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"

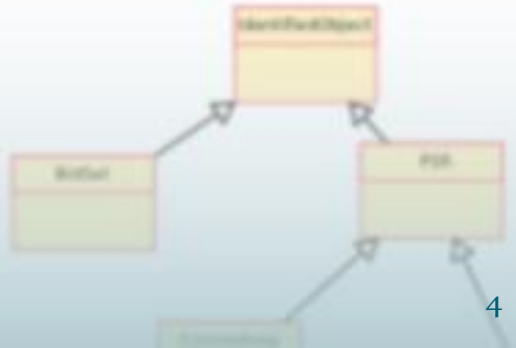
- RDFS (Resource Description Framework Schema)
  - proširivi jezik koji obezbeđuje elemente za zadavanje RDF resursa.

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.

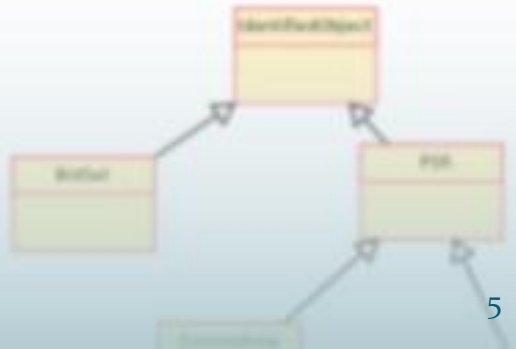
CIMTool alat

- 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



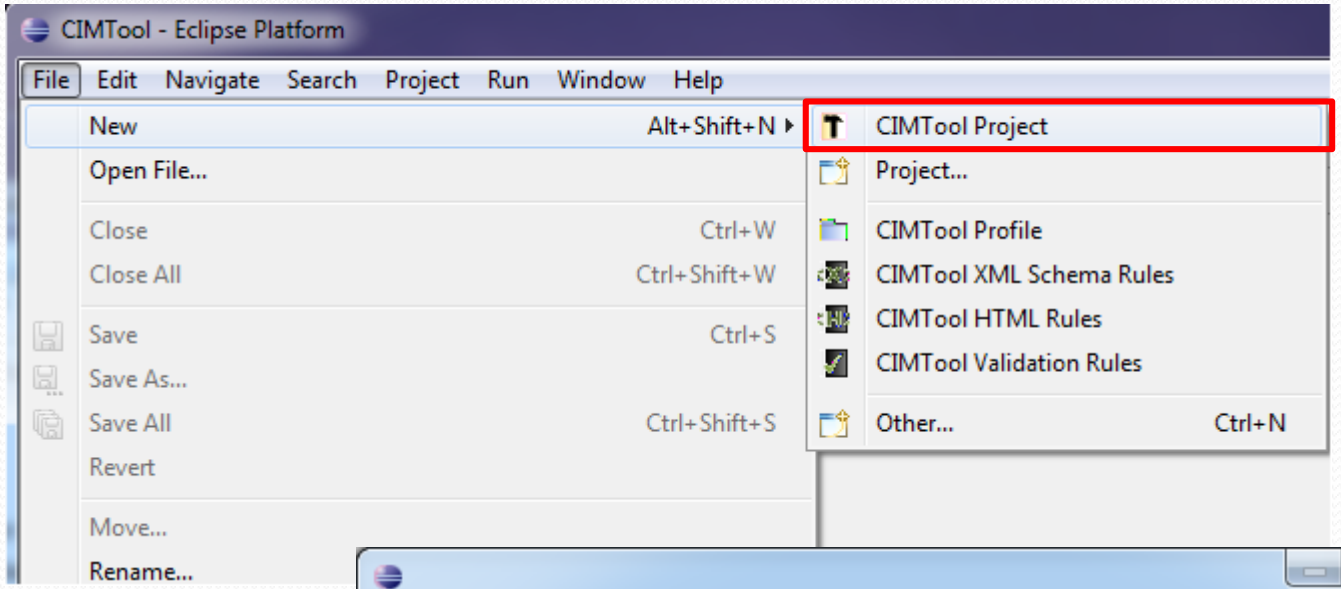
Osnovne operacije u CIMTool alatu

