



# ESnet

ENERGY SCIENCES NETWORK

# ESnet Update

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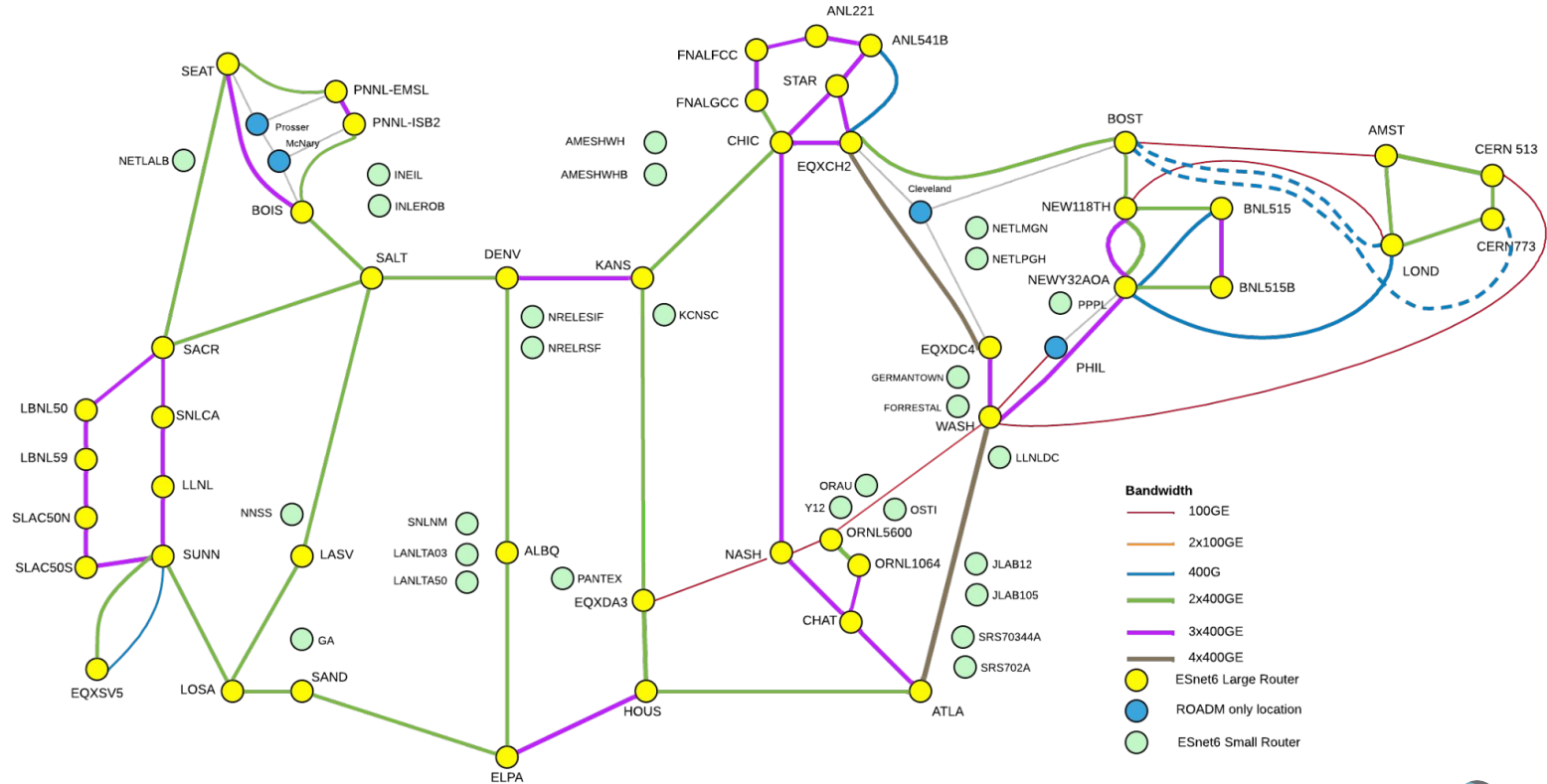


