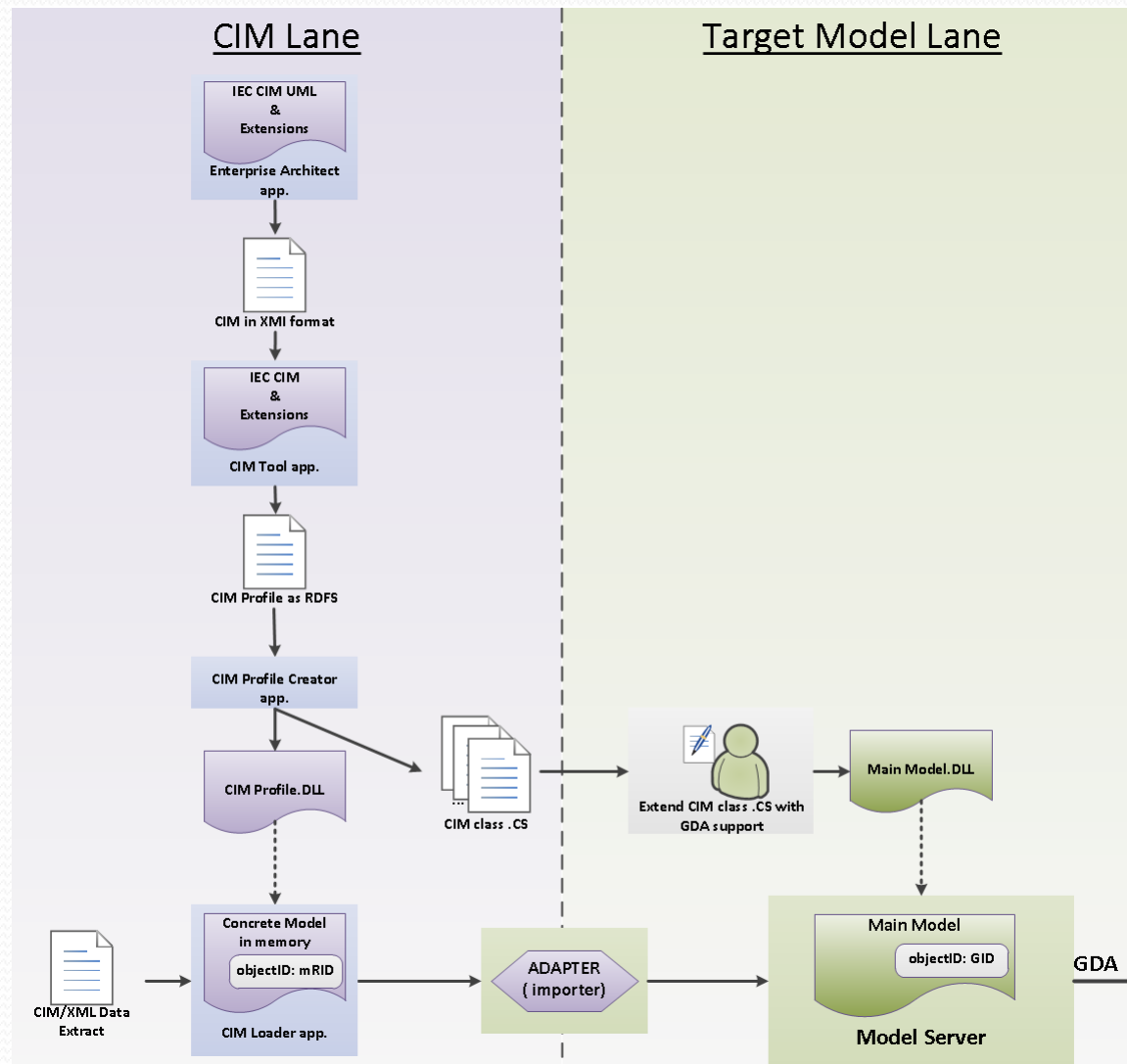


Standardi i modeliranje elektroenergetskih sistema

VEŽBA 3:

