ANI & ESnet5 Deployment

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History

1. Transport Contract signed in June 2011
   - Dark Fiber
   - Optical Network
2. Router Contract signed in August 2011
   - 10 ALU 7750-SR Routers delivered August through October
3. ANI Phase1 and more up before SC11!
   - 6 100G waves (NERSC-SUNN, SUNN-SALT, SALT-STAR, STAR-ANL, STAR-ORNL, STAR-MANLAN)
   - 8 100G Routers deployed by SC (including 2 in Seattle)
4. SC Cleanup
   - Recovered equipment from SC11
   - Pulled 100G router out of SALT
   - Converted SUNN-SALT & SALT-STAR to SUNN-STAR circuit

Future

Firm Dates

1. National Backbone Dark fiber accepted in Feb 2012 (99.99% done)
2. National Backbone Optical network ready to provision waves in April 2012
3. ESnet5 transition completed, ESnet4 10G backbone circuits on the Level3 Infinera system turned down no later than November 2012

Soft Dates

1. Consolidate ESnet4 IP and SDN routers to make room in racks for 100G routers in some hubs starting in February
2. Cut BAYMAN over to BayExpress in June
3. Recover 100G routers from TestBed at ANL and NERSC for deployment in the hubs by Summer

Outline

- Understanding the Capabilities
  - Assets
  - Services
- Building the networks
  - Dark Fiber Network
  - Optical Transport Network
  - Routed Network

Assets: 3 Separate Networks!

- Dark Fiber Network
  - Long Haul fibers available for experimental uses for the near future
  - Will used for the next generation network once we outgrow the Optical Transport Network.
- Optical Transport Network
  - Lots of capacity
    - Up to 44 100G waves on the backbone
    - Up to 88 100G waves on the Chicago and Bay Express
    - Up to 61 100G waves on the ORNL Express
  - Provides point to point wave services for IP, SDN & Testbed purposes
- 100G Routed network
  - Engineered to support science applications at 100G speeds

