

Update on Happenings in Internet2 Network Services

Progress in evolving to a next generation R&E network for US
Researchers

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Network Services, Internet2

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Welcome:

2020 SAACC Meeting

Agenda

Intros / Welcome
NGI Update
Service Model

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WHAT IS THE INTERNET2 NEXT GENERATION INFRASTRUCTURE PROGRAM ?

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 into the broader campus, regional and cloud environment around us.*





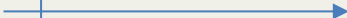









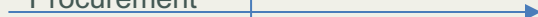


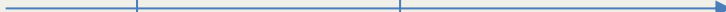



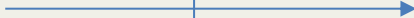
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5 Solutions = R&E Value

- Support the Data Intensive Researcher
- Support Software Driven Infrastructure
- Support Cloud for Research & Administration
- Readily Enable Ecosystem-Wide Solutions
- Reset Economics for Scale



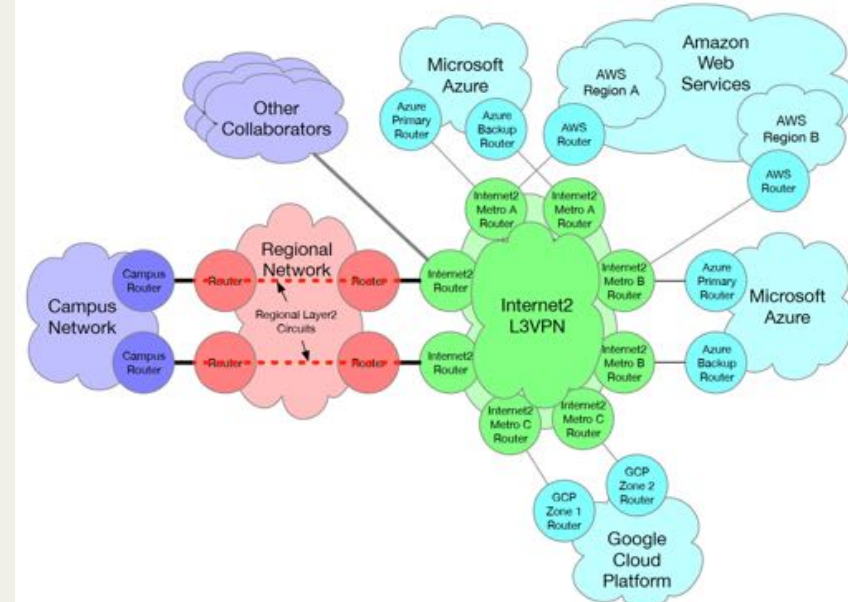
How we think about the NGI Work Effort / Where are we now?

| | Listen | Define | Ideate | Prototype & Show | Implement |
|---------------------------|---|--|---|--|---|
| • Service Model |  |  |  |  |  |
| • Optical |  |  |  |  |  |
| • Packet |  |  |  |  Procurement & Prototyping |  |
| • Orchestration (service) |  |  |  | | |
| • Telemetry |  |  |  |  | |

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Cloud Services & Rapid Private Interconnect (RPI)

- **Cloud Connect** - national resilient footprint for:
 - AWS Direct Connect (Hosted Interconnect >500Mbps)
 - Support for Jumbo Frames
 - Google Dedicated Interconnect
 - Microsoft Azure Express Route
- Automated **Cloud Connect Portal**
 - Provides API-based provisioning at Layer2 & Layer3
- **RPI** – incremental 10G and 100G ports rapidly provided at the 7 peering points
- **perfSONAR** support for the cloud



NEXT GENERATION INFRASTRUCTURE

Internet2 Cloud Connect Stats

| Cloud Provider | Subscribers (Campus) | Regional Providers |
|-------------------------------|-------------------------|--------------------|
| AWS Direct Connect | 58 | 17 |
| Microsoft Express Route | 70 | 15 |
| Google Dedicated Interconnect | 9 | 4 |

