Global Research Platform & SC20 NRE Demonstrations And Experiments

Joe Mambretti, Director, (j-mambretti@northwestern.edu)
International Center for Advanced Internet Research (www.icair.org)
Northwestern University
Director, Metropolitan Research and Education Network (www.mren.org)
Co-Director, StarLight (www.startap.net/starlight), Director, StarLight International/National Communications Exchange Facility (www.startap.net/starlight),
PI IRNC: RXP: StarLight SDX, Co-PI Chameleon, PI-iGENI, PI-OMNINet

XNET Forum, Nov 13, 2020
International Conference On High Performance Computing Networking, Storage and Analytics
November 9-20, 2020

iCAIR

ST★RLIGHTSDX

Next Generation Distributed Enviroment For Global Science

GLOBAL RESEARCH PLATFORM

STARLIGHT℠

Global Research Platform (GRP)

- The Global Research Platform (GRP) Is An International Scientific Collaboration

- This Initiative Is Creating A Distributed Environment For Data Intensive Science

- The GRP Provides Advanced Ubiquitous Services That Integrate Resources Around the Globe At Light Speed (100 Gbps Or Faster)

- GRP Facilitates High-Performance Data Gathering, Analytics, Transport, Computing, and Storage.

- Ref www.theglobalresearchplatform.net

Selected Applications

GENI
www.geni.net

Open Storage Network
www.openstorage network.org

OSG
www.openscience grid.org

Polar Geospatial Center
www.pgc.umn.edu

LSST
www.lsst.org

ISS
www.nasa.gov/ station

Virgo
www.virgo-gw.eu

LHC
home.cern/science/ accelerators/large- hadron-collider

GLEON
www.gleon.org

OSiRIS
www.osris.org

GRP
theglobalresearch platform.net/

IceCube
icecube.wisc.edu

Pierre Auger Observatory
www.auger.org

SKA
www.skatelescope. org

LIGO
www.ligo.caltech. edu

LHCONE
twiki.cern.ch/twiki/bin /view/LHCONE/ WebHome

XSEDE
www.xsede.org

PRP
pacificresearch platform.org

Chameleon
www.chameleon cloud.org

Belle II
www.belle2.org

XENON
xenon.astro. columbia.edu

SDSS
www.sdss.org

USGS EROS
www.usgs.gov/ centers/eros

Blue Waters
bluewaters.ncsa. illinois.edu

Jetstream
www.jetstream- cloud.org

LHCOPN
twiki.cern.ch/twiki/bin /view/LHCOPN/ WebHome

PRAGMA
www.pragma- grid.net

CHASE-CI
www.calit2.net/ newsroom/artic le.php?id=2910

NEON
www.neonscience. org

CENTRA
www.global centra.org

SAGE2
sage2.sagecommons. org

Genomic Science Program
genomicscience. energy.gov

LBNF/DUNE/ ProtoDUNE
lbnf.fnal.gov

NOvA
novaexperiment. fnal.gov

ALMA
www.alma observatory.org

IVOA
www.ivoa.net

Compilation by Maxine Brown and Joe Mambretti

STARLIGHT

GRP: Services, Architecture, Technology

- Architecture: "Global Science DMZ"
- Services Optimized For Science Workflows
- High Performance Transport Over WANs For Large Capacity Data Streams E2E
- Enhanced Virtualization
- Highly Programmable
- Specialized Components (Software Stacks, Next Gen DTNs, Advanced APIs, Customized Devices, Federation, INT, P4, etc.)
- Interdomain Dynamic Provisioning
- Production Resources Adjacent to Testbeds

STARLIGHT™

Positioning And Integrating Building Blocks

Global Research Platform: Global Lambda Integrated Facility Available Advanced Network Resources

Visualization courtesy of Bob Patterson, NCSA; data compilation by Maxine Brown, UIC.
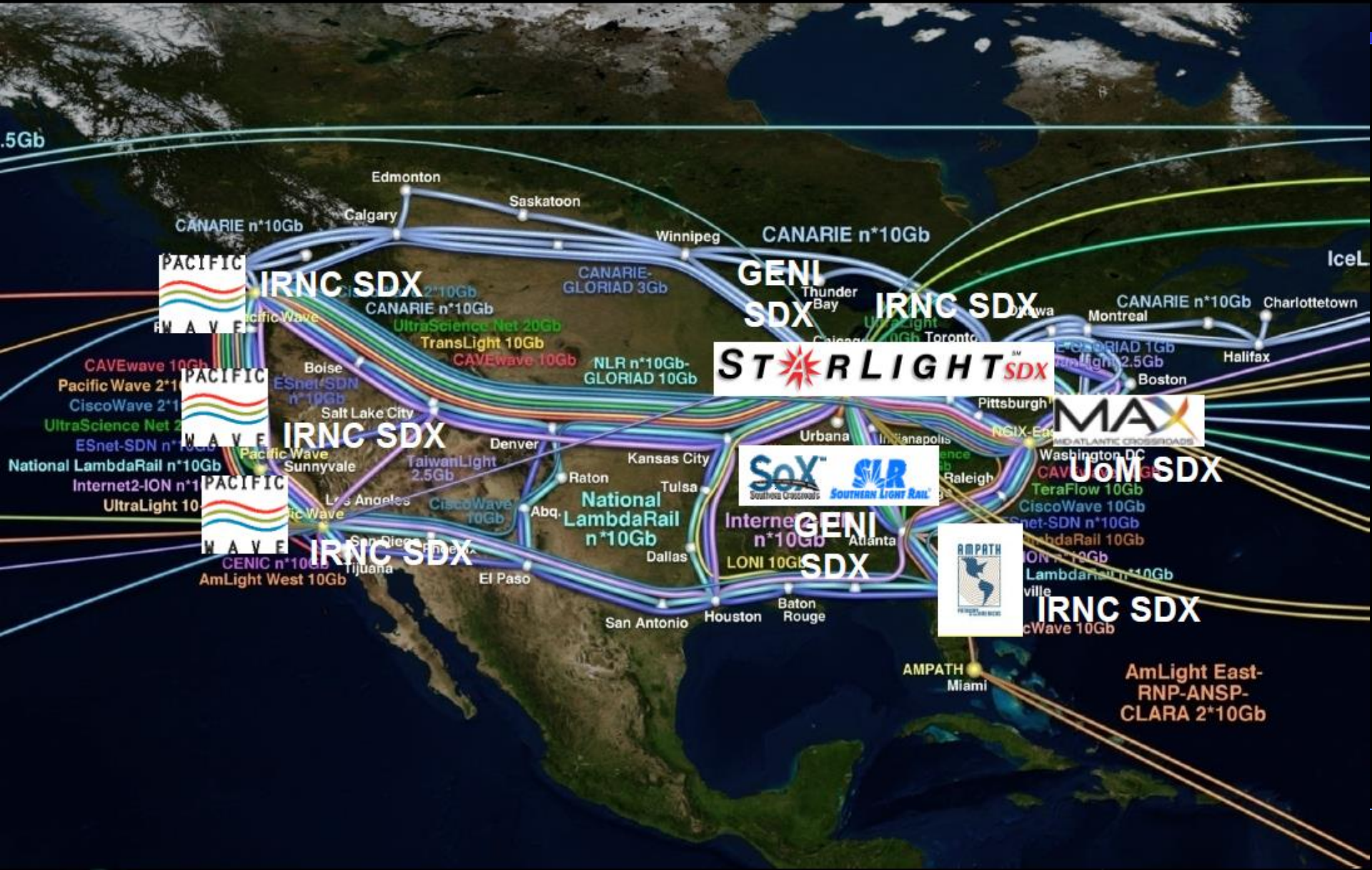
iCAIR

www.glif.is

STARLIGHT℠

AutoGOLE Fabric 2020

Emerging US SDX Interoperable Fabric

StarLight – "By Researchers For Researchers"

StarLight: Experimental Optical Infrastructure/**Proving Ground For Next Gen Network Services**
Optimized for High Performance Data Intensive Science
Multiple 100 Gbps **(60+** Paths)
StarWave
100 G Exchange
World's Most Advanced Exchange
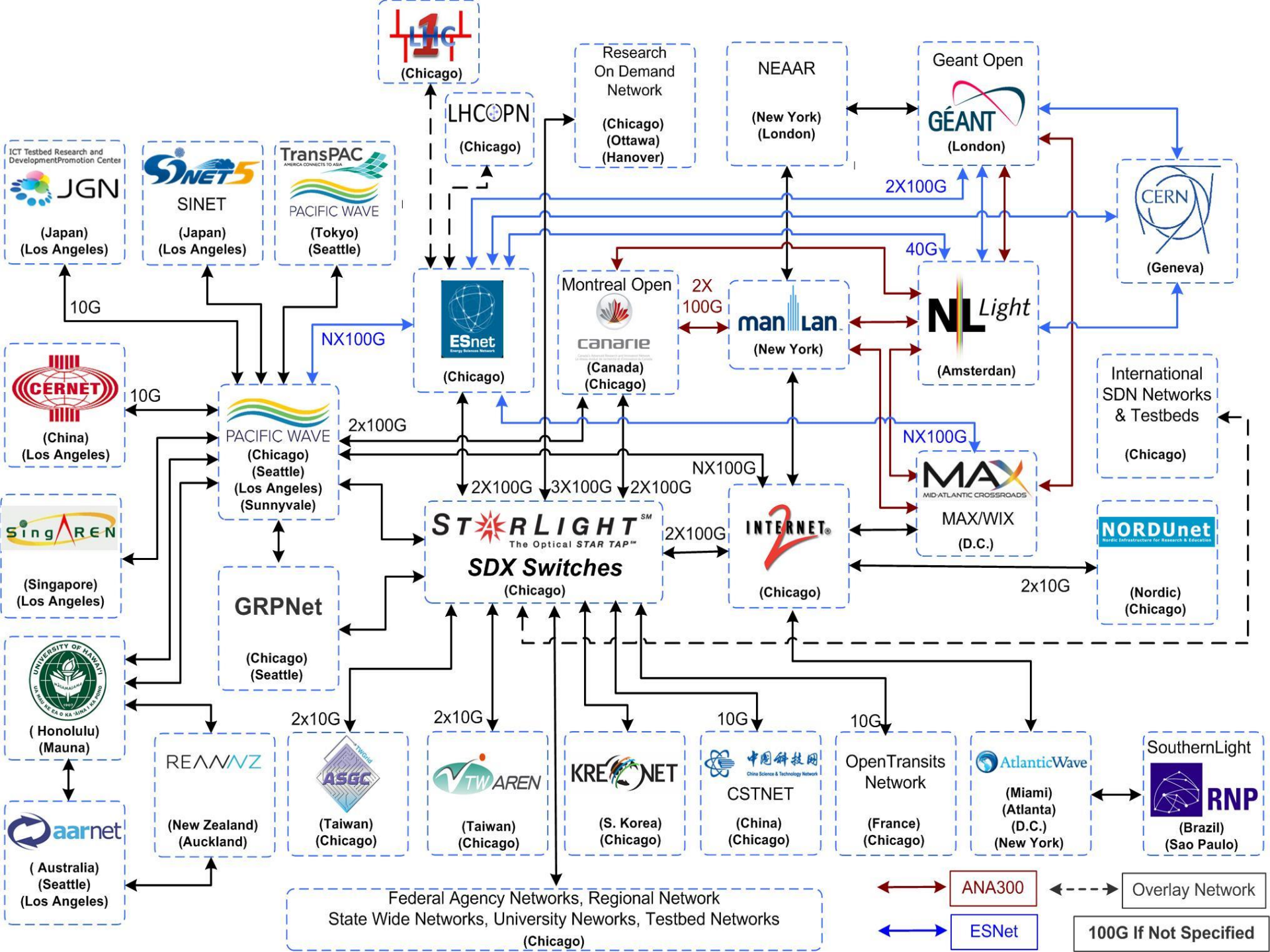Multiple First of a Kind
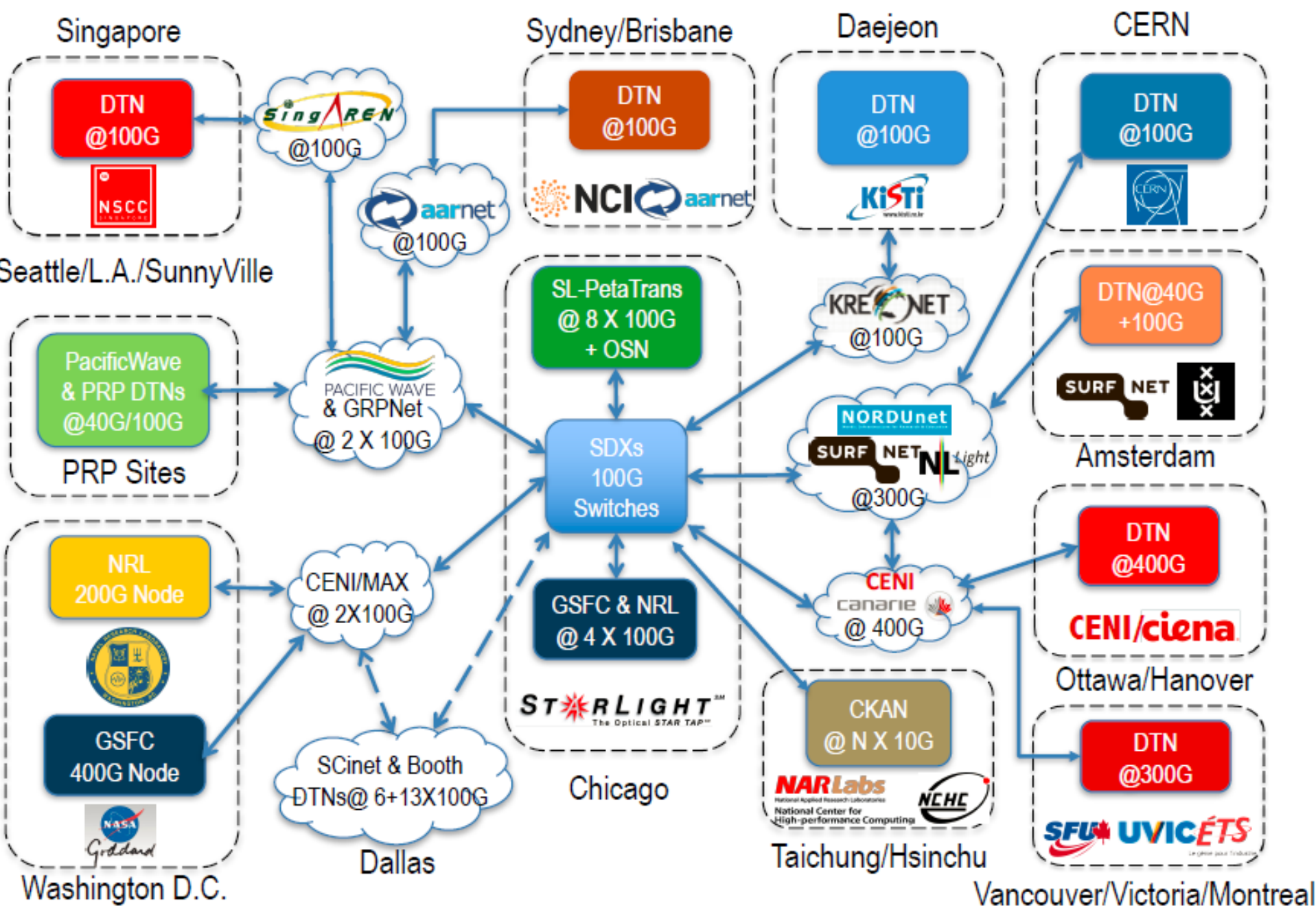Services and Capabilities

View from StarLight

Abbott Hall, Northwestern University's Chicago Campus

iCAIR

ST★RLIGHT℠

LHC
(Chicago)

Research On Demand Network
(Chicago)
(Ottawa)
(Hanover)

NEAAR
(New York)
(London)

Geant Open
GÉANT
(London)

LHCOPN
(Chicago)

CERN
(Geneva)

ICT Testbed Research and Development Promotion Center
JGN
(Japan)
(Los Angeles)

SINET5
SINET
(Japan)
(Los Angeles)

TransPAC
AMERICA CONNECTS TO ASIA
PACIFIC WAVE
(Tokyo)
(Seattle)

ESnet
Energy Sciences Network
(Chicago)

NX100G

Montreal Open
canarie
(Canada)
(Chicago)

2X 100G

man LAN
(New York)

2X100G

NL Light
(Amsterdam)

40G

2X100G

International SDN Networks & Testbeds
(Chicago)

CERNET
(China)
(Los Angeles)

10G

PACIFIC WAVE
(Chicago)
(Seattle)
(Los Angeles)
(Sunnyvale)

2x100G

SingAREN
(Singapore)
(Los Angeles)

GRPNet
(Chicago)
(Seattle)

STARLIGHT
The Optical STAR TAP
SDX Switches
(Chicago)

2X100G   3X100G   2X100G

NX100G

NX100G

MAX
MID-ATLANTIC CROSSROADS
MAX/WIX
(D.C.)

INTERNET2
(Chicago)

2X100G

2x10G

NORDUnet
Nordic Infrastructure for Research and Education
(Nordic)
(Chicago)

UNIVERSITY OF HAWAII
(Honolulu)
(Mauna)

REANNZ
(New Zealand)
(Auckland)

2x10G

ASGC
(Taiwan)
(Chicago)

2x10G

TWAREN
(Taiwan)
(Chicago)

KRE NET
(S. Korea)
(Chicago)

10G

中国科技网
China Science & Technology Network
CSTNET
(China)
(Chicago)

10G

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

PetaTrans: Petascale Sciences Data Transfer

JOINT BIG DATA TESTBED
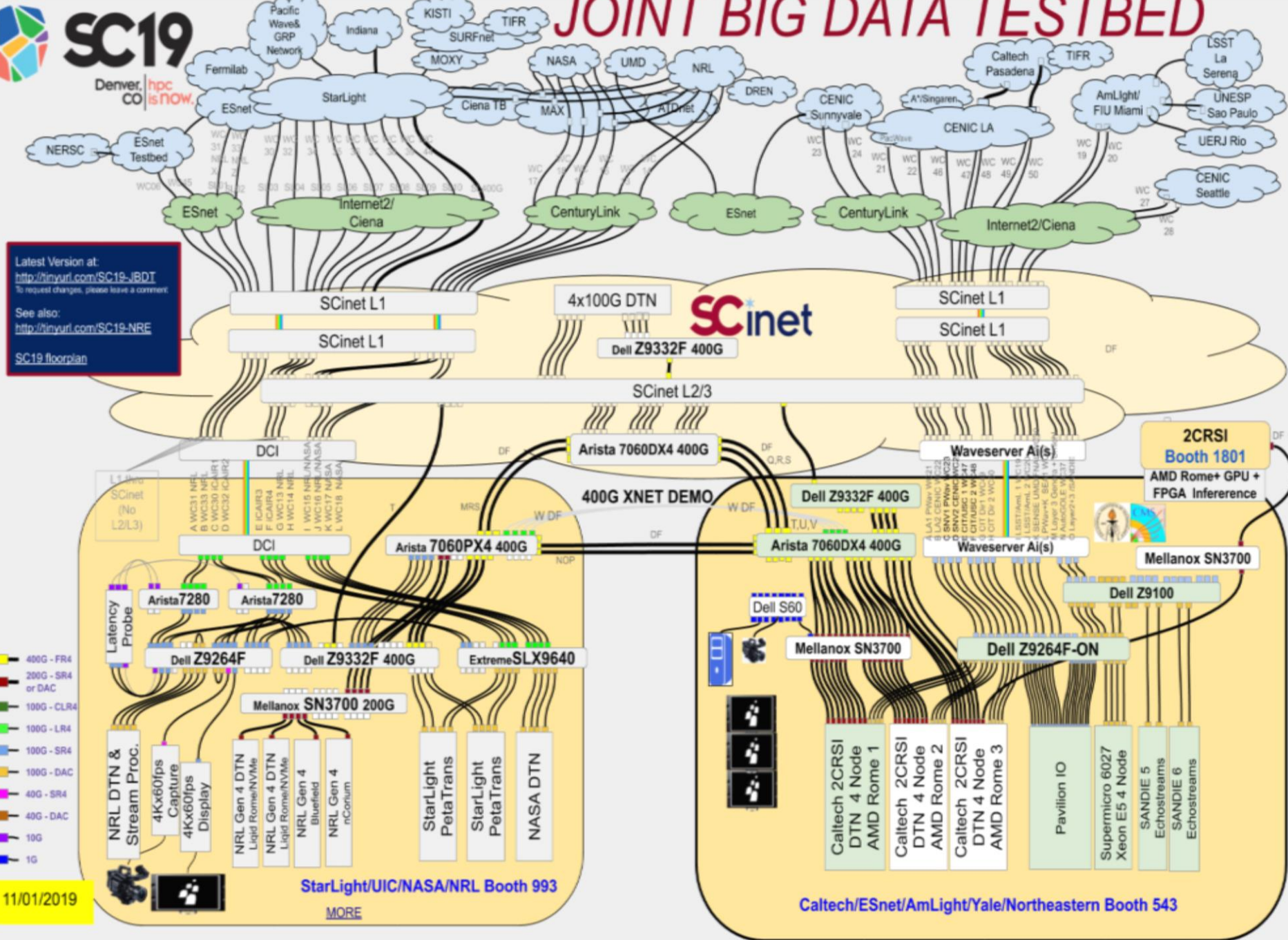
CENI NRE Map for SC20

List of NREs:

NRE NRL B
SL-3
SL-4
SL-5
SL-7
SL-9
NRE-12
SL-8

200G
100G
2x 150G
100G
100G
100G
2x100G

NRE09-GRP Service: DTNaaS for Petascale Sciences Data Transfer
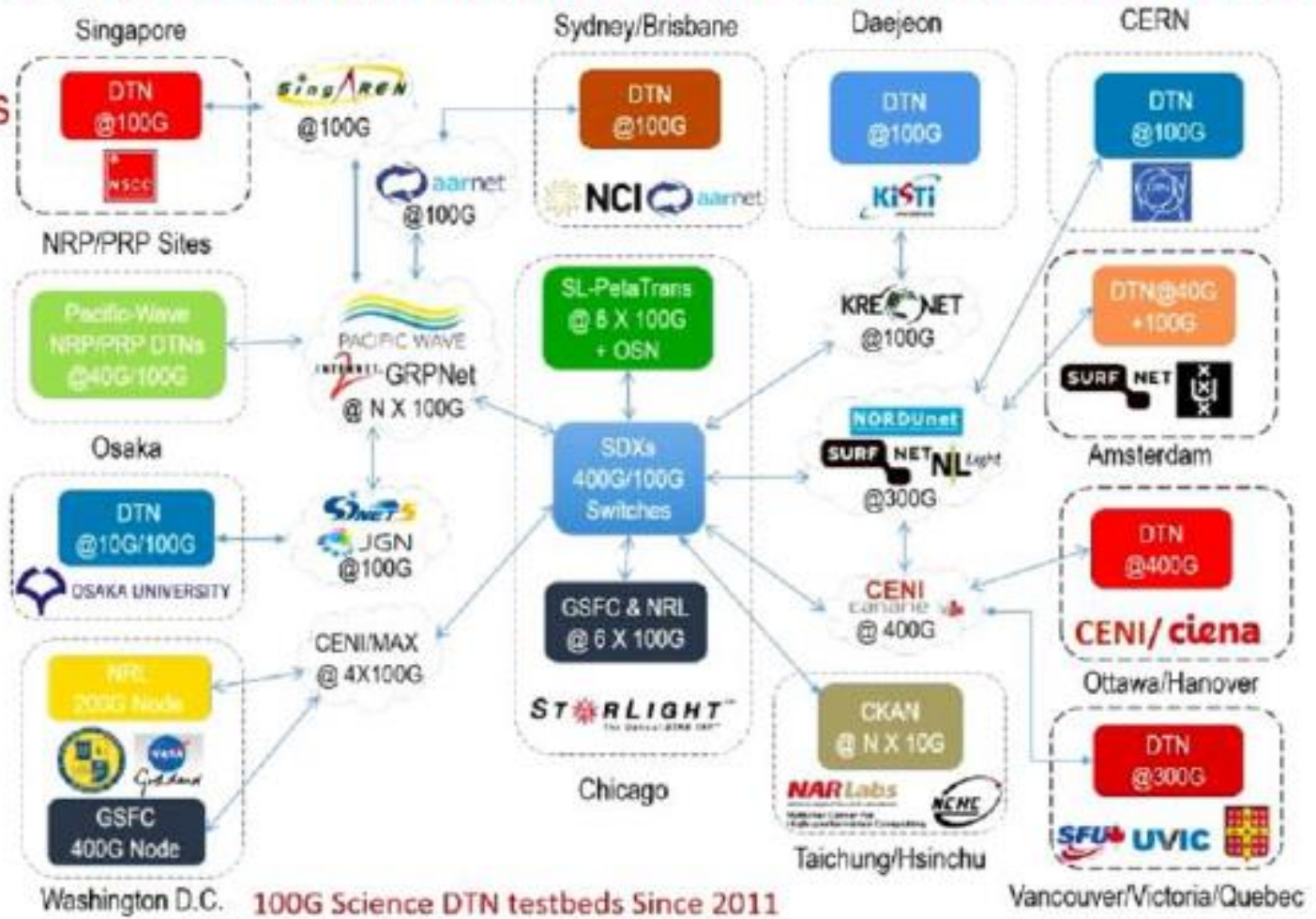
Source: Jim Chen, iCAIR

StarLight SDX DTN-as-a-Service
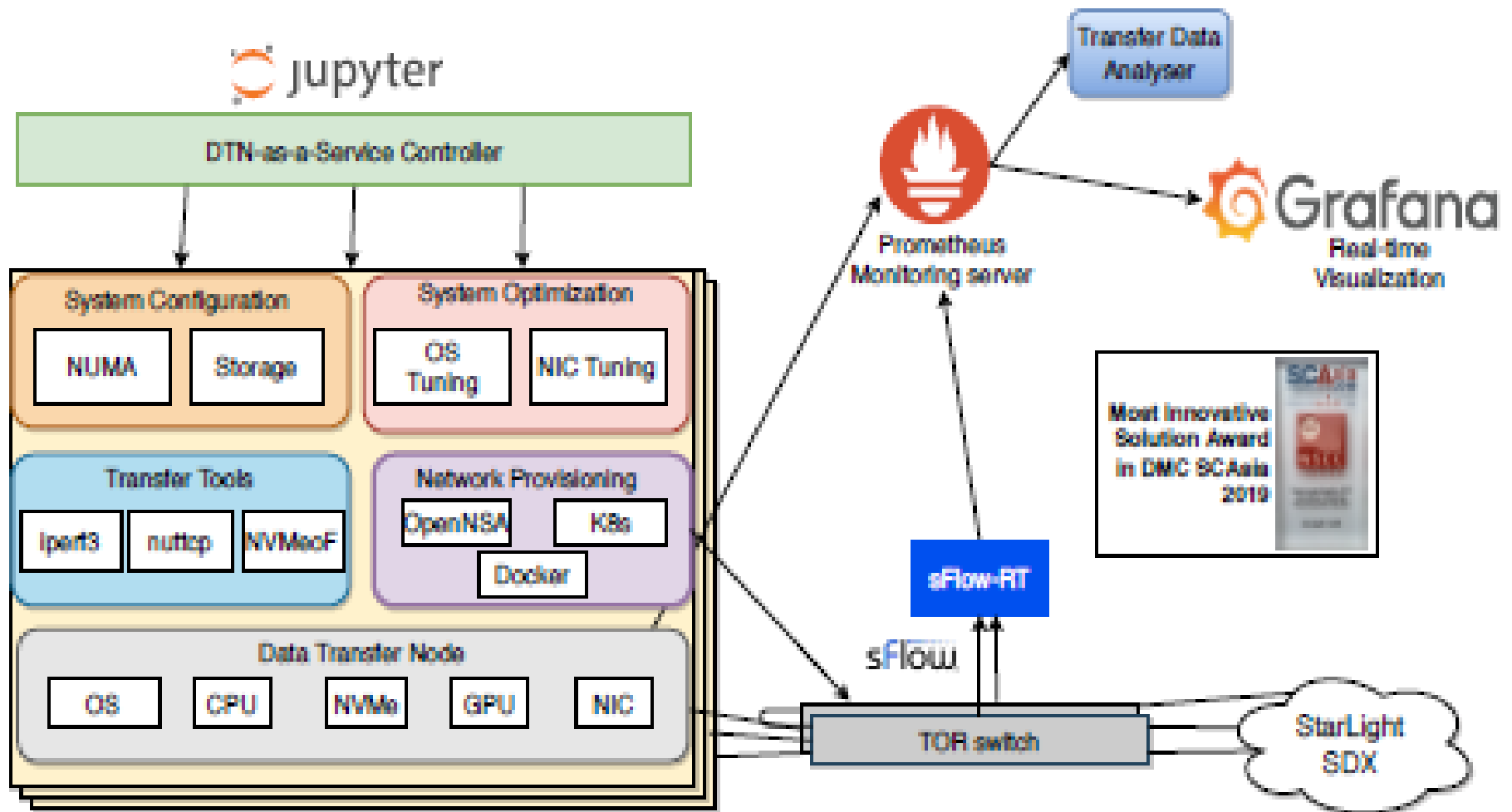
SCinet DTN-as-a-Service @ SC20

- For SC20, DaaS supports XNET Experiments, 12+ NREs: ROCE over WAN, P4 Experiments/Demonstrations, SENSE/openNSA integration, Kubernetes Federation, PCI-e Gen4 DTNs and Many More, Including The "Bring-Your-Own-Testbed Concept"
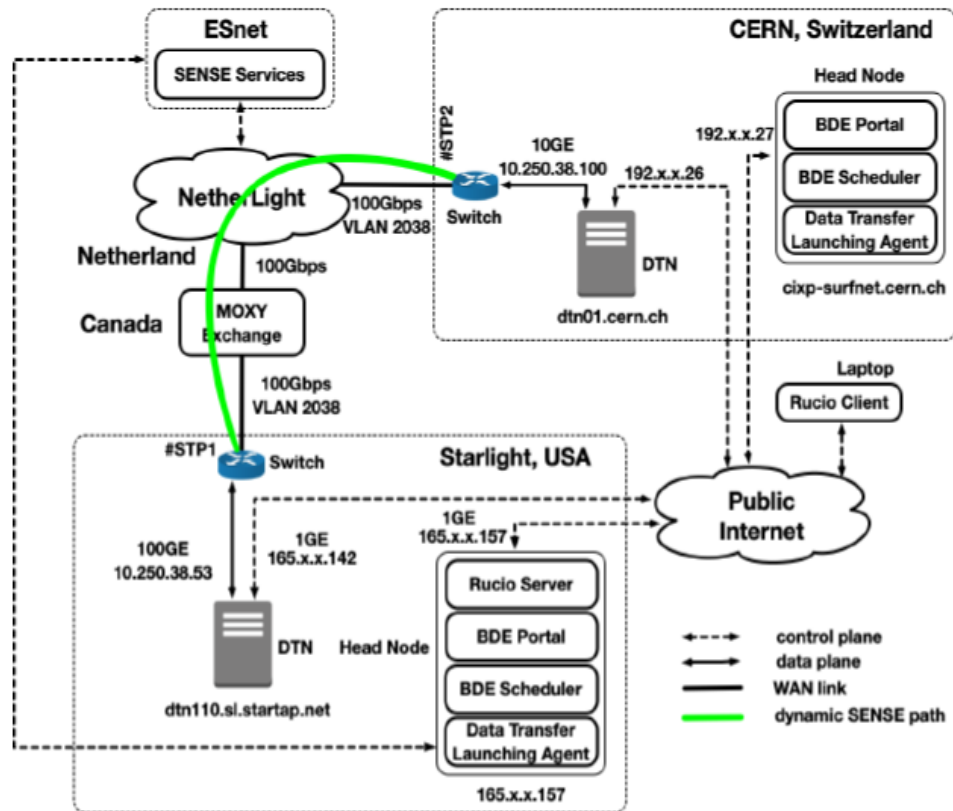
STARLIGHT℠

International/National Testbeds

- **IRNC Software Defined Exchange (SDX) International Testbed Integration**

- **(Supported By GRP)**

- **~25 Major Computer Science/Networking Research Testbeds Are Supported By The StarLight Exchange**

- **Federation Architecture Begining To Emerge**
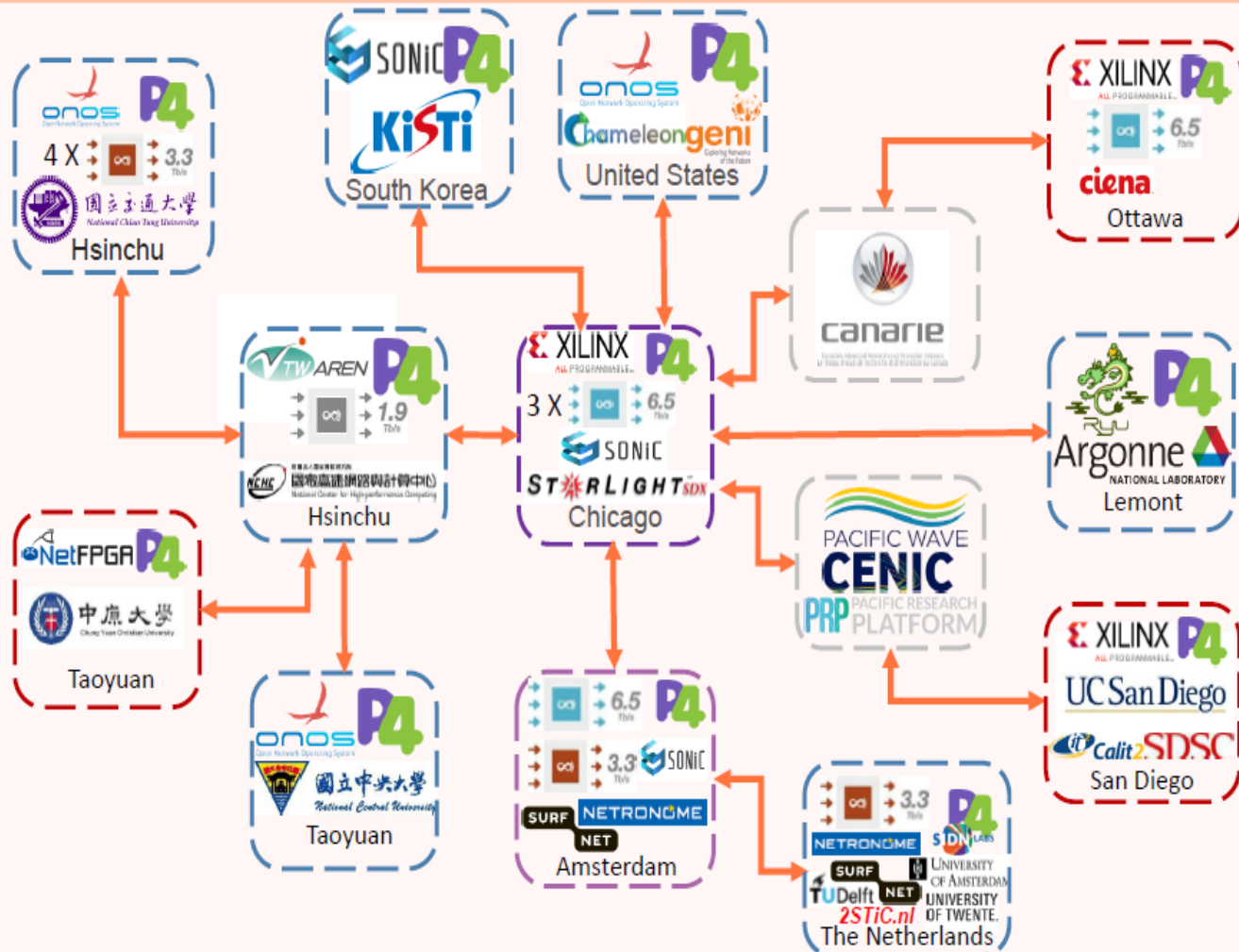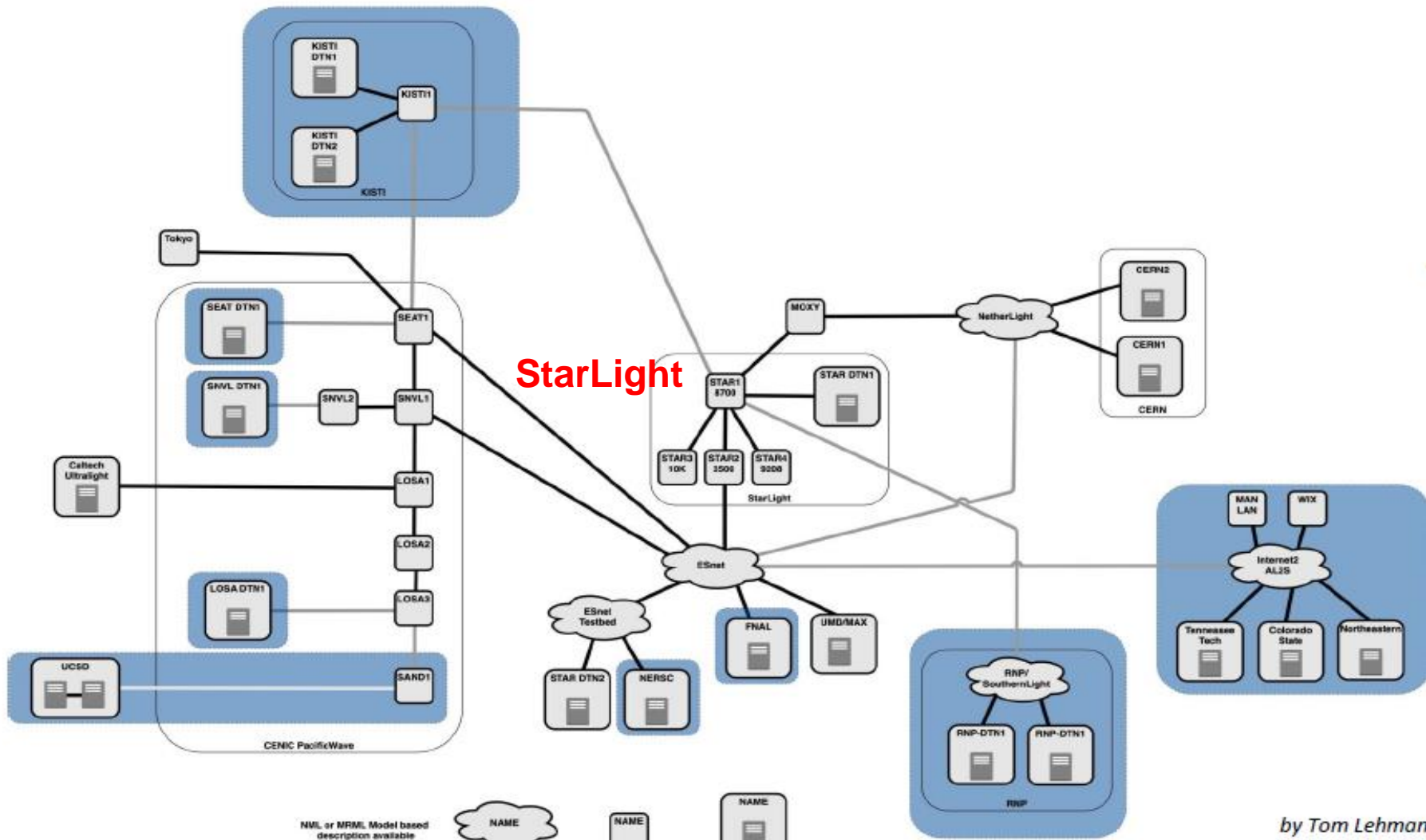
STARLIGHT SM

ROBIN Cross-Atlantic Testbed

StarLight site:

- DTN: *dtn110.sl.startap.net*, with several Intel NVMe drives for data storage, a 100GE Mellanox NIC for data transfer, and a 1G NIC for control.
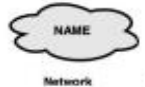
- Head node: *165.x.x.157*, with a 1G NIC for control.

CERN site:

- DTN: *dtn01.cern.ch*, with a rotational disk for data storage, a 10GE Mellanox NIC for data transfer, and 1G NIC for control.

- Head node: *cixp-urfnet.cern.ch*, with a 1G NIC for control.

StarLight

Chameleon

www.chameleoncloud.org

CHAMELEON: A LARGE SCALE, RECONFIGURABLE EXPERIMENTAL INSTRUMENT FOR COMPUTER SCIENCE

Kate Keahey

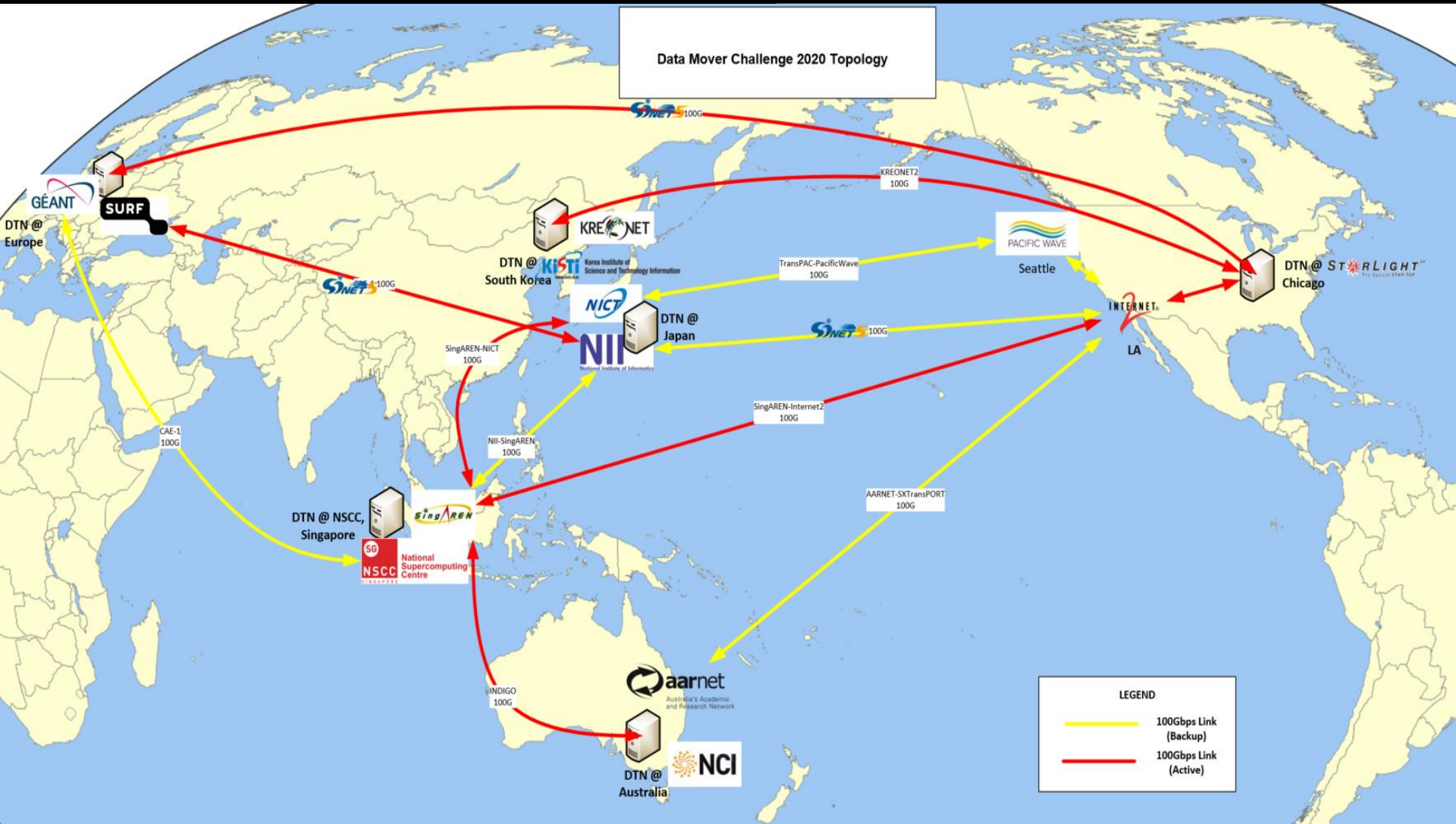**Joe Mambretti, Pierre Riteau, Paul Ruth, Dan Stanzione**

THE UNIVERSITY OF CHICAGO   TACC   renci   NORTHWESTERN UNIVERSITY   NSF

Ilya Baldine PI, RENCI: FABRIC

Supercomputing Asia Data Mover Challenge 2020

Data Mover Challenge 2020 Topology

Next GRP Workshop

- **Date: September 13-17, 2021**
- **Place: Innsbruck Austria, Co Located With eSCience Conference**

- **Global Research Platform Website:**
- **www.theglobalresearchplatform.net**

THANKS!

- **Academia Scinica, AmLight, AARnet, Asia-Pacific Research Platform Consortium, AutoGOLE Consortium, CalTech, CANARIE, CENIC, CERN, Ciena Research Lab, Esnet, Cybera, Fermi National Accelerator Laboratory, Global Research Platform Consortium, International Center for Advanced Internet Research Northwestern University, KISTI, LHC Networking Consortium, NASA Goddard Space Flight Center, Metropolitan Research and Education Network (MREN), MREN Research Platform Consortium (MRP), Mid-Atlantic Crossroads (MAX), Naval Research Laboratory, National Energy Research Scientific Computing Center (NERSC), National Science Foundation, Pacific Research Platform, Pacific Wave, RNP, SingAREN, StarLight International/National Communications Exchange Facility Consortium, SURFnet, TWAREN, University of California San Diego, University of Illinois Chicago, University of Amsterdam, et al**

www.startap.net/starlight

**Thanks to the NSF, DOE, NASA,
NIH, DARPA
Universities, National Labs,
International & Industrial
Partners,
and Other Supporters**

STARLIGHT SM