

# GigaPort

## Research networking: The next phase

**Kees Neggers**

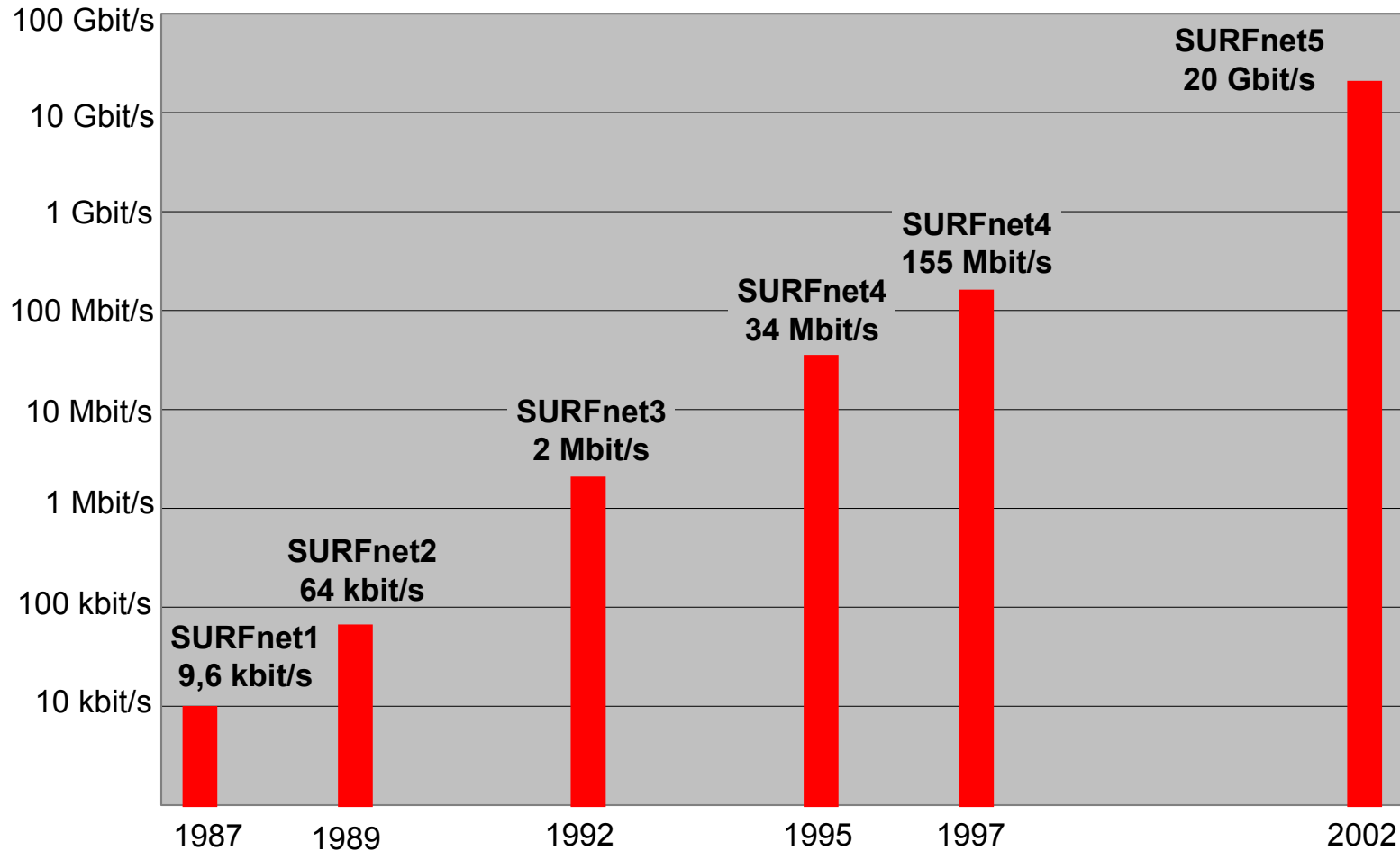
**SURFnet**

**20<sup>th</sup> NORDUnet Networking Conference**

**April 17, 2002 Copenhagen**

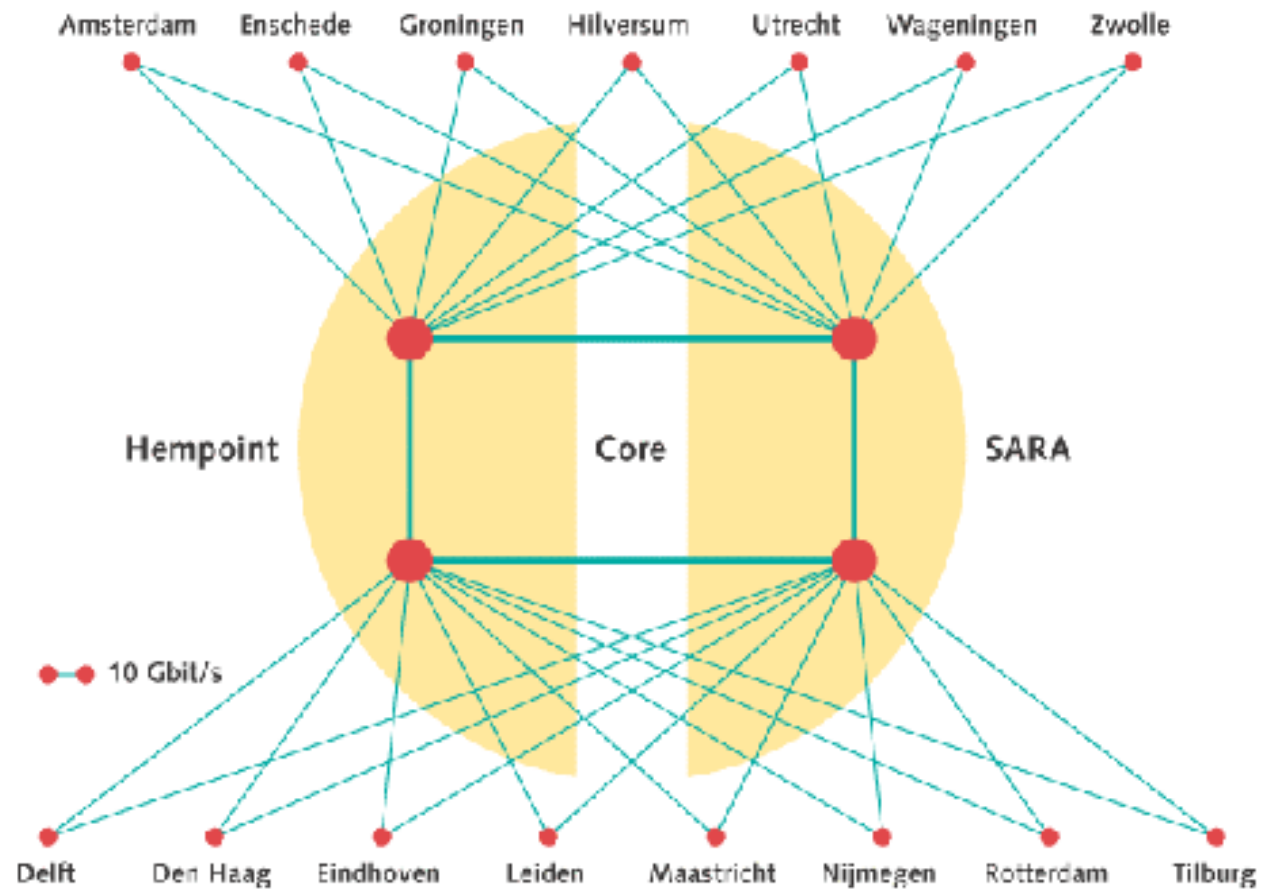
