INTERNET2®

www.internet2.edu

Internet2 and international partners

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Networks reachable via AMPATH – by country

Europe-Middle East

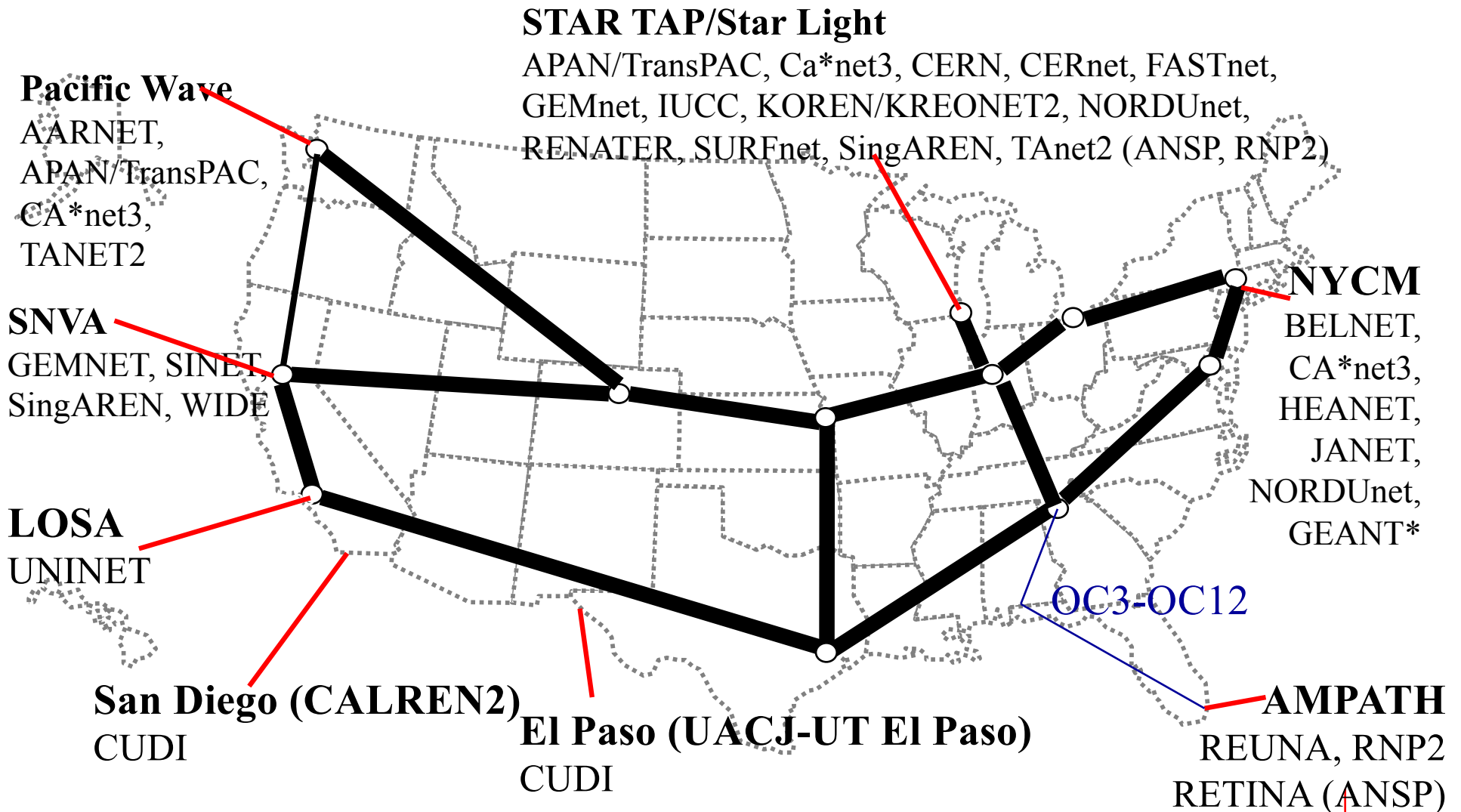|	
Austria	Italy
Belgium	Latvia
Bulgaria	Lithuania
Croatia	Luxembourg
Czech Republic	Netherlands
Cyprus	Norway
Denmark	Poland
Estonia	Portugal
Finland	Romania
France	Slovakia
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Iceland	Switzerland
Ireland	United Kingdom
Israel	*CERN

Asia-Pacific

Australia
China
Hong Kong
Japan
Korea
Singapore
Taiwan
Thailand

Americas

Argentina
Brazil
Canada
Chile
Mexico
United States

How?
STAR TAP, Abilene, CA*net ITN

STAR TAP/Star Light
APAN/TransPAC, Ca*net3, CERN, CERnet, FASTnet, GEMnet, IUCC, KOREN/KREONET2, NORDUnet, RENATER, SURFnet, SingAREN, TAnet2 (ANSP, RNP2)

Pacific Wave
AARNET,
APAN/TransPAC,
CA*net3,
TANET2

SNVA
GEMNET, SINET, SingAREN, WIDE

LOSA
UNINET

San Diego (CALREN2)
CUDI

El Paso (UACJ-UT El Paso)
CUDI

NYCM
BELNET,
CA*net3,
HEANET,
JANET,
NORDUnet,
GEANT*

OC3-OC12

AMPATH
REUNA, RNP2
RETINA (ANSP)

* ARNES, CARNET, CESnet, DFN, GRNET, RESTENA, SWITCH, HUNGARNET, GARR-B, POL-34, RCCN, RedIRIS

Asia to US connectivity (April 2002)

Country	Network	BW(mbps)	Interconnect
APAN/US	TransPAC	622	Tokyo to P. Wave
		622	Tokyo to Star Light
Australia	AARNET	310	Pacific Wave
China	CERNET	10	STAR TAP
Korea	KOREN/KREONET2	45	STAR TAP
Japan	SINET	155	Abilene, Sunnyvale
Japan	WIDE (ipv6 only)	45	Abilene, Sunnyvale
Japan	GEMNET	33	Abilene, Sunnyvale
Singapore	SingAREN	27	STAR TAP, Sunnyv.
Taiwan	TANET2	90	Pacific Wave
Thailand	UNINET	10	Abilene, LA

Europe to US connectivity (April 2002)

Country	Network	BW(mbps)	Interconnect
Belgium	BELNET	155	NYC
CERN	CERN	622	STAR TAP
Ireland	HEANET	310	NYC/STAR TAP
Israel	IUCC	45	STAR TAP
Netherlands	SURFnet	1244+	Star Light
Nordic Countries	NORDUnet	622	NYC/Star Light
U.K.	JANET	2400	NYC
Russia	FASTnet	45	STAR TAP
Europe	GEANT	5000	NYC

Who?

- **Mainly universities**
  - Almost all major research universities
  - Some smaller universities

- **Research Laboratories**
  - National/government-sponsored research labs
  - Some industry research labs

- **Other education**
  - Further education/community colleges
  - Some elementary, Secondary schools

- www.internet2.edu/international
  - Links to most of the networks/organizations listed

- www.startap.net
  - More information about reachable networks

- ARENA (funded in part by NSF)
  - Interactive atlas:
    - Links to research and education networks
    - NOC and technical contact information
    - Who connects to which network
    - Which networks are connected together (peer)
    - Pathfinder tool draws a path and shows bandwidth from one institution to another

arena.internet2.edu

ARENA

The Advanced Research and Education Network Atlas (ARENA) project is a compendium of information about advanced research and education (R&E) networks around the world. The Atlas database includes various types of network maps, administrative, technical and operational contacts for networks, and information about connections between networks, providing several tools with which to explore this information and the relationships between networks. The goal of the project is to facilitate the engineering and use of advanced networks by the research and education community.

Explore the Atlas

- Browse the Table of Contents [help]
  - North America
  - South America
  - Europe and the Middle East
  - Far East Asia and Oceania

- Find a path between any two sites with Pathfinder [help]

- Search the Database [help]

  [   ] Go

- How to use the Atlas tools

Contribute to ARENA

Is there information that is incorrect or missing? Click here to add or edit information in ARENA.

ARENA Contacts

- **General Information**
  arena@internet2.edu

- **Project Management**
  Guy Almes (PI)
  Heather Boyles
  E Paul Love

- **Developers**
  Adam Edelman
  David Russcol

Useful Links

- Internet2 International
- TERENA Compendium
- STARTAP
- NLANR Applications Database

The ARENA project is currently in the process of collecting information from R&E networks around the world. Because of this, some of the information displayed in the tools may be incomplete. If you have information to add to the ARENA database, please contribute here.

