

# **AutoGOLE / SENSE WG and Infrastructure**

## **Infrastructure and Services for Network and Domain Science Workflow Innovation**

**5th NRP Workshop  
March 21, 2024  
UCSD, La Jolla, CA**

**National Research Platform International Extensions, Including  
the Global Research Platform**

Tom Lehman  
Energy Sciences Network (ESnet)  
Lawrence Berkeley National Laboratory

# National Research Platform International Extensions, Including the Global Research Platform

12:20 pm – 1:20 pm PT, VROOM, Atkinson Hall

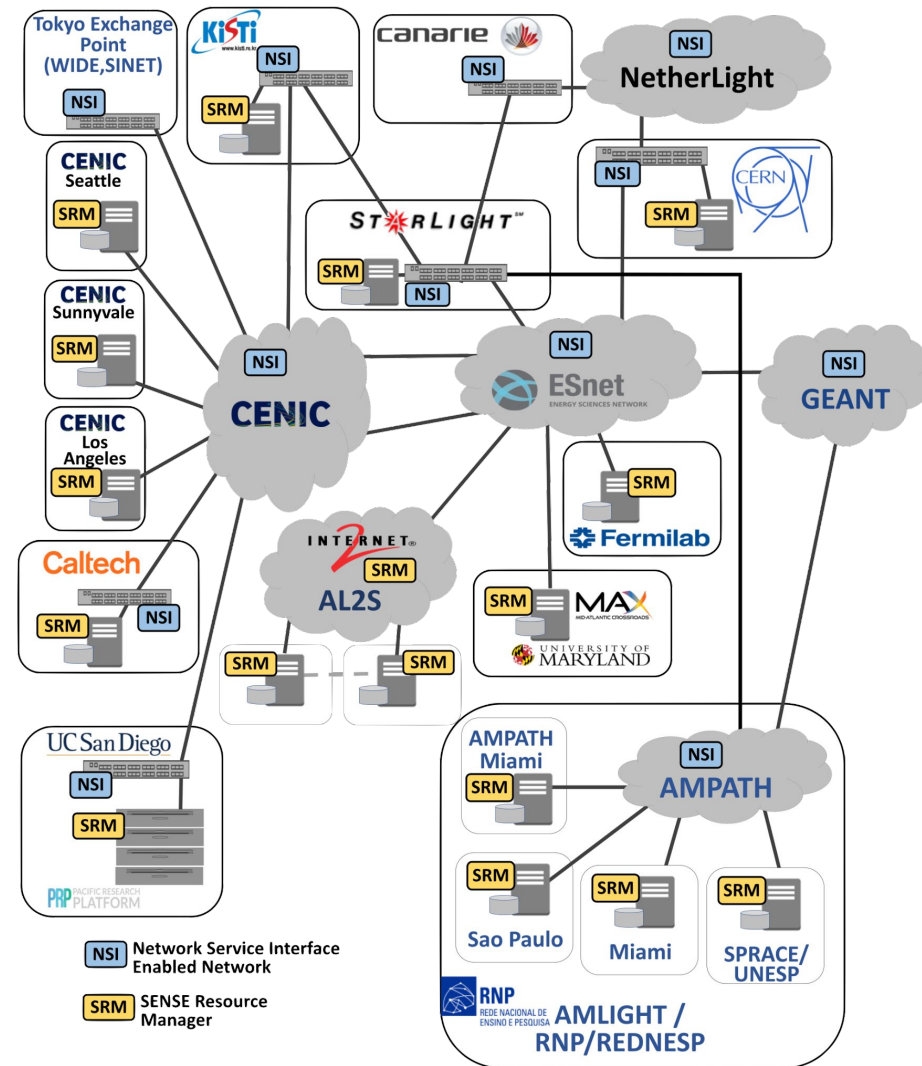
- Introduction to Session (Joe Mambretti) (12:20 – 12:30, 10 min)
- NSF International Research Connections Program (Kevin Thompson) (12:30-12:40, 10 min)
- AutoGOLE/SENSE (Tom Lehman) (12:40-12:50, 10 min)
- Asia Pacific Research Platform (Jeonghoon Moon) (12:50-1:00, 10 min)
- Ampath/AmLight (Julio Ibarra) (1:00-1:10, 10 min)
- CENI International Testbed (Gauravdeep Shami) (1:10-1:20) (10 min)
- GNA-DiS Overview (Harvey Newman) (1:15-1:25, 10 min)

# AutoGOLE / SENSE Working Group

- Worldwide collaboration of open exchange points and R&E networks interconnected to deliver network services end-to-end in a fully automated way. NSI for network connections, SENSE for integration of End Systems and Domain Science Workflow facing APIs.
- Key Work areas:
  - **Control Plan Monitoring**: Prometheus/Grafana based
  - **Data Plane Verification and Troubleshooting Service**: Initial Deployment Underway
  - **AutoGOLE related software**: Ongoing enhancements to facilitate deployment and maintenance (Kubernetes, Docker based systems)
  - **Experiment, Research, Use Case support**: Support for multiple activities including NOTED, Gradient Graph, P4 Topologies, Named Data Networking (NDN), Data Transfer Systems integration and testing.
- Key Objective:
  - The AutoGOLE Infrastructure should be persistent and reliable enough to allow most of the time to be spent on experiments and research.
- WG information - <https://www.gna-g.net/join-working-group/autogole-sense/>

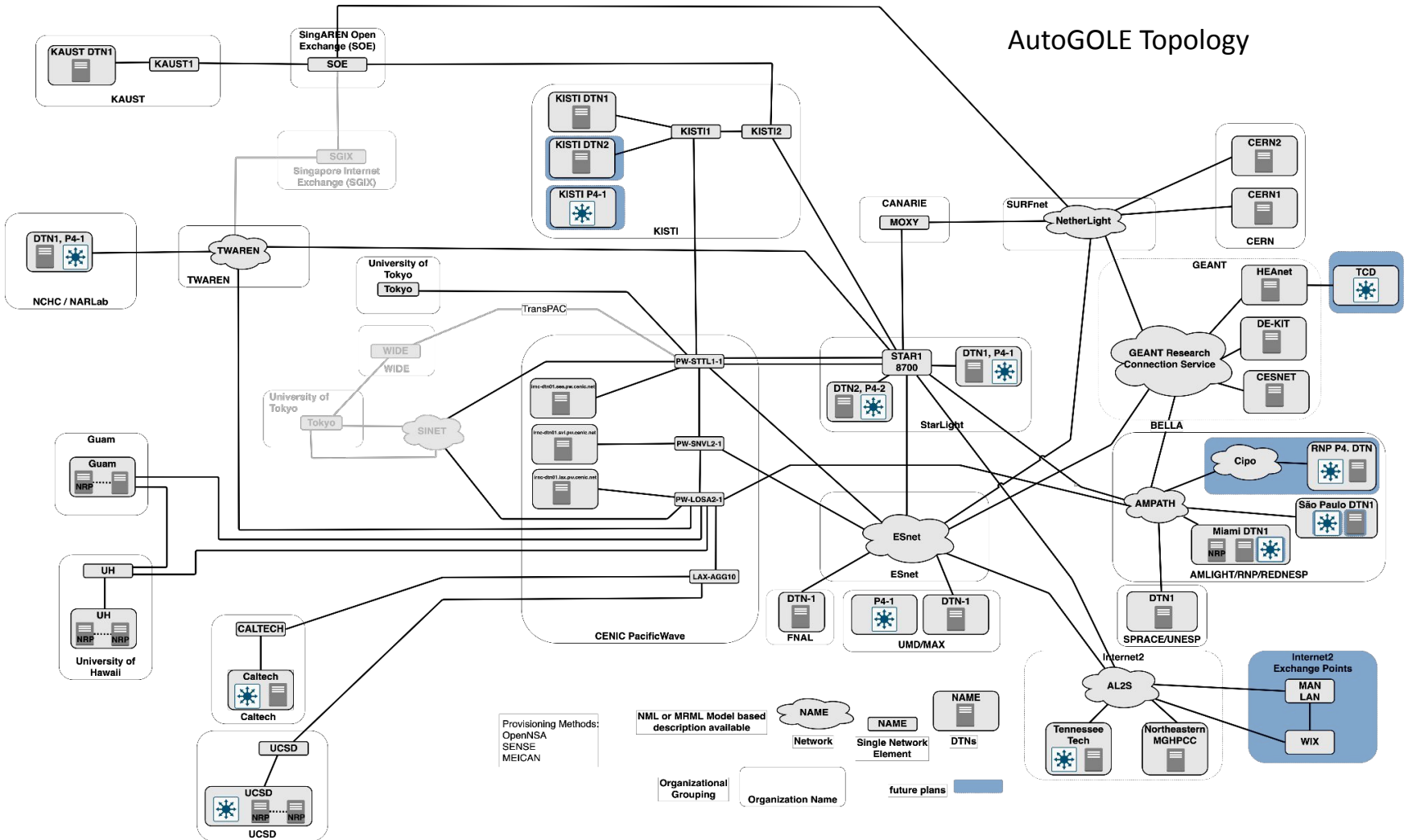
# SENSE/AutoGole

- AutoGOLE, NSI, and SENSE working together provide the mechanisms for complete end-to-end services which includes the network and the attached End Systems (DTNs).
- Possible Provisioning Objectives: Layer 2 isolation, Guaranteed QoS, Managing Flows Path/Link usage





