

AutoGOLE/SENSE Working Group



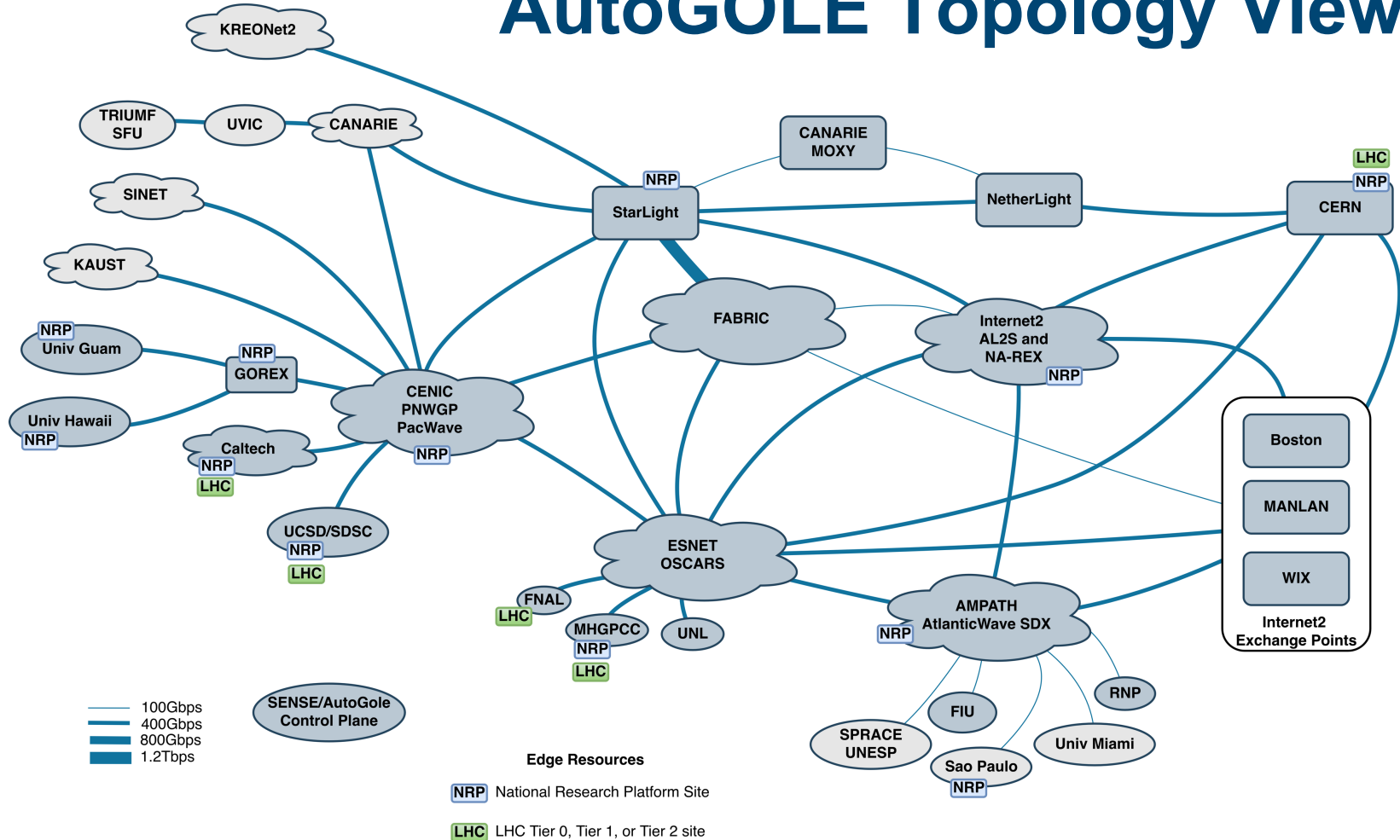
Tom Lehman (ESnet)
Marcos Schwarz (RNP)