⊞ SingAREN (Singapore)
TANET2 (Taiwan)
UNINET (Thailand)
WIDE (Japan)

North America
⊞ Abilene (USA)
⊟ CANet3 (Canada)
   ⊟ NeteraNet (Canada)
       Lethbridge Community College (Canada)
       Mount Royal College (Canada)
       Northern Alberta Institute of Technology (Canada)
       Southern Alberta Institute of Technology (Canada)
       The Banff Centre (Canada)
       University of Alberta (Canada)
       University of Calgary (Canada)
       University of Lethbridge (Canada)
DREN (USA)
ESnet (USA)
⊞ NISN (USA)
⊞ NREN (USA)
Red-CUDI (Mexico)
vBNS (USA)

South America
⊟ AMPATH
   ⊞ University of Puerto Rico (Puerto Rico)

NeteraNet — Microsoft Internet E...

NeteraNet
Right click to print this page

Location: Canada

Homepage: http://www.netera.ca/

Upstream: CANet3: Popup | TOC

Maps:

Contact Information [hide]
Administrative:
Ken Hewitt
Phone: 403-220-4904
Email: kdhewitt@netera.ca

Technical:
Gary Finley
Phone: 403-220-2571
Email: gfin@netera.ca

NOC:

This path is probably the best one, but one of the other possible paths (if any) may actually be more efficient. Click here to view all paths.

Optimal path is as follows:

- Michigan State University; upstream connection at unknown bandwidth to
- MREN; upstream connection at 155 Mbps to
- Abilene; peering connection at 1000 Mbps to
- CANet3; downstream connection at 2.5 Gbps to
- NeteraNet

Route Details

The bandwidth of one or more links is unknown.

The ARENA database cannot completely model every network situation in the Internet2 database. Therefore, the Pathfinder may produce implausible results in some cases. It can, however, be used as a general guide for navigating the networks connected to Internet2.

The ARENA project is currently in the process of collecting information from R&E networks around the world. Because of this, some of the information displayed in the tools may be incomplete. If you have information to add to the ARENA database, please contribute here.
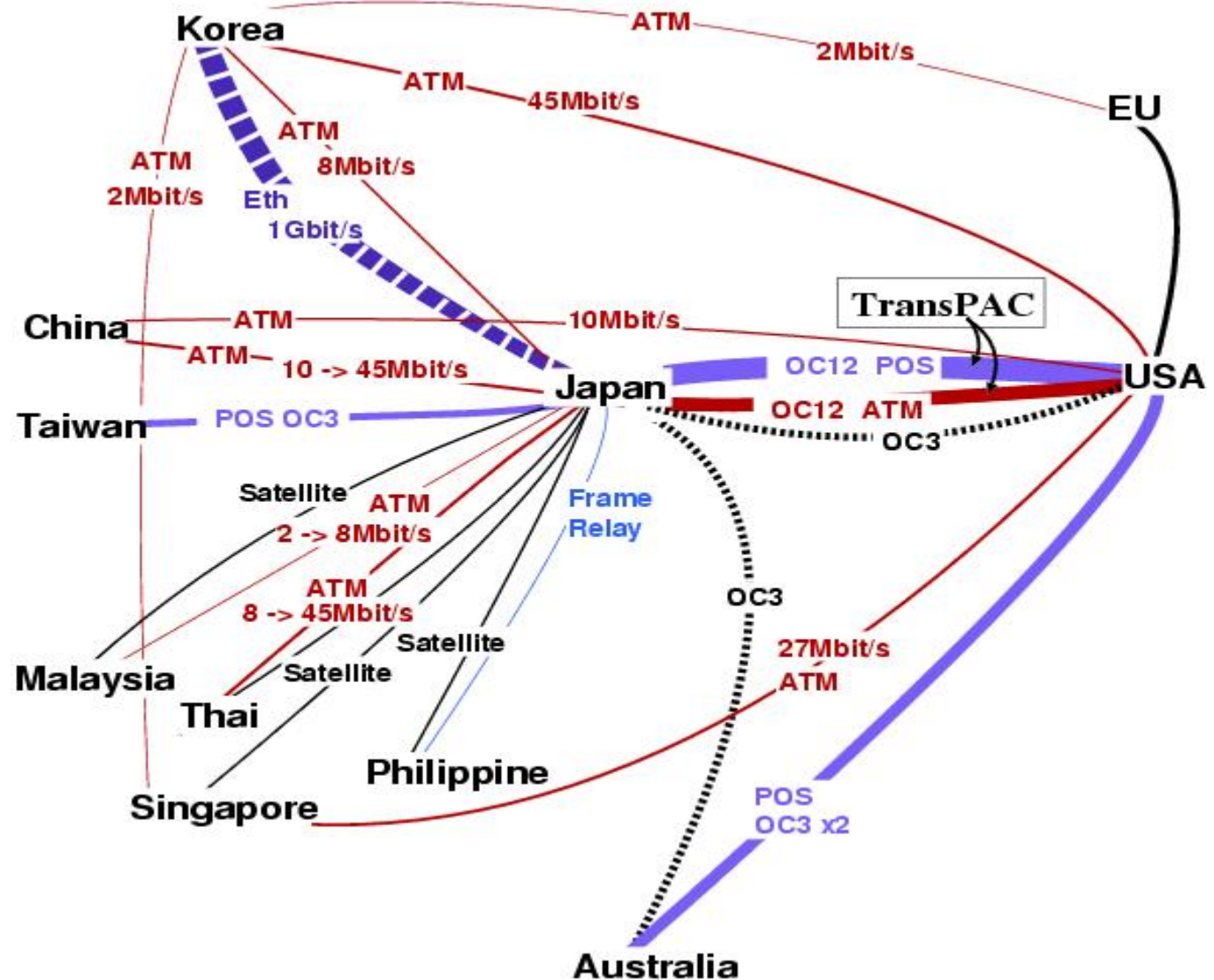
APAN
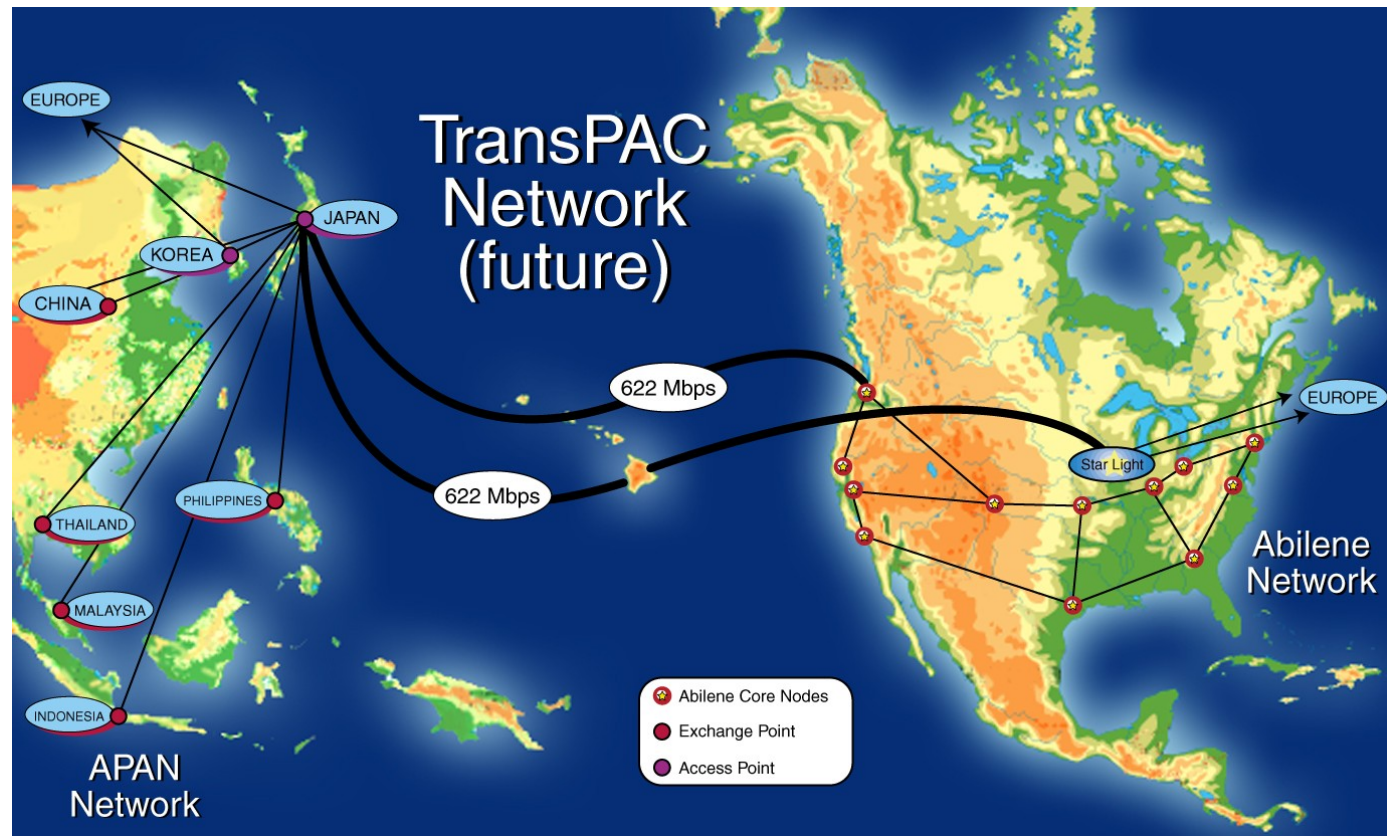## http://www.apan.net