U.S. DEPARTMENT OF  
**ENERGY**

Office of Science



# ESnet Backbone



# Trans-Atlantic & EU ring upgrades

- **Now In Production:**

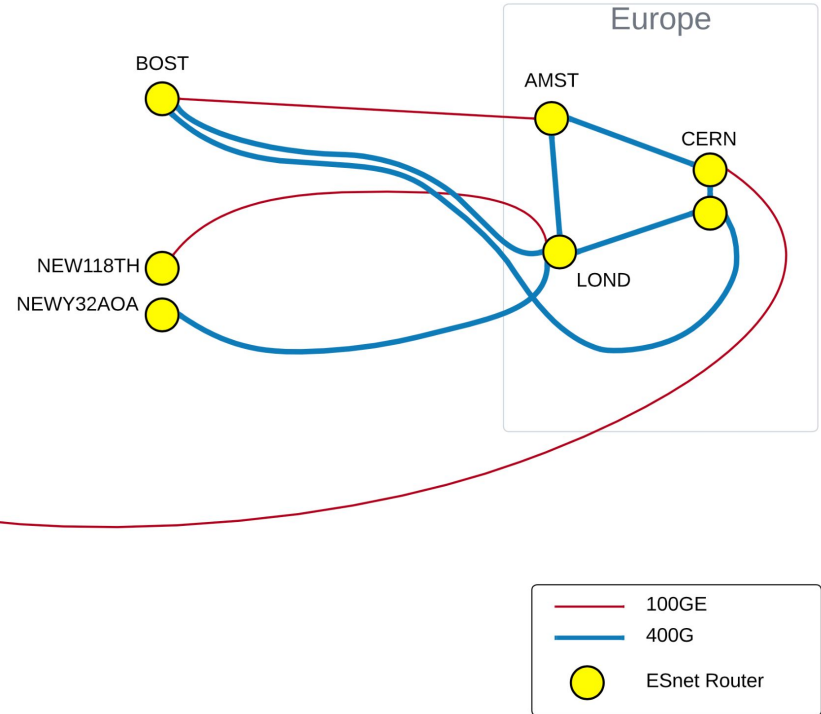
- 400G + 100G New York - London
- 100G Boston to Amsterdam
- 100G Washington to Geneva
- 400G Boston - CERN
- 400G Europe Ring
  - working with GEANT
  - Next phase will be 2x400G (9/24)

- **Currently underway:**

- 400G Boston - London (this week!)

