SUNET during more than 20 years

NSC Anniversary

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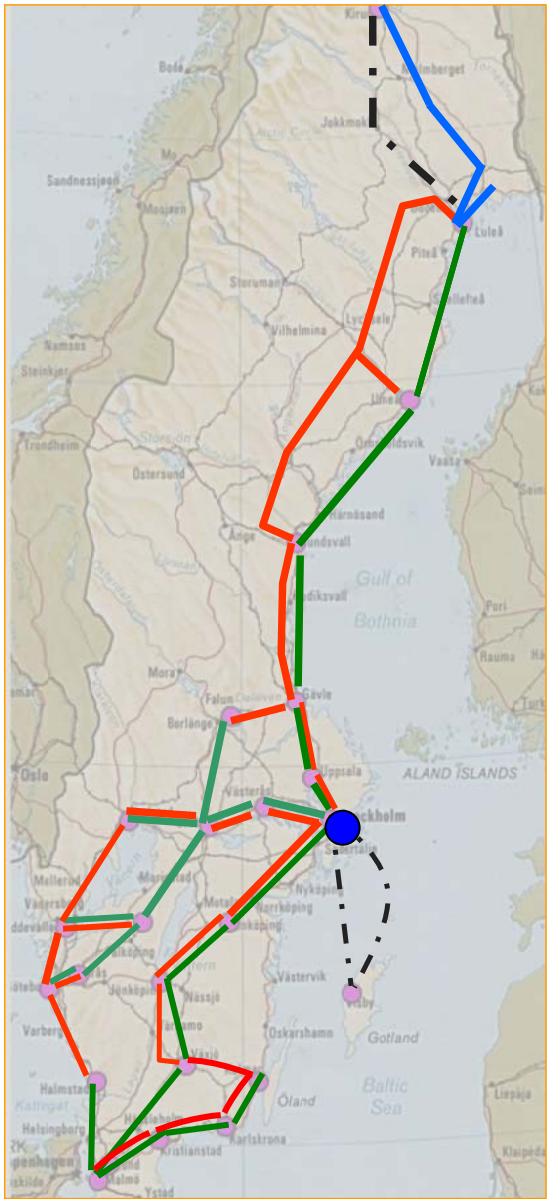
SUNET

What?

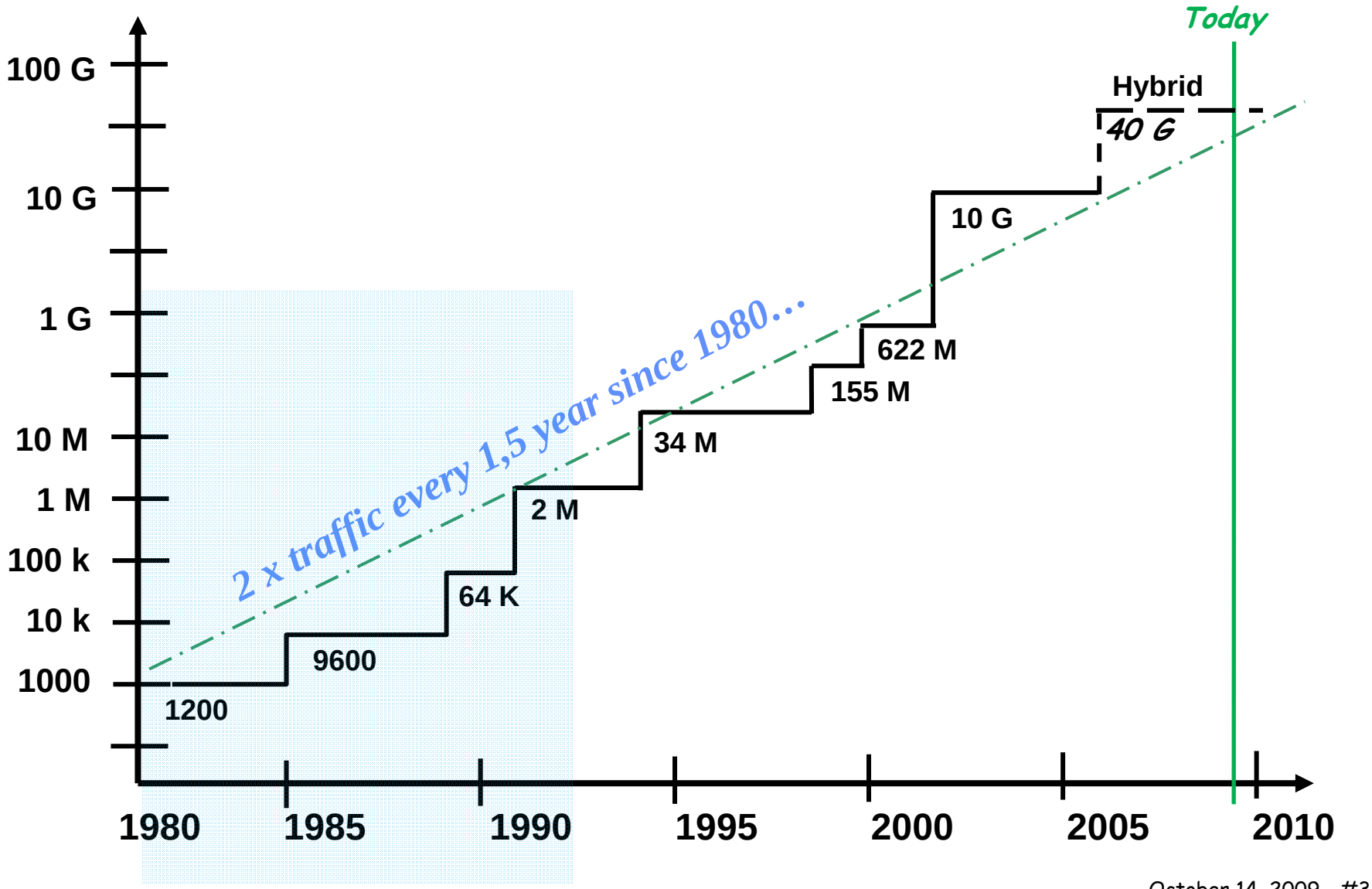
- **Give Swedish universities access to national and international connectivity of high class**
- **Key factors are availability and capacity**
- **Should not be a bottleneck in the Universities communication with the rest of the world**

Who?