- APAN is Asian partner on TransPAC link
- APAN network made up of country-owned p2p links contributed to APAN

TransPAC
http://www.transpac.org

■Connections APAN to US

- OC-12 POS Seattle (Pacific Wave) to Tokyo
- OC-12 ATM Chicago (StarLight) to Tokyo
- Together 1.244 Gbps Tokyo to the US

AARNET
http://www.aarnet.edu.au/

- **155mbps**
  - Plan to run unprotected and utilize double bandwidth

- **Connects at Pacific Wave**

- **Supports academic and research community in Australia**

Connections to International R&E Networks
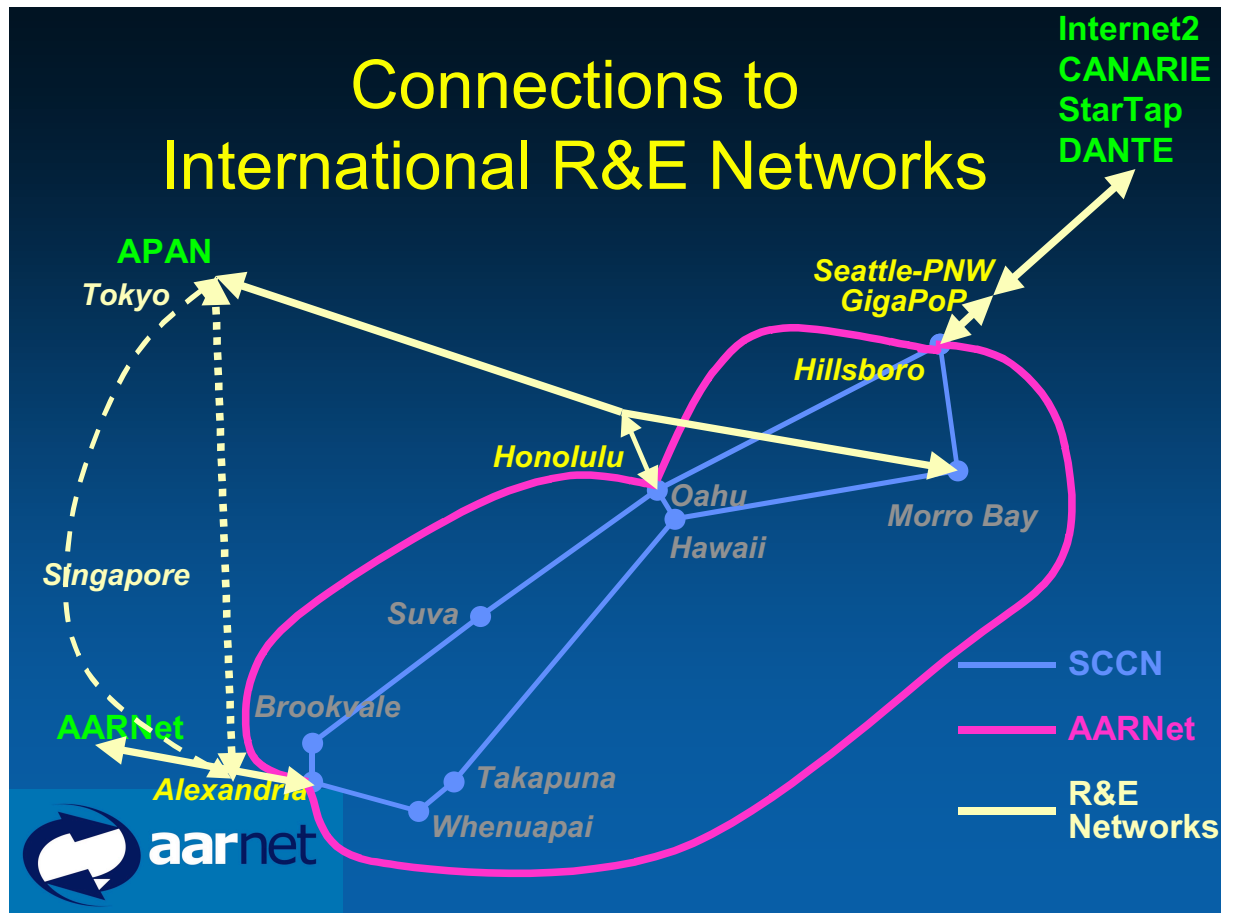
Source: George McLaughlin, AARNET

- **10mbps connection to STAR TAP**

- **10mbps to Japan (APAN)**

- **Within China:**
  - 16x2.5G DWDM system (two lambda's are currently running)
  - OC48 POS links to 8 cities
  - OC3 POS SDH links to all provincial capitals (except Lhasa)
  - unicast and multicast

Source: Xing Li, CERNET

KOREN/KREONET2
http://www.koren21.net, http://www.kreonet2.net

- Sharing 45mbps lin across Pacific to STAR TAP
  - KREONET2 is led by KISTI and funded by Ministry of Sci & Tech
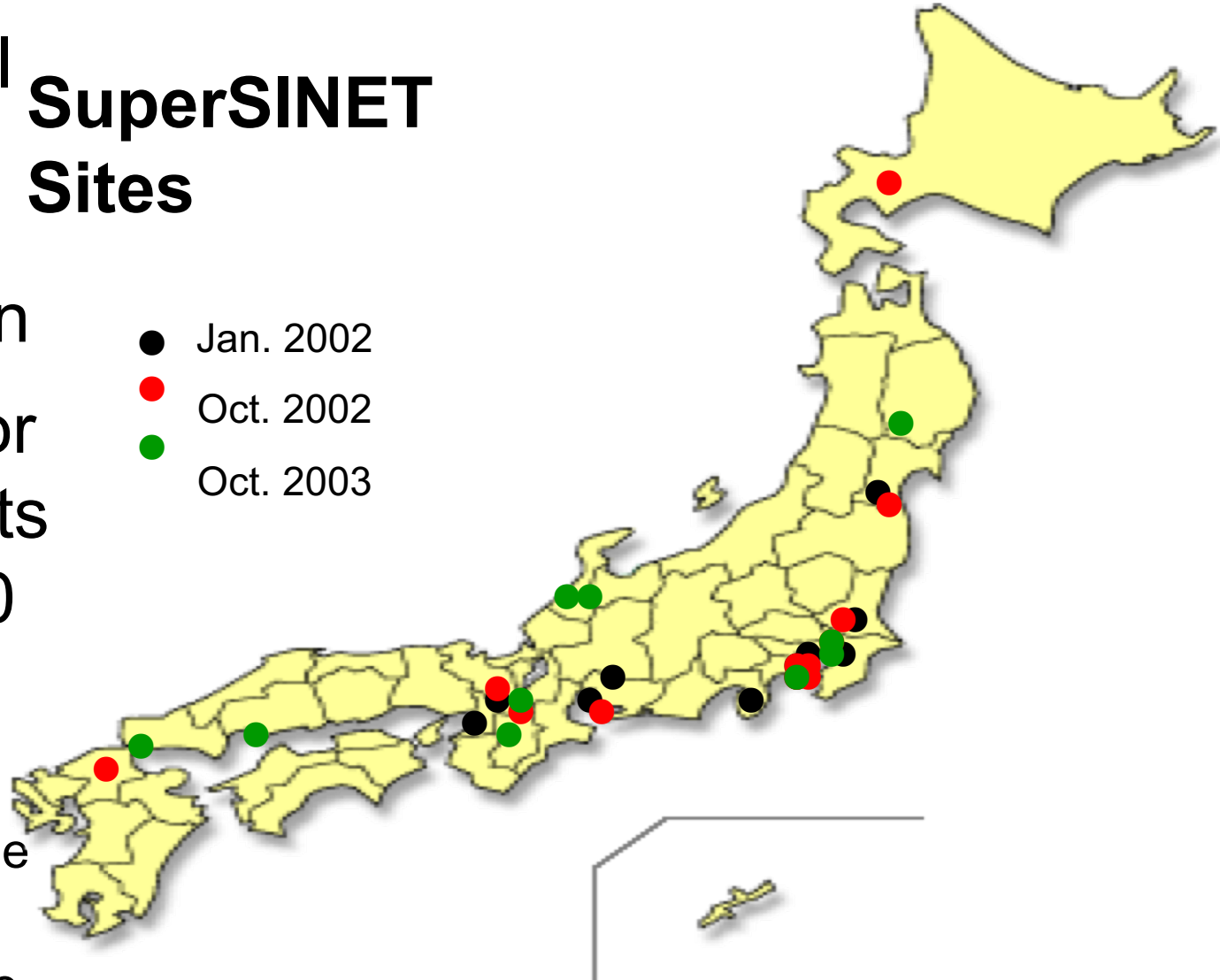 - KOREN is funded by Ministry of Info and Comm and operated b Korea Telecom