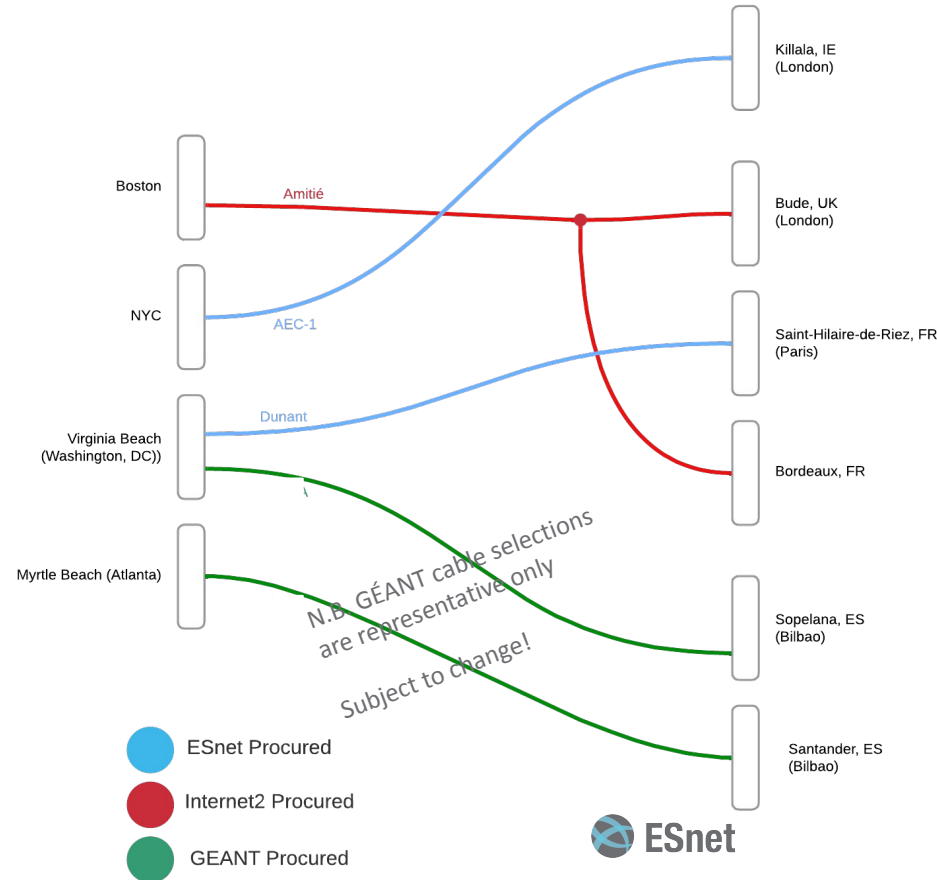
- **Planning 3+ Tbps by end of 2027**

- Capacity & resiliency primarily driven by HL-LHC



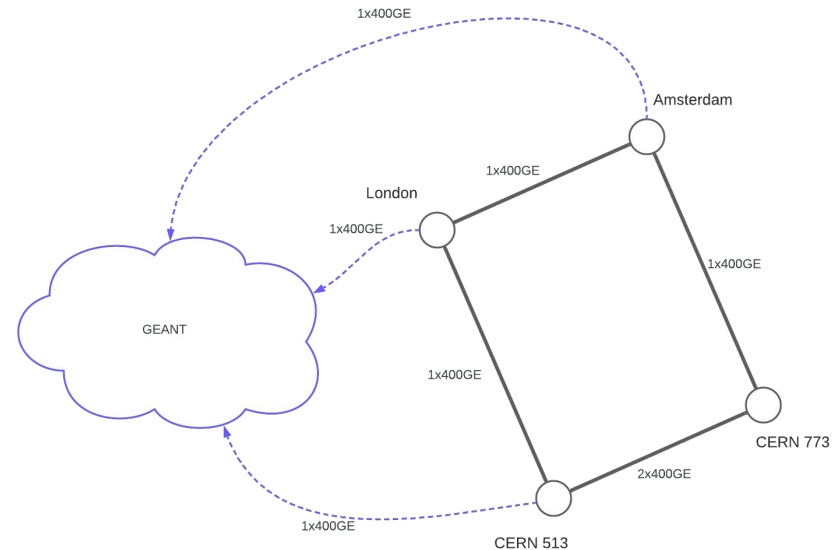
# Future US - Europe Connectivity Plans

- Collaborating with GEANT to share spectrum on subsea
- Plan: collectively acquire optical spectrum across 4+ diverse cables
- ESnet-targeted cables are fixed; still some variability in GEANT plans
- Depending on GEANT's spectrum procurement timelines, we may investigate additional 400GE lit services for interim diversity