There are an additional 75 Subscribers in the Queue

As of 1/22/20

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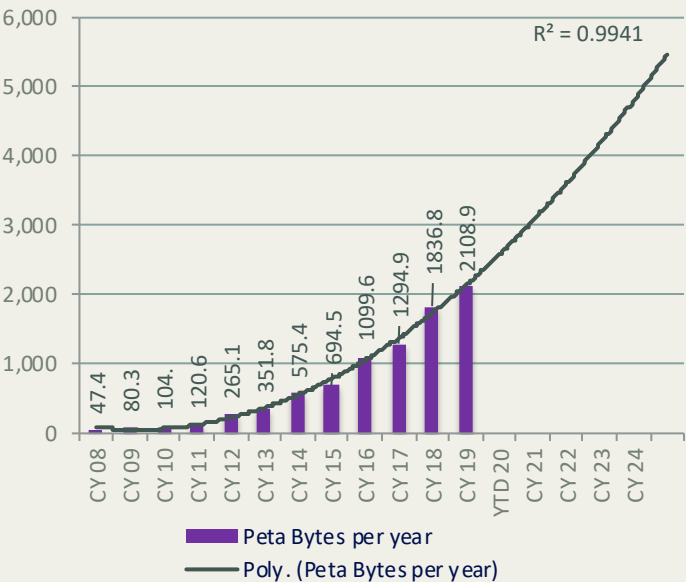


NEXT GENERATION INFRASTRUCTURE



Peering & Cloud Capacity Augments

Internet2 Network Total PetaBytes
Carried Per Year (Calendar Year)



I2-PX Peering Capacity

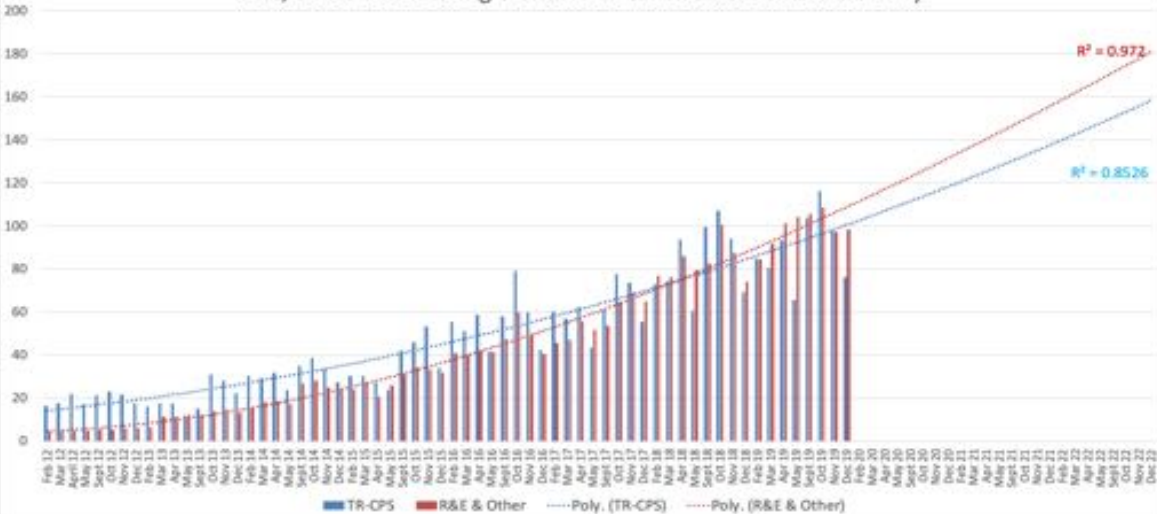
2019

2020

980 Gbps

3110+ Gbps

R&E/Other and Peering Trendlines - PB-Mo Academic Year Only



NEXT GENERATION INFRASTRUCTURE

Services Portfolio

What we have done:

- Lifted “caps” on I2PX
- Increased peering capacity
- New Cloud Connect Portal Features
 - QoS / 10G support / new GUI
 - Layer 2 & 3 VPN's on demand
 - Jumbo Frames for AWS
- Beginning to Introduce I2-RUSH esports peers
- MANRS Office Hours

What we can do:

- Improve cloud-connect workflow
 - Pre-provisioning vlans & OESS accounts a key enabler for rapid deployment
 - Better coordinate training & related materials for operators and users
- Secure Routing of our networks and members
 - Finish MANRS across community
 - Accelerate Routing Registry Activities
- More office hours, staff development in software, automation, telemetry, security
- Investigate a “last resort” internet option in platform package

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INFRASTRUCTURE IMPROVEMENTS

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What's new in Protocol? We're moving towards...