KOREN Topology

SINET
http://www.nii.ac.jp/network-e.html
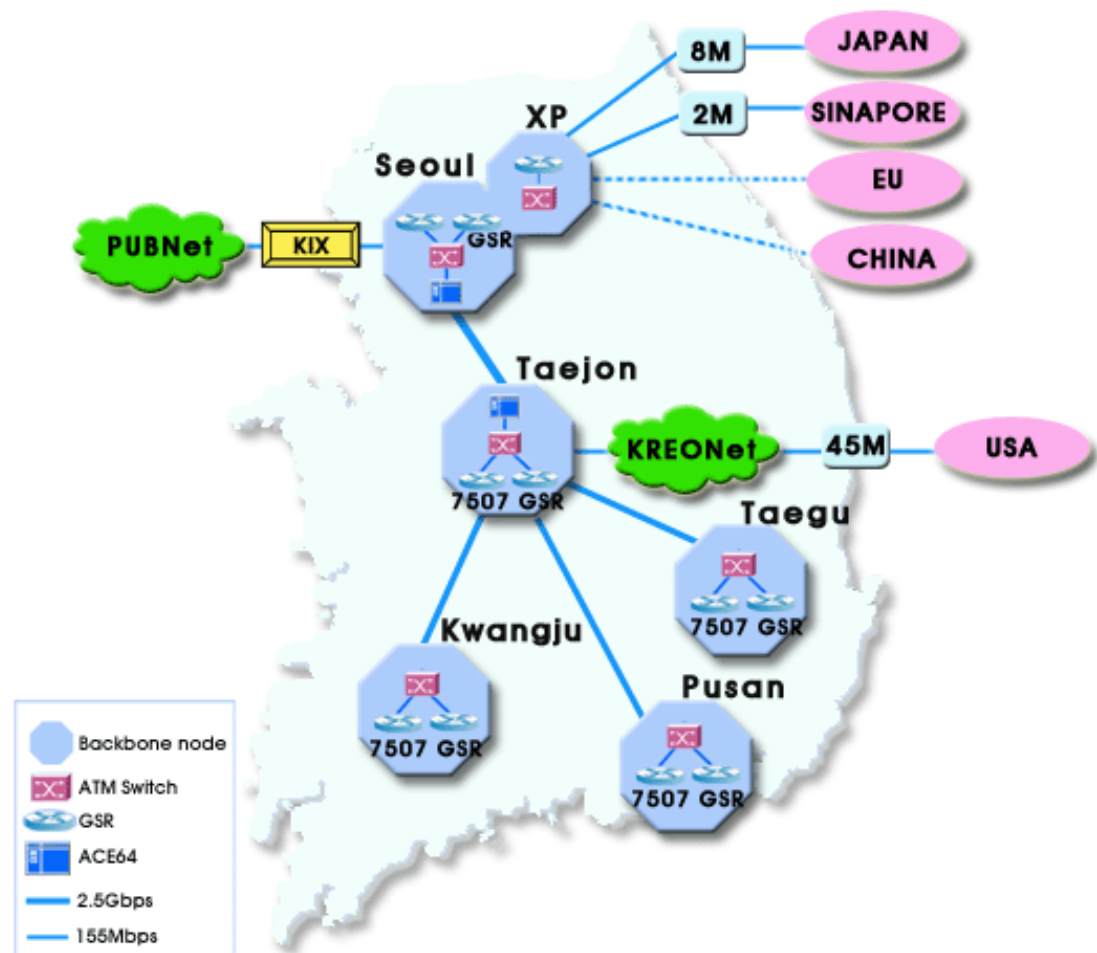
- SINET national backbone network for higher education
- SuperSINET for research projects (~14 versus 300 SINET universities)
  - 10gbps backbone in Japan
  - 155mbps Abilene in Sunnyvale

SuperSINET Sites

- Jan. 2002 (black)
- Oct. 2002 (red)
- Oct. 2003 (green)

WIDE IPv6 Connection
http://www.wide.ad.jp/

■First international, native IPv6 connection

- 45mbps Tokyo to Sunnyvale
- Connects to Abilene IPv6 router in Sunnyvale
- DV over IP applications development
    - Fujitsu at University of Maryland
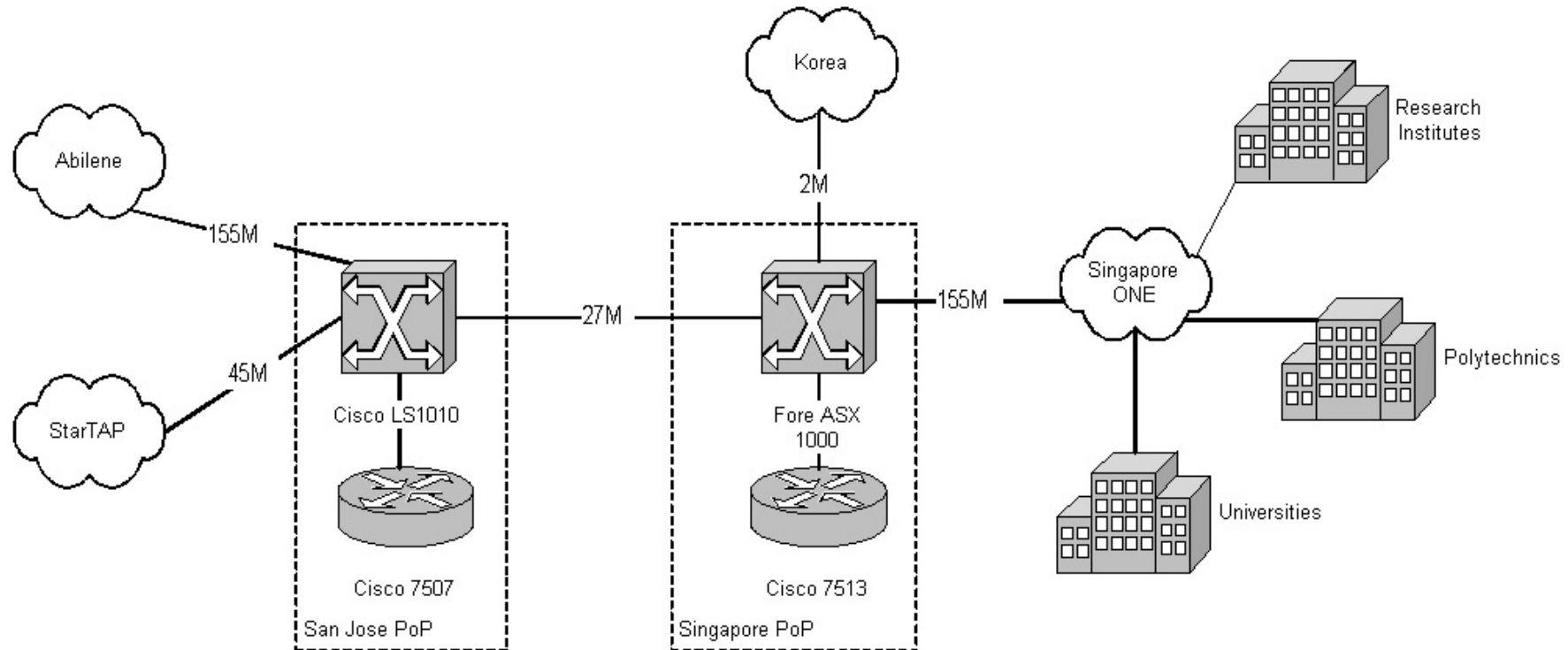
GEMNET