# AutoGOLE Topology



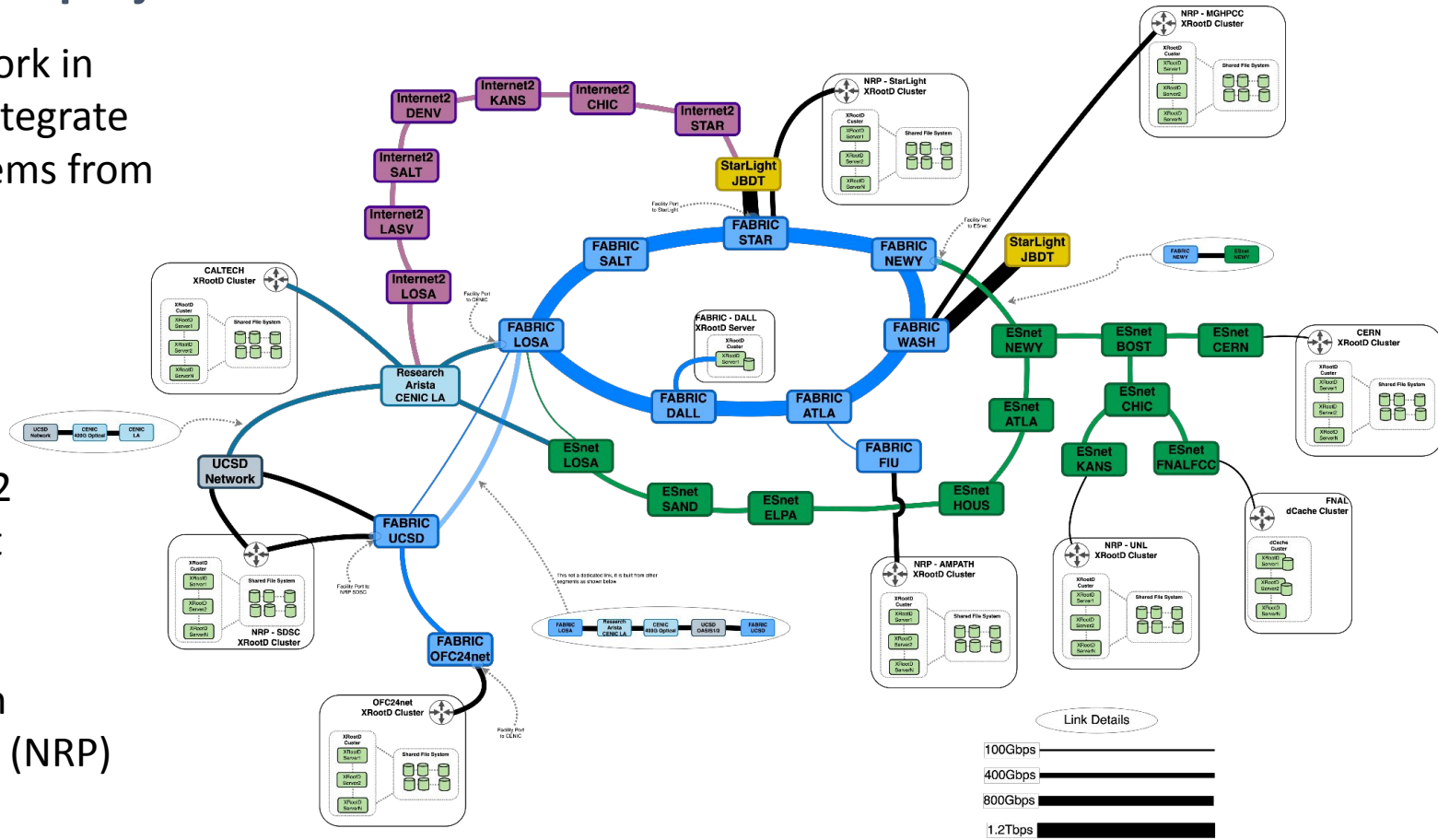
# SENSE/AutoGole

- The AutoGOLE infrastructure has a large global reach
- It has evolved to include a variety of network services from many different network providers/owners
- A key focus now is on integrating the edge resources such as:
  - National Research Platform (NRP) site
    - many distributed NRP Kubernetes based deployments
  - Domain Science Workflow Prototype/Development Systems
  - Others

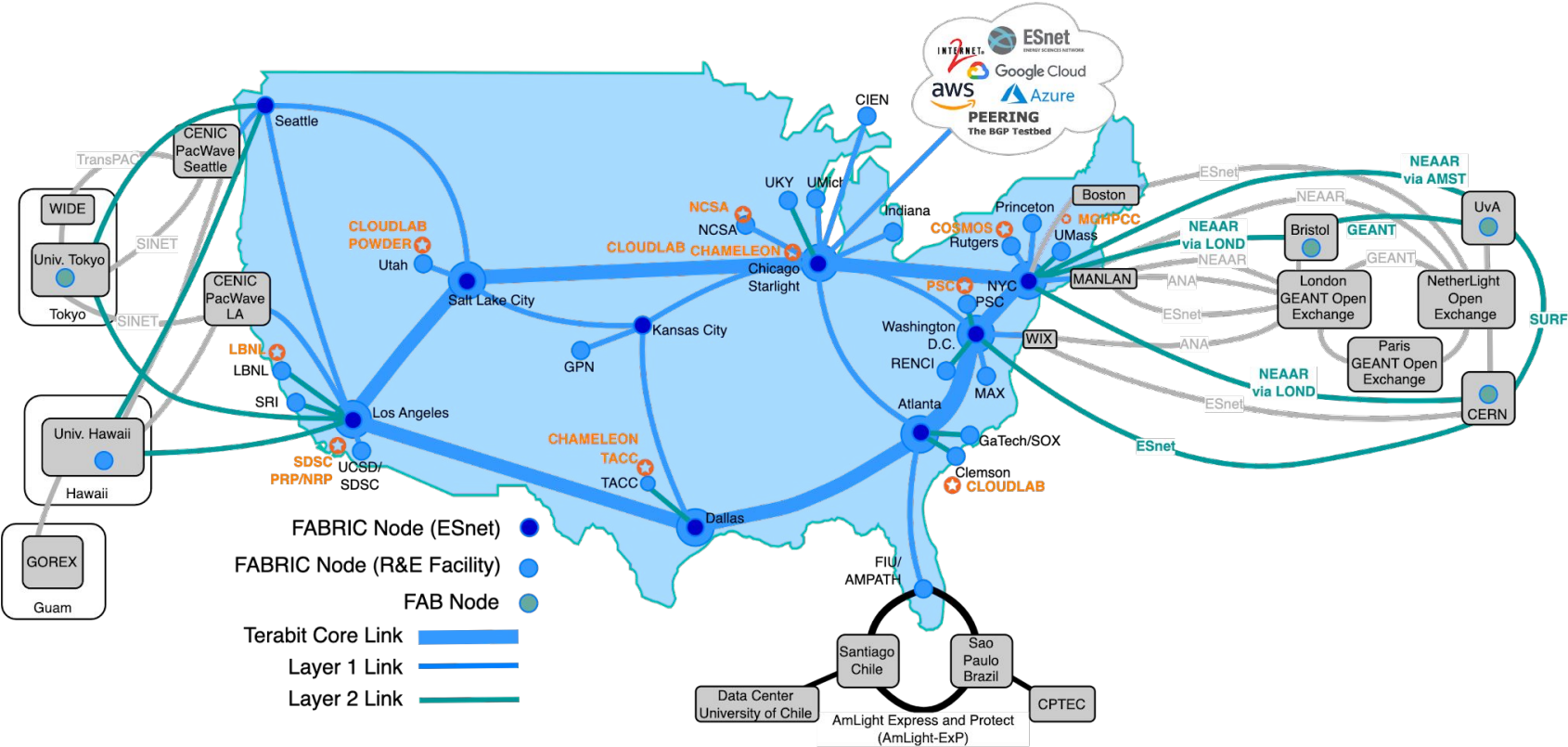
# Network Services and Edge Site Integration across multiple providers and projects

This shows work in progress to integrate services/systems from the following providers:

- CENIC
- UCSD
- ESnet
- Internet2
- StarLight
- FABRIC
- National Research Platform (NRP)

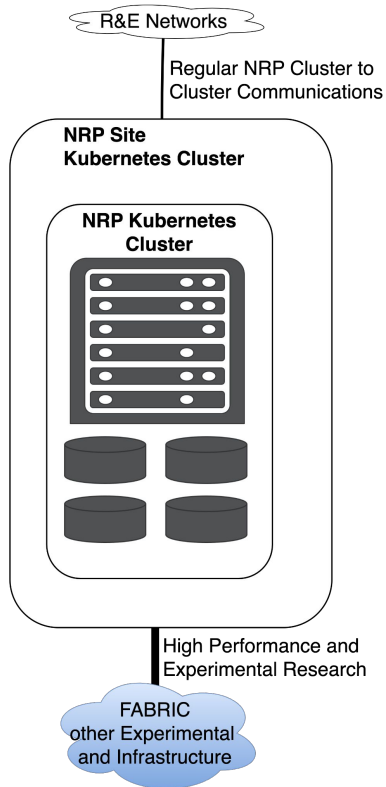


# FABRIC Topology



# NRP Connection to Advanced Network

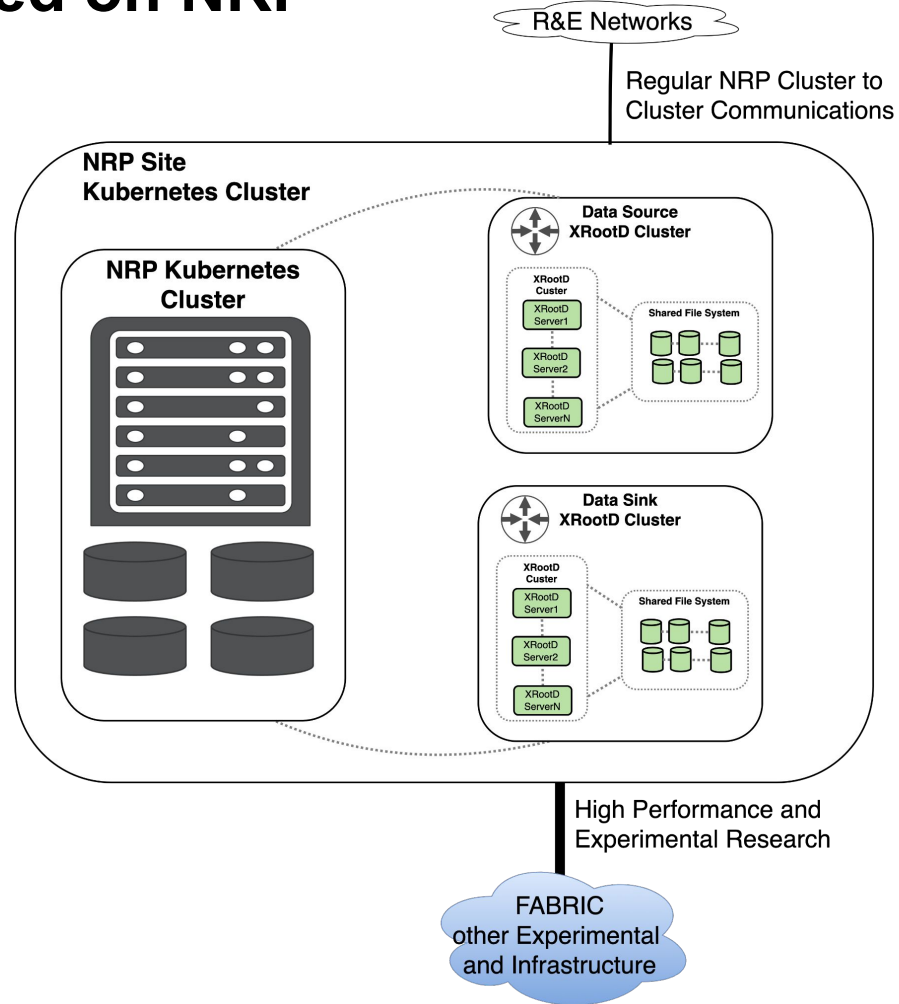
## Services



- Connecting an NRP Cluster to any experimental infrastructure simply requires connecting one or more new dataplane connections to the experimental infrastructure.
- This can be easily accomplished using the Multus CNI container network interface (CNI) plugin for Kubernetes, which enables attaching multiple network interfaces to pods
- This new dataplane interface can then be used to attached to a wide variety of advanced network services.
- The standard NRP Kubernetes cluster connection to the R&E internet is use as normally for cluster to cluster traffic.