Simple – Scalable – Seamless

Unified Forwarding – Traffic Engineering –
On Demand Next Hop – Failure Protection –
Service Chaining

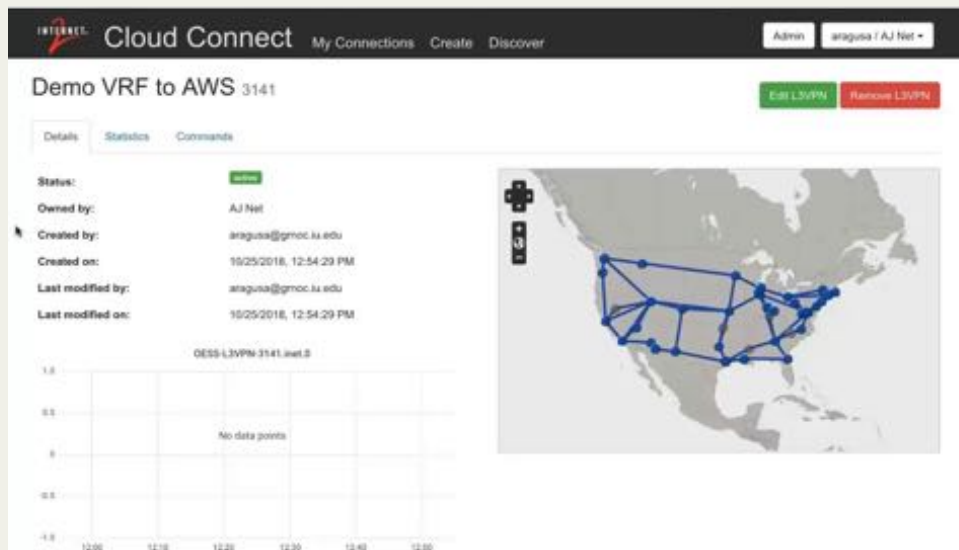


Standards-Based (MP-BGP) control plane to
advertise MAC or IP addresses & vlan tag

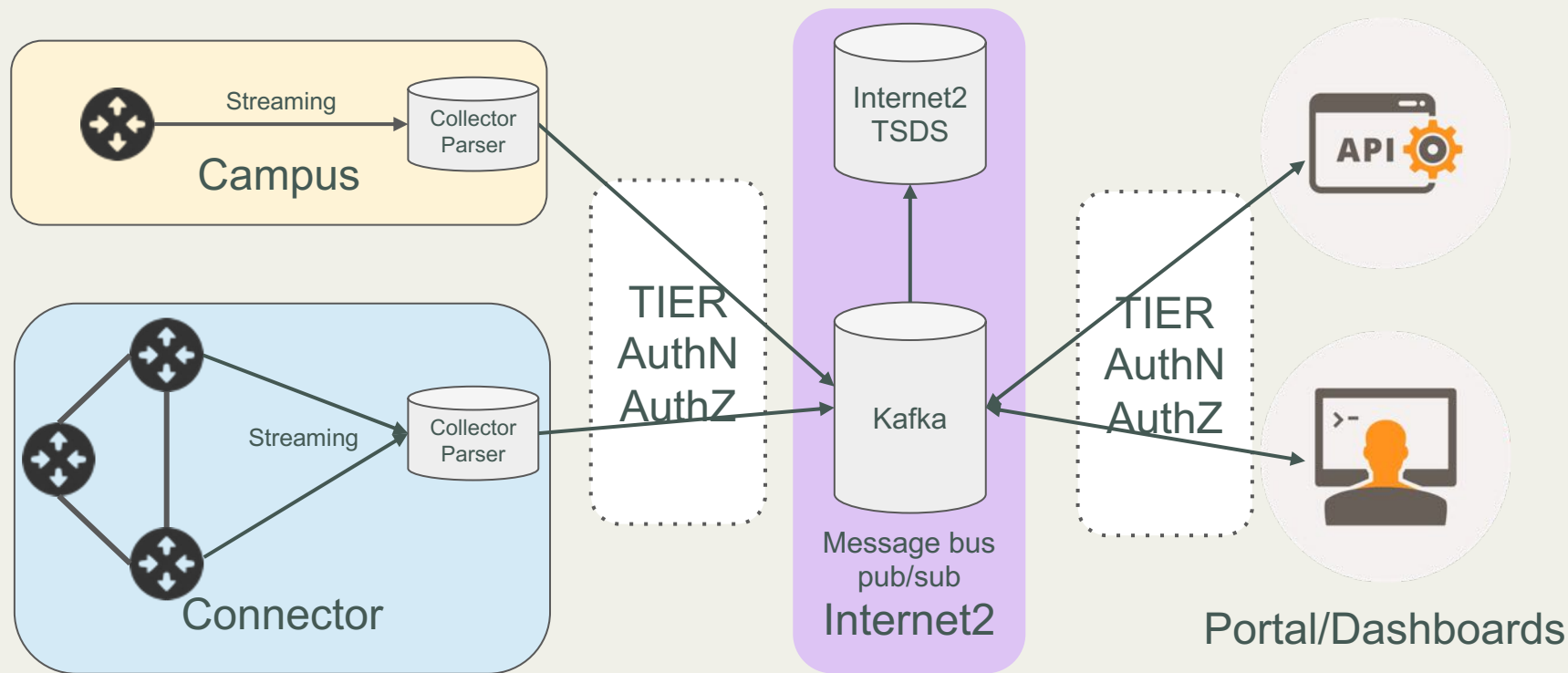
Replaces/Simplified MPLS L2 Tunnels
Opportunities for some future L3 services as well