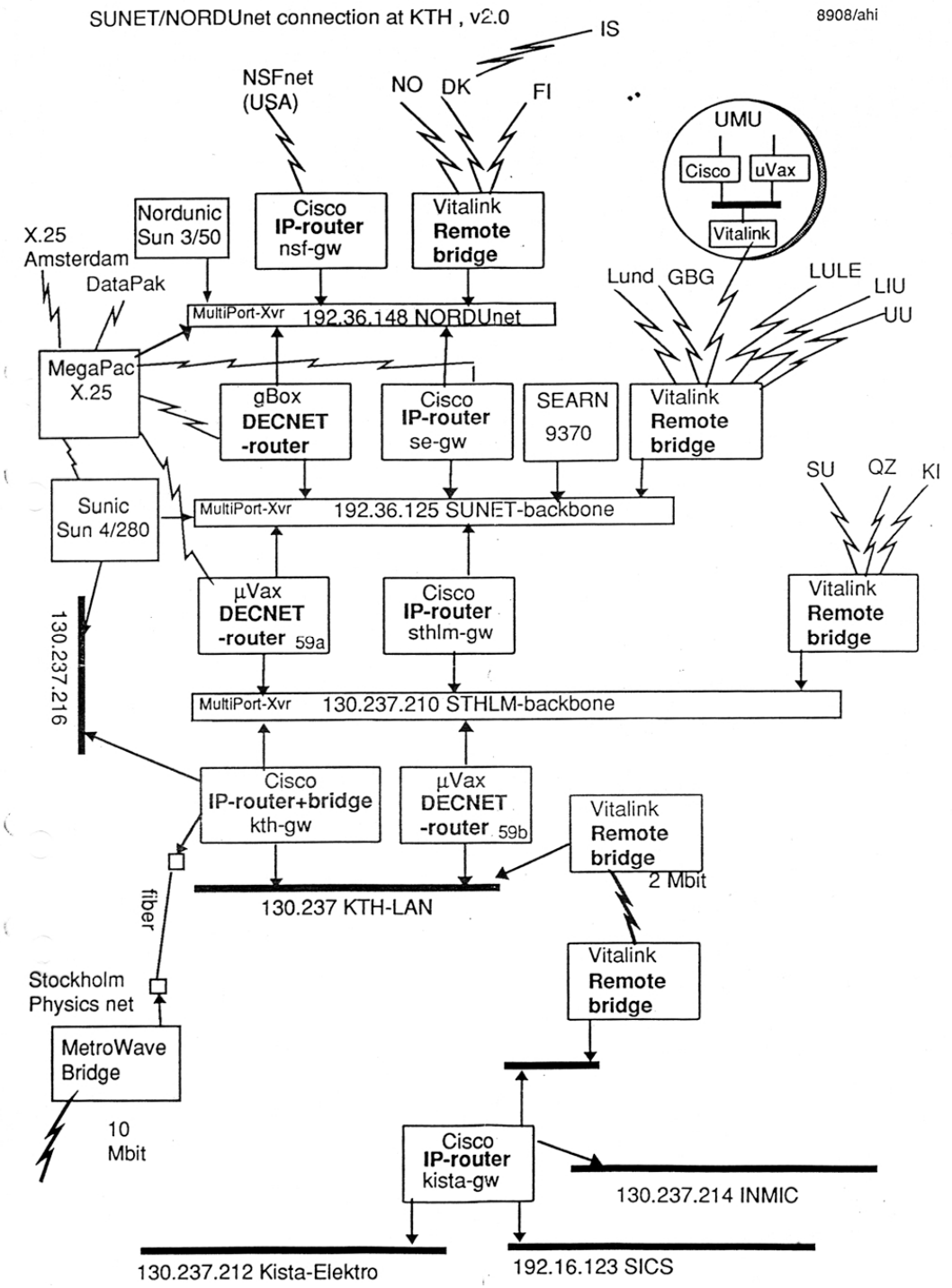
- ***All* universities (31), nationwide**
  - **Used by "everybody", such as: HPC Centers, Researchers, Teachers, Students, Administrative personnel**
- **Central govt. museums and art schools**
- **External organizations, with close relations to universities**