# XRootD Clusters Deployed on NRP

- Use NRP to build XRootD Source and Sink Cluster in same location
- Connect that Kubernetes pod to experiment research network infrastructure
- adjust the network services and topology as needed by research/test objectives

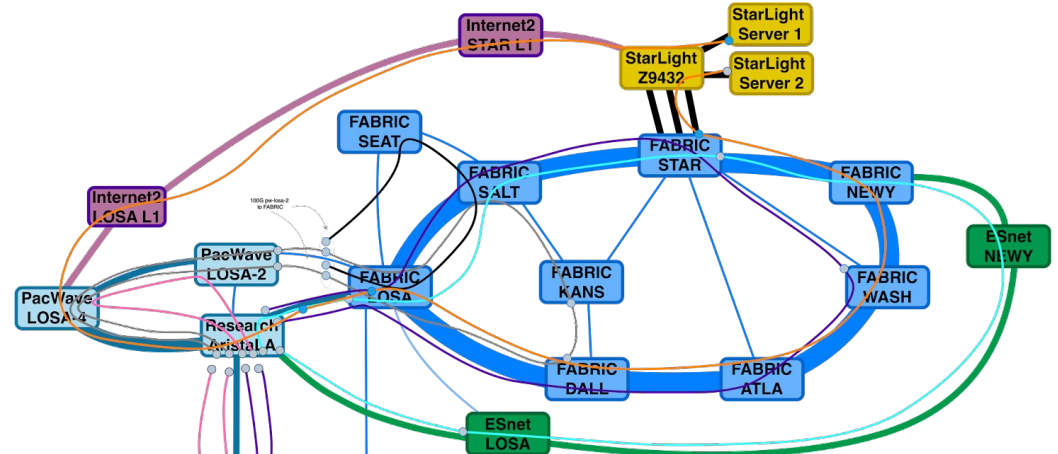


# NRP Integration with Advanced Network Services

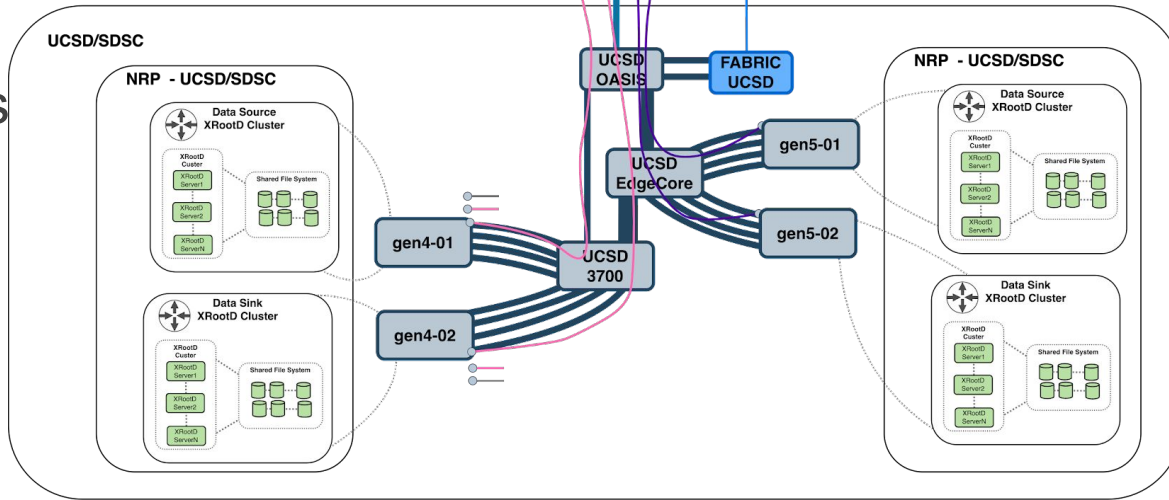
Multiple Network/Resource

Integration

- FABRIC, NRP, ESnet, CENIC, StarLight, Internet2



XRootD source and sink clusters in same location - variable RTTs



- 131 ms RTT
  - 122 ms RTT
  - 108 ms RTT
  - 80 ms RTT
  - 58ms RTT
  - 6 ms RTT
- 100Gbps
- 400Gbps
- 800Gbps
- 1.2Tbps

**Thanks!**



# Extra Slides

# AutoGOLE / SENSE WG - Software

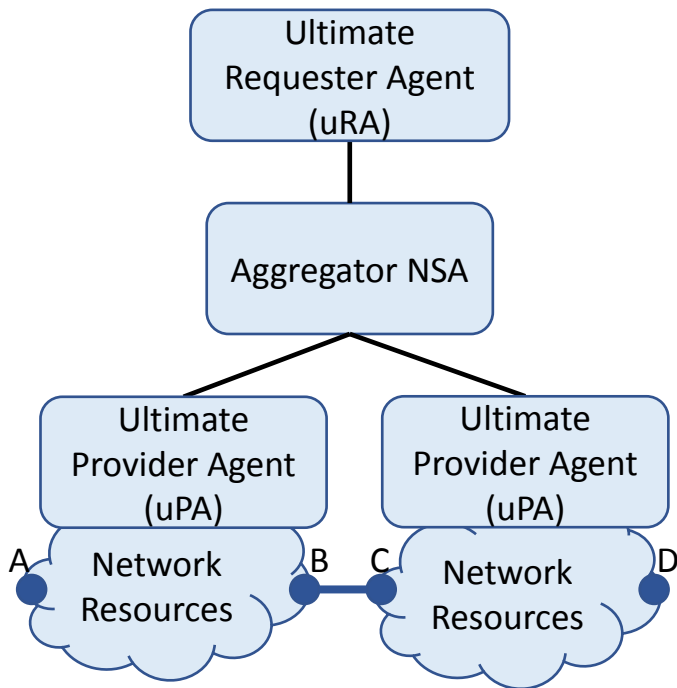
- GNA-G AutoGOLE/SENSE WG homepage
  - <https://www.gna-g.net/join-working-group/autogole-sense>
- Co-Chairs:
  - Tom Lehman (ESnet)
  - Marcos Felipe Schwarz (RNP)
  - Hans Trompert (SURF)
  - Buseung Cho (KISTI)
- AutoGOLE/SENSE Working Group mailing list
  - [autogole@lists.gna-g.net](mailto:autogole@lists.gna-g.net)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

# 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

# OpenNSA

NSI based Provider (uPA)



# Safnari

NSI Aggregator

The screenshot shows the NSI Safnari web interface. The top navigation bar includes the ESnet logo and the title "NSI Safnari". Below the navigation bar, there are tabs for "Usage" and "Connections". The "Connections" tab is active, displaying a table of connection details for a specific connection: "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:dtn0.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 Isanca.pacificwave.net:2016:topology:dtn0.lsanca?vlan=3988 To Isanca.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:snv12-pw-sw-1_e7_2?vlan=3988 To snvaca.pacificwave.net:2016:topology:snv12-pw-sw-1_e2_2?vlan=3988	Released, Inactive	none
ST-64a9e1b353	stt1wa.pacificwave.net:2016:nsa	From stt1wa.pacificwave.net:2016:topology:icas-stt1wa01-03_e1_1?vlan=3988 To stt1wa.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

# MEICAN – NSI Visualization and Provisioning

Step 1: Path

Source

- Isanca.pacificwave.net  
Network: `Isanca.pacificwave.net:2016`  
Port: `dtn0.Isanca`  
VLAN: `3987`
- snvaca.pacificwave.net  
Network: `snvaca.pacificwave.net:2016`  
Port: `snvl2-pw-sw-1_e2_2`  
VLAN: `3987`
- sttlwa.pacificwave.net  
Network: `sttlwa.pacificwave.net:2016`  
Port: `icair-grp`  
VLAN: `3987`
- icair.org  
Network: `icair.org:2013`  
Port: `nl-cern1`  
VLAN: `3987`
- canarie.ca  
Network: `canarie.ca:2017`  
Port: `ANA1`  
VLAN: `3987`
- netherlight.net  
Network: `production7`  
Port: `Asd001A_8700 07-8/2 CERN`  
VLAN: `3987`

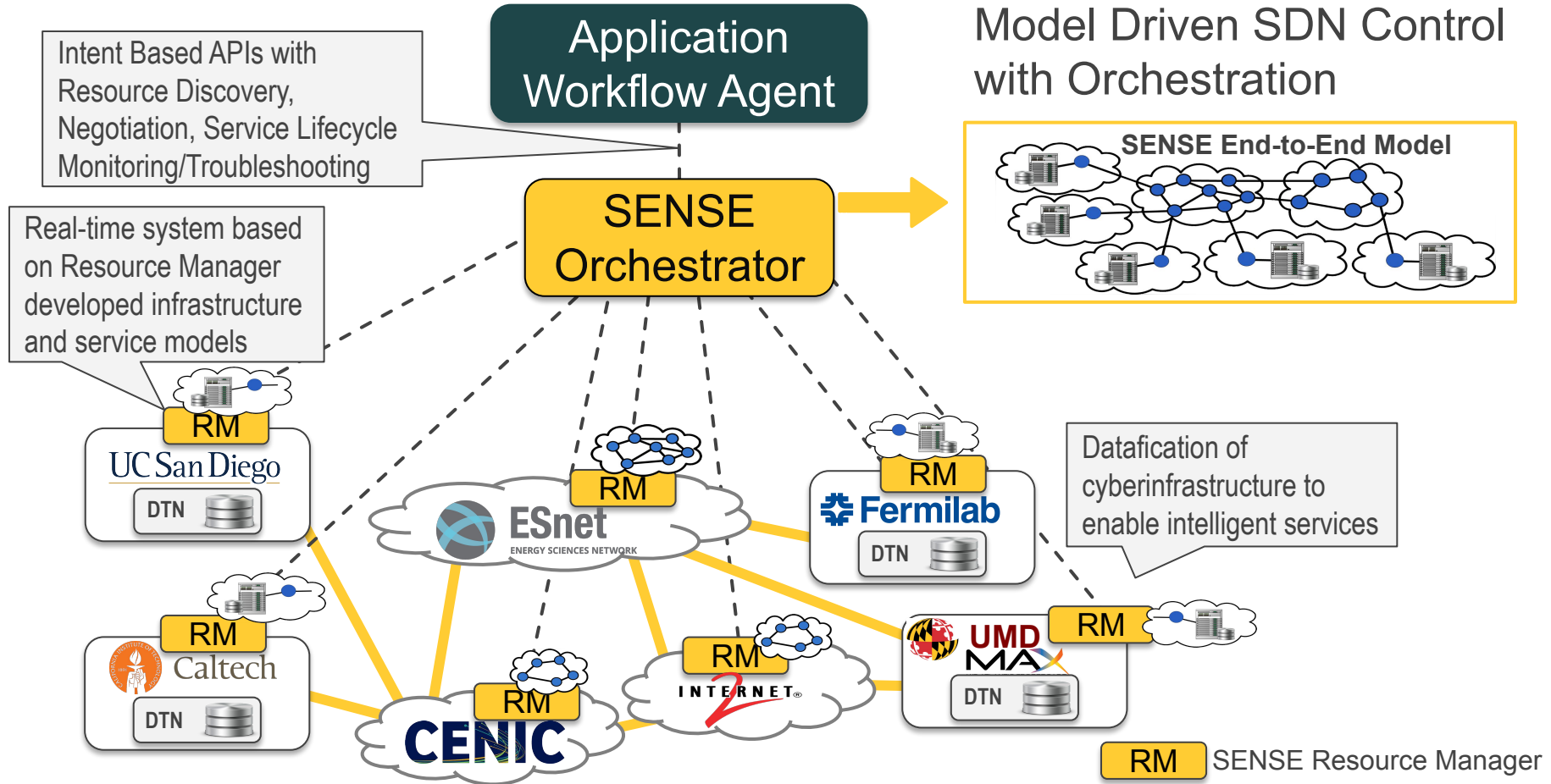
Destination



# Integration of End-Site Resources and Science Workflows

- Automated provisioning and traffic engineering of paths across wide area networks and exchange points is important
- Added value for science applications includes integration of these services with:
  - End Site network, compute, and storage infrastructure
  - Science workflow agents and middleware