- 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

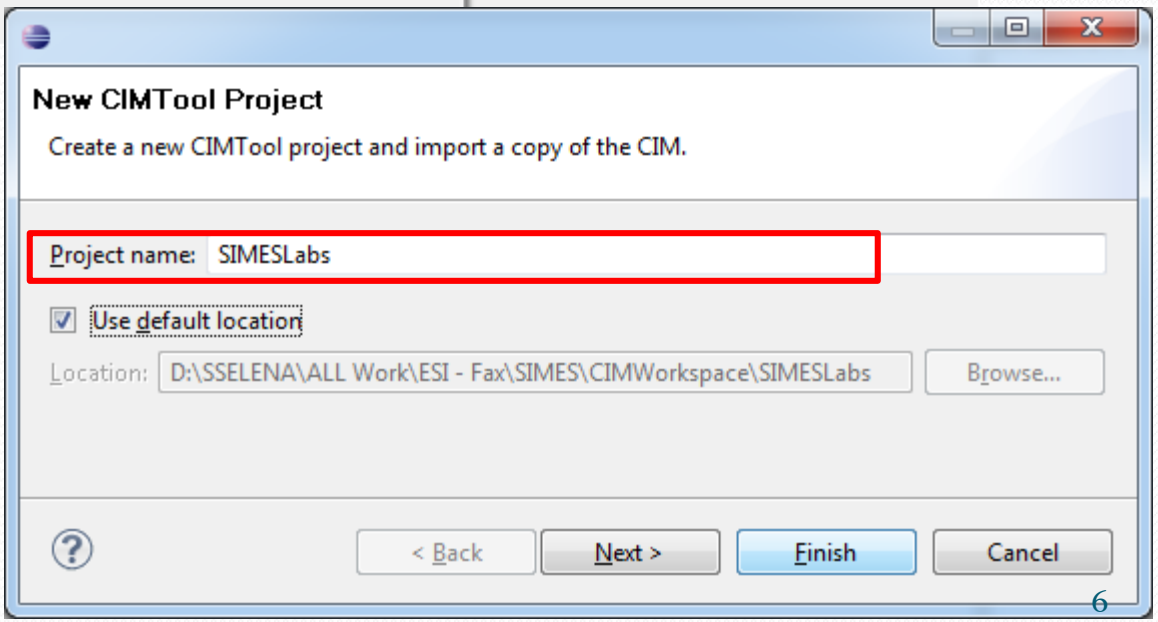


CIMTool: kreiranje projekta

- Korak 1

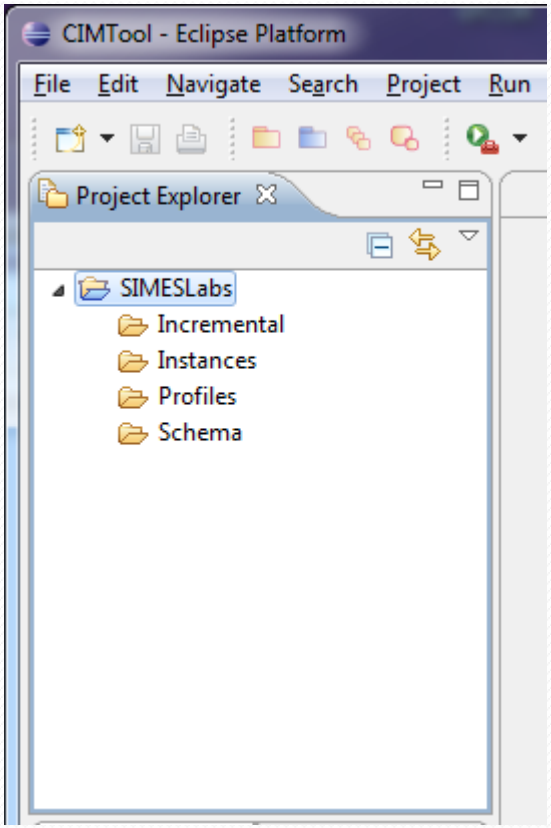


- Korak 2



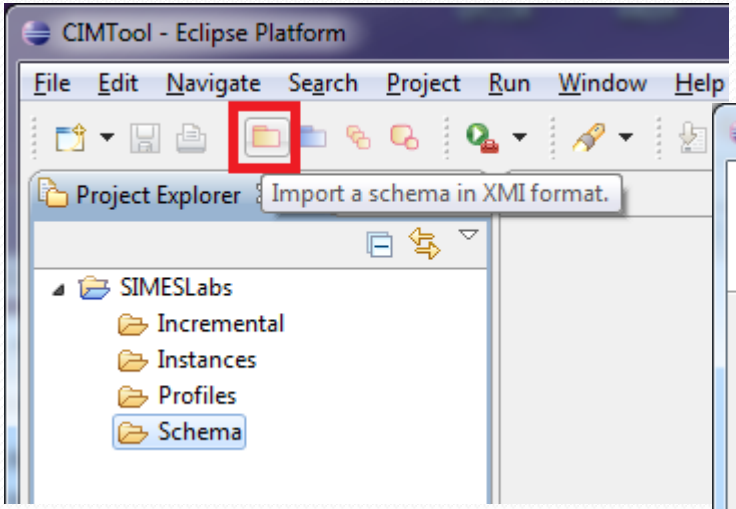
CIMTool: kreiranje projekta

- Prikaz kreiranog projekta u "*Project Explorer*" prozoru

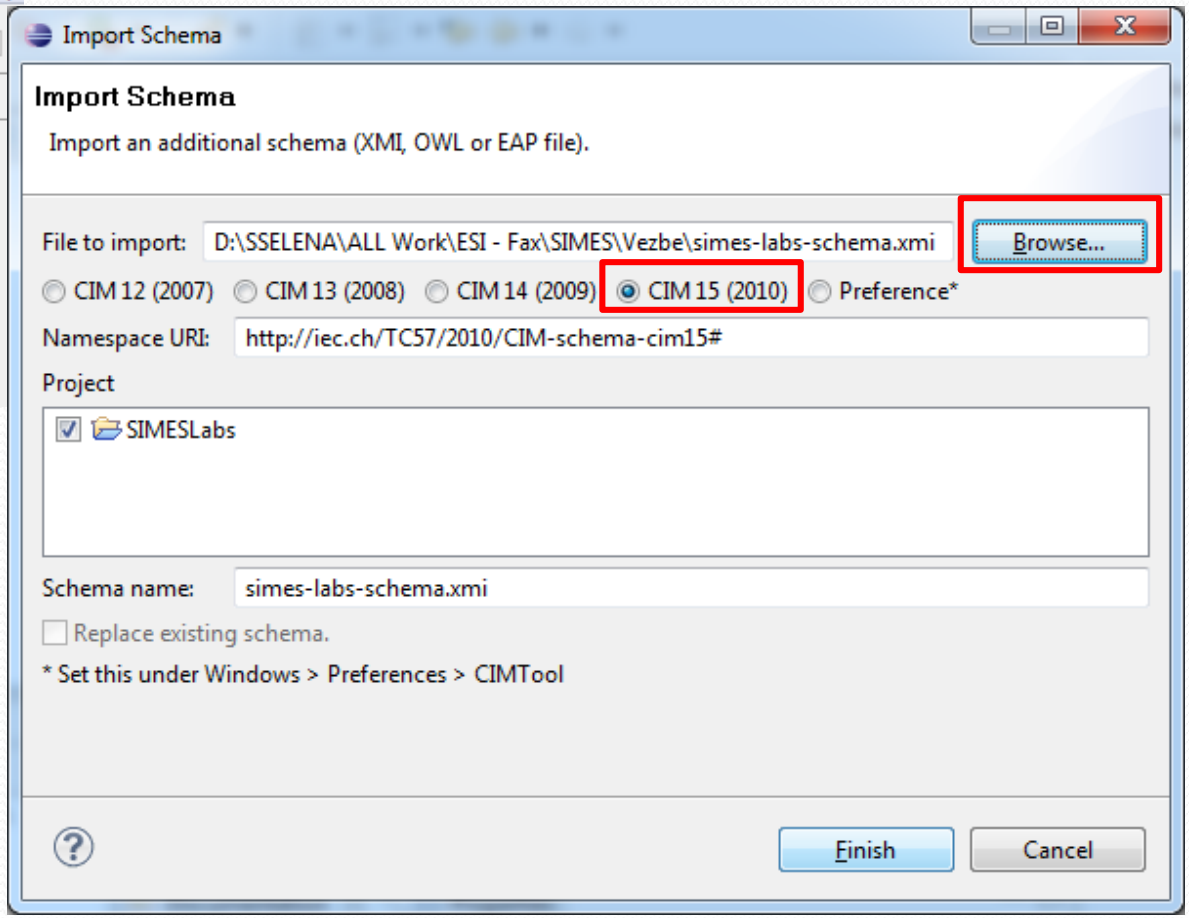


CIMTool: učitavanje šeme modela u XMI formatu

- Korak 1

