IDM
Business Rules

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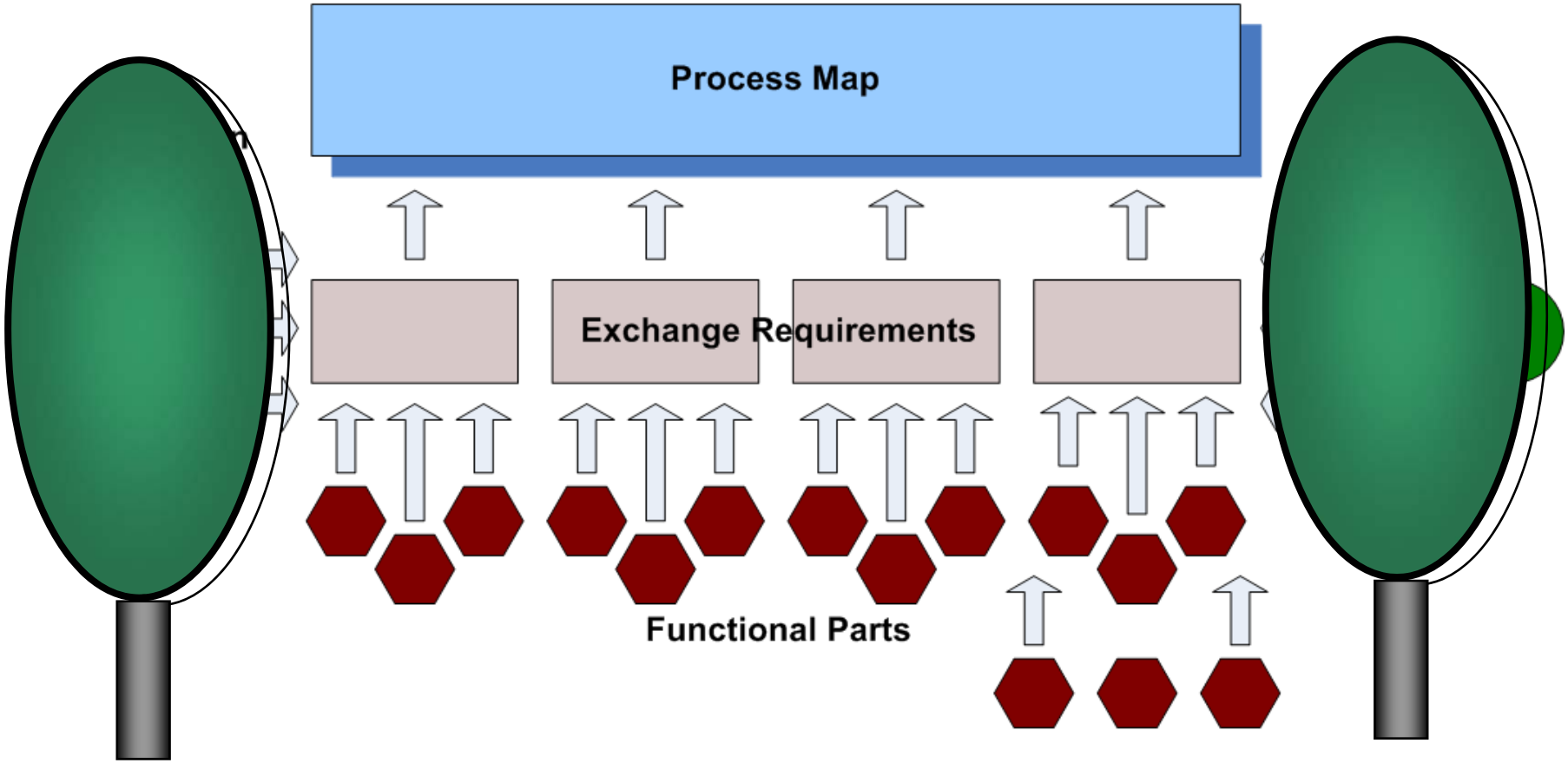
IDM Technical Architecture



Focus on Business Rules and Verification Tests

Tests

Tests can be checked
Tests can be automated

Verification tests

- build on the validation of the building model
- validate against purpose of exchange

Business rules

- project standards and processes
- enterprise standards and processes
- national standards and processes

Tests and non-Tests

What's the difference ?

Test

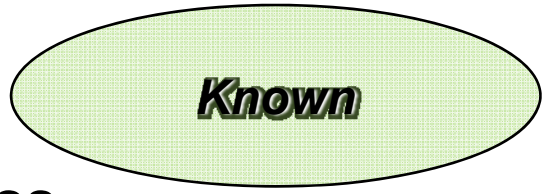
- '... is an approved vapour barrier'
- '... has a permeability of less than 1 perm'

Non-Test

- '... is weather-proof'
- '... is a vapour barrier'

Boolean and Logical Tests

Contractual Specifications must be testable



Boolean test

- yes, true, pass
- no, false, fail

Logical test

- yes, true, pass
- unsure, unknown, indeterminate
- no, false, fail

Users

Tests serve a purpose

- aware of process and business impacts
- doesn't need technical detail about use of information in the process
- does not need to know about software or format

- needs to know what information to expect and how to use it in the business process
- does not need to know about software or format

- writes software + data exchange interface
- needs to know what users expect from software
- needs to know about the exchange format

Tests

Types of test

- objects (including relationships) present or absent
- values present or absent from range or lists

Examples

- internal spaces present but no external spaces
- naming of spaces to BS 4157 conventions
- layering to BS1192:2007
- take-off classified to RICS BCIS
- materials named as on enterprise approved lists

Compliance tier	Topics covered	Example failure	Detection
Validity	Domain expertise Application requirements	Escape from room with no door.	Domain application rules, results.
IDM	**Project process based requirements, Expectations, Fitness for purpose.**	**Absence of connections on HVAC**	**?**
IFC endorsed property set usage (ie IFC2x4, IFD).	Naming, value types	Incorrect spelling of 'PsetSpace_Common'	Inspection
IFC view definition: Coordination or Code-Checking.	Anticipated entities. Implementation Agreements.	Absence of space boundaries	IAI Certification
IFC schema rules	Cardinality and 'where' rules	Empty list in material relationship	Toolkit validation
IFC schema content	Entities and properties	Incorrect number or type of attributes	Toolkit read/write
ISO-10303 STEP SPF:Part21 or XML:Part28	File layout and syntax	Incomplete comment delimiters	General read/write code

Technical Concept

Which of these five are Tests?

Description of information required and specification of values to be set

Name of entity/attribute or property set/property to be used

Mandatory (actual/ recommended) or Optional to use

Description	Entity/Pset/Functional Part	MAN	REC	OPT
Specify the system occurrence in which elements will participate *A system opening is directly specified as an occurrence.*	IfcSystem OR IfcElectricalCircuit	✓		
Set the global unique identifier	IfcSystem.GlobalId → IfcGloballyUniqueId OR IfcElectricalCircuit.GlobalId → IfcGloballyUniqueId	✓		
Assert the owner history of the system	IfcSystem.OwnerHistory → fp_apply_owner_history OR IfcElectricalCircuit.OwnerHistory → fp_apply_owner_history	✓		
Specify the name of the system. *Although this is an optional attribute within IFC, it must be asserted for system.*	IfcSystem.Name → IfcLabel OR IfcElectricalCircuit.Name → IfcLabel		✓	
Specify a description for the system *Whilst the description does not add value to the semantics of the system, it can provide significant information for later project stages.*	IfcSystem.Description → IfcText OR IfcElectricalCircuit.Description → IfcText			✓

