StarLight International/National Communications Exchange Facility And ESnet6

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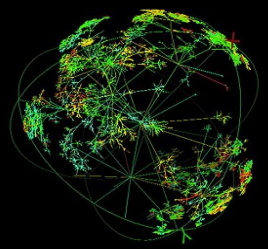
Americas Research Platform Workshop 2022
Co-located With IEEE International Conference On eScience
Salt Lake City, Utah
Oct 11, 2022

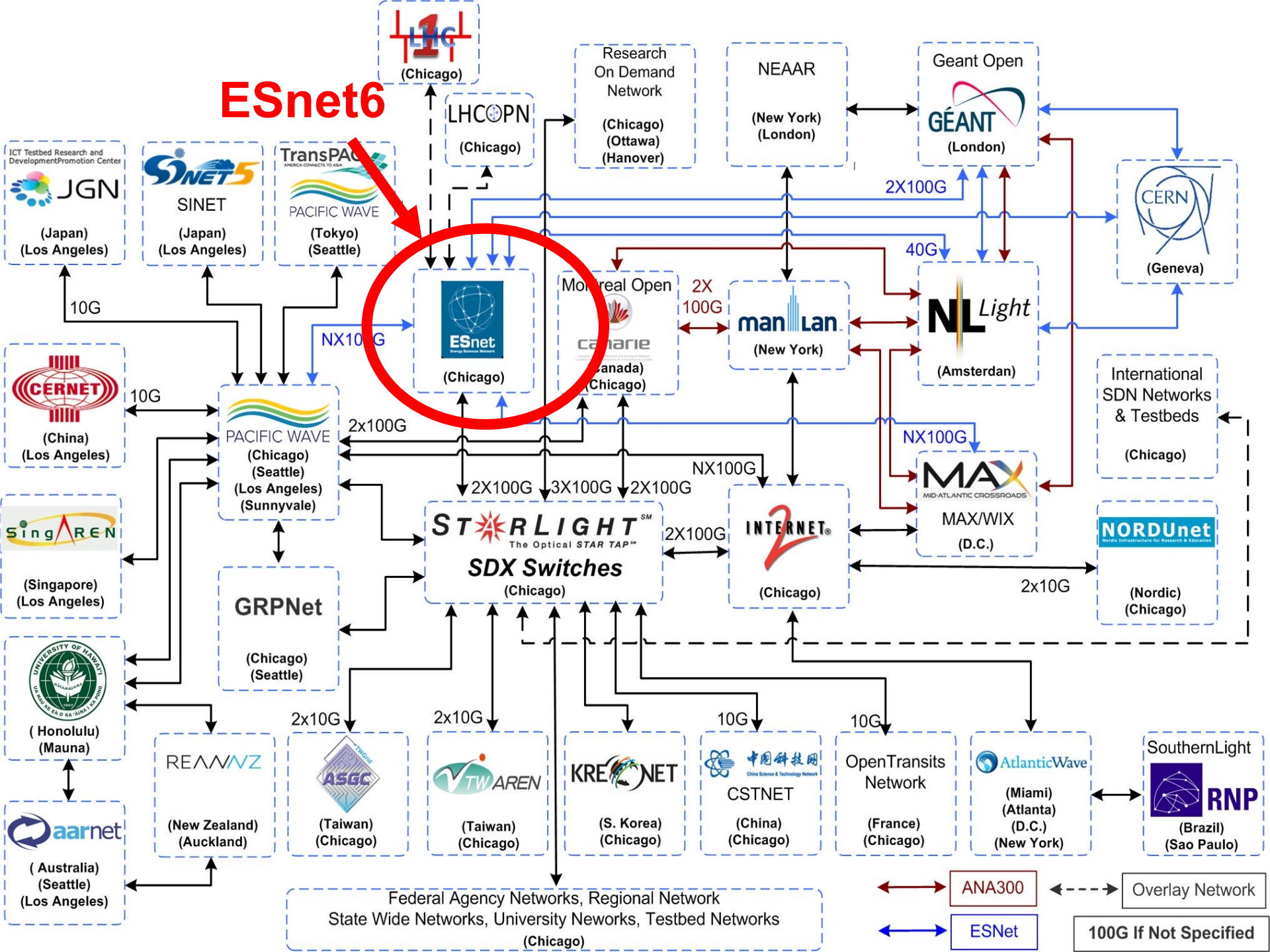


iCAIR

STARLIGHT SDX

StarLight And ESnet6

- For Almost Two Years, the StarLight Consortium Worked With the ESnet Organization On Plans for And Implementation Of ESnet6
- The Implementation Has Been Completed And This Success Is Being Celebrated This Week
- ESnet6 Is a Key Resource For Large Scale Global Science