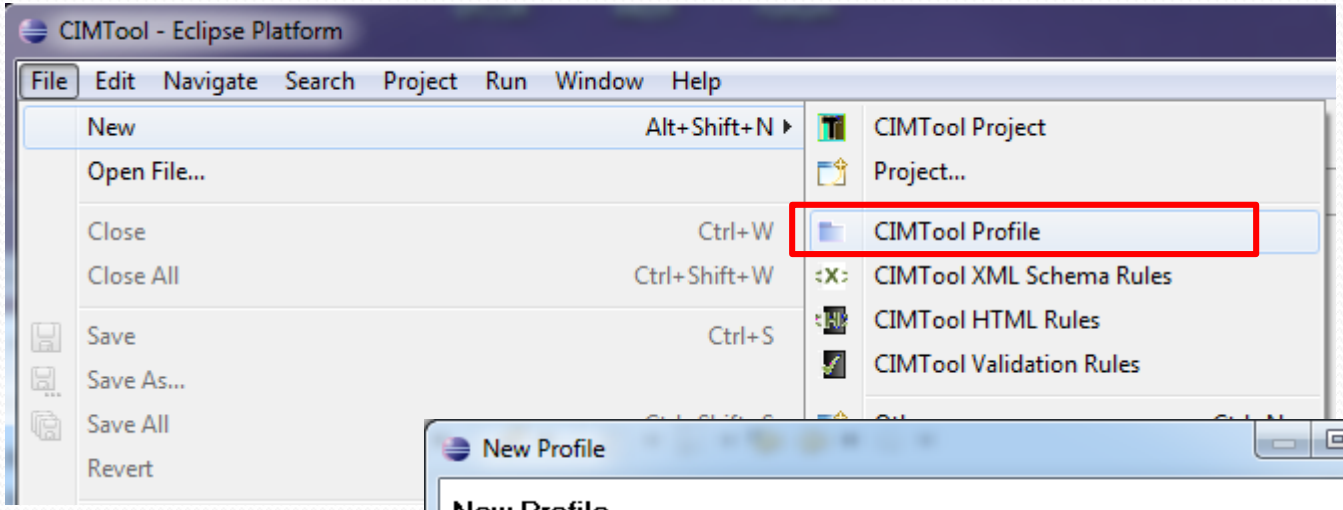


- Korak 2

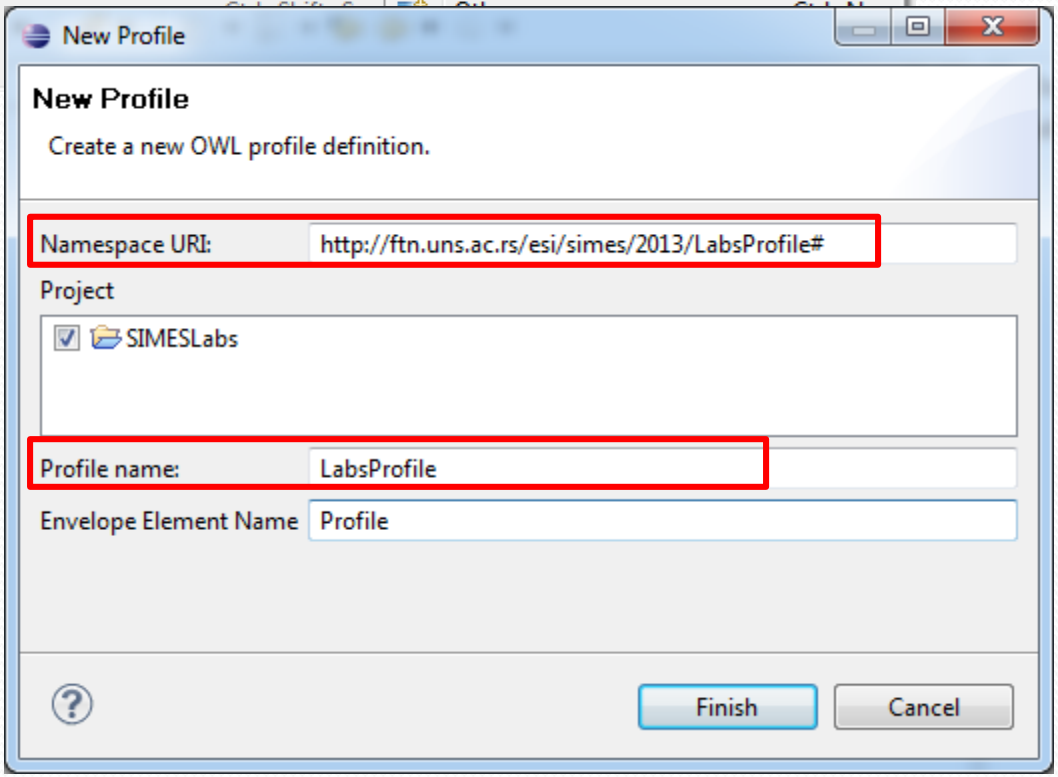


CIMTool: kreiranje CIM profila

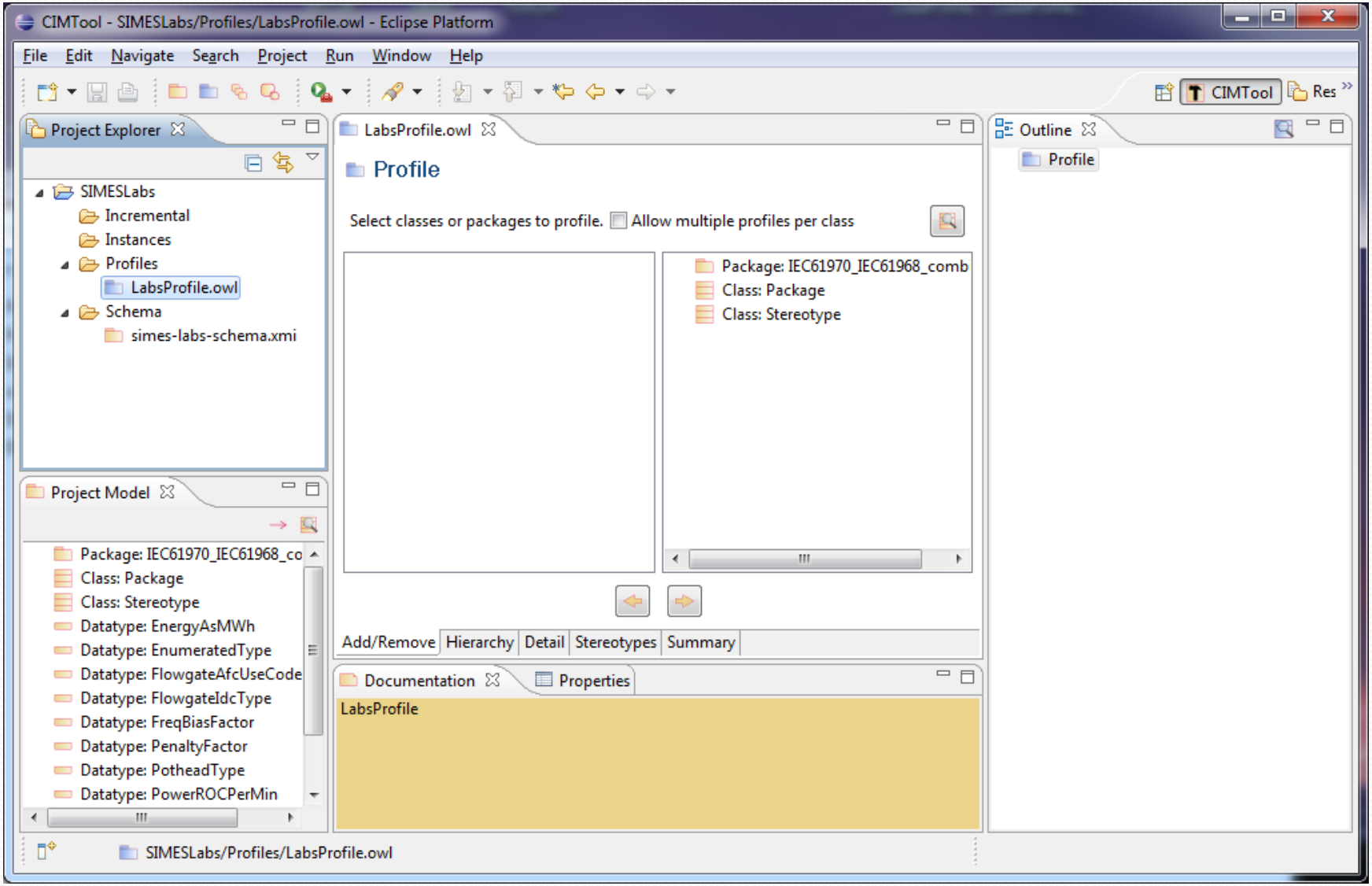
- Korak 1



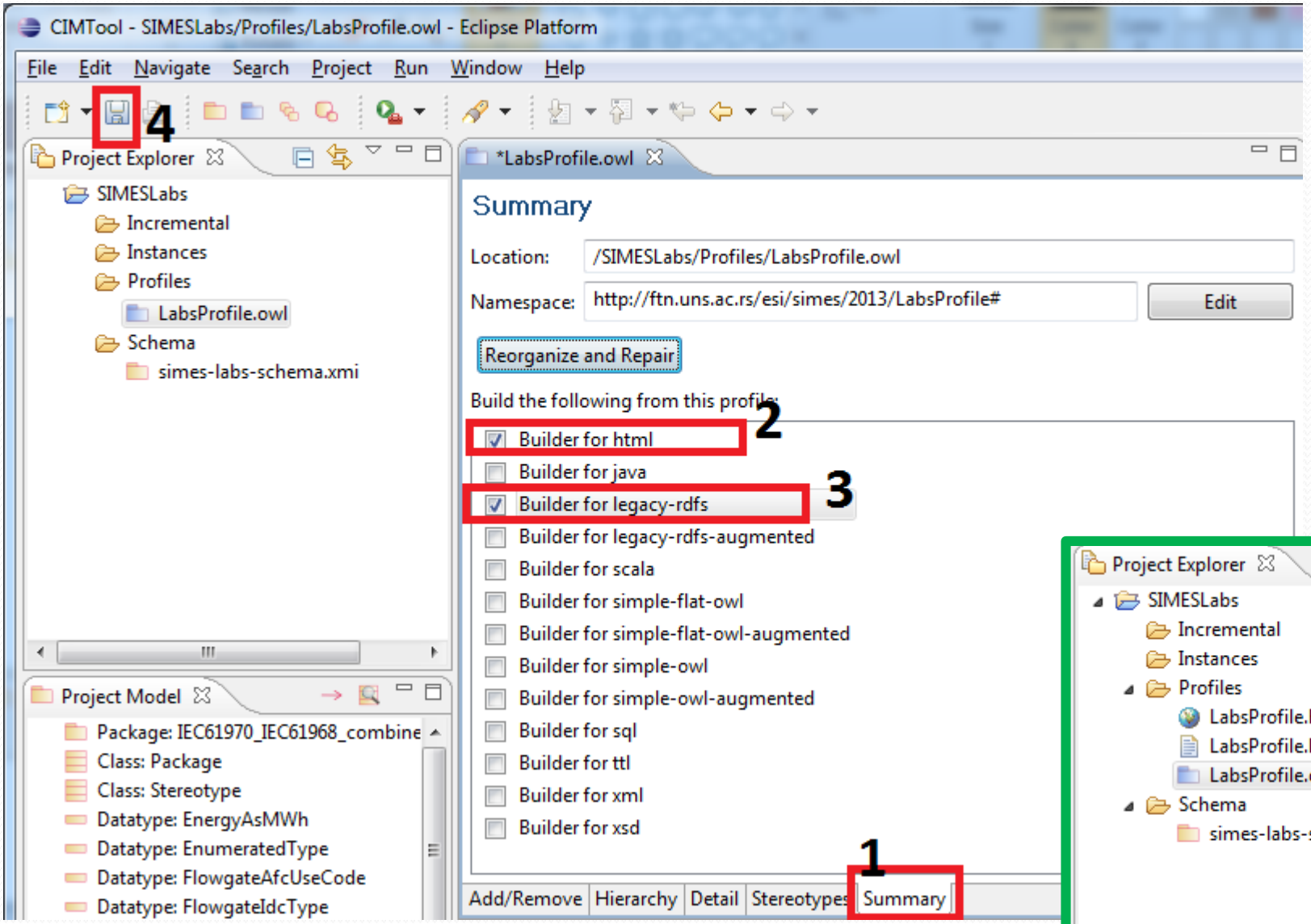
- Korak 2



CIMTool: kreiranje CIM profila

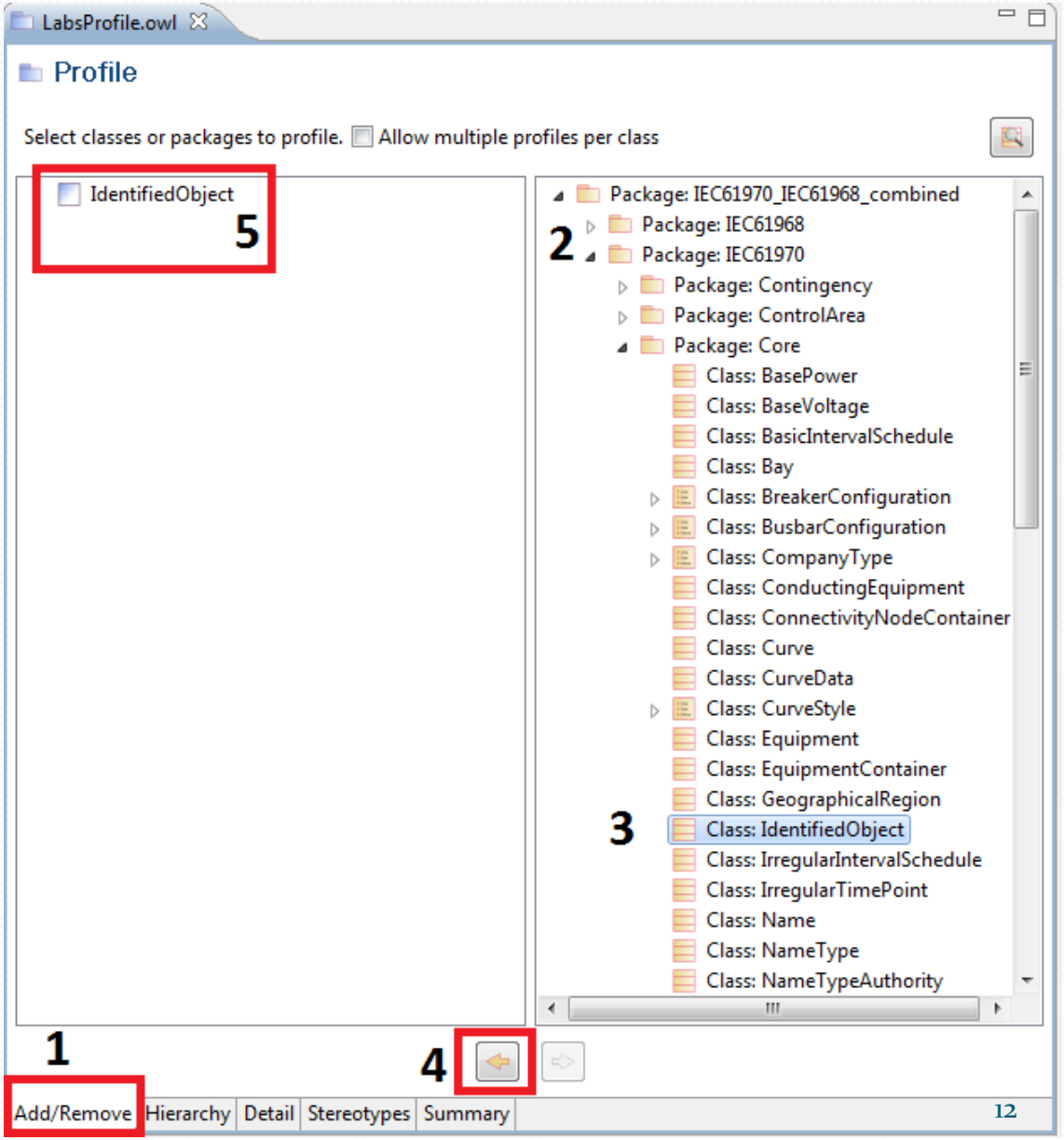


CIMTool: Biranje formata zapisa CIM profila



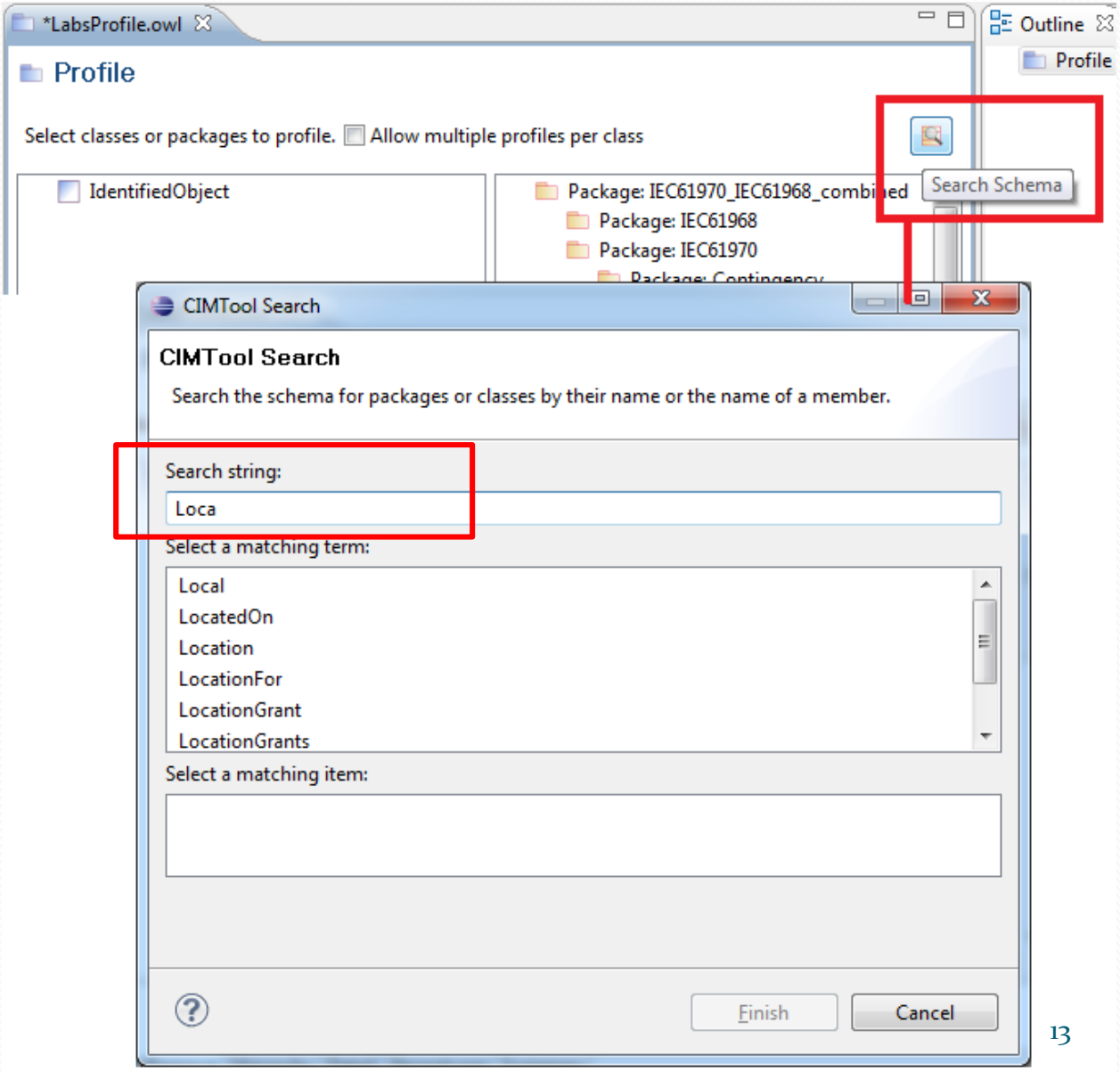
CIMTool: Dodavanje klase u CIM profil

- Prvi način:
  - odabirom iz liste