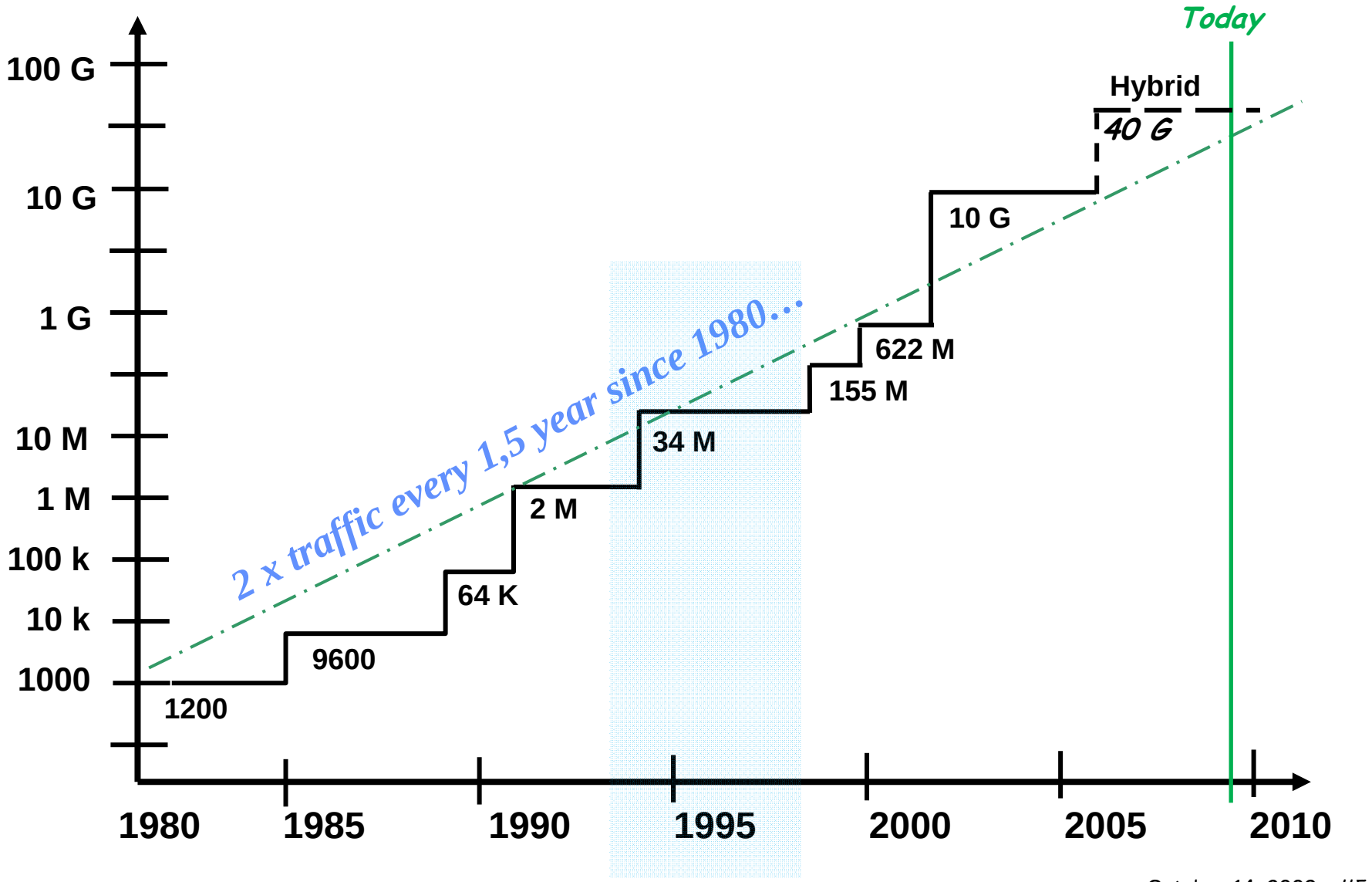
SUNET core transmission capacity



1987-1992

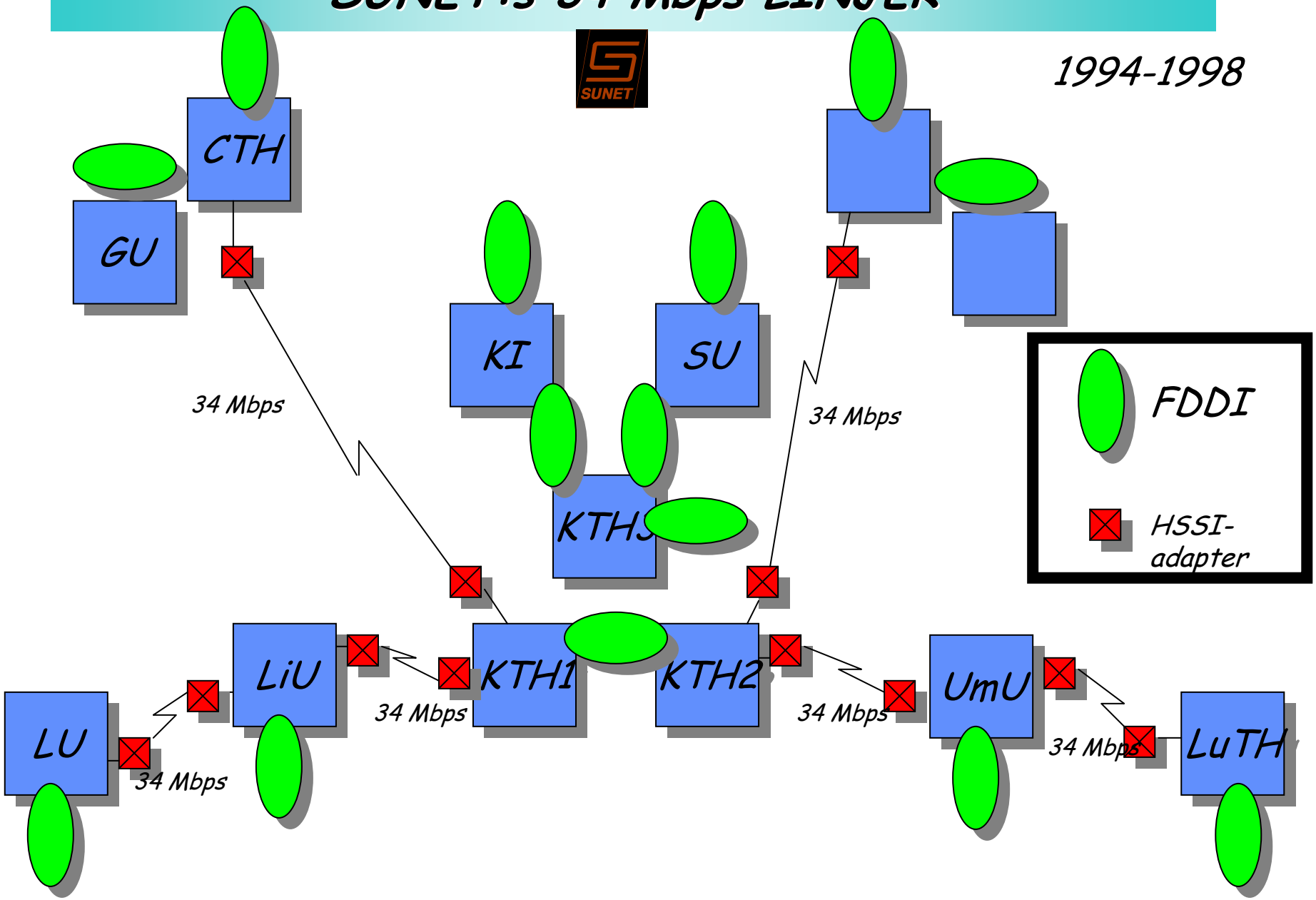

SUNET/NORDUnet connection at KTH , v2.0
8908/ahi
IS
NSFnet
(USA)
NO
DK
FI
UMU
Cisco
uVax
Vitalink
Nordunic
Sun 3/50
Cisco
IP-router
nsf-gw
Vitalink
Remote
bridge
X.25
Amsterdam
DataPak
MultiPort-Xvr
192.36.148 NORDUnet
Lund
GBG
LULE
LIU
UU
MegaPac
X.25
gBox
DECNET
-router
Cisco
IP-router
se-gw
SEARN
9370
Vitalink
Remote
bridge
SU
QZ
KI
Sunic
Sun 4/280
MultiPort-Xvr
192.36.125 SUNET-backbone
µVax
DECNET
-router 59a
Cisco
IP-router
sthlm-gw
Vitalink
Remote
bridge
130.237.216
MultiPort-Xvr
130.237.210 STHLM-backbone
Cisco
IP-router+bridge
kth-gw
µVax
DECNET
-router 59b
Vitalink
Remote
bridge
2 Mbit
fiber
130.237 KTH-LAN
Vitalink
Remote
bridge
Stockholm
Physics net
MetroWave
Bridge
10
Mbit
Cisco
IP-router
kista-gw
130.237.214 INMIC
130.237.212 Kista-Elektro
192.16.123 SICS

