

Standardi i modeliranje elektroenergetskih sistema

VEŽBA 2:

Upotreba CIMTool alata za kreiranje CIM profila u
RDFS formatu

CIM, RDF, RDFS

- CIM (Common Information Model)
 - apstraktni model koji je razvila Radna grupa 13 Tehničkog komiteta 57 Međunarodne elektrotehničke komisije
 - postao je međunarodni standard IEC 61970-301.
 - opisan je pomoću UML-a.
- RDF (Resource Description Framework)
 - definisan familijom W3C (World Wide Web Consortium) standarda kao model za opis mašinski čitljivih meta-podataka.
 - opisuje resurse u obliku subjekat-predikat-objekat “tripleta”
- RDFS (Resource Description Framework Schema)
 - proširivi jezik koji obezbeđuje elemente za zadavanje RDF resursa.

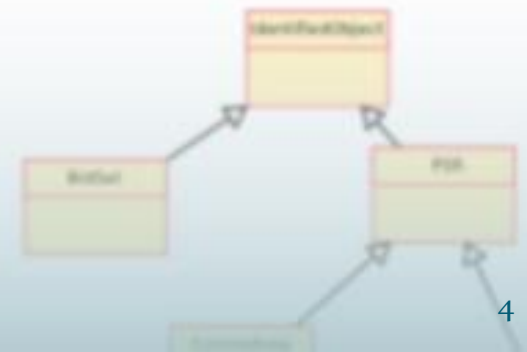
CIM Profile

- Profil predstavlja skup definicija klasa, njihovih atributa i međusobnih veza u okviru jedne šeme. Profil predstavlja opis modela podataka koji je podskup neke nadređene šeme.
- Osnovna uloga profila je definisanje domenskih i kontekstno zavisnih modela.
- Zadavanje profila je moguće u nekoliko oblika i to RDFS, XSD, kao tekstualni ili HTML dokument.
- Jednostavno rečeno svi delovi CIM-a su opcioni u zavisnosti od aplikacije i njenih zahteva. Zbog ovakvog stava, neophodan je bio poseban dokument koji bi specifikovao neophodne delove. Takav dokument je nazvan CIM Profil.

CIMTool alat

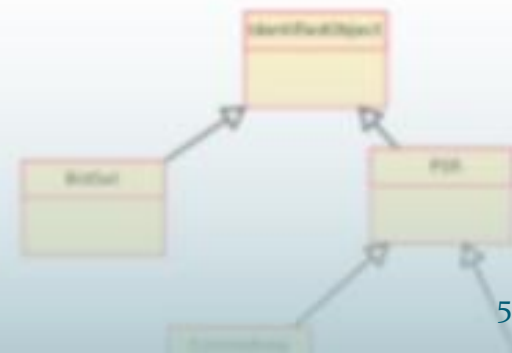
- Opensource alat
 - Site: <http://wiki.cimtool.org/index.html>
- Implementiran je kao plugin za Eclipse platformu
- Koristimo ga za dizajn CIM profila na bazi UML šeme modela date u XMI formatu

CIMTool



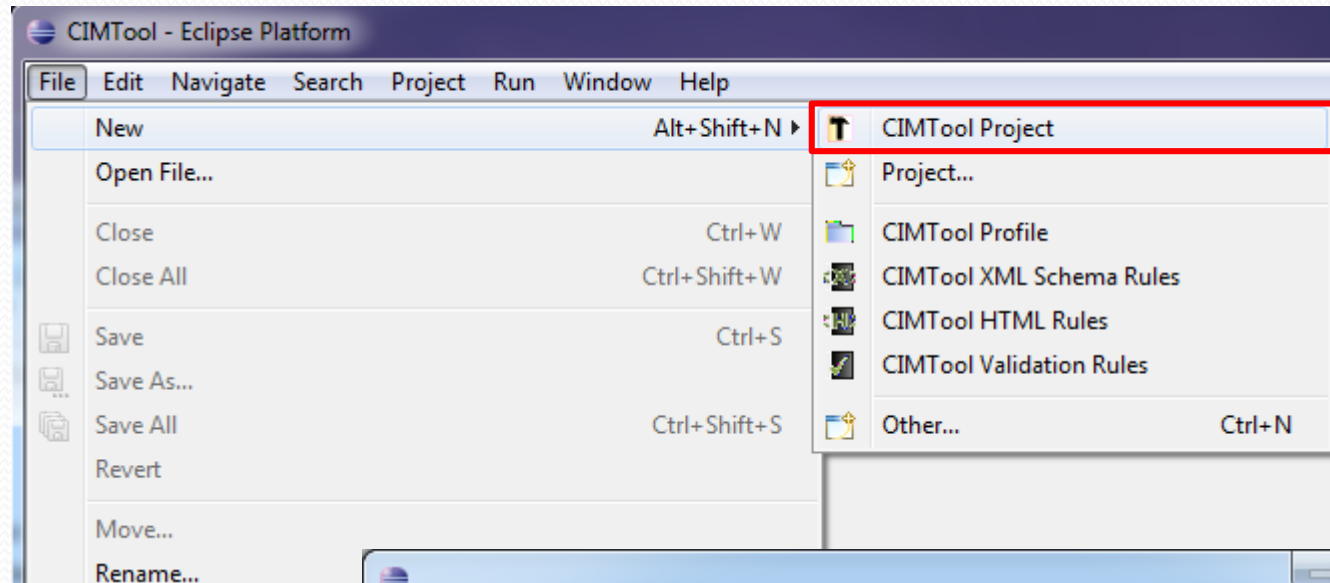
Osnovne operacije u CIMTool alatu

- Kreiranje CIMTool projekta
- Učitavanje šeme modela date u XMI formatu
- Kreiranje CIM profila
 - Biranje formata zapisa CIM profila
 - HTML
 - RDFS
 - Dodavanje klase
 - Dodavanje atributa klase
 - Konfiguracija klasa i atributa u profilu
- Import postojećeg CIM profila u projekat
- Import postojećeg CIMTool projekta