GNA-G Community Meeting
Q3 2026
September 15,16 2026

AutoGOLE / SENSE WG

- GNA-G AutoGOLE/SENSE WG
 - <https://www.gna-g.net/join-working-group/autogole-sense>
- Co-Chairs:
 - Tom Lehman (ESnet)
 - Marcos Felipe Schwarz (RNP)
 - Hans Trompert (SURF)
 - Buseung Cho (KISTI)
- AutoGOLE/SENSE Working Group mailing list
 - autogole@lists.gna-g.net
- Zoom meetings
 - every two weeks on Tuesdays, 10am ET

AutoGOLE Topology View

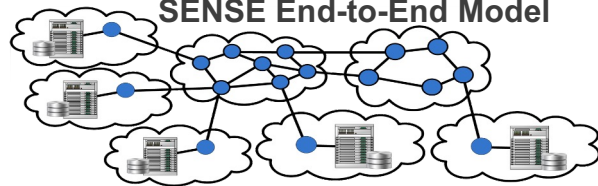


Network and Edge Systems APIs

SENSE Orchestrator

Talks with multiple APIs
One "Driver" for each instance

SENSE End-to-End Model



-SENSE builds connected network graph
-enables advanced service computation and provisioning

SENSE API

Site RM

CENIC

NSI API

NSI

RNP

NSI API

NSI

ESnet

NSI API

NSI

StarLight

SENSE API

Site RM

NSI API

NSI

NetherLight

SENSE API

