

COMMIT/

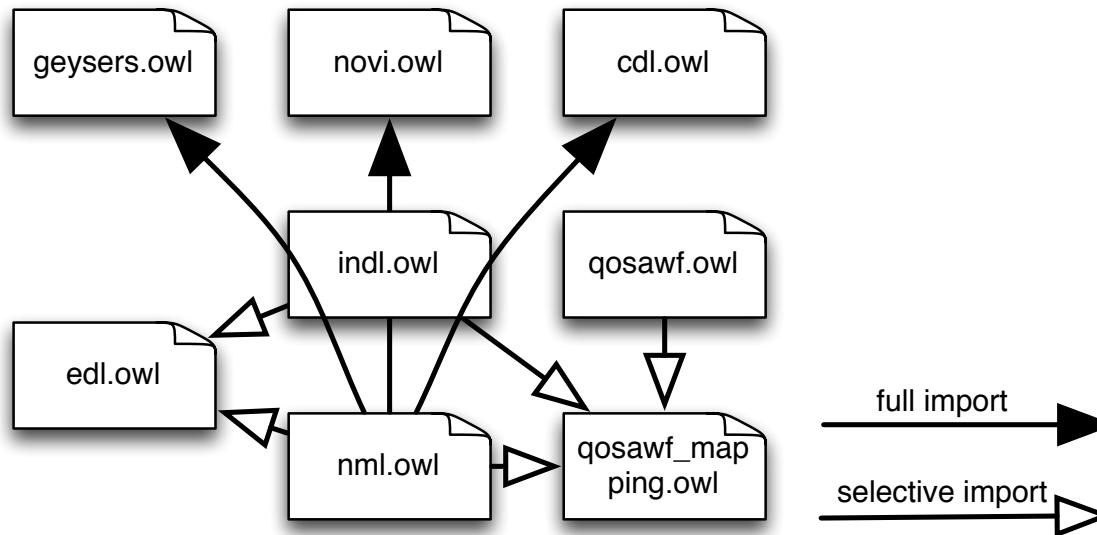
INDL IN USE

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University of Amsterdam



UNIVERSITY OF AMSTERDAM

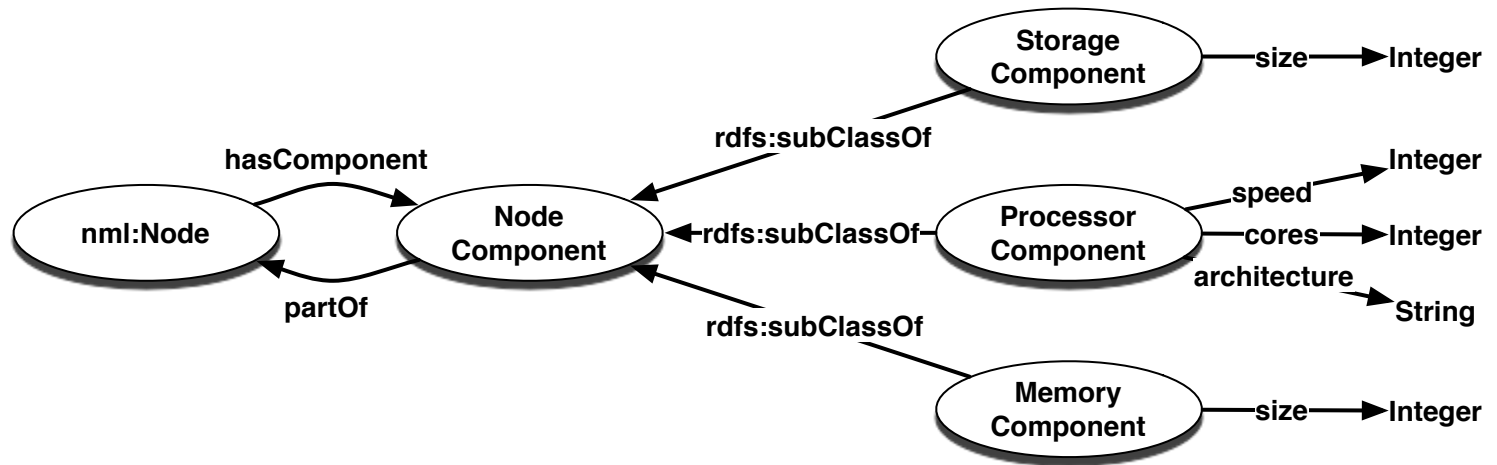
THE INDL FAMILY OF ONTOLOGIES



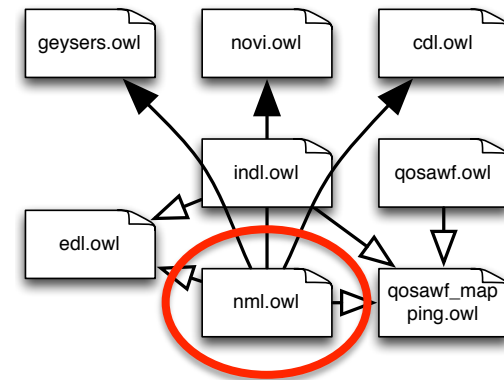
INDL captures the concept of virtualization in computing infrastructures and describes the storage and computing capabilities of the resources.