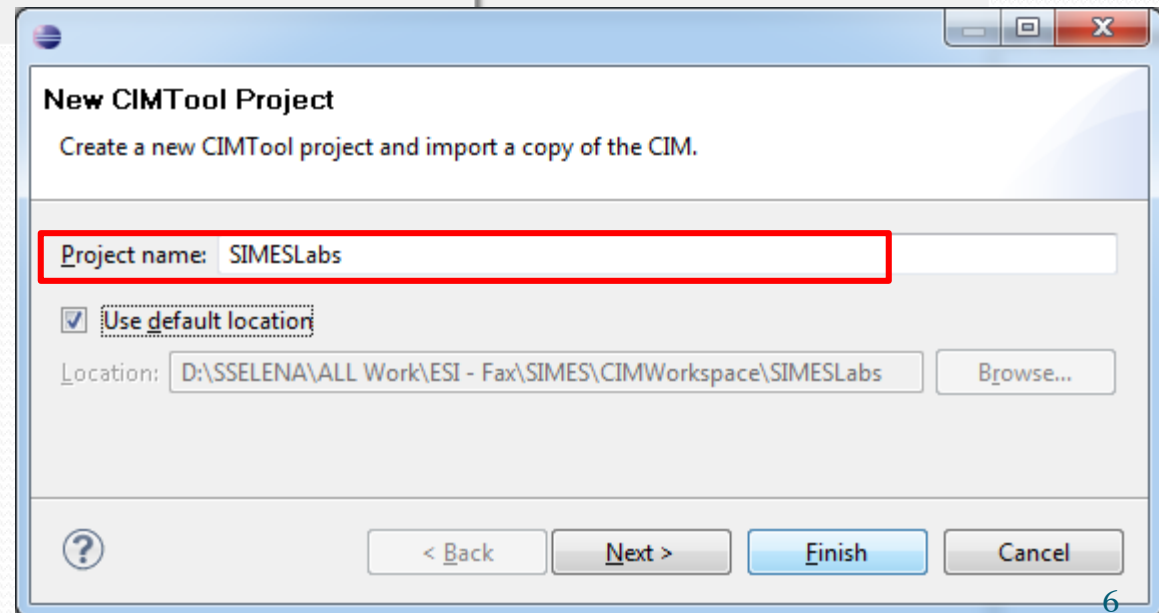


CIMTool: kreiranje projekta

- Korak 1

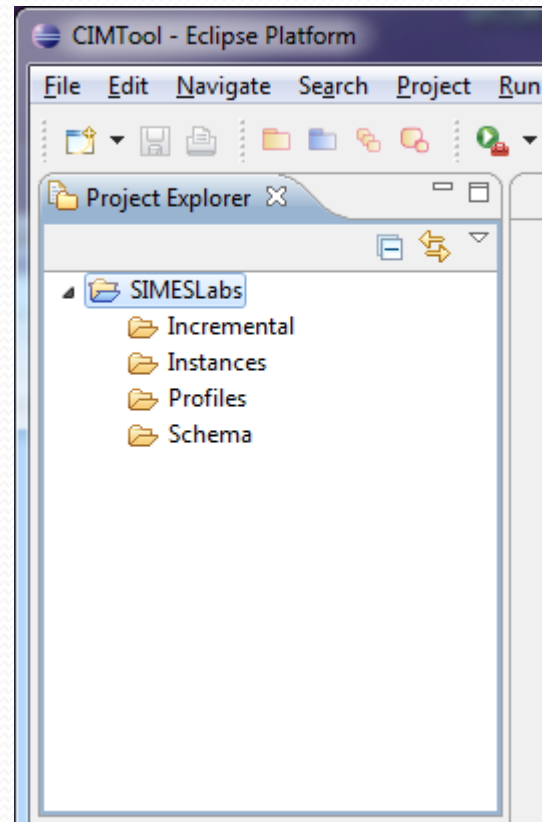


- Korak 2



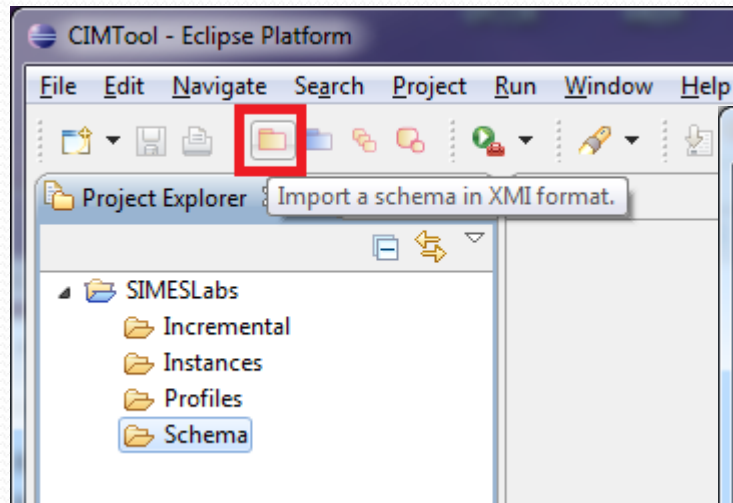
CIMTool: kreiranje projekta

- Prikaz kreiranog projekta u “*Project Explorer*” prozoru

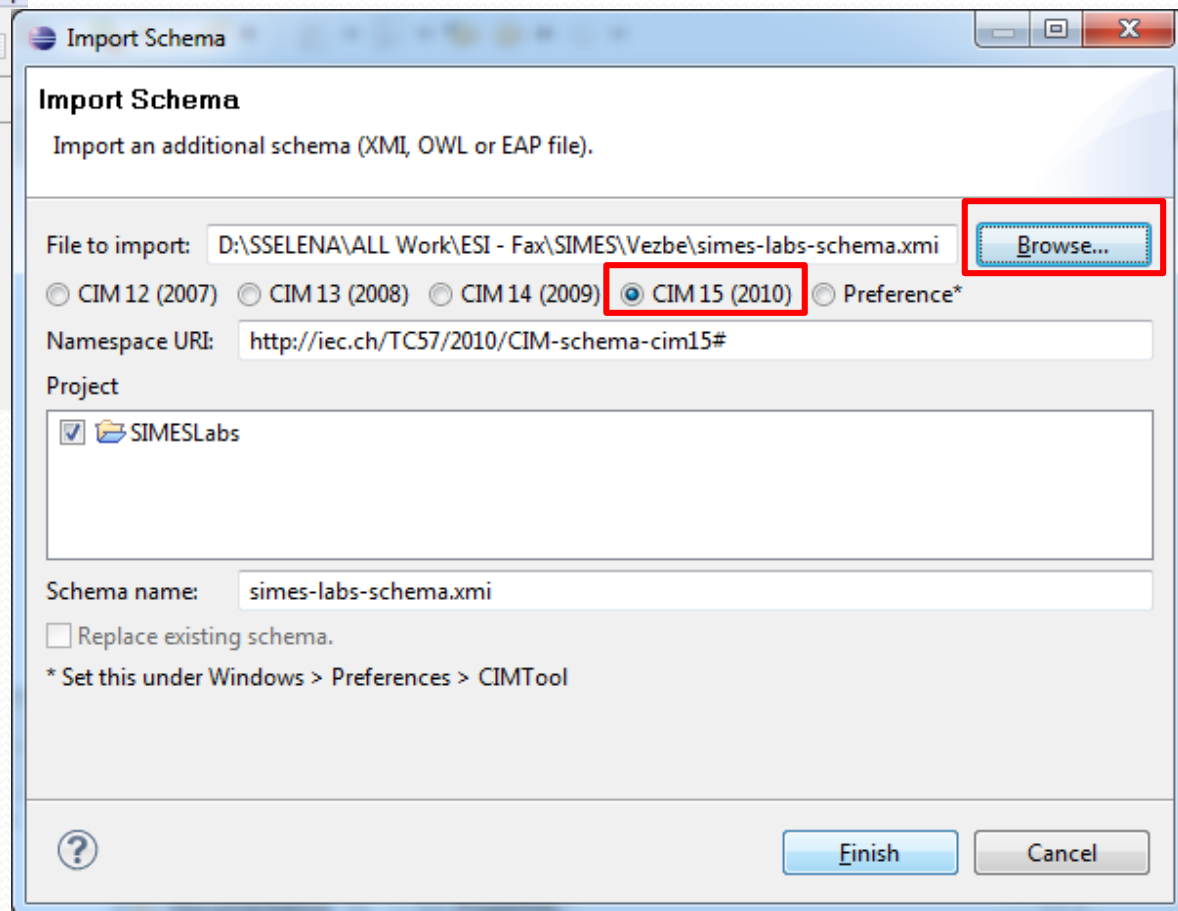


CIMTool: učitavanje šeme modela u XMI formatu

- Korak 1

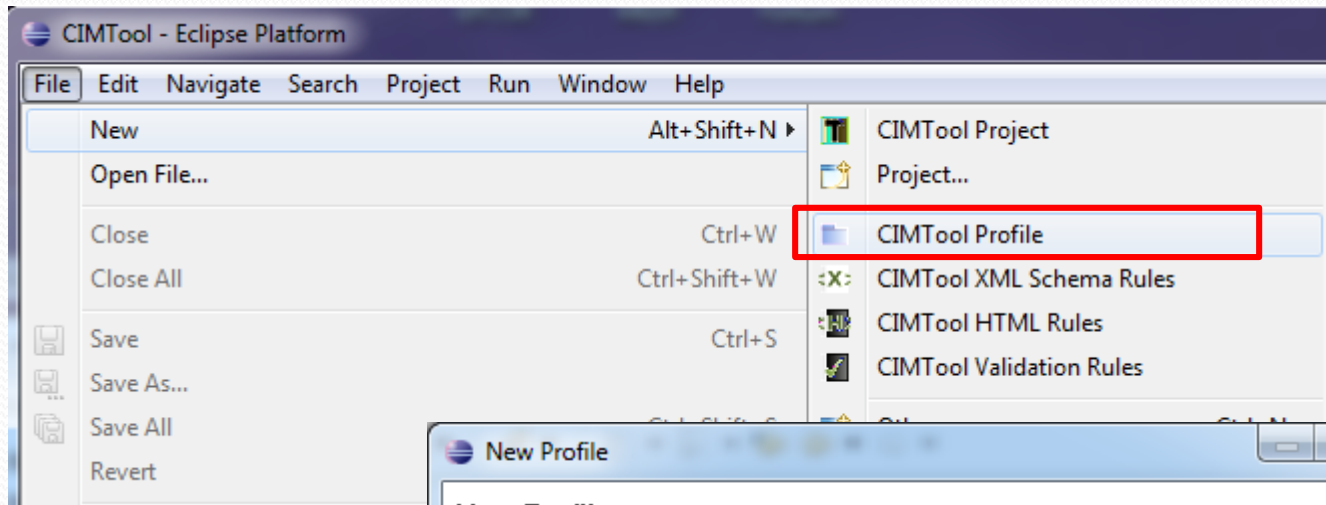


- Korak 2

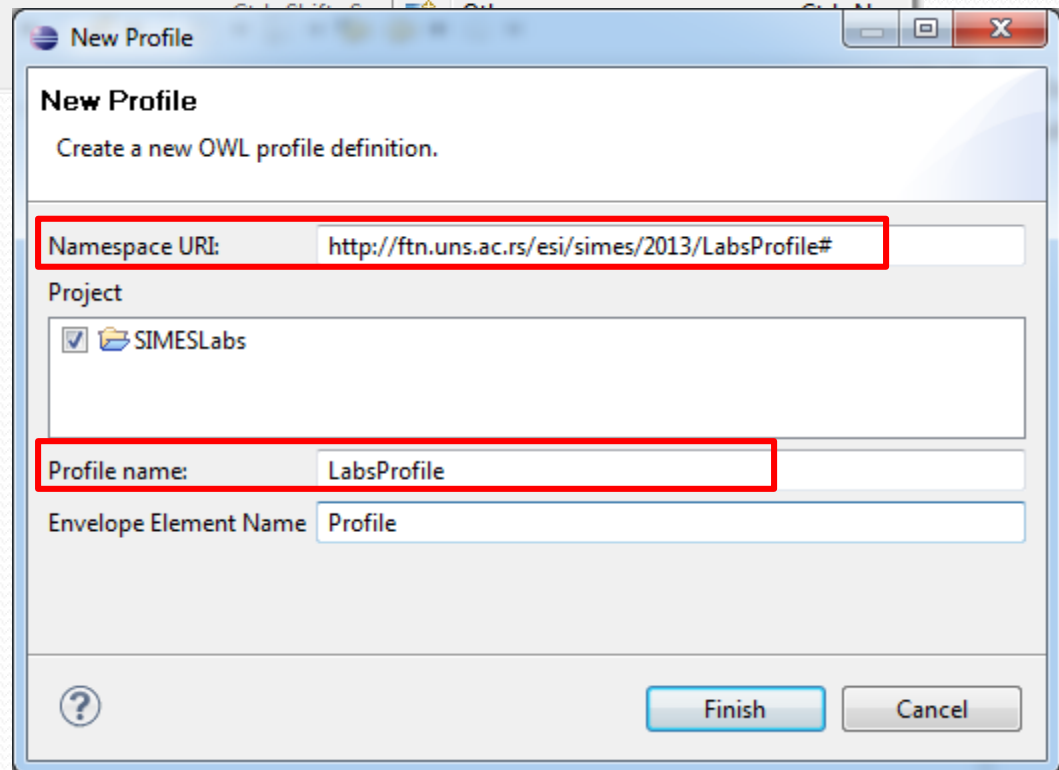


CIMTool: kreiranje CIM profila

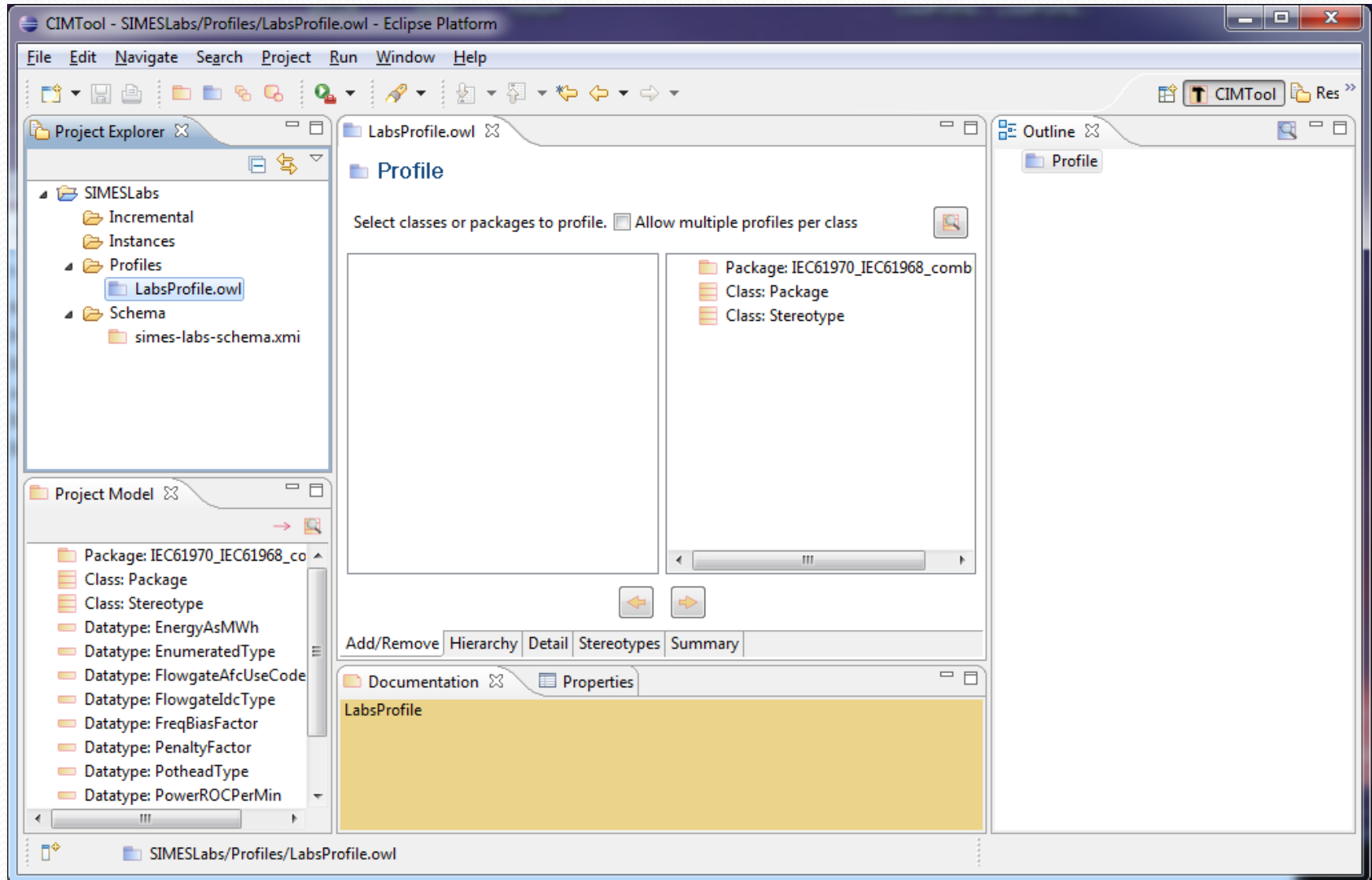
- Korak 1