Site RM

Sites,
Edge
Systems

Looking Glass API

I2

Internet2

NSI API

NSI

CANARIE
MOXY

SDX API

SDX

Ampath
AtlanticWave
SDX

NSI API

NSI

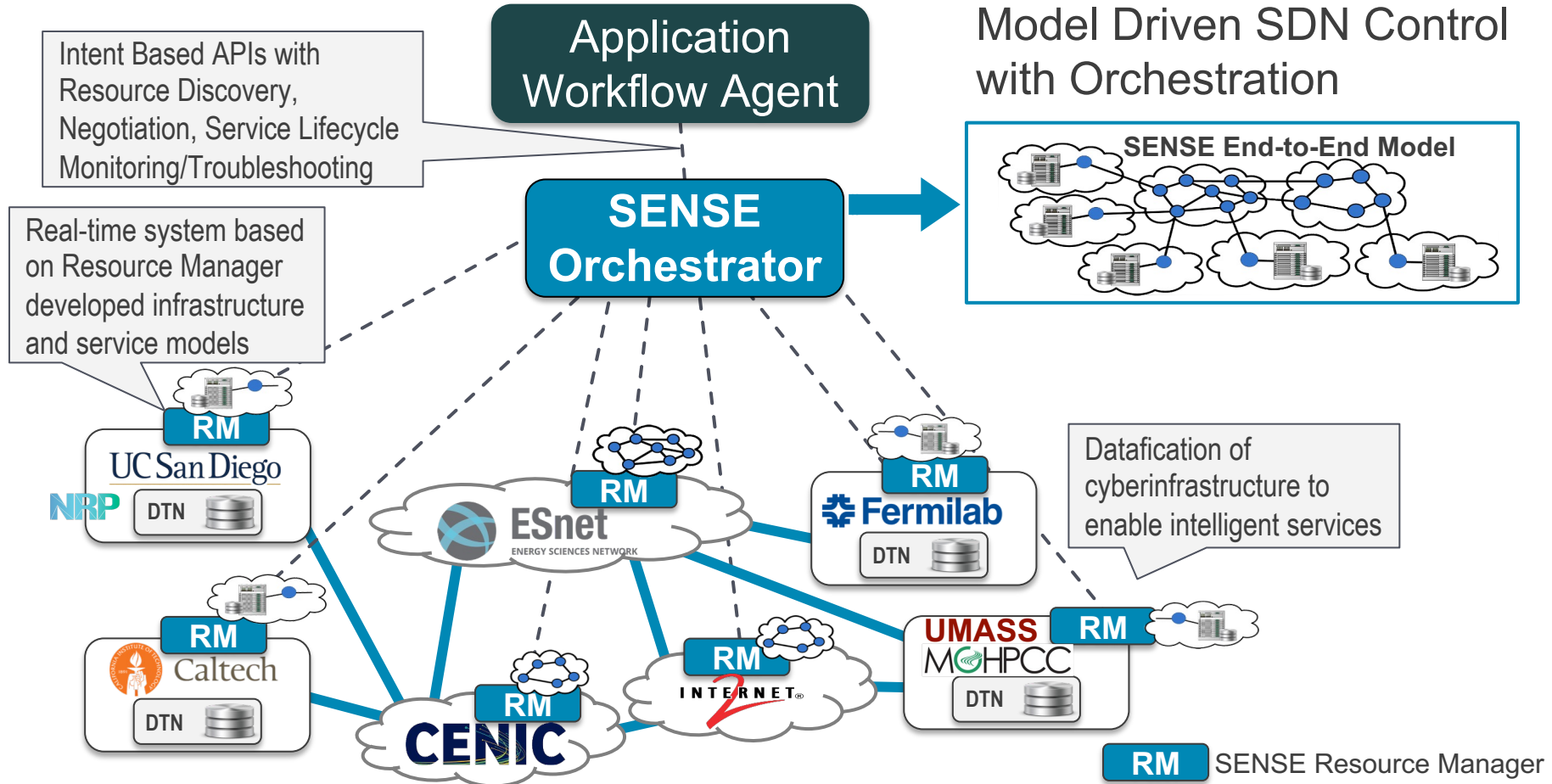
Boston

MANLAN

WIX

Internet2 Exchange
Points

SENSE Architecture



Model Driven Orchestration

- Modeling schemas based on OGF Network Markup Language (NML) and extensions to Multi-Resource Markup Language (MRML)
 - <https://ogf.org/documents/GFD.206.pdf>
 - <https://github.com/esnet/nml-mrml>
- Utilizes Resource Description Framework (RDF) and OWL 2 Web Ontology Language W3C Specifications
- Everything can be modeled as Resources (things) and Statements (relationships). Represented as collection of subject-predicate-object (triples).

SENSE-O Main

Model Visualization

urn:ogf:network.es.net:2013:

PREVIOUS

NEXT

hasBidirectionalPort (33)

