



# ESnet

ENERGY SCIENCES NETWORK

# ESnet6 and Future Growth

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**LHCOPN/LHCONE Meeting**

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Office of Science



# Outline

- ESnet6 update
  - Backbone transitions
  - Automated provisioning
  - Capacity targets
- LHCONE service updates
- LHCOPN service updates
- Transatlantic

# Major Backbone Changes in last Year

- Optical
  - Deployed 74+ Ciena 400G circuits
  - Finished the OLS buildout on the new fiber to ANL.
  - Upgraded 3 of the Infinera CHM2T circuits to 400G.
- Routers
  - Completed deploying and transitioning 42 ESnet6 routers into service
  - Retired approximately half of the ESnet5 routers, including all MX960s, MX480s.
  - Transitioned routed traffic off of almost all core 100G links to 400G links.
  - The 100G Infinera CHM2T circuits are primarily carrying OSCARS today.
- Automation
  - Migrated Service Edges & BGP Peers on 42 routers to orchestrated and automated services.
  - Currently managing 1882+ service subscriptions in the orchestrator!
  - Nearly all network service turnups and transitions are being done using automated tools at this point!

# ESnet Backbone Transitions

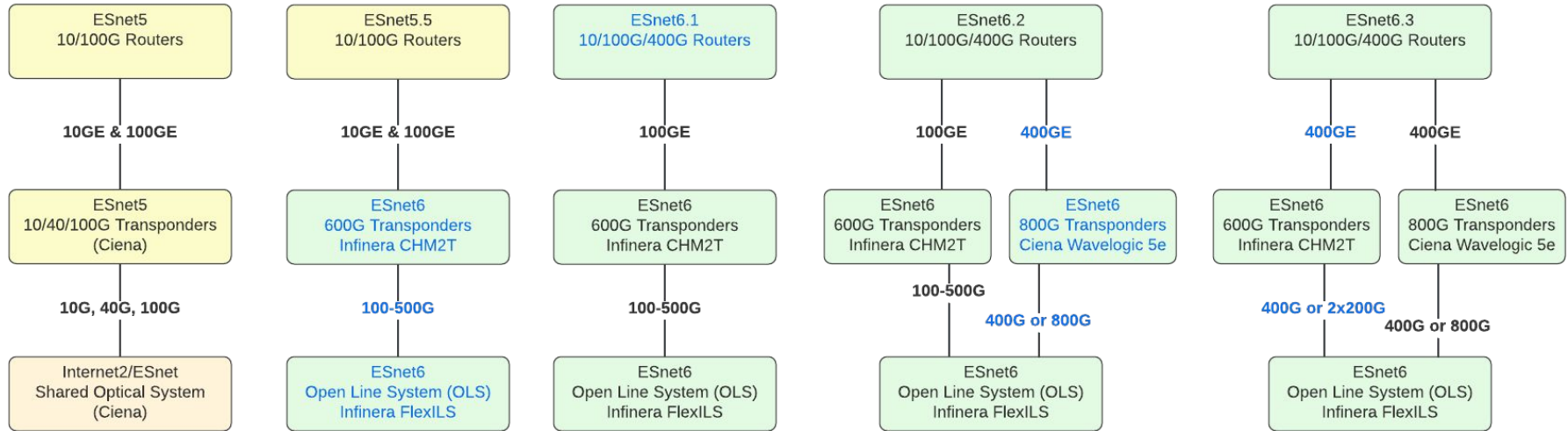
Replaced Optical Layer  
Eliminated 10G & 40G Waves