Testable

Testable

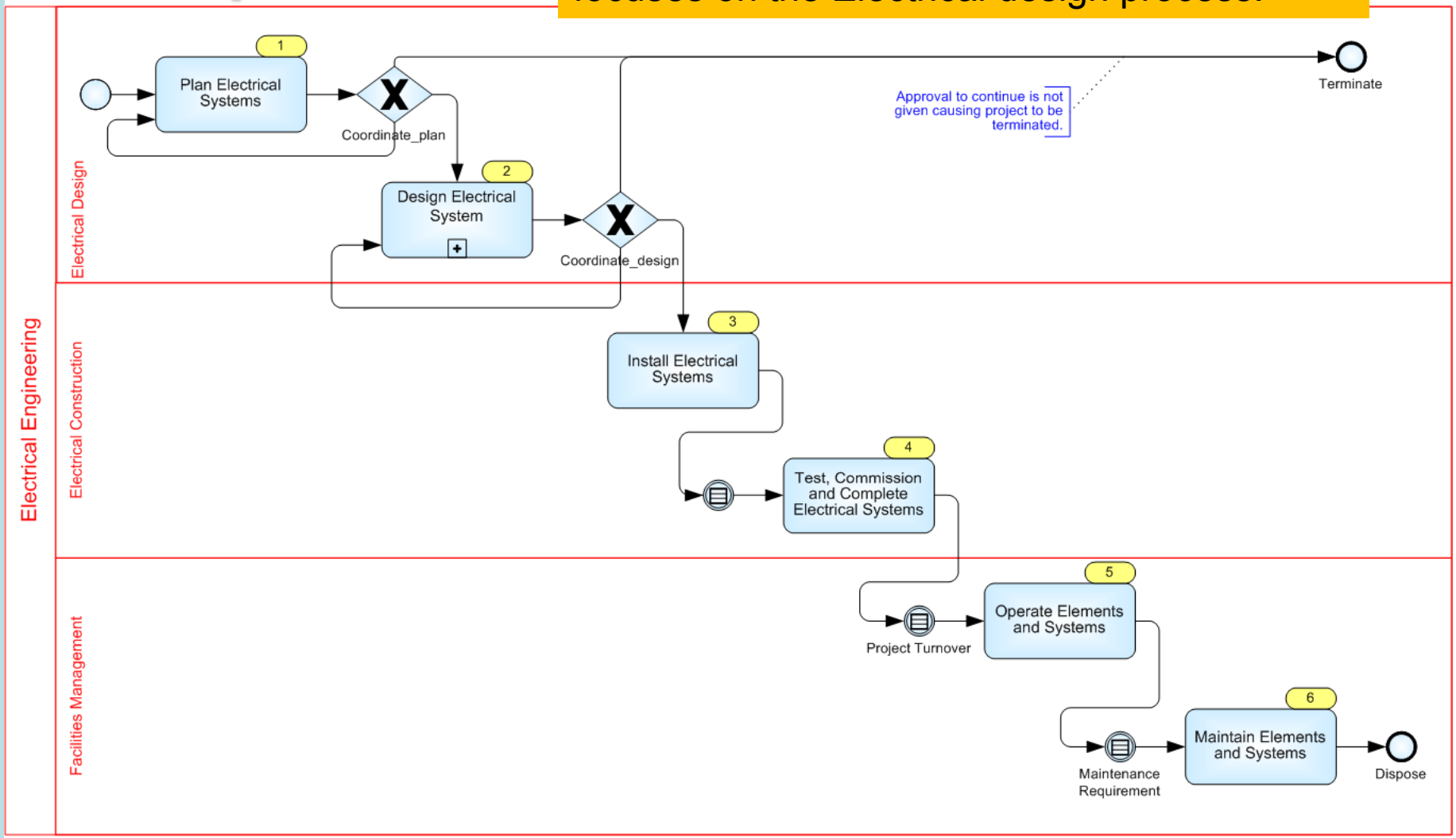
Testable

Not Testable

Not Testable

Example

This example is from the HITOS project and focuses on the Electrical design process.



Electrical Engineering	author: Jeffrey Wix version: 0.3 status: created	created: 20/12/2005 15:24:35 modified: 05/03/2006 14:31:29	buildingSMART
Electrical Engineering			
Top level diagram for electrical project electrical engineering	bpmn_electrical_engineering.vsd		

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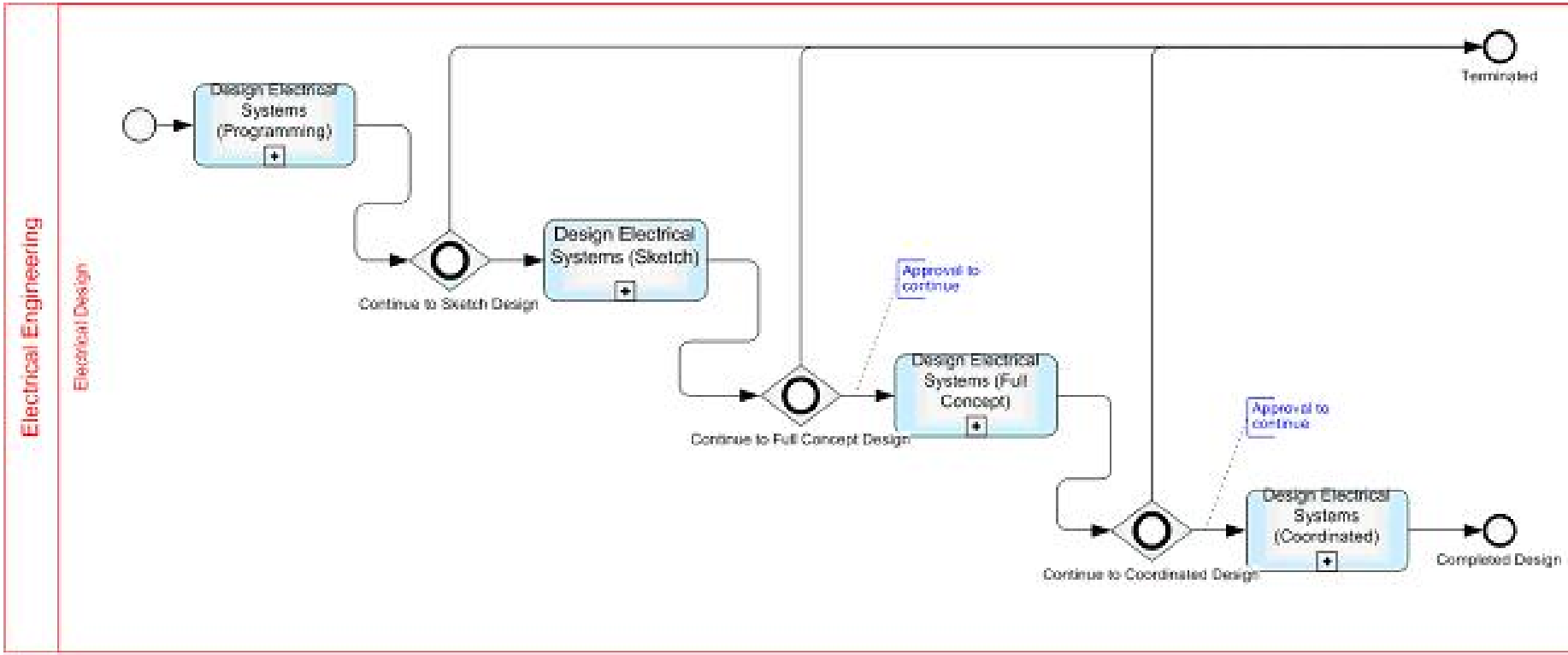
Process: electrical design

- Pre-requisites for electrical design
- Criteria for completion of electrical design



