COMMIT/

INDL IN USE

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THE INDL FAMILY OF ONTOLOGIES

INDL captures the concept of virtualization in computing infrastructures and describes the storage and computing capabilities of the resources.

A key feature is the decoupling of virtualization, connectivity and functionalities.
NODE COMPONENTS
NML

NML - Network Markup Language is a standard (since May 2013).

This has been developed by several people (not just UvA) within the OGF.

See: “Network Markup Language Base Schema version 1”

The Network Markup Language has two different normative syntaxes:
- regular XML defined using an XML Schema (XSD)
- OWL RDF/XML syntax, defined in an OWL schema. The OWL syntax is aimed at Semantic Web-oriented applications, the XML syntax is suitable for any application.
EXAMPLES

<nml:Node rdf:about="urn:ogf:network:example.net:2013:nodeA">
    <nml:name>Node_A</nml:name>
    <nml:locatedAt rdf:resource="urn:ogf:network:example.net:2013:redcity"/>
</nml:Node>

<nml:BidirectionalPort rdf:about="urn:ogf:network:example.net:2013:port_X.1501">
    <nml:name>X.1501</nml:name>
    <nml:hasPort rdf:resource="urn:ogf:network:example.net:2013:port_X.1501:out"/>
</nml:BidirectionalPort>
COMMIT/ INDL CONNECTING MODELS

CDL AND EDL

The CineGrid Description Language.

*Which services are available to the CineGrid users? How do make infrastructure resources and services match?*

The Energy Description Language

*How do we model the power consumption consumption of devices? How do we use this information to make prediction and estimation to increase energy efficiency?*

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**Diagram: CineGrid Description Language**

- **Node**
  - hasCapability
  - useEnergySource
  - atPowerState
- **Power Capability**
  - capability
- **Energy Source**
  - electricityPrice
  - emissionPerUnitofEnergy
  - workinghour
- **Power State**
  - state
  - ratedPower
- **Device**
  - pixelX
  - pixelY
- **Group**
  - hasElements
- **Cluster**
  - hasElements: (Host)
- **Host**
  - hasName
  - OS
- **Service**
  - providesService
  - providedBy
  - hasElement: (Service)
  - capabilities
  - maxStreams
- **DisplayService**
  - pixelX
  - pixelY
- **StorageService**
  - totalDiskSpace
  - freeDiskSpace
- **StreamService**
  - capabilities
  - maxStreams
- **NTTDisplayService**
- **SAGEDisplayService**
- **SAGEStreamService**
- **NFSStorageService**
- **iRODSStorageService**
- **NFTStreamService**
- **NTTDisplayService**
- **Infrastructure**
  - hasElements: (Device)
  - hasElements: (Cluster)
  - hasElements: (Node)
  - hasElements: (Exchange)
- **Element**
  - providesService
  - hasElements: (Host)
- **Exchange**
  - hasElements: (not Exchange)

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**Diagram: Energy Description Language**

- **Node**
  - hasCapability
  - useEnergySource
  - atPowerState
- **Power Capability**
  - capability
- **Energy Source**
  - electricityPrice
  - emissionPerUnitofEnergy
  - workinghour
- **Power State**
  - state
  - ratedPower
- **GreenEnergy**
- **BrownEnergy**

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**Diagram: Dependencies**

- **geysers.owl**
- **novi.owl**
- **cdl.owl**
- **indl.owl**
- **qosawf.owl**
- **nml.owl**
- **qosawf_map**
- **ping.owl**
- **edl.owl**
- **full import**
- **selective import**
NML IN USE FOR AUTOMATED GOLE/NSI

To create a functional description of multi-layer and multi-domain networks. It can be used for aggregated or abstracted topologies.
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TOPOLOGY EXCHANGES

Architecture implementation (SC14)

- **Topology Index** — Stores the location of the served topologies
- **Topology Provider** — Serves the topology files
- **Topology Consumer** — Processes the topology information

[Diagram showing the topology exchanges and their components]

*https://agg.netherlight.net/dds/*
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TOPOEX DEMO

Topology Overview  Pathfinder  Network graph  Architecture details

Topology Index

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<th>Index URL</th>
<th><a href="http://145.100.132.178:5000">http://145.100.132.178:5000</a></th>
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<td>Updates received</td>
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Lookup service

| Lookup Service URL | http://145.100.132.178:5010 | Number of STPs | 260 | Update Interval | 190 |

Topology providers

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<tr>
<th>Topology provider name</th>
<th>Topology provider url</th>
<th>Domain representing</th>
<th>Current version of NML</th>
<th>Topology changes</th>
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</tbody>
</table>
COMMIT/ INDL (CDL) IN USE

VAMPIRES AND OPEN CLOUD EXCHANGES

User

Modules

Web Portal
Content Metadata Repository
Resource Metadata Repository
Execution Engine

Resources

Network
GN3PLUS: OPENNAAS

We are working at the integration of the ontologies in the OpenNaaS system.
GN3PLUS: MOTE

MOTE researches multi-domain topology descriptions supporting network provisioning for SDN technologies.

Challenge is to bridge:
- intra-domain operations of OpenFlow
- inter-domain provisioning in the Network Service Interface (NSI) Framework.
THE GREEN NETWORK SERVICE
WHAT NEXT?

For the community:
• Effort should go to consolidate and standardize.
• The advantages of a common language.

For us INDL ontologies are the models we use to support our research.

The ‘I want’ infrastructure:
• An energy efficient computation and data transport
• A seamless multi-domain programmable network path
• Access to multi-provider cloud exchanges.