SUNET core transmission capacity

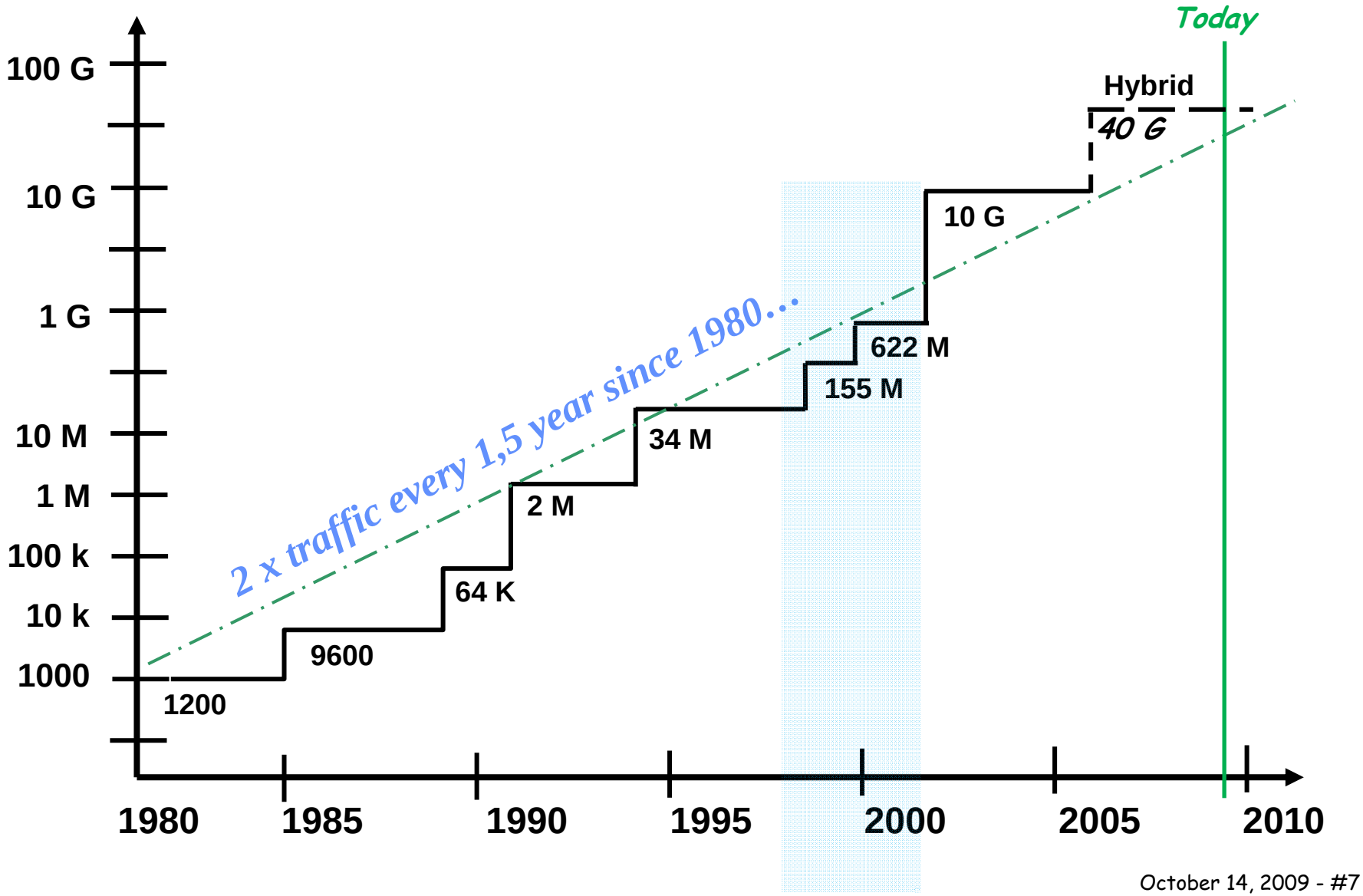


SUNET:s 34 Mbps LINJER

1994-1998

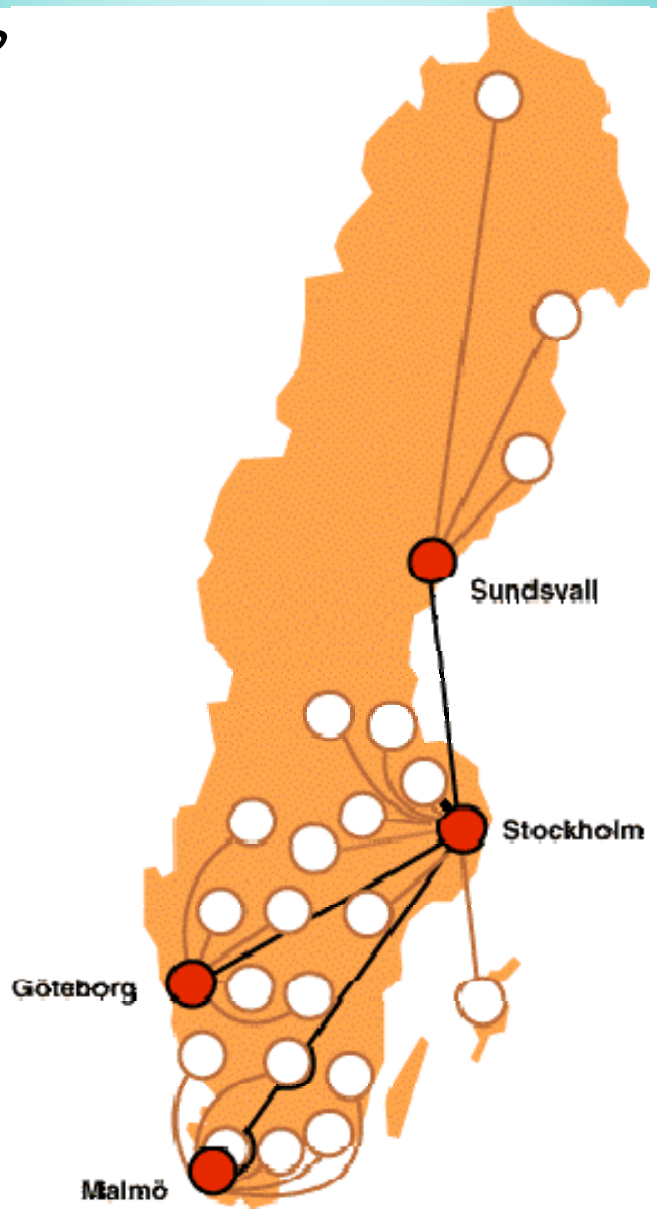


SUNET core transmission capacity

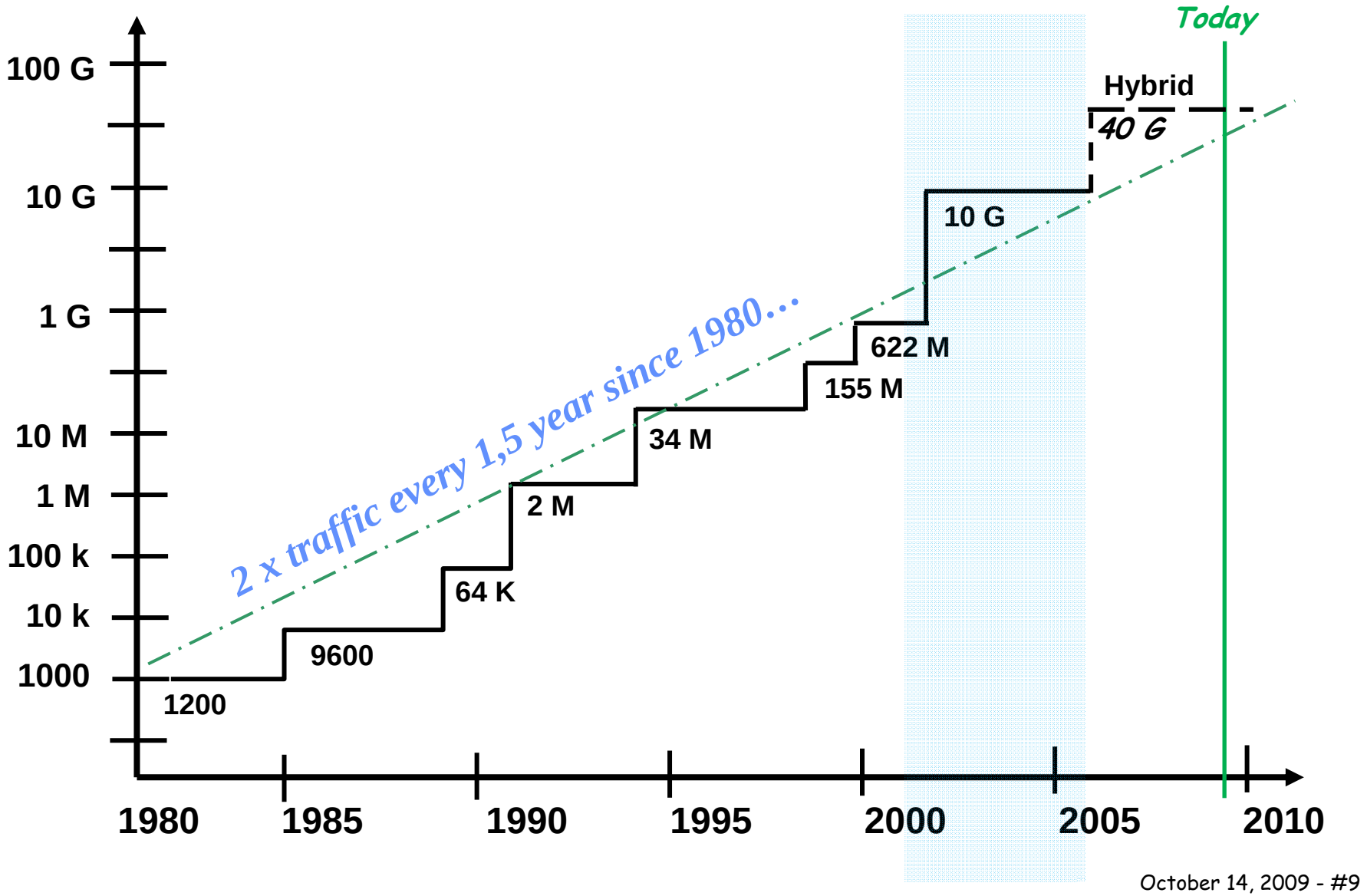


SUNET 155

1998 - 2002



SUNET core transmission capacity



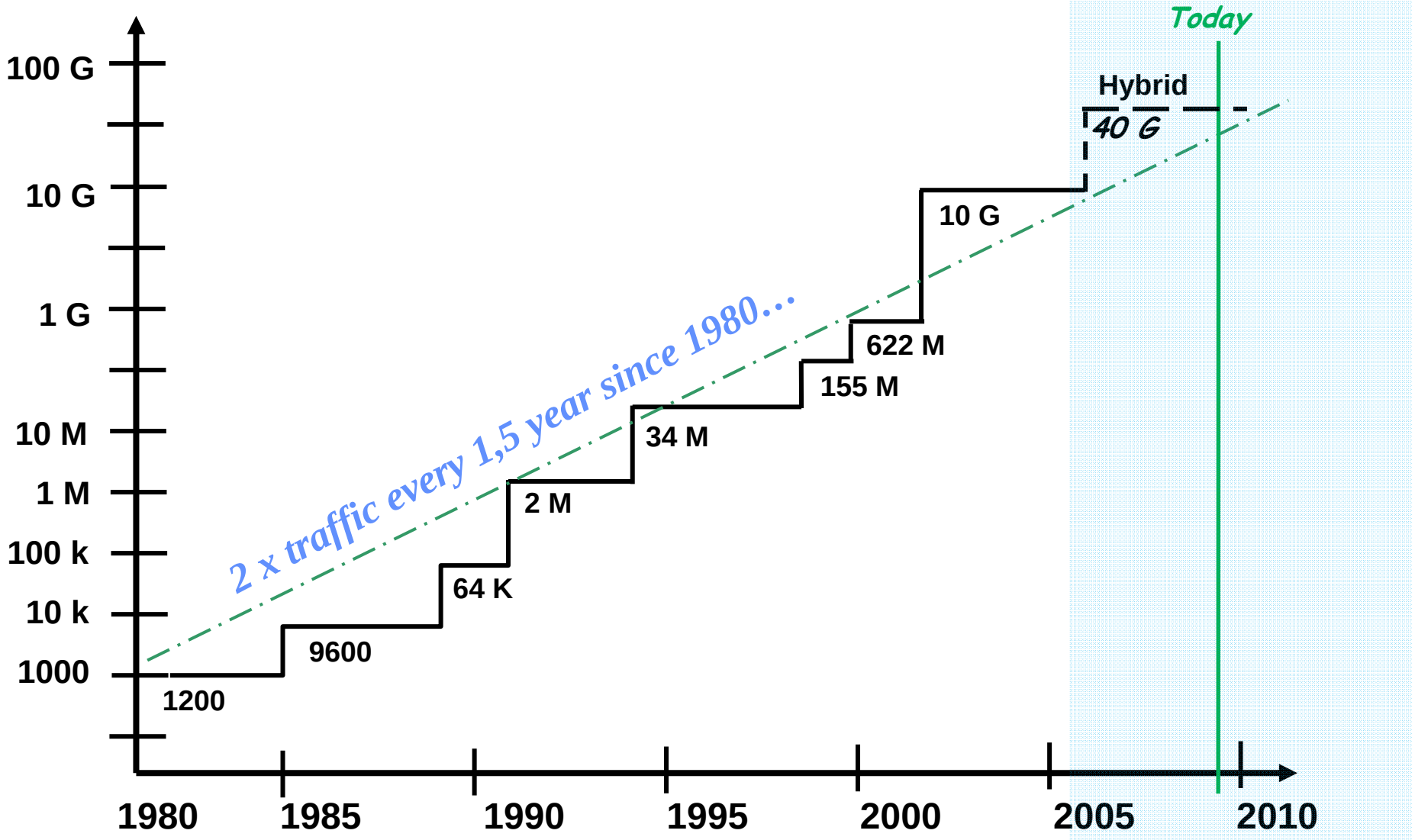
GigaSunet

2002 - 2007

Stamnät:
10 Gbit/sek

Lokalnät:
2,5 Gbit/sek

SUNET core transmission capacity

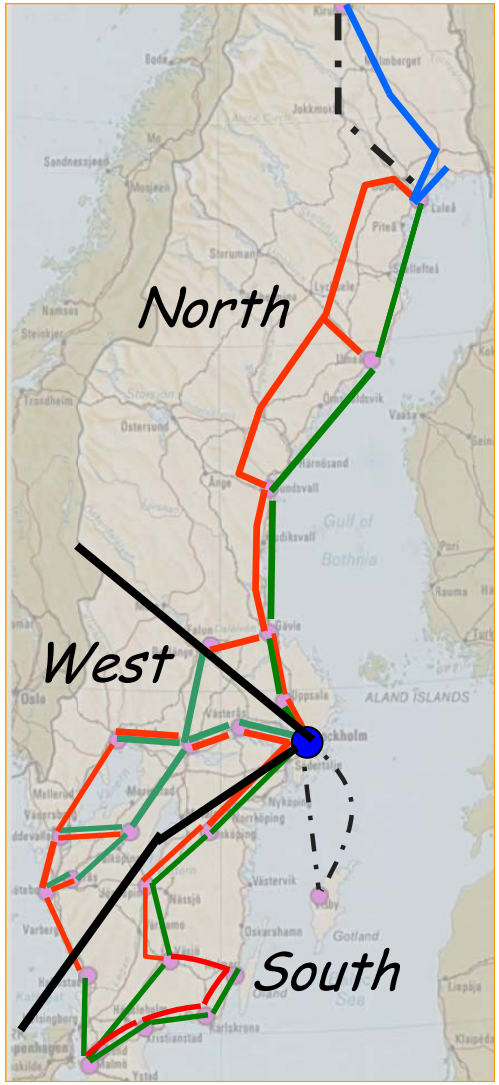


The OptoSunet Network