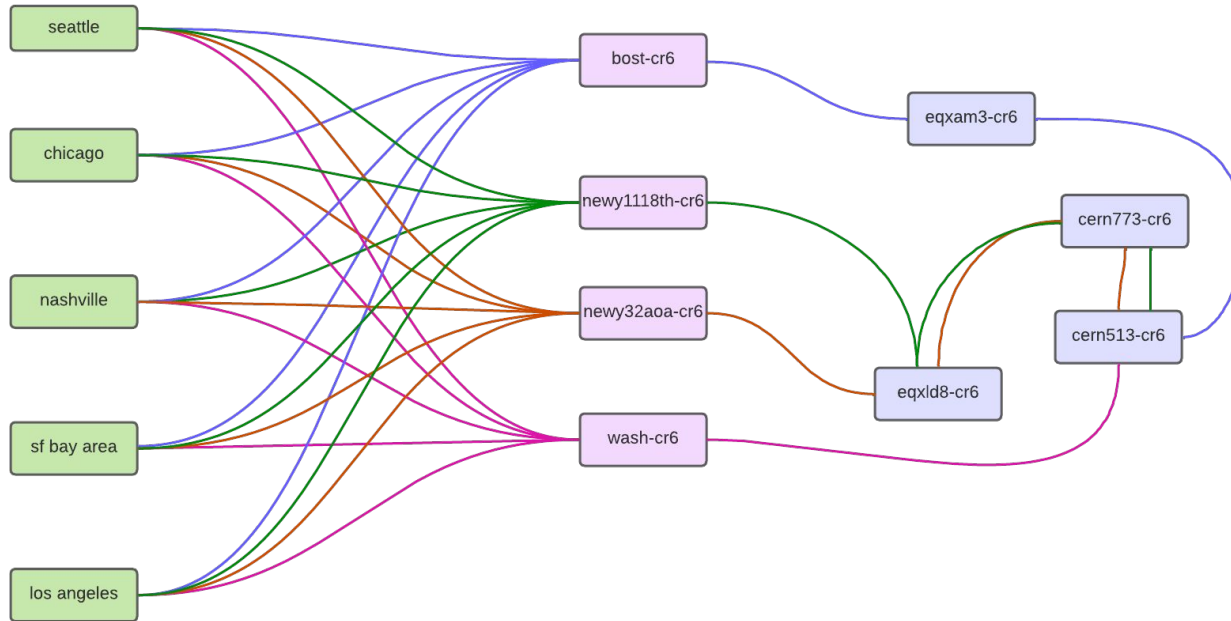


# GEANT Peerings & US-EU Routing

- Typical ESnet R&E routing policy is to "cold-potato" all traffic:
  - accept traffic into ESnet as close to the source as possible (ask peers to "hot-potato" to ESnet)
  - deliver traffic as close to where it is going, keeping it on ESnet for as long as we can
  - Implemented via BGP MED attributes indicating relative costs
- Treat all TA links possible as "internal to ESnet"
- Configured policy on ESnet routers to load-balance traffic to/from Europe *across all available TA paths*
  - Overrides shortest-path routing
  - Up to 6 paths to choose from
  - Can weight some paths heavier than others.



# Trans-Atlantic IGP Traffic Engineering Example



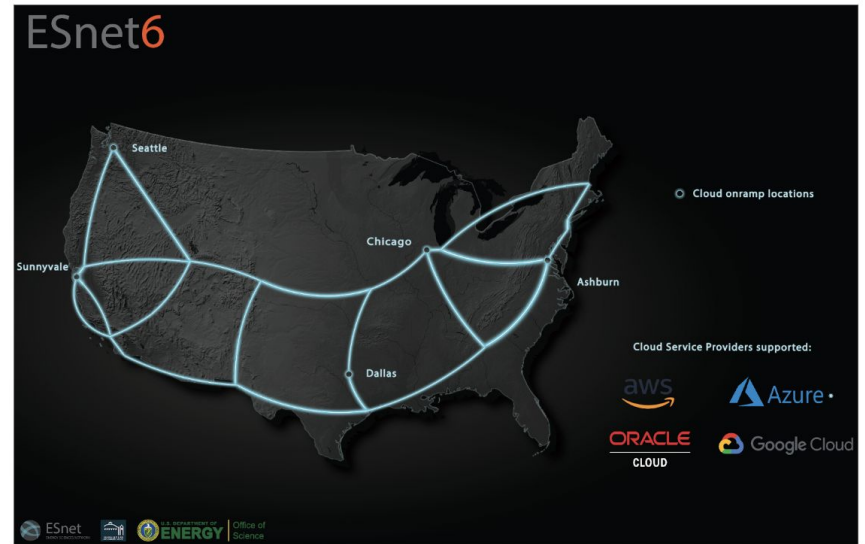
... And many more routers, where  
LHCONE sites connect