ESnet6
LHC
(Chicago)
LHCOPN
(Chicago)
Research On Demand Network
(Chicago)
(Ottawa)
(Hanover)
NEAAR
(New York)
(London)
Geant Open
GÉANT
(London)
CERN
(Geneva)
ICT Testbed Research and DevelopmentPromotion Center
JGN
(Japan)
(Los Angeles)
SINET
(Japan)
(Los Angeles)
TransPAC
PACIFIC WAVE
(Tokyo)
(Seattle)
2X100G
40G
10G
NX100G
ESnet
(Chicago)
Montreal Open
canarie
(Canada)
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2X
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(New York)
NL Light
(Amsterdan)
CERNET
(China)
(Los Angeles)
10G
PACIFIC WAVE
(Chicago)
(Seattle)
(Los Angeles)
(Sunnyvale)
2x100G
International SDN Networks & Testbeds
(Chicago)
NX100G
2X100G
3X100G
2X100G
NX100G
MAX
MID-ATLANTIC CROSSROADS
MAX/WIX
(D.C.)
SingAREN
(Singapore)
(Los Angeles)
STARLIGHT
The Optical STAR TAP
SDX Switches
(Chicago)
2X100G
INTERNET2
(Chicago)
2x10G
NORDUnet
(Nordic)
(Chicago)
GRPNet
(Chicago)
(Seattle)
(Honolulu)
(Mauna)
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REANNZ
(New Zealand)
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ASGC
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TWAREN
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KREONET
(S. Korea)
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CSTNET
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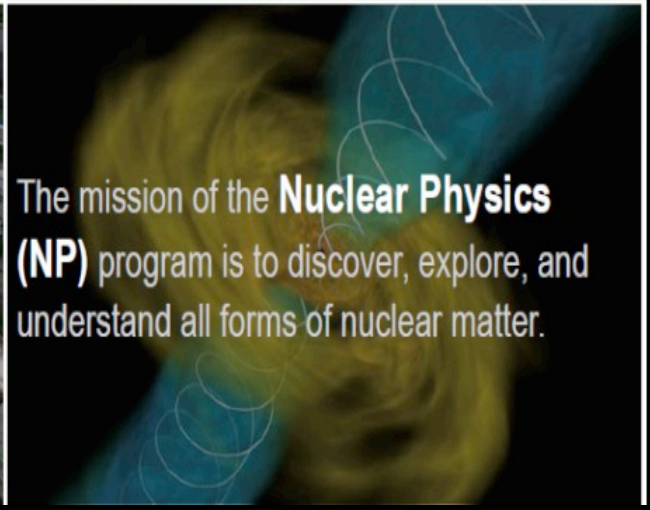
(Chicago)
OpenTransits Network
(France)
(Chicago)
AtlanticWave
(Miami)
(Atlanta)
(D.C.)
(New York)
SouthernLight
RNP
(Brazil)
(Sao Paulo)
aarnet
(Australia)
(Seattle)
(Los Angeles)
Federal Agency Networks, Regional Network
State Wide Networks, University Neworks, Testbed Networks
(Chicago)
ANA300
Overlay Network
ESNet
100G If Not Specified

DOE Office of Science - Largest supporter of basic research in the physical sciences in the US



Source: Chin Guok, ESnet

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DOE Office of Science - Uniquely positioned for large scale collaborative science*

*DOE Office of Science facilities also support other collaborations, e.g., LHC, LSST, etc

Source: Chin Guok, ESnet

Preparation for High-Luminosity LHC (2027)