■NTT Labs-owned and operated network

- Connects NTT Research Labs in Japan
- Plus several radio telescope installations
- Plus U. Kyoto and U. Tok
- 2.4Gb/s circuits
- 33mbps connection to US, of which 10mb PVC to Abilene, also to STAR TAP

Radio Frequency Signals from Space

Usuda Deep Space Center (ISAS)

KSP Kashima Station

Kashima Space Research Center (CRL)

Nobeyama Radio Observatory (NAO)

2.4Gb/s ATM Network

NTT Musashino R&D Center

KSP Miura Station (CRL)

KSP Tateyama Station (CRL)

KSP Koganei Station

National Astronomical Observatory
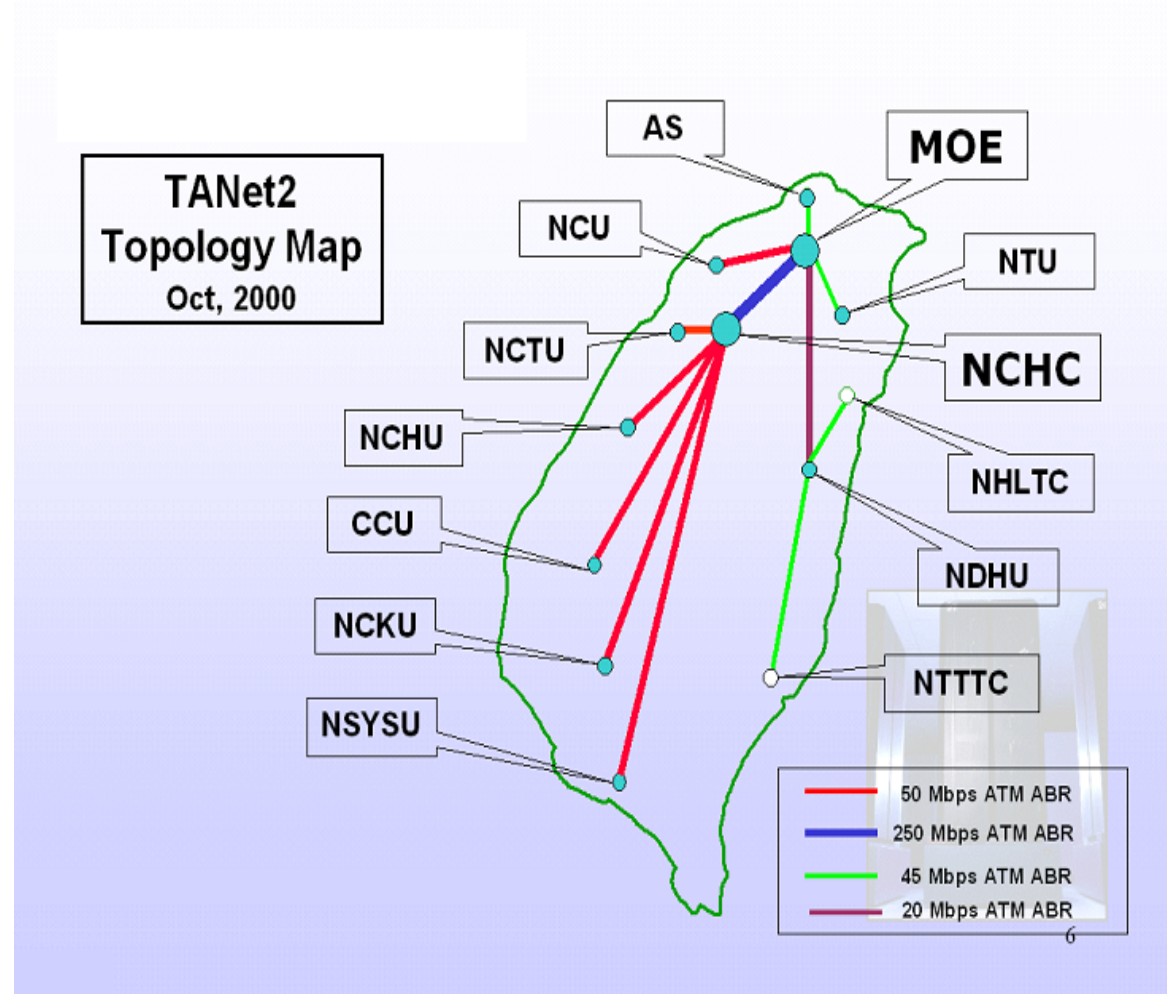
Communications Research Laboratory
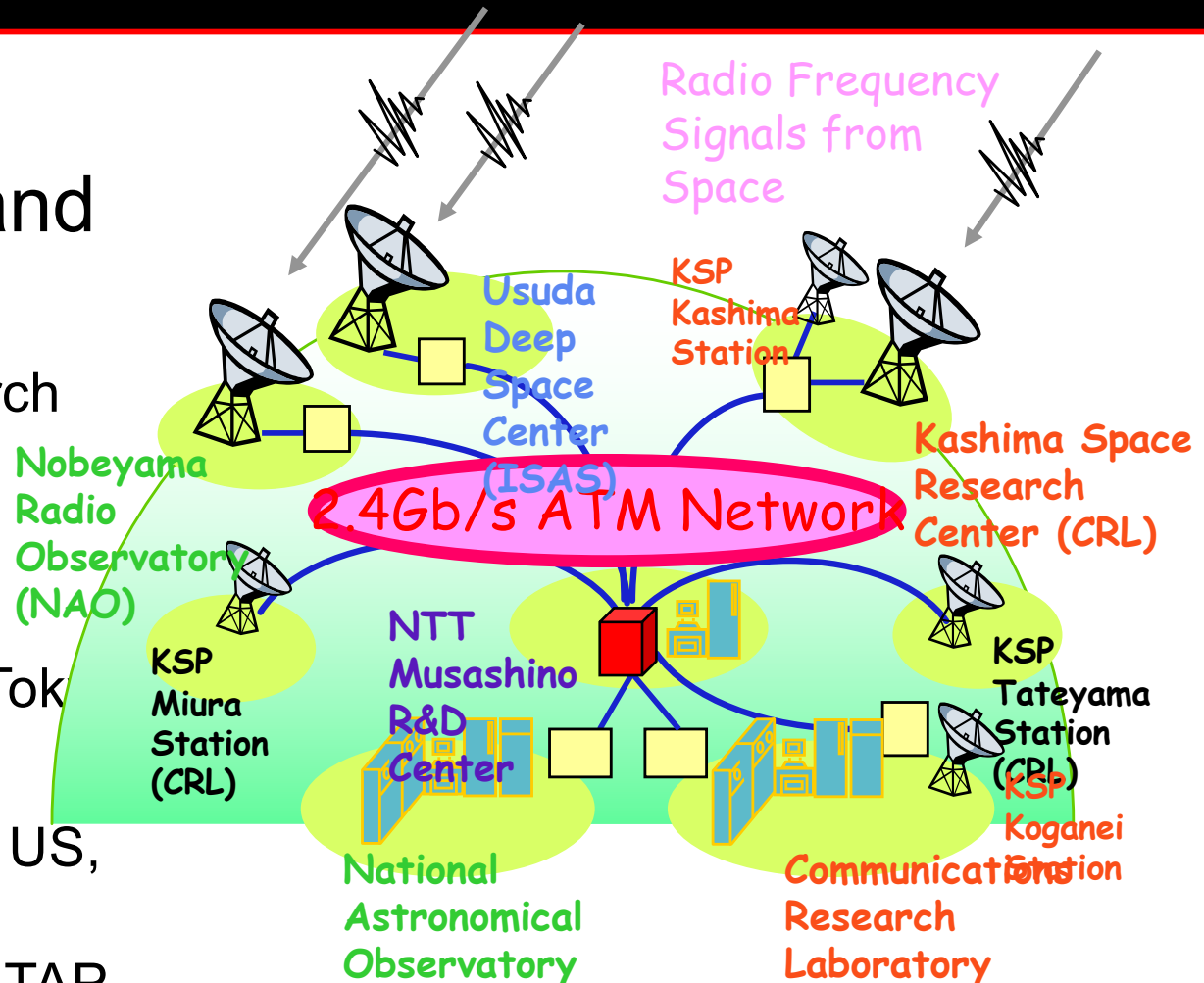
■Currently 27mbps across Pacific

- Peers with Abilene in Sunnyvale
- 45mbps PVC to STAR TAP/AADS switch

- ■**Recently upgraded to 90mbps connection to Pacific Wave, Seattle**
  - Connects select few, high-end research institutions in Taiwan
  - Peers with several nets at Pacific Wave