Replaced Routers  
Eliminated most 10GE circuits

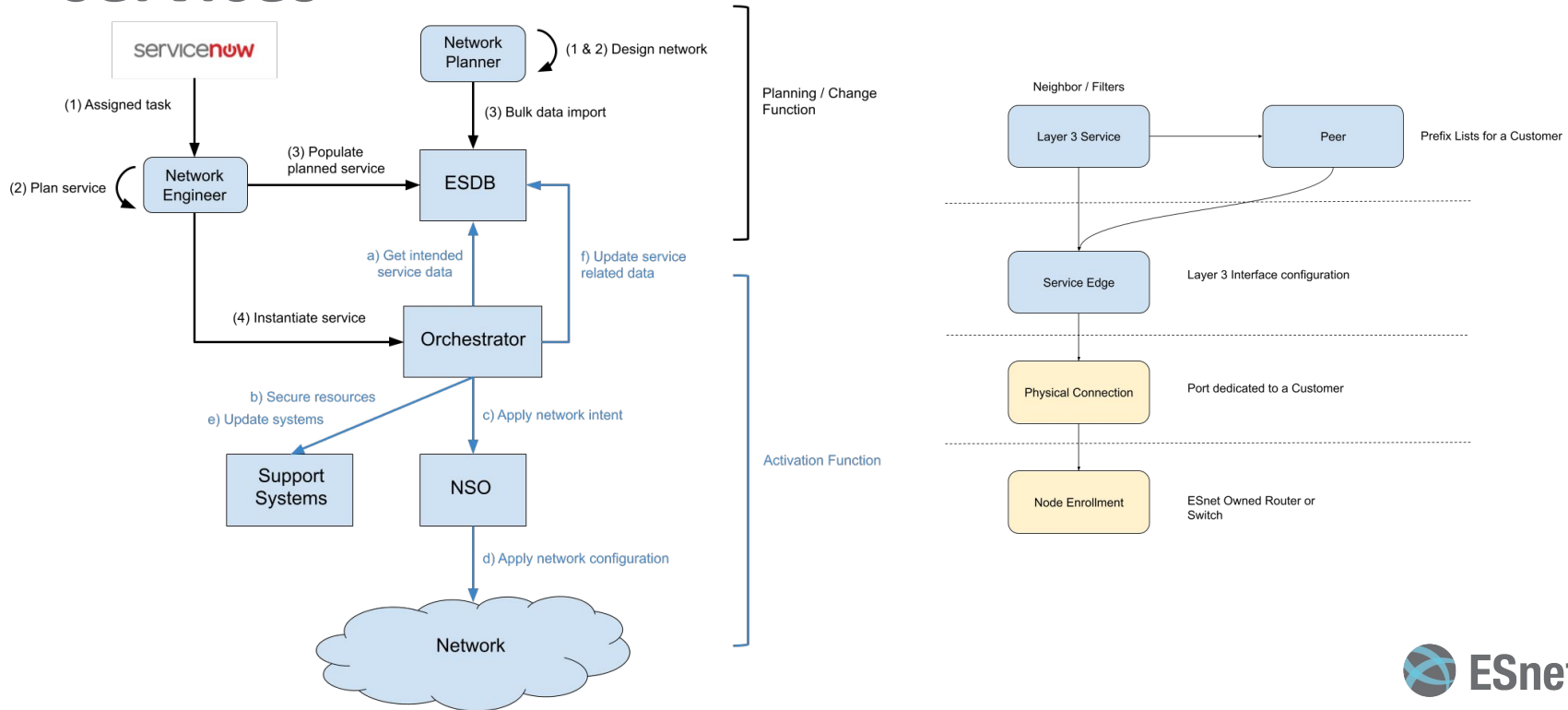
Deploy Transponder P2  
Add at least 1x400GE to each optical segment

Replace 100GE QSFP28s with 400GE AOC on Transponder P1  
Convert Nx100GE to an additional 1x400GE on each optical segment