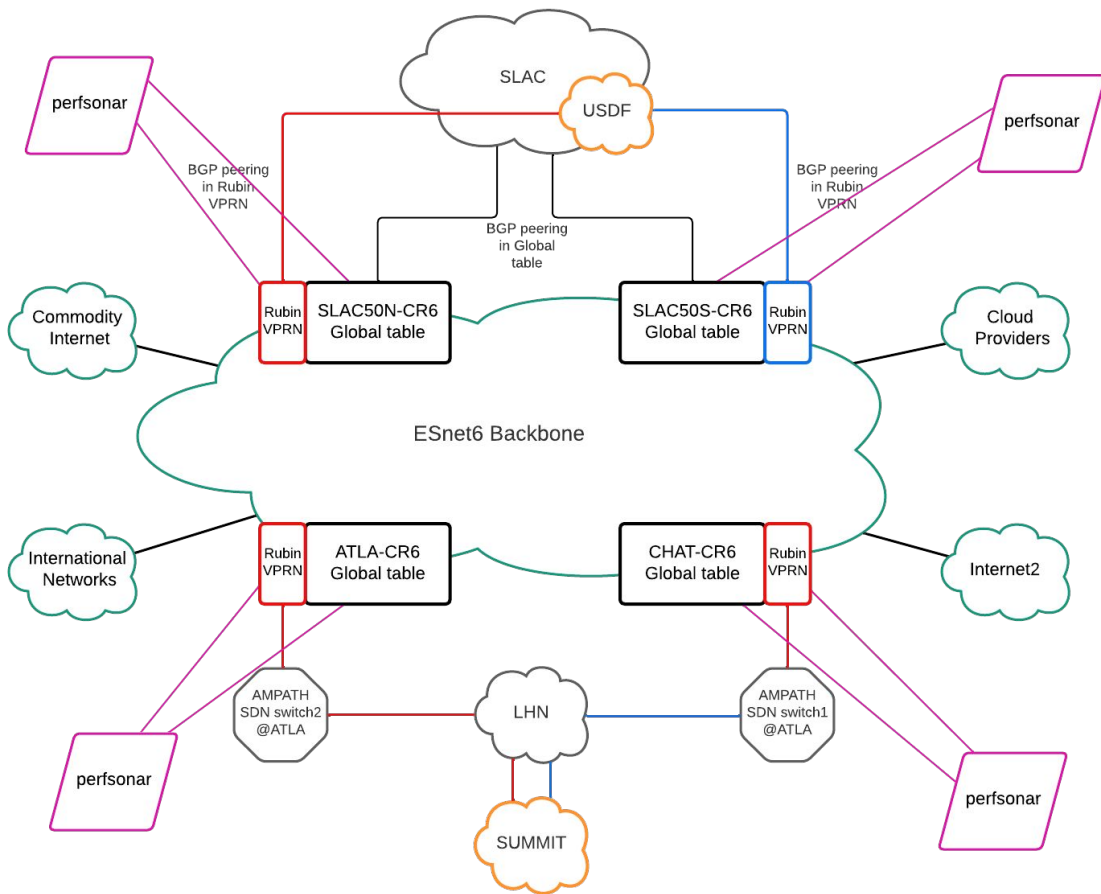
# ESnet Cloud Connect

- via private fiber interconnects
  - 5x100G to Google (one more pending)
  - 3x100G to Oracle
- via fabrics
  - 6x100G to Microsoft
  - 6x100G to Amazon

## Private Cloud Interconnects to nearly any provider

- 5 locations (each 2x100G) to PacketFabric
  - OSCARS connectivity across ESnet
  - possibility for API-based provisioning end-to-end
- 2 locations (each 2x10G) to Equinix Fabric