Services

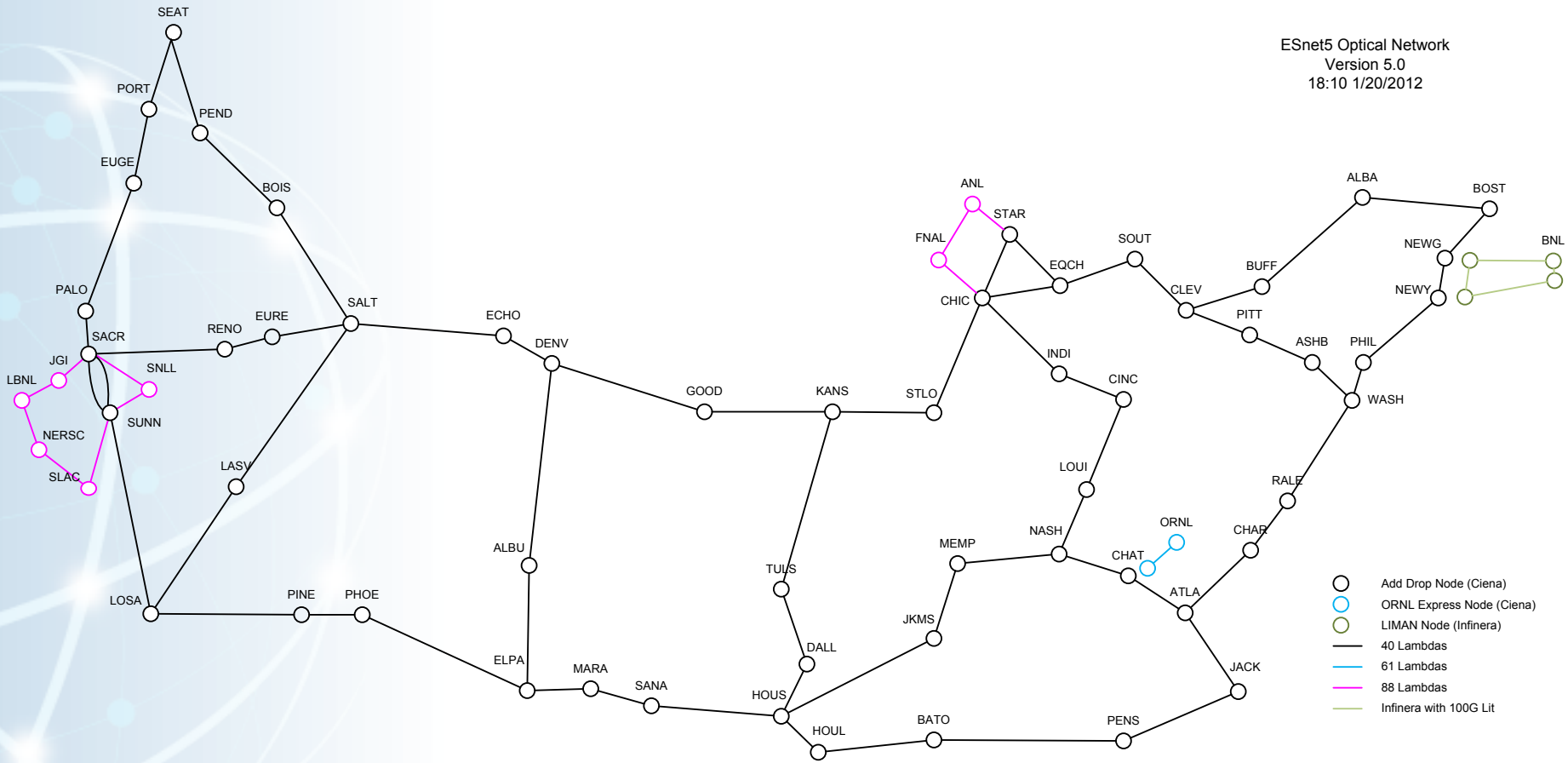
- Routed Network
  - Traditional IP Services
  - Current OSCARS/SDN services and on-demand circuits
    - Minutes to provision, services last minutes to years
- Optical Transport Network
  - Point to Point long-lived circuits
    - Weeks to months to provision, services last until components redeployed
    - Provisioning circuits will require physically deploying transponders
  - Limited SONET like re-routing around failures might be possible in the express networks. Not likely in the WAN due to the regen requirements.
- Dark Fiber Network
  - Provisioning services will require provisioning space & power at end-points, regen and amp huts, installing transport gear, etc. This will take months.

Dark Fiber Network

LBNL Long Haul Dark Fiber Routes
12,924 miles

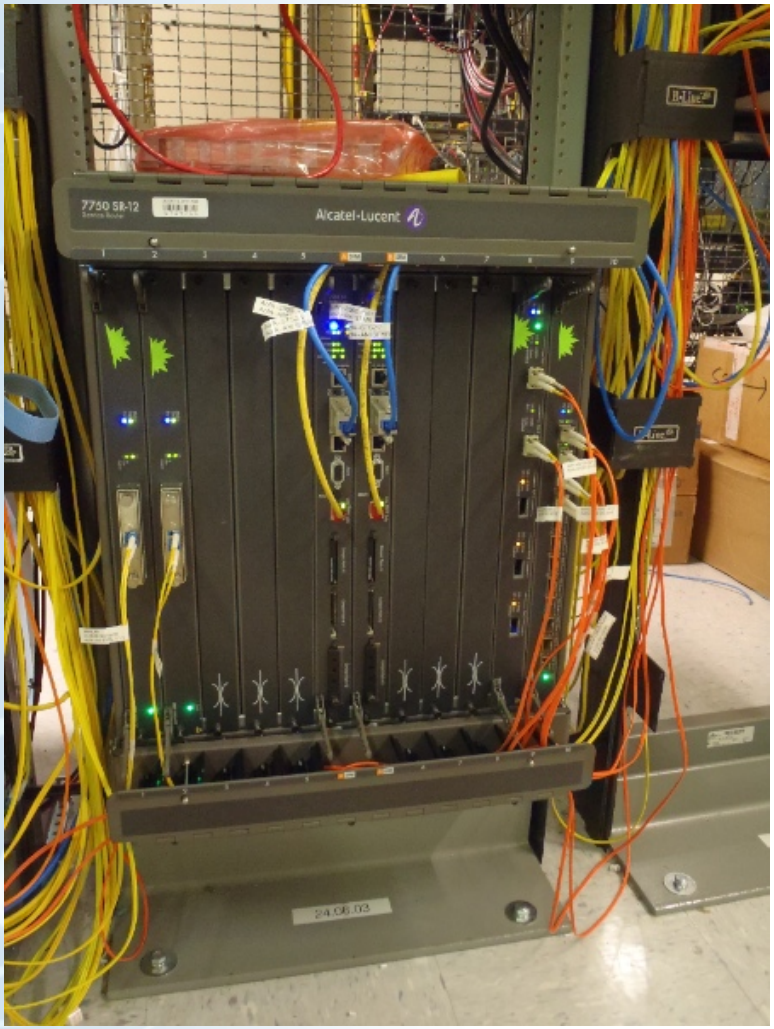
~~BayExpres Metro Fibers: 432 miles~~
~~ChiExpress Metro Fibers: 167 miles~~
NYExpress Metro Fibers: 6 miles

