TNC 19 : Automation, Orchestration & Virtualization BoF

Rob Vietzke
rvietzke@internet2.edu
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Agenda

Internet2 Background

Use Case Stories / Requirements

Automation, Orchestration & Virtualization Program Status Update & Next Steps

Discussion

Internet2 Network Today

- *Services:*
  - *Advanced Layer 1 Spectrum & Waves*
  - *Advanced Layer 2 Ethernet VLANS*
    - *Point to Point vlan networks*
    - *Point to Multipoint vlan Networks*
    - *Point to Cloud Direct connect Networks*
    - *Portal and API Driven on demand networks*
  - *Advanced Layer 3 Virtual Networks*
    - *Research and Education Network*
    - *Internet2 Peer Exchange (formerly TR-CPS)*
    - *Internet2 Cloud Connect Multicloud VRF*
    - *MANRS Support*
    - *Portal and API Driven on demand networks*
  - *Other: Private Networks, dDOS, etc*
  - *With regional & global partners, Internet2 extends throughout the US and to Africa, Asia, Australia, Europe & South America*

15,500 Miles Dark Fiber • 65 Ciena 6500 Optical Add Drops • 45 Juniper MX960 MPLS Nodes • 180-200 petabytes moved per month • 1.85 exabytes moved in 2018

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What is NGI?

- *The Next Generation Infrastructure Program is a full set of activities to review and update the services, value and supporting technology of the Internet2 infrastructure portfolio (and relationships in the larger ecosystem)*
  - *Includes the services and service models through which the community adopts Internet2 infrastructure services*
  - *Includes a number of infrastructure upgrade projects*
  - *Includes new features, primarily driven by software, automation and systems virtualization to allow the infrastructure to be more readily integrated in to the broader campus, regional and cloud environment around us.*

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2022 Community Requirements:
Support of Research
Automated & Programmable
Cloud & Peer Connected
Embedded Security
Regional/National Integration
Infrastructure Sharing
Academic Enterprise Support
Global Reachability
Operational Telemetry
Research Data
Resilient
Economics & Scalability
Operations
Secure

5 Stories NGI Must Support

- Support the Data Intensive Researcher
- Support Software Driven Infrastructure
- Support Cloud for Research and Administration
- Deliver Ecosystem-wide Solutions
- Reset Internet2 Economics for Scale

- All of these, perhaps except network economics, are reliant on evolving software/automation capabilities

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2020 Automation, Orchestration, Virtualization Planning Agenda

Our Evolving Service Portfolio

Research & Education Services

- L3 Global R&E
- L3 I2-Peering Exchange
- L3 on-demand
- L3 LHC/OSG/NRP/ERN Science Networks
- L3 dDOS Service
- L2 Circuits
- L1 Waves/Spectrum

Interconnect Services
(to/from Peer exchanges)

- L3 I2-Peering Exchange
- (reduced restrictions)
- L2/L3 Rapid Private Network Ports (low cost bundles of ports)
- L3 (yourAS) on-demand VRF
- L3 Router on demand
- L2 Circuits
- L1 Waves/Spectrum

Cloud Connect Services
(enabling campus move to the cloud)

- L3 Multi-Cloud Private VRF
- L3 I2-Peering Exchange
- AWS / GCP / MAER Integration
- L2 Circuits
- L1 Waves/Spectrum

Advanced Expectations / Advanced Operations / Telemetry / Automation / Orchestration

NGI: *Software, Systems, Automation*

Systems supporting Service Evolution:

- Telemetry Service
- Performance Assurance Systems & Services
- Self Service Network Services
  - Cloud Connect Portal / OESS 2.0
  - Future evolution includes flow and telemetry influenced orchestrated services

Supporting Technology:

Automation

Virtualization

Orchestration

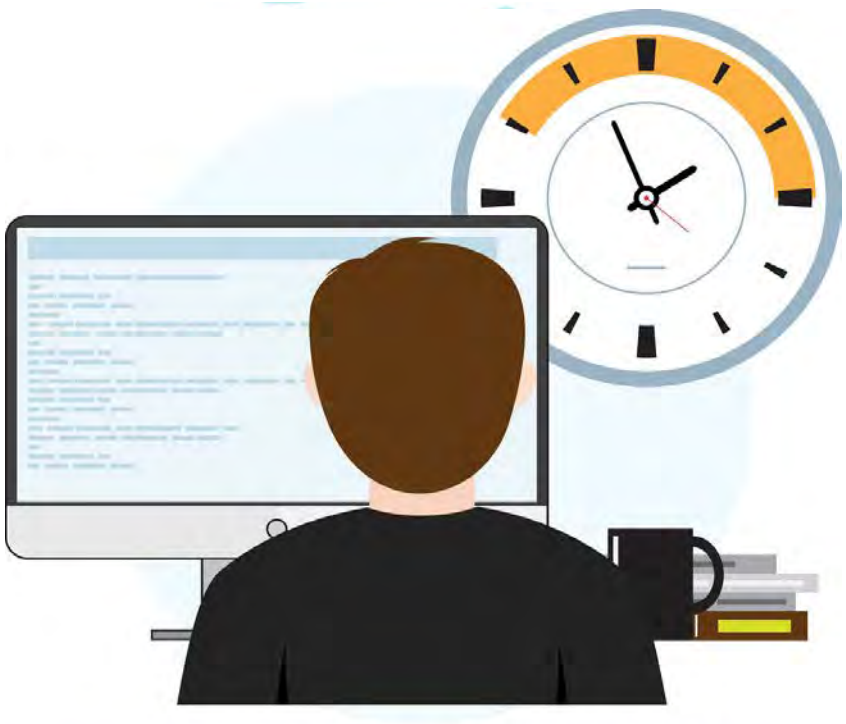
Trust & Identity

NGI: *Software, Systems, Automation*

- Goal: Automate internal processes & configurations
  - consistency, rapid delivery
- Goal: Add self-service & API features
  - reduce time to results
  - enable infrastructure sharing
  - Support network researchers and distributed operations
- Goal: Update measurement & analytics tools
- Goal: Provide leading network security capabilities
  - Enable and protect science & administrative workflows

NGI: *Today's environment*

- Cloud-connect portal (OESS 2.0.2) – Is our primary user-facing self-service tool, includes cloud connectivity, on demand L3 VRF, on demand L2
- GlobalNOC tools – our primary backend support system (dB, alarming, measurement,
- Pacific Research Platform & Open Science Grid are our experimental efforts in NFV/Virtualization above the network



Today's environment (cont'd)

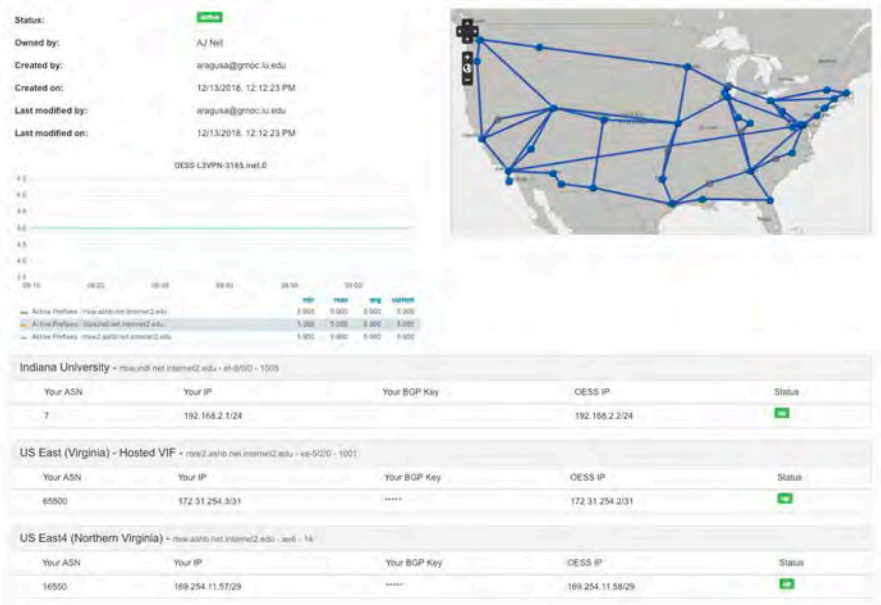
Released cloud-connect portal (OESS 2.0.2)