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:

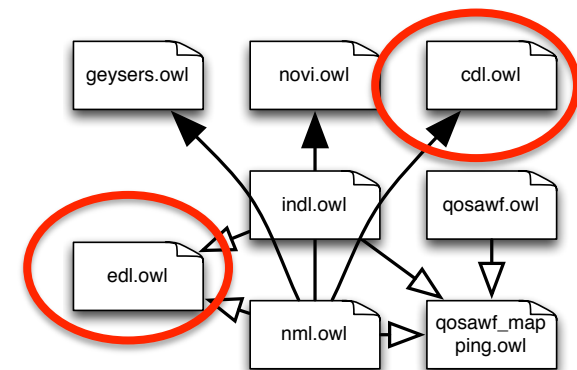
- regular XML defined using an XML Schema (XSD)
- OWL RDF/XML syntax, defined in an OWL schema. The OWL syntax is aimed at Semantic Web-oriented applications, the XML syntax is suitable for any application.

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:hasOutboundPort rdf:resource="urn:ogf:network:example.net:2013:nodeA:port_X:out"/>
  <nml:hasOutboundPort rdf:resource="urn:ogf:network:example.net:2013:nodeA:port_Y:out"/>
  <nml:hasInboundPort rdf:resource="urn:ogf:network:example.net:2013:nodeA:port_X:in"/>
  <nml:hasInboundPort rdf:resource="urn:ogf:network:example.net:2013:nodeA:port_Y:in"/>
</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:hasPort rdf:resource="urn:ogf:network:example.net:2013:port_X.1501:in"/>
</nml:BidirectionalPort>
```

CDL AND EDL

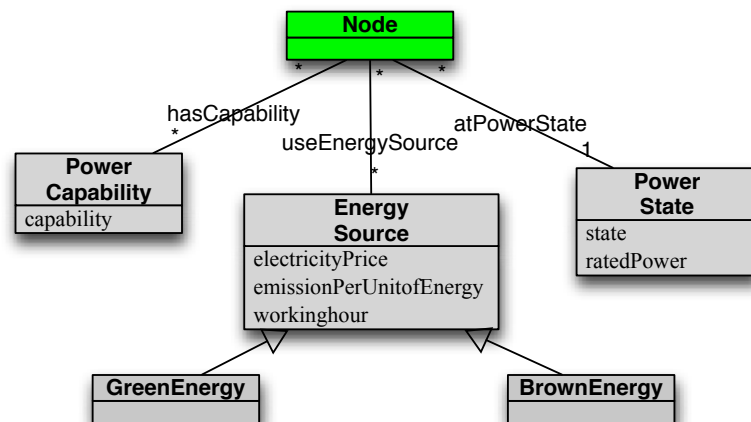
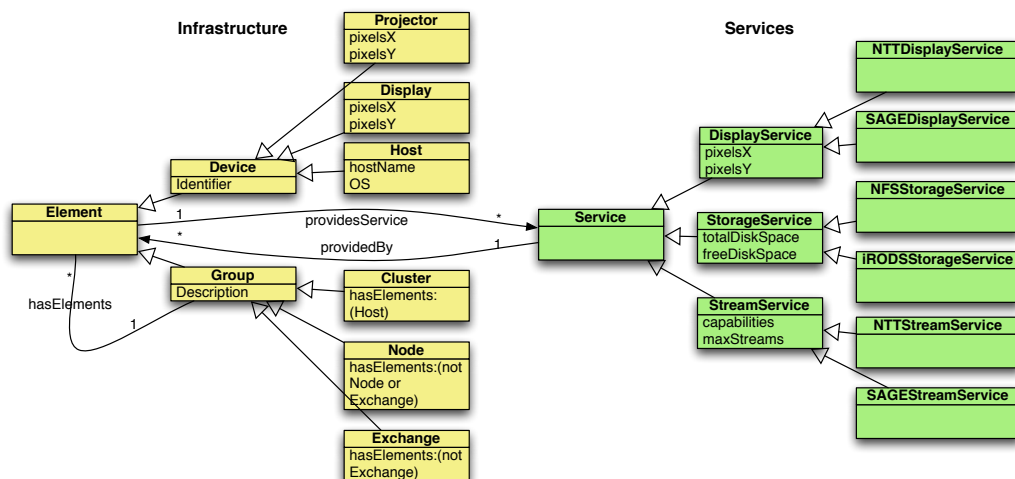


The CineGrid Description Language.

