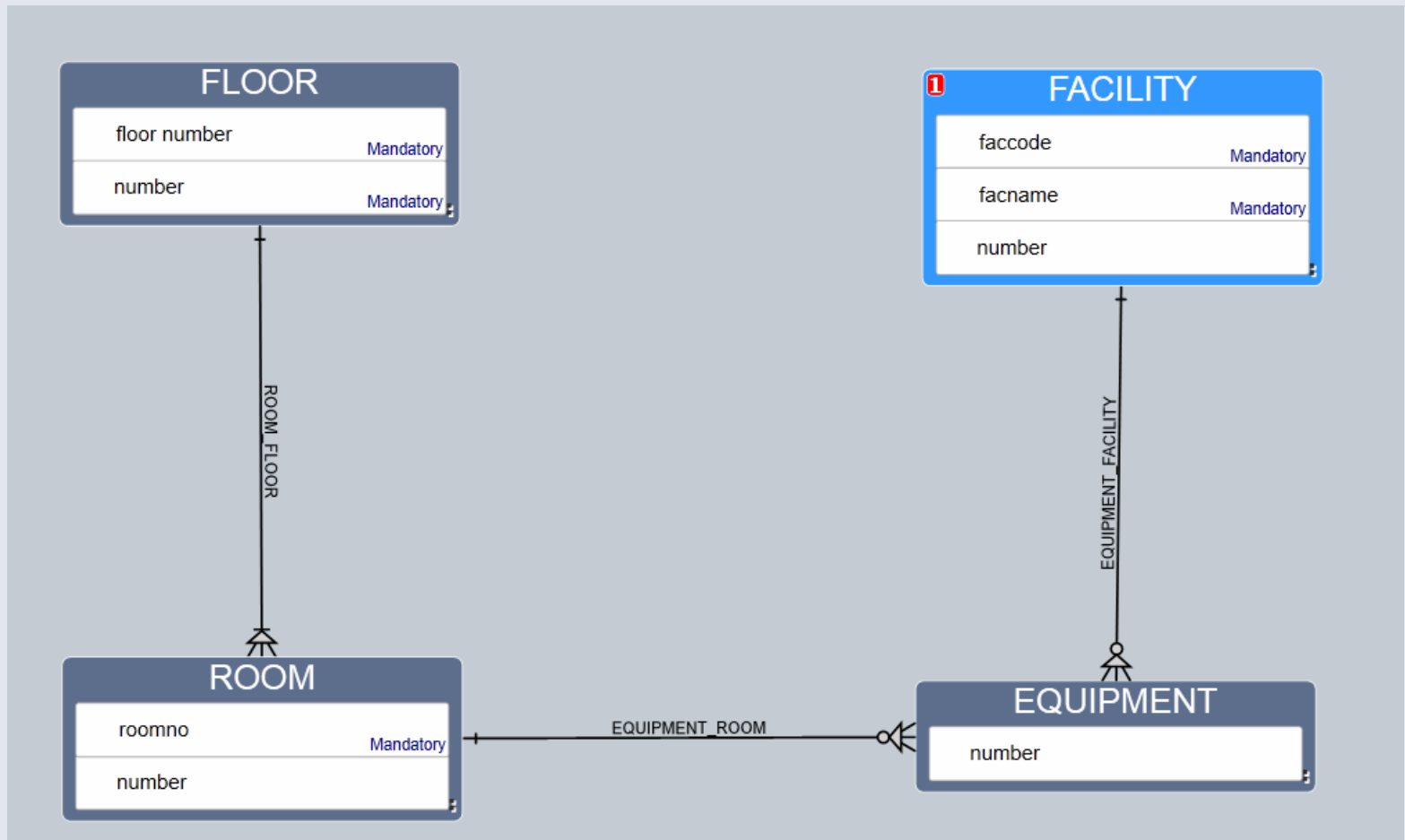


HAN geeft je de ruimte

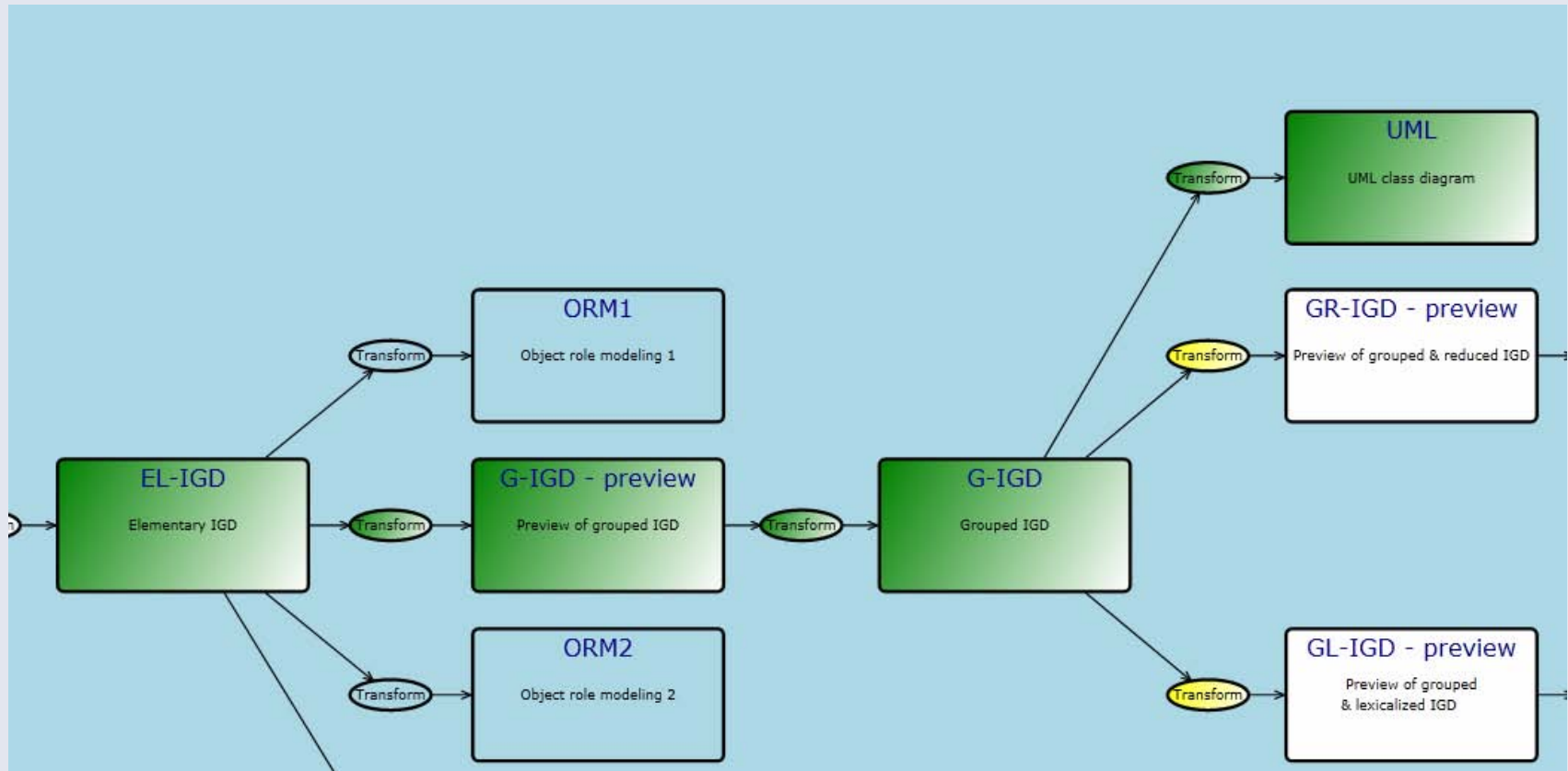
ER transformation



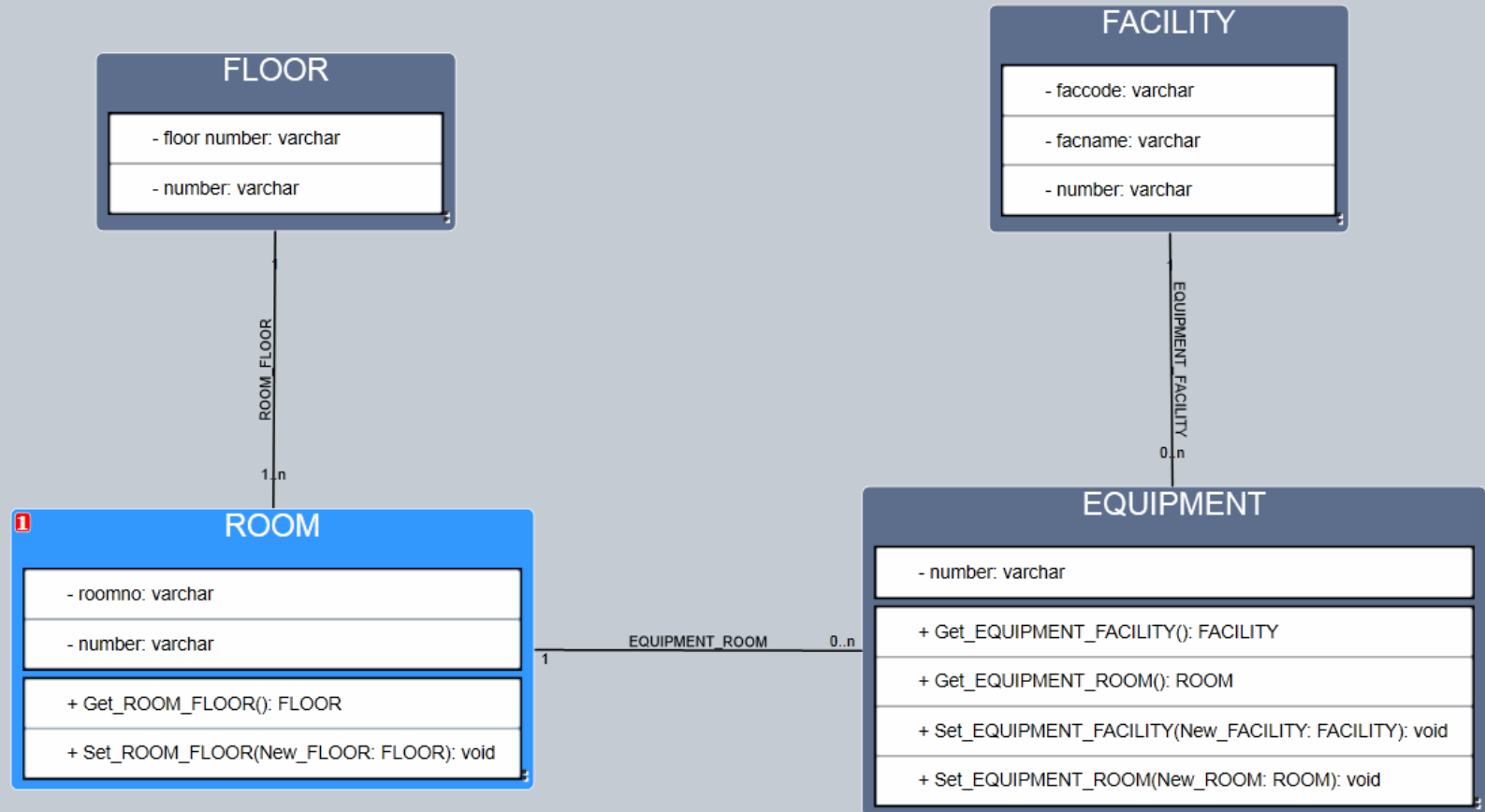
ER transformation



UML transformation



UML Transformation



Final projects by students

- BPMN editor/comparison in Graphity (Centric)
- Claqua as interactive conversation (RU)
- Data vault algorithm
- Anchor modeling – 3rd NF comparison speed
- Generating testcases for GLR
- SBVR application generation (Usoft)
- BPMN generation of batch processes (Usoft)
- ORM Anchor modeling transformation

- Remove 'has ...' from diagram
 - More constraints, constraint language?
 - Generalization
 - Recursive identification
 - Overlapping fact type expressions
 - New input from theoretical research
 - Better SQL script (constraints, subtype, triggers)
 - Sub types in application
 - Better RE with dirty data, missing PK & FK
 - ER entry with immediate transformation to FCO-IM
 - FCO ER
 - More application meta data
-

Docenten (Technische) Informatica

- 2 FTE
- U hebt een relevante wo- of hbo-masteropleiding. U bent een ervaren informaticaspecialist met relevante werkervaring, opgedaan in het bedrijfsleven. We zoeken collega's die flexibel inzetbaar zijn voor onderwijs in zowel technische als niet-technische informatica en goed thuis zijn op zoveel mogelijk van deze terreinen: (Embedded) Software Engineering, kennis van OO-programmeertalen bijvoorbeeld Java, C#, C++, UML voor analyse en ontwerp van systemen en embedded media objects. U hebt visie en een verfrissende kijk op uw vakgebied. U bent creatief en ondernemend en hebt uitstekende didactische, sociale en communicatieve vaardigheden. Omdat van hogeschooldocenten tevens verwacht wordt dat zij onderzoek verrichten, is affiniteit met en/of ervaring in het uitvoeren van onderzoek een pre.