- L2 – PtP and PtMP
- L3 – Cloud VRF (Internet2 AS)
  - AWS, GCP, Azure API's
- Traffic and BGP status
- Manual Workgroup and Directory Services

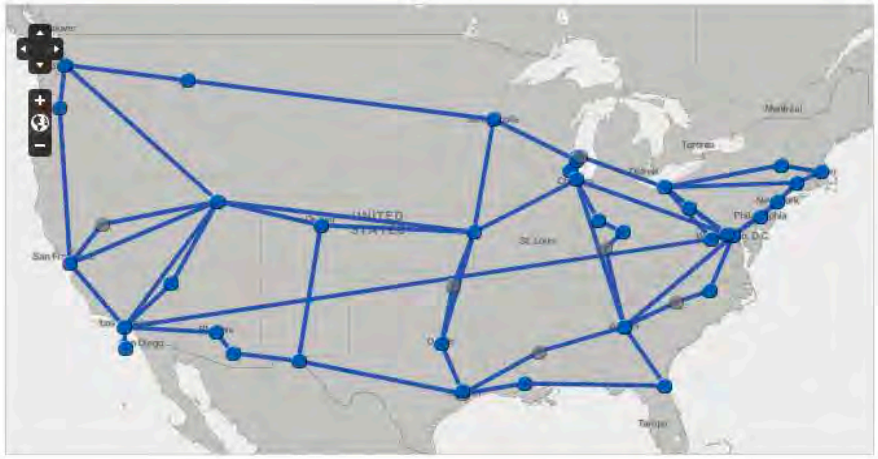
Evolution Items –

- Grouper/CoManage support (migration of workgroups)
- Prefix Lists
- Your-AS
- On Demand perfSONAR at interconnection points

Cloud Connect Portal 2.0.2



Status:	active
Owned by:	AJ Net
Created by:	aragusa@grnoc.iu.edu
Created on:	12/13/2018, 12:12:23 PM
Last modified by:	aragusa@grnoc.iu.edu
Last modified on:	12/13/2018, 12:12:23 PM