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

The Energy Description Language

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



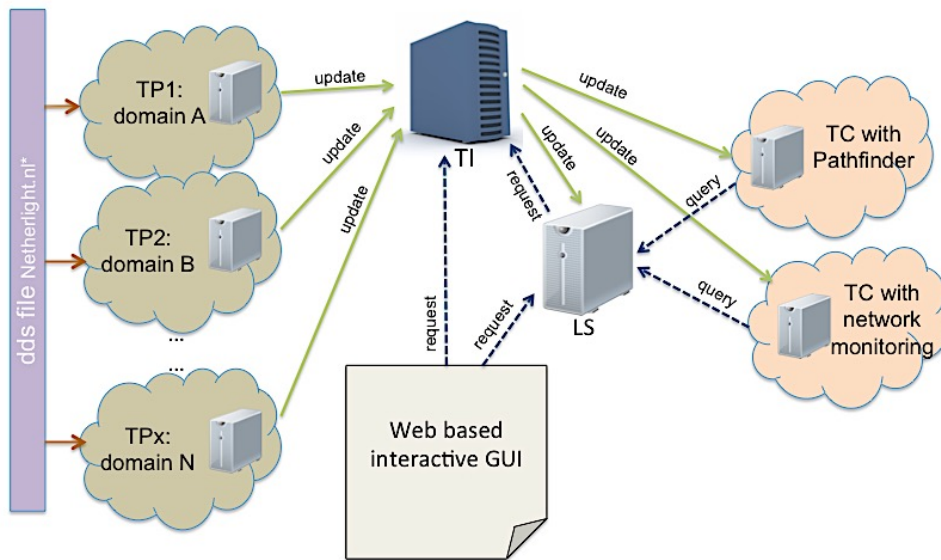
NML IN USE FOR AUTOMATED GOLE/NSI

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

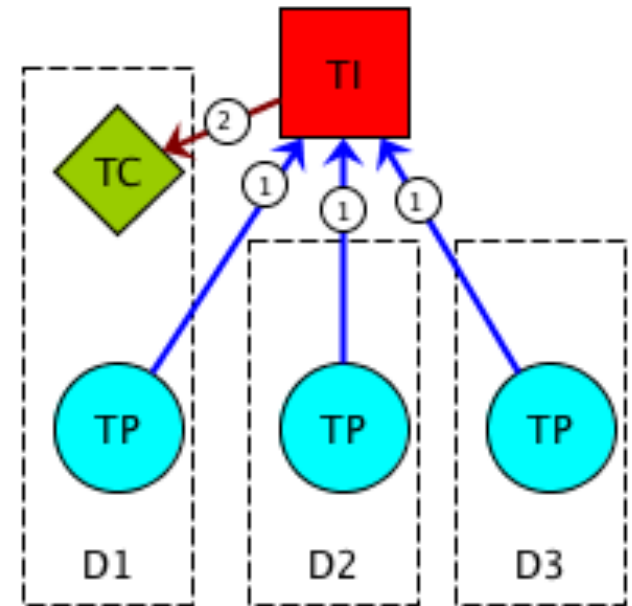


TOPOLOGY EXCHANGES

Architecture implementation (SC14)



*<https://agg.netherlight.net/dds/>



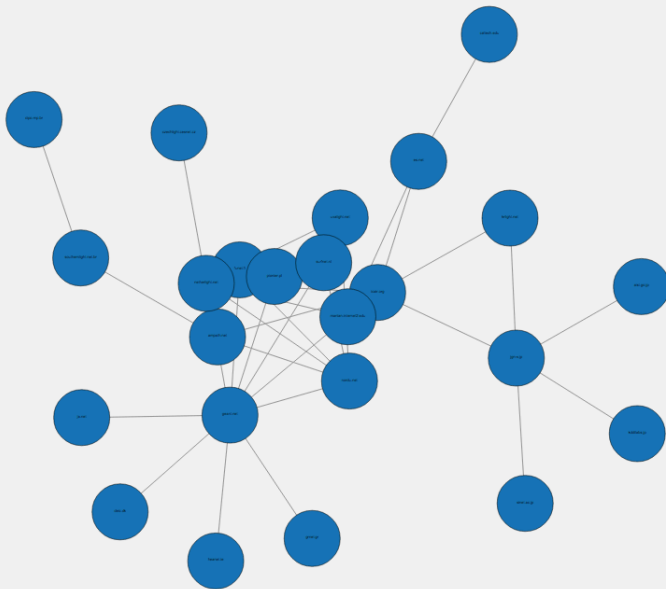
- **Topology Index** — Stores the location of the served topologies
- **Topology Provider** — Serves the topology files