# SENSE Architecture



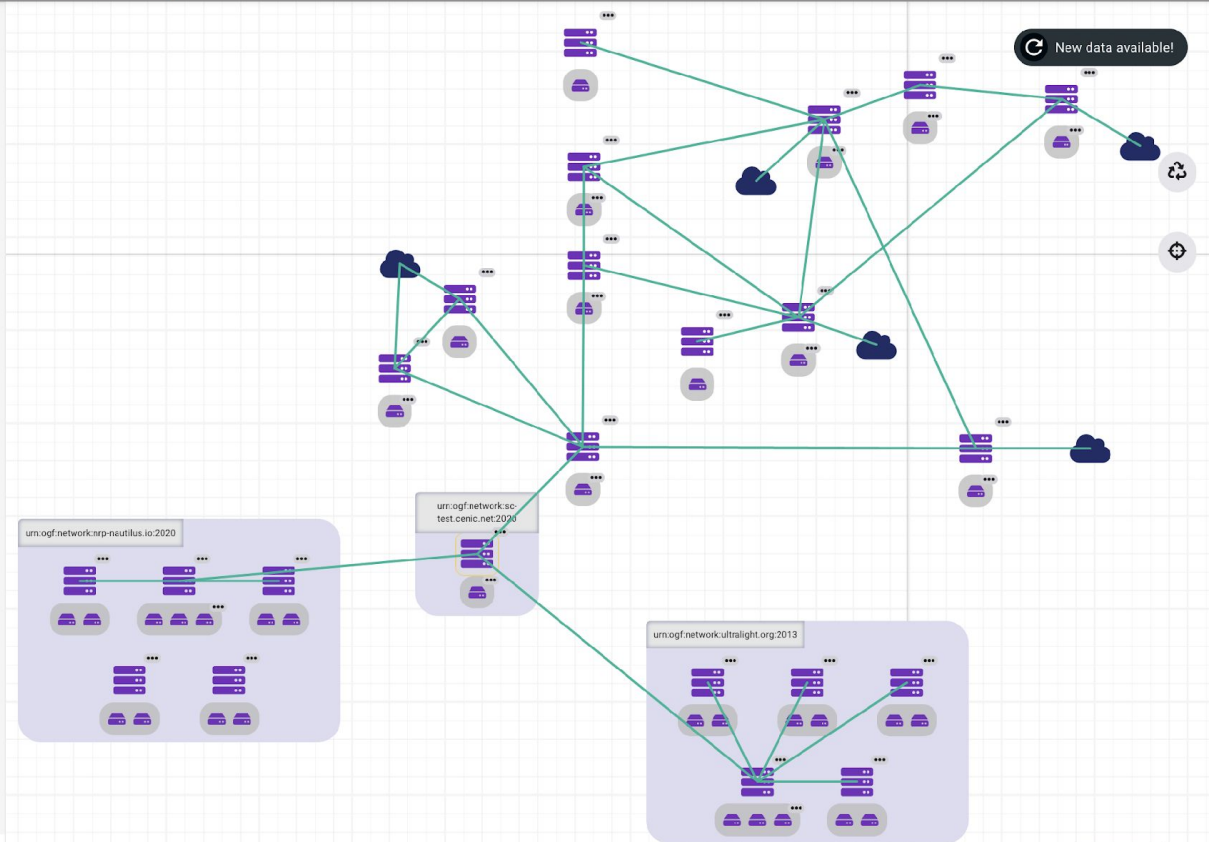
# SENSE - Model based Resource Descriptions

urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0

PREVIOUS

NEXT

- hasBidirectionalPort* (6)
- urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Ethernet10-1
  - urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Ethernet9-1
  - urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Port-Channel501
  - urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Port-Channel502
  - urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Ethernet1-1





# SENSE Orchestrator View

- Based on real time collection of models from Resource Managers

The screenshot displays the SENSE Orchestrator View interface. At the top, there is a navigation bar with tabs for CATALOG, DRIVERS, VISUALIZATION, and ADMIN. A 'System Refresh On' button with a green checkmark is visible, along with 'ACCOUNT' and 'LOGOUT' links. Below the navigation bar, the main content area is split into two panels. The left panel shows a search bar with the text 'urn:ogf.network.es.net:2013:' and two buttons, 'PREVIOUS' and 'NEXT'. Below the search bar, there is a list of URNs under the heading 'existsDuring'. The list includes:

- urn:ogf.network.es.net:2013::eqx-ash-cr5:3\_1\_1:+
- urn:ogf.network.es.net:2013::wash-cr5:10\_1\_2:+
- urn:ogf.network.es.net:2013::ameslab-rt1:xe-0\_1\_7:+
- urn:ogf.network.es.net:2013::chic-cr55:1\_1\_c11:+
- urn:ogf.network.es.net:2013::star-cr55:1\_1\_c21:+
- urn:ogf.network.es.net:2013::denv-cr5:4\_1\_1:+
- urn:ogf.network.es.net:2013::aofa-cr5:3\_1\_1:+
- urn:ogf.network.es.net:2013::ameslab-rt2:xe-0\_1\_7:+
- urn:ogf.network.es.net:2013::doe-gtn-rt2:xe-2\_0\_2:+

The right panel displays a network diagram with various nodes and connections. The nodes are represented by purple icons with '\*\*\*' above them, and some are connected to cloud icons. The diagram is overlaid on a grid background. In the bottom right corner, there is a 'Clipboard' button.

# AutoGOLE/SENSE - Integrating and Orchestrating services across multiple Infrastructures

CATALOG

VISUALIZATION

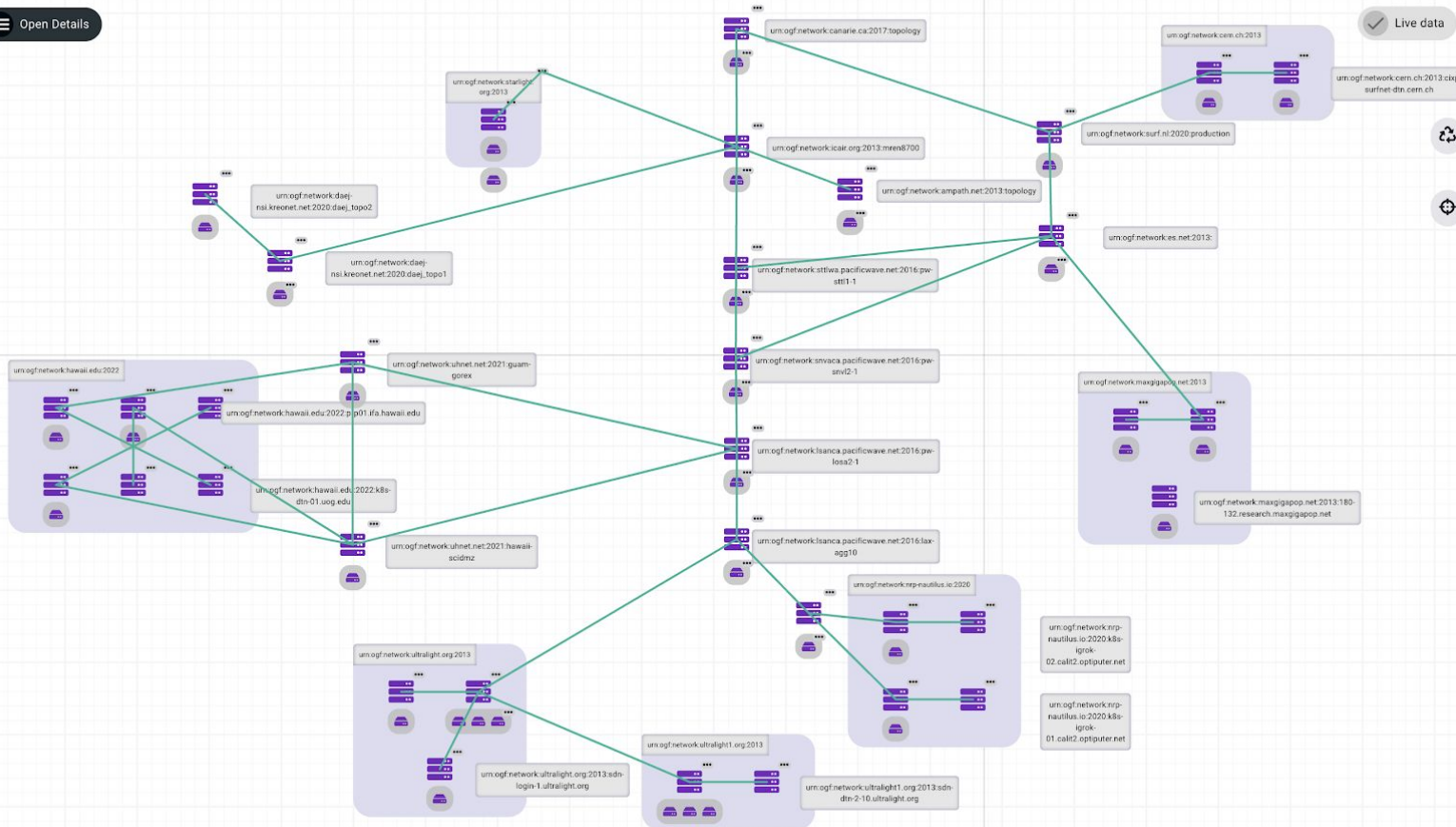
System Refresh On



ACCOUNT

LOGOUT

Open Details



Clipboard



# SENSE Orchestrator - User Template

- Read-only with VLAN Range, Run Independently, 3 instance allocation

### Service Template Example

Allocation and Editable VLAN Range

Licenses

tlehman - 3 slot(s) given.  
allocation

+

MAKE EDITABLE

Selected: DATA > CONNECTIONS > 0 > TERMINALS > 1 >

VLAN\_TAG

Validator (optional)  
3987-3989

Use a list of comma-separated values, a numeric range, or a raw regex without slashes (ex. \*uri:\*)

```
object ▶ data ▶ connections ▶ 0 ▶ terminals ▶ 1 ▶ vlan_tag
▼ DNC root schema {2}
  ▼ data {2}
    type : Multi-Path P2P VLAN
    ▼ connections [1]
      ▼ 0 {4}
        ▼ bandwidth {2}
          qos_class : guaranteedCapped
          capacity : 1000
        ▼ suggest_ip_range [1]
          ▼ 0 {2}
            start : 10.251.86.10/24
            end : 10.251.86.20/24
          name : Connection 1
        ▼ terminals [2]
          ▼ 0 {3}
            vlan_tag : any
            assign_ip : true
            uri : urn:ogf:network:calit2.optiputer.net:2020:k8s-gen4-01.calit2.optiputer.net
          ▼ 1 {3}
            vlan_tag : 3987
            assign_ip : true
            uri : urn:ogf:network:cern.ch:2013:cixp-surfnet-dtn.cern.ch
        service : dnc
```