Uvod u Parser CIM profila datog u RDFS formatu

Tok podataka pri inicijalizaciji modela elektroenergetske mreže



Utvrdživanje

- Enterprise Architect alat
- CIMTool alat
- Zadatak

CIMTool: Pregled RDFS formata zapisa CIM profila

The screenshot displays the CIMTool application within the Eclipse Platform. The main window shows the RDFS format of the CIM profile, with the following XML content:

```
<?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#" />
    <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 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 shows the Documentation and Properties tabs, with the Documentation tab selected, displaying the PowerTransformerProfile.

Namespaces u RDFS dokumentu

```
<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" >
```

Deklaracija paketa u RDFS formatu

- Primer paketa

```
<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 the electrical characteristics of Transmission and Distribution networks.
This package is used by network applications such as State Estimation,
Load Flow and Optimal Power Flow.</rdfs:comment>
  <rdfs:label>Wires</rdfs:label>
  <rdf:type rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#ClassCategory"/>
</rdf:Description>
```

- Bitni elementi

- rdf:about – identifikator resursa
- belongsToCategory – pripadnost drugom paketu
- type – tip resursa:
 - <http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#ClassCategory>

Deklaracija klase u RDFS formatu 1/3

- Primer apstraktne klase

```
<rdf:Description rdf:about="#IdentifiedObject">
  <cims:belongsToCategory rdf:resource="#Package_Core"/>
  <rdfs:comment>This is a root class to provide common naming attributes for
  all classes needing naming attributes</rdfs:comment>
  <rdfs:label>IdentifiedObject</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
```

- Bitni elementi

- rdf:about – identifikator resursa
- belongsToCategory – pripadnost paketu
- type – tip resursa:
 - <http://www.w3.org/2000/01/rdf-schema#Class>

Deklaracija klase u RDFS formatu 2/3

- Primer *concrete* klase

```
<rdf:Description rdf:about="#PowerTransformer">
  <rdfs:subClassOf rdf:resource="#Equipment"/>
  <cims:belongsToCategory rdf:resource="#Package_Wires"/>
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#byreference"/>
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#concrete"/>
  <rdfs:comment>An electrical device consisting of two or more coupled windings,
  with or without a magnetic core, for introducing mutual coupling between
  electric circuits...</rdfs:comment>
  <rdfs:label>PowerTransformer</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
```

- Bitni elementi

- ...
- subClassOf – roditeljska-klasa
- stereotype – iskorišćen za dodatni opis resursa:
 - <http://langdale.com.au/2005/UML#concrete>
 - <http://langdale.com.au/2005/UML#byreference>

Deklaracija klase u RDFS formatu 3/3

- Primeri prostih klasa tj. *Datatype* klasa

```
<rdf:Description rdf:about="#Voltage">
  <rdfs:comment>Electrical voltage.</rdfs:comment>
  <rdfs:label>Voltage</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
<rdf:Description rdf:about="#KWActivePower">
  <rdfs:comment>Active power in kilowatts.</rdfs:comment>
  <rdfs:label>KWActivePower</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
<rdf:Description rdf:about="#Impedance">
  <rdfs:comment>Ratio of voltage to current.</rdfs:comment>
  <rdfs:label>Impedance</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
```

- Razlika u odnosu na klase je da ne sadrže sledeće elemente
 - belongsToCategory – podrazumeva se paket *Domain*
 - subClassOf – nema generalizacije među njima

Deklaracija enumeracije u RDFS formatu

- Primer enumeracije

```
<rdf:Description rdf:about="#WindingType">
  <cims:belongsToCategory rdf:resource="#Package_Wires"/>
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#enumeration"/>
  <rdfs:comment>Winding type.</rdfs:comment>
  <rdfs:label>WindingType</rdfs:label>
  <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>
```

- Bitni elementi

- rdf:about – identifikator resursa
- belongsToCategory – pripadnost paketu
- type – tip resursa:
 - <http://www.w3.org/2000/01/rdf-schema#Class>
- stereotype – iskorišćen za dodatni opis resursa:
 - <http://langdale.com.au/2005/UML#enumeration>

Deklaracija vrednosti enumeracije u RDFS formatu

- Primer vrednosti enumeracije

```
<rdf:Description rdf:about="#WindingType.primary">  
  <rdfs:label>primary</rdfs:label>  
  <rdf:type rdf:resource="#WindingType"/>  
</rdf:Description>
```

- Bitni elementi

- rdf:about – identifikator resursa
- type – referencira Enumeraciju putem identifikatora

Deklaracija atributa u RDFS formatu 1/5

- Primer atributa prostog (*primitive*) tipa