Indiana University - rtsw.indi.net.internet2.edu - et-8/0/0 - 1005

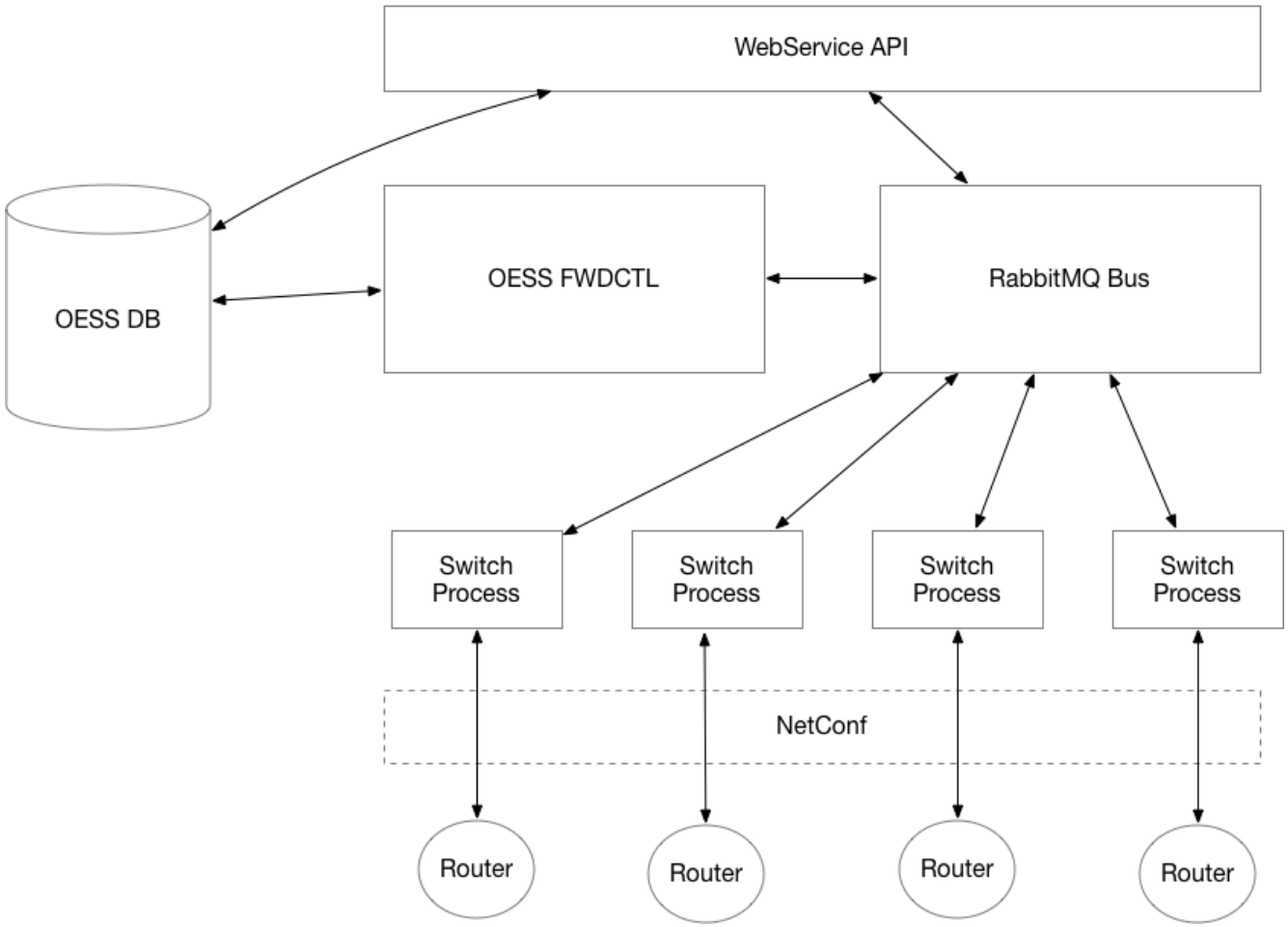
Your ASN	Your IP	Your BGP Key	OESS IP	Status
7	192.168.2.1/24		192.168.2.2/24	up

US East (Virginia) - Hosted VIF - rtsw2.ashb.net.internet2.edu - xe-5/2/0 - 1001

Your ASN	Your IP	Your BGP Key	OESS IP	Status
65500	172.31.254.3/31	*****	172.31.254.2/31	up

US East4 (Northern Virginia) - rtsw.ashb.net.internet2.edu - ae6 - 14

Your ASN	Your IP	Your BGP Key	OESS IP	Status
16550	169.254.11.57/29	*****	169.254.11.58/29	up


WebService API
OESS DB
OESS FWDCTL
RabbitMQ Bus
Switch Process
Switch Process
Switch Process
Switch Process
NetConf
Router
Router
Router
Router

Automation: GlobalNOC Tools Automation Agenda

Year One goal of the GRP Automation project is to automate 80% of the changes to the core L2/3 equipment for networks the GlobalNOC staff actively configure.

- **Project 1 – “Set System”, beginning Monday, May 20**
- **Project 2 – Global Prefix lists**
- **Project 3 – Per-Peer Prefix lists**
- **Project 4 – Campus**
- **Project 5 – Interface Backbone**
- **Project 6 – Interface Customer/Peer**
- **Project 7 – Service Provisioning**
- **Project 8 – Campus**

