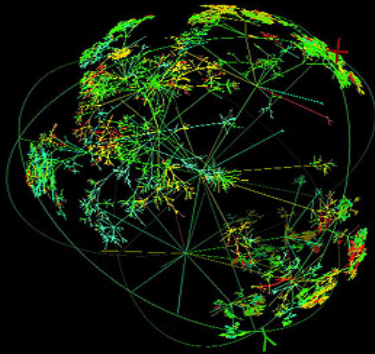


OMNINet

Joe Mambretti, Director, (j-mambretti@nwu.edu)

**International Center for Advanced Internet Research (www.icaair.org)
Director, Metropolitan Research and Education Network (www.mren.org)
Partner, StarLight/STAR TAP (www.startap.net/starlight)
PI-OMNINet (www.icaair.org/omninet)**



**JET
New Port News, Va**

April, 2004



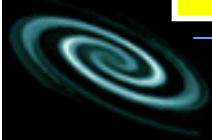
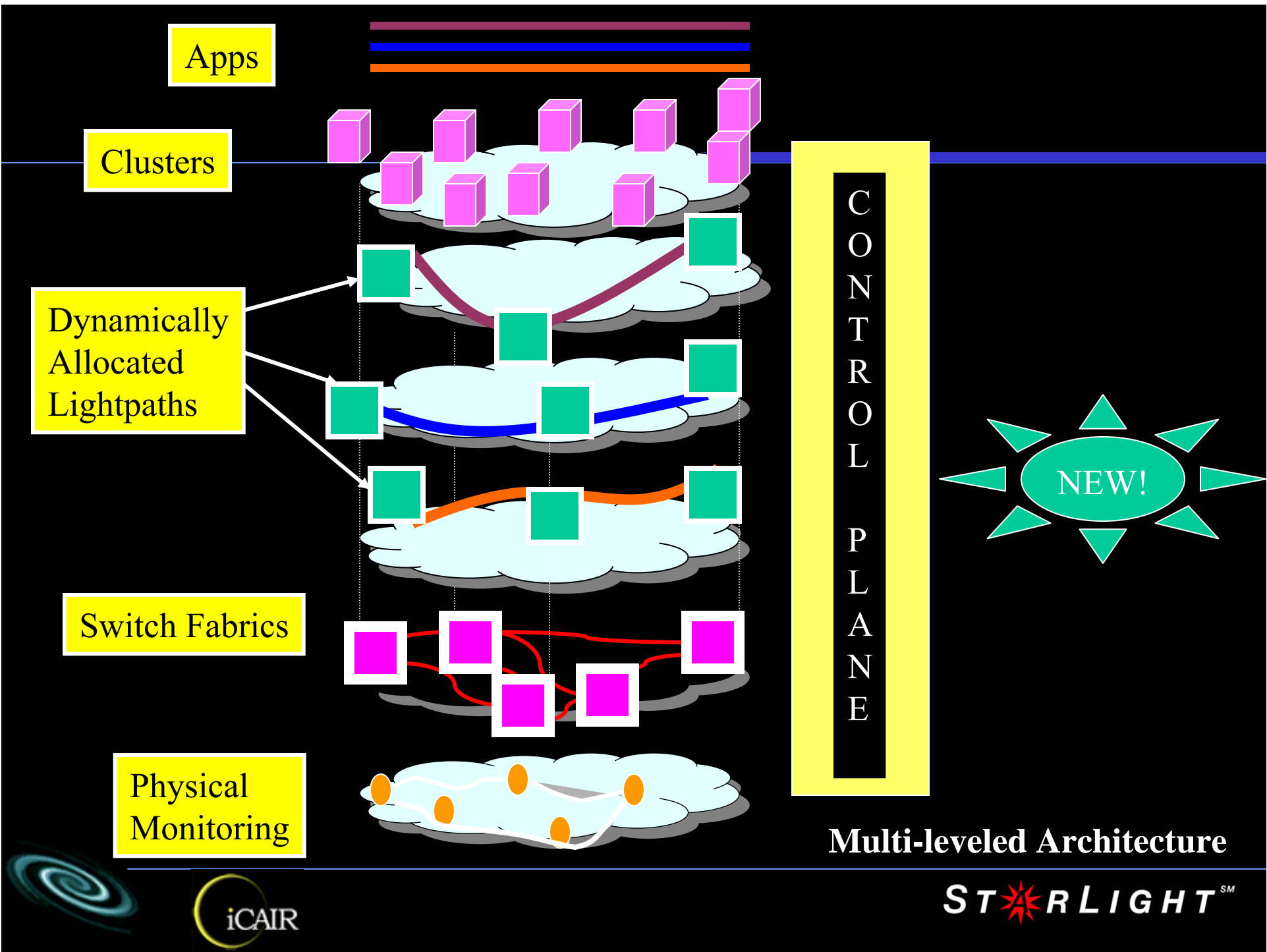
Introduction to iCAIR:

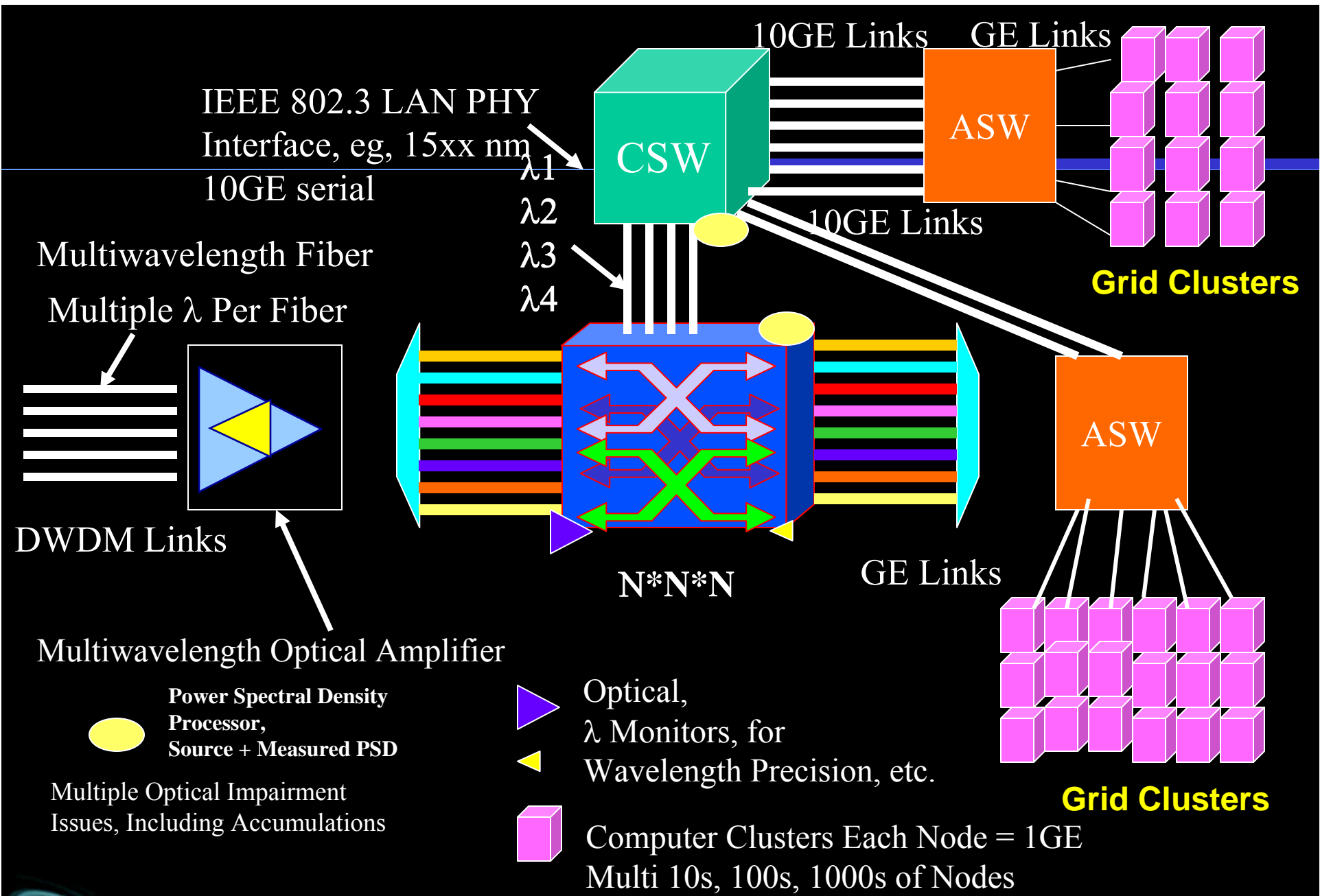


Accelerating Leading Edge Innovation and Enhanced Global Communications through Advanced Internet Technologies, in Partnership with the Global Community

- **Creation and Early Implementation of Advanced Networking Technologies - The Next Generation Internet All Optical Networks, Terascale Networks**
- **Advanced Applications, Middleware, Large-Scale Infrastructure, NG Optical Networks and Testbeds, Public Policy Studies and Forums Related to NG Networks**







Power Spectral Density Processor, Source + Measured PSD

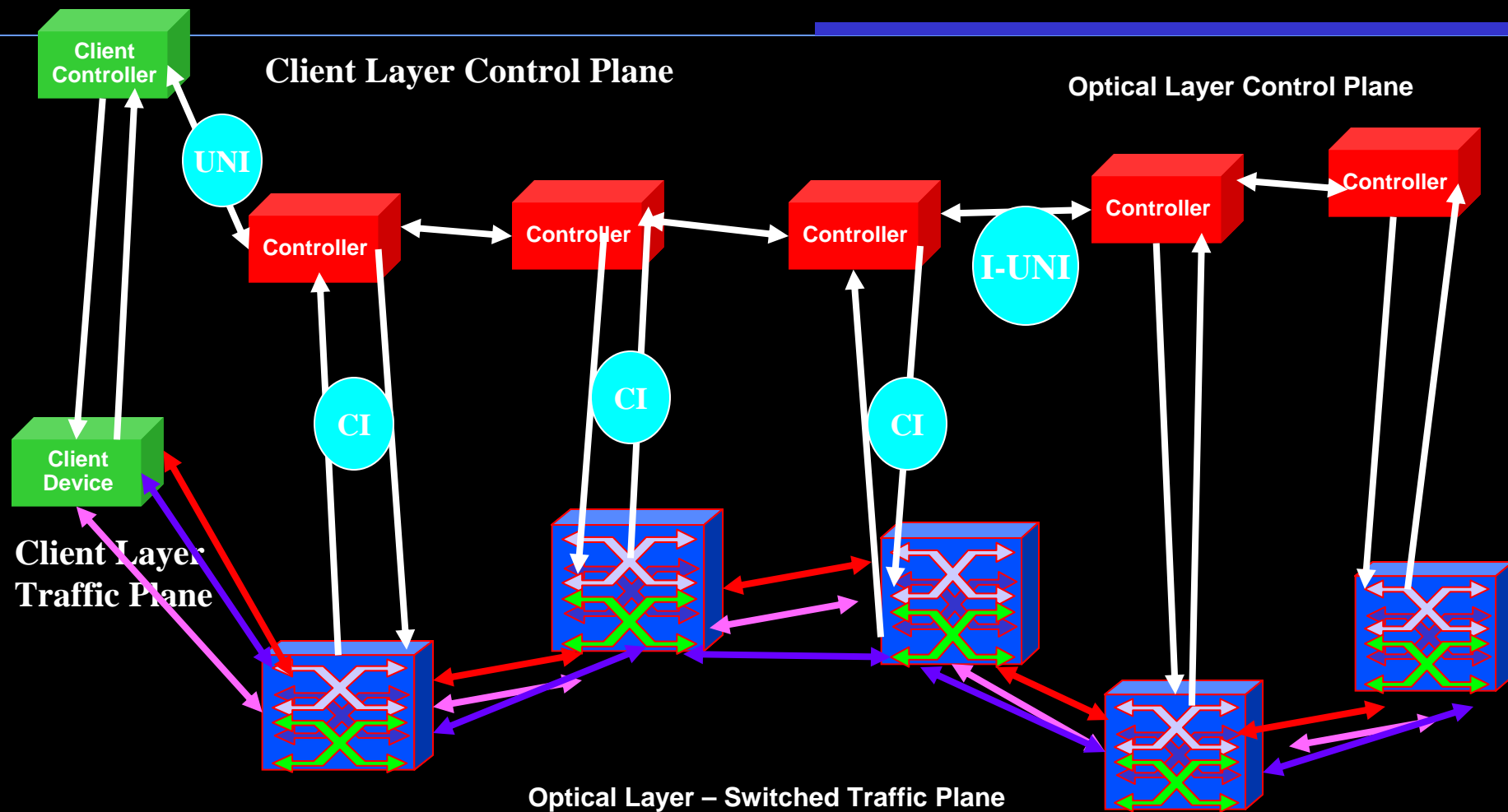
Multiple Optical Impairment Issues, Including Accumulations

Optical, λ Monitors, for Wavelength Precision, etc.

Computer Clusters Each Node = 1GE Multi 10s, 100s, 1000s of Nodes

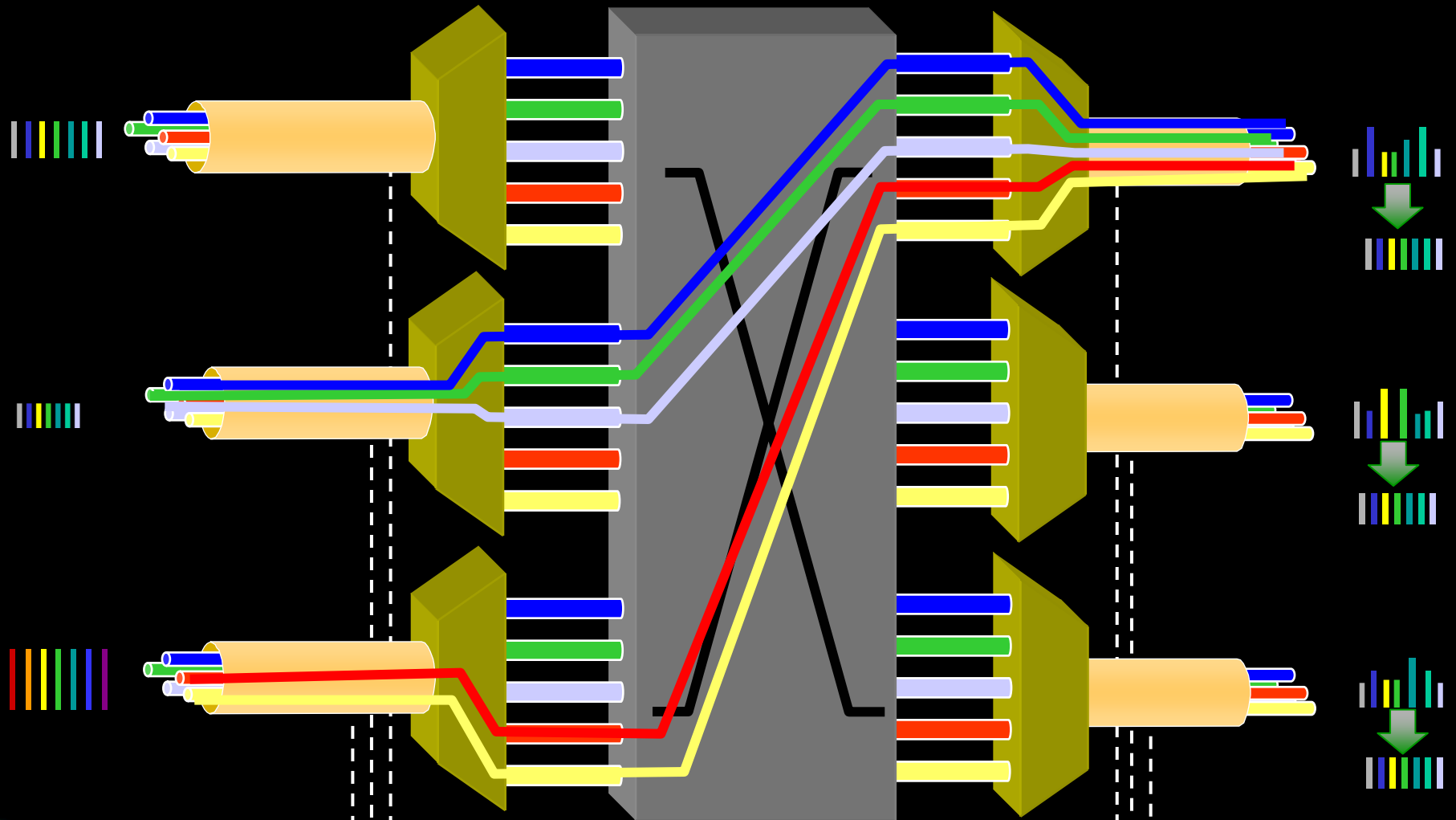


Optical Layer Control Plane



+ Optical Dynamic
Intelligent Network (ODIN)
for Dynamic Provisioning

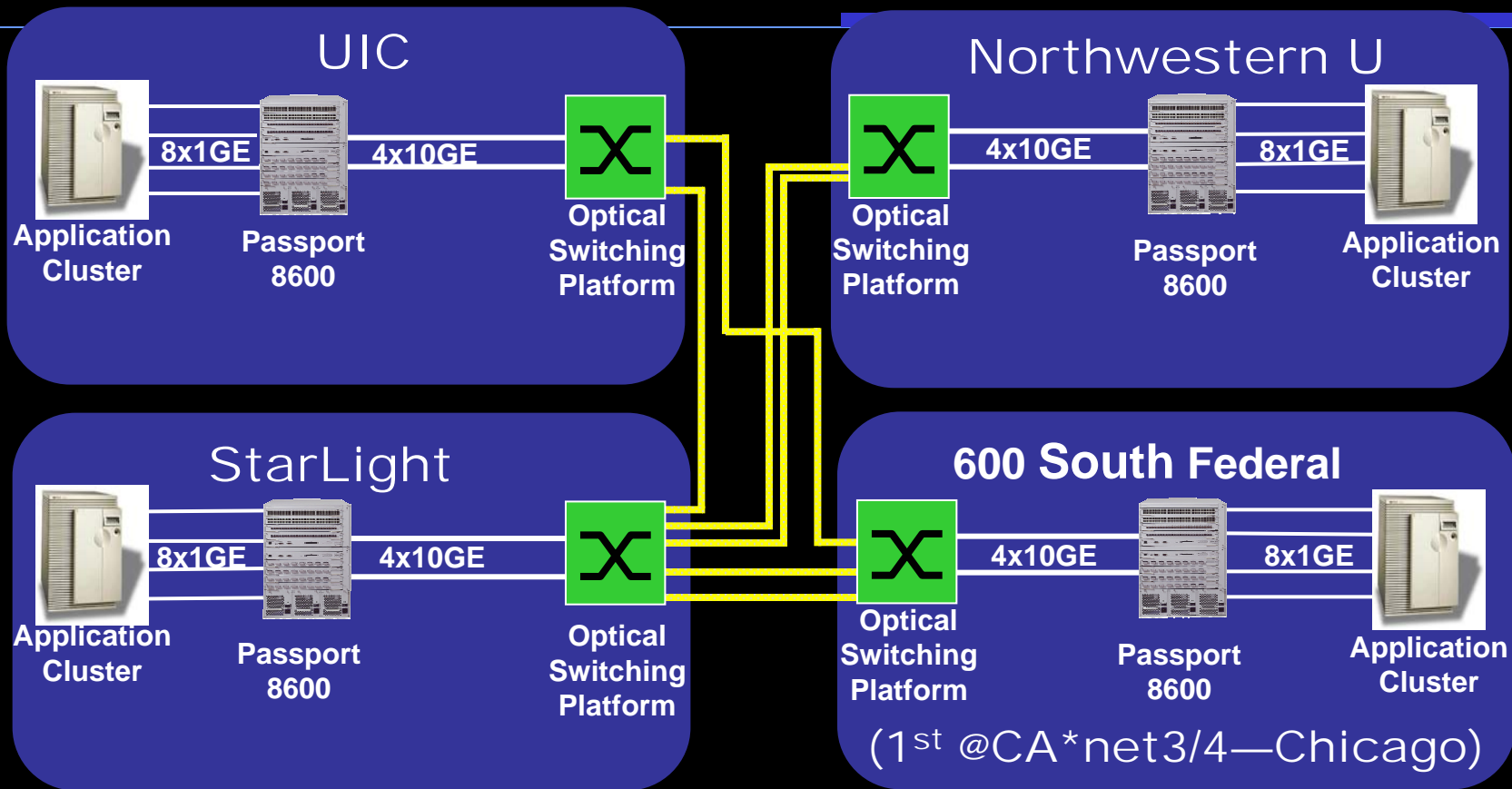
OMNInet Testbed Experiments (MREN Used as Out-of-Band Control Channel)



Performance Monitoring & Control

LIGHTSM

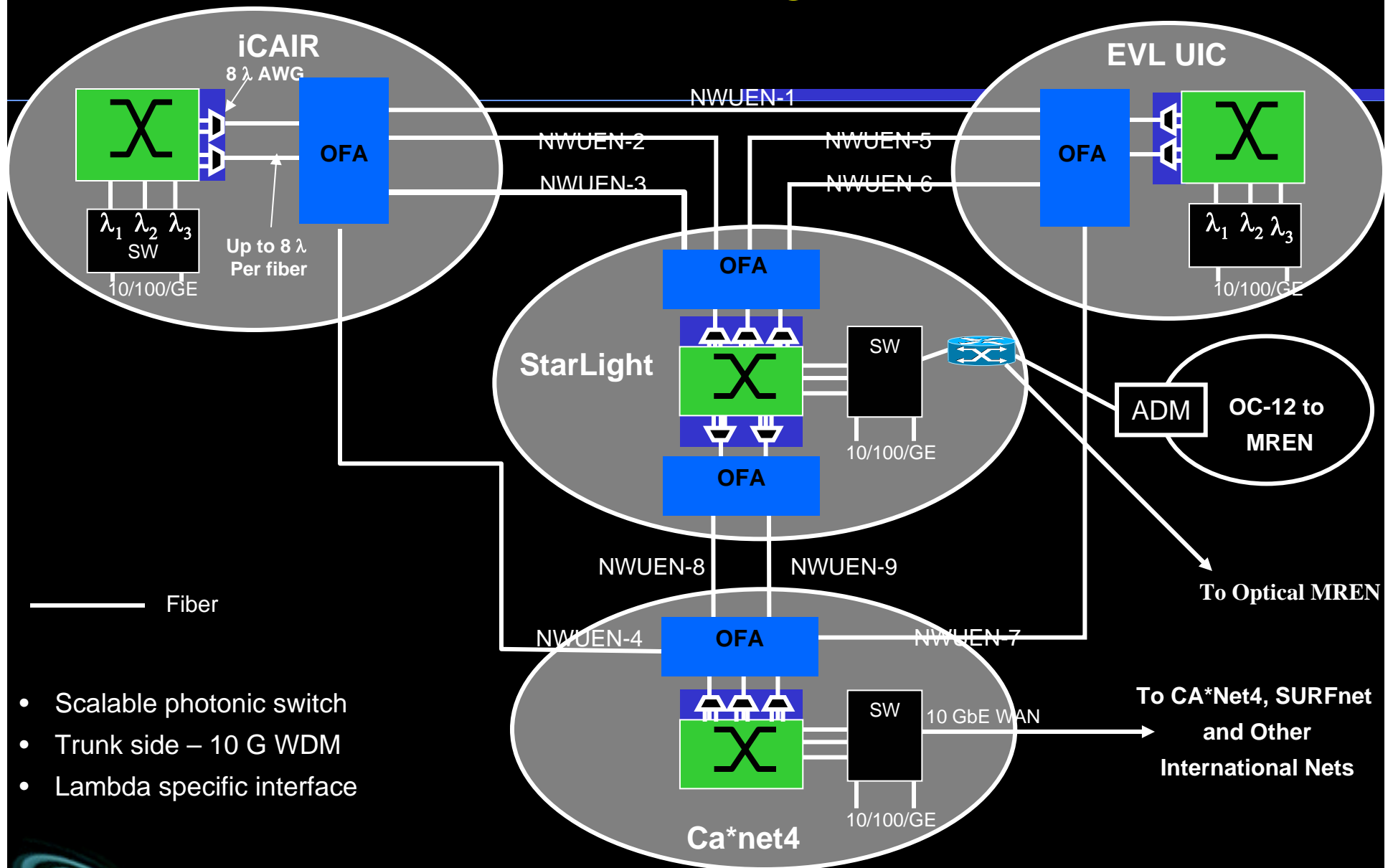
OMNInet Technology Trial: January 2002



- A four-site network in Chicago -- the first 10GE service trial!
- A test bed for all-optical switching and advanced high-speed services
- Partners: SBC, Nortel, iCAIR at Northwestern, EVL, CANARIE, ANL



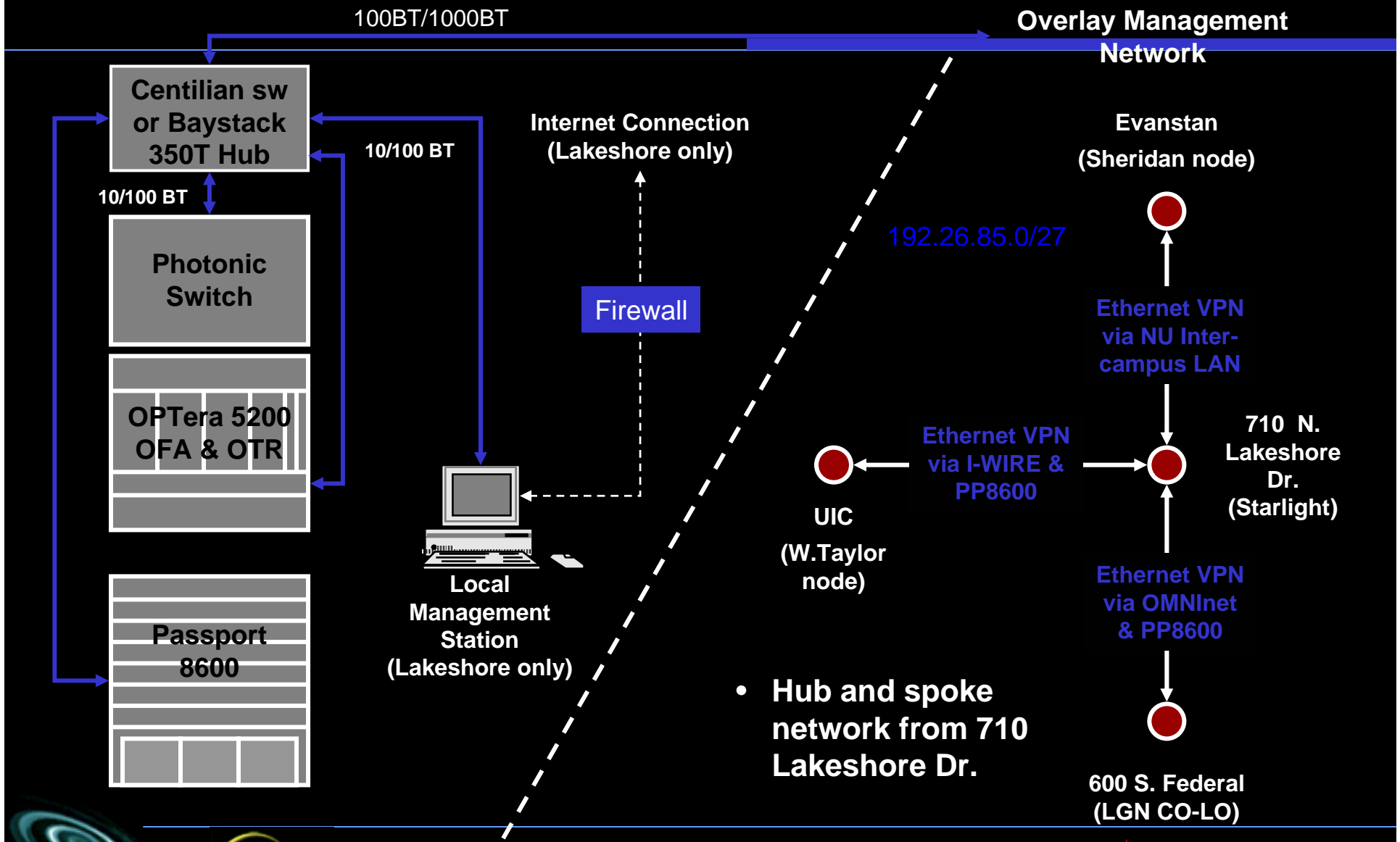
Testbed Configuration



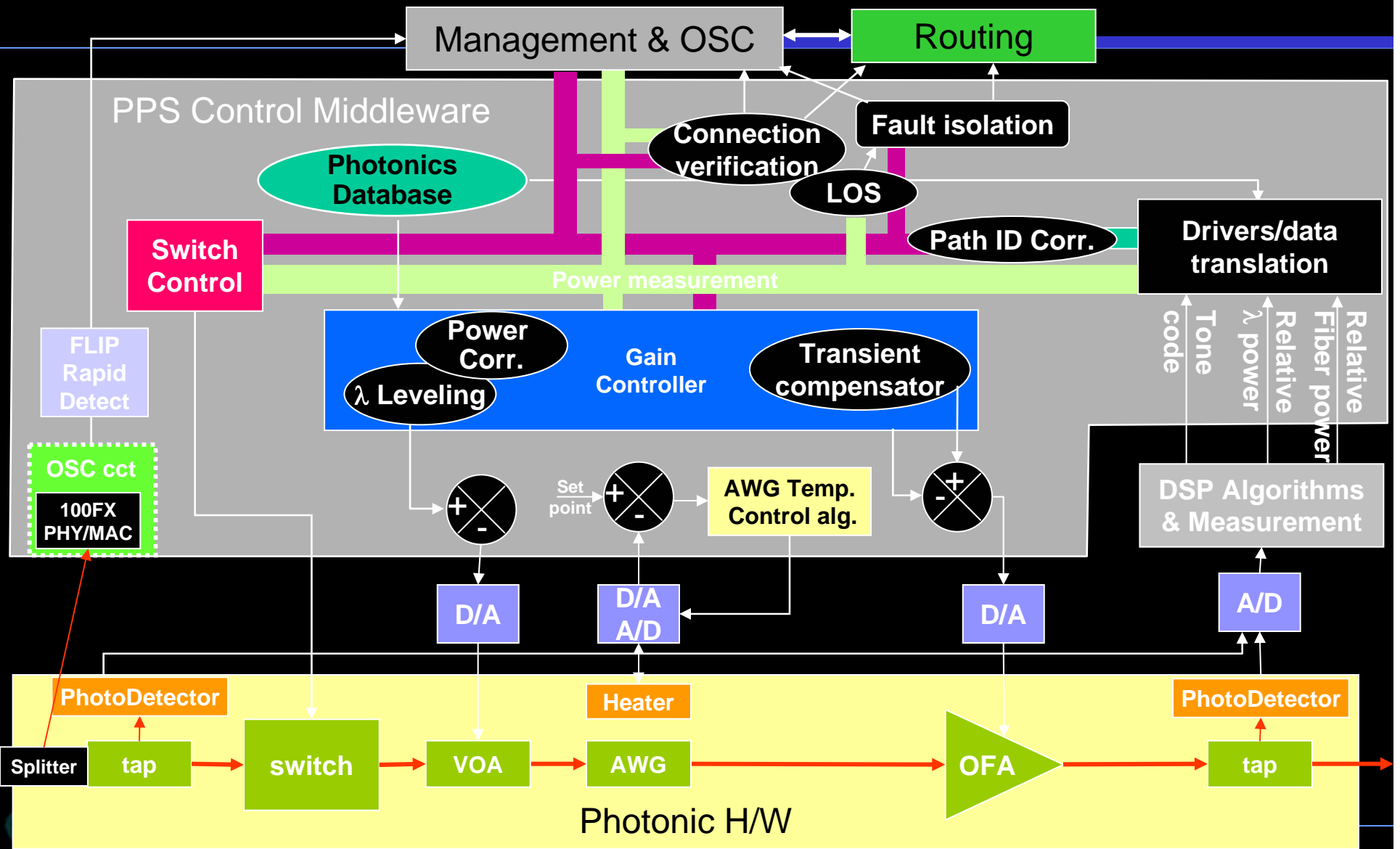
- Scalable photonic switch
- Trunk side – 10 G WDM
- Lambda specific interface



Overlay Management network (Typical Site & Inter-site Network)



Photonic Performance Subsystem



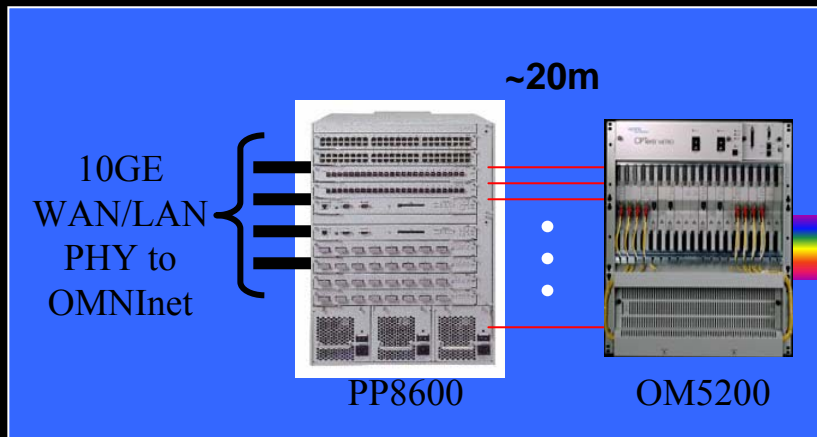
Source: Kent Felski, Nortel

STARLIGHT



iCAIR Grid Clusters and OM5200 DWDM System

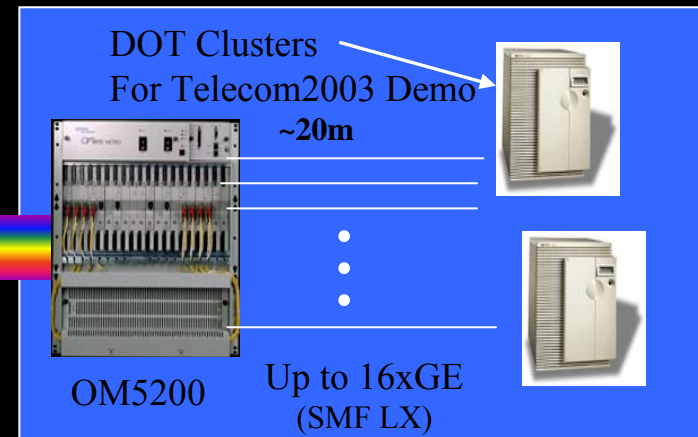
Leverone Hall Data Com Center



DWDM on Technological Institute

Dedicated Fiber

4-fibers
~1km



DWDM Between Cluster Site and OMNInet Core Node in Evanston

- The implementation is lambdas (unprotected).
- Installed shelf capacity and common equipment permits expansion of up to 16 lambdas through deployment of additional OCLD, and OCI modules.
- A fully expanded OM5200 system is capable of supporting 64 lambdas (unprotected) over the same 4-fiber span.

GRID Distributed Optical Testbed Components



← Cluster



← Advanced Photonics

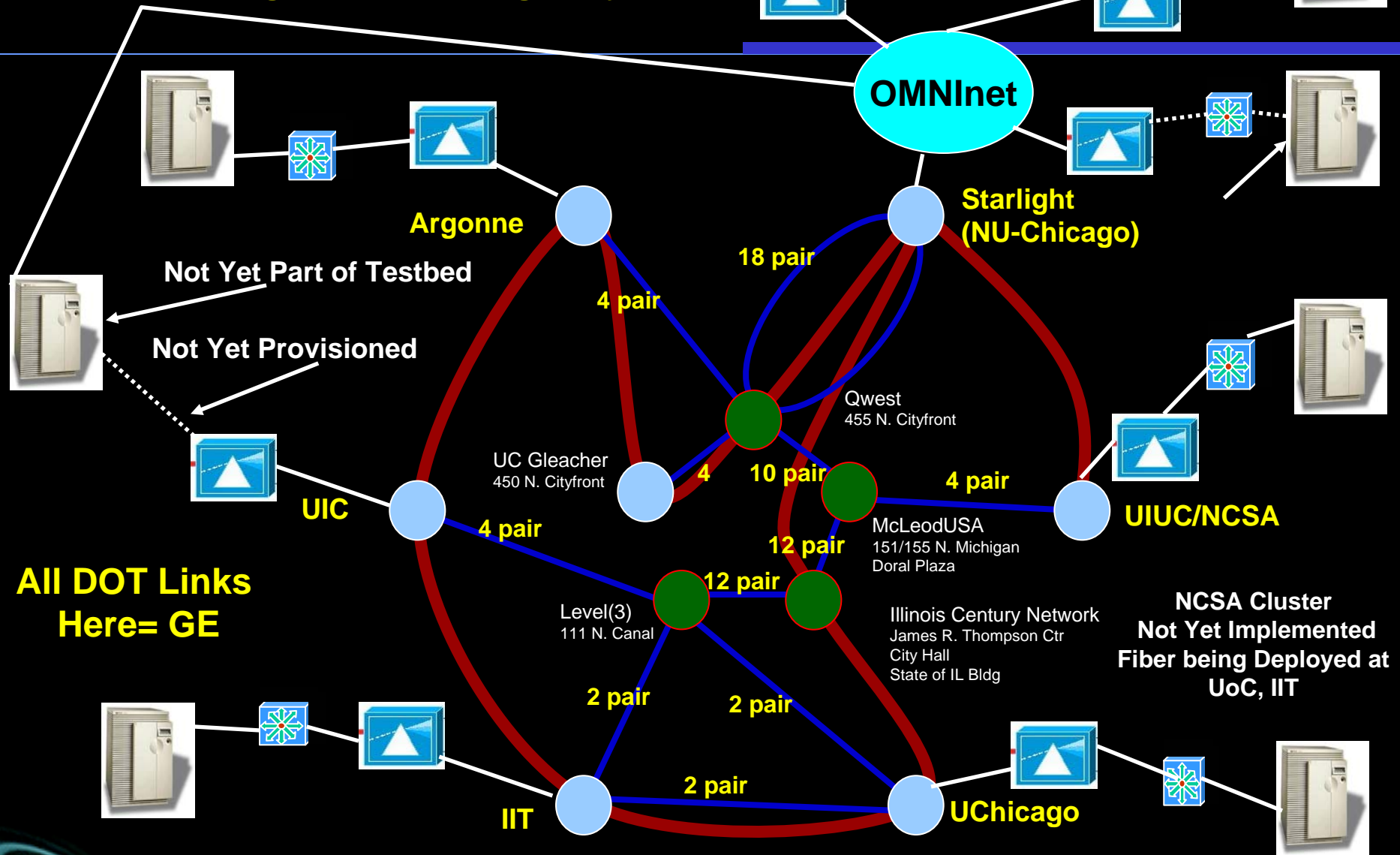
Environmental Conditioning, Power



← Cluster

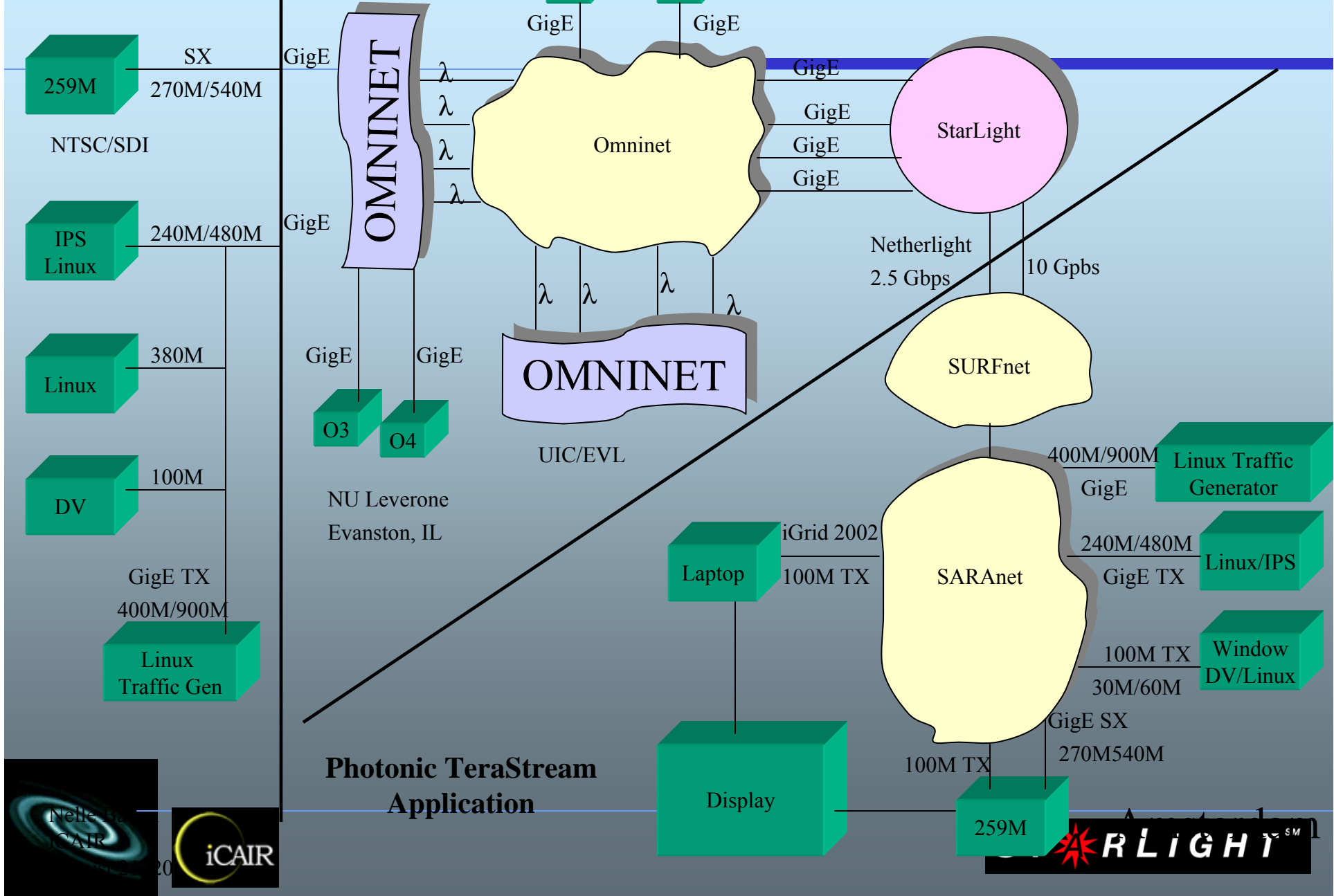
DOT Sites, I-WIRE, and OMNInet

No Routing –L2 Switching Only!



iCAIR

Chicago



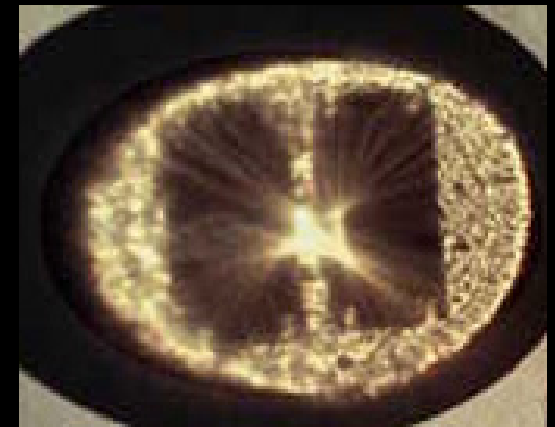
iGrid 2002

United States and The Netherlands

Photonic TeraStream

- International Center for Advanced Internet Research (iCAIR), Northwestern University, USA
- University of Amsterdam, The Netherlands

This project showcases new technologies and techniques being developed on the StarLight/NetherLight testbed and on OMNInet in support of high-performance digital media and extremely-high-performance data transfer.



This 10Gbps capability is being used to develop a reference model for a next-generation core optical metro network infrastructure. This infrastructure will allow access to and dynamic interaction with very large amounts of data. This application can utilize multi-Gbps today; in the future, it may utilize multiple 10GigE streams.

www.icaair.org



STARLIGHTSM

iGrid 2002

United States

Optical Dynamic Intelligent Network (ODIN)

- International Center for Advanced Internet Research
- Electronic Visualization Laboratory
- Laboratory for Advanced Computing, UIC

ODIN is mechanism that allows global applications to use intelligent signaling to provision their own international lightpaths to optimize network based resource discovery and performance.



www.icair.org, www.evl.uic.edu, www.lac.uic.edu



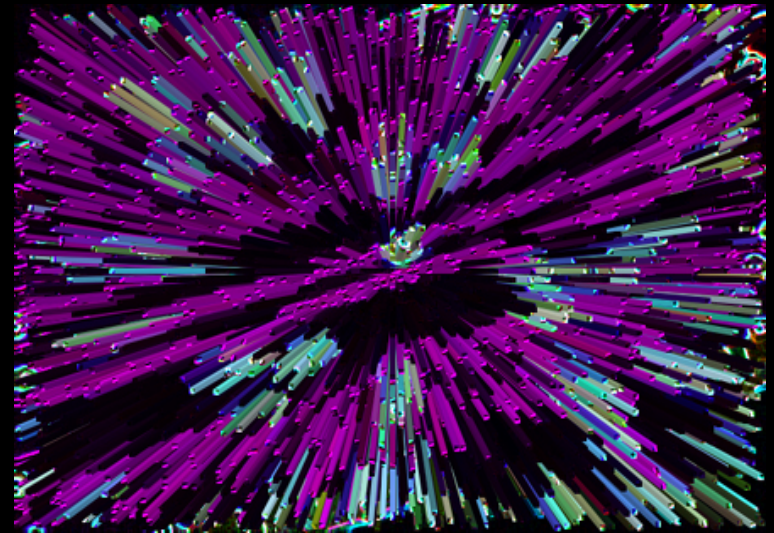
STARLIGHTSM

iGrid 2002 United States

Terascale High-Performance Optical Resource Regulator (THOR)

- International Center for Advanced Internet Research
- Electronic Visualization Laboratory
- Laboratory for Advanced Computing, UIC

THOR is a method of provisioning and managing lightpaths on wavelength-switched networks



www.icair.org, www.evl.uic.edu, www.lac.uic.edu



STARLIGHTSM

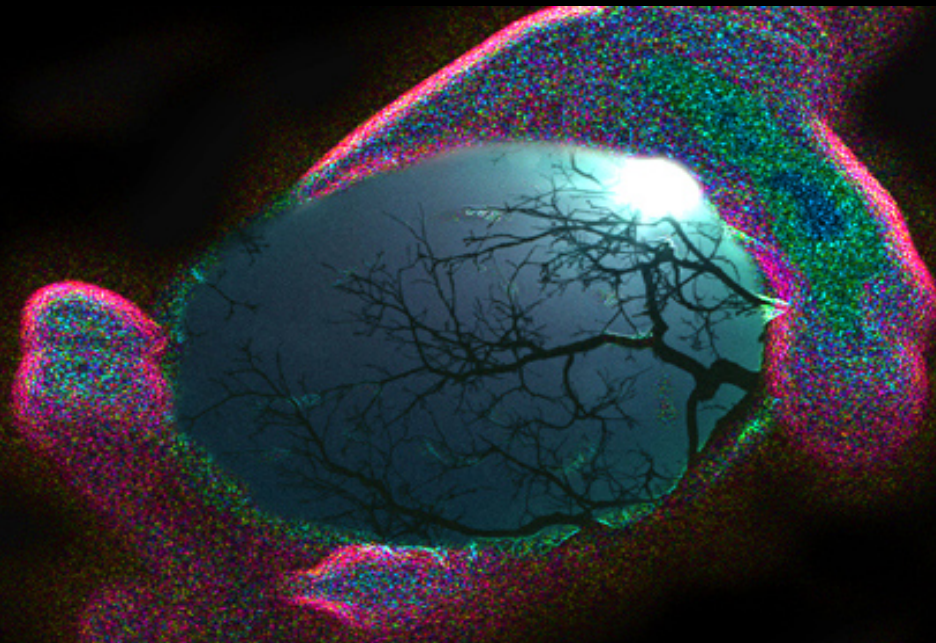
iGrid 2002

United States – Set New World Record for Data Transport

Photonic Data Services

- Laboratory for Advanced Computing, UIC
- National Center for Data Mining, UIC
- International Center for Advanced Internet Research
- SURFnet, NetherLight

At iGRID2002 the LAC, NCDM and iCAIR demonstrated Photonic Data Services (PDS) and set a new data transit record, based on several new protocols designed for high performance optical networks



www.lac.uic.edu, www.icaair.org



STARLIGHTSM

Photonic Data Services Stack – Cooperative Project with LAC

6. Data Intensive Applications

5a. Storage
(UCSD)

5b. Data Web
Serv. (UIC/LAC)

5c. Data Grid
Services

4. Transport – TCP, UDP, SABUL,... (UIC/LAC)

3. IP

2. Photonic Path Serv. – ODIN, THOR,... (NW)

1. Physical



DARPA DWDM-RAM Large Scale Data+Dynamic Lambdas – Demonstrated at GGF9 & SC2003

HP-PPFS

Data Intensive App2

Data Intensive App3

Data Intensive App4

Grid Data
Management
Services

Data Web
Services

Data Grid Services

Grid L3-L7 OGSA Compliant

Dynamic Path Services (ODIN, THOR, etc), OGSA Compliant, Soon WSRF

Dynamic vLANs

Dynamic Lightpaths

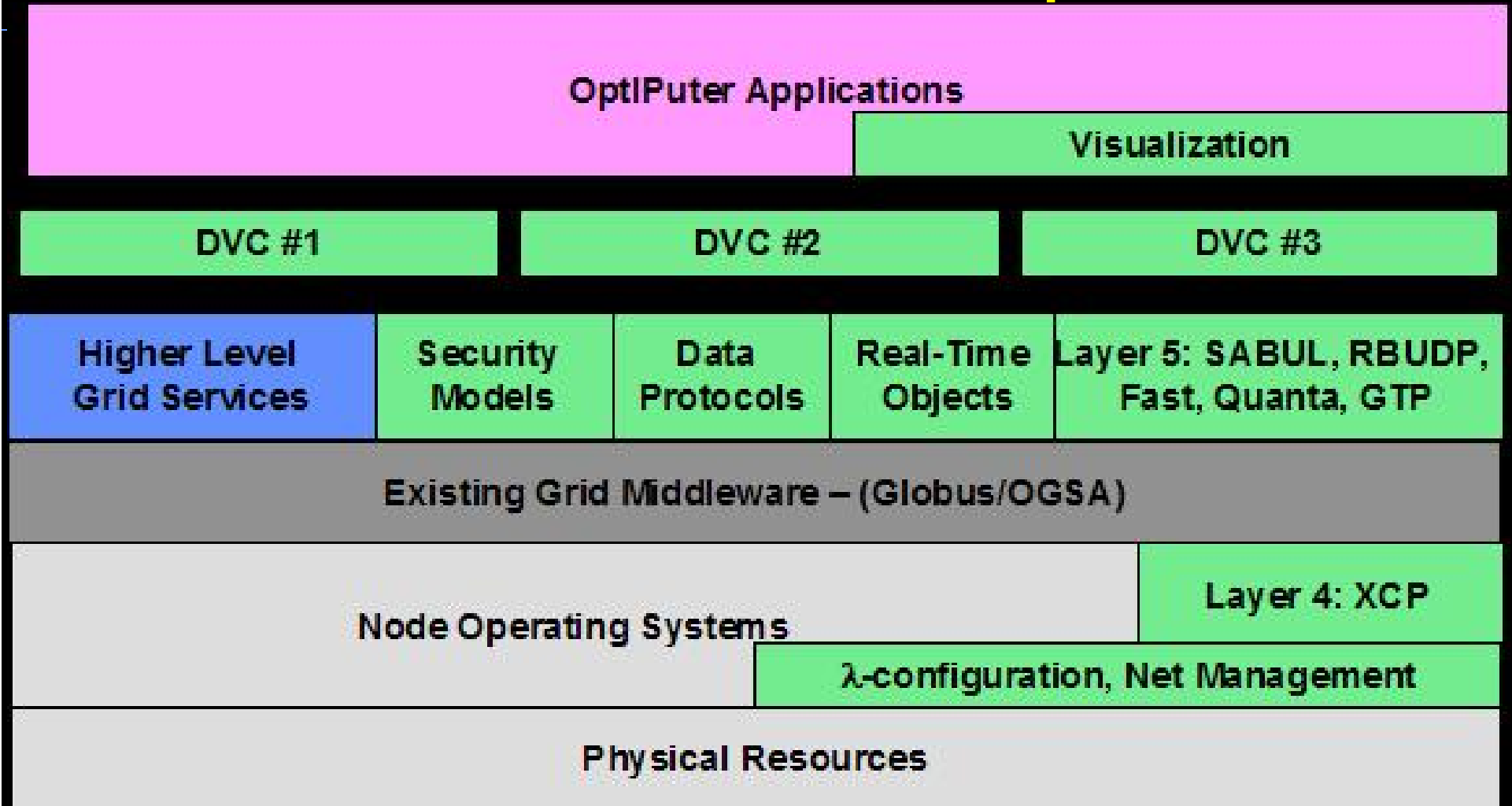
Physical Processing Monitoring and Adjustment

New
Control Plane
And
Management
Plane
Processes



STARLIGHTSM

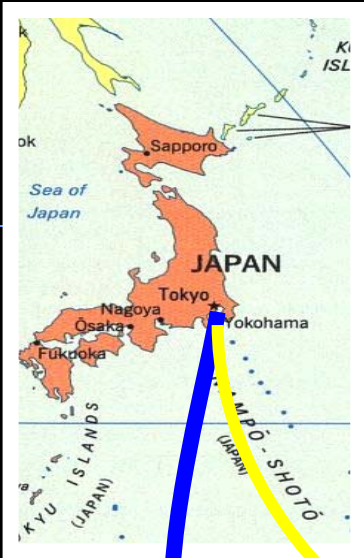
OptIPuter Open Source LambdaGrid Software for Distributed Virtual Computers



Source: Andrew Chien, UCSD
OptIPuter Software Architect



TransLight Lambdas



European lambdas to US

- 8 GigEs Amsterdam—Chicago
- 8 GigEs London—Chicago

Canadian lambdas to US

- 8 GigEs Chicago-Canada-NYC
- 8 GigEs Chicago-Canada-Seattle

US lambdas to Europe

- 4 GigEs Chicago—Amsterdam
- 3 GigEs Chicago—CERN

European lambdas

- 8 GigEs Amsterdam—CERN
- 2 GigEs Prague—Amsterdam
- 2 GigEs Stockholm—Amsterdam
- 8 GigEs London—Amsterdam

TransPAC lambda (yellow)

- 1 GigE Chicago—Tokyo

IEEAF lambdas (blue)

- 8 GigEs NYC—Amsterdam
- 8 GigEs Seattle—Tokyo