hasService

urn:ogf:network.es.net:2013:topology:ServiceDomain:EVT1-A-GOLE

hasServiceDefinition

urn:ogf:network.es.net:2013:topology:ServiceDefinition:EVT1-A-GOLE

name

es.net

type

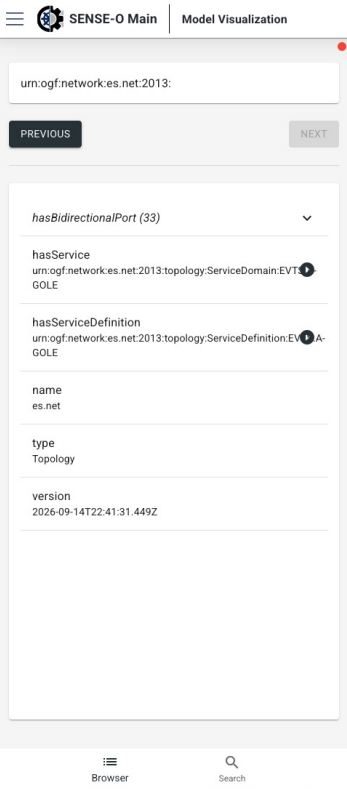
Topology

version

2026-09-14T22:41:31.449Z

Browser

Search



 SENSE-O Main
 Model Visualization



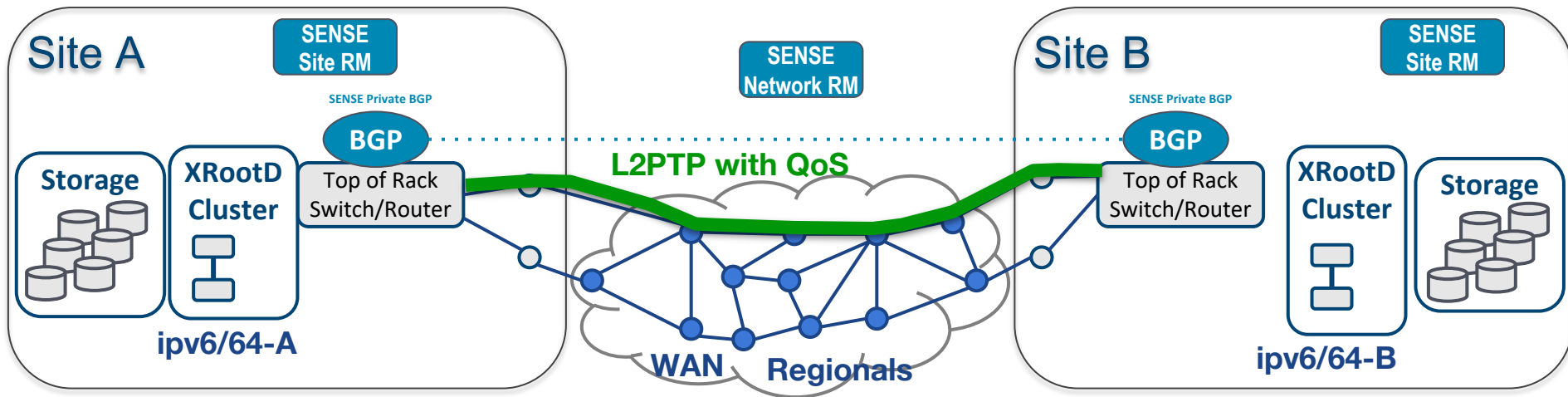
AutoGOLE / SENSE WG – Objectives and Vision

- Infrastructure which provides “end-to-end” network services in a fully automated manner
 - the network elements
 - the network stacks inside the attached end systems (DTNs)
- Leverages the open source software based on:
 - Network Service Interface (NSI): multidomain network provisioning
 - SENSE: end-system provisioning and realtime integration with network services
- Persistent Infrastructure, somewhere in between production and a testbed
 - Network Research, Experiments, Testing
 - Topologies and Services for Domain Science integration and research

AutoGOLE / SENSE Infrastructure - What does it enable?

- Develop and test prototypes which can include the following in one end-to-end workflow
 - production networks services and infrastructure
 - research/prototype networks services and infrastructure
 - production end site systems and data
 - research/prototype end site systems and data
- Traffic Engineer network paths to include high performance links which are not available via regular R&E BGP routing
- Allows application workflows and site systems to determine their capabilities and needed improvement areas
- Provides a mechanism to develop and test systems and network services to know what types of upgrades are needed for production networks and site systems
- provide the reasons and data to justify production system upgrades