JSON View

Alias

# SENSE - Northbound API



Sign Up

Log In

SENSE-O-Intent-API 2.0.3



Export



Info



Tags



Servers



Search



workflow\_combined ^

GET /profile

GET /profile/{uuid}

GET /instance

POST /instance/{siUUID}

DELETE /instance/{siUUID}

GET /instance/{siUUID}/status

PUT /instance/{siUUID}/{action}

GET /intent/instance/{siUUID}

workflow\_phased ^

GET /profile

GET /profile/{uuid}

GET /instance

POST /instance/{siUUID}

DELETE /instance/{siUUID}

GET /instance/{siUUID}/status

Aa



SAVE

Read Only

```
1 openapi: 3.0.2
2 info:
3   version: 2.0.3
4   title: SENSE-O Northbound Intent API
5   description: StackV SENSE-O Northbound REST API Documentation
6
7 servers:
8   - url: "https://dev1.virnao.com:8443/StackV-web/restapi"
9
10 security:
11   - oAuth2Keycloak: []
12
13 tags:
14   - name: workflow_combined
15     description: |-
16       methods for single-phase workflows (minimal provisioning
17       steps)
18     `instance/{siUUID}/{action}` uses `provision`, `cancel`
19     and `repvovision` calls.
20
21   - name: workflow_phased
22     description: |-
23       methods for two-phase commit workflows (useful for co
24       -scheduling)
25     `instance/{siUUID}/{action}` uses `propagate`, `release`,
26     `reinststate` and `commit` calls.
27
28   - name: service
29     description: service workflow methods
30   - name: instance
31     description: Service instance methods
32   - name: profile
```

Last Saved: 8:18:31 pm - Feb 28, 2022

VALID

## SENSE-O Northbound Intent API

2.0.3 OAS3

StackV SENSE-O Northbound REST API Documentation

Servers

https://dev1.virnao.com:8443/StackV-we...

Authorize

workflow\_combined

methods for single-phase workflows (minimal provisioning steps) `/instance/{siUUID}/{action}` uses `provision`, `cancel` and `repvovision` calls.

GET

/profile Get skimmed profile data

GET

/profile/{uuid} Get single profile

GET

/instance Generate new service instance UUID

# SENSE/AutoGole Service Example

CATALOG    DETAILS    DRIVERS    VISUALIZATION    ADMIN    System Refresh On    ACCOUNT    LOGOUT

DETAILS

VISUALIZATION

ADDONS

LOGGING

**AMPATH-Caltech-P4.T22**  
Instance Alias

d00cc2c6-a8a2-4cf1-b22b-bb021c3daca1  
Reference UUID

marcos.schwarz@rnp.br  
Owner

2022-11-05 00:41:16.0  
Creation Time

**REINSTATE**  
Instance State

**READY**  
Instance Substatus

Service has been successfully verified.

CANCEL    ARCHIVE/DELETE    MODIFY

Clipboard

# SENSE/AutoGole Service Intent

CATALOG

DETAILS

DRIVERS

VISUALIZATION

ADMIN

System Refresh On



ACCOUNT

LOGOUT

## Intent Viewer

Intent History

[CURRENT] [PROVISIONED] Created Nov 12, 2022, 2:34:42 AM | Intent UUID c87e030c-6c0d-47da-a986-212757d9f011

## SERVICE INTENT

```
{
  "service_instance_uuid": "d00cc2c6-a8a2-4cf1-b22b-bb021c3daca1",
  "data": {
    "type": "Multi-Path P2P VLAN",
    "connections": [
      {
        "bandwidth": {
          "qos_class": "bestEffort"
        },
        "name": "Connection 1",
        "terminals": [
          {
            "vlan_tag": "any",
            "uri": "urn:ogf:network:ampath.net:2013:topology:rare-mia0001"
          },
          {
            "vlan_tag": "any",
            "uri": "urn:ogf:network:ultralight.org:2013:dellos9_s0:hundredGigE_1-3"
          }
        ]
      }
    ]
  }
}
```

Clipboard



# SENSE/AutoGole Service Visualization

- DETAILS
- VISUALIZATION
- ADDONS
- LOGGING

## ADDITION

urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0

PREVIOUS

NEXT

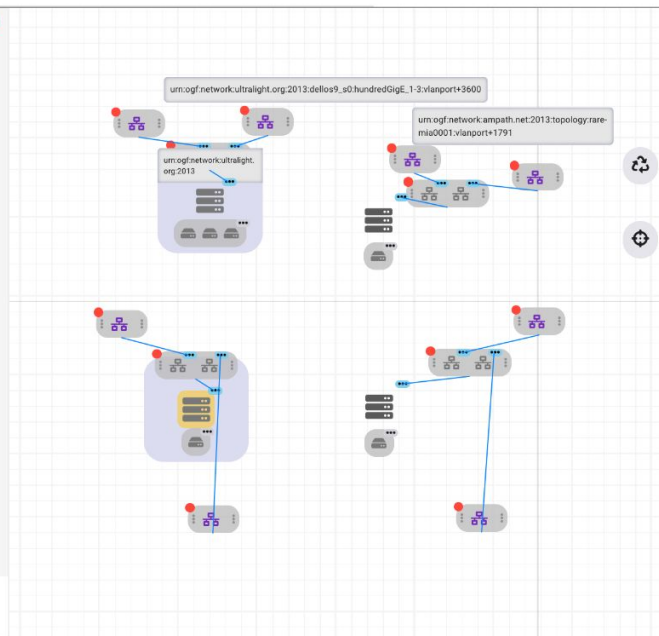
*hasBidirectionalPort (2)*

- urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Port-Channel501
- urn:ogf:network:sc-test.cenic.net:2020:aristaeos\_s0:Ethernet11-1

*hasService*

urn:ogf:network:sc-

- Browser
- Verification
- Search





# SC23 SENSE Services Provisioned ~ Nov 14, 18:00 UTC

## Service Instances

ALIAS	REFERENCE UUID	STATE	CREATED	OWNER
[SC23-PROD] NOTED-FNAL-V2023 2	ad118e39-f203-496a-83f2-c961a380608b	CREATE - READY	2023/11/13 16:24:10	edoardo.martelli@cern.ch
[SC23-PROD] NRE013-Caltech-WC14-V1779	7f27d0b5-6ae2-4a3b-b25d-8a814375126	CREATE - READY	2023/11/13 00:29:09	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-V3611-Starlight-V1785	88f4f37e-f993-4eb4-be03-9d2fc6393335	CREATE - READY	2023/11/12 23:38:25	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC13-V3605	e53d4954-2c62-40d4-b288-0299e019b19b	CREATE - READY	2023/11/12 23:13:37	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-NA-REX-V3847	cf8d370b-f3a3-4f75-b3cf-65133ddd445b	CREATE - READY	2023/11/12 00:24:51	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC14-V1782	a091ce99-bd9b-4431-9f21-258c689e1353	CREATE - READY	2023/11/12 00:23:10	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC13-V3607	3496a40a-24de-4501-8766-dd099d5b84c4	CREATE - READY	2023/11/12 00:08:41	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC12-V3617	40a2dab0-79d9-4d57-ae88-c2a8294daae	CREATE - READY	2023/11/12 00:02:10	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC14-V1781	60fa1402-0d1d-44c3-92c6-62182687a378	CREATE - READY	2023/11/10 17:47:05	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC13-V3606 2	a0456e72-f03f-4a45-b47f-e0a049537229	CREATE - READY	2023/11/10 17:23:40	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-WC12-V3616	28b3f4bf-6a42-4bc0-b5b4-1ea73d3b8b3c	CREATE - READY	2023/11/10 17:17:44	marcos.schwarz@mp.br
[SC23-PROD] NRE013-Caltech-NA-REX-V3846 2	c8e83762-6815-40bb-8b3d-0c44c88f0595	CREATE - READY	2023/11/10 01:06:03	marcos.schwarz@mp.br
▲ Caltech-UCSD-P4.T3	49fec4dc-747c-4e37-b343-9e81c2be9985	CREATE - READY	2023/11/06 18:05:55	marcos.schwarz@mp.br
▲ [SC23-PROD] NOTED-V2023-ESnet	b6d22f0e-5ab7-437b-b488-4cbcedce7f88	CREATE - READY	2023/11/03 01:28:37	admin
▲ [SC23-PROD] NOTED-V2024-ESnet	4ecd54b6-771c-4272-af37-7e3566921c02	CREATE - READY	2023/11/02 20:15:21	admin
▲ [SC23-PROD] CMS-FNAL-LOSA-3614	e2170b1a-b058-4edc-9848-b4d1da813ee2	CREATE - READY	2023/10/31 18:57:26	admin
▲ [SC23-PROD] CMS-FNAL-LOSA-3612	ee516b1a-3400-444e-abdc-86c4c7de81a1	CREATE - READY	2023/10/31 18:56:44	admin
▲ [SC23-PROD] CMS-FNAL-LOSA-3611	69eebb0c-0a13-4a7c-aa67-b16a5a3da542	CREATE - READY	2023/10/31 18:56:27	admin
▲ [SC23-PROD] CMS-FNAL-LOSA-3610	c355a53e-4e73-465e-ba81-03b1cee7cb5f	CREATE - READY	2023/10/31 18:56:09	admin
Caltech-Starlight-P4.T2	65ae5d81-663f-45d1-94cc-660fc2e42b4	CREATE - READY	2023/10/31 14:53:04	marcos.schwarz@mp.br
▲ AMPATH-SouthernLight-P4.T2	79a86802-d34c-425e-8491-4d6b30046444	CREATE - READY	2023/09/21 16:50:00	marcos.schwarz@mp.br
▲ AMPATH-SouthernLight-P4.T1	30693344-ff00-4e7e-ad6b-43c402f82260	CREATE - READY	2023/09/01 17:57:31	marcos.schwarz@mp.br
▲ AMPATH-Starlight-P4.T1	c1f941c0-df04-4069-823e-9b0466c1d859	CREATE - READY	2023/09/01 17:18:42	marcos.schwarz@mp.br