OESS / Cloud Connect Portal Features Additions

- Up to 10G for AWS, Google, Azure
- Jumbo frames for AWS
- Transition to new UI for L2 and L3 completed
- Ready for Trusted Identity integration soon.
- Allow self-provisioning of users within workgroups.



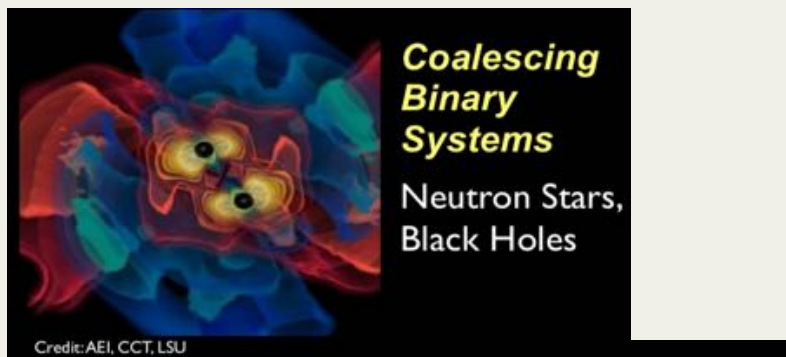
Telemetry - Community Collaboration



Utah / Penn State Prototype – Others strongly encouraged to "opt in"

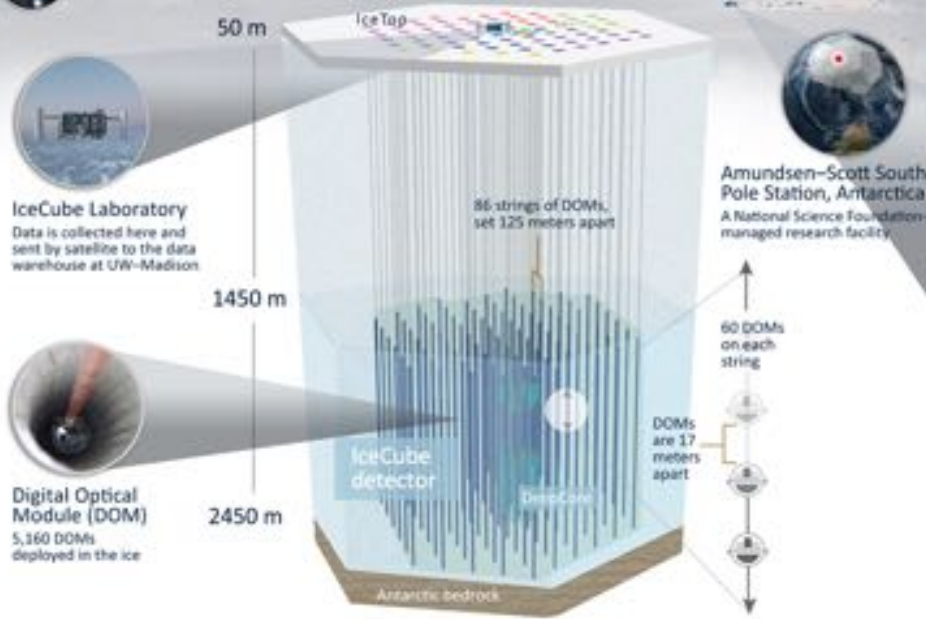
Open Science Grid / Internet2 Collaboration expands with new 100G science data caches

Leveraging the OSG HTC stack and cloud peering adjacency to enable science.