- **Topology Consumer** — Processes the topology information

TOPOEX DEMO



Topology Overview Pathfinder Network graph Architecture details

Network Graph (Wed, 19 Nov 2014 22:51:34 GMT)



Topology Index

Index URL	http://145.100.132.178:5000	Domains registered	24
Number of subscribers	3	Updates received	6925

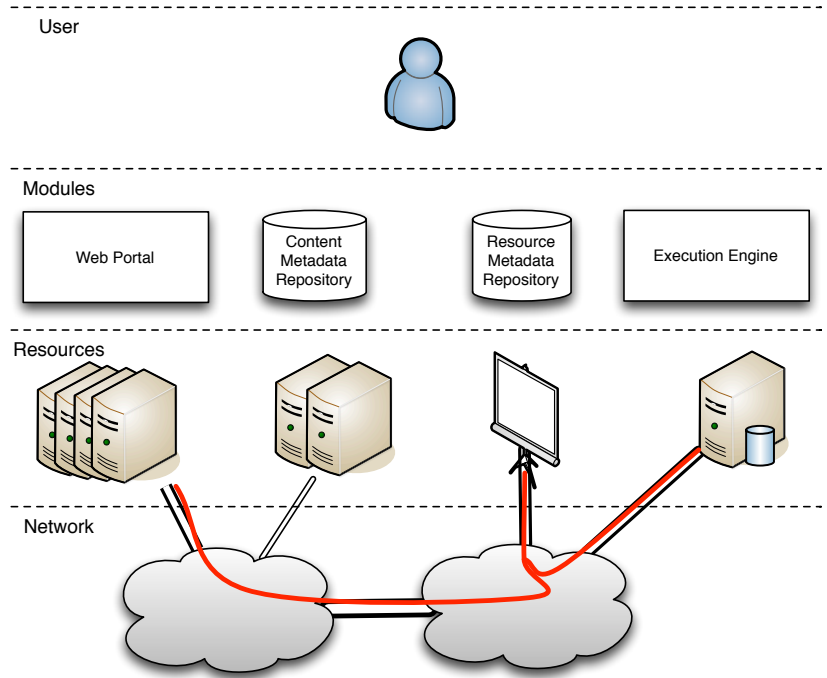
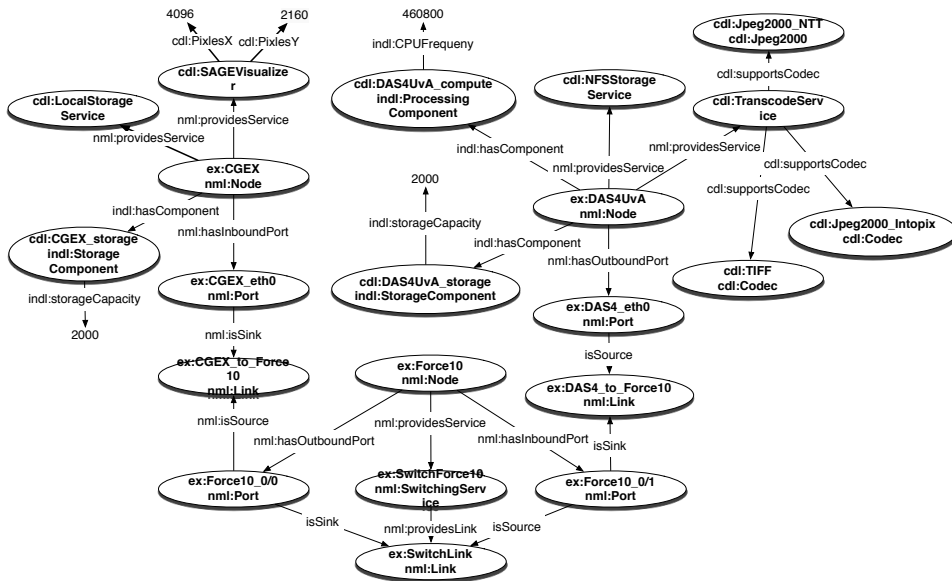
Lookup service

Lookup Service URL	http://145.100.132.178:5010	Number of STPs	260	Update Interval	180
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Topology providers