```
<rdf:Description rdf:about="#IdentifiedObject.mRID">
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#attribute"/>
  <rdfs:comment>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.</rdfs:comment>
  <rdfs:label>mRID</rdfs:label>
  <cims:dataType rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#IdentifiedObject"/>
  <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:1"/>
  <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Description>
```

- Bitni elementi

- rdf:about – identifikator resursa
- type – tip resursa:
 - <http://www.w3.org/1999/02/22-rdf-syntax-ns#Property>
- stereotype – iskorišćen za dodatni opis resursa:
 - <http://langdale.com.au/2005/UML#attribute>
- dataType – tip podatka koji je prost tip (string, integer, boolean, ...¹²)

Deklaracija atributa u RDFS formatu 2/5

- Primer atributa prostog (*primitive*) tipa

```
<rdf:Description rdf:about="#IdentifiedObject.mRID">
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#attribute"/>
  <rdfs:comment>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.</rdfs:comment>
  <rdfs:label>mRID</rdfs:label>
  <cims:dataType rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:domain rdf:resource="#IdentifiedObject"/>
  <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:1"/>
  <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Description>
```

- Bitni elementi

- ...
- domain – referencira klasu kojoj atribut pripada
- multiplicity - kardinalitet
 - <http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:o..1>
 - <http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:1>

Deklaracija atributa u RDFS formatu 3/5

- Primer atributa izvedenog (*datatype*) tipa

```
<rdf:Description rdf:about="#TransformerWinding.ratedU">
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#attribute"/>
  <rdfs:comment>The rated voltage (phase-to-phase) of the winding,
  usually the same as the neutral voltage.</rdfs:comment>
  <rdfs:label>ratedU</rdfs:label>
  <cims:datatype rdf:resource="#Voltage"/>
  <rdfs:domain rdf:resource="#TransformerWinding"/>
  <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:0..1"/>
  <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Description>
```

- Razlika u elementima
 - dataType – referencira tip podatka koji je izveden tip tj. **klasa**

Deklaracija atributa u RDFS formatu 4/5

- Primer atributa tipa enumeracije

```
<rdf:Description rdf:about="#PowerTransformer.function">
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#attribute"/>
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#ftn"/>
  <rdfs:comment>Purpose of the transformer within the network. (Copied from 61970:TransformerAsset)</rdfs:comment>
  <rdfs:label>function</rdfs:label>
  <rdfs:range rdf:resource="#TransformerFunctionKind"/>
  <rdfs:domain rdf:resource="#PowerTransformer"/>
  <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:1"/>
  <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Description>
```

- Razlika u elementima

- range – referencira tip podatka koji je **enumeracija** (za razliku od prostih/izvedenih tipova ne koristi se dataType element)

- Obratiti pažnju na

- stereotype – <http://langdale.com.au/2005/UML#ftn>

Deklaracija atributa u RDFS formatu 5/5

- Primer atributa tipa asocijacije (referenca)

```
<rdf:Description rdf:about="#TransformerWinding.PowerTransformer">
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#byreference"/>
  <cims:stereotype rdf:resource="http://langdale.com.au/2005/UML#ofAggregate"/>
  <rdfs:comment>A transformer has windings</rdfs:comment>
  <rdfs:label>PowerTransformer</rdfs:label>
  <rdfs:range rdf:resource="#PowerTransformer"/>
  <rdfs:domain rdf:resource="#TransformerWinding"/>
  <cims:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdf-schema-extensions-19990926#M:1"/>
  <rdf:type rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#Property"/>
</rdf:Description>
```

- Razlika u elementima

- range – referencira tip podatka koji je **klasa** (za razliku od prostih/izvedenih tipova ne koristi se dataType element)
- stereotype – iskorišćen za dodatni opis resursa:
 - <http://langdale.com.au/2005/UML#byreference>
 - <http://langdale.com.au/2005/UML#ofAggregate>

Parser CIM profila datog u RDFS formatu

- Postavka zadatka
 - učitati RDFS dokument (koji definiše CIM profil) u odgovarajući objektni model u memoriji;
 - odštampati sadržaj objektnog modela u tekstualni izveštaj (paketi, klase u paketu, atributi u klasi).
- Implementacija
 - C#
 - Bazirana na klasi: *System.Xml.XmlReader* ([doc link](#))