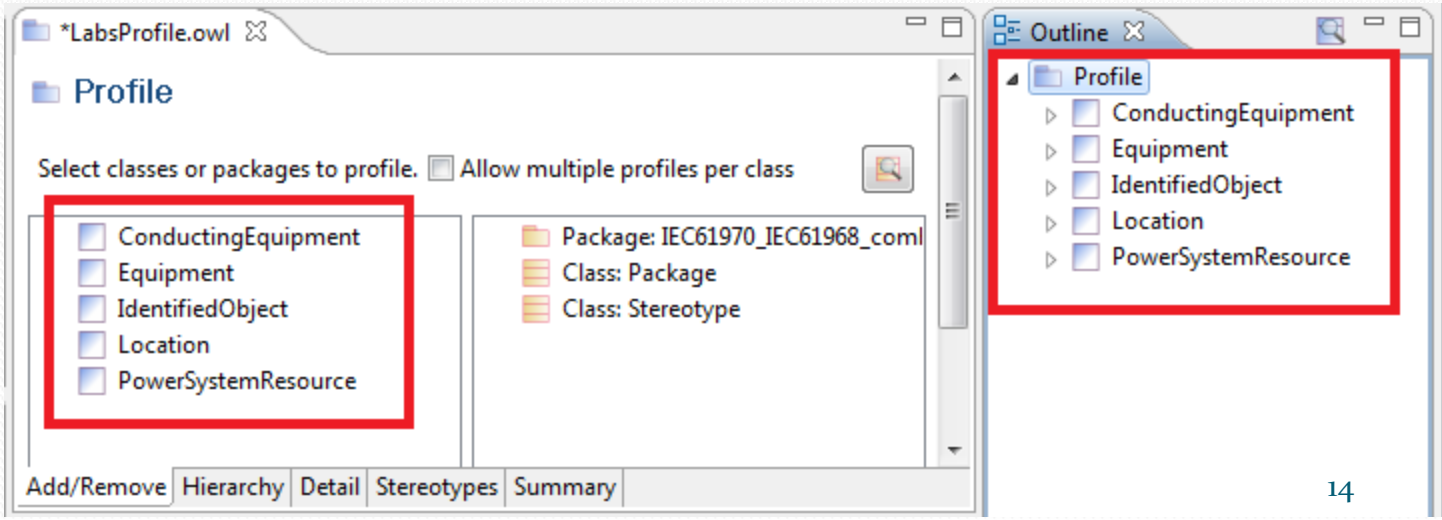
CIMTool: Dodavanje klase u CIM profil

- Drugi način:
  - *Search Schema*



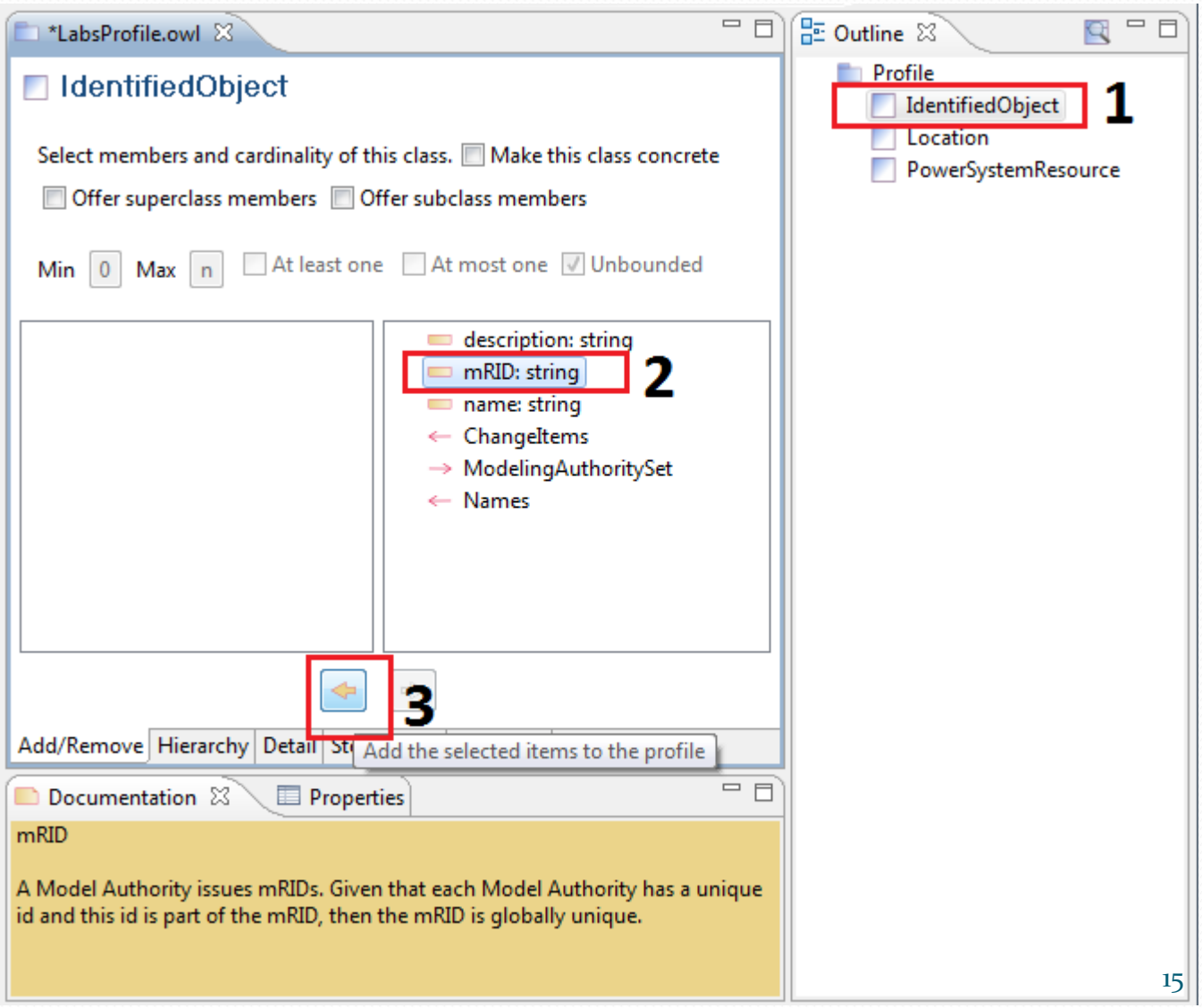
CIMTool: Dodavanje klase u CIM profil

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



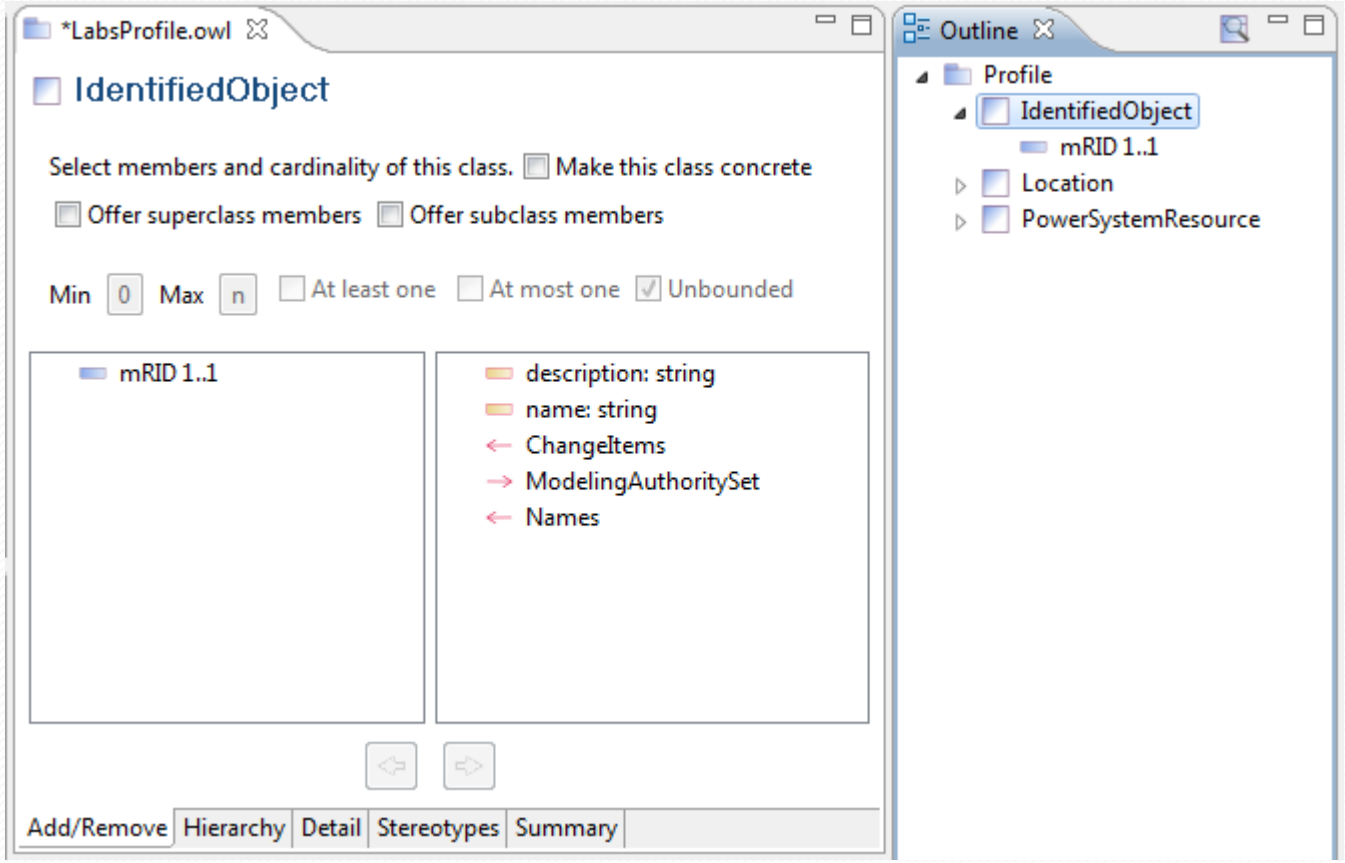
CIMTool: Dodavanje atributa u CIM profil

- Koraci:



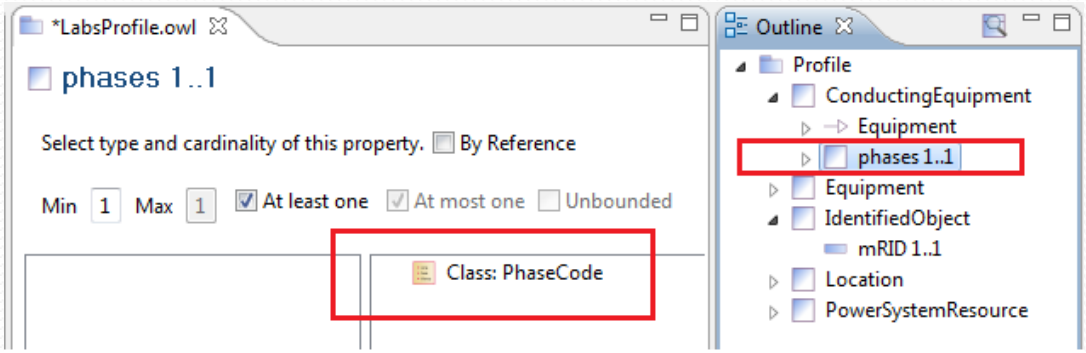
CIMTool: Dodavanje atributa u CIM profil

- Rezultat:

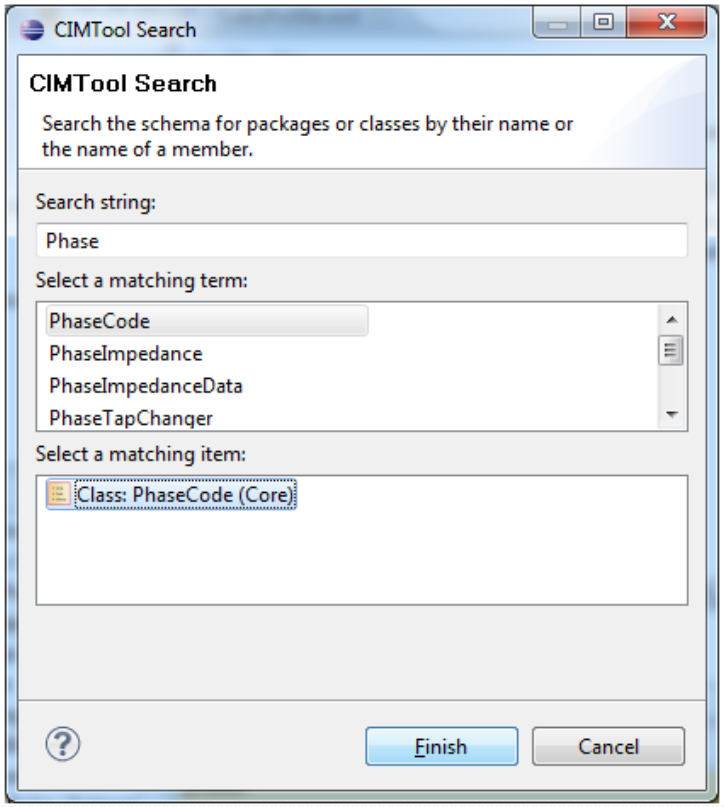


CIMTool: Dodavanje atributa u CIM profil

- Slučaj atributa čiji tip podatka je enumeracija

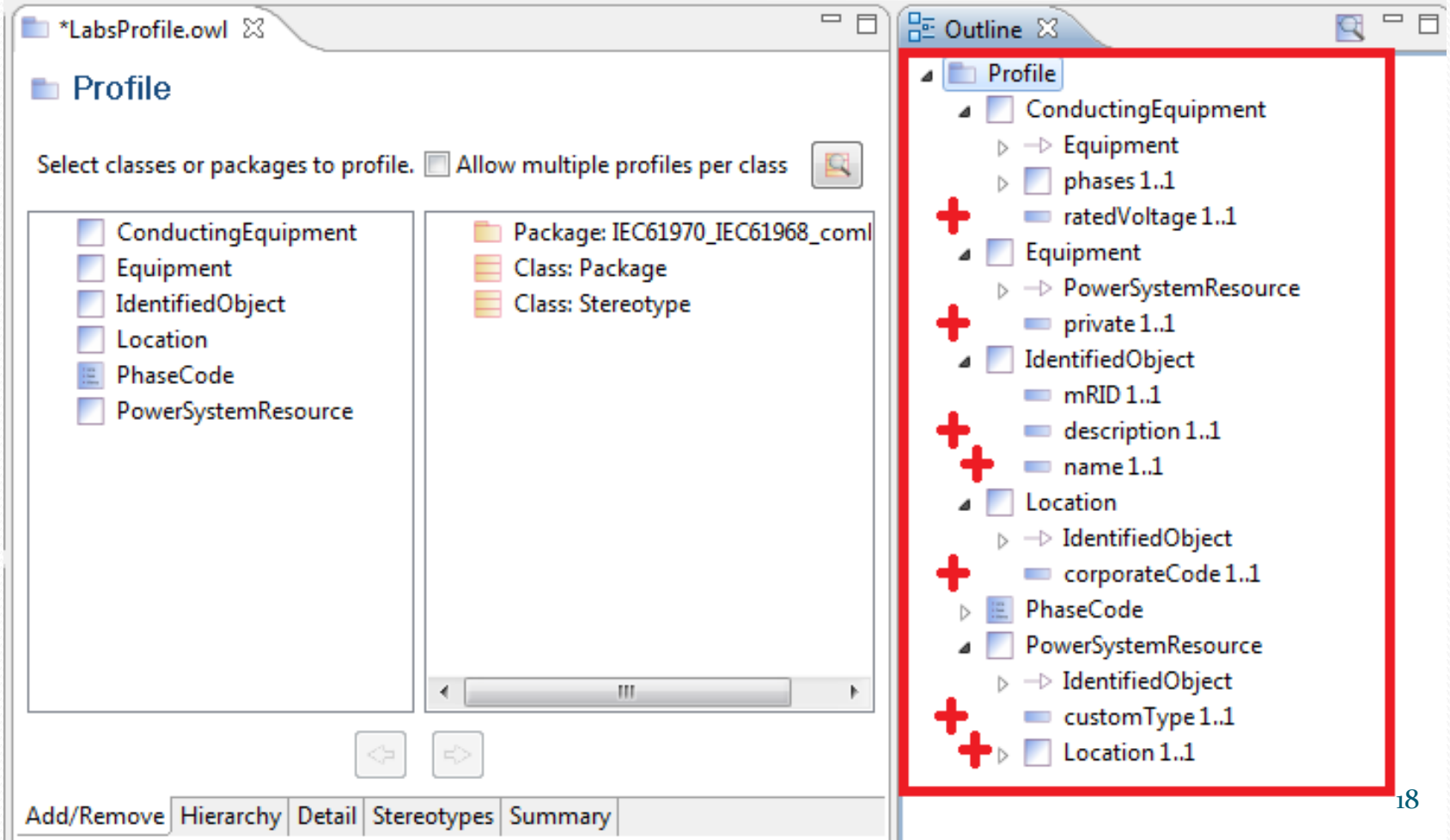


find enum class & add it to profile



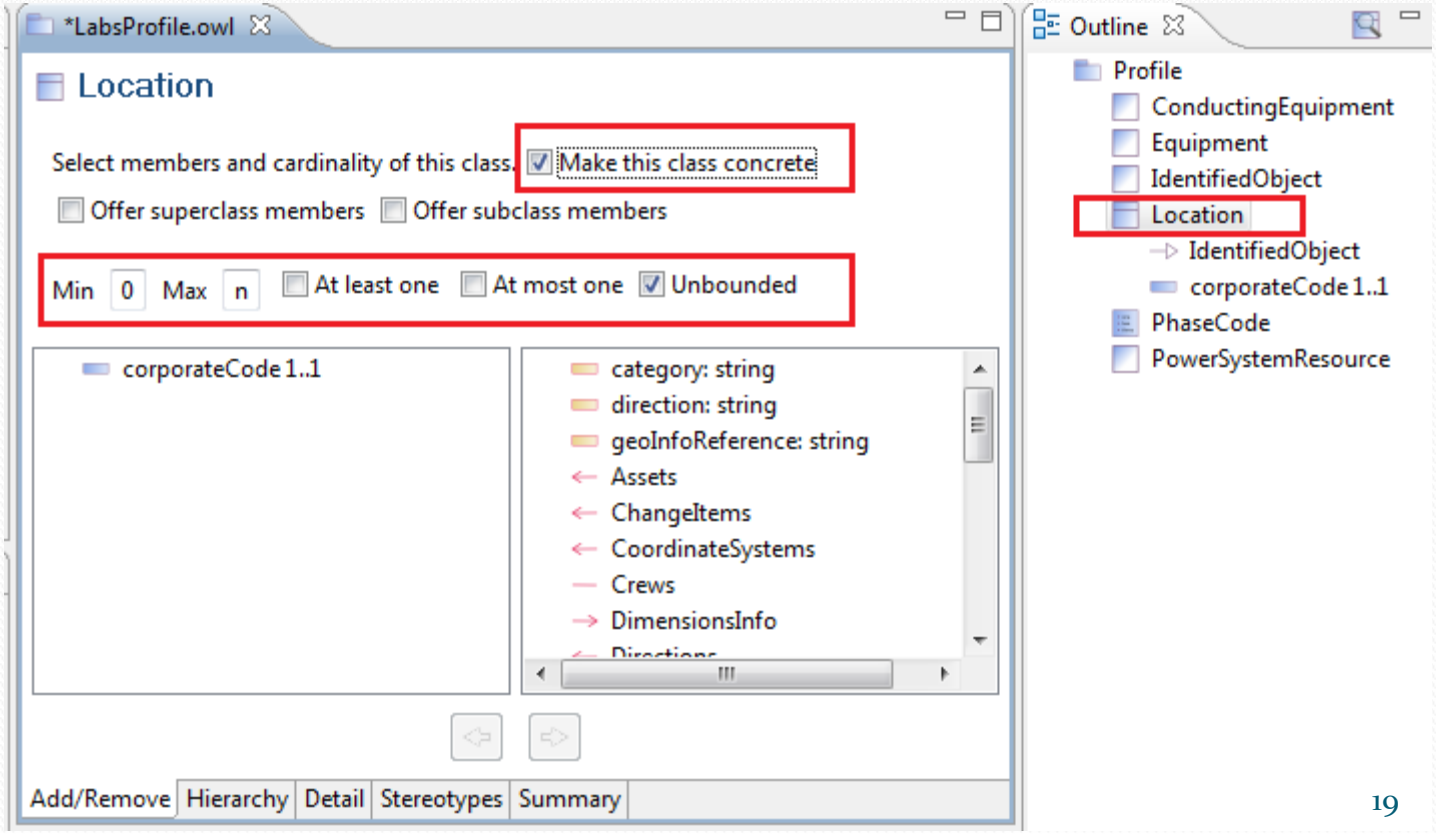
CIMTool: Dodavanje atributa u CIM profil

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



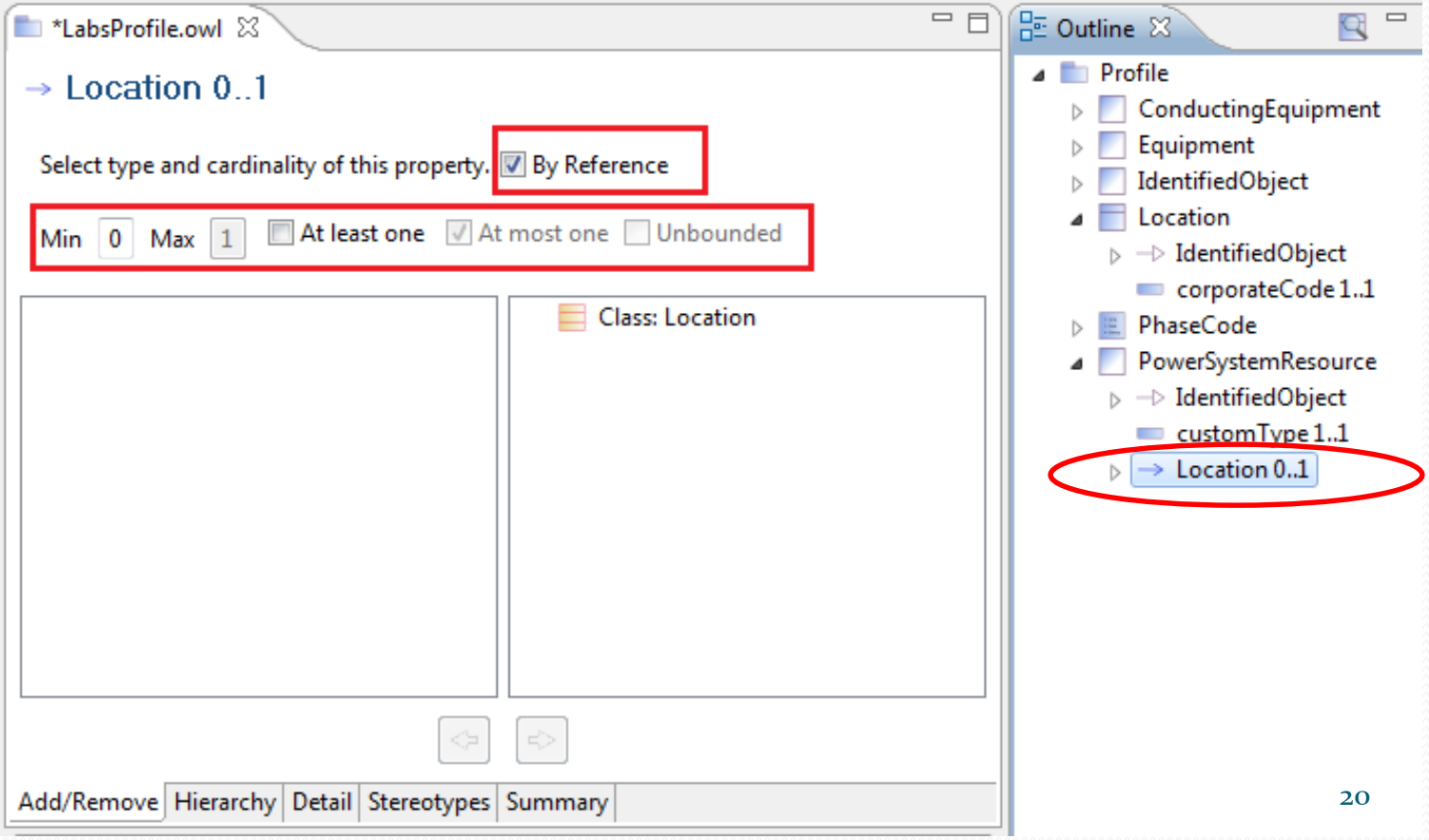
CIMTool: Konfiguracija klase u CIM profilu