New 100G backbone nodes coming online:

- Kansas City (Thanks GPN!)
- Sunnyvale
- Chicago
- New York
- Houston
- Amsterdam - soon (Thanks SURF!)

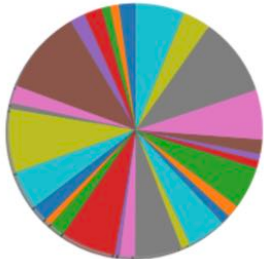


ICECUBE / Open Science Grid Demonstrate Massive Cloud Burst for Multi-messenger astronomy at SC'19

Internet2 assisted staging/moving 26 TB of data to providers

On demand for 2 hours: GPU's equivalent to 90% of the capacity of the largest supercomputer in the world

Events processed per Cloud Region



3 Continents
3 Cloud Providers
51,000 GPU's
350 petaflops capacity
26 TB moved
2 Hours



NGI Optical Upgrade



Program Highlights

- Nationwide Upgrade of Optical Kit
 - Open Line System
 - Flex Grid (>100 Ghz channels)
- Upgrading to SMF28 ULTRA Fiber
 - On most paths / some new huts
- New 400-800G transponders for Internet2 backbone circuits
- Substantially greener profile (space, power)
 - Approximately \$2.75m/yr in savings resulting from “upgrade”
- Implementation underway



NGI Packet Update



Packet RFP responses received

Community/Staff Evaluation underway

- Protocol Support
- Hardware Form Factors/Power
- Security/Telemetry/etc
- TCO 5/8 Years
- Partnership

Testbed and / or field Testing likely



Responses
Received

ARISTA

CISCO

Juniper
NETWORKS

NOKIA

Also: New Secure Management Network being deployed with Optical

Simplify operations,
coordination and service
activities across Atlantic and
Pacific Exchange Points

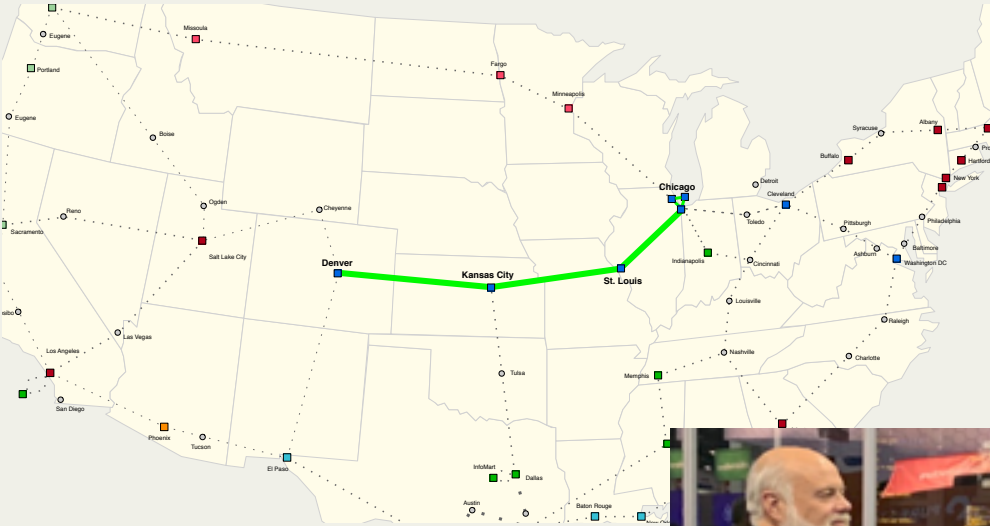
US-IX Collaboration

- Initiative of PacificWave and Internet2 to more closely align operations, capabilities and services at MANLAN, WIX and PacificWave
- Includes dedicated 100G Interconnect and shared backup paths
- Upcoming activities include:
 - Develop a shared portal
 - Upgrade perfSONAR infrastructure



Internet2 & Partners awarded “Spirit of Innovation Award” at SC’19

... for the collaboration delivering over
2Tbps of capacity and a “first in R&E”
400G link from Chicago to Denver.



THANK YOU!

An enormous community effort across many collaborations is showing progress and promise!