# SC23 SENSE Services Provisioned~ Nov 14, 18:00 UTC

CATALOG    DETAILS    DRIVERS    VISUALIZATION    ADMIN    System Refresh On ✓    ACCOUNT    LOGOUT

## Service Instances

Show Archived CURRENTLY 2023/11/14 18:12:32 UTC

ALIAS	REFERENCE UUID	STATE	CREATED	OWNER
...(6)	...(6)	REINSTATE - READY	...(6)	...(3)
[SC23-PROD] Packet-Marking-V2026-ESnet-2	7a1dc44c-131a-4820-baa9-009ebdb6937c	REINSTATE - READY	2023/11/09 04:38:04	admin
[SC23-PROD] NOTED-V3694-ESnet-GEANT	527e080f-8089-4fe2-b581-25b954d4ddc1	REINSTATE - READY	2023/11/08 21:18:54	admin
[SC23-PROD] FABRIC-V1006-ESnet-1	46518b01-7fae-434c-b9f9-496a013b4c5c	REINSTATE - READY	2023/11/08 14:14:18	tlehman@es.net
[SC23-PROD] NOTED-V3694 2	3beea24d-4888-40c6-9742-48296409801d	REINSTATE - READY	2023/11/06 16:48:43	bruno.hoeft@kit.edu
[SC23-PROD] CMS-FNAL-LOSA-3613	5a2510b2-95b5-4246-8220-5200f4ef3ce9	REINSTATE - READY	2023/10/31 19:01:38	admin
[SC23-PROD] CMS-FNAL-LOSA-3615	0969e61d-dffa-4cdd-a4f8-9f887ff55dba	REINSTATE - READY	2023/10/31 18:57:56	admin

PAGE 1 OF 1 (DISPLAYING ROWS 1 TO 6)    <    <    >    >

# Example Service Visualization

- DETAILS
- VISUALIZATION
- ADDONS
- LOGGING

ADDITION

urn:ogf:network:ultralight.org:2013:dell0s9\_s0:hundredGigE\_1-3-vlanp

PREVIOUS

NEXT

belongsTo

urn:ogf:network:ultralight.org:2013:dell0s9\_s0:service+vsw.conn+65ae5d81-45d1-94cc-660fc2ce42b4.vt+12-policy-Connection\_1.vlan+1792

hasLabel

urn:ogf:network:ultralight.org:2013:dell0s9\_s0:hundredGigE\_1-3.vlanport+17

tag

urn:ogf:network:service+65ae5d81-663f-45d1-94cc-660fc2ce42b4.vt+12-policy-Connection\_1

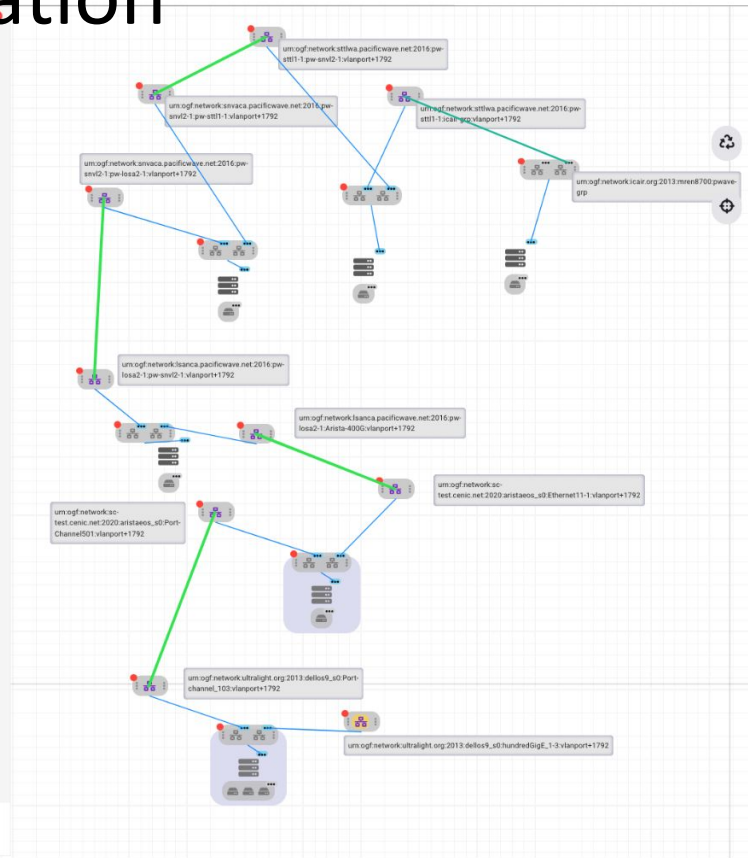
type

BidirectionalPort

Browser

Verification

Search



# Example Service Detailed View

CATALOG

DETAILS

DRIVERS

VISUALIZATION

ADMIN

System Refresh On

ACCOUNT

LOGOUT

DETAILS

VISUALIZATION

ADDONS

LOGGING

Caltech-Starlight-P4.T2

Alias

65ae5d81-663f-45d1-94cc-660fc2ce42b4

Reference UUID

marcos.schwarz@rnp.br

Owner

10/31/2023, 8:53:28 AM

Creation Time

CREATE

Orchestration Phase

READY

Orchestration Status

SCHEDULE

10/31/2023, 8:53:43 AM

Scheduled Start

10/31/2024, 8:53:28 AM

Scheduled End

STABLE

Configuration Status

Service has been successfully verified.

CANCEL

ARCHIVE/DELETE

MODIFY

VERIFY

# Example Service Verification View

DETAILS

DETAILS

VISUALIZATION

ADDONS

ADDONS

LOGGING

LOGGING

Verified

urn:ogf:network:icair.org:2013:mren8700:p4test:vlanport+1792:icair-grp

urn:ogf:network:snvaca.pacificwave.net:2016:pw-snv12-1:pw-losa2-1:vlanport+1792

urn:ogf:network:stlwa.pacificwave.net:2016:pw-stt11-1:pw-snv12-1:vlanport+1792:label+1792

urn:ogf:network:ultraflight.org:2013:dellos9\_s0.service+vsw.conn45d1-94cc-660fc2ce42b4:vt+i2-policy-Connection\_1:vlan+1792

urn:ogf:network:ultraflight.org:2013:dellos9\_s0.hundredGigE\_1-3:

urn:ogf:network:icair.org:2013:mren8700:switch:EVTS.A-GOLE:conn+65ae5d81-663f-45d1-94cc-660fc2ce42b4:vt+i2-policy-Connection\_1:vlan+1792

urn:ogf:network:icair.org:2013:mren8700:pwave-grp:vlanport+1792

urn:ogf:network:icair.org:2013:mren8700:p4test:vlanport+1792

urn:ogf:network:ultraflight.org:2013:dellos9\_s0.hundredGigE\_1-3:

urn:ogf:network:snvaca.pacificwave.net:2016:pw-snv12-1:pw-stt11-1:vlanport+1792

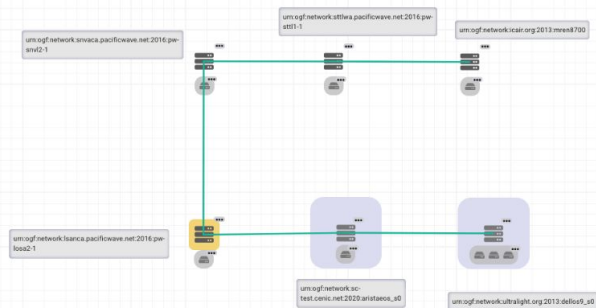
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urn:ogf:network:stlwa.pacificwave.net:2016:pw-stt11-1:icair-grp:vlanport+1792

Browser

Verification

Search

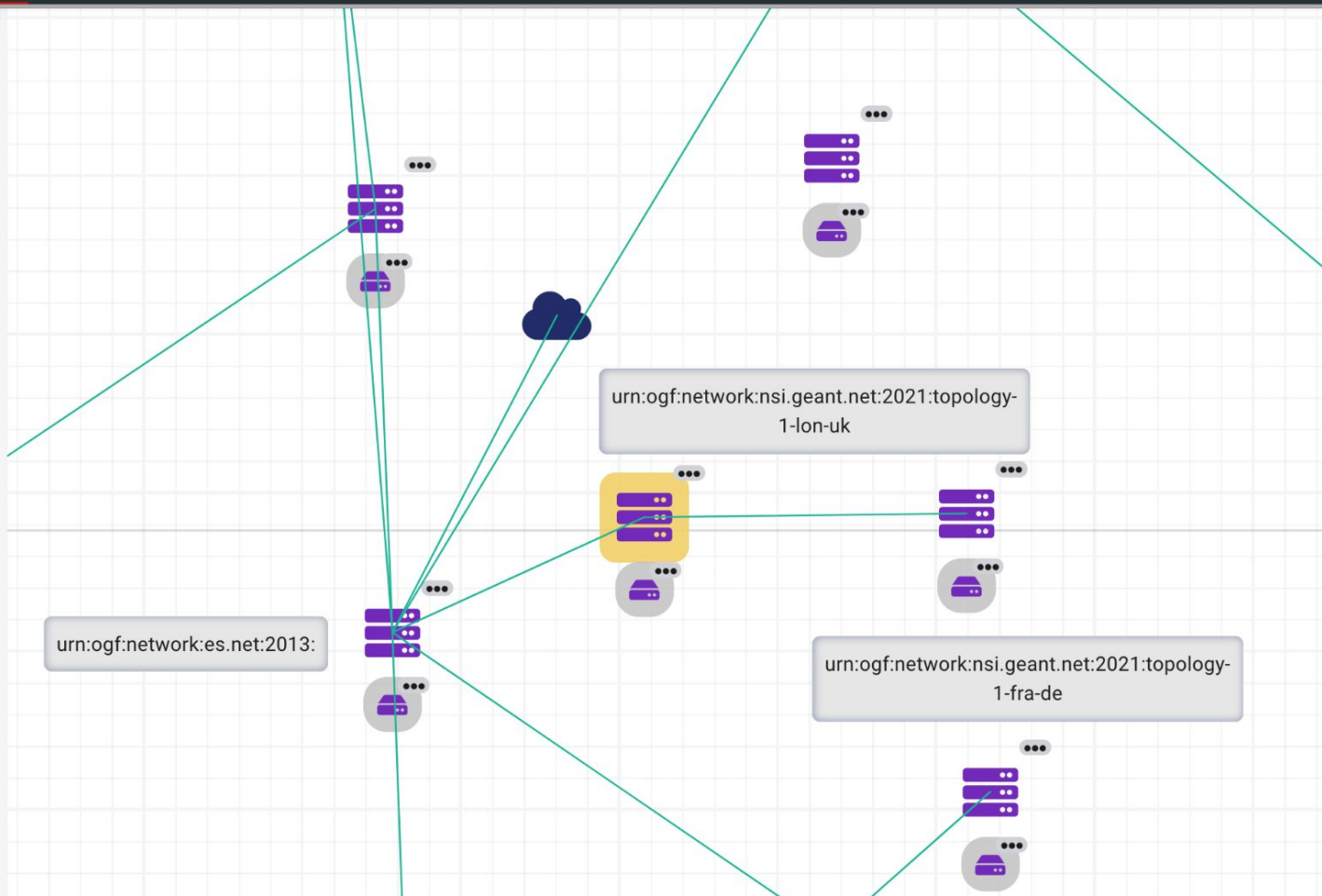


# AutoGOLE GEANT Peering

urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk

PREVIOUS NEXT

- hasBidirectionalPort (10)
- urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-fra-de.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:surfnft
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-dub2-ie.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-poz-pl.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:2-lis-pt.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-dub-ie.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-bud-hu.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-ams-nl.nsi.geant.net
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:esnet1
  - urn:ogf:network:nsi.geant.net:2021:topology-1-lon-uk:1-pra-cz.nsi.geant.net