Optical Network



Optical Network Status

Routed network: Built with ALU 7750-SR



12 slot Router

- 2 Switch Fabric Module slots
  - Combined Switch Fabric, and routing engine
- 10 line card slots
  - Supports interface speeds from T1 to 100GE.

Cards that we have

- SFM-4
- 1x100GE
- 12x10GE (2 port oversubscribed)
- 5x10GE

100G Client Side Optics

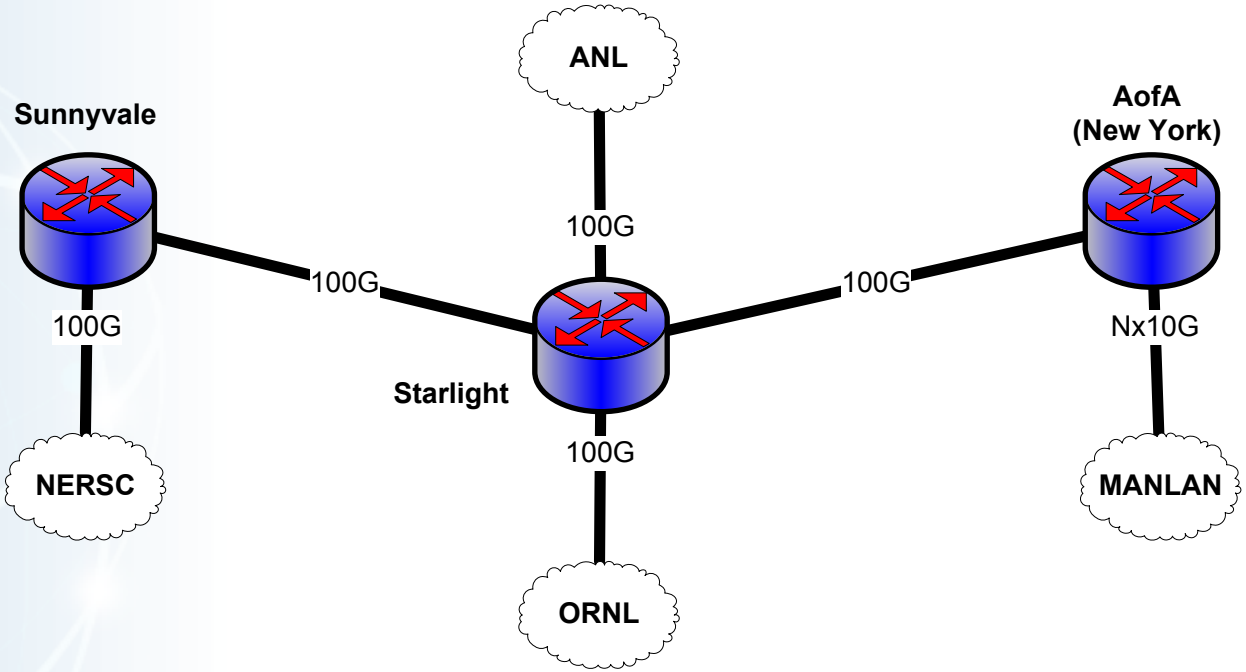
There are 2 real options right now: IEEE Standard: LR-4, and Industry Standard 10x10 MSA (Sometimes called LR-10) www.10x10msa.org

We have standardized on the 10x10 MSA as implemented by Santur (now Neophotonics) PD100-TXLED 10 Km CFPs for our network.