- *Abstract* VS *Concrete* class
- Instance occurrence



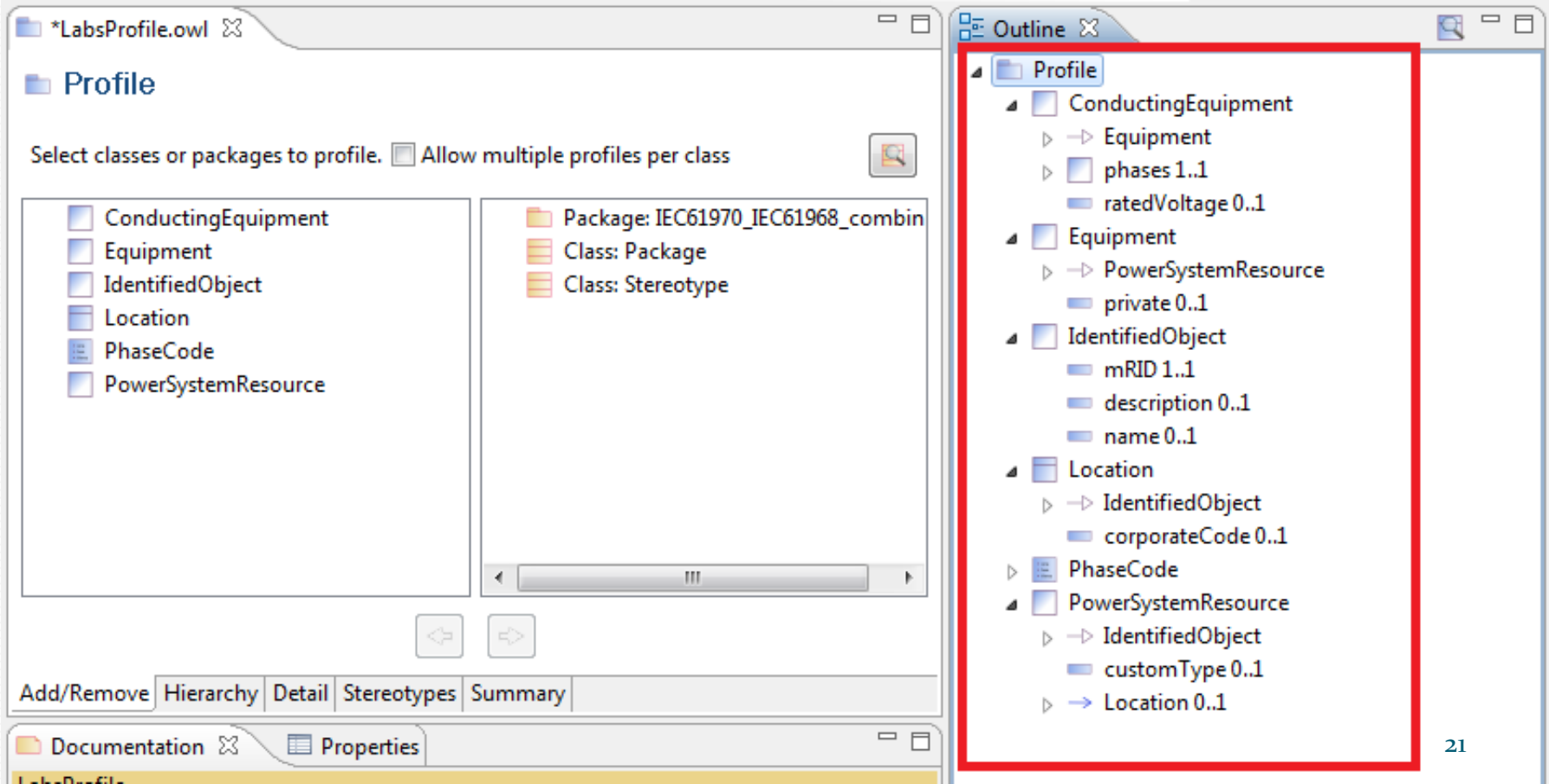
CIMTool: Konfiguracija atributa u CIM profilu

- Opcija „*By reference*“
- Kardinalitet



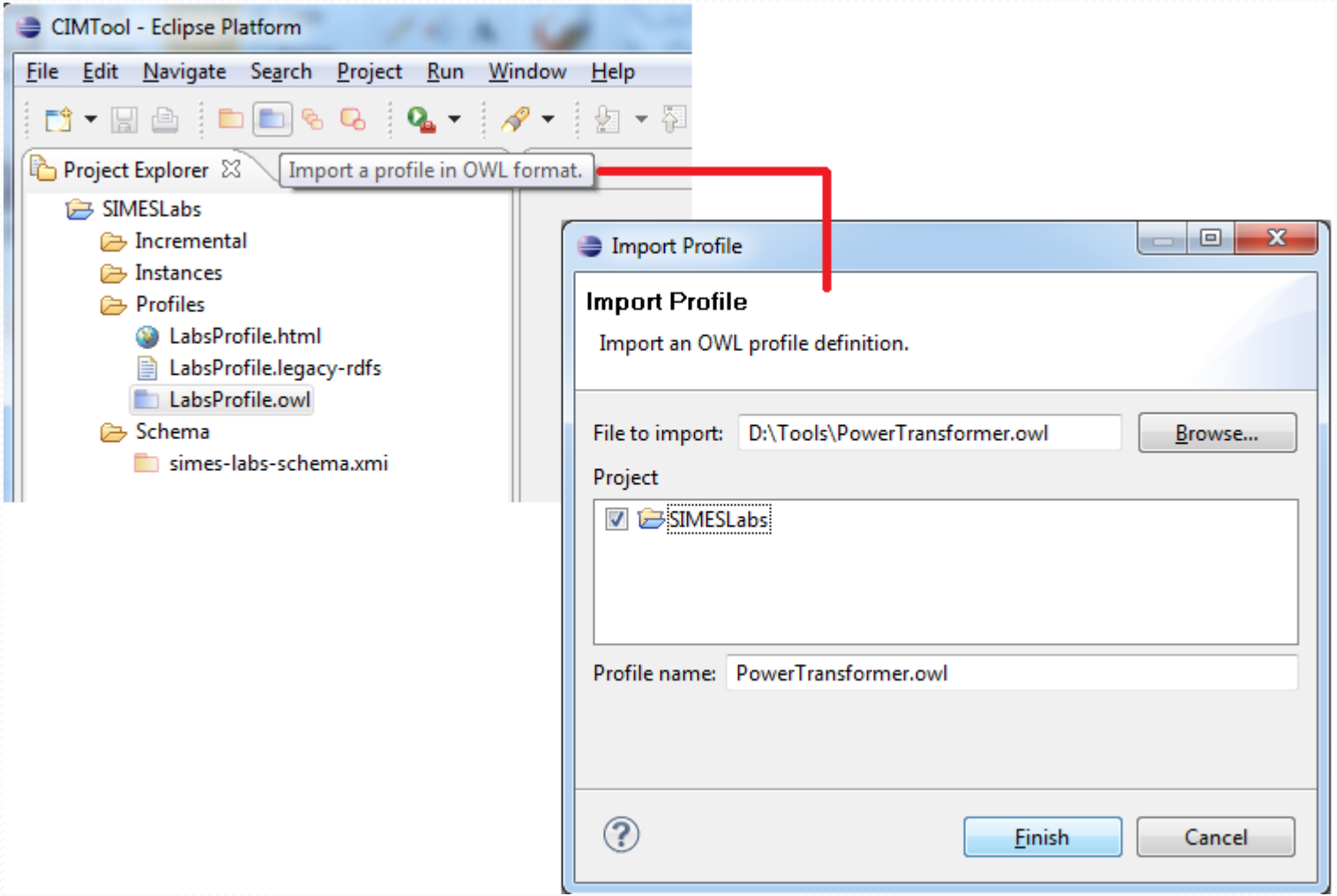
CIMTool: Konfiguracija atributa u CIM profilu

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



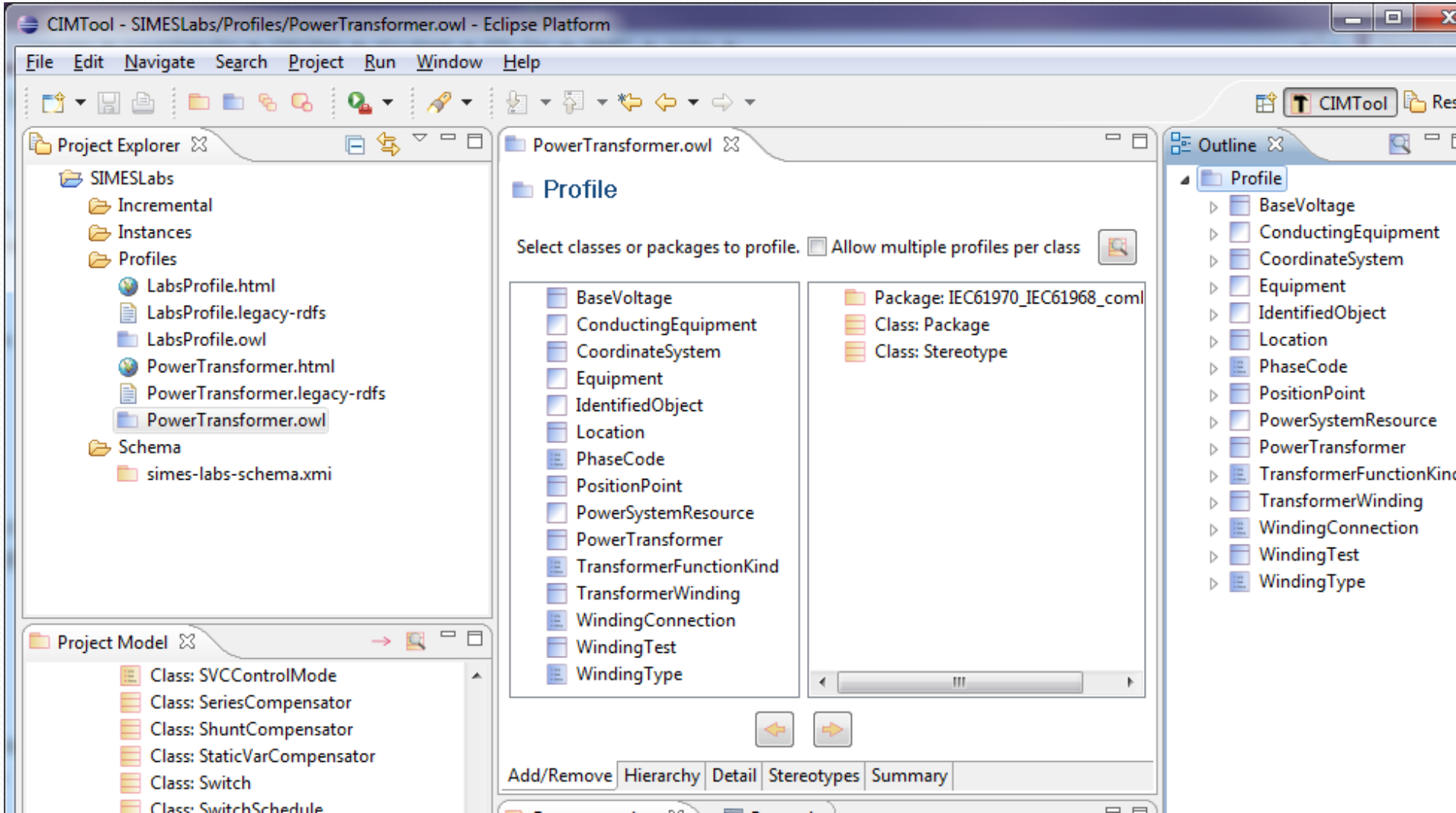
CIMTool: Import postojećeg CIM profila u projekat