# SENSE/AutoGoLe Control Plane Monitoring



# SENSE/AutoGole Control Plane Monitoring

General / Home ☆ 🔊

📊 📄 ⚙️ 🖨️

### General dashboards

- All Status (Variable) ☆
- Full DTN Monitoring (Variable) ☆
- Home ☆

### Dashboards for SiteRM

- NRM\_CENIC SiteRM ☆
- T2\_BR\_SPRACE SiteRM ☆
- T2\_CH\_CERN SiteRM ☆
- T2\_US\_Caltech\_Test SiteRM ☆

### Alerts for SiteRM

- 🔴 SiteRM Agent Not OK for T2\_US\_SDSC **ALERTING** for 4 days
- 🔴 SiteRM Debugger Not OK for T2\_US\_SDSC **ALERTING** for 4 days
- 🔴 SiteRM Ruler Not OK for T2\_US\_SDSC **ALERTING** for 4 days
- 🔴 HTTP Status Code alert for T3\_BR\_RNP **PAUSED** for 12 days

### Dashboards for NSI

- Ampath NSI ☆
- Canarie NSI ☆
- ESNet NSI ☆
- GEANT NSI ☆

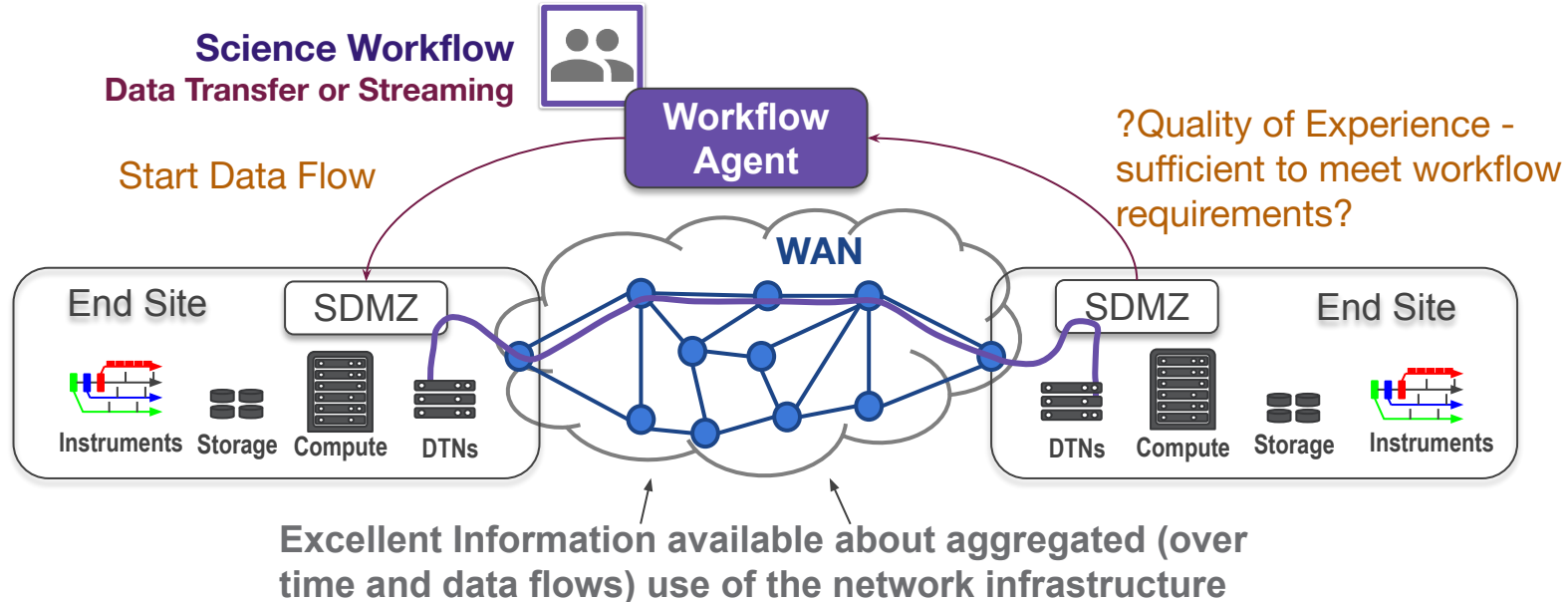
### Alerts for NSI

- 🔴 HTTP Status Code alert for Canarie **ALERTING** for 2 months
- 🔴 HTTP Status Code alert for ESNet **ALERTING** for 2 months
- 🔴 HTTP Status Code alert for GEANT **ALERTING** for 9 days
- 🔴 HTTP Status Code alert for HEANet **ALERTING** for 9 days



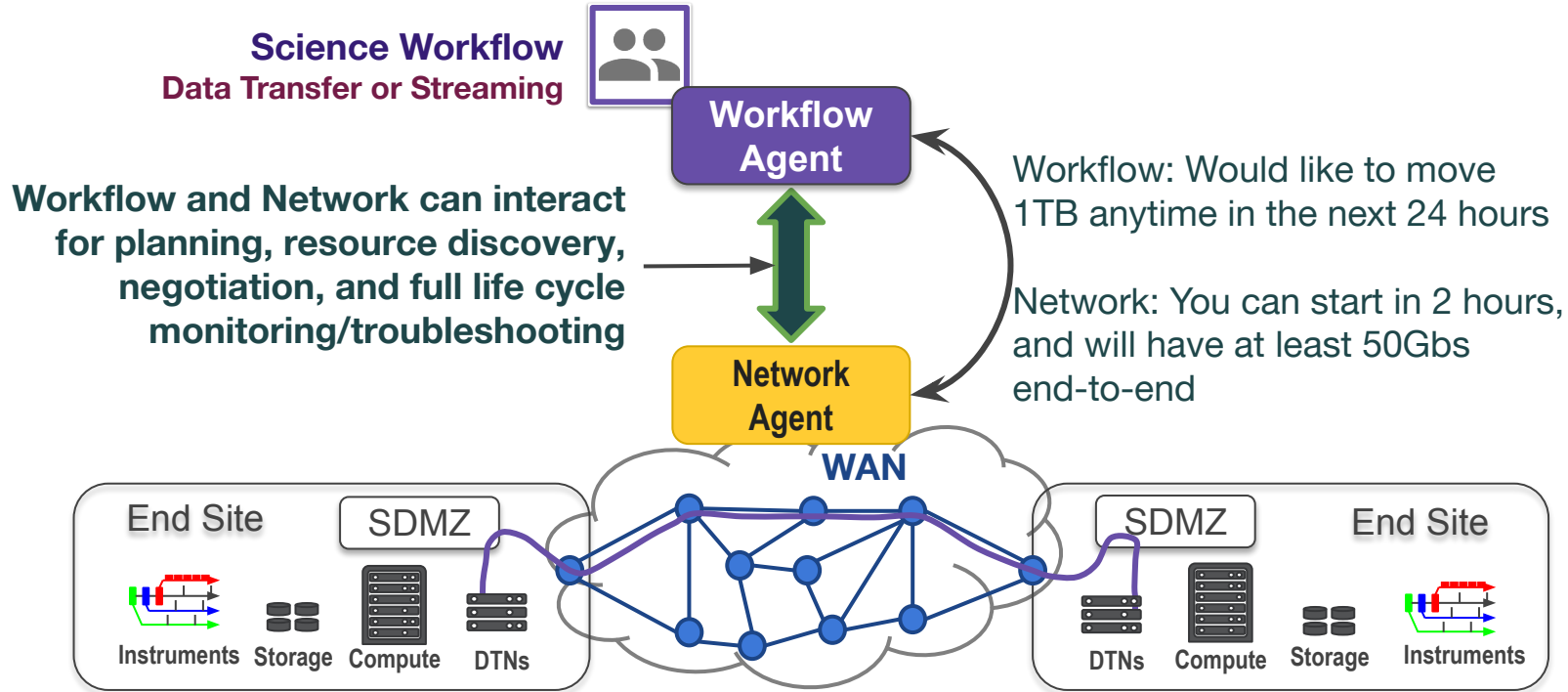
# Enable Science Workflow and Network Interaction with Deterministic "Quality of Experience"

- No realtime per flow data available for planning or monitoring
- No "deterministic" network services available
- Start data flow, and hope for the best



