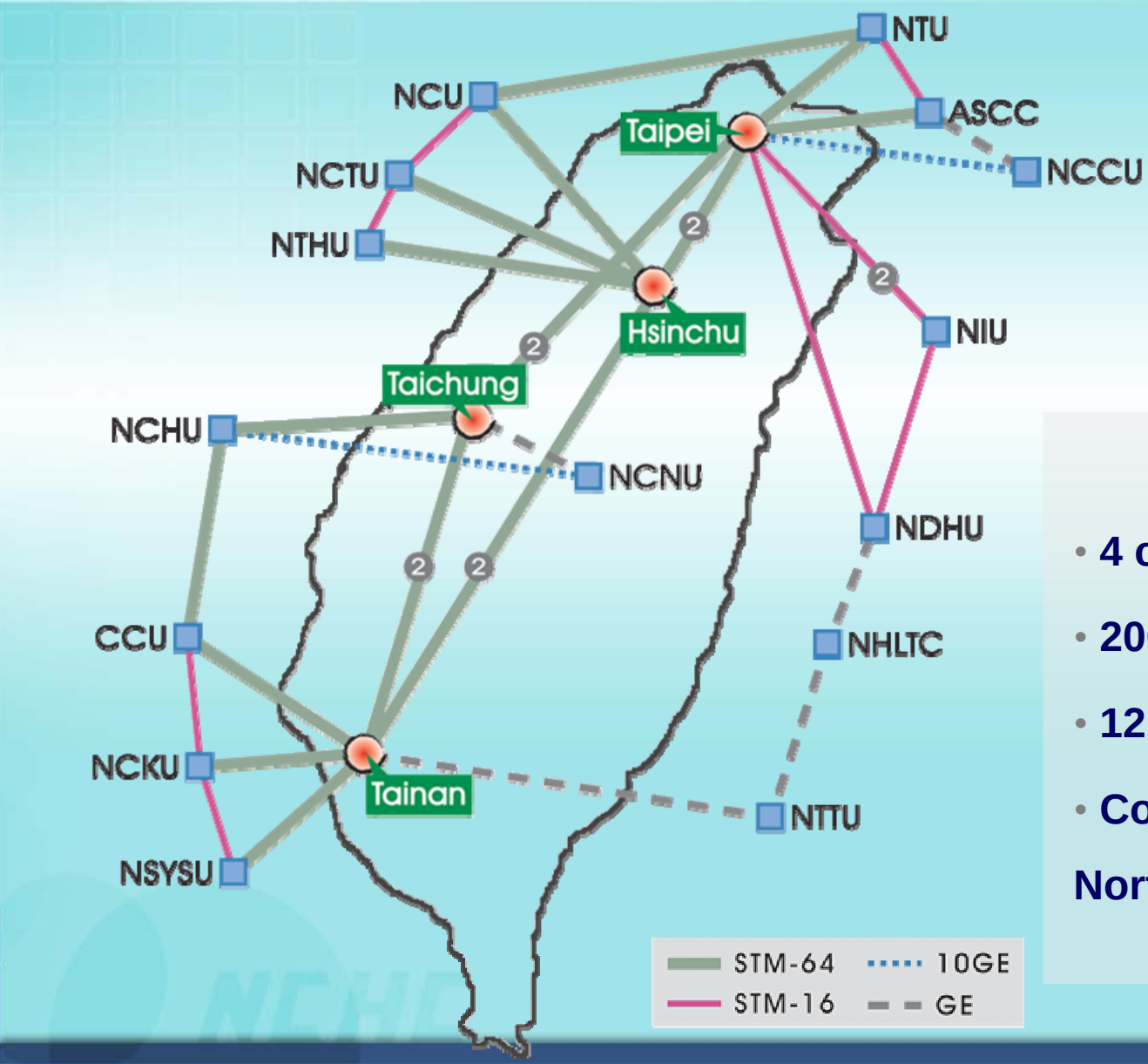
財團法人國家實驗研究院
國家高速網路與計算中心
National Center for High-Performance Computing