Specific process details

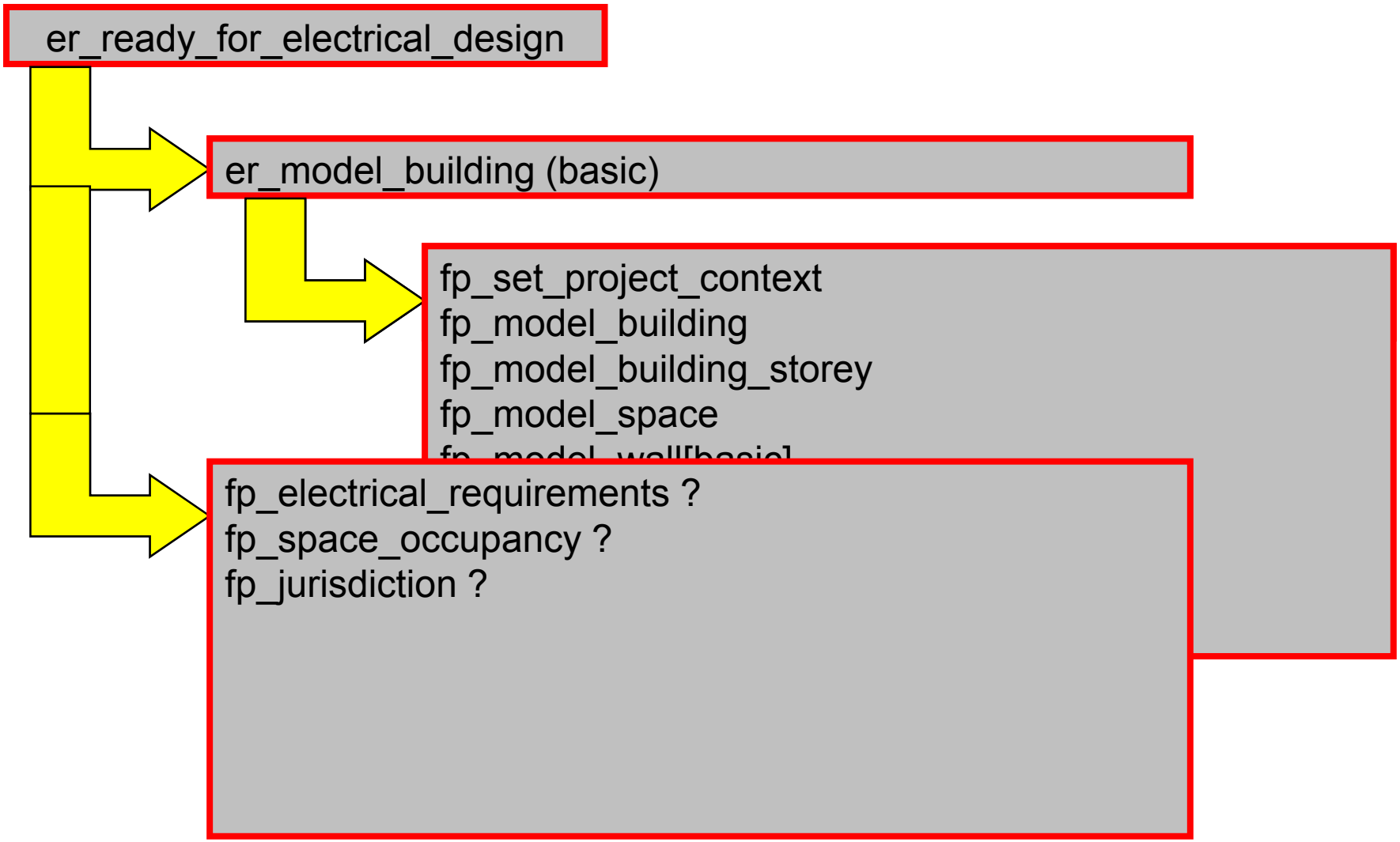
This process includes determining:

- Estimate of load to determine incoming size
- Identify main vertical routes using indicated spaces
- Location, sizing and identification of technical spaces
- Costing for presentation is by high level aggregation element such as lighting overall (1 less digit in classification table!).
- Specification of types of system and principles of operation.
- Sketch design [BIM] showing technical spaces, vertical distribution routes, key horizontal routes using cable carriers to describe principal routing

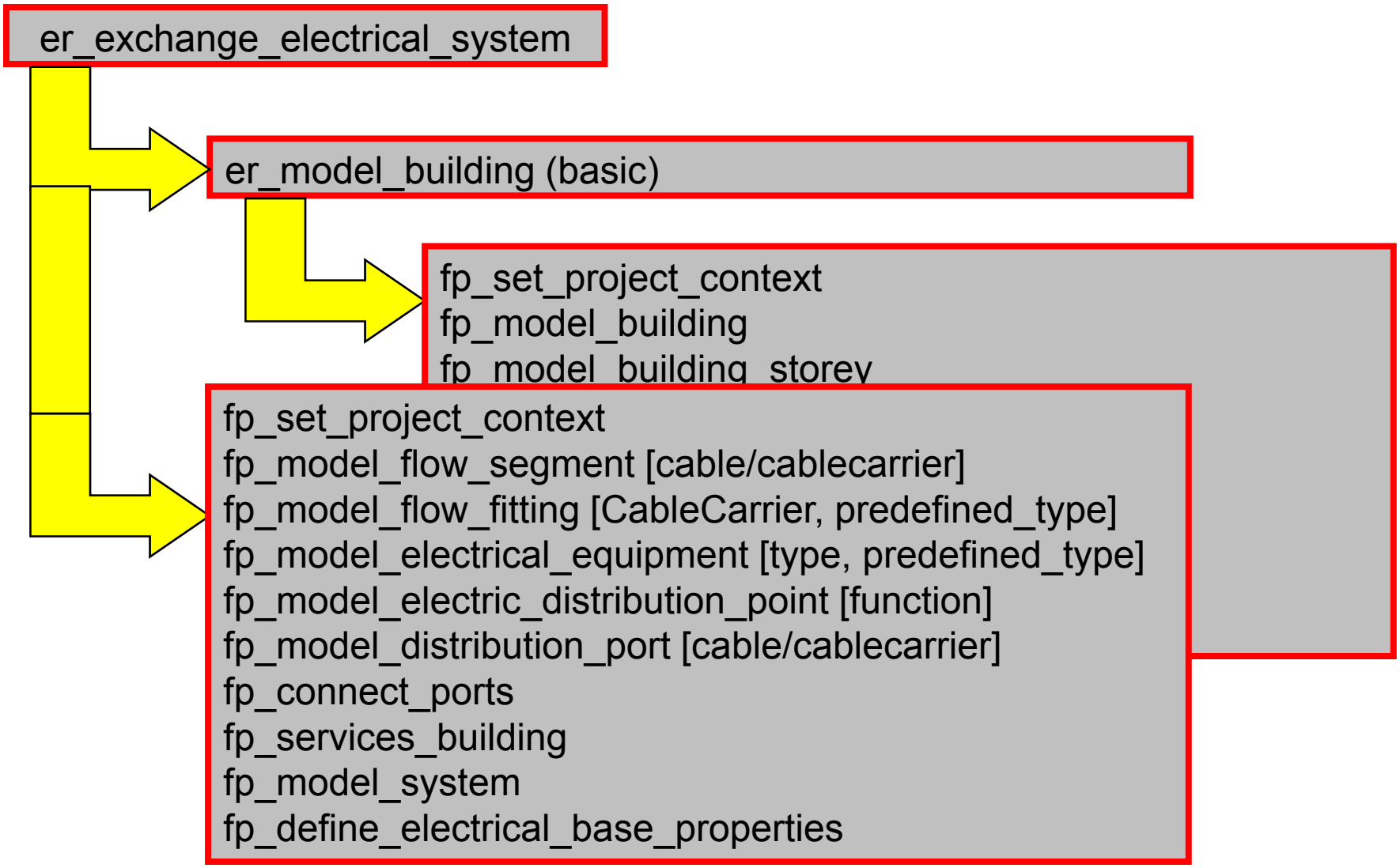
Specifics for Norwegian Practice

- NS3451, Building element level of systems (down to level of whole system such as all lighting)
- Costing uses NS3453 (standard table for building categories) likely to be based on sq.m. prices against known previous example buildings.

er: ready_for_electrical_design



er: exchange_electrical_design



Sample tests

Usually applicable to all schema versions
Frequently tighten IFC schema constraints

- { 1 <= self.BasePhase <= 3 }
- Exists(self.Name)
- self.BaseVoltage in [110,250,260]
- self.BaseFrequency >= 50
- PropertyExists('Graphical','LayerName')

Extending the FP with Clauses

Description	Entity	Name and Test Clause
Model the correct number of ports for the element to which the ports are assigned: for example: **flow terminals terminate a distribution system.**	*a subtype of (Ifc) Distribution Element* **Ifc Flow Terminal**	**flow_terminals_ should_have_ one_port** **sizeof (self.hasPorts) = 1**