- Koraci

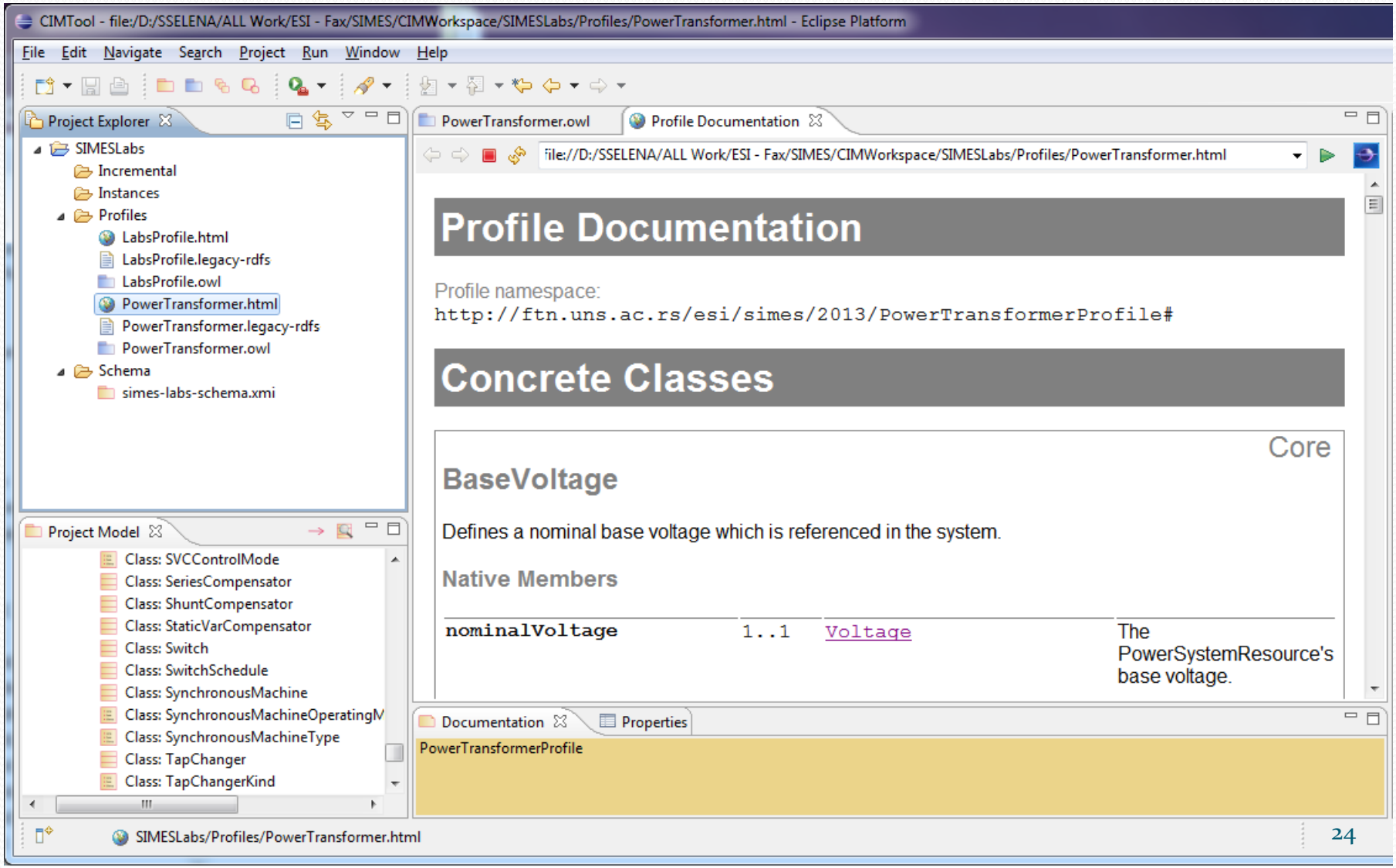


CIMTool: Import postojećeg CIM profila u projekat

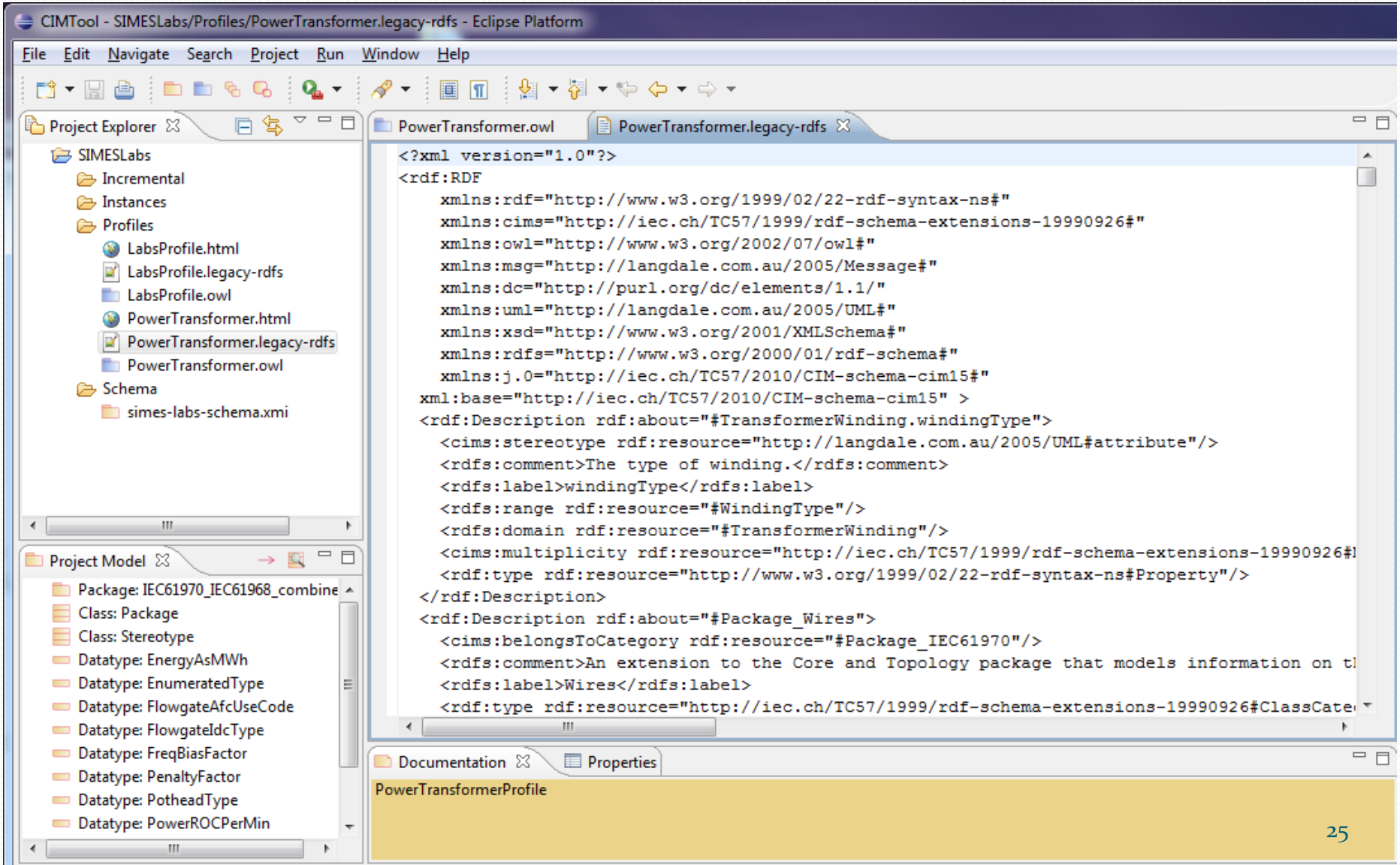
- Rezultat



CIMTool: Pregled HTML formata zapisa CIM profila

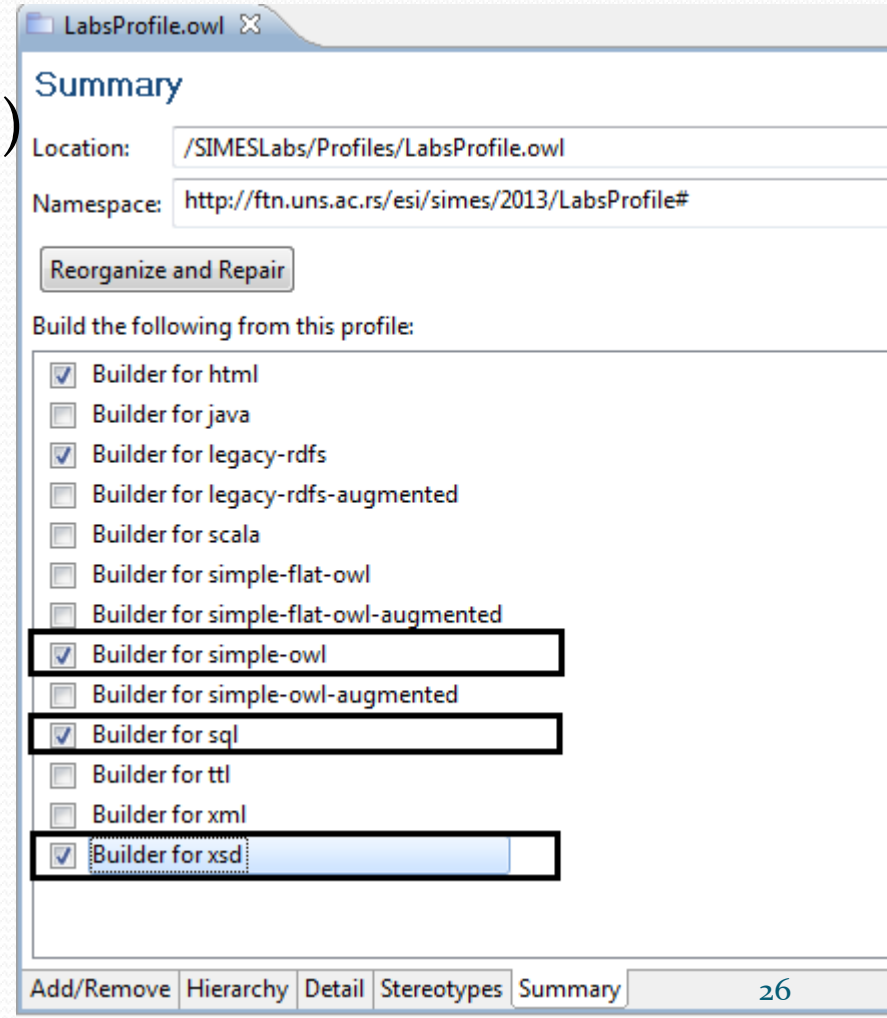


CIMTool: Pregled RDFS formata zapisa CIM profila



CIMTool: Biranje formata zapisa CIM profila

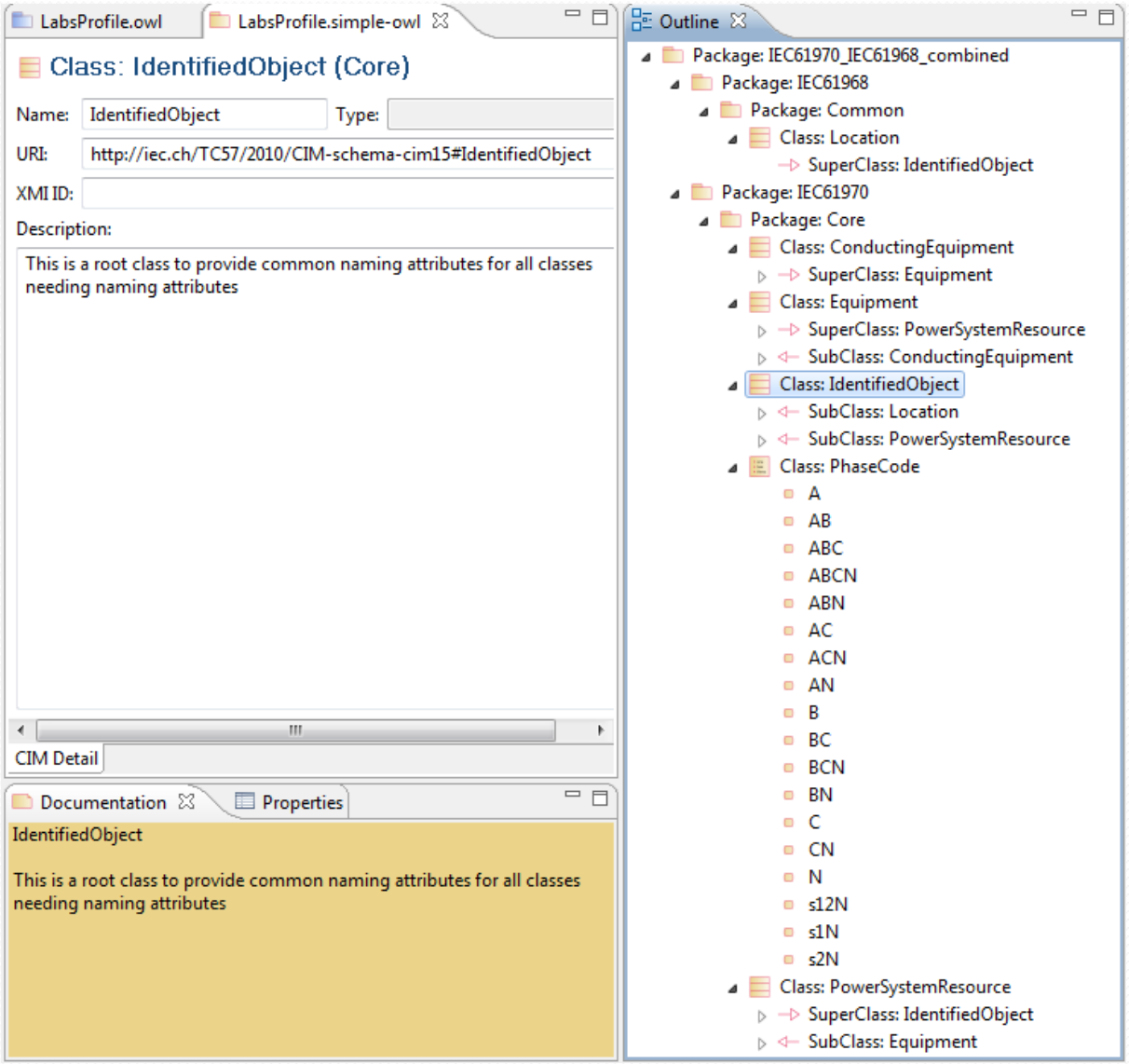
- Na raspolaganju su i drugi formati od kojih izdvajamo:
  - XSD
  - OWL (Web Ontology Language)
  - SQL