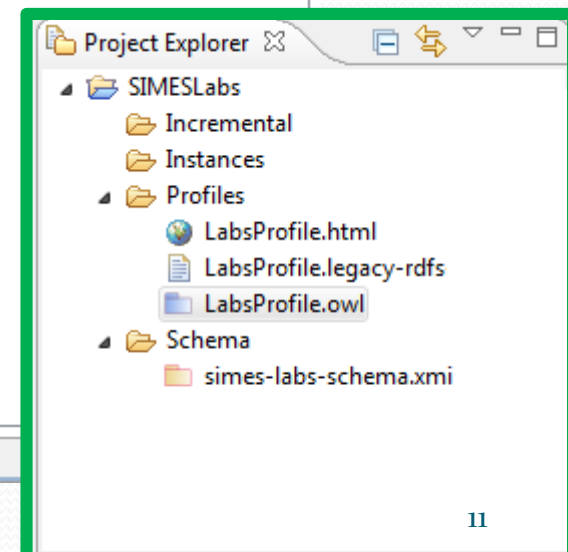
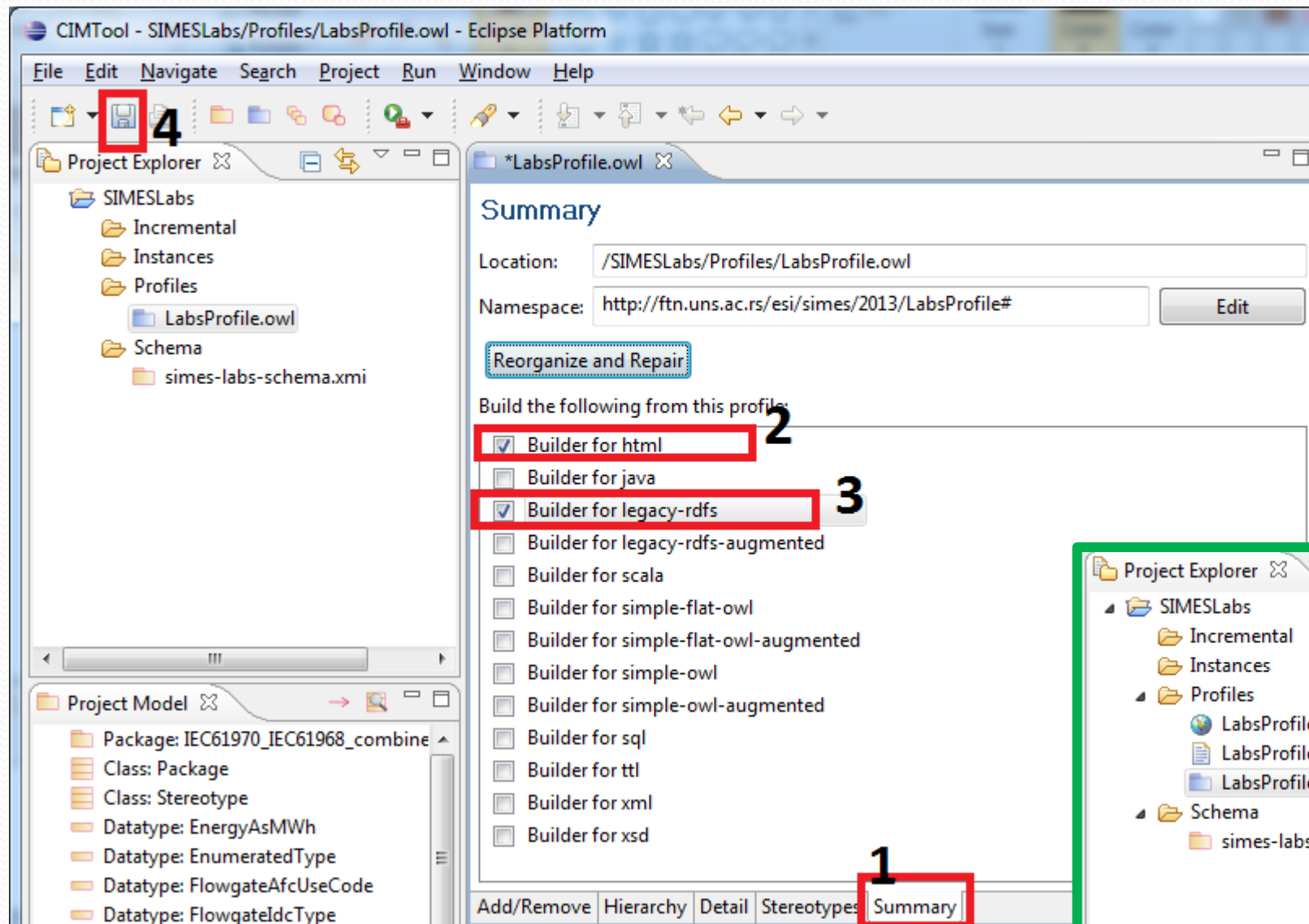
- Korak 2



CIMTool: kreiranje CIM profila



CIMTool: Biranje formata zapisa CIM profila

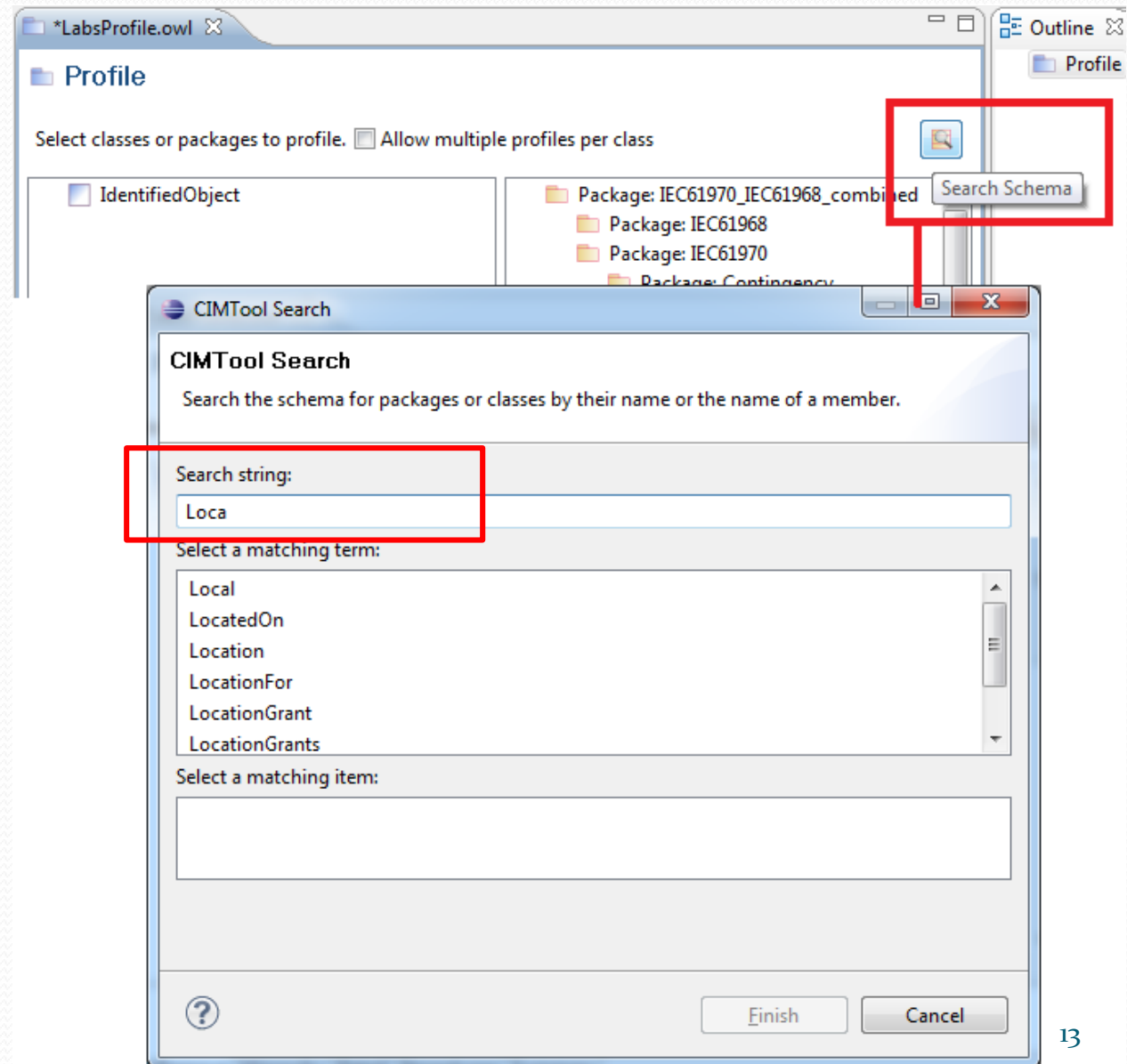


- Prvi način:
 - odabirom iz liste



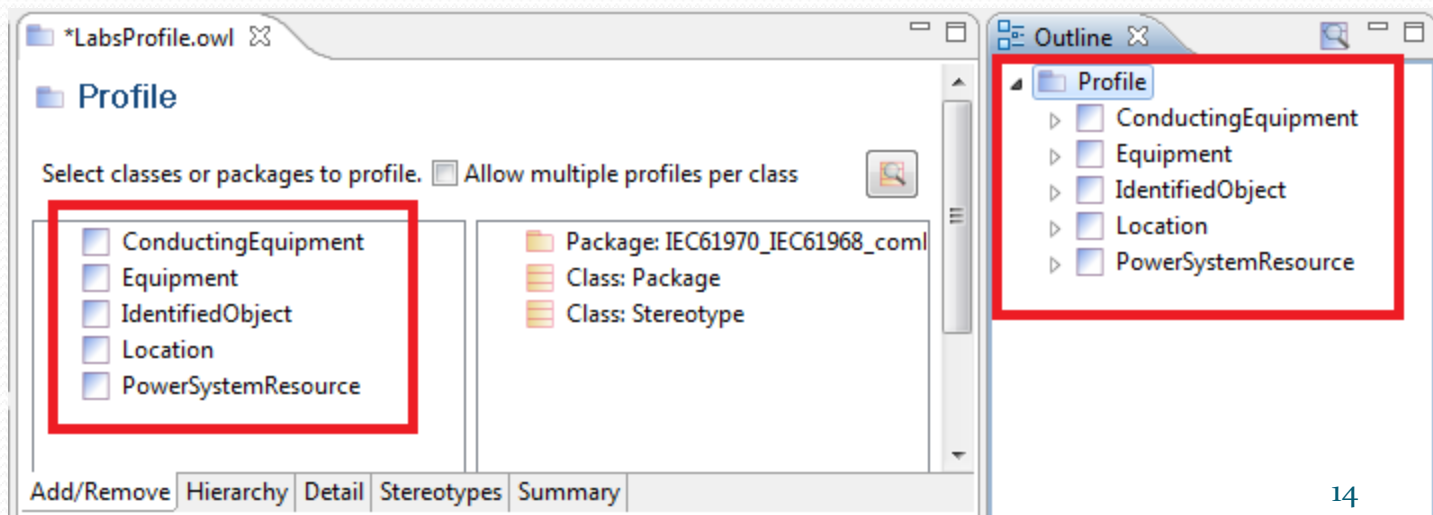
CIMTool: Dodavanje klase u CIM profil

- Drugi način:
 - *Search Schema*



CIMTool: Dodavanje klase u CIM profil

- Vežba 2.1 :
 - Dodati u CIM profil klase:
 - IdentifiedObject
 - Location
 - PowerSystemResource
 - Equipment
 - ConductingEquipment
 - Cilj je dobiti prikaz kao na slici