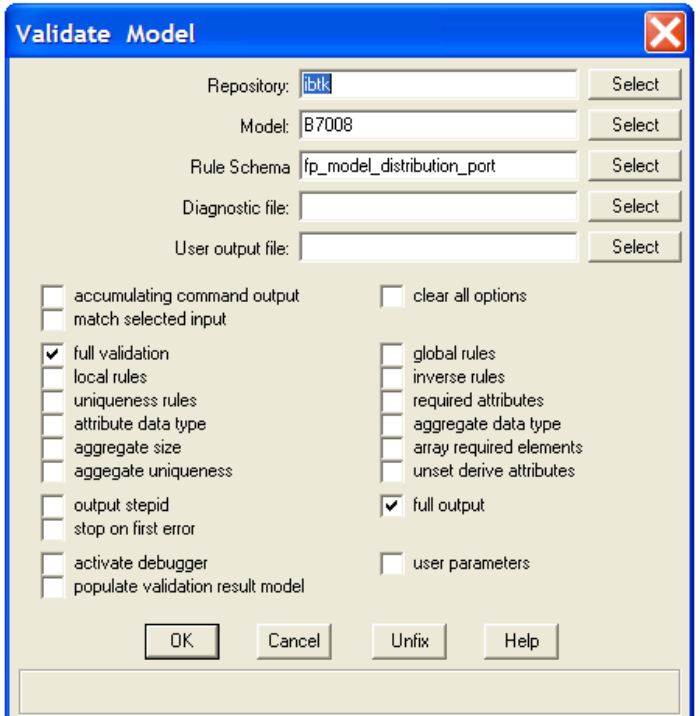
```
#75= idmLOGICALTEST(
        ' 12345678901234567890 75',
        'br_flow_terminals_should_have_one_port',
        'flow terminals terminate a distribution system.', $,
        '2005-10-03','2005-11-09',$,.F.,(#50,#51),
        'IfcFlowTerminal',
        'sizeof(self.hasPorts)=1'
);
```

Formal Validation Test

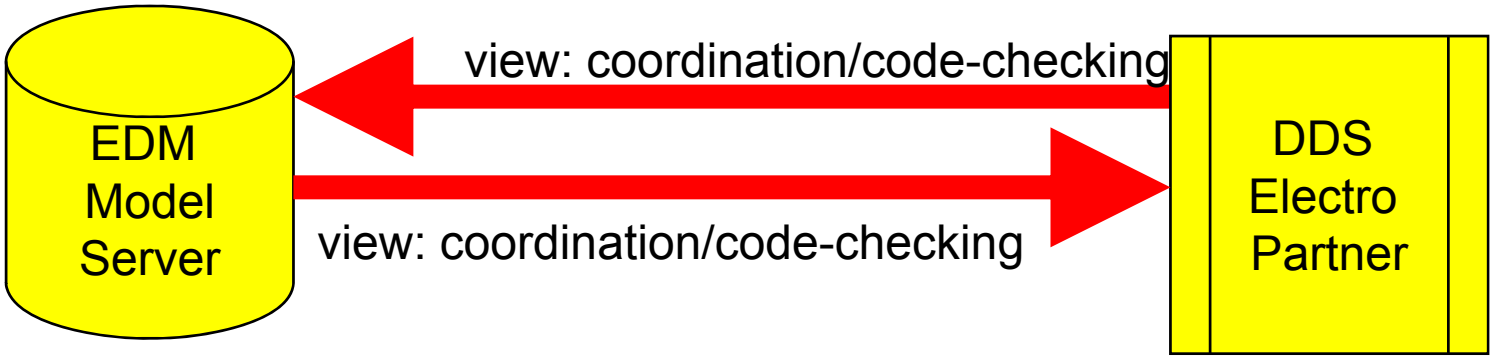
- RULE_SCHEMA **fp_model_flow_terminal** FOR ifc2x2_final;
  - entity **ifcFlowTerminal**;
    - where
      br_flow_terminal_should_have_one_port :
      sizeof(self.hasPorts)=1;
  - end_entity;
- end_rule_schema;

Raw result from Validation

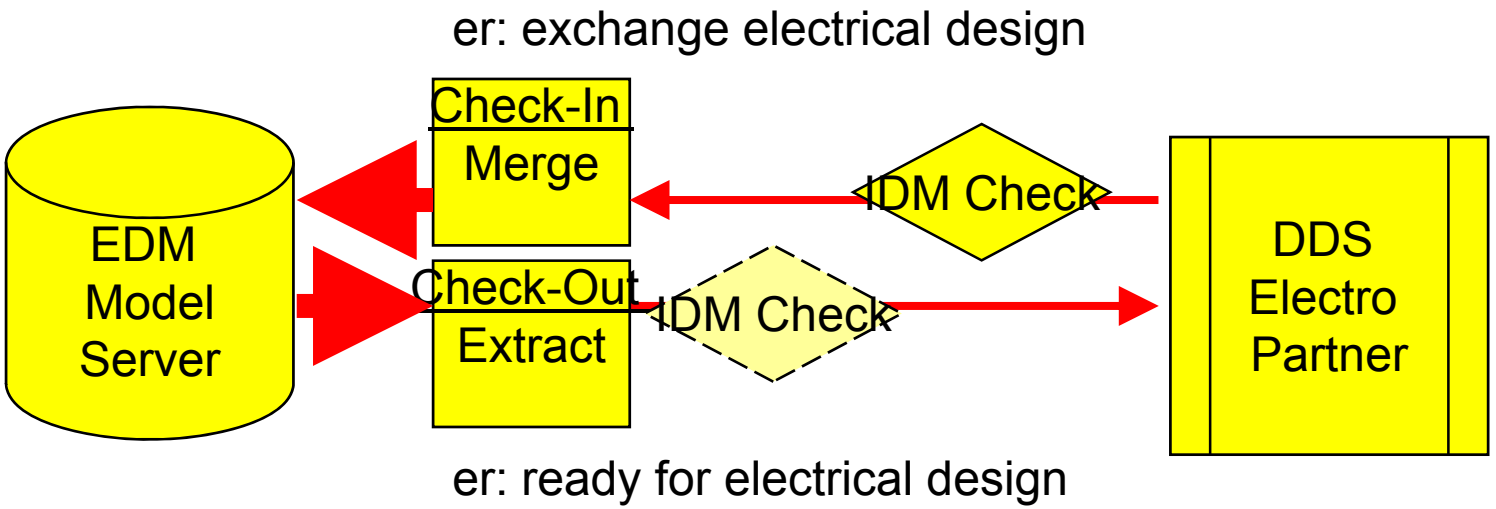
- Validation report by: **EDM Model Checker**
  - Model: DataRepository.**B7009**
  - Rule schema: **fp_model_flow_terminal**
- **FAILED**: **br_flow_terminal_should_have_one_port**
  - **IFC FLOW TERMINAL**
  - 0gjMzbm9rCiP0CdYXc4_ZD
  - Intake1
  - Fan Intake 1
  - at (2.400m 1.500m 2.700m)