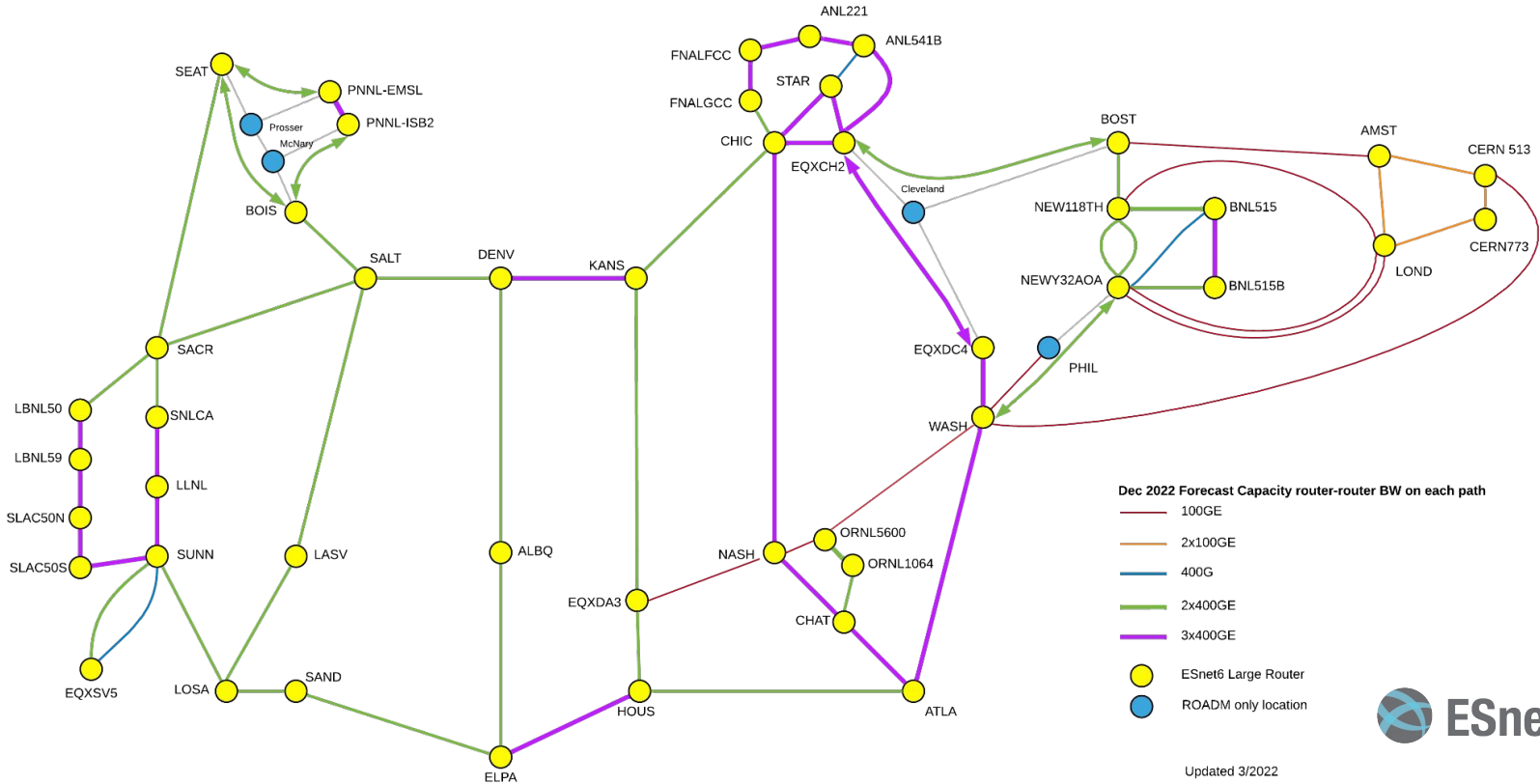
Today



# Most of our router provisioning activities are now using the automation stack to deploy services



# December 2022 Target Backbone Capacity



Updated 3/2022



# LHCONE service changes

- All LHCONE connections in North America on new ESnet6 routers
- Bug fix or feature?
  - apply BGP prepending community policy to all bgp peers
- Later this year:
  - Software upgrade of routers,
    - fixes netflow issues & enables SciTag packet marking
  - Upgrade of EU routers to new platform
  - Migration from LDP to SR/MPLS

# LHCOPN service updates

- All LHCOPN connections in North America on new ESnet6 routers
- Updating QOS policies
- Testing L2 Flow data metrics



# ESnet Transatlantic paths

- Currently 4x100G + 100G NEA3R
- ESnet is making significant acquisitions for new transatlantic capacity
- Multiple paths are being acquired for capacity and resilience.
- Plans only made public as sensitive procurements progress.
- In most (all?) cases, partnering with other R&E networks

# ESnet's first 400G Transatlantic additions

- Spectrum on Amitié cable system
- Expected initial provisioning
  - 400G Boston-London
  - 400G Boston-Bordeaux
  - late 2022 / early 2023
- Internet2/CANARIE also on this cable
- Terrestrial builds & upgrades will be required





## Other ESnet6 service additions

# WAN Black Hole Routing Service

A new ESnet6 Security Service replacing an ad hoc manual process used previously.

It discards traffic destined **to** IPv4 or IPv6 destinations at the ingress edges of the ESnet network.

Example use cases include:

- Mitigate DDOS attacks aimed at a single ESnet customer host
- Stop communication destined to botnet command & control nodes

This is a simple service that we are using to develop the internal frameworks and processes necessary to develop and support more advanced security services

# WAN Black Hole Routing - Service Architecture