CIMTool: Dodavanje atributa u CIM profil

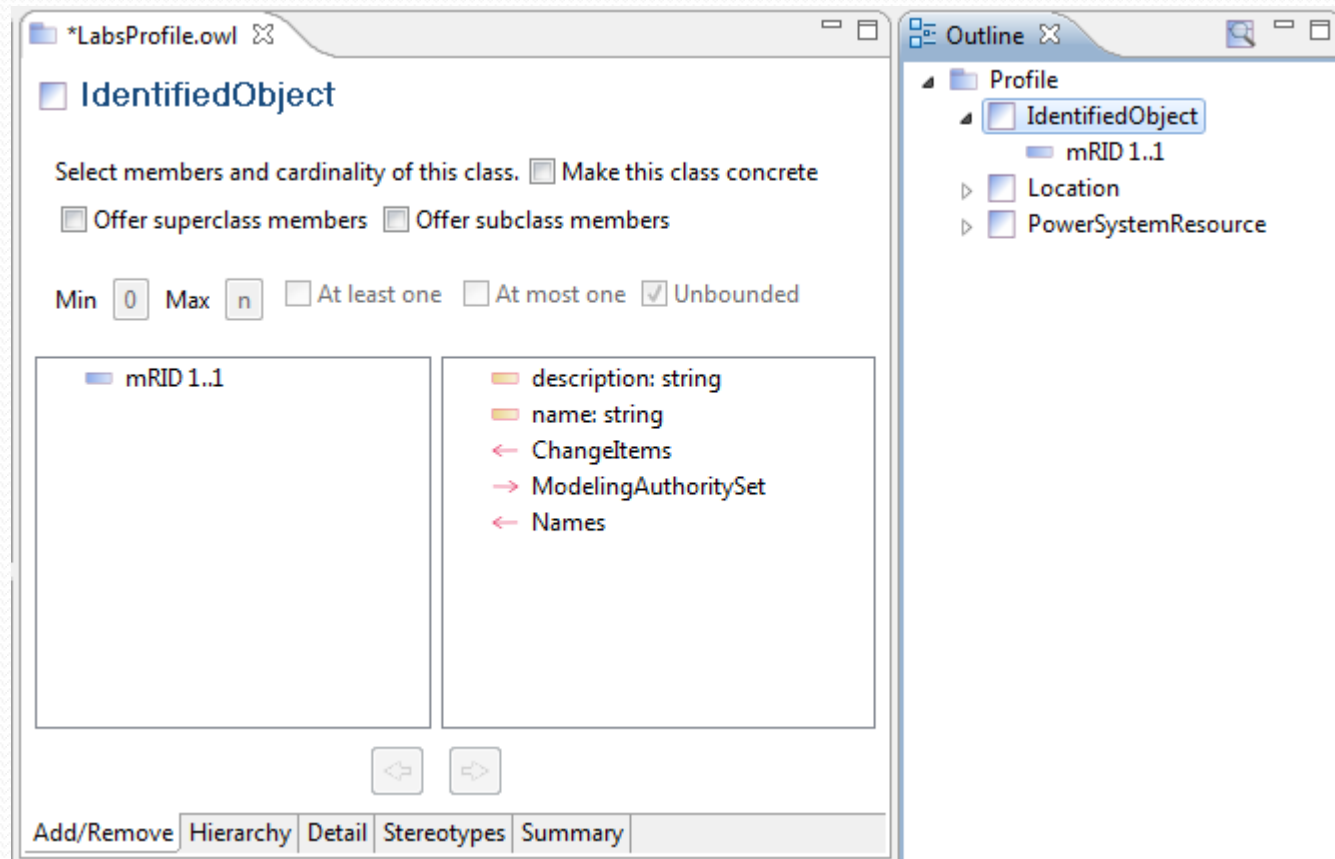
- Koraci:

The screenshot displays the CIMTool interface with the following components:

- IdentifiedObject Class Configuration:**
 - Buttons: ☐ Make this class concrete, ☐ Offer superclass members, ☐ Offer subclass members.
 - Cardinality: Min 0, Max n, ☐ At least one, ☐ At most one, ☒ Unbounded.
 - Attributes List:
 - description: string
 - mRID: string** (highlighted with a red box and labeled '2')
 - name: string
 - ChangeItems
 - ModelingAuthoritySet
 - Names
- Outline Panel:**
 - Profile
 - IdentifiedObject** (highlighted with a red box and labeled '1')
 - Location
 - PowerSystemResource
- Action Buttons:**
 - Add** (highlighted with a red box and labeled '3')
 - Add/Remove
 - Hierarchy
 - Detail
 - St...
- Properties Panel:**
 - Documentation
 - mRID
 - A Model Authority issues mRIDs. Given that each Model Authority has a unique id and this id is part of the mRID, then the mRID is globally unique.

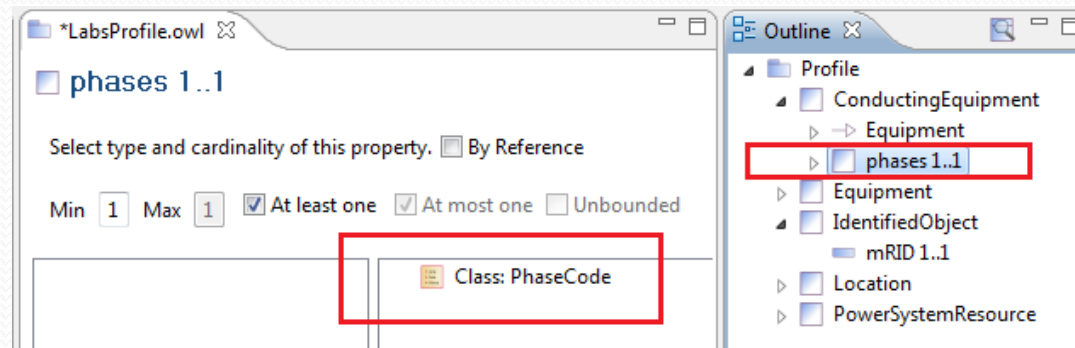
CIMTool: Dodavanje atributa u CIM profil

- Rezultat:

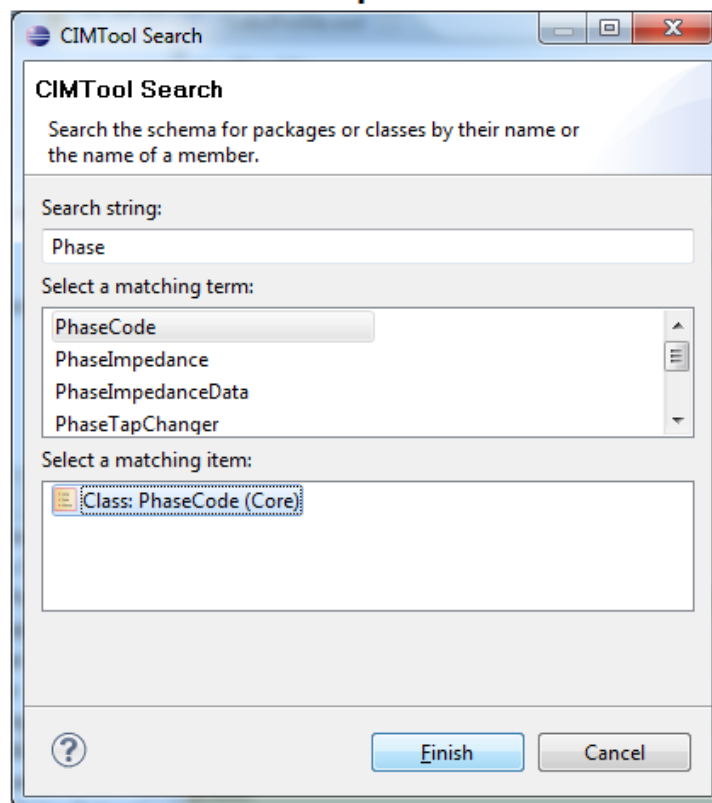


CIMTool: Dodavanje atributa u CIM profil

- Slučaj atributa čiji tip podatka je enumeracija

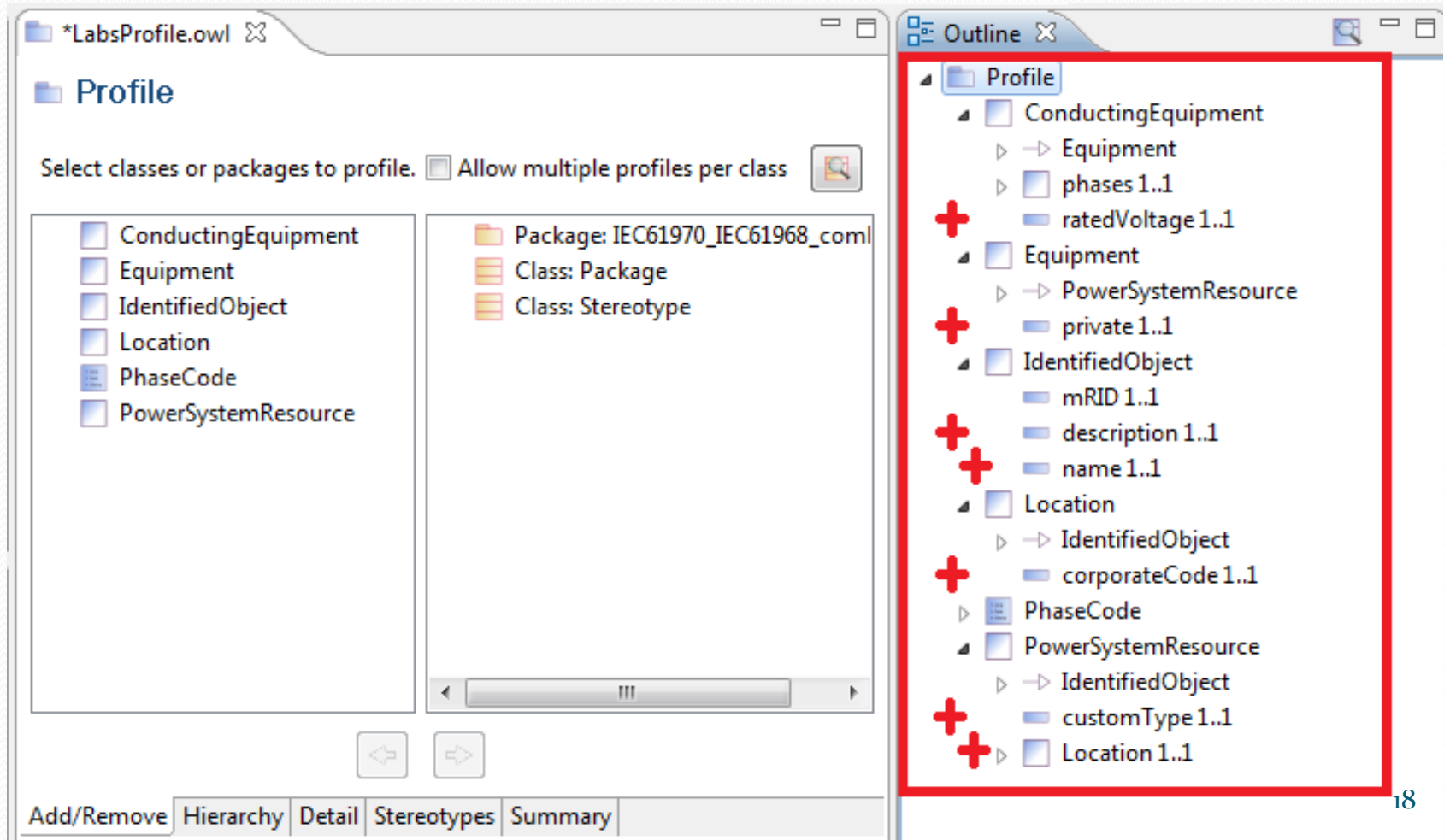


find enum class & add it to profile



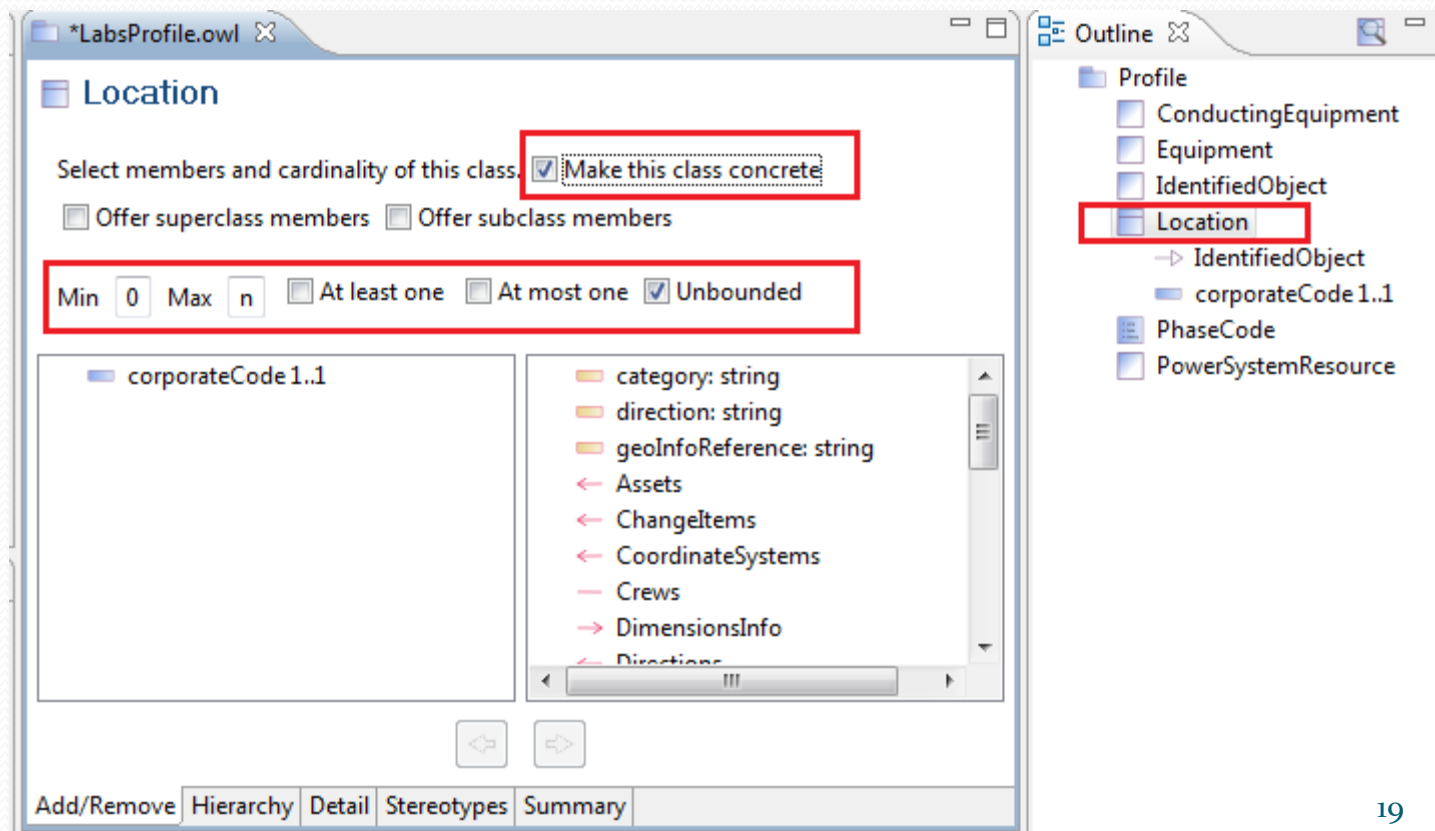
CIMTool: Dodavanje atributa u CIM profil

- Vežba 2.2:
 - Dodati u klase CIM profila attribute kao na slici



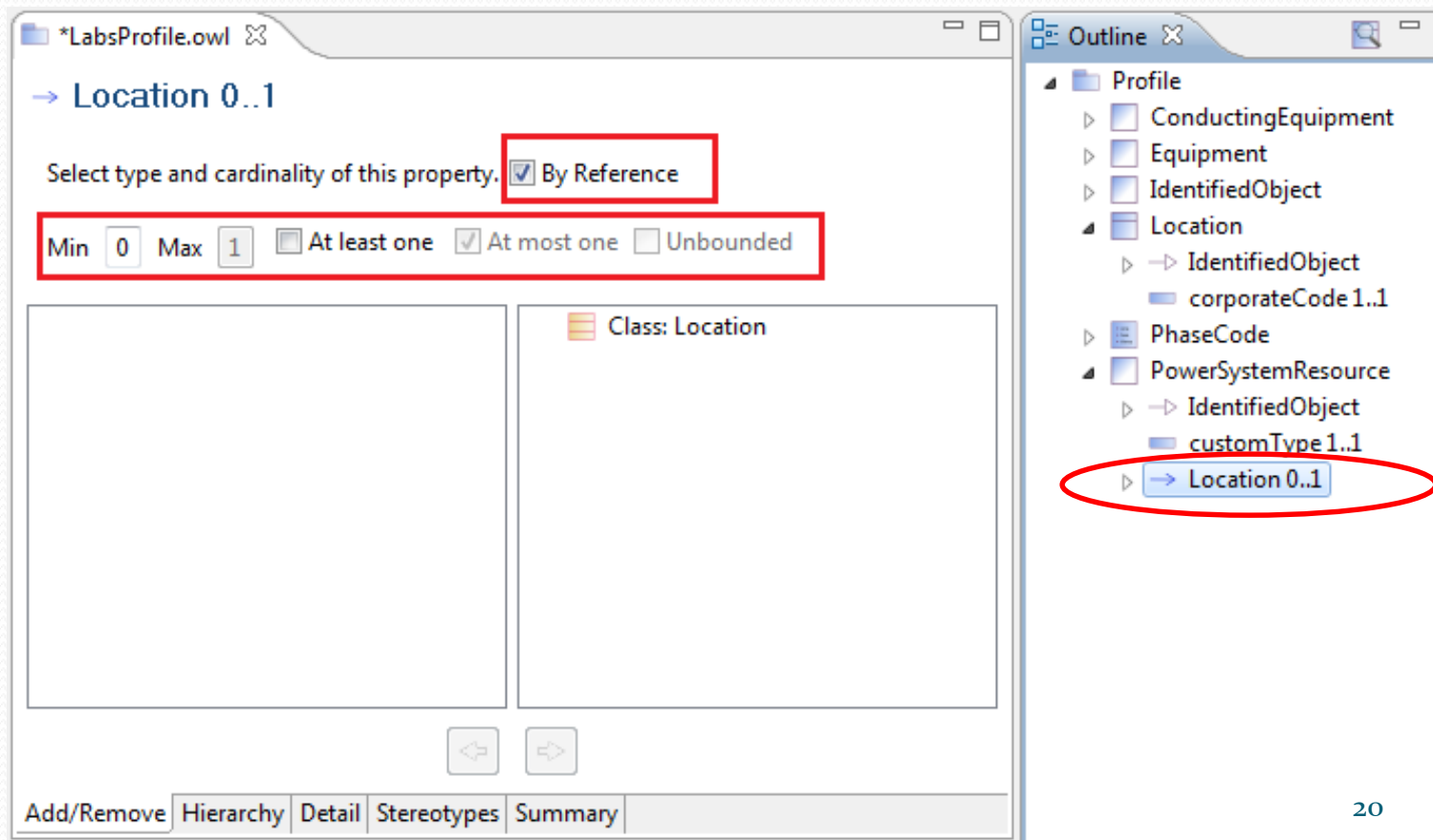
CIMTool: Konfiguracija klase u CIM profilu

- *Abstract VS Concrete* class
- Instance occurrence



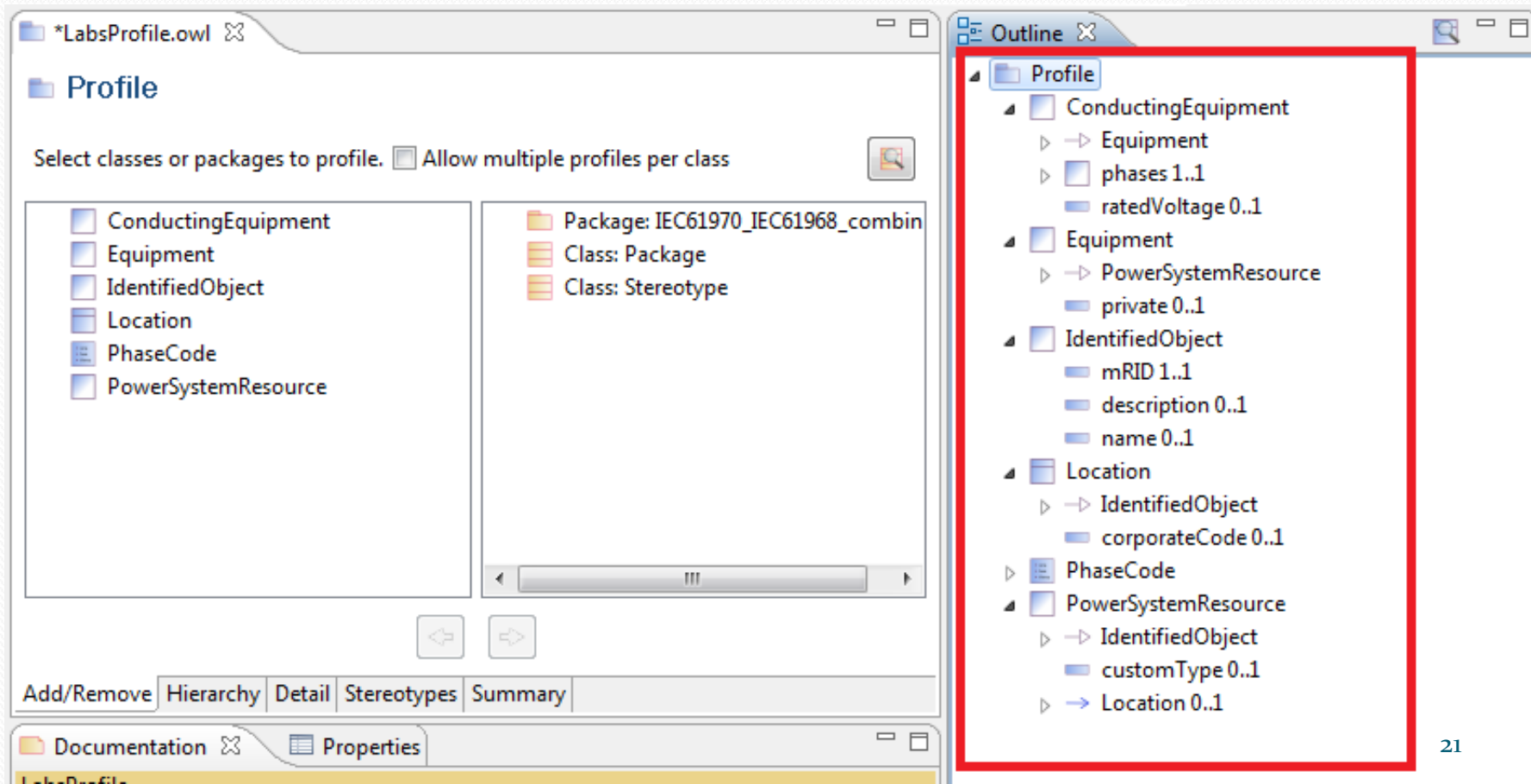
CIMTool: Konfiguracija atributa u CIM profilu