A passive, transparent, optical network - that allows us to do changes/upgrades at the end points without changes to any component in the core "transport" network

Since April 2007

OptoSunet



- 3 systems
  - North, West and South (7663 km fiber)
- 2 networks (80 channels) per system
  - Red and Green
  - Redundancy on layer 3
- Fully redundant network
    - Red – Green separation
- Support:
    - Router connectivity
    - Dedicated high bw pt-pt connectivity
- Cost efficient GE and 10GE
    - But also 40G+ ready

Two components of OptoSunet

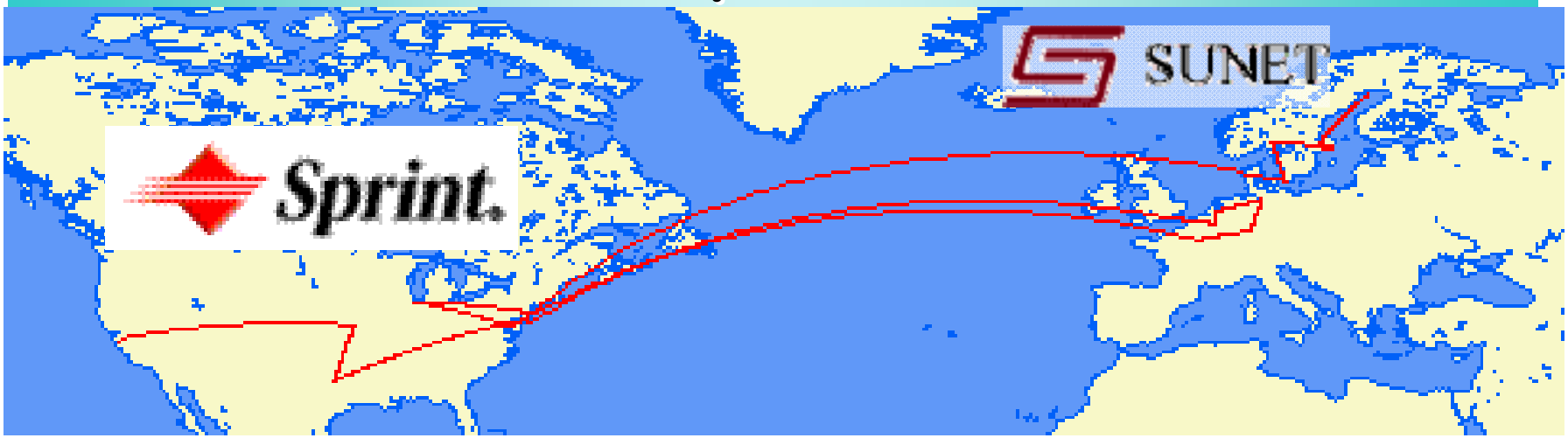
- **The routed IP network:**
  - Everyone at the Swedish universities
  - For the ”traditional” day-to-day work
  - Connecting many-to-many
  - Millions of connections

- **The dedicated point-to-point connections:**
  - Researchers with special needs (“long” duration)
    - Radio Astronomers
    - High Energy Physicists
    - Life sciences
    - Grid Computing
    - Etc.
  - A “few” connections