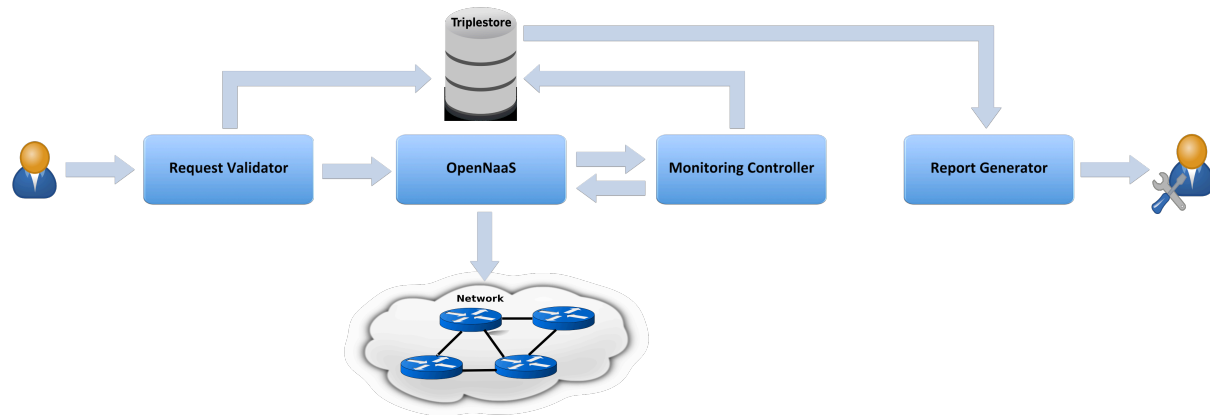
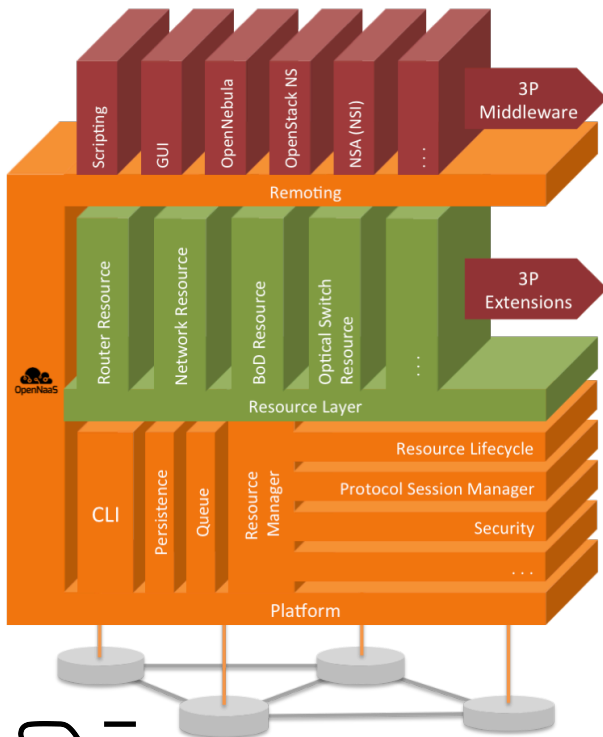
Topology provider name	Topology provider url	Domain representing	Current version of NML	Topology changes
tp_5102	http://145.100.132.178:5102	geant.net	2014-11-19T21:44:28.976Z	459
tp_5103	http://145.100.132.178:5103	pionier.pl	2014-11-19T21:44:28.025Z	459
tp_5101	http://145.100.132.178:5101	surfnet.nl	2014-11-12T15:49:38+01:00	1
tp_5106	http://145.100.132.178:5106	aist.go.jp	2014-09-10T12:49:00Z	1
tp_5107	http://145.100.132.178:5107	sinet.ac.jp	2013-07-26T10:42:44Z	1