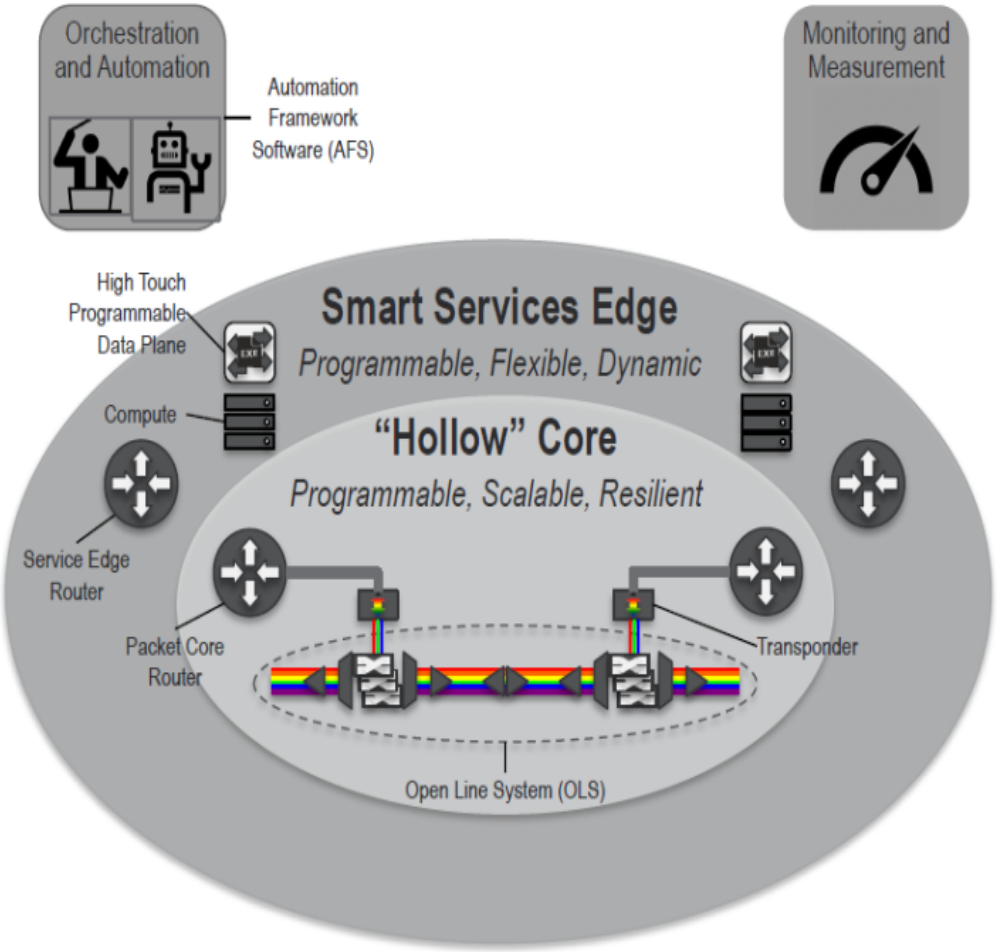
- Current projections:
  - 400G connectivity needed per T2
    - recall there are numerous T2's in the US for ATLAS and CMS, served through regional exchanges
  - Needs likely driven by storage, w/ tradeoffs on placement.
    - ~5-12 PB typical now, possibly 20-40 PB per site in 2027
  - on-network caches?

- *Data Challenges (full software stack)*
  - *10% of the target 2021* *# should match Run 3*
  - *30% in 2023* *# 2x100 per Tier2?*
  - *60% in 2025* *# probably want 400G per Tier2*
  - *100% in 2027* *# 400G or more per Tier2*