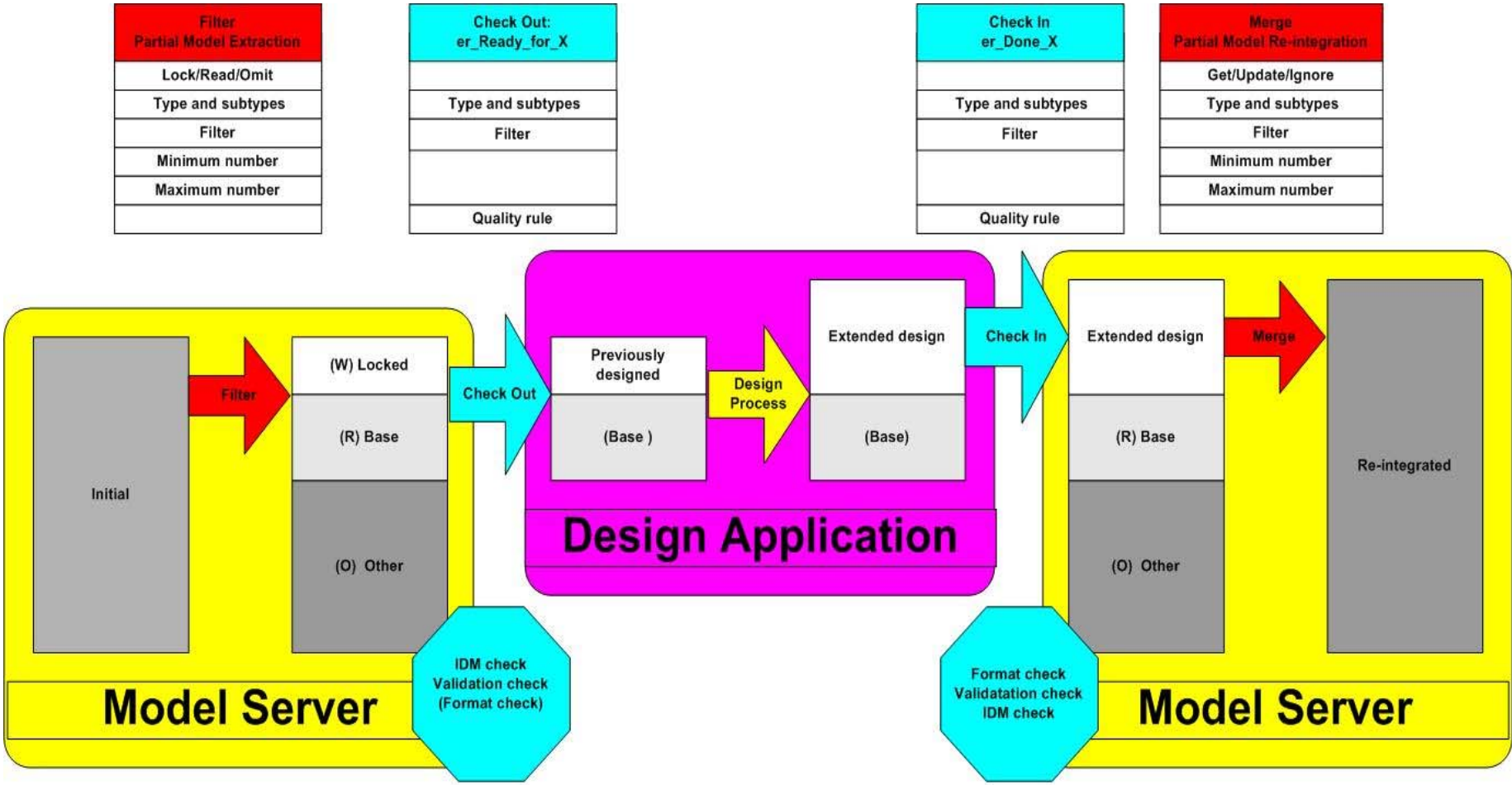
File based design development



Tromso HITOS Check-Out, Check-In

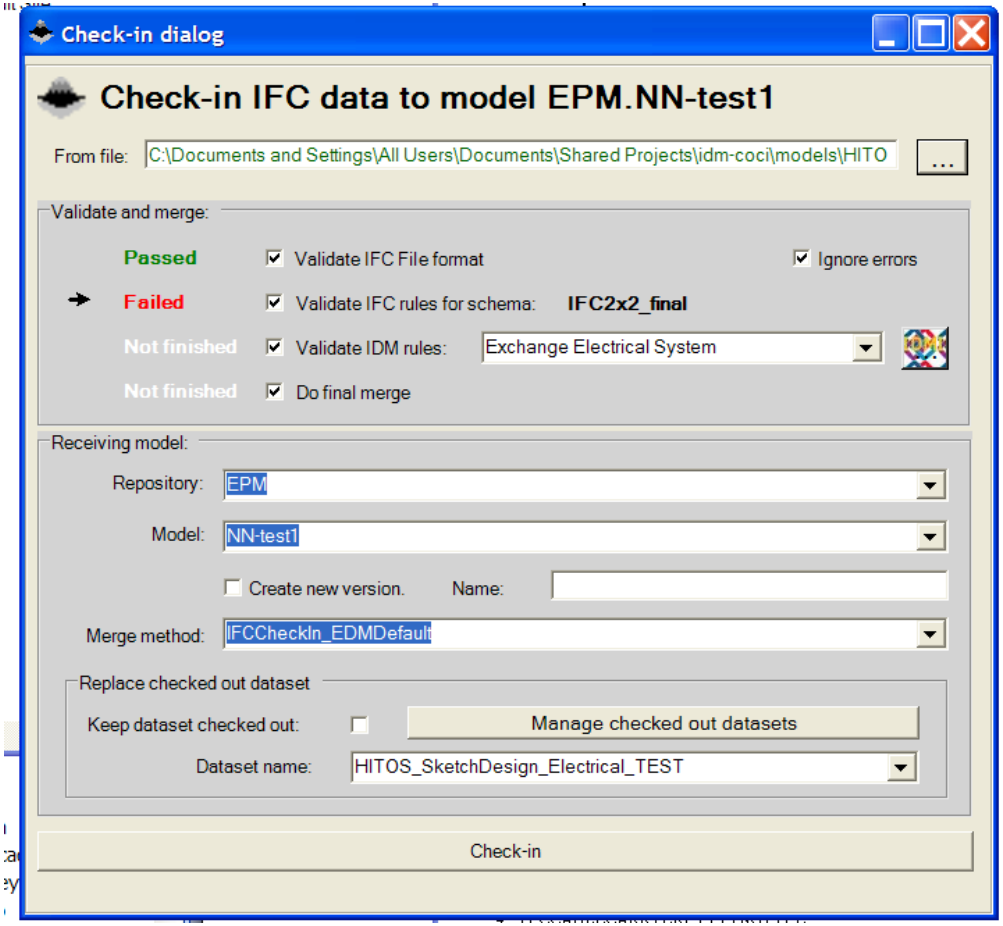


Full Check-Out and Check-In Processes



Check-in example (1)