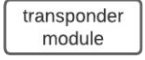




LEGEND



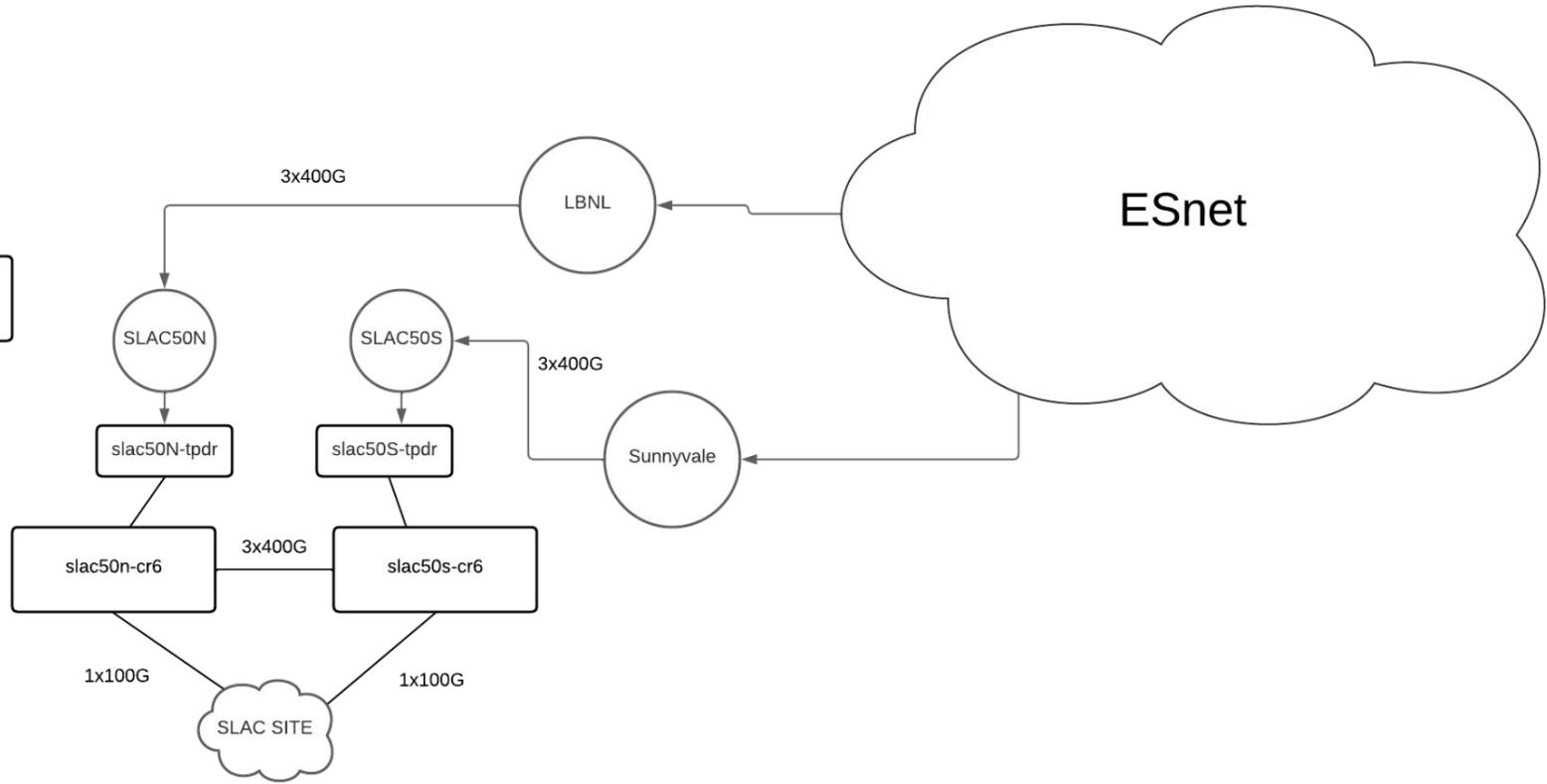
ROADM

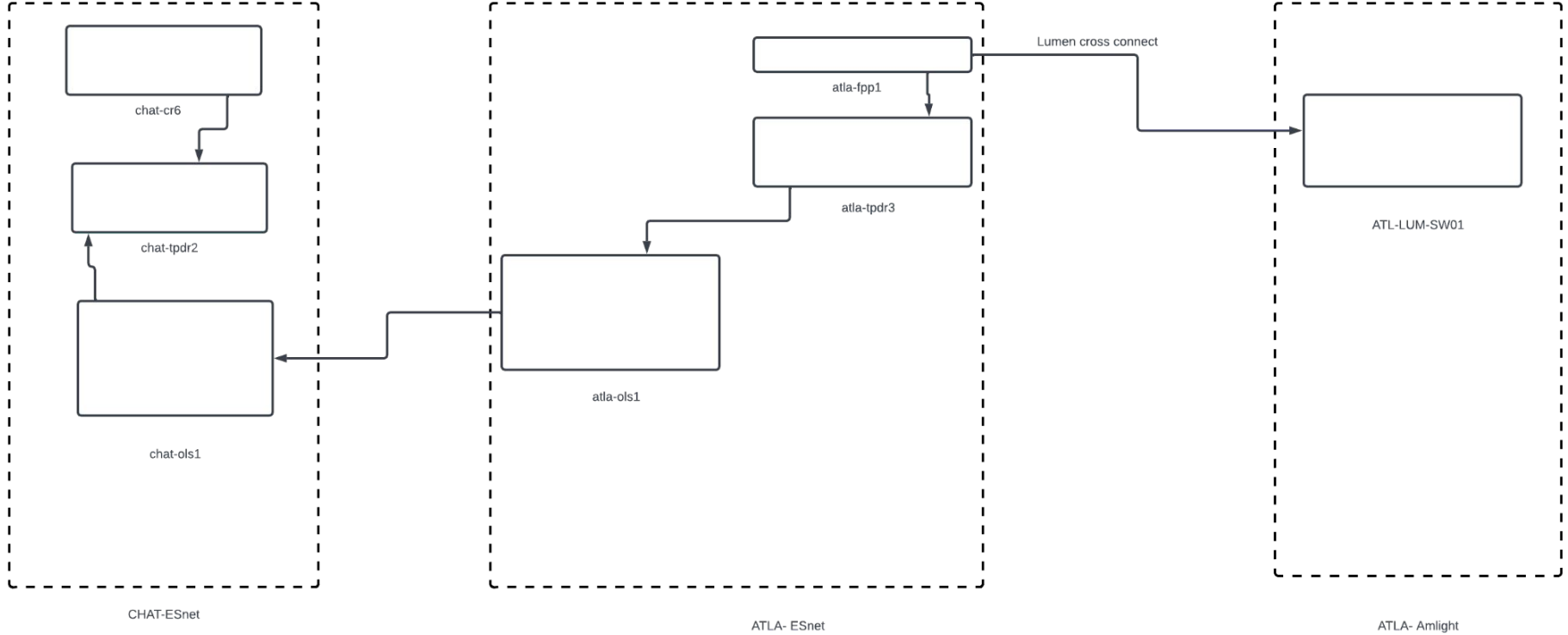