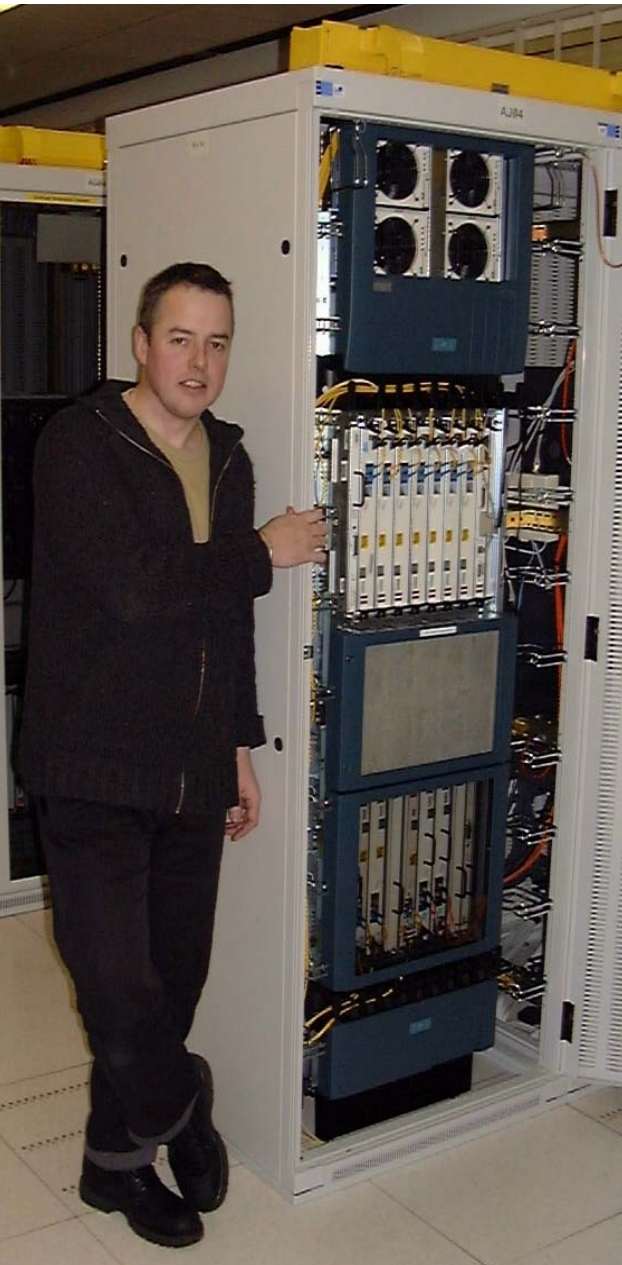
- **1972 First public demonstration of ARPANET**
- **1982 Start of EUNET via dial up links**
- **1992 Start of Ebone 256 Kbps**
- **2002 Start of Lambda Networking 10 Gbps**
- **2012 ???**