- Failed before IDM check

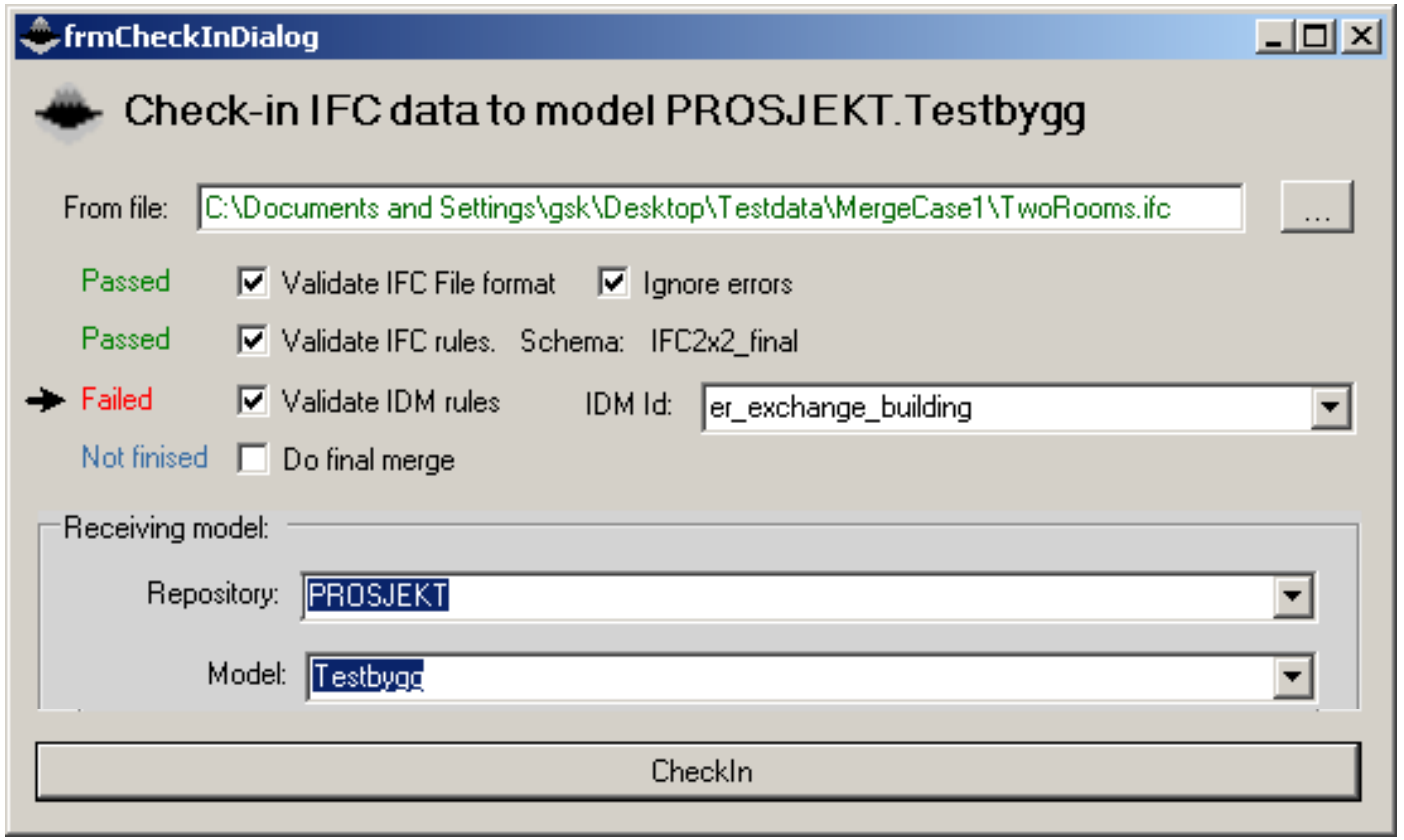


Ifc Electrical Circuit unrelated to any contents

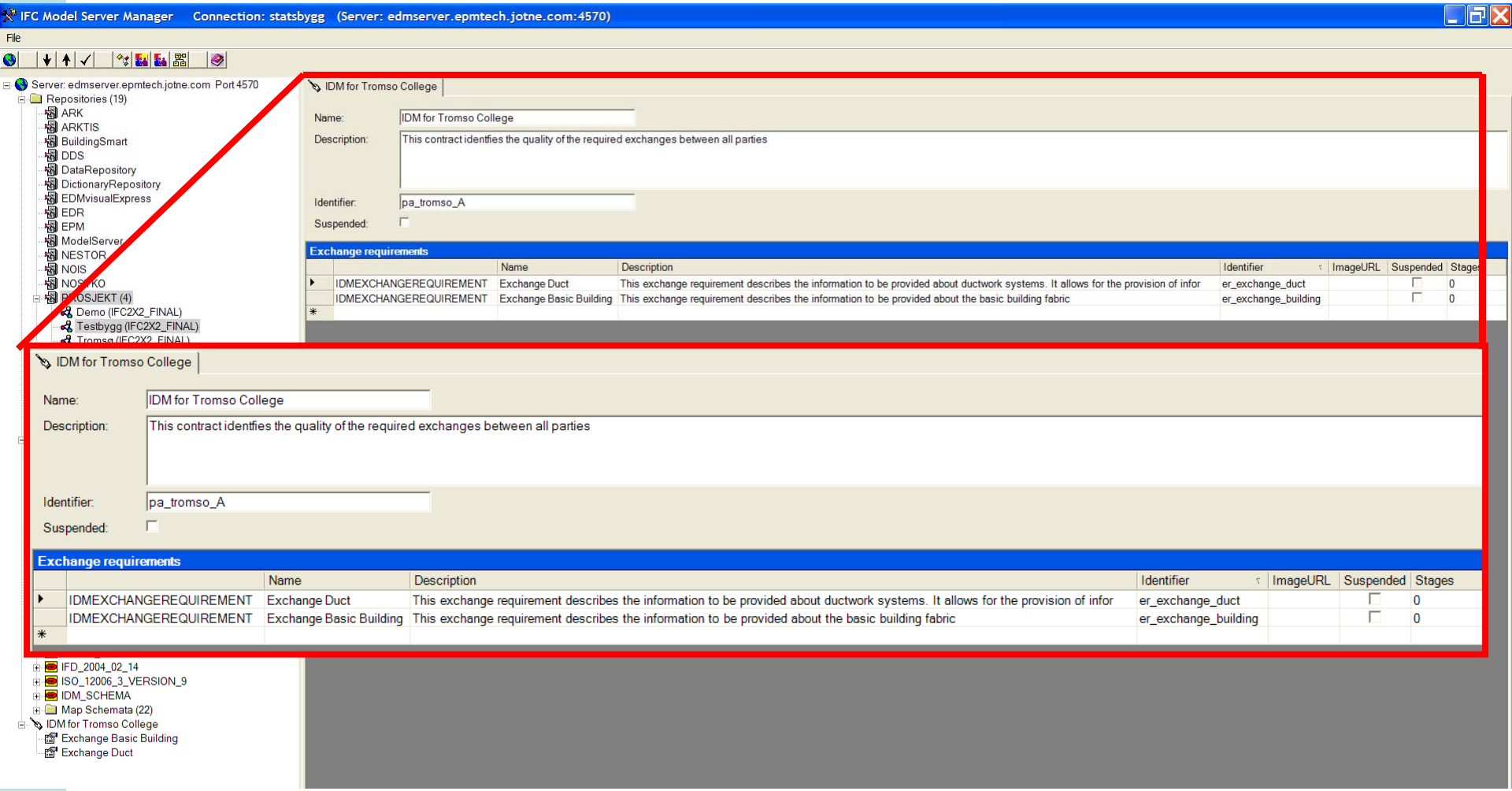
ISGROUPEDBY = Violating INVERSE rule. Expected: [1:1]; Actual: 0

Check-in example (2)