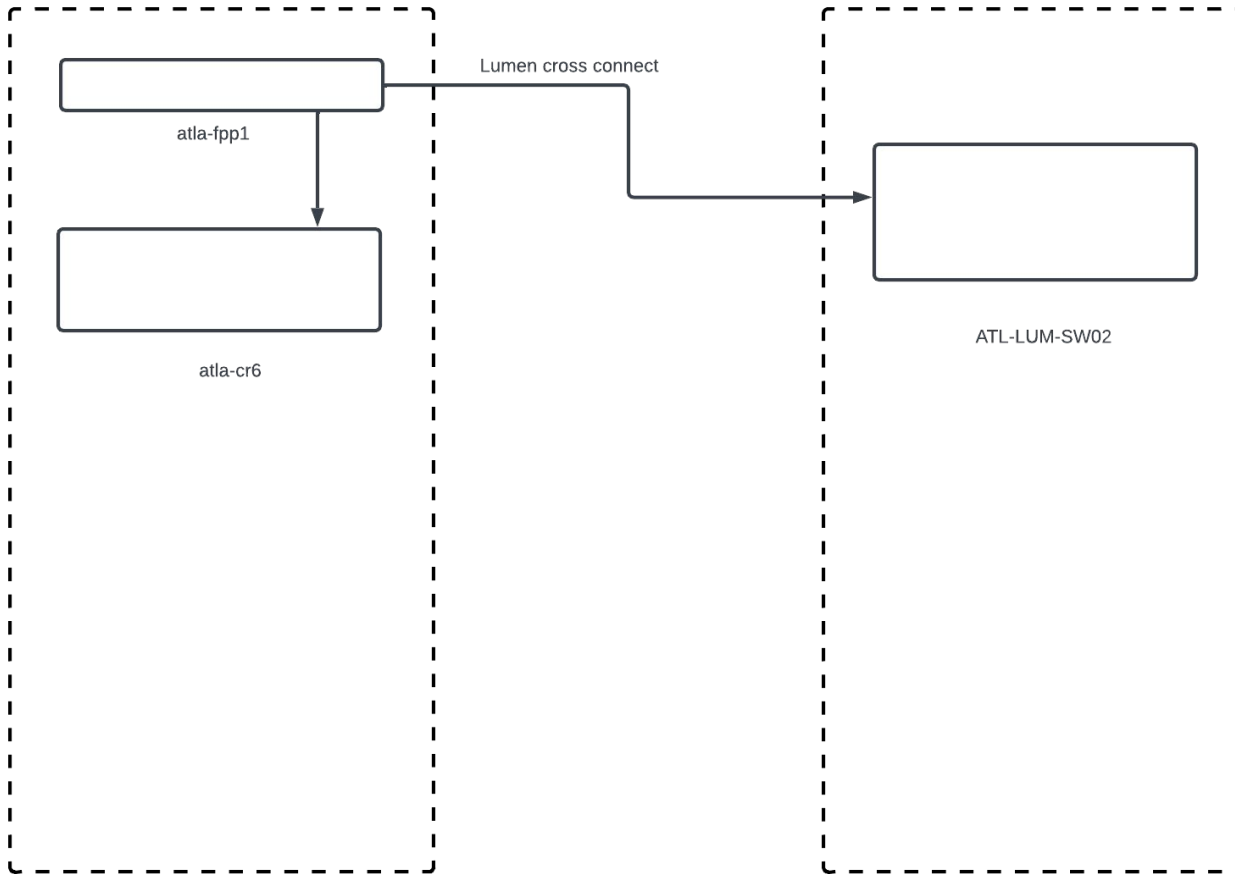
transponder module



Router







ATLA- ESnet

ATLA- Amlight



Questions...