Layer 3 over L2PTP, shortcut-routing between two site clusters

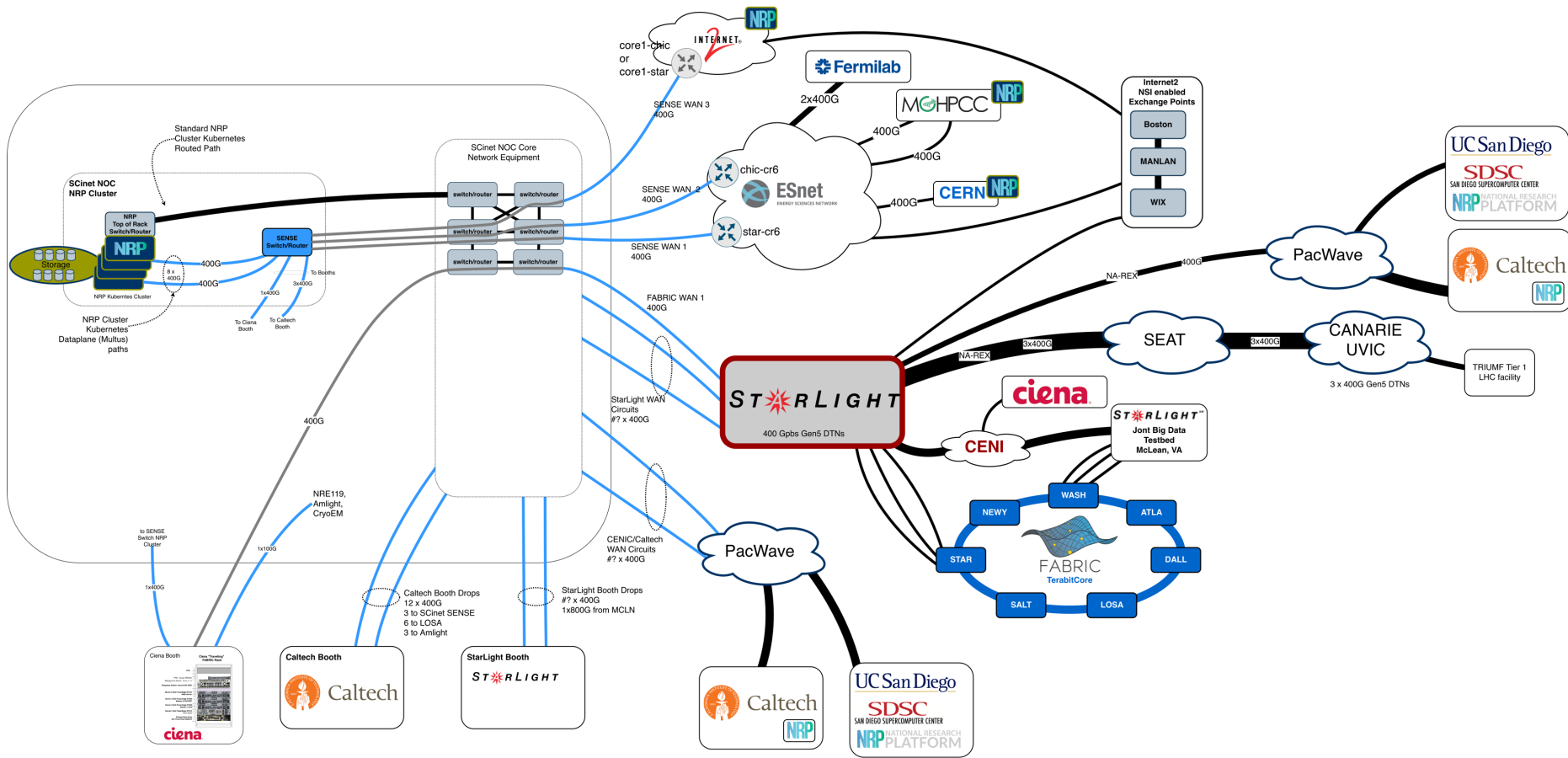


- ipv6 based shortcut routing, uses existing site IP addressing/routing
- SENSE provisions L2PTP VPN between Top of Rack Routers, with guaranteed bandwidth
- Private BGP used to advertise only service specific ipv6/64 subnets

SC26 Demonstrations using AutoGOLE/SENSE

- Multiple NREs using AutoGOLE/SENSE infrastructure
 - NREs names and abstracts to be listed on SC26 SCinet web page
- SENSE/AutoGOLE integration with the Rucio, FTS and XRootD data access and management systems, Global P4 Lab, PolKA, AmLight, FABRIC, NRP, among others.