ESnet

ESnet6 Architecture

Enabling Network Services Innovation



ESnet6 Software Components

Assurance
- Fault management
- Root cause analysis
- Incident management

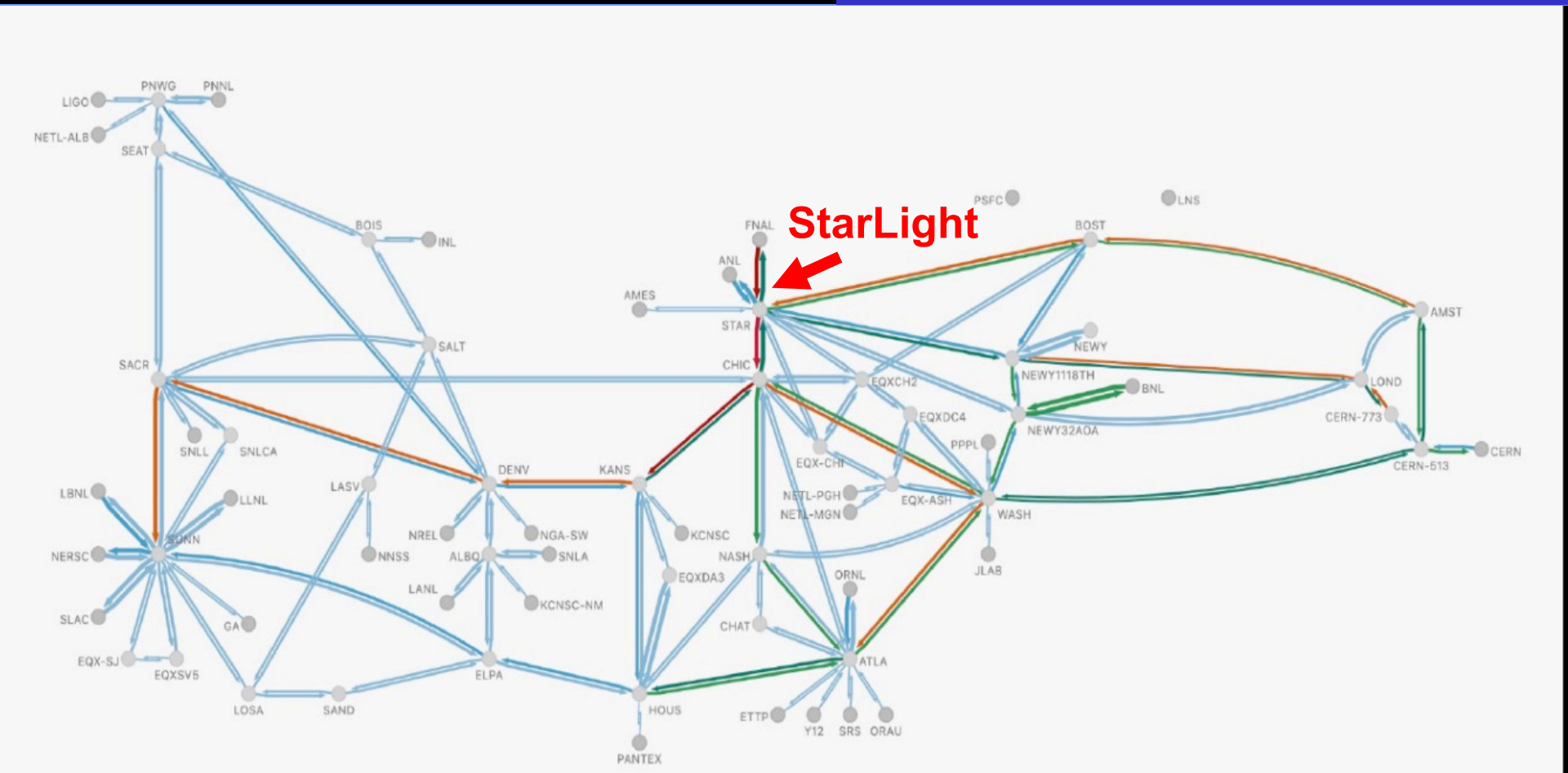
Provisioning
- Workflow orchestration
- Automated provisioning

Security
- Audit logging
- Black hole routing
- IP prefix monitoring

Analytics
- Time series data
- Streaming telemetry
- High touch telemetry
- Traffic planning

Unified Data Model
- Intent
- Discovery
- Topology

Metro, Regional, National, International Networking



https://my.es.net

ESnet

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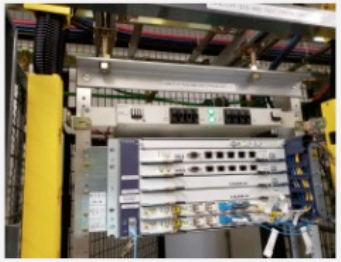
Phase 1 - Done!