Telemetry

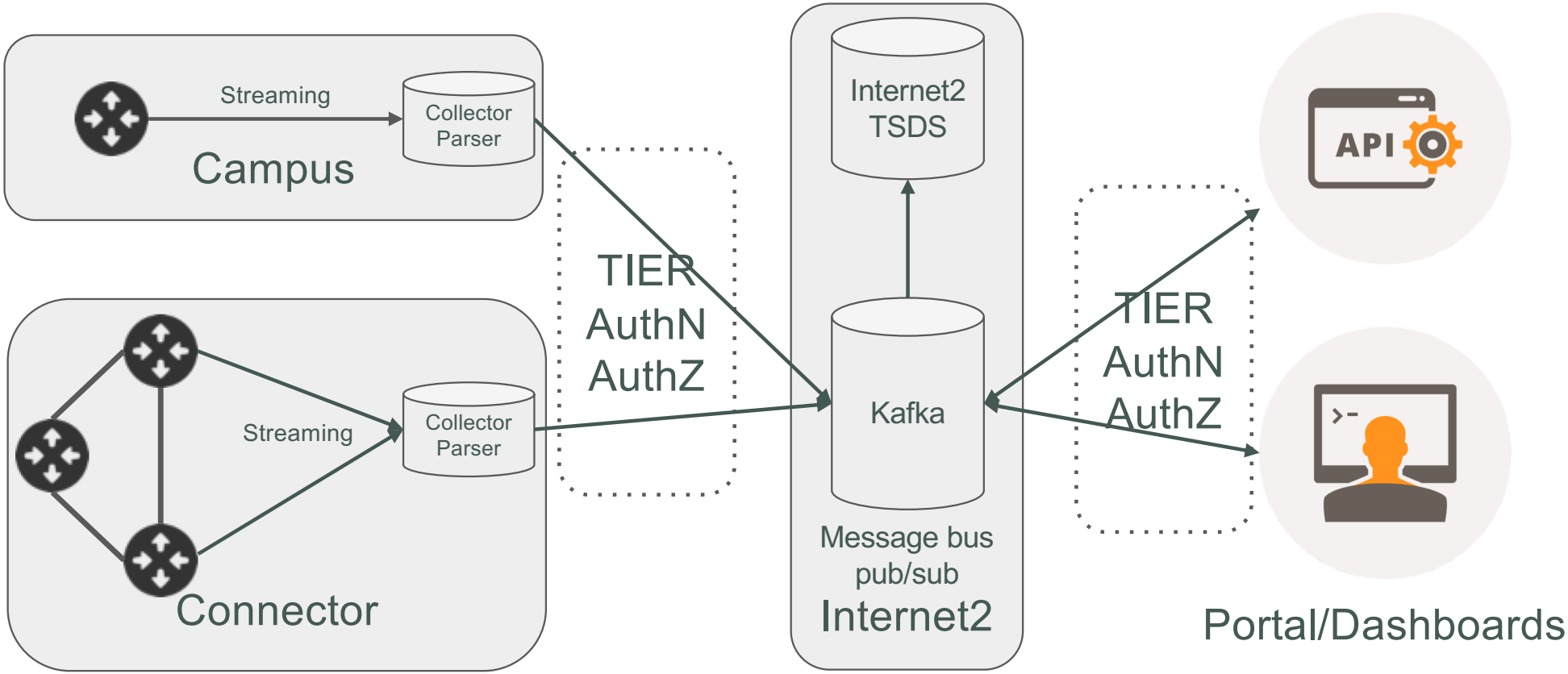
Current State

- SNMP polling, data stored in TSDS
  - Query via Grafana and API
- Netflow to Deepfield
  - Limited sharing - if shared it is anonymized
- Syslog to aggregators and Splunk

Future State

- SNMP will continue to survive on life support
- Netflow - broader sharing
- Syslog
- Streaming Telemetry
  - Data (interface stats, buffers, etc) streamed frequently (1-2 sec)
  - Opportunities for end to end monitoring
- BMP - BGP Monitoring Protocol