# Elevate Network to First Class Resource

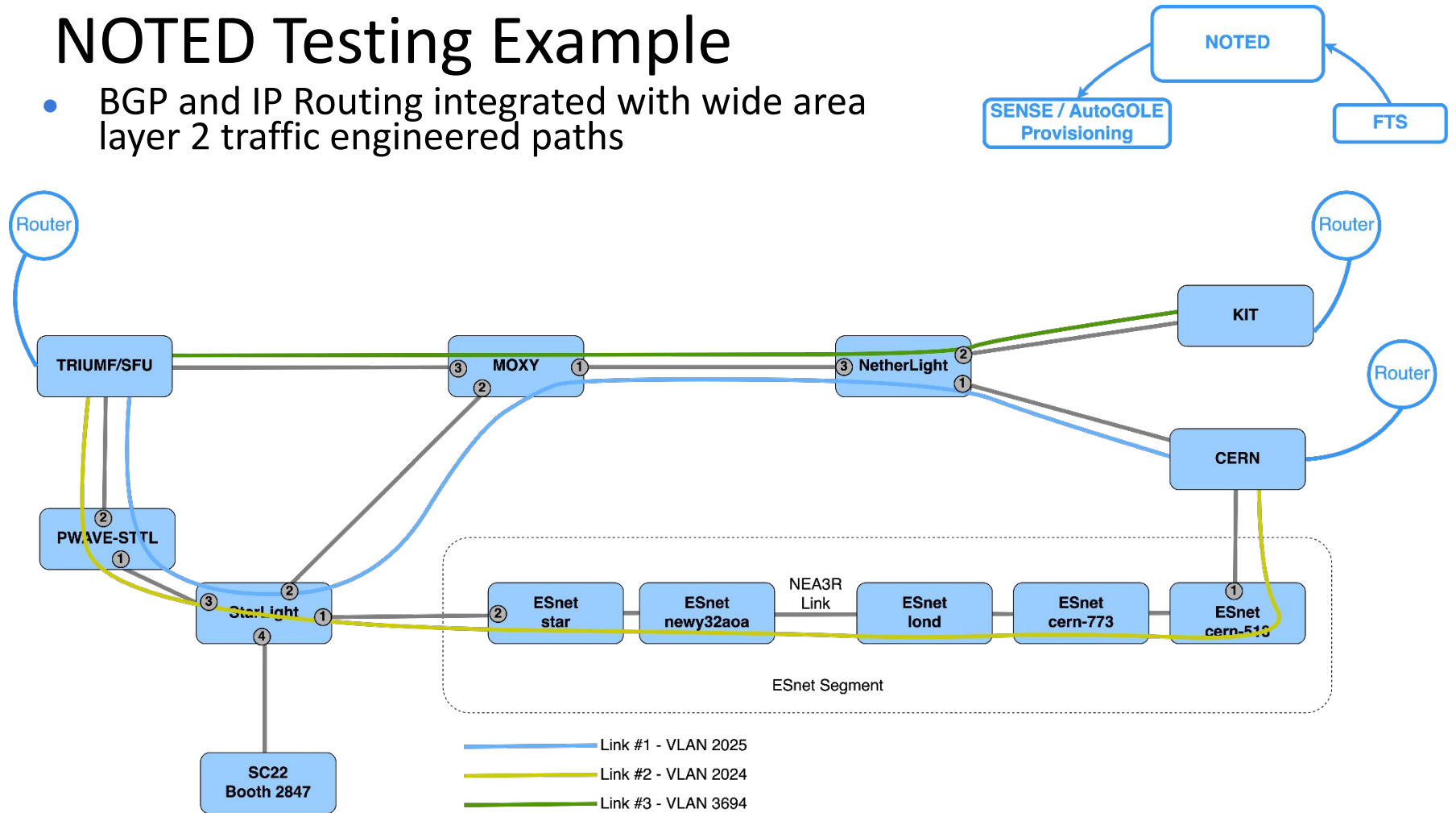
## API driven Automation and Orchestration



- Allows workflows to identify data flows which are higher priority
- Allows the network to traffic engineer to fully utilize all network paths

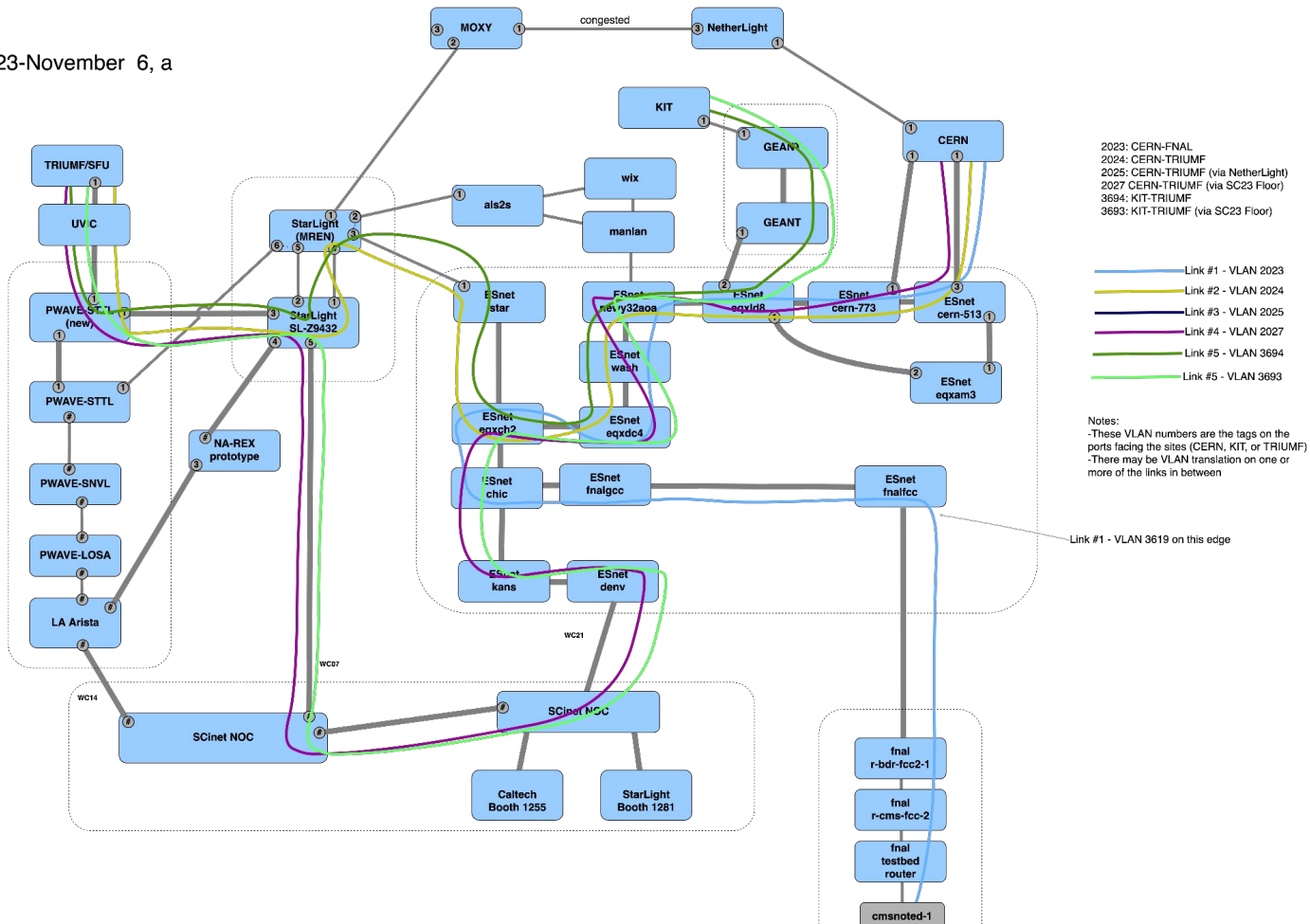
# NOTED Testing Example

- BGP and IP Routing integrated with wide area layer 2 traffic engineered paths



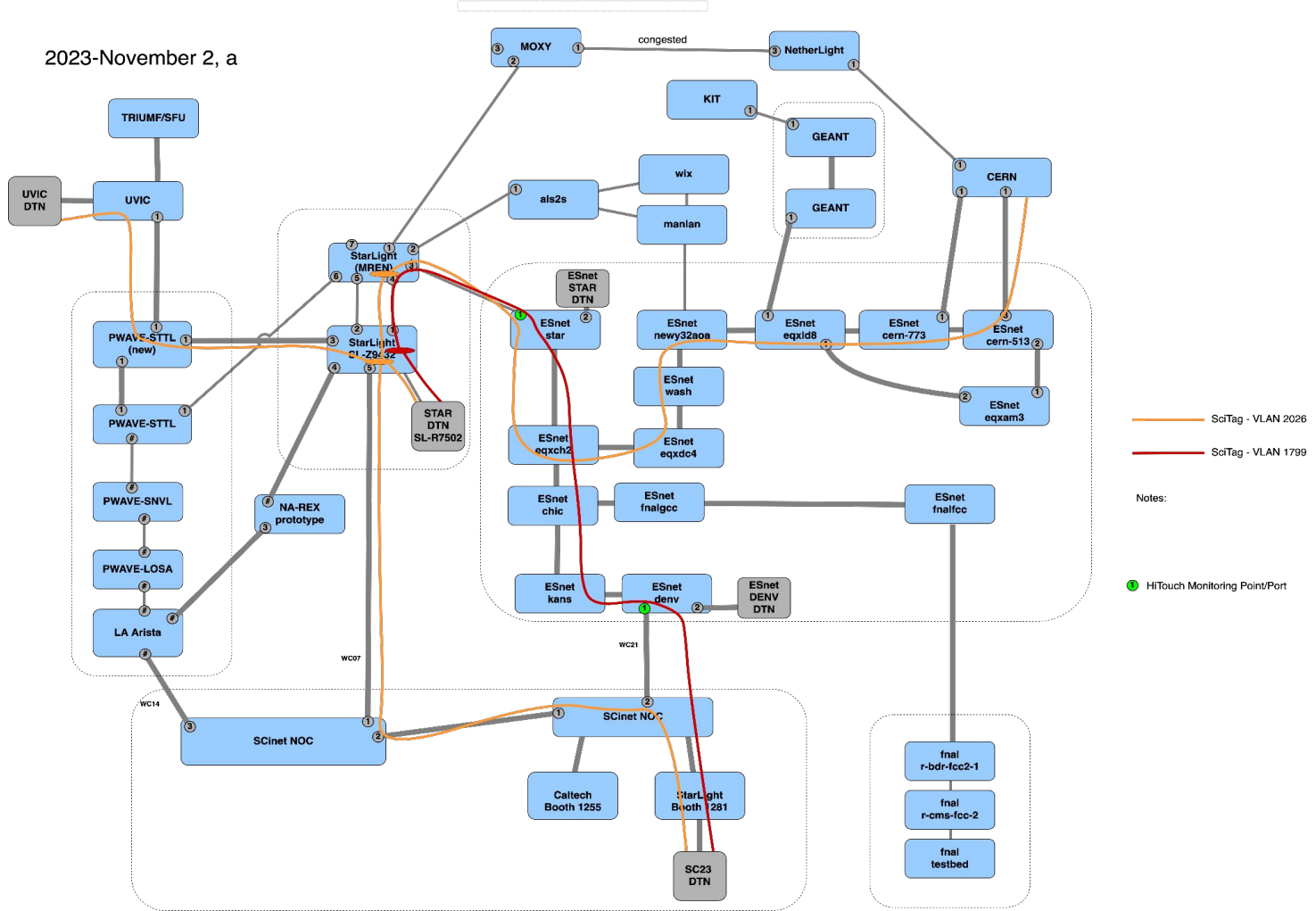
# NOTED Example

2023-November 6, a



2023-November 2, a

# Packet Marking Example



# Important Link Management

- There are multiple transatlantic links, operated by multiple organizations
- Desire is to be able to more flexibly control how these are utilized on per flow, group, or use basis
- Do not want to manage "every" flow in the network, however should be able to manage "any" flow in the network