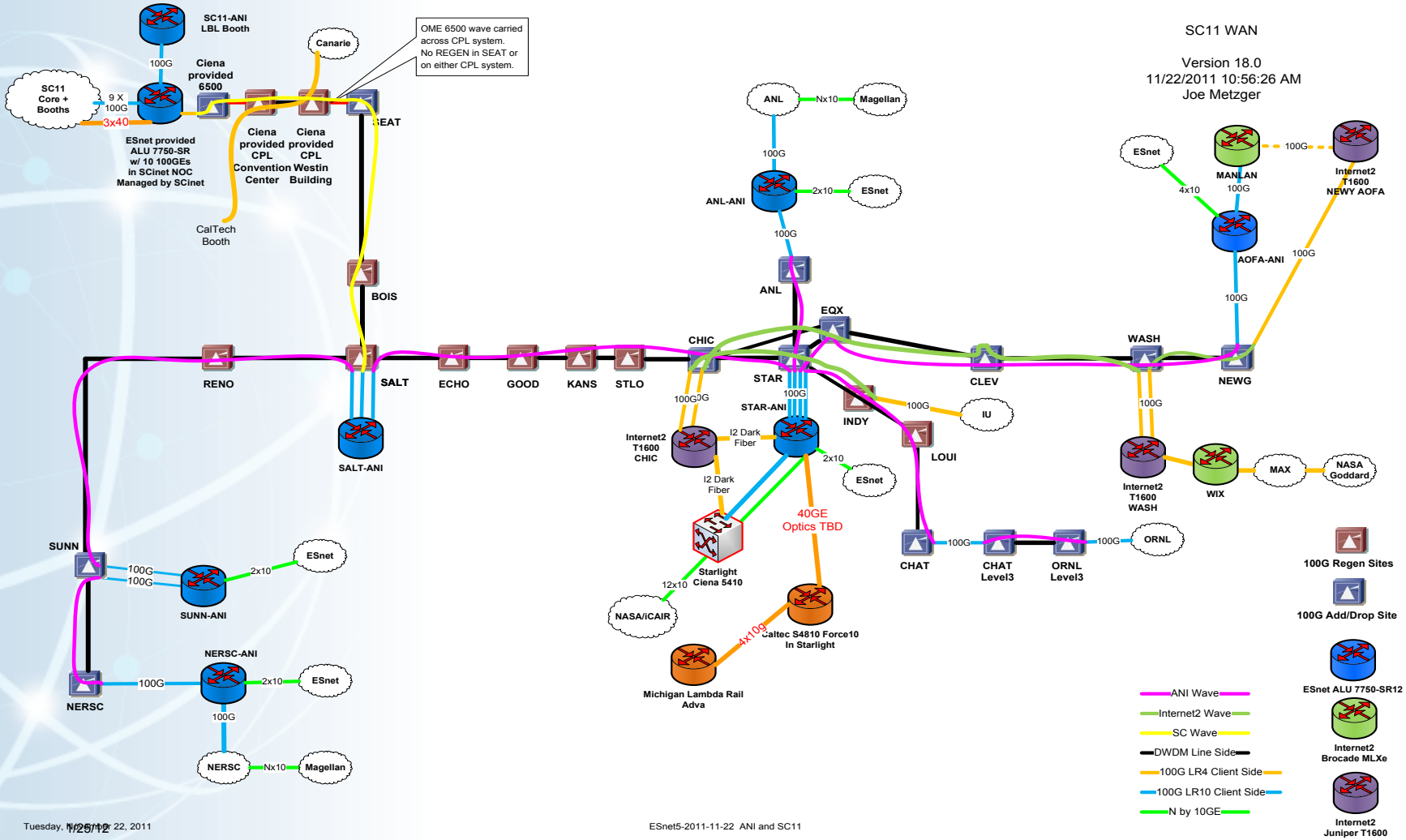
We have demonstrated interoperability between:

- Ciena 6500s
- ALU 7750's
- Brocade
- Juniper MX

ANI Phase 1
(Absolute minimum to meet base milestones.)