NCHC Research over Lightpaths

Te-Lung Liu, Shi-Wei Lo
NCHC

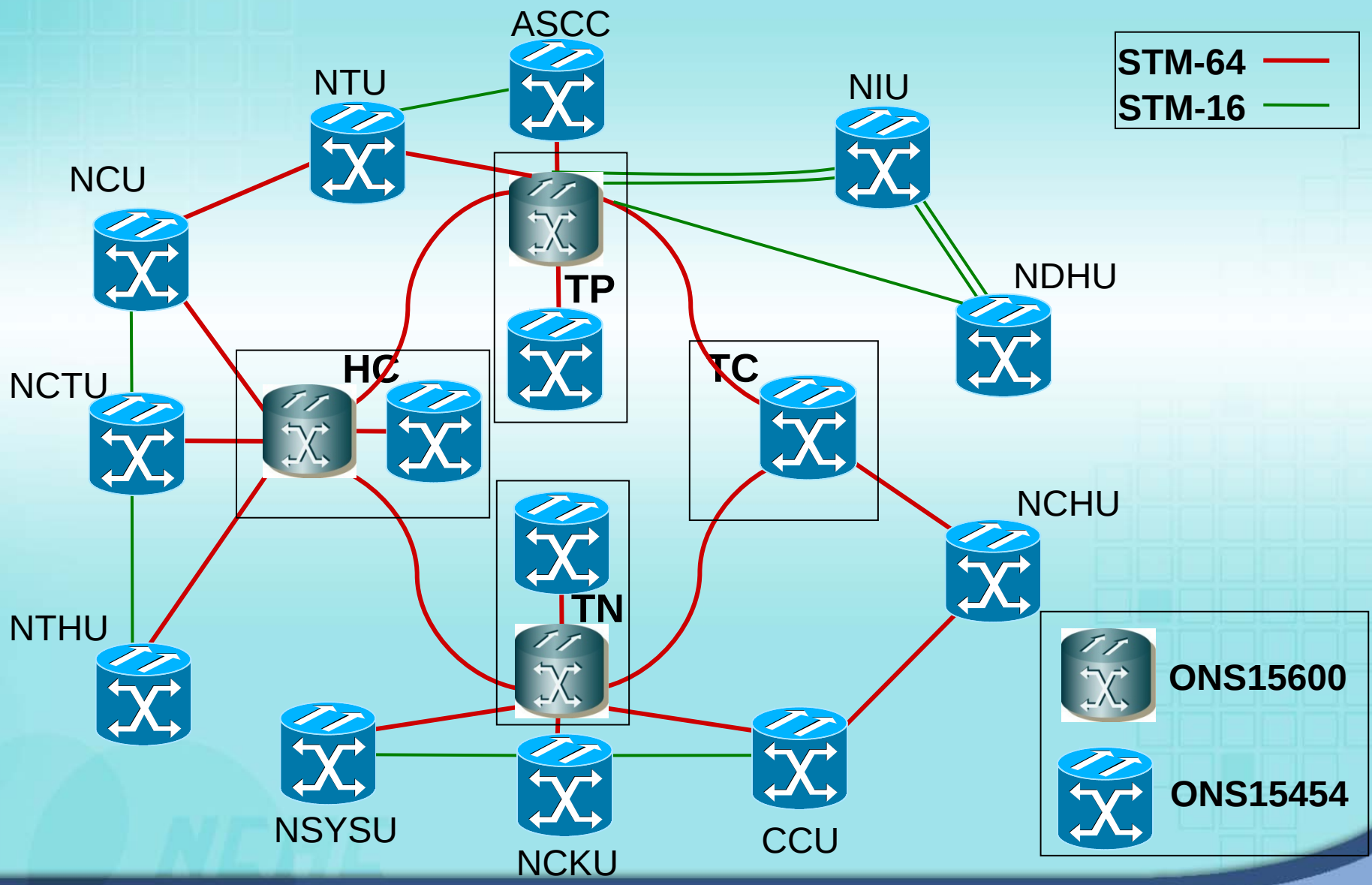
DATE:8/29/06

TWAREN Architecture

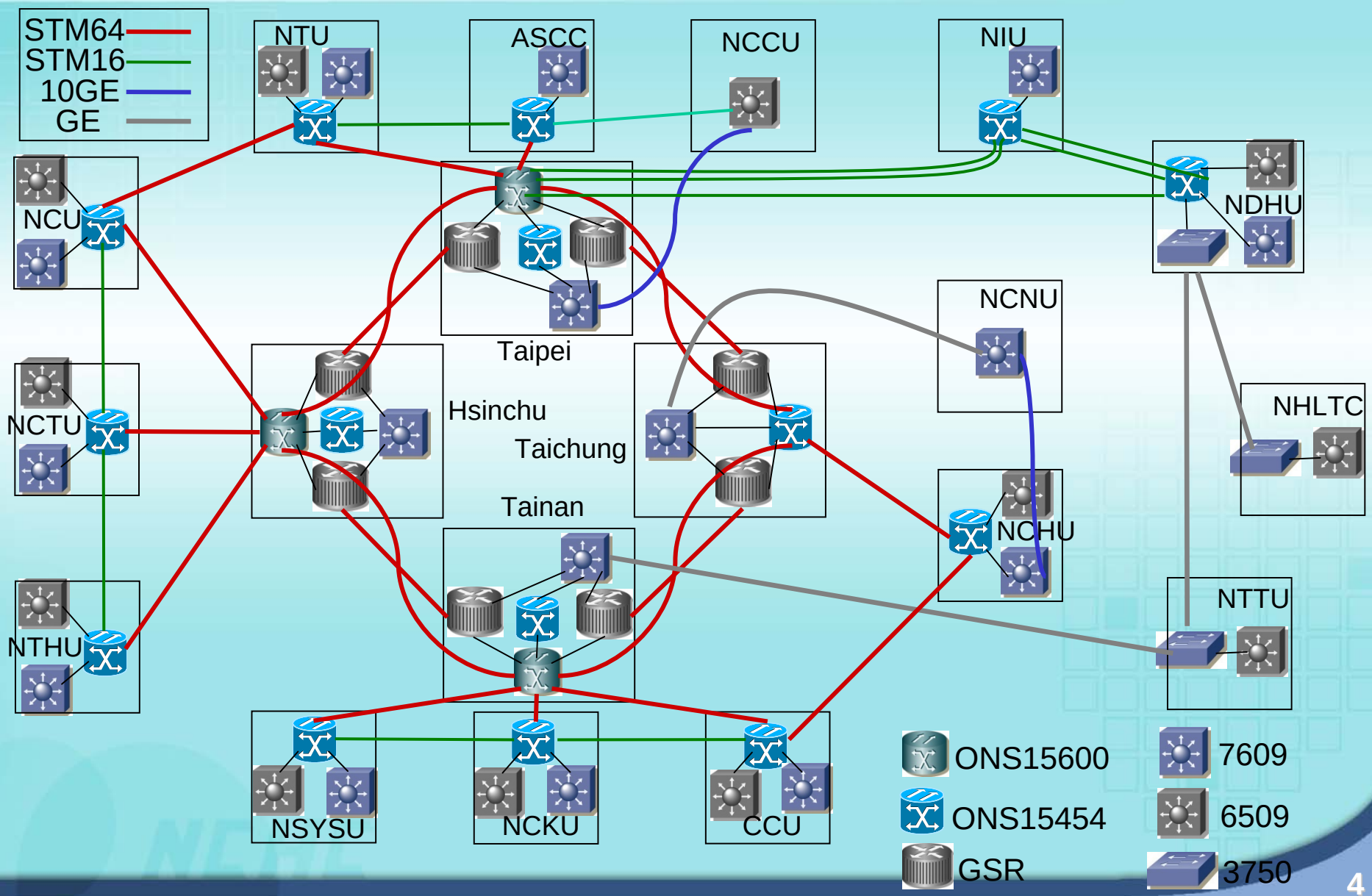


- 4 core nodes
- 20G backbone
- 12 GigaPops
- Connects HPC resources in North and South Taiwan

Optical Backbone



Interconnecting with L1/L2/L3 devices



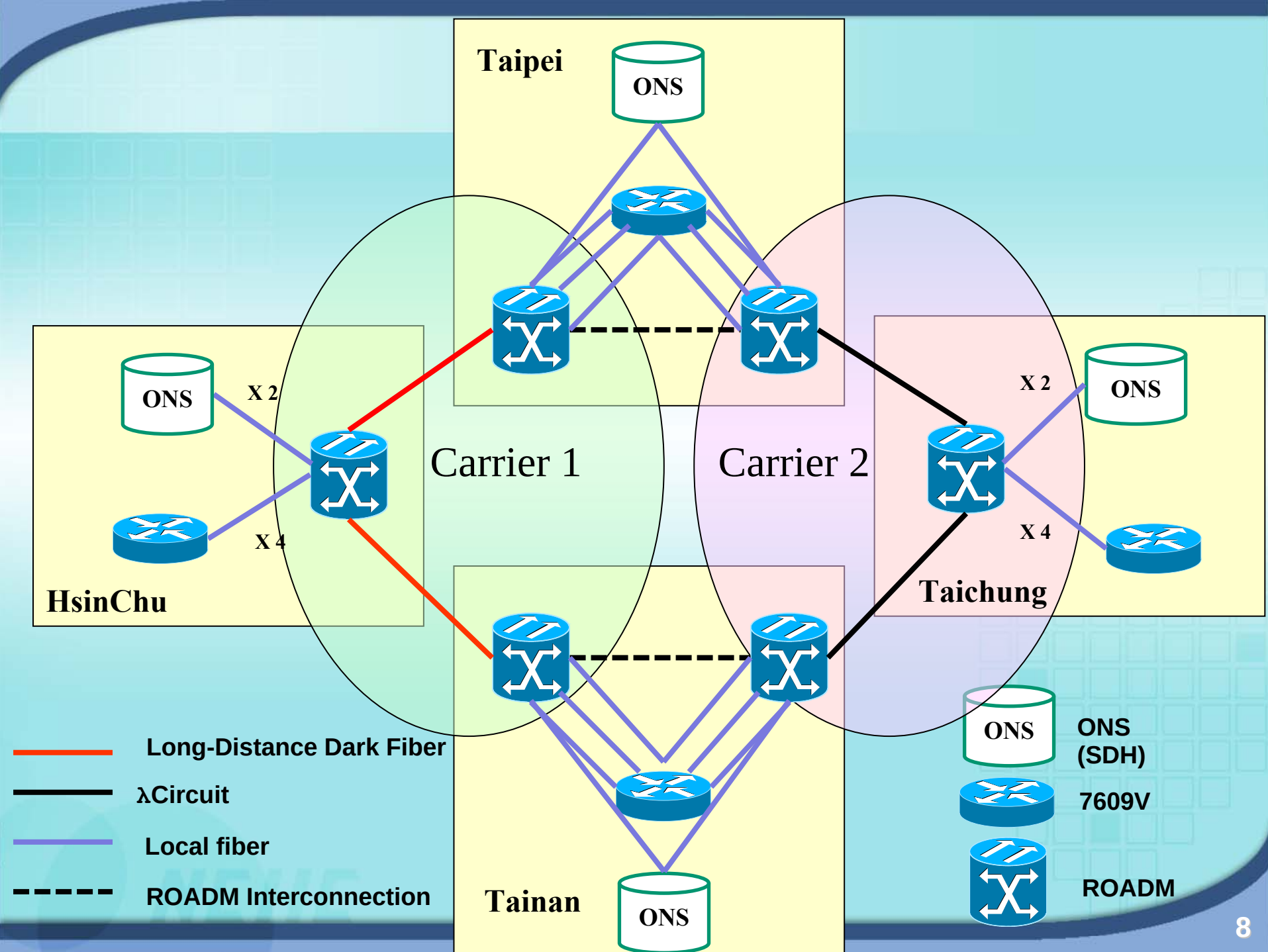
TAIWANLight – Stretch TWAREN to GLIF community

- Pacific Crossing to USA's west coast upgraded to 5 Gb/s
- Connections between LA, Palo Alto, Chicago, and New York are 2.5 Gb/s
- Connects to the rest of the world via the U.S.'s Abilene Network
- Connection expanded to Europe in 2006 (IEEAF donated 622 Mbps of bandwidth/fiber optic cable)