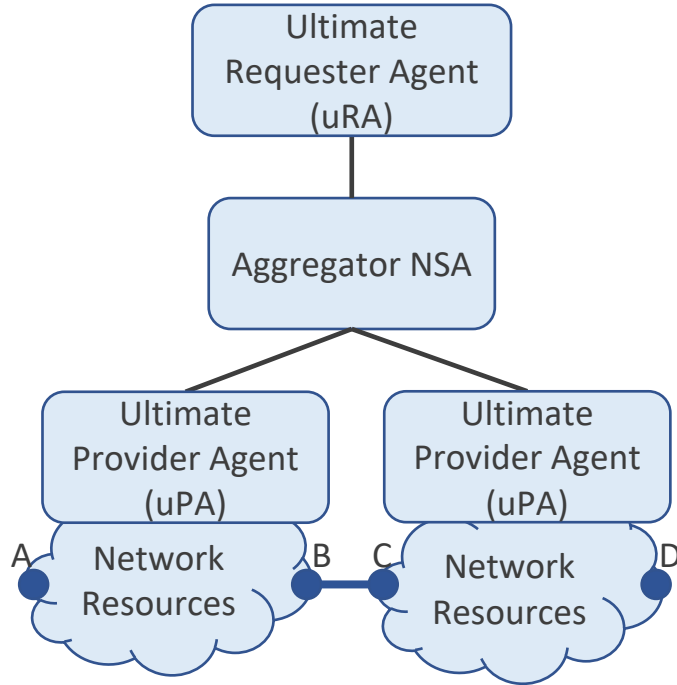
SC26 Demonstrations Topology



extra slides

OpenNSA

NSI based Provider (uPA)



Safnari

NSI Aggregator



NSI Safnari

Usage

Connections

Connection 6dfa8e66-cd18-4d57-bb3a-5b17c44c267f - CERN DTN - LA DTN with ERO - VLAN3988 - jhess

Start: 2019-12-03T21:53:44.796Z **End:** 2019-12-04T21:48:44.796Z
Bandwidth: 200 **Version:** 0
Global id: - **Requester:** urn:ogf:network:cal.bears:2019:nsa:requester
Source: urn:ogf:network:lsanca.pacificwave.net:2016:topology:dt0.lsanca?vlan=3988
Destination: urn:ogf:network:netherlight.net:2013:production7:cern-1?vlan=3988

Child connection ID	NSA	Path	Status	Error?
LS-fa09b582ce	lsanca.pacificwave.net:2016:nsa	From lsanca.pacificwave.net:2016:topology:dt0.lsanca?vlan=3988 To lsanca.pacificwave.net:2016:topology:losa2-pw-sw-1_e1_1?vlan=3988	Released, Inactive	none
SN-740979f3c0	snvaca.pacificwave.net:2016:nsa	From snvaca.pacificwave.net:2016:topology:snvl2-pw-sw-1_e7_2?vlan=3988 To snvaca.pacificwave.net:2016:topology:snvl2-pw-sw-1_e2_2?vlan=3988	Released, Inactive	none
ST-64a9e1b353	sttlwa.pacificwave.net:2016:nsa	From sttlwa.pacificwave.net:2016:topology:icas-sttlwa01-03_e1_1?vlan=3988 To sttlwa.pacificwave.net:2016:topology:icair-grp?vlan=3988	Released, Inactive	none
IC-b47da37bc7	icair.org:2013:nsa	From icair.org:2013:topology:pwave-grp?vlan=3988 To icair.org:2013:topology:nl-cern1?vlan=3988	Released, Inactive	none
19001CS08-ANA	canarie.ca:2017:nsa	From canarie.ca:2017:topology:CHCG1?vlan=3988 To canarie.ca:2017:topology:ANA1?vlan=3988	Released, Inactive	none
890861b8-c20f-4968-aa4e-a670ef507c6	netherlight.net:2013:nsa:safnari	From netherlight.net:2013:production7:ana-1?vlan=3988 To netherlight.net:2013:production7:cern-1?vlan=3988	Released, Inactive	none

NSI Software

- OpenNSA
 - <https://github.com/BandwidthOnDemand/opennsa>
 - <https://github.com/NORDUnet/opennsa>
 - <https://nordunet.github.io/opennsa/>
- SuPA (SURF ultimate Provider Agent)
 - <https://workfloworchestrator.org/SuPA/>
 - <https://github.com/workfloworchestrator/SuPA>
- Uses OFG defined Network Markup Language (NML)