Telemetry - Community Collaboration



Service Provisioning at the edges

Current State

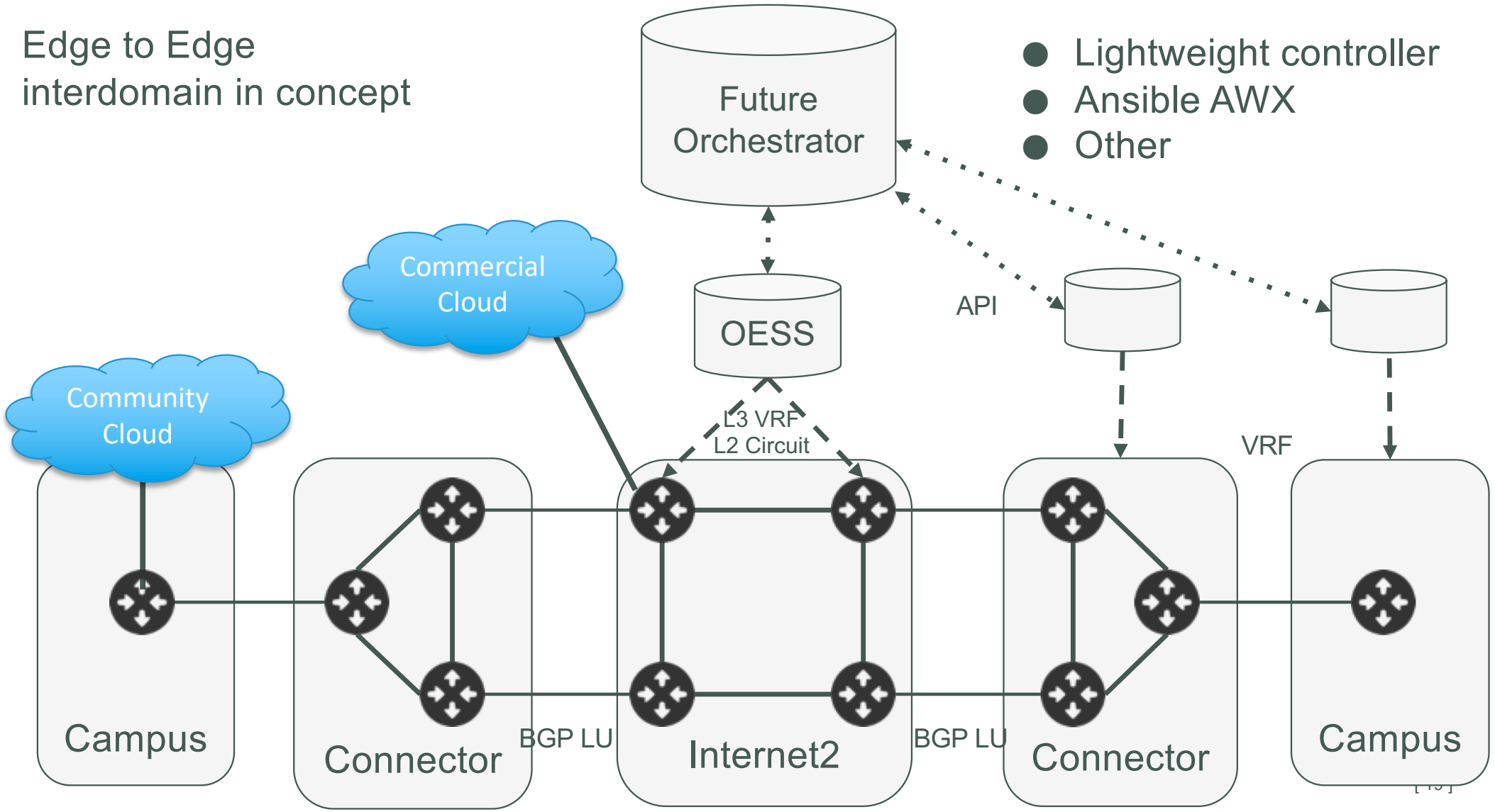
- OESS for Layer 2/3 VPNs across Internet2
  - Access to cloud providers and other members
- Connectors/regionals provision VLANs or separate VPNs
- Process involves coordination between multiple entities
  - 5+ for campus to campus
- No orchestration, minimal automation

Potential Future State

- Service orchestration and provisioning across multiple domains
- Seamless MPLS
  - Works with differing topologies and label transport protocols
  - Internet2 using Segment Routing, connector using RSVP, campus using LDP
  - Segment routing simplifies this
- Developing a model for service provisioning at the edges

Pilot opportunity!

Edge to Edge
interdomain in concept



Discussion?

Karl Newell knewell@internet2.edu
Mark Brochu mbrochu@internet2.edu
Rob Vietzke rvietzke@internet2.edu

Grover Browning (Automation) gcbrowni@iu.edu