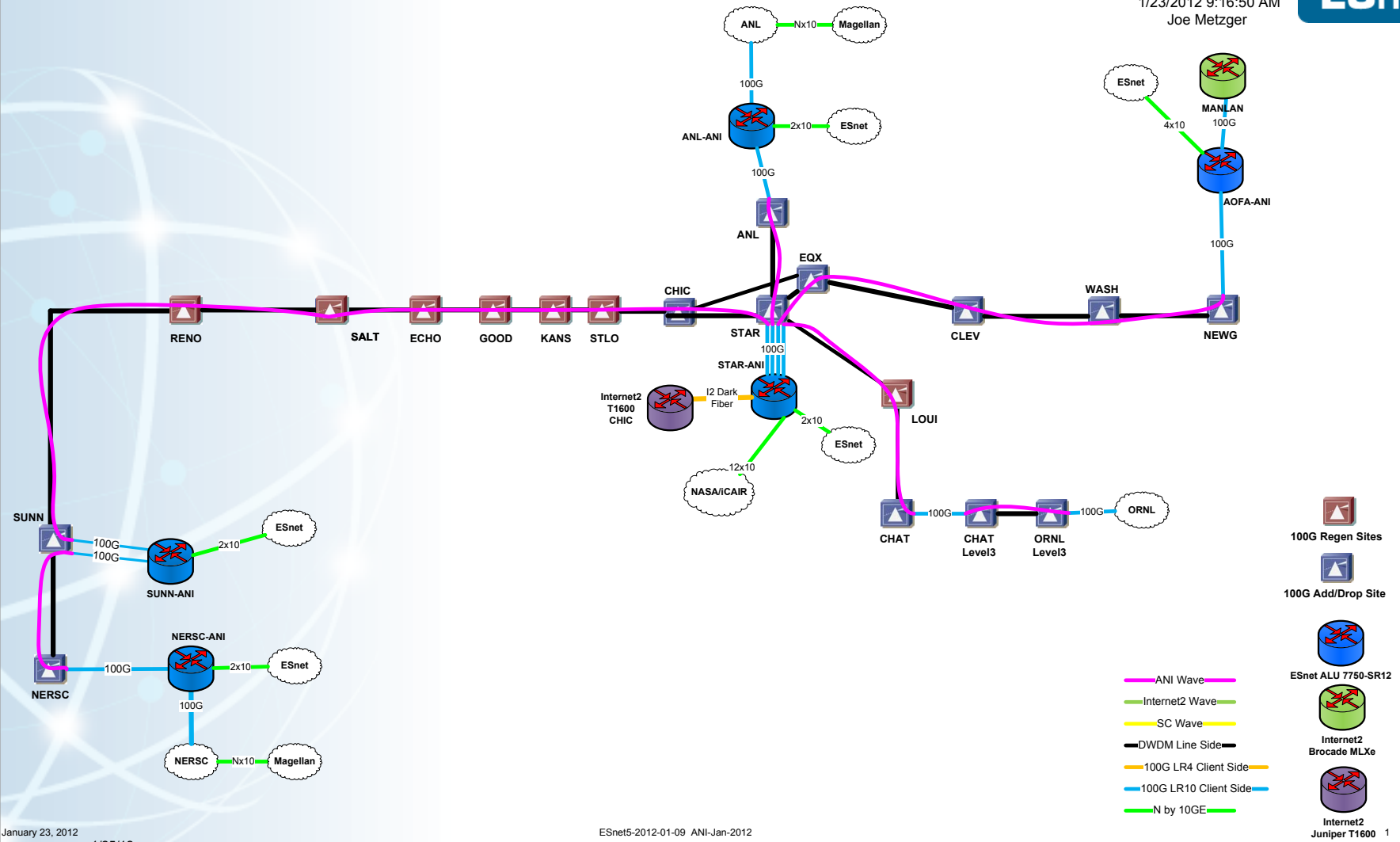
SC11 100G Network including ANI



ANI Network January 2012

Jan 2012 ANI Network

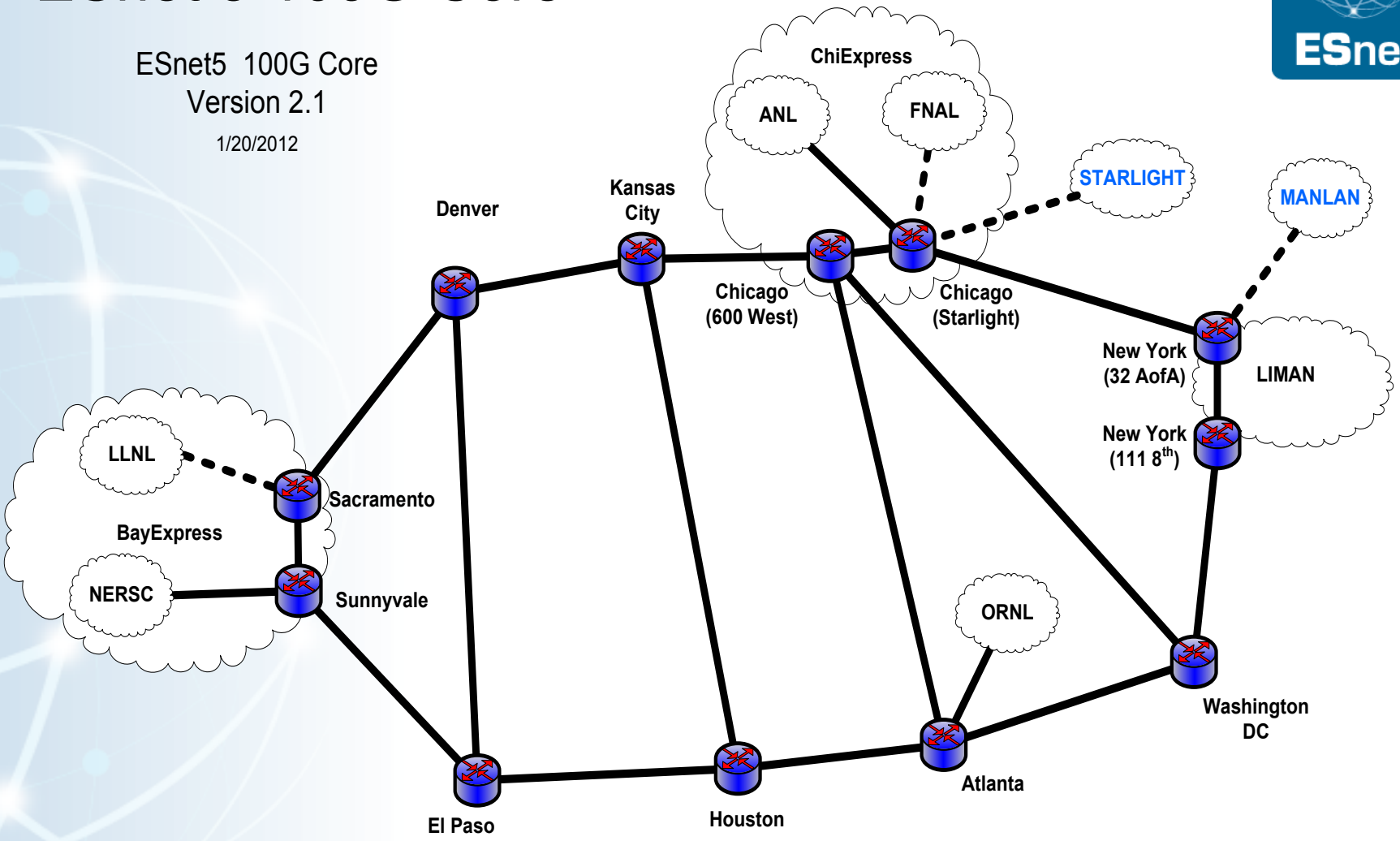
Version 18.0
1/23/2012 9:16:50 AM
Joe Metzger



ESnet 5 100G Core

ESnet5 100G Core
Version 2.1

1/20/2012



ESnet5

Key Design Aspects

- 100G core
- Fewer routers
- Dual connections to metro rings

Some of the open questions:

- Hardware Availability Dates
- Seattle: Do we do 100G up to Seattle now?
- Albuquerque, Boston, Boise: nx10G vs breaking out 100G wave
- Las Vegas: How does having a new optical node in a different location in Vegas affect our current hub in the Switch Nap facility?
- Budget