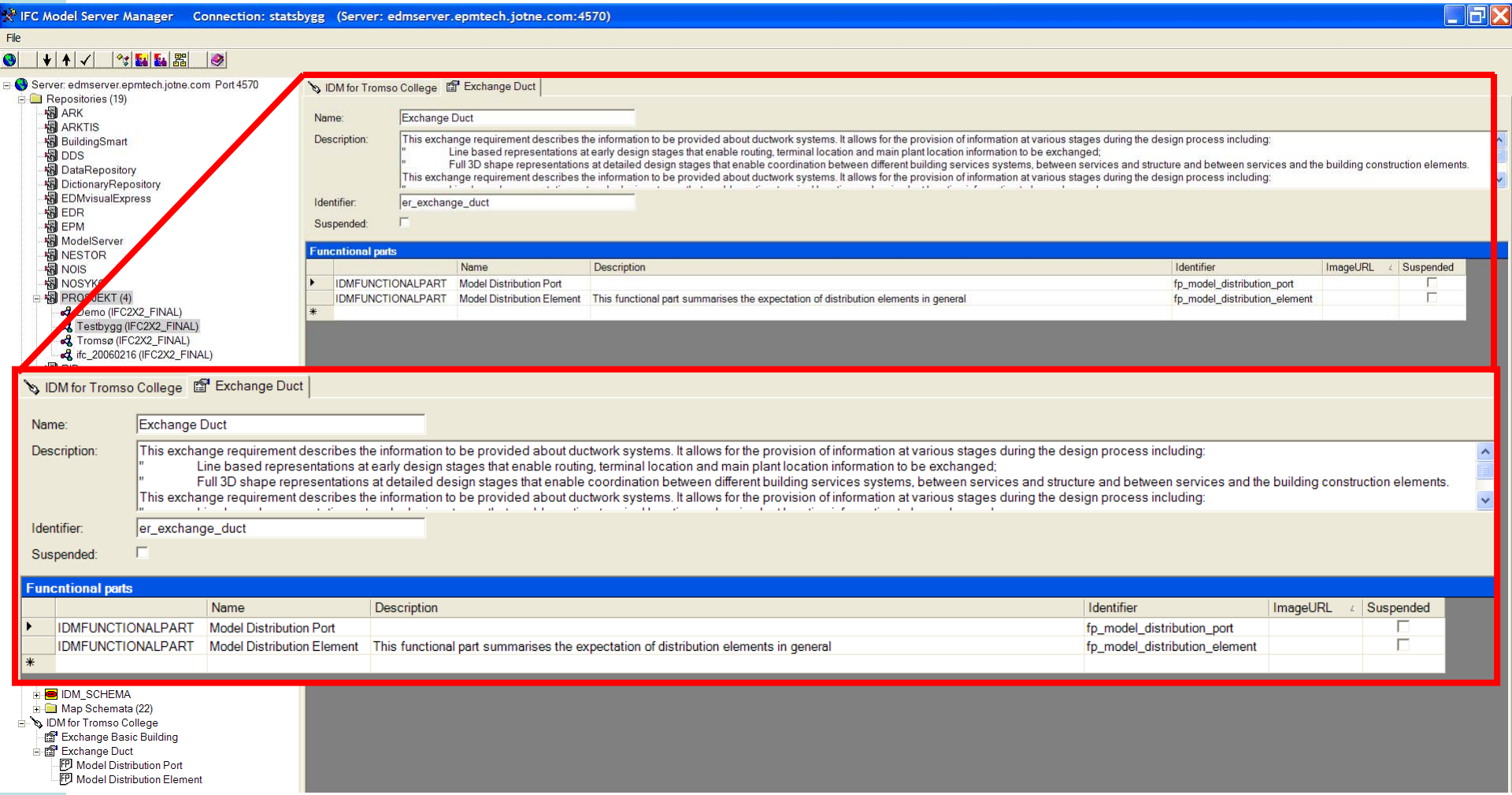
- Failed during IDM check



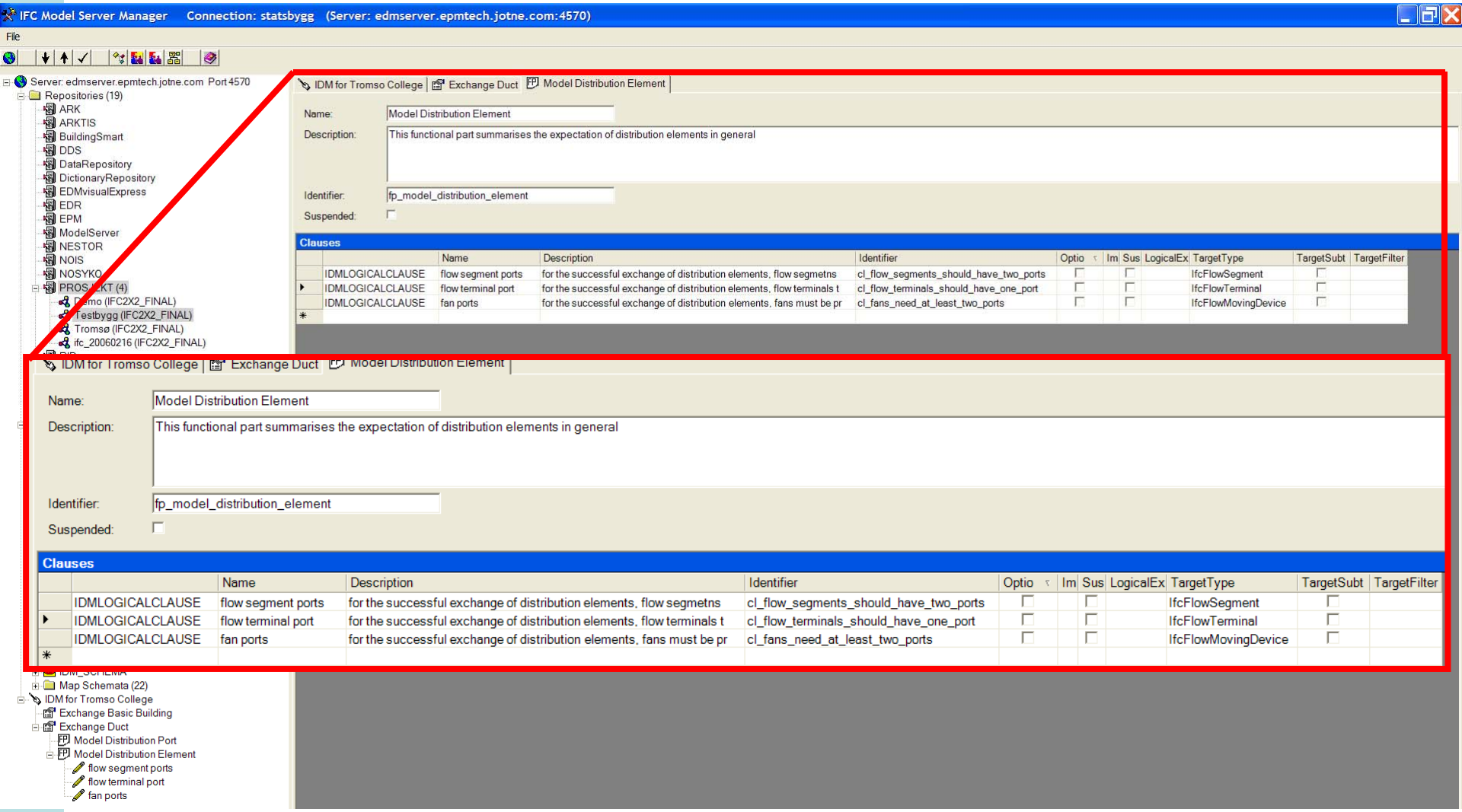
Describe the PA and add ERs



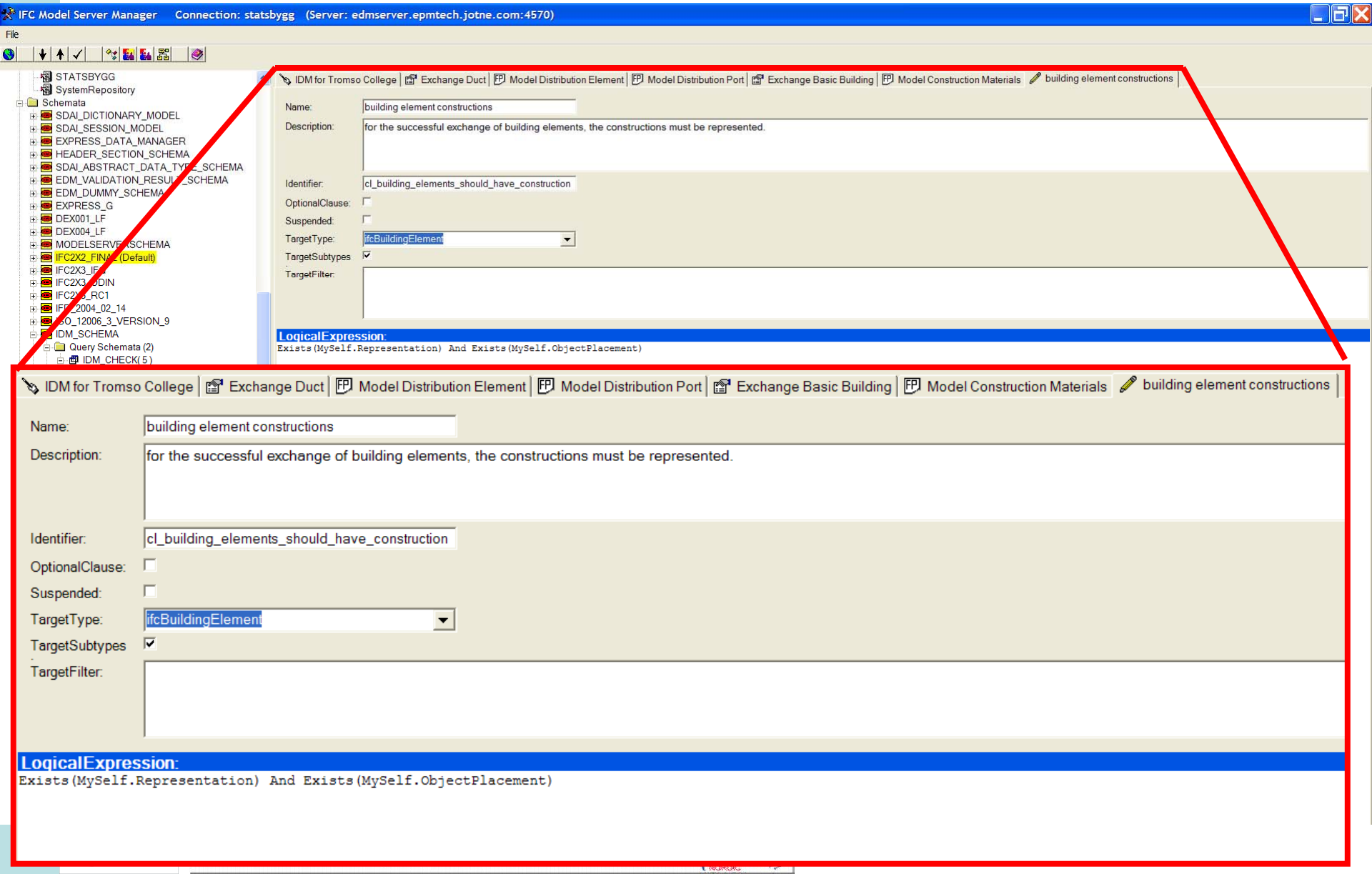
Describe the ER and add FPs