DWDM/ROADM All-Optical Design for Next-Generation TWAREN

Design Concept

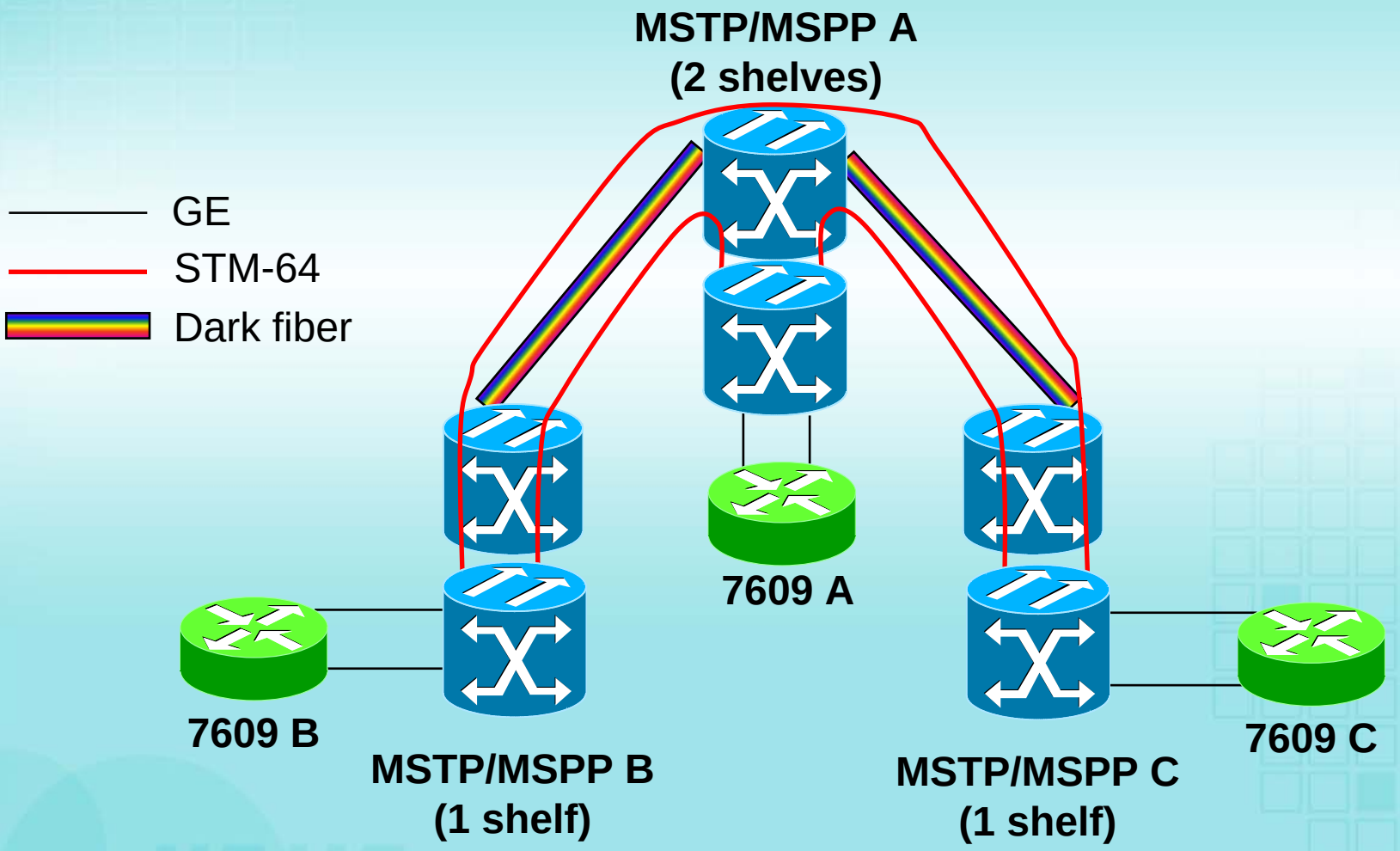
- Migrate four core nodes to ROADM in the first stage
  - scheduled in the mid 2010
- Circuits and ROADM devices in a single bid
  - Divided into two parts for two carriers
  - Challenges for ROADM interconnection

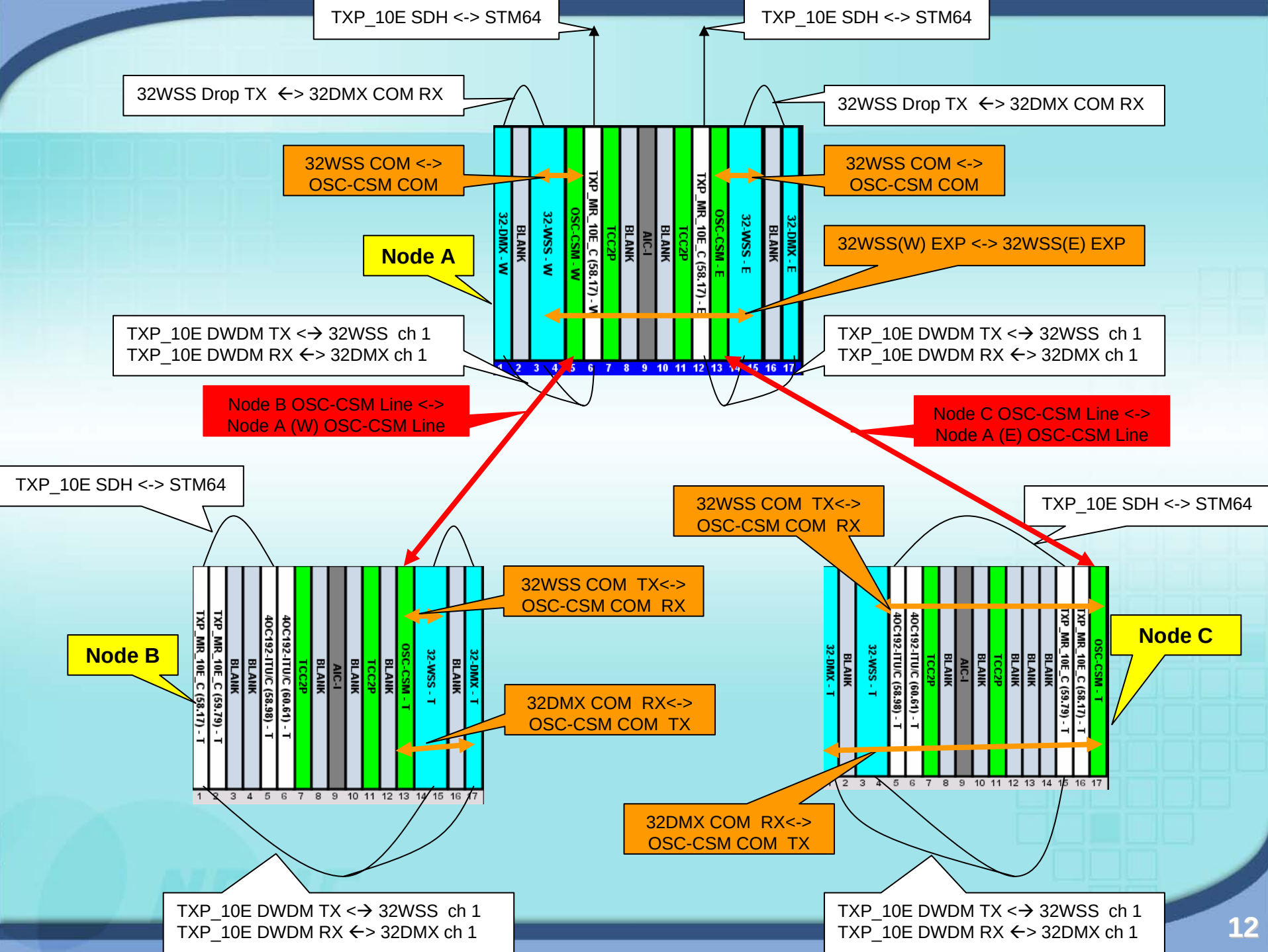

Taipei
ONS
Carrier 1
Carrier 2
ONS
X 2
X 4
HsinChu
X 2
ONS
X 4
Taichung
Tainan
ONS
Long-Distance Dark Fiber
λCircuit
Local fiber
ROADM Interconnection
ONS
ONS (SDH)
7609V
ROADM

Alarm Correlation in Hybrid IP/Optical Network

TWAREN Optical Labs

Lab Network Topology




TXP_10E SDH <-> STM64
TXP_10E SDH <-> STM64
32WSS Drop TX <-> 32DMX COM RX
32WSS Drop TX <-> 32DMX COM RX
32WSS COM <-> OSC-CSM COM
32WSS COM <-> OSC-CSM COM
Node A
32WSS(W) EXP <-> 32WSS(E) EXP
TXP_10E DWDM TX <-> 32WSS ch 1
TXP_10E DWDM RX <-> 32DMX ch 1
TXP_10E DWDM TX <-> 32WSS ch 1
TXP_10E DWDM RX <-> 32DMX ch 1
Node B OSC-CSM Line <-> Node A (W) OSC-CSM Line
Node C OSC-CSM Line <-> Node A (E) OSC-CSM Line
TXP_10E SDH <-> STM64
TXP_10E SDH <-> STM64
32WSS COM TX<-> OSC-CSM COM RX
32WSS COM TX<-> OSC-CSM COM RX
Node B
Node C
32DMX COM RX<-> OSC-CSM COM TX
32DMX COM RX<-> OSC-CSM COM TX
TXP_10E DWDM TX <-> 32WSS ch 1
TXP_10E DWDM RX <-> 32DMX ch 1
TXP_10E DWDM TX <-> 32WSS ch 1
TXP_10E DWDM RX <-> 32DMX ch 1

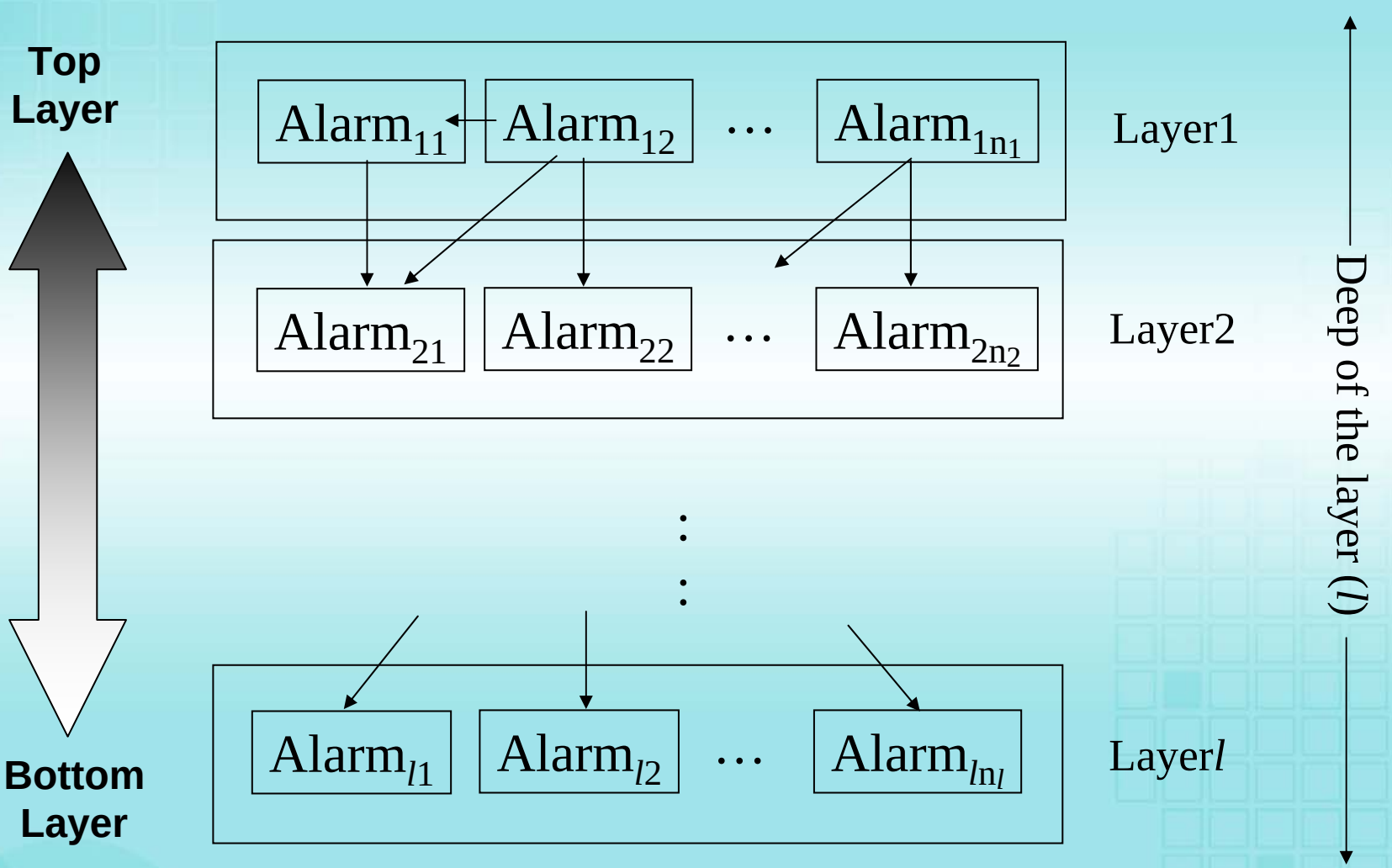
Hybrid IP/Opitcal Networks

- Hybrid networks contain Layer3 IP / Layer2 Switching networks with underlying optical infrastructure as its backbone.
- Optical infrastructure may consist of DWDM/ROADM wavelength-division technology and SONET/SDH time-division technology.

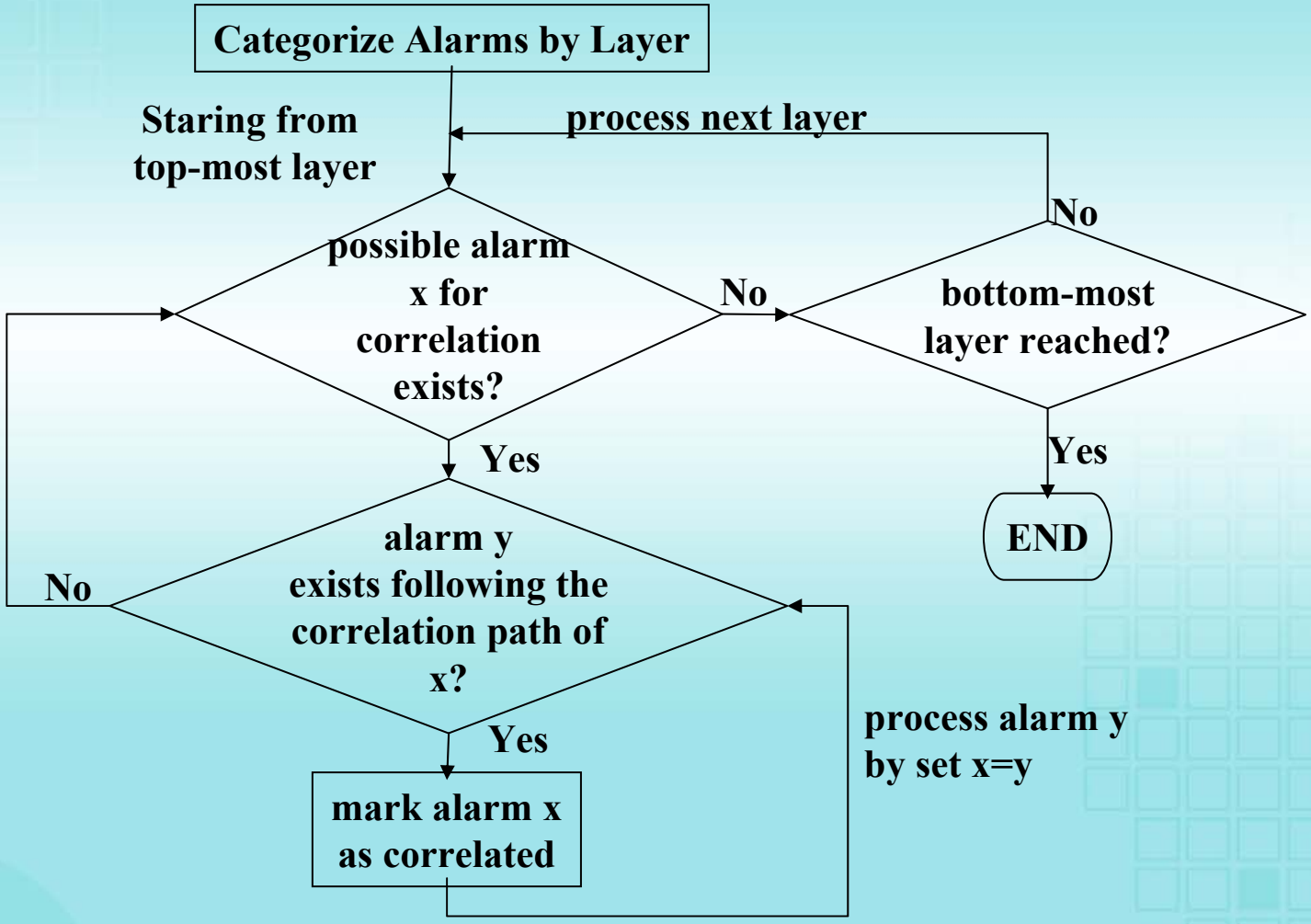
Alarm Management in Hybrid Networks

- If any disruption occurs in lower layer, it will cause upper layer alarms.
- Tens of alarms will show up in burst, which confuse network operators and engineers.
  - Fault location identification is possible with proper alarm analysis/correlation

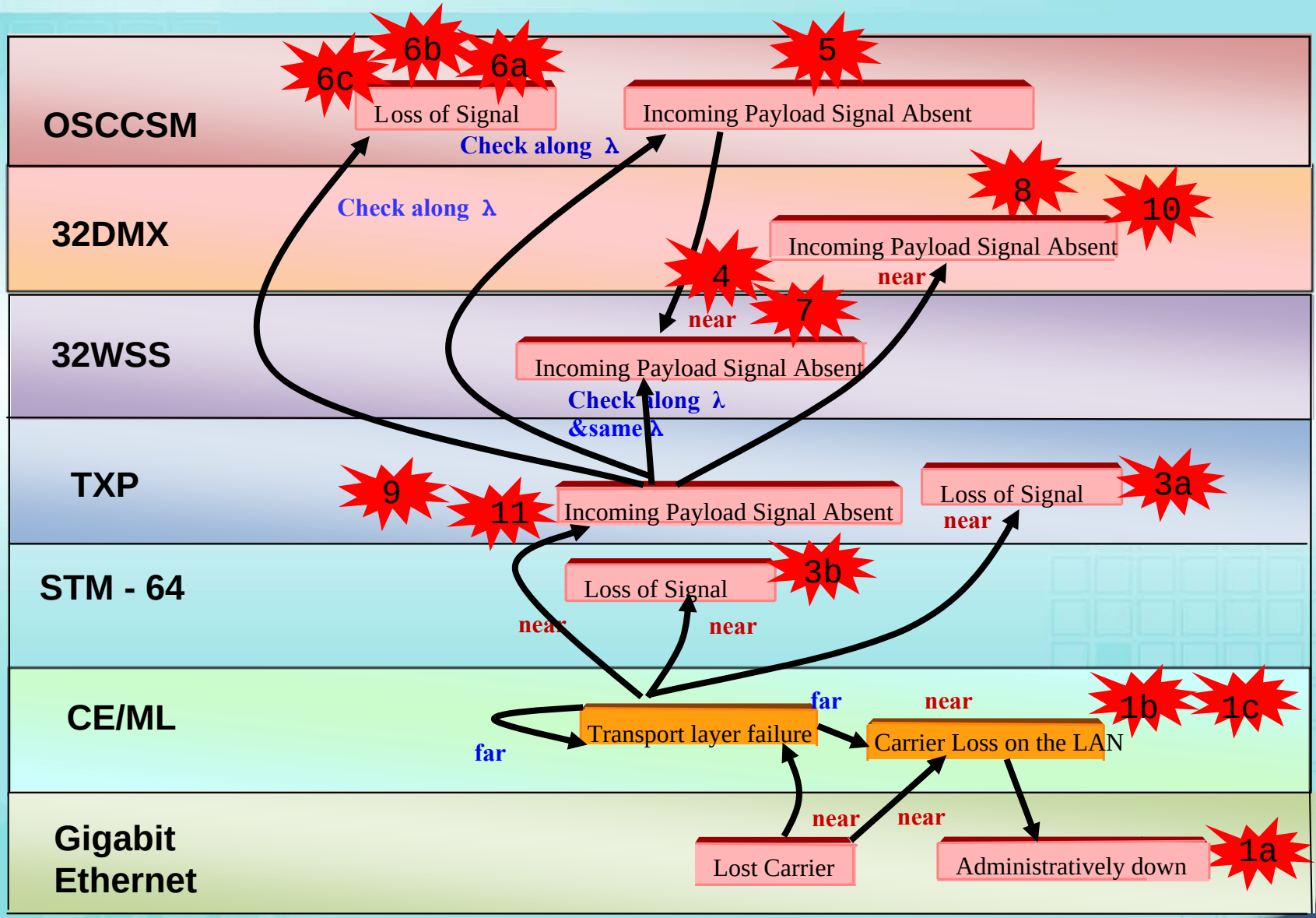
Correlation Diagram

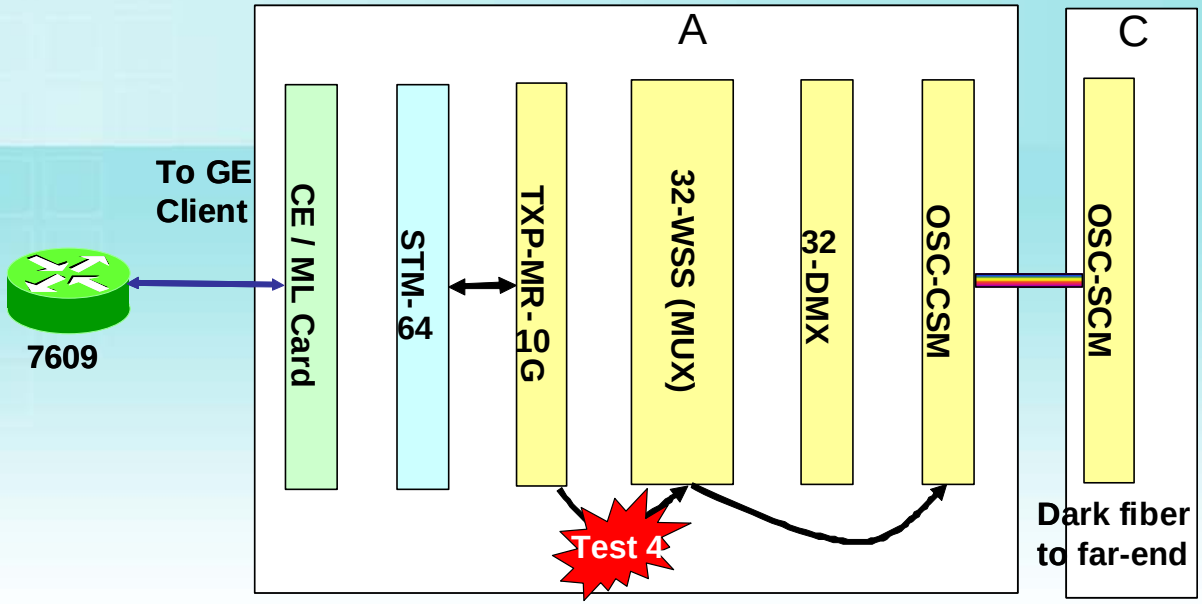


Alarm Correlation Algorithm



Alarm Correlation Diagram



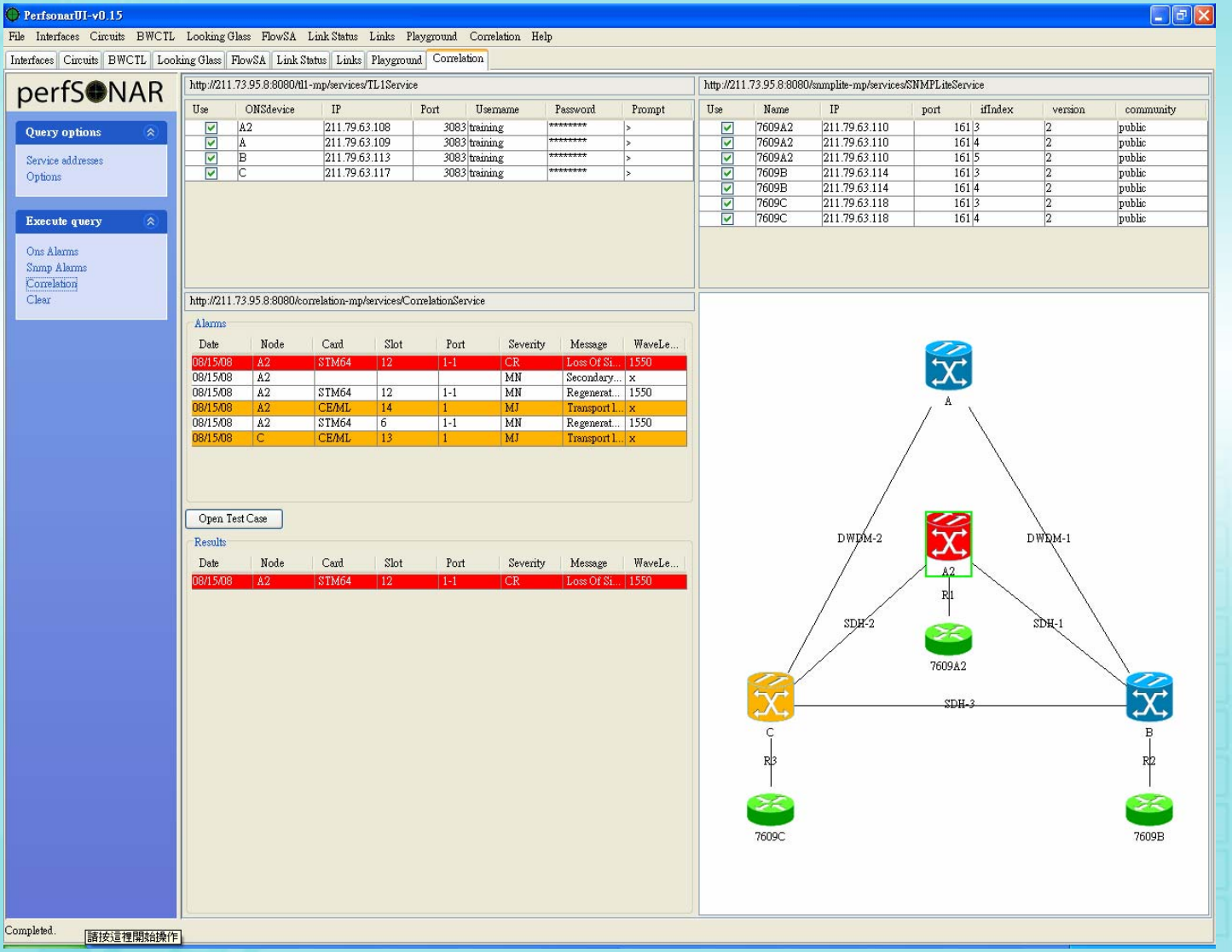


	Layer	Alarm Descriptions	Alarm source (near-end or far-end)	Affected card/module
Test 4	IP	Lost Carrier	Router A Router C	GigabitEthernet
	IP	Transport layer failure	Node A Node C	CE/ML
	Wavelength	Incoming Payload Signal Absent	Node C	TXP-MR-10G
	Wavelength	Incoming Payload Signal Absent	Node A	32-WSS
	Fiber	Incoming Payload Signal Absent	Node A	OSC-CSM

Results

- 75%, 87%, and 91% alarms are correlated in average when network disruption in IP Layer, SDH Layer, and DWDM layer respectively.

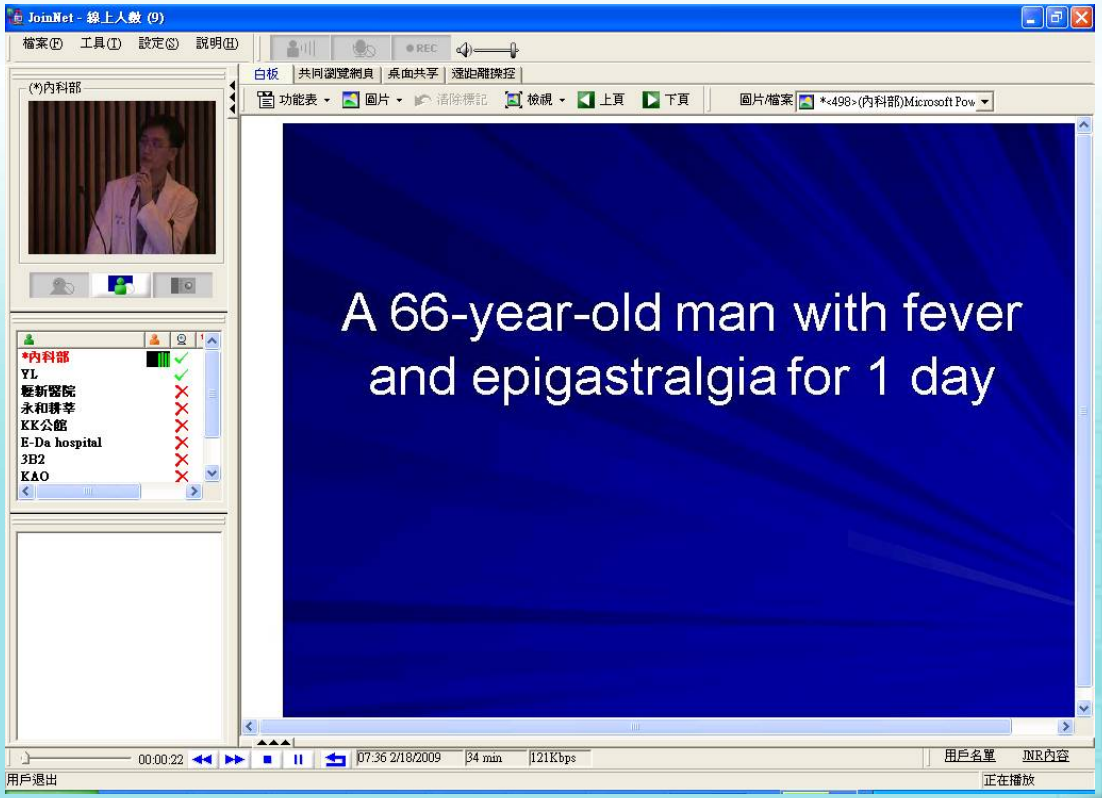
Implementation on perfSONAR



Domestic/International Medical Collaborations

Medical Video Trainings in Taiwan

- Cross hospital medical case discussions and video trainings are periodically held by using video conference platforms.
  - Colife (developed by NCHC)
  - JoinNet

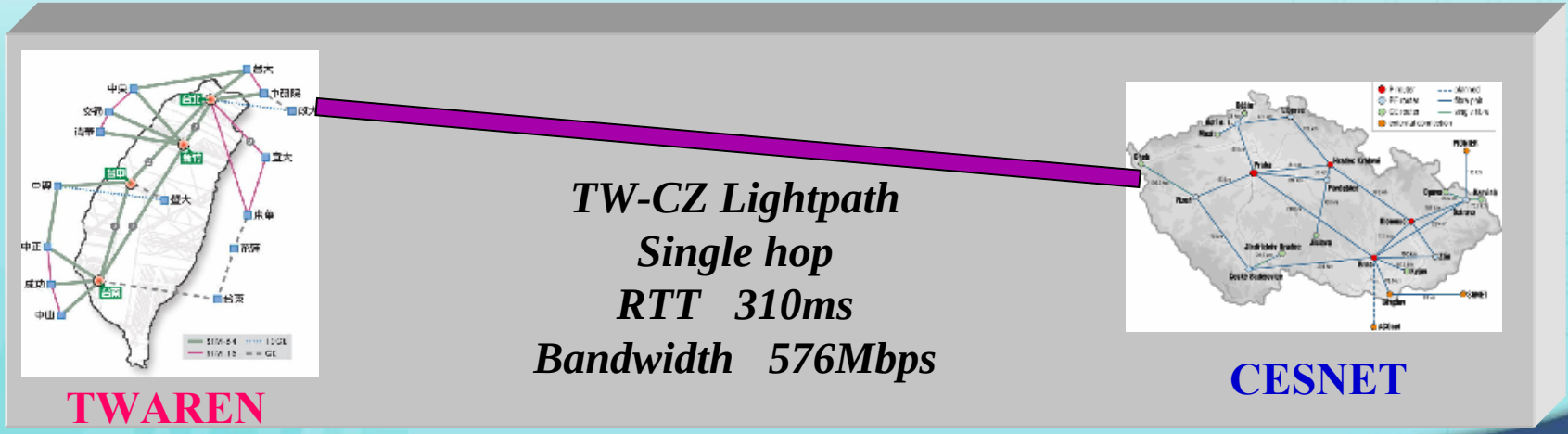


Medical Video Trainings

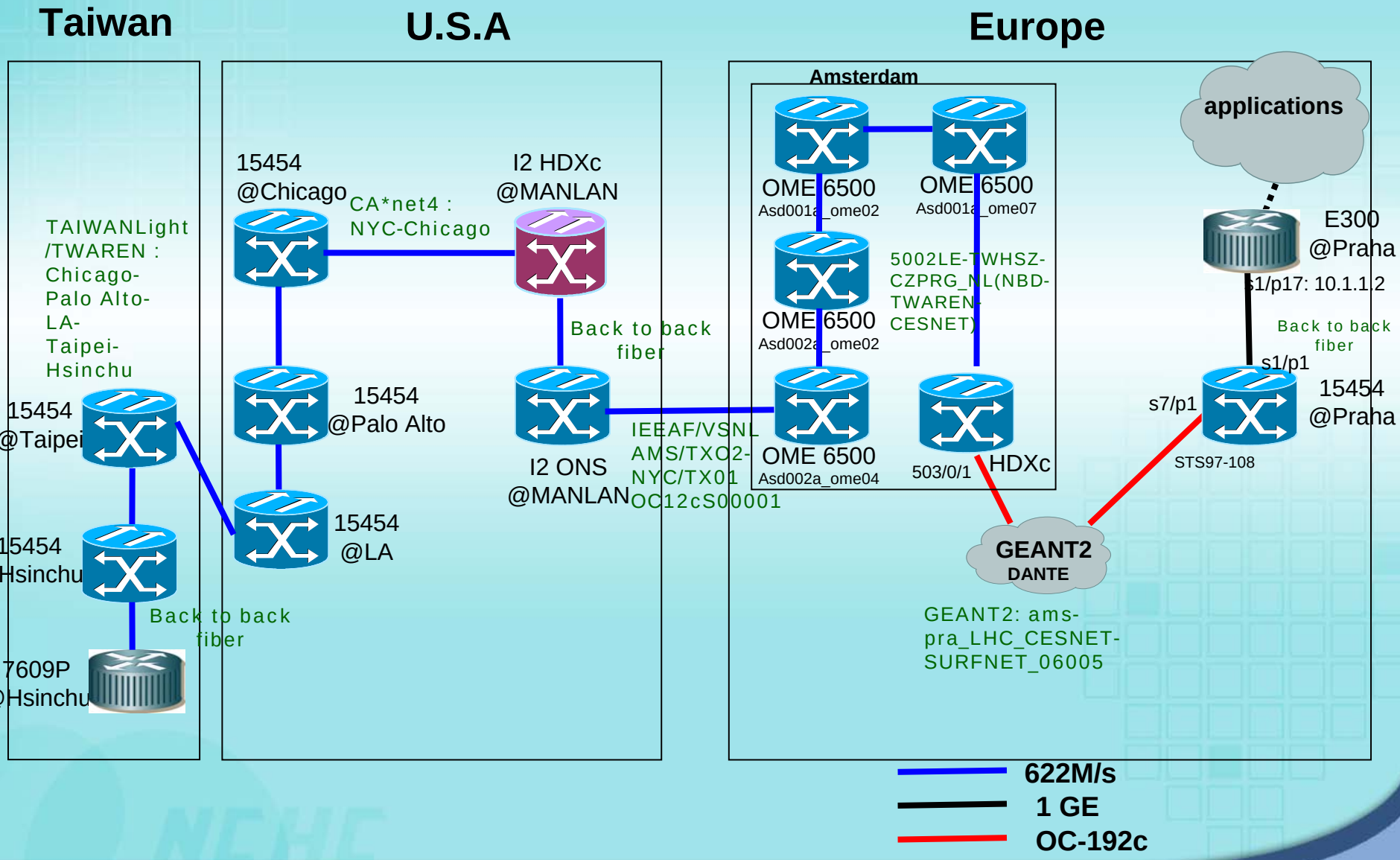
- The video trainings and case discussions effectively helped the doctors in Taiwan to:
  - Share their expertise on difficult medical cases,
  - Quickly adopt the knowledge of analysis and therapy to emergent diseases like H1N1, and
  - Learn new methods of surgery and treatments visually and interactively.
- Usually over 50 hospitals and hundreds of doctors and nurses participated and benefited.

TWAREN-CESNET connection

- A direct lightpath that connects TW and CZ is provisioned through Pacific and Atlantic oceans in 2008/2.
  - Joint work among TWAREN, CA*net, MANLAN, NetherLight and CESNET
- ***IPv6*** and ***Multicast*** are enabled and several video streams are exchanged between TWAREN and CESNET.
- Further collaborations on ***live medical streaming*** and ***HPC computing*** are going on.

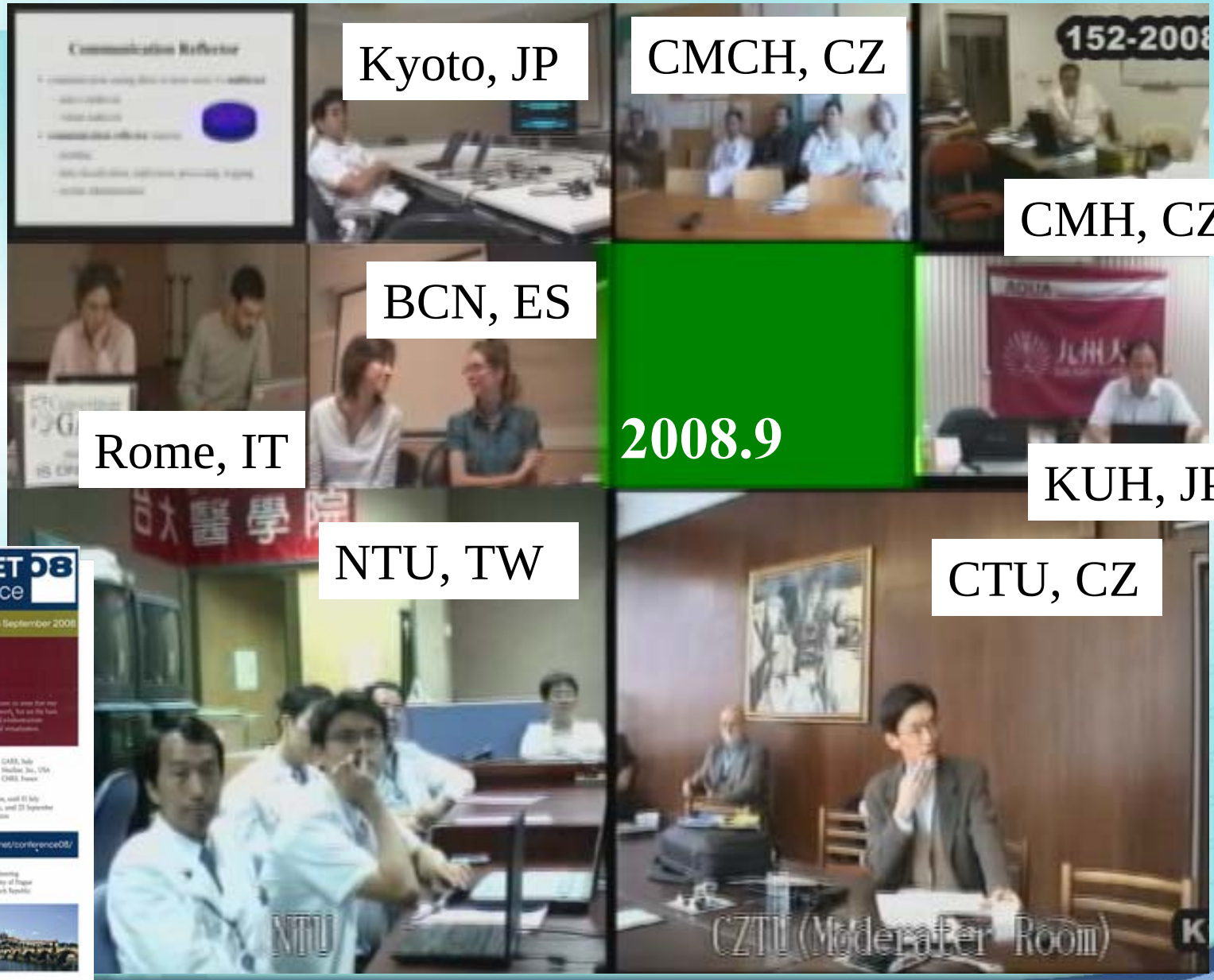


TWAREN-CESNET Optical Topology



Live Medical Streaming Demo

•2008/9: Demo of gastrointestinal endoscopy in CESNET08 conference (8 sites in Japan, Taiwan, Italy, Spain and Czech).

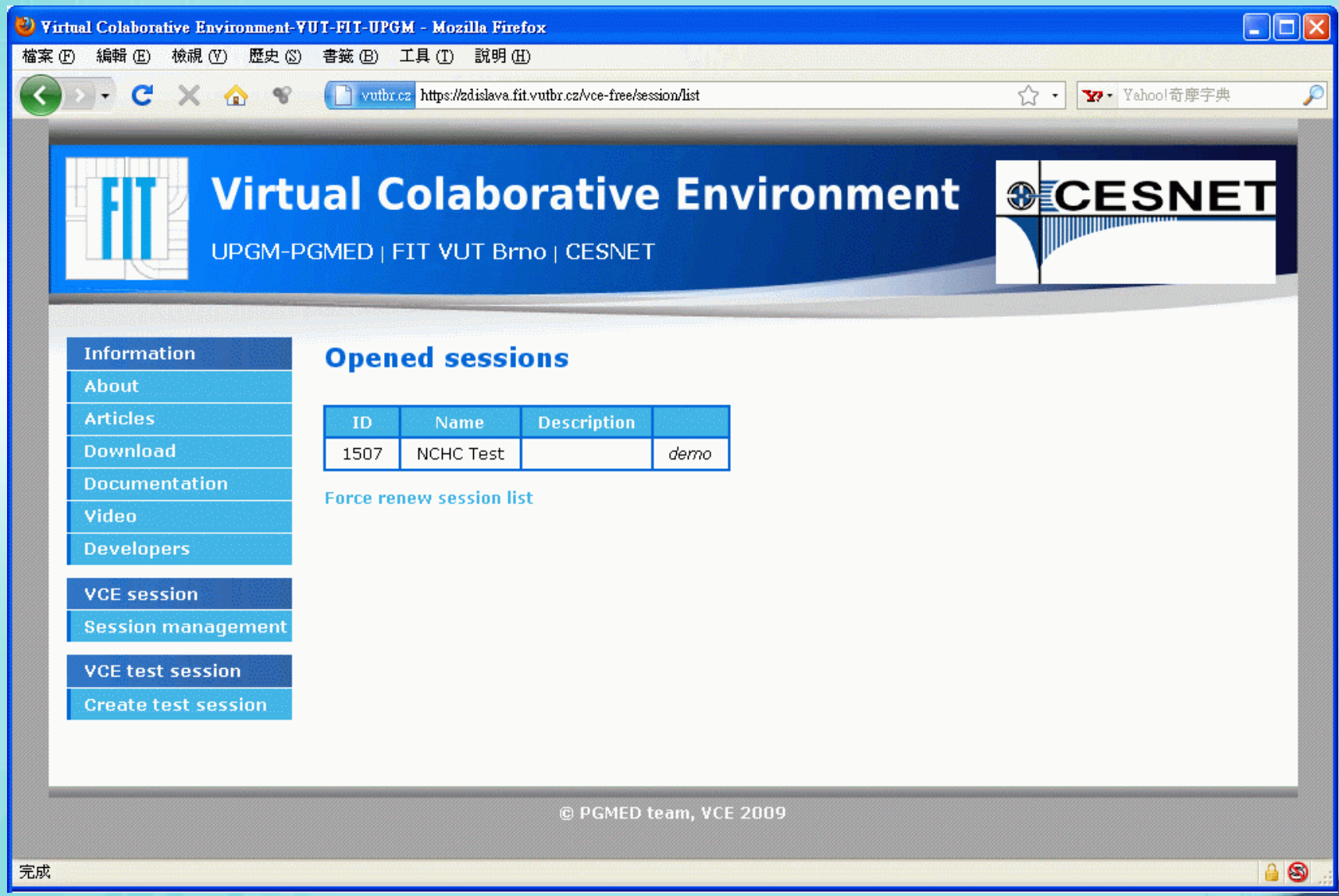

Kyoto, JP
CMCH, CZ
CMH, CZ
BCN, ES
Rome, IT
2008.9
KUH, JP
NTU, TW
CTU, CZ
NTU
CZTU (Moderater Room)


CESNET conference 08
Prague, 25–26 September 2008
security
middleware
virtualization
Topics:
Keynote speakers:
Registration fees and deadlines:
http://www.ces.net/conference08/
Venue:
CESNET

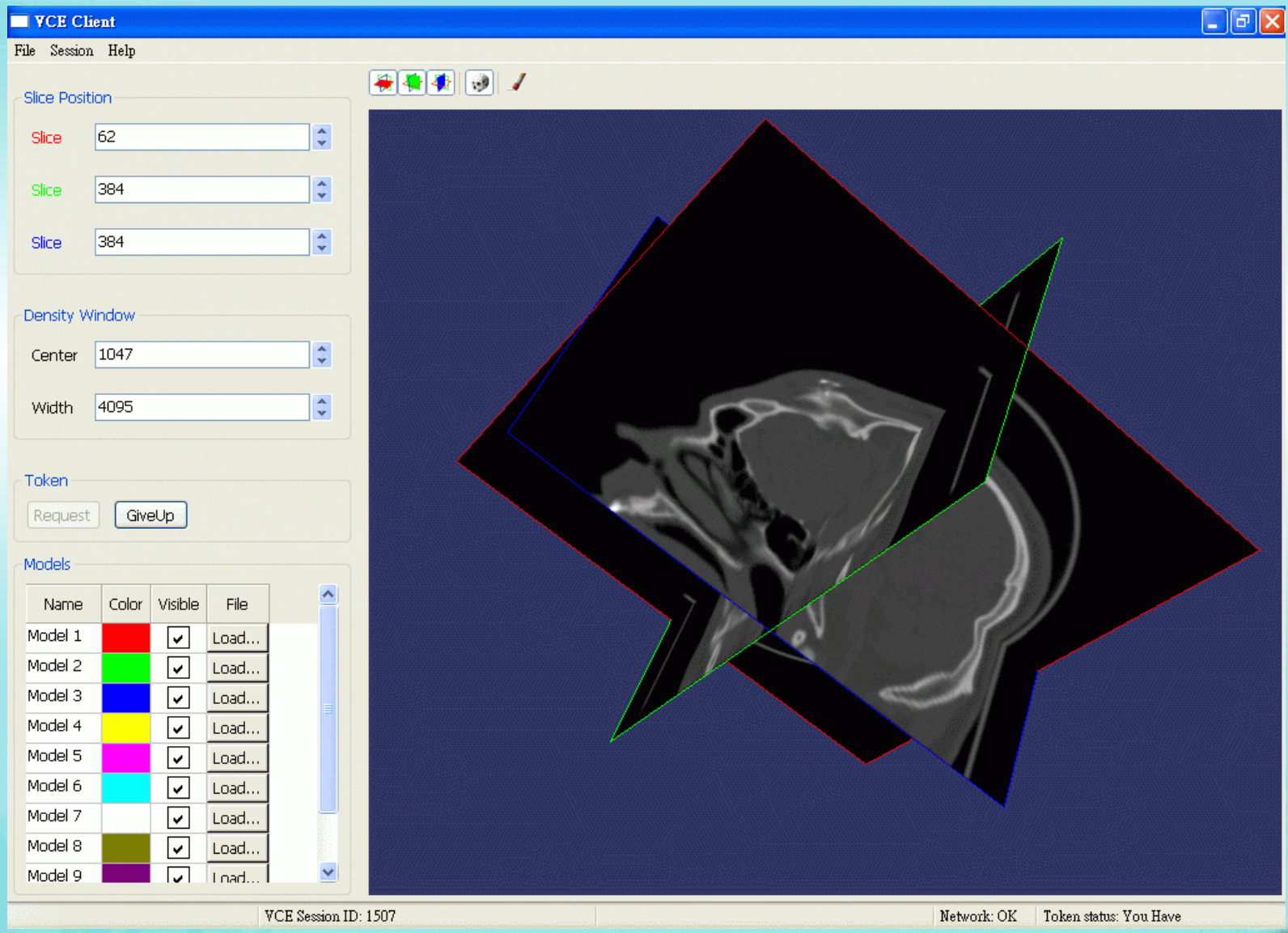
3D Interactive Medical Imaging

- Collaborated with CESNET and Brno University of Technology, we have been facilitating the 3D medical imaging of Computerized Tomography (CT) collaboration between National Taiwan University Hospital and doctors in Brno.
- A fully interactive way for remotely separated doctors to analyze and discuss the same subject.
- Enables the possibility of medical collaboration all over the world.

3D Interactive Medical Imaging



3D Interactive Medical Imaging




Thank You
Questions?
www.nchc.org.tw