tp_5104	http://145.100.132.178:5104	czechlight.cesnet.cz	2014-09-02T19:56:02Z	1

VAMPIRES AND OPEN CLOUD EXCHANGES



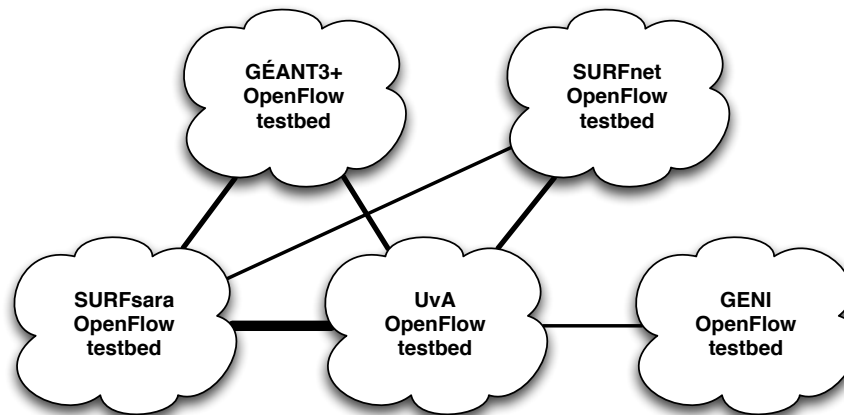
GN3PLUS: OPENNAAS

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



Green Routing Path Selection

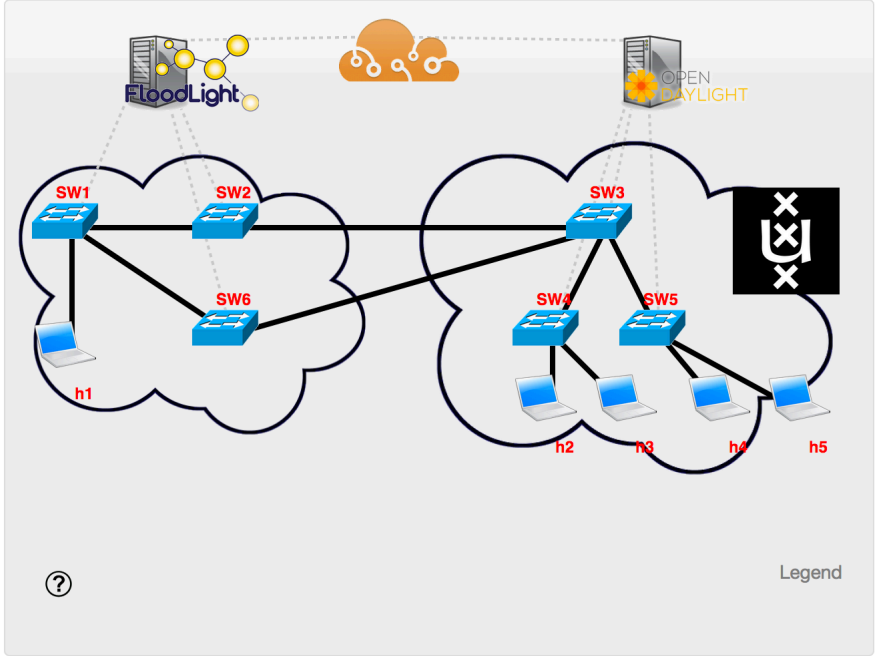
User: admin
Logout
SE
System and Network Engineering

Home Route Table ▼ Insert new Route Settings

Switch Information:

- DPID:
- Controller IP:
- Controller Port:
- Power Consumption:

Flow table:



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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.