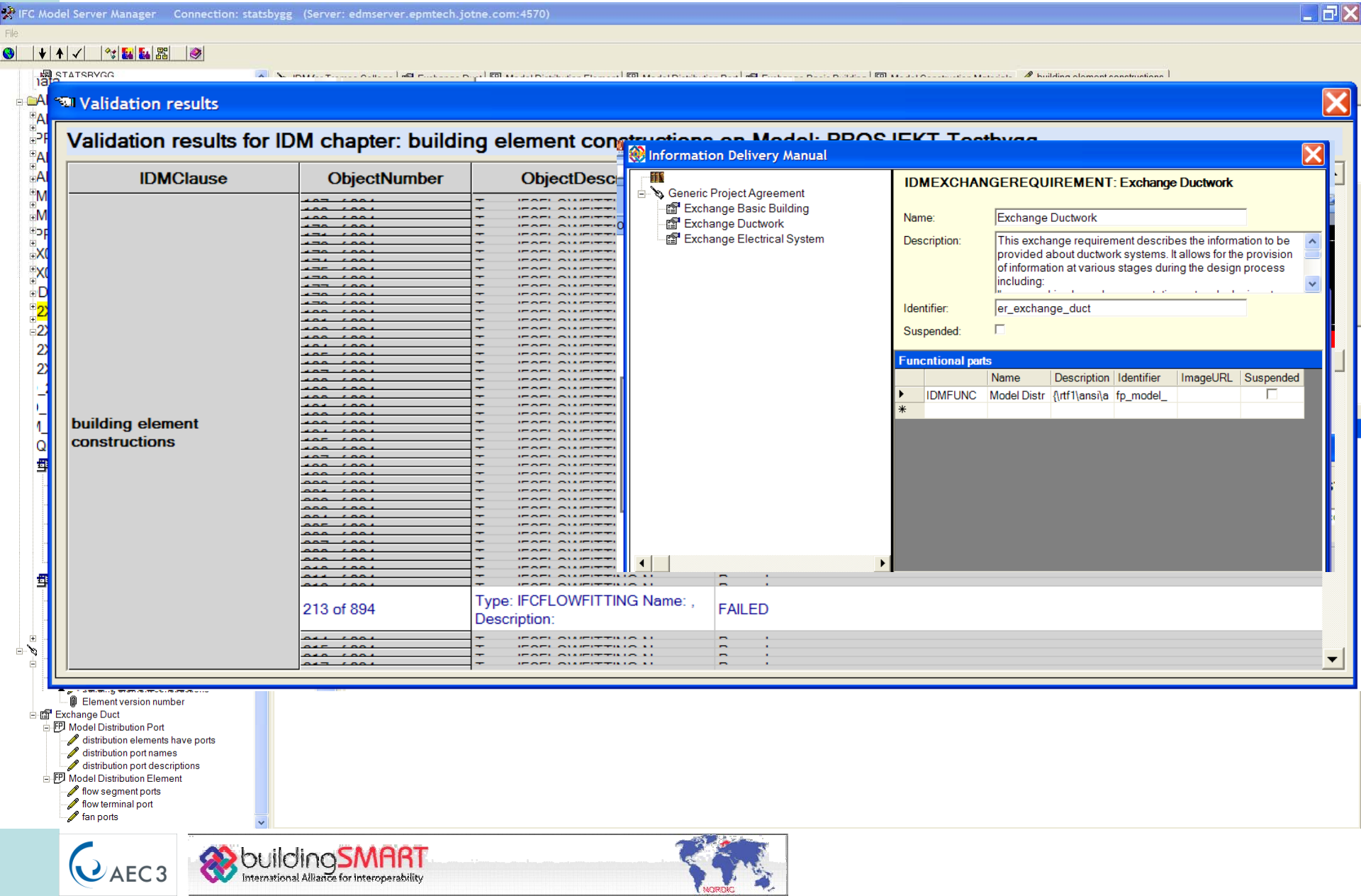
Describe the FP and add Clauses



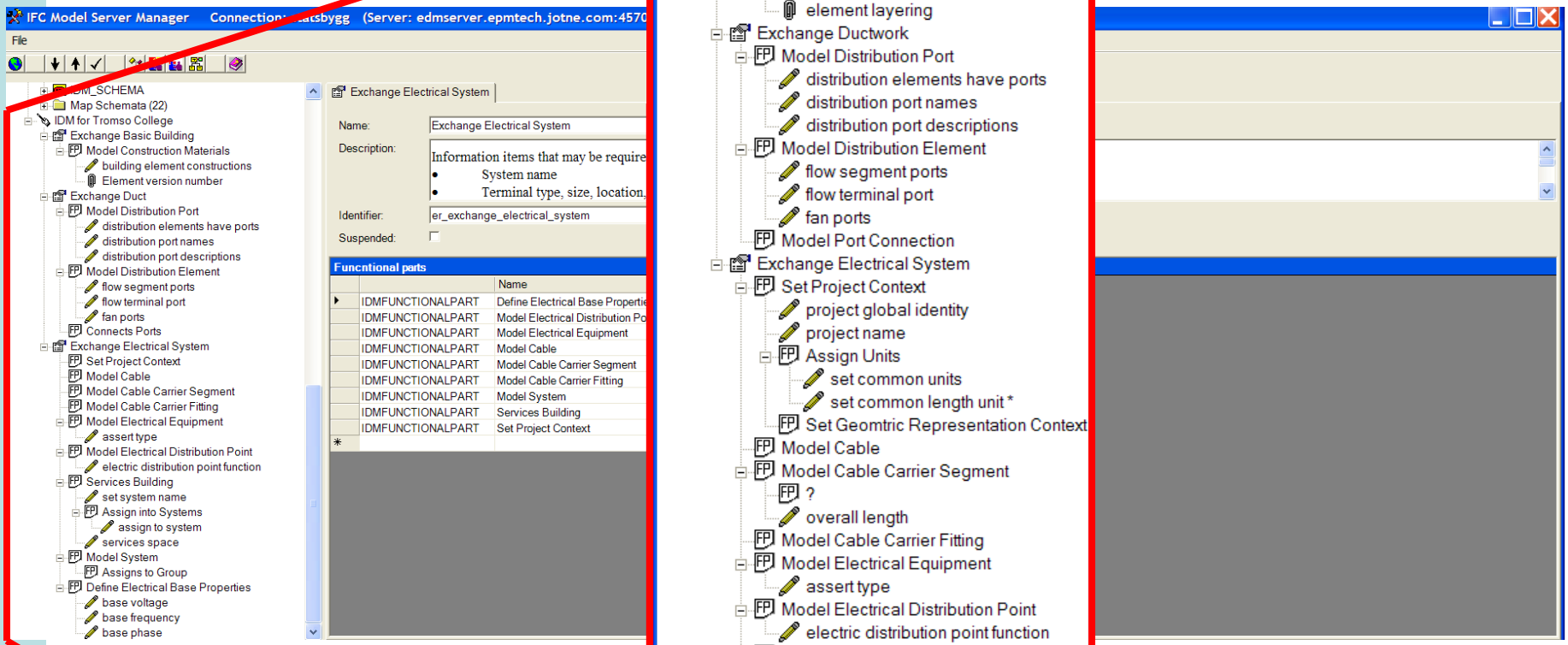
Describe and test the Clause



Results from the Clause



IDM coverage



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