# History of the SURFnet infrastructure

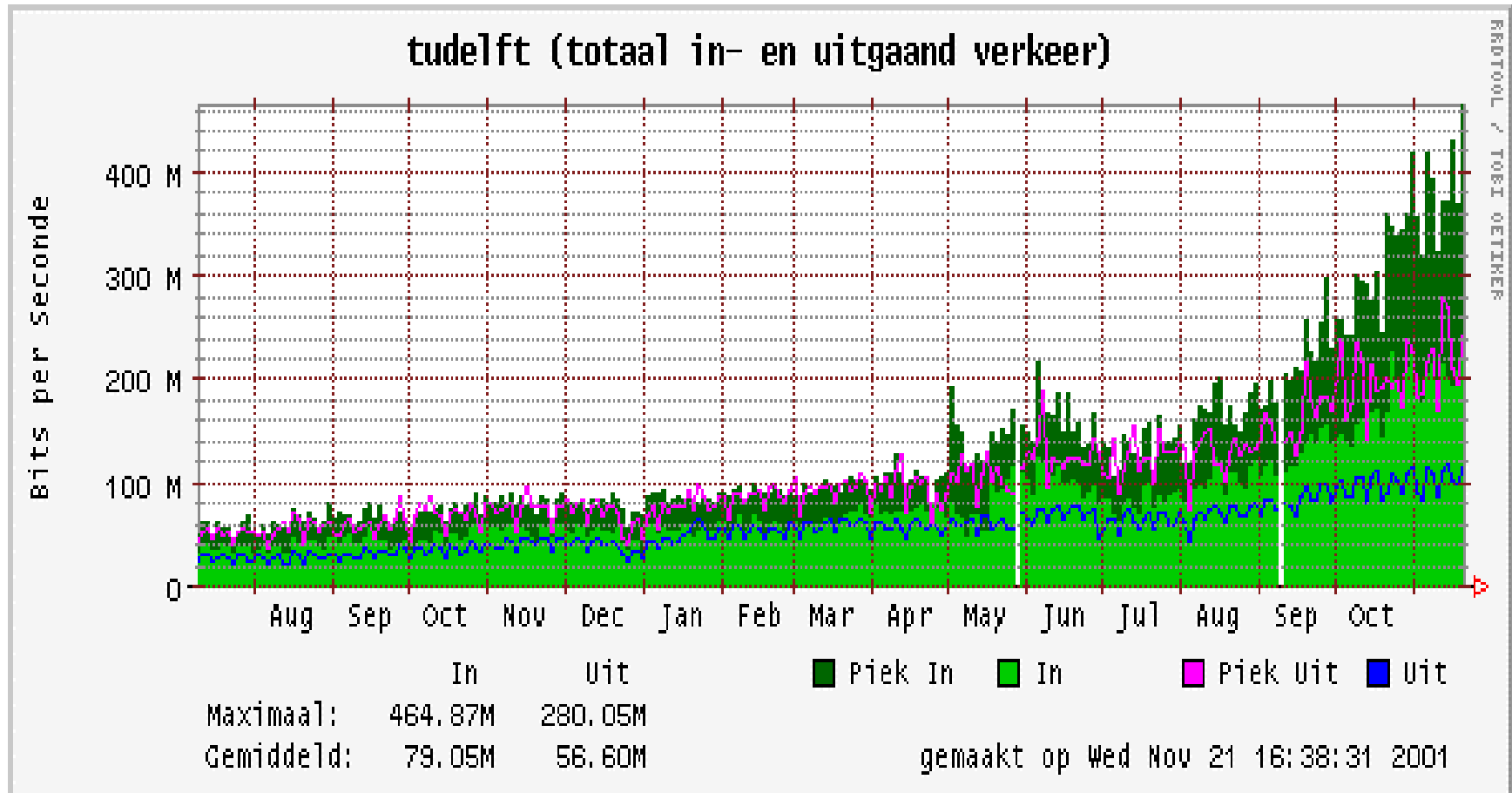


# SURFnet5 up and running

**GigaPort**