Some SUNET achievements during the past years

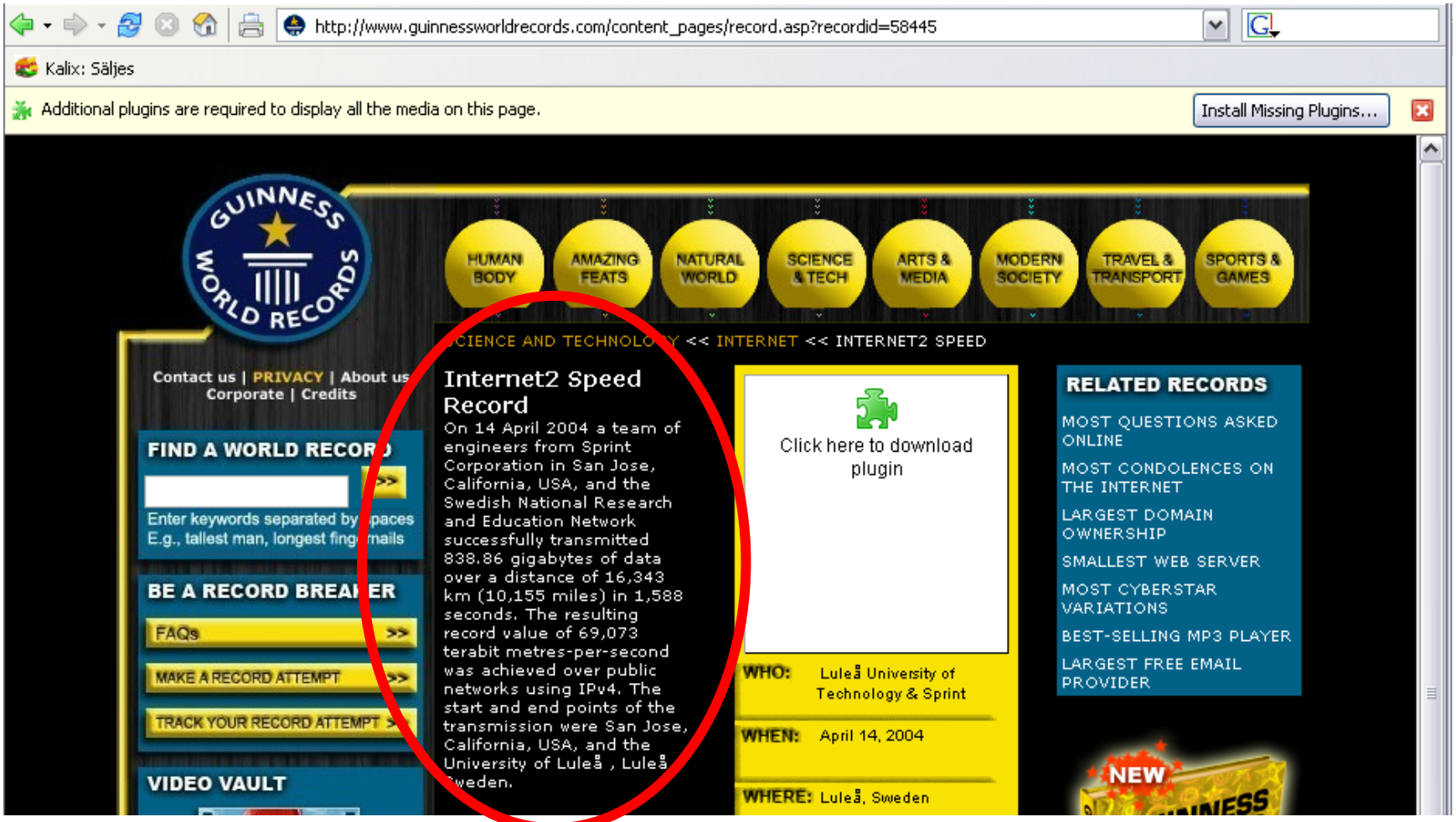
World record!

Internet Land speed record [2004]



- Distance (according to the LSR rules) from Luleå, Sweden to San Jose, CA is approx. 28 983 km (18 013 miles).
- 1 966 080 000 000 bytes in 3 648,81 sec = 4 311 Mbit/s.
- ≈ 1 831 Gbyte (2 800 CDs) in an hour. Not a single bit error during this time, i.e. 15 728 640 000 000 bits (!) was transmitted correctly (not counting other traffic on the links).
- 42(!) router hops, 120 000 data packets per second.

… Recognized in the Guinness world book of records!



First long-haul 40 Gbit/sec in Europe [2007]

40 Gigabit per second, "Plug and Play" Circuit

40 Gbit/sec Luleå – New York [Nov 2008]

- 40 Gbit/sec Luleå-New York, ~9 600 km
- The world's longest 40 Gbit/sec connection
- First trans-Atlantic 40G
- Ciena gear on LLA-STO + MSQ-NYC

SUNET

NORDUnet
Nordic Infrastructure for Research & Education

Sprint

TeliaSonera

TAT-14

CISCO

STRATALIGHT COMMUNICATIONS

Summary of the exciting SUNET development

From modems, capacity and leased lambdas to:

- Dark fiber
- Hybrid networking
  - Routed with 10 Gbit/s access
  - Point-to-point 40G, 10GE, 2.5G, GE
- Passive, Transparent Optical Network
- Fully Redundant
- 40G ready
- Tunable Lasers
- Programmable ports
- Router Consolidation
- Reduced Cost
- Future Proof
- …

Current and Future Needs of the HPC Community?