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>
```

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



CIMTool: Pregled SQL formata zapisa CIM profila

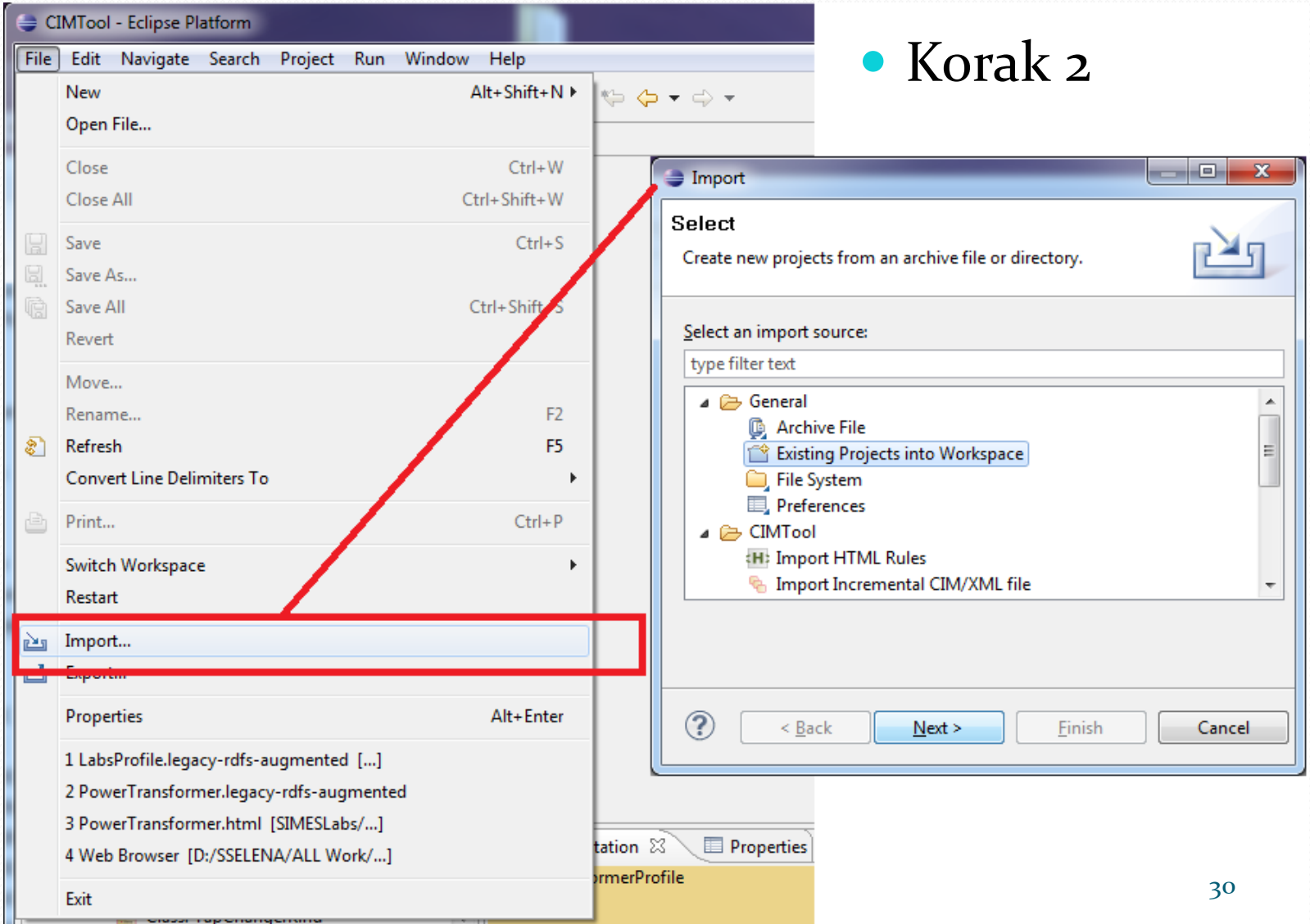
LabsProfile.owl | LabsProfile.sql

```
-- 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 1

- Korak 2



CIMTool: Import postojećeg CIM projekta

- Korak 3

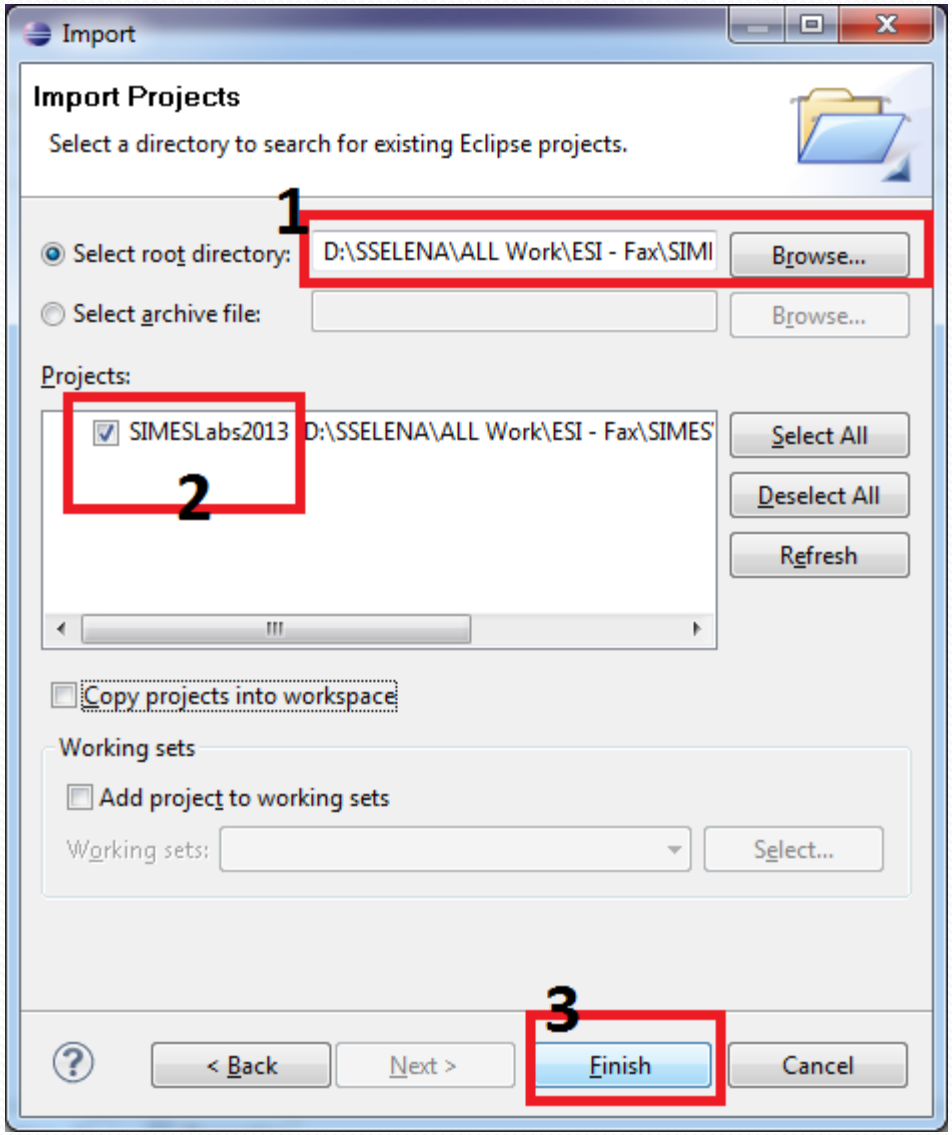
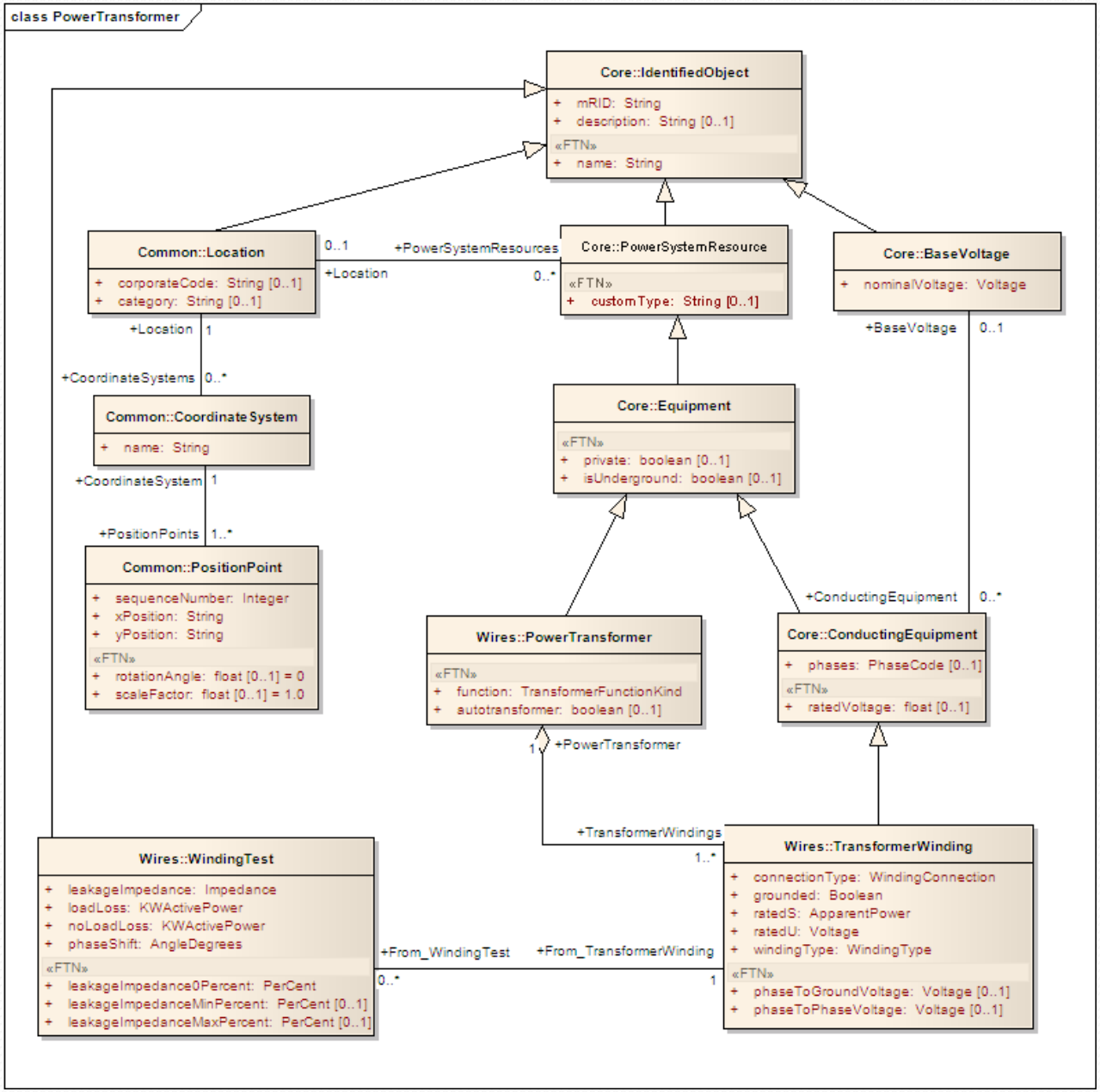


Diagram klasa CIM profila



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, atribute).