- Opcija „*By reference*“
- Kardinalitet



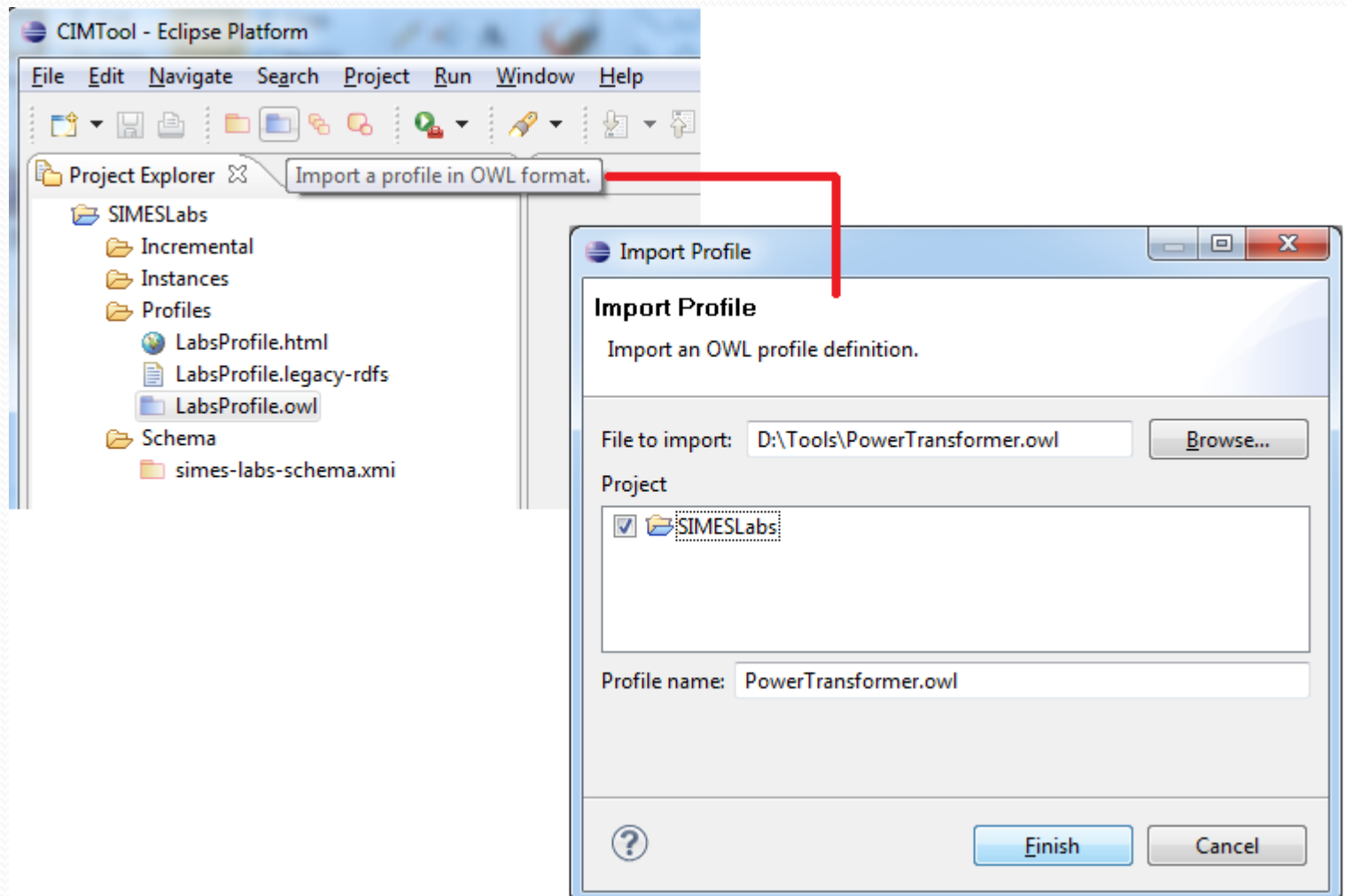
CIMTool: Konfiguracija atributa u CIM profilu

- Vežba 2.3:
 - Konfigurisati kardinalitete atributa u CIM profilu kao na slici



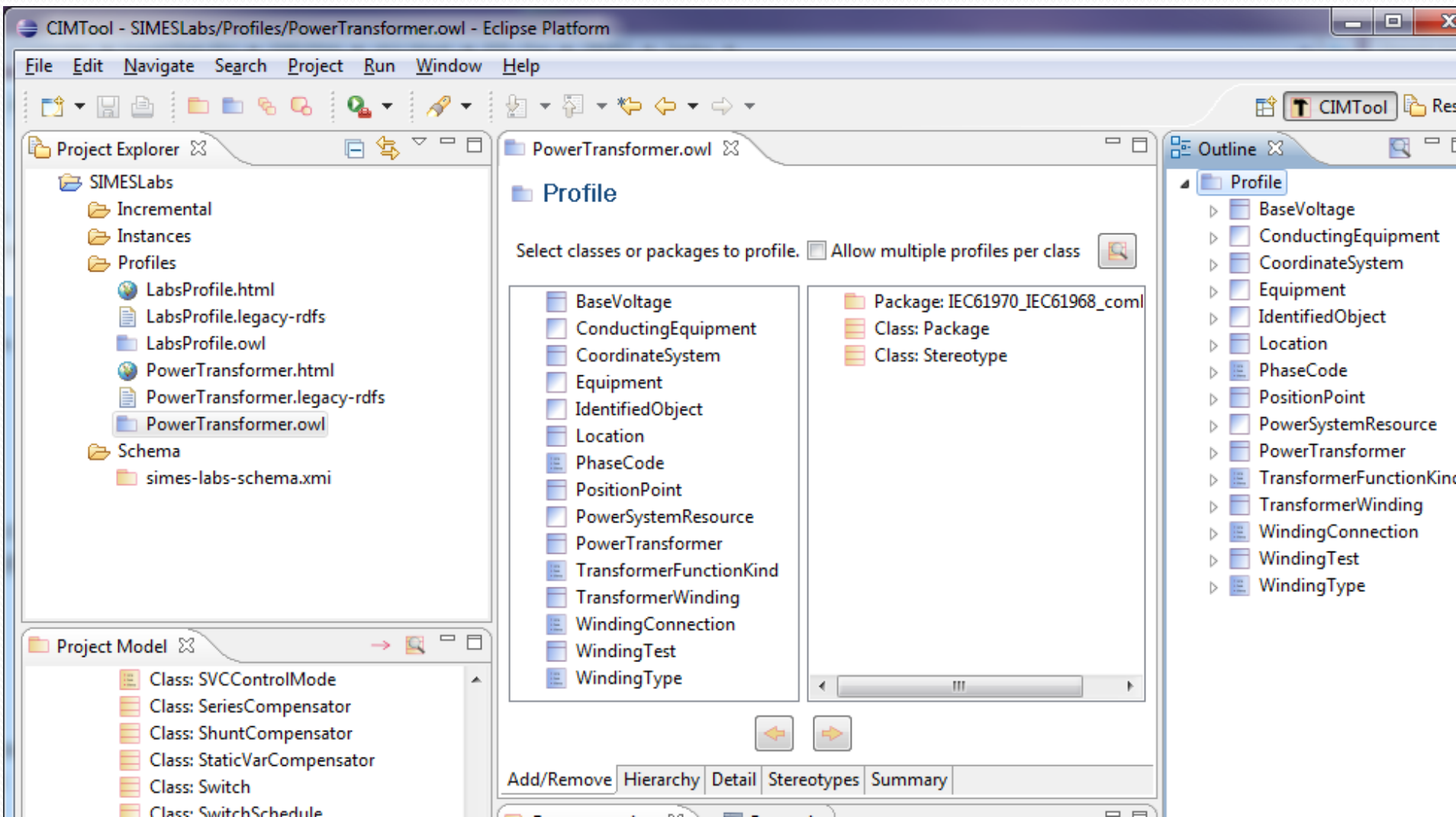
CIMTool: Import postojećeg CIM profila u projekat

- Koraci



CIMTool: Import postojećeg CIM profila u projekat

- Rezultat



CIMTool: Pregled HTML formata zapisa CIM profila

The screenshot displays the CIMTool Eclipse IDE interface. The top menu bar includes File, Edit, Navigate, Search, Project, Run, Window, and Help. The Project Explorer on the left shows the project structure under SIMESLabs, including Profiles and Schema folders. The Project Model view at the bottom left lists various classes like SVCControlMode, SeriesCompensator, and SynchronousMachine. The main editor area shows the 'Profile Documentation' for 'PowerTransformer.html'. It includes the profile namespace URL and a section for 'Concrete Classes' with details for the 'BaseVoltage' class, including its native members and a description of its nominal voltage.

Profile Documentation

Profile namespace:
<http://ftn.uns.ac.rs/esi/simes/2013/PowerTransformerProfile#>

Concrete Classes

BaseVoltage Core

Defines a nominal base voltage which is referenced in the system.

Native Members

Member Name	Cardinality	Domain	Description
nominalVoltage	1..1	Voltage	The PowerSystemResource's base voltage.

PowerTransformerProfile

CIMTool: Pregled RDFS formata zapisa CIM profila

The screenshot displays the Eclipse IDE interface for CIMTool, specifically showing the RDFS format of a CIM profile. The main editor window, titled "PowerTransformer.legacy-rdfs", contains the following XML code:

```
<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:cims="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:msg="http://langdale.com.au/2005/Message#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:uml="http://langdale.com.au/2005/UML#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:j.0="http://iec.ch/TC57/2010/CIM-schema-cim15#"
  xml:base="http://iec.ch/TC57/2010/CIM-schema-cim15" >
  <rdf:Description rdf:about="#TransformerWinding.windingType">
    <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#attribute"/>
    <rdfs:comment>The type of winding.</rdfs:comment>
    <rdfs:label>windingType</rdfs:label>
    <rdfs:range rdf:resource="#WindingType"/>
    <rdfs:domain rdf:resource="#TransformerWinding"/>
    <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#1"/>
    <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
  </rdf:Description>
  <rdf:Description rdf:about="#Package_Wires">
    <cims:belongsToCategory rdf:resource="#Package_IEC61970"/>
    <rdfs:comment>An extension to the Core and Topology package that models information on t
    <rdfs:label>Wires</rdfs:label>
    <rdf:type rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#ClassCate
```

The left sidebar shows the Project Explorer with the following structure:

- SIMESLabs
 - Incremental
 - Instances
 - Profiles
 - LabsProfile.html
 - LabsProfile.legacy-rdfs
 - LabsProfile.owl
 - PowerTransformer.html
 - PowerTransformer.legacy-rdfs
 - PowerTransformer.owl
 - Schema
 - simex-labs-schema.xmi

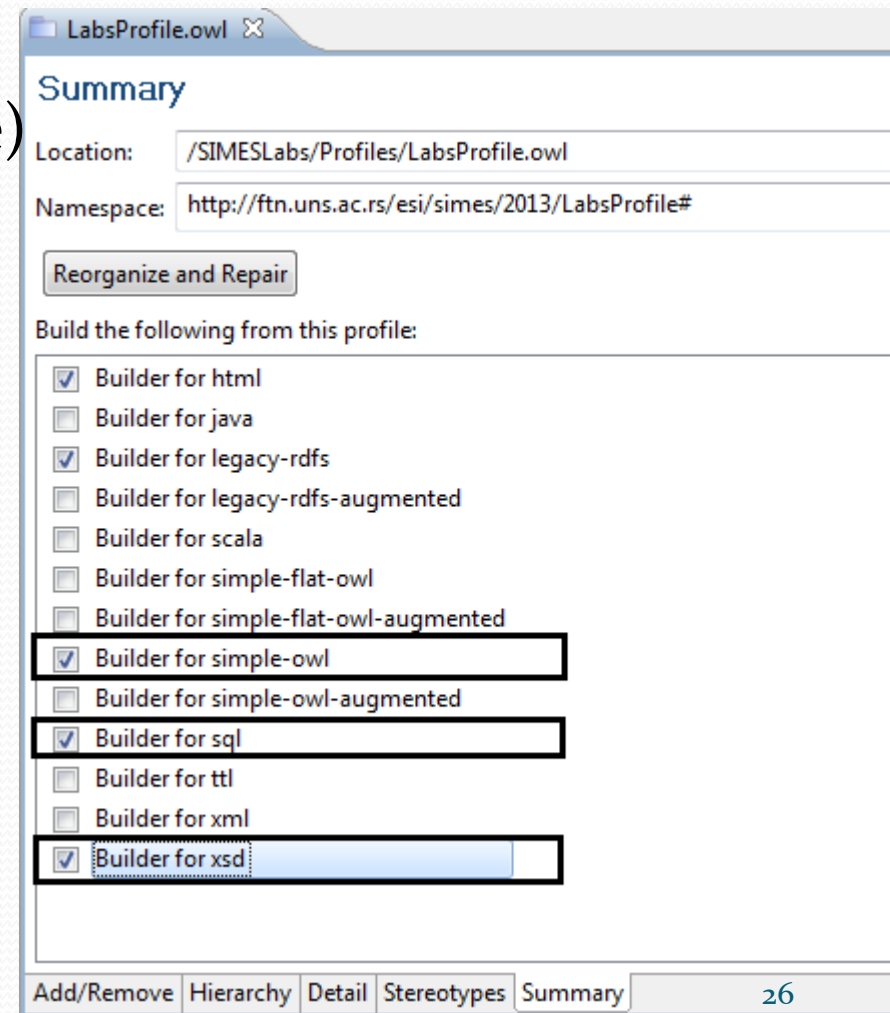
The bottom left pane shows the Project Model with the following structure:

- Package: IEC61970_IEC61968_combine
 - Class: Package
 - Class: Stereotype
 - Datatype: EnergyAsMWh
 - Datatype: EnumeratedType
 - Datatype: FlowgateAfcUseCode
 - Datatype: FlowgateIdcType
 - Datatype: FreqBiasFactor
 - Datatype: PenaltyFactor
 - Datatype: PotheadType
 - Datatype: PowerROCPeMin

The bottom right pane shows the Documentation and Properties tabs, with the Documentation tab selected, displaying "PowerTransformerProfile".

CIMTool: Biranje formata zapisa CIM profila

- Na raspolaganju su i drugi formati od kojih izdvajamo:
 - XSD
 - OWL (Web Ontology Language)
 - SQL



CIMTool: Pregled XSD formata zapisa CIM profila

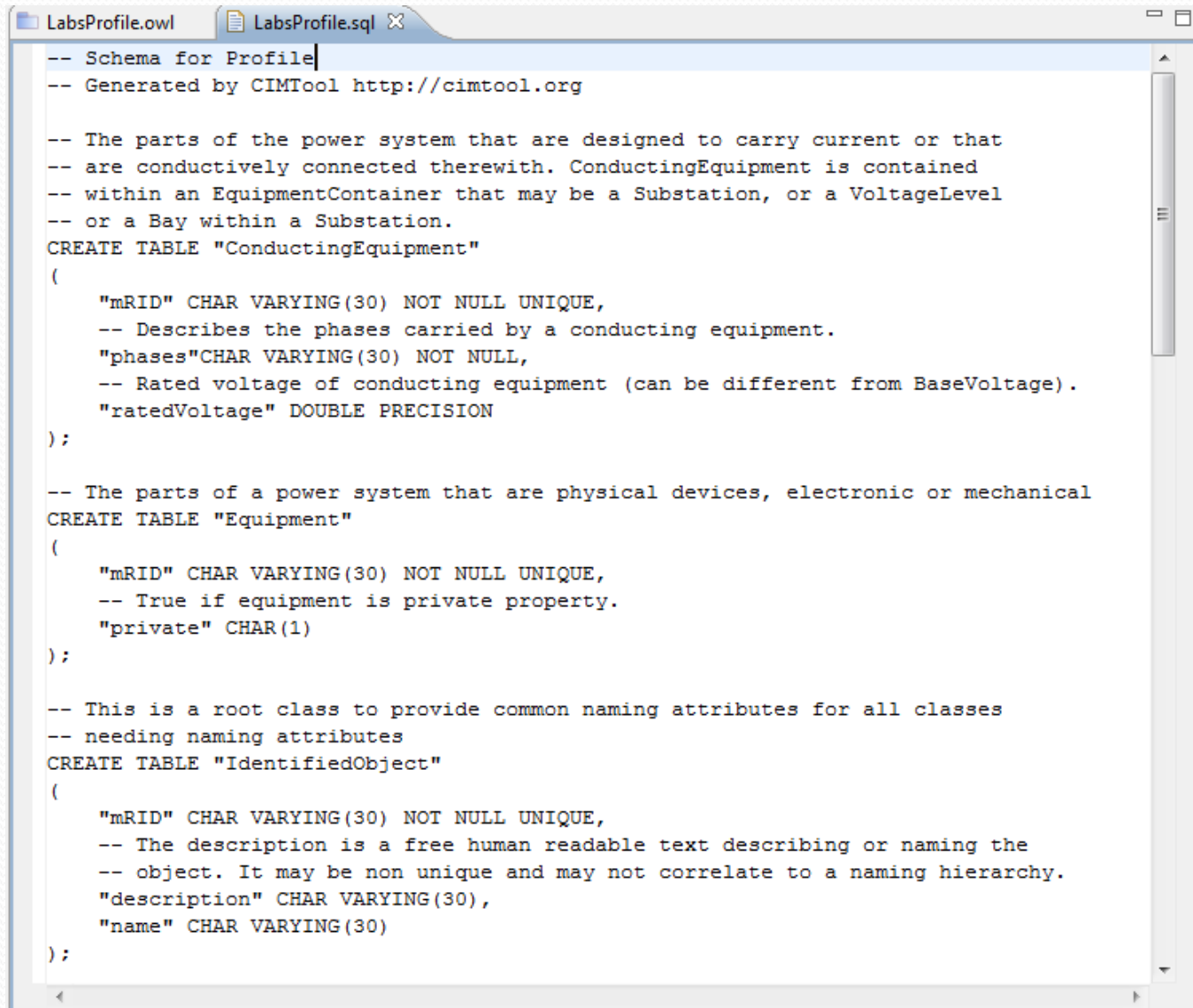
```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:a="http://langdale.com.au/2005/Message#" xmlns:sawsdl="
http://www.w3.org/ns/sawsdl" targetNamespace="http://ftn.uns.ac.rs/esi/simes/2013/LabsProfile#" elementFormDefault="qualified"
attributeFormDefault="unqualified" xmlns="http://langdale.com.au/2005/Message#" xmlns:m="
http://ftn.uns.ac.rs/esi/simes/2013/LabsProfile#">
  <xs:annotation/>
  <xs:element name="Profile" type="m:Profile"/>
  <xs:complexType name="Profile">
    <xs:sequence>
      <xs:element name="Location" type="m:Location" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="ConductingEquipment" sawsdl:modelReference="http://iec.ch/TC57/2010/CIM-schema-cim15#ConductingEquipment">
    <xs:annotation>
      <xs:documentation>The parts of the power system that are designed to carry current or that are conductively connected
therewith. ConductingEquipment is contained within an EquipmentContainer that may be a Substation, or a VoltageLevel or a
Bay within a Substation.</xs:documentation>
    </xs:annotation>
    <xs:complexContent>
      <xs:extension base="m:Equipment">
        <xs:sequence>
          <xs:element name="phases" minOccurs="1" maxOccurs="1" sawsdl:modelReference="
http://iec.ch/TC57/2010/CIM-schema-cim15#ConductingEquipment.phases">
            <xs:annotation>
              <xs:documentation>Describes the phases carried by a conducting equipment.</xs:documentation>
            </xs:annotation>
            <xs:complexType sawsdl:modelReference="">
              <xs:attribute name="ref" type="xs:string"/>
            </xs:complexType>
          </xs:element>
          <xs:element name="ratedVoltage" minOccurs="0" maxOccurs="1" type="xs:float" sawsdl:modelReference="
http://iec.ch/TC57/2010/CIM-schema-cim15#ConductingEquipment.ratedVoltage">
            <xs:annotation>
              <xs:documentation>Rated voltage of conducting equipment (can be different from BaseVoltage).
            </xs:documentation>
            </xs:annotation>
          </xs:element>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
</xs:schema>
```

CIMTool: Pregled *simple*-OWL formata zapisa CIM profila

The screenshot displays the CIMTool application interface, which is used for viewing and editing CIM profiles in OWL format. The interface is divided into several panes:

- Class: IdentifiedObject (Core)**: This pane shows the details of the selected class. It includes fields for Name (IdentifiedObject), Type, URI (http://iec.ch/TC57/2010/CIM-schema-cim15#IdentifiedObject), and XMI ID. The Description field contains the text: "This is a root class to provide common naming attributes for all classes needing naming attributes".
- Outline**: This pane shows a hierarchical tree of the CIM profile. The tree structure is as follows:
 - Package: IEC61970_IEC61968_combined
 - Package: IEC61968
 - Package: Common
 - Class: Location
 - SuperClass: IdentifiedObject
 - Package: IEC61970
 - Package: Core
 - Class: ConductingEquipment
 - SuperClass: Equipment
 - Class: Equipment
 - SuperClass: PowerSystemResource
 - SubClass: ConductingEquipment
 - Class: IdentifiedObject (highlighted)
 - SubClass: Location
 - SubClass: PowerSystemResource
 - Class: PhaseCode
 - A
 - AB
 - ABC
 - ABCN
 - ABN
 - AC
 - ACN
 - AN
 - B
 - BC
 - BCN
 - BN
 - C
 - CN
 - N
 - s12N
 - s1N
 - s2N
 - Class: PowerSystemResource
 - SuperClass: IdentifiedObject
 - SubClass: Equipment

CIMTool: Pregled SQL formata zapisa CIM profila



```
LabsProfile.owl  LabsProfile.sql X
-- Schema for Profile
-- Generated by CIMTool http://cimtool.org

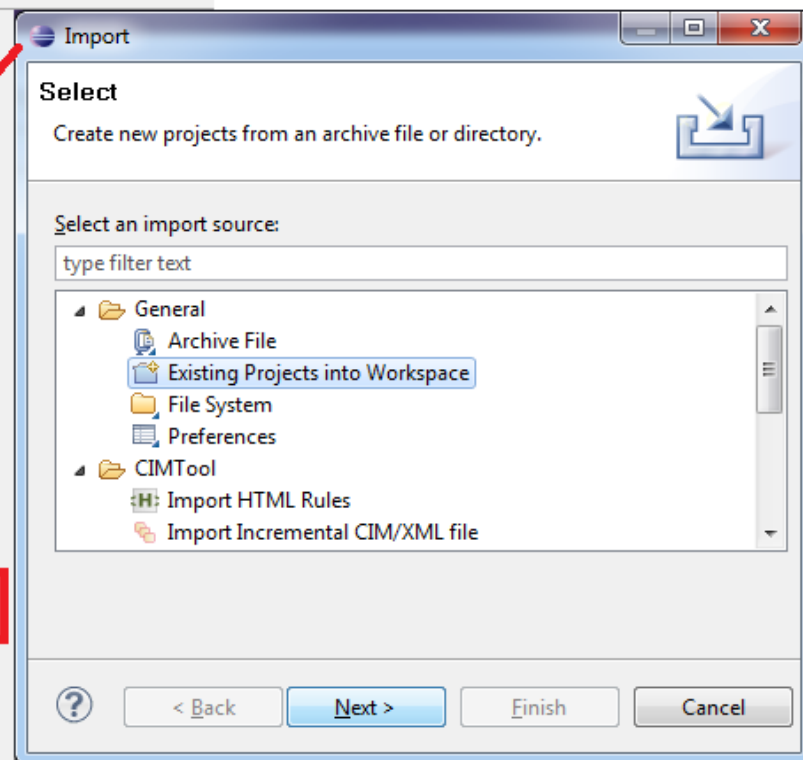
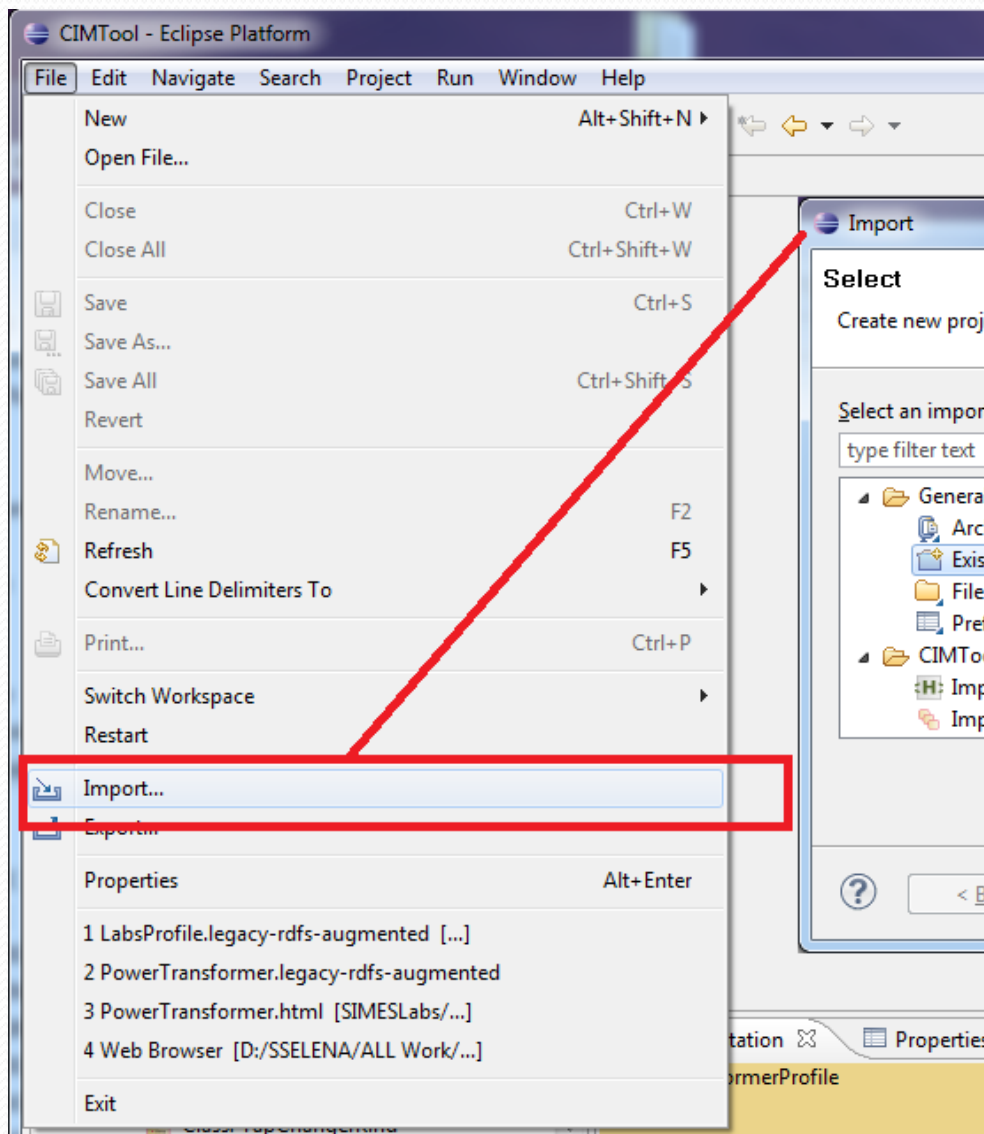
-- The parts of the power system that are designed to carry current or that
-- are conductively connected therewith. ConductingEquipment is contained
-- within an EquipmentContainer that may be a Substation, or a VoltageLevel
-- or a Bay within a Substation.
CREATE TABLE "ConductingEquipment"
(
    "mRID" CHAR VARYING(30) NOT NULL UNIQUE,
    -- Describes the phases carried by a conducting equipment.
    "phases" CHAR VARYING(30) NOT NULL,
    -- Rated voltage of conducting equipment (can be different from BaseVoltage).
    "ratedVoltage" DOUBLE PRECISION
);

-- The parts of a power system that are physical devices, electronic or mechanical
CREATE TABLE "Equipment"
(
    "mRID" CHAR VARYING(30) NOT NULL UNIQUE,
    -- True if equipment is private property.
    "private" CHAR(1)
);

-- This is a root class to provide common naming attributes for all classes
-- needing naming attributes
CREATE TABLE "IdentifiedObject"
(
    "mRID" CHAR VARYING(30) NOT NULL UNIQUE,
    -- The description is a free human readable text describing or naming the
    -- object. It may be non unique and may not correlate to a naming hierarchy.
    "description" CHAR VARYING(30),
    "name" CHAR VARYING(30)
);
```

CIMTool: Import postojećeg CIM projekta

- Korak 2



- Korak 1

CIMTool: Import postojećeg CIM projekta

- Korak 3

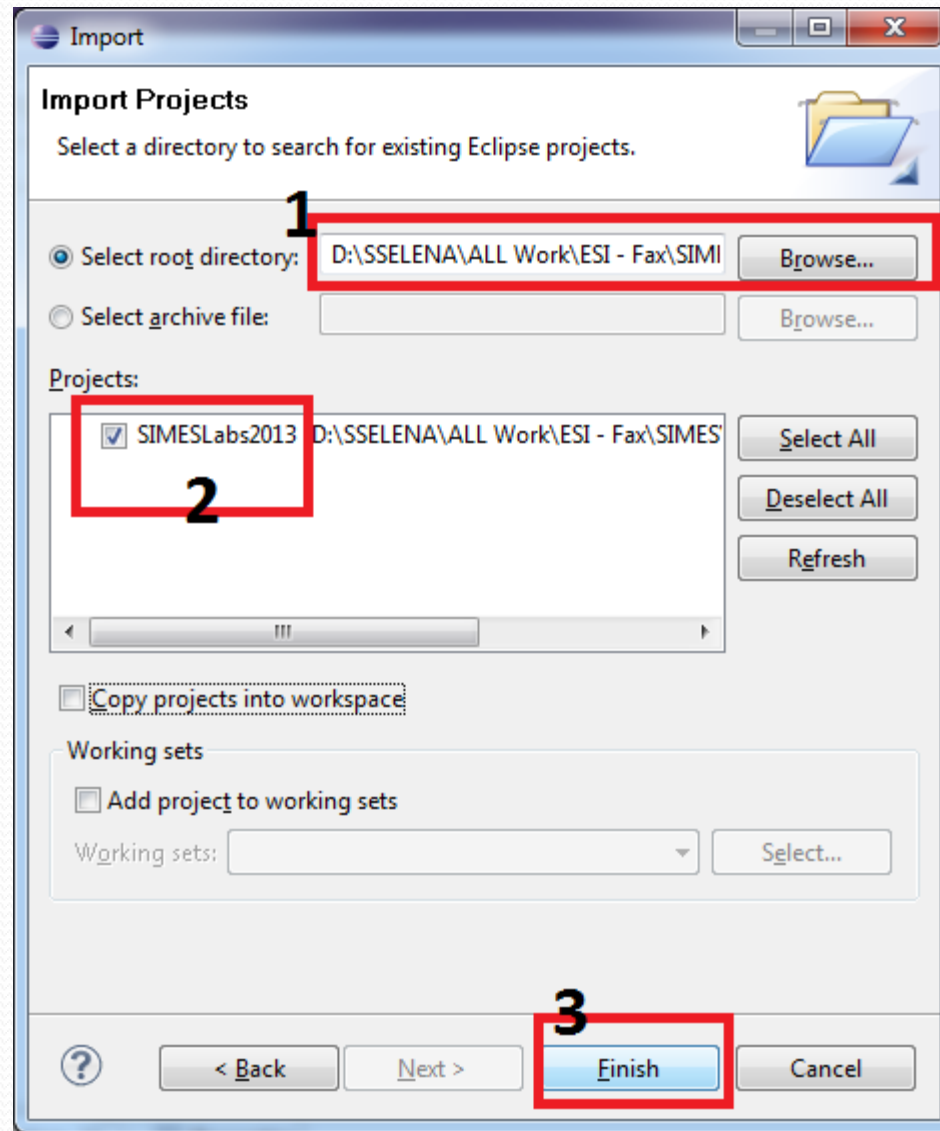
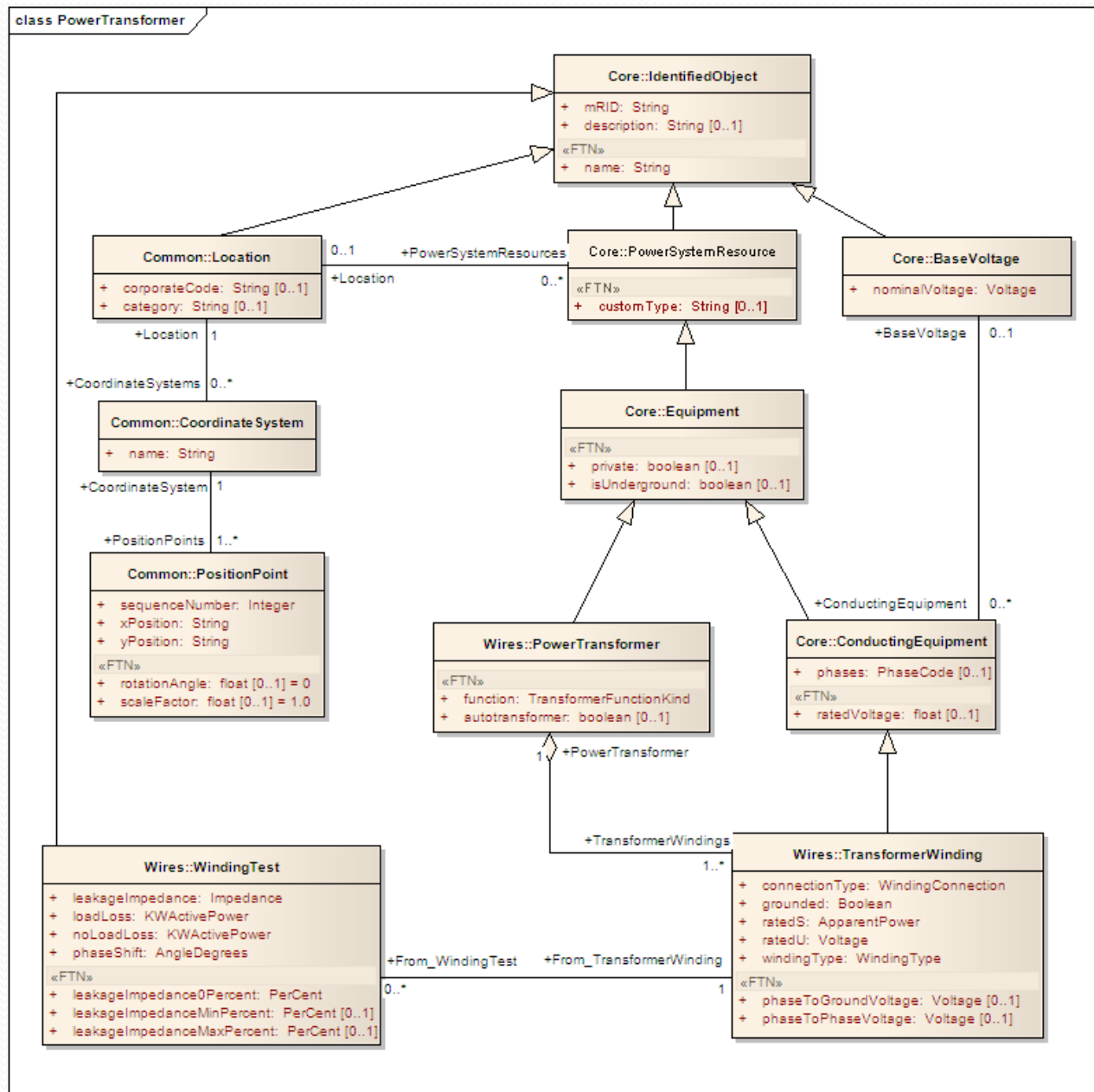


Diagram klasa CIM profila



Zadatak: Izmena CIM profila

- 1) U EA alatu napraviti izmene *PowerTransformer* diagrama:
 - 1) dodati novi atribut u postojeću klasu
 - 2) dodati novu klasu (koristiti generalizaciju)
 - 3) definisati asocijaciju izmedju 2 klase (razlikovati tipove asocijacija).
- 2) Izgenerisati XMI file.
- 3) Učitati izgenerisani XMI file u dati CIMTool projekat.
- 4) U *PowerTransformer* profilu ispratiti izmene prethodno uradjene na diagramu klasa.
- 5) Snimiti izmenjen profil u RDFS formatu i pronaći dodate elemente (klase, attribute).