15,000+ Miles of Fiber

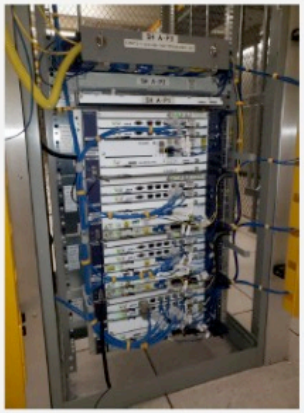
300+ Colo Facilities

Infinera Flex-ILS Optical System

272 Amplifiers



37 ROADMS



Layer

Assurance | Provisioning

Security | Analytics

Data Model

Snet5 Mgmt Net

Phase 1 Transponders

Open Line System

ESnet Fiber | ANL Fiber

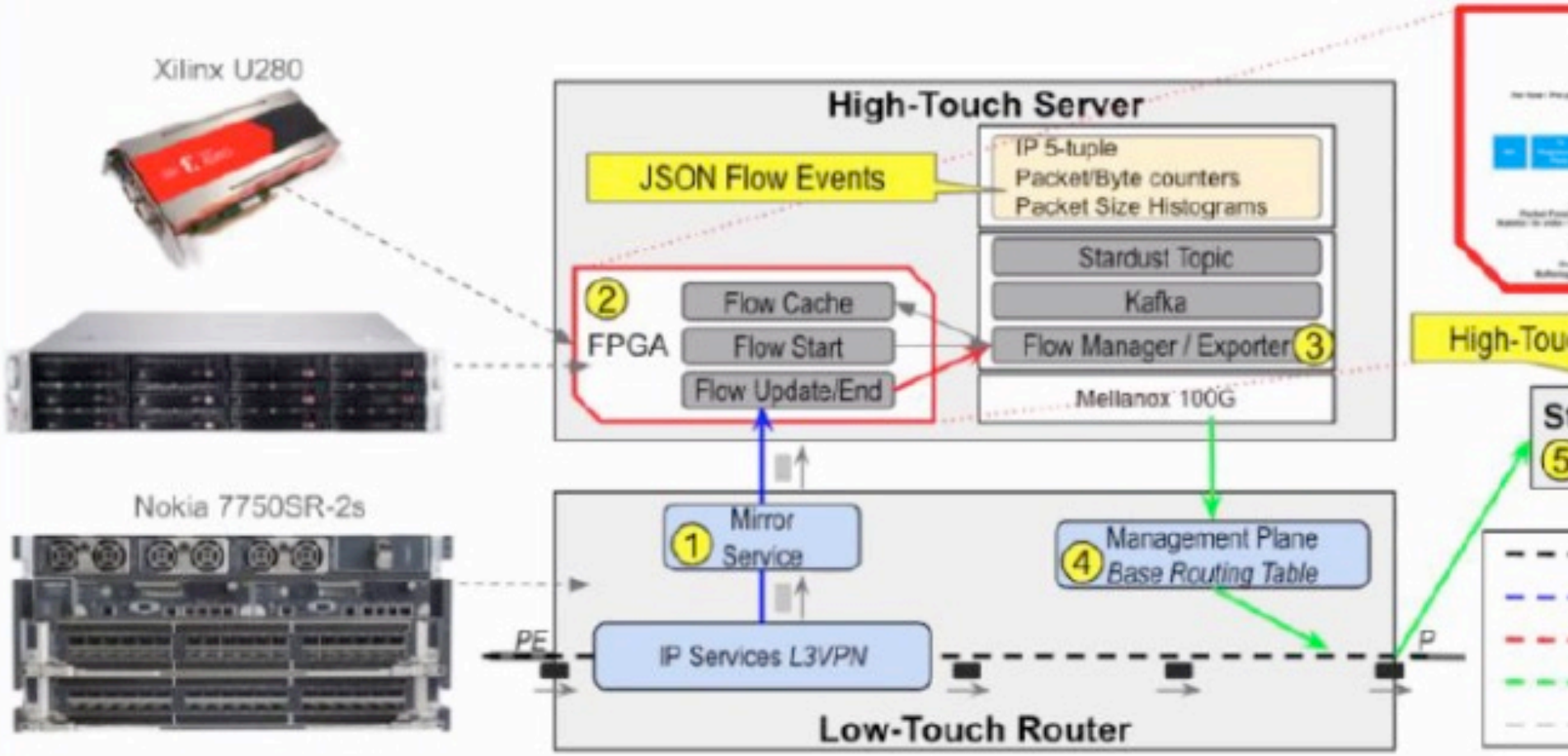
ESnet Colo | ESnet6 Mgr

72 Groove Transponders

Source: Dale Carter

ESnet6 High-Touch Platform - Unprecedented Packe

Source: Chin Guok

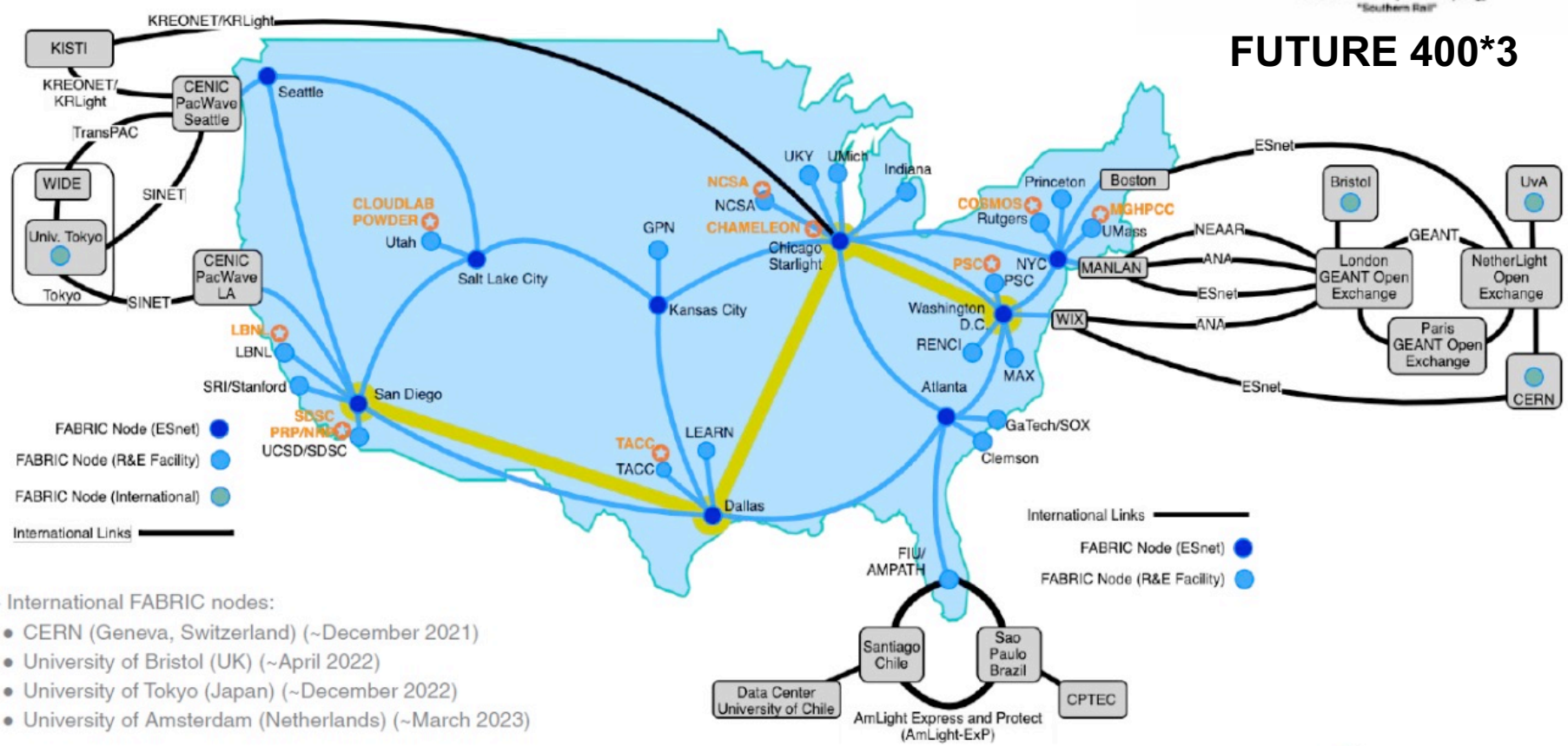


1. Mirror Service - Allows selective flows in the dataplane to be duplicated, truncated and sent to the FPGA for proc
2. Programmable Dataplane (DP) - Every packet updates internal counters/flow state. Only flow start/end packets
3. Flow Exporter - Processes flow start/end events to update the Dataplane flow cache. Periodically collects flow s into Kafka.
4. Management Plane Base Routing Table - Provides connectivity to Remote Servers.
5. Stardust Logstash - Subscribes to Hightouch Kafka Topic for Stardust and consumes flow event records, insertin

FABRIC And FAB

FUTURE 400*3

FAB (FABRIC Across Borders)



4 International FABRIC nodes:

- CERN (Geneva, Switzerland) (~December 2021)
- University of Bristol (UK) (~April 2022)
- University of Tokyo (Japan) (~December 2022)
- University of Amsterdam (Netherlands) (~March 2023)

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