TANet2 Topology Map Oct, 2000

AS
NCU
NCTU
NCHU
CCU
NCKU
NSYSU
MOE
NTU
NCHC
NHLTC
NDHU
NTTTC

50 Mbps ATM ABR
250 Mbps ATM ABR
45 Mbps ATM ABR
20 Mbps ATM ABR

6

■**Funded by Ministry of University Affairs in Thailand**

- Connects most universities in Thailand
- Via 155mbps links
- Currently has 10mbps PVC to Los Angeles
- Peers with Abilene in L.A.
- Other major net in Thailand is run by NECTEC (Ministry of Science & Tech funding)

Pacific Wave
http://www.pacificwave.net/

- Project of the Pacific NorthWest Gigapop

- 2 gigE switches in telco hotel (Westin Building) in Seattle

- Interconnecting AARNET, Abilene, CA*net3, DREN, ESNET, TANET2 others

- **TERENA (Trans European Research and Education Network Association)**
  - Membership association of National Research Networks (NRNs)
  - No network, but technology and applications working groups
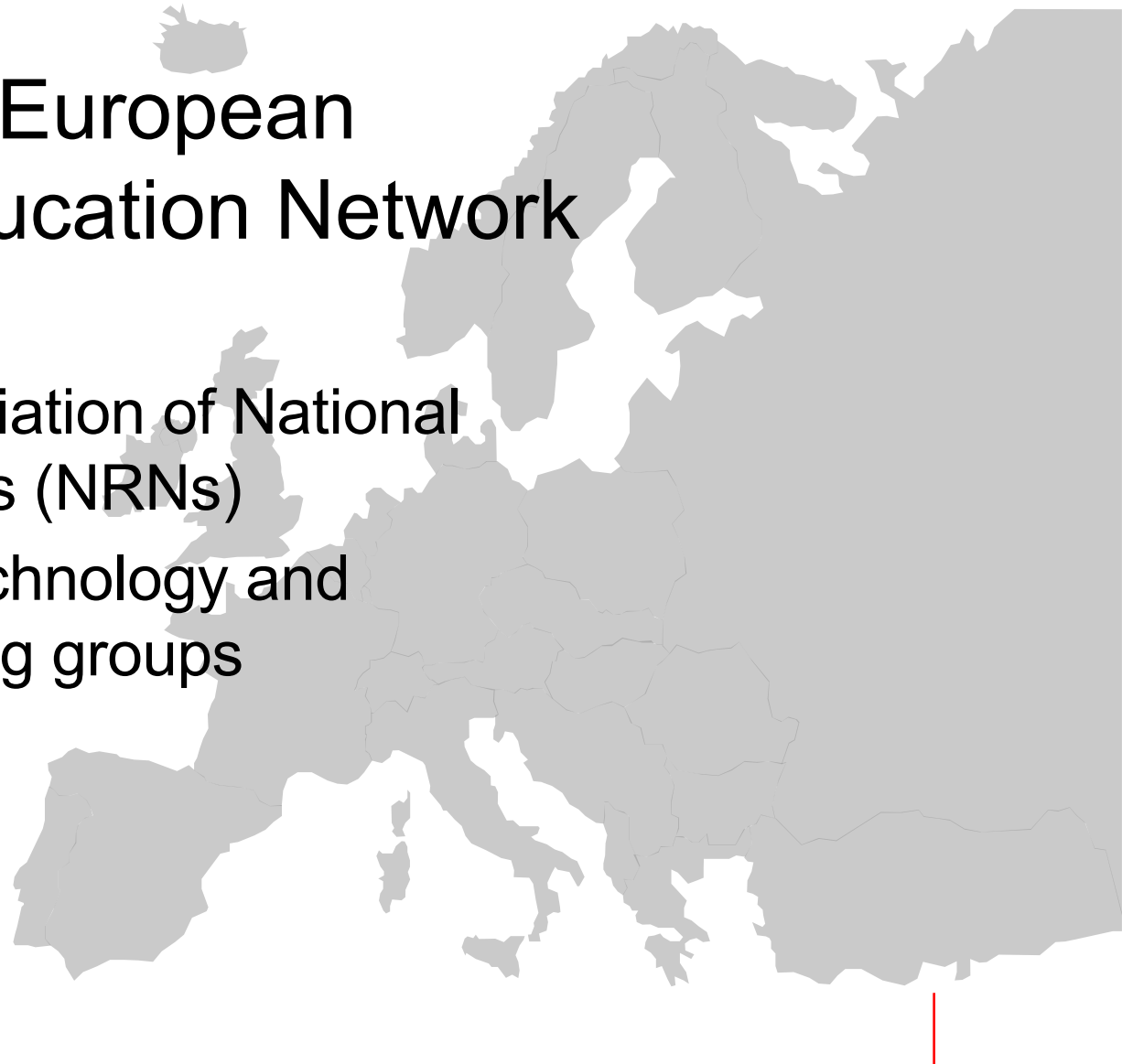
- **Middleware Development**
  - JISC work in U.K.
  - TERENA working groups
- **CERN experiments**
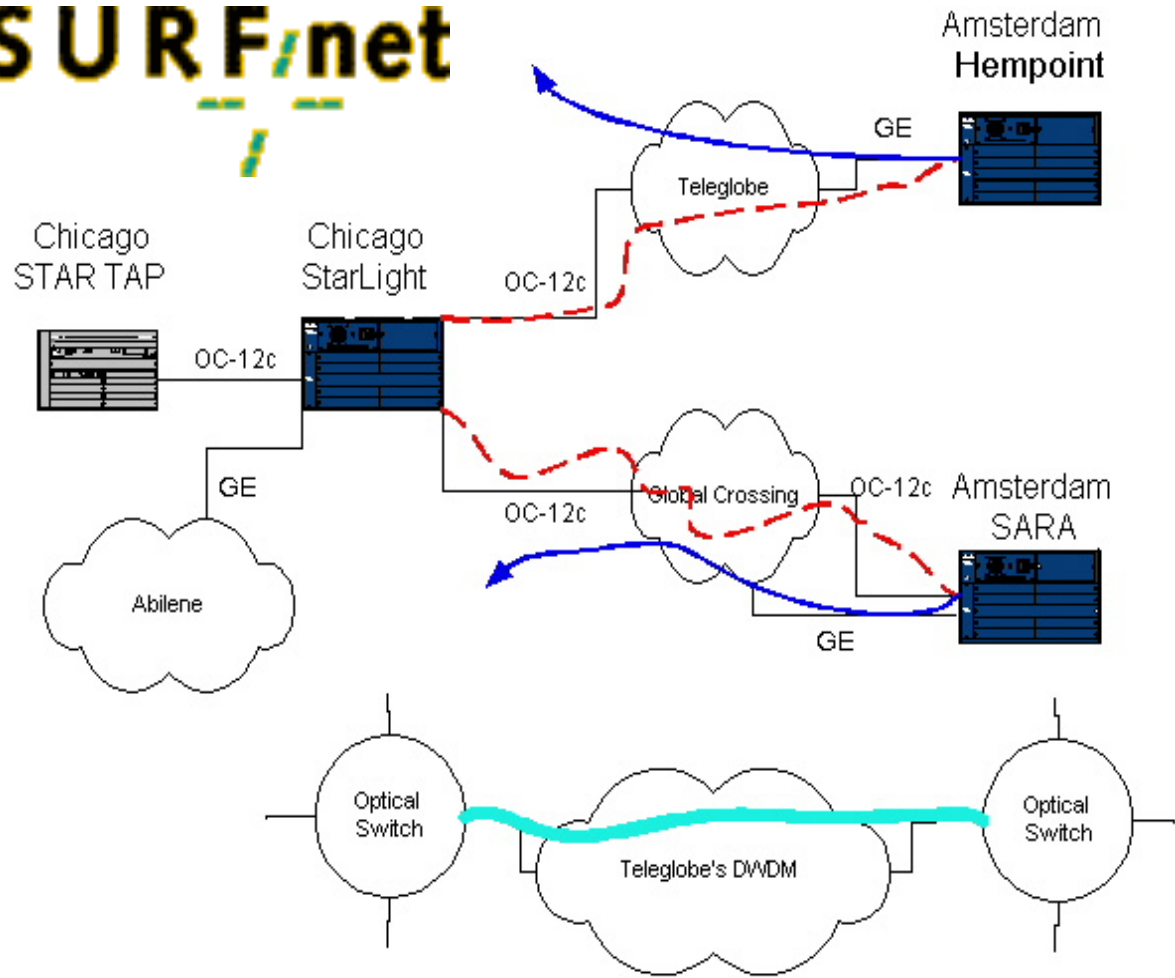- **Medical Applications**
  - NIH and Ireland
- **Shared Classroom**
  - Penn and Grenoble
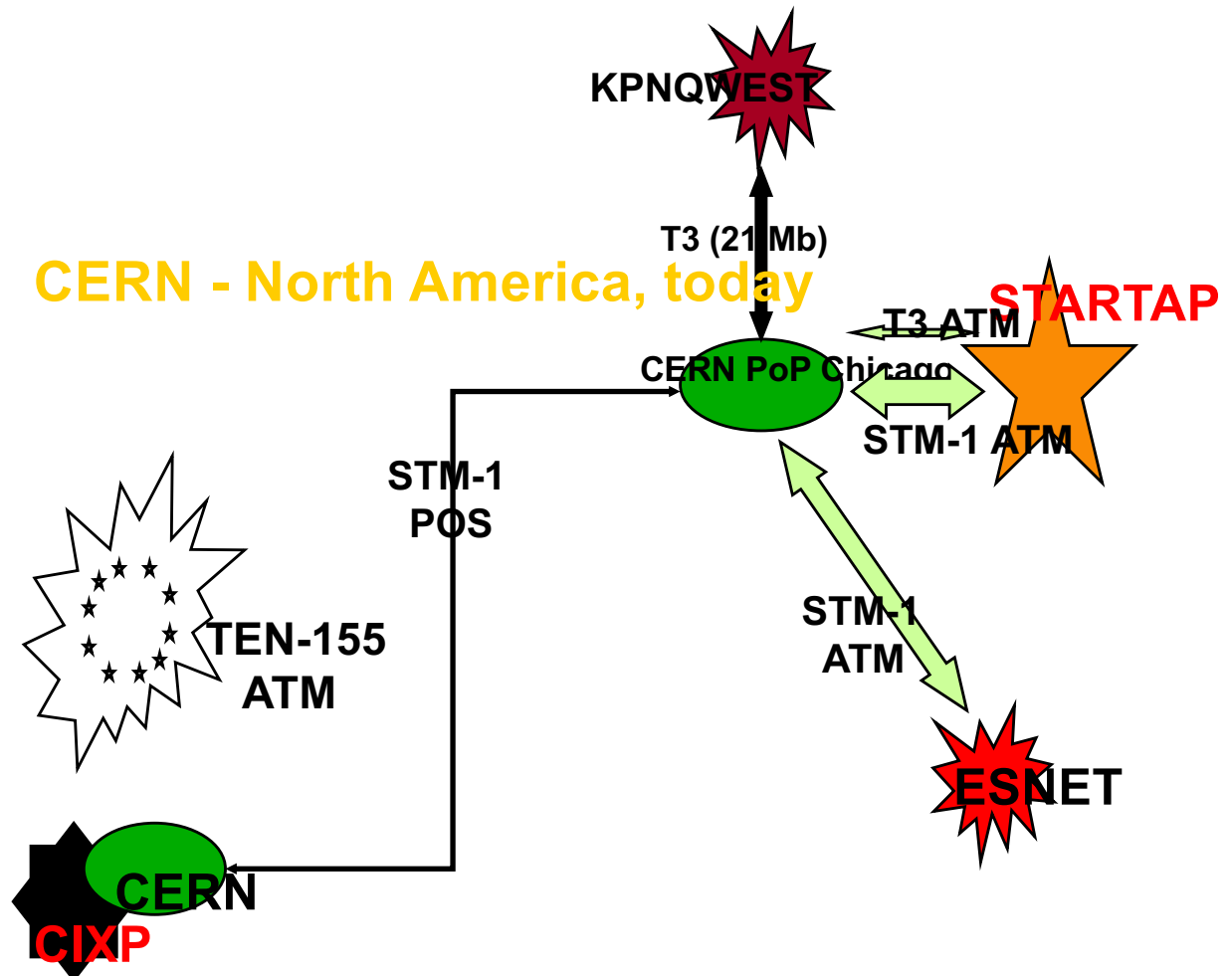 - Duke in Germany

SURFnet
http://www.surfnet.nl/

- 2x622mbps to StarLight (production)
- Lambda for research (2.5gbps)
- StarLight counterpart in Amsterdam

Source: Erik-Jan Bos

- April 2002: OC12 to StarLight

- Summer 2002: DataTag OC48 (2.4gbps) to StarLight

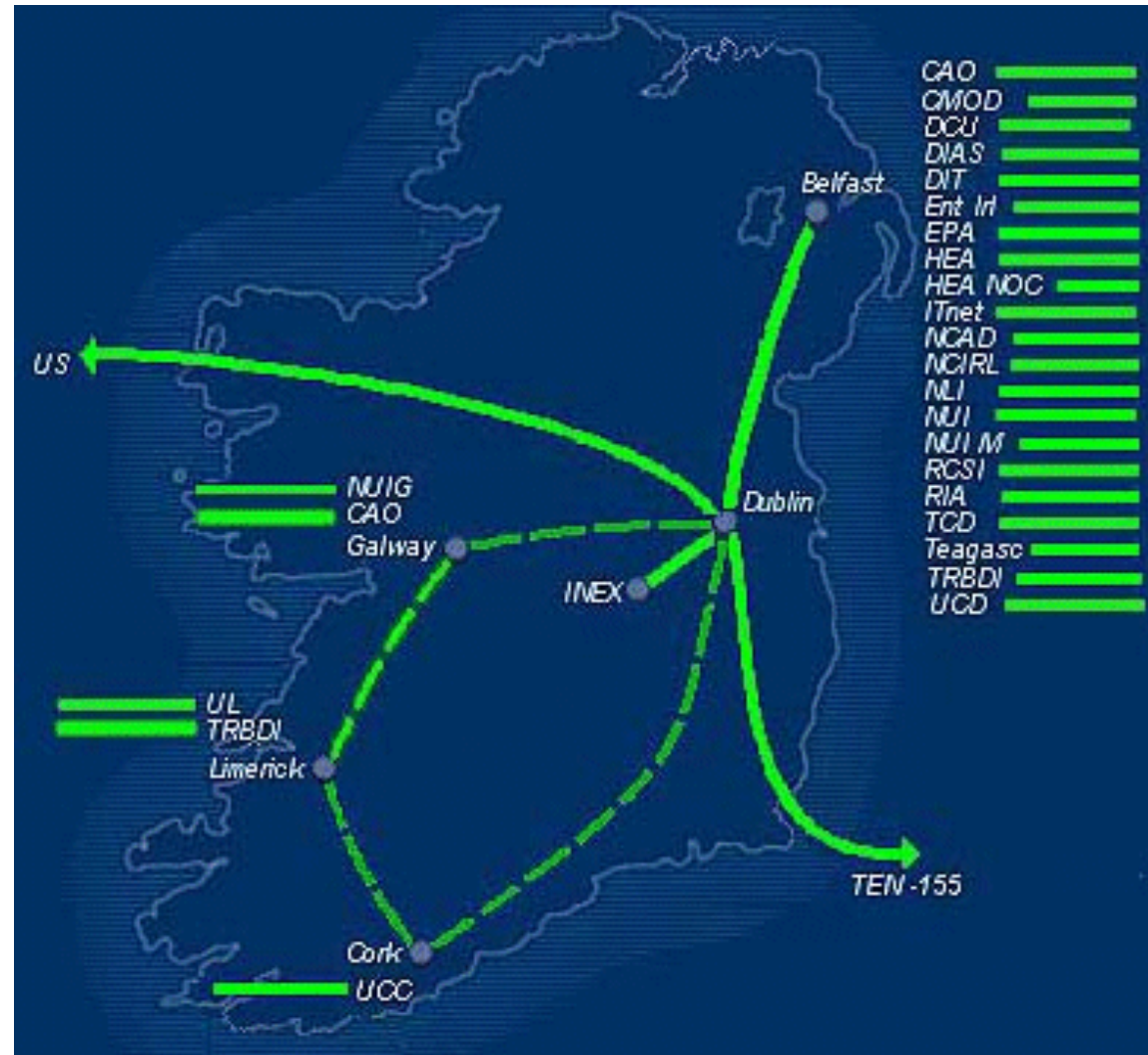**CERN - North America, today**

KPNQWEST

T3 (21 Mb)

STARTAP

CERN PoP Chicago

T3 ATM

STM-1 ATM

STM-1 POS

TEN-155 ATM

STM-1 ATM

ESNET

CERN

CIXP

Source: Paolo Moroni, CERN
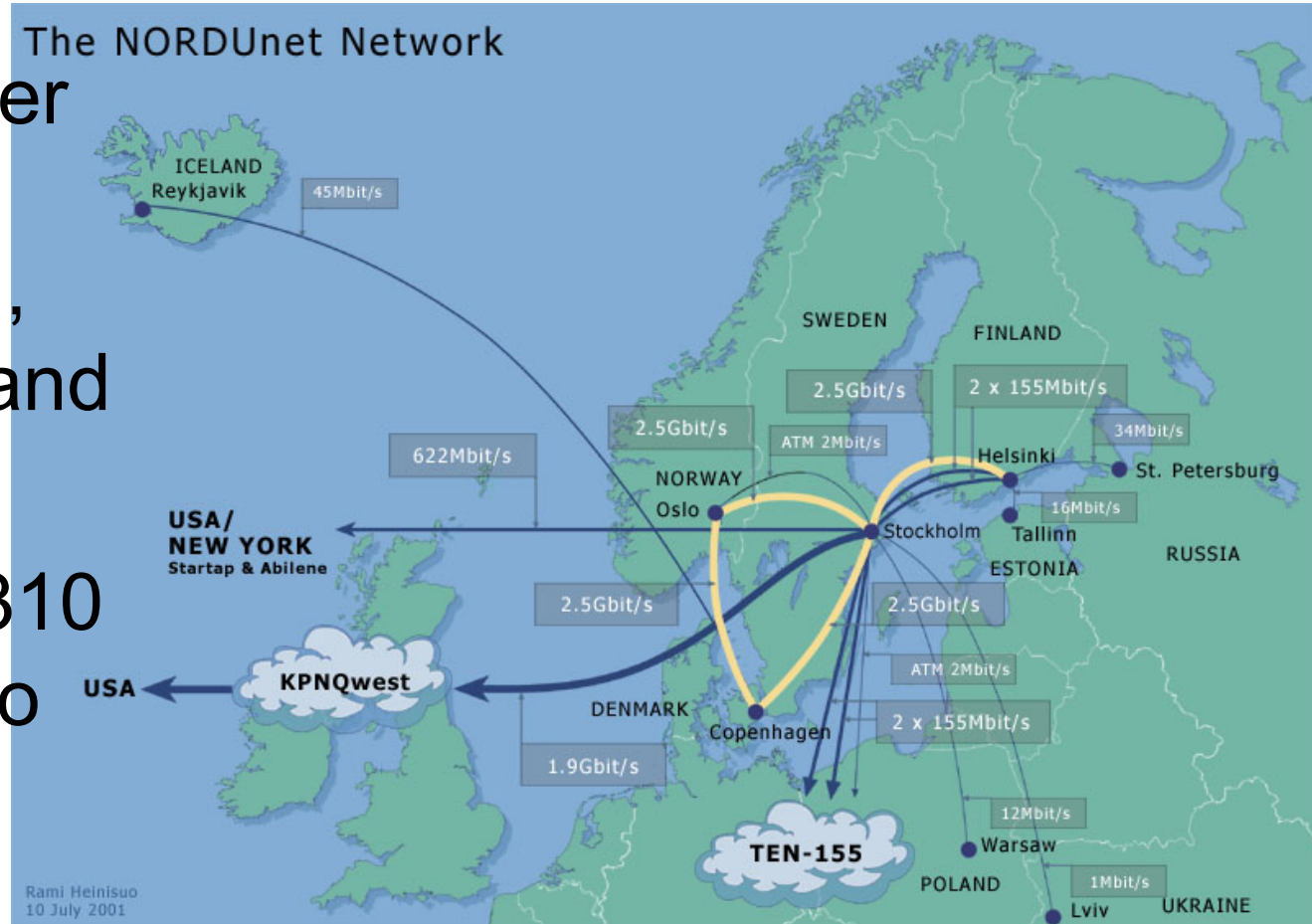
HEANET
http://www.heanet.ie

- Serves the Irish universities

- Using 2 of several OC3 (155mbps) links to peer in NYC

- Upgrading backbone to 155mbps

- Connects together networks of Denmark, Iceland, Finland, Norway and Sweden

- Upgraded from 310 to 622 (plus 155 to StarLight (production))

The NORDUnet Network

Providing transit to RUNNET (Russia), EENET (Estonia), UARNET (Ukraine) and NASK (Warsaw, Poland)
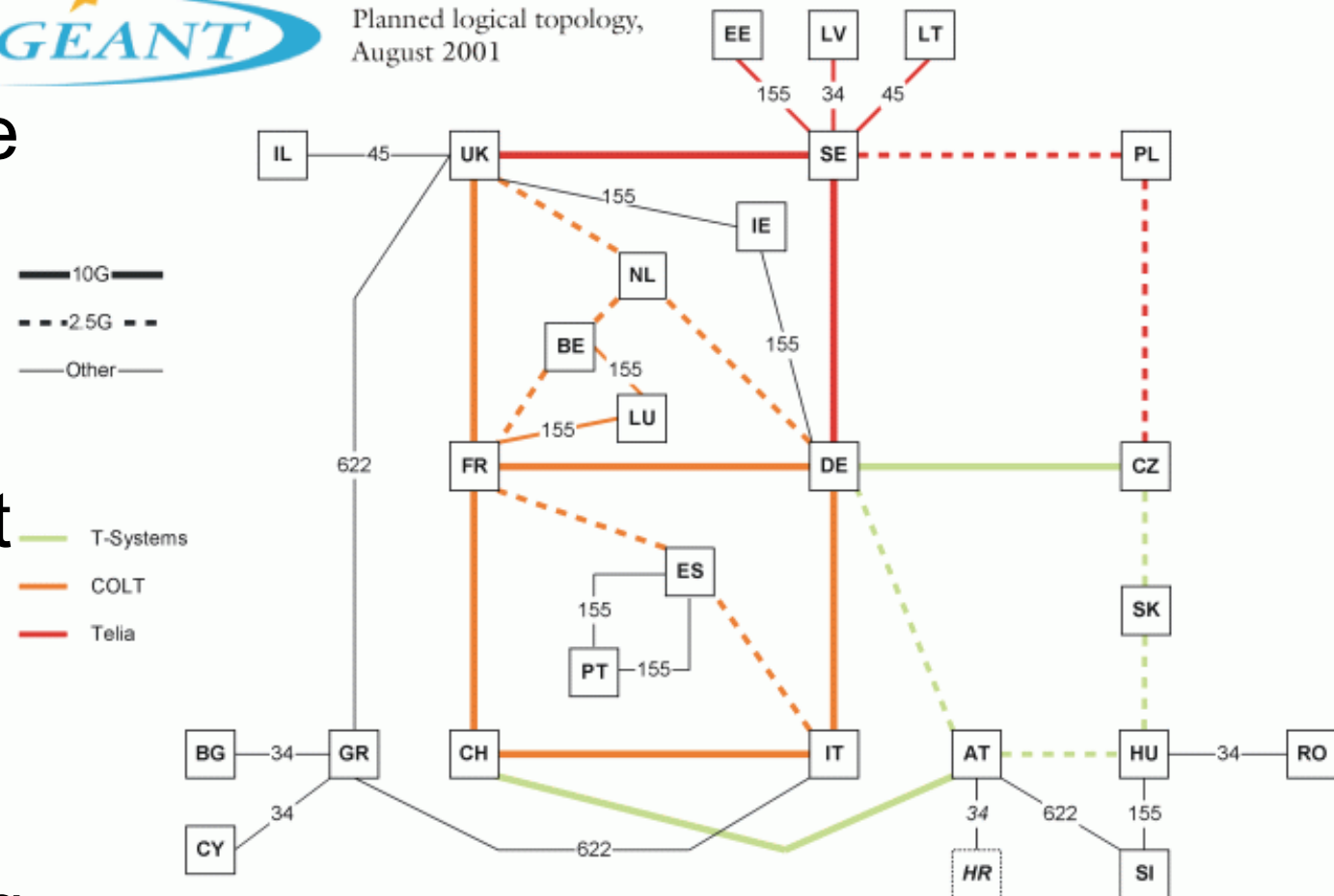
GEANT
http://www.dante.org.uk

- Consortium of NRNs in Europe
- 10gbps European backbone
- NRN access at 2.5gbps
- 2x2.5gbps across Atlantic
- Interconnecting in NYC

GEANT
Planned logical topology, August 2001

JANET
http://www.ja.net

- 2.5gbps backbone in UK

- Connects MANs – connecting universities

- New 2.5gbps to US

- 622mbps used to peer with Abilene

- Also peers with CA*net3 and ESnet

- Discussions underway for GTRN partner in Asia

- Goal: cooperatively, cohesively manage intercontinental infrastructure

- Expect POPs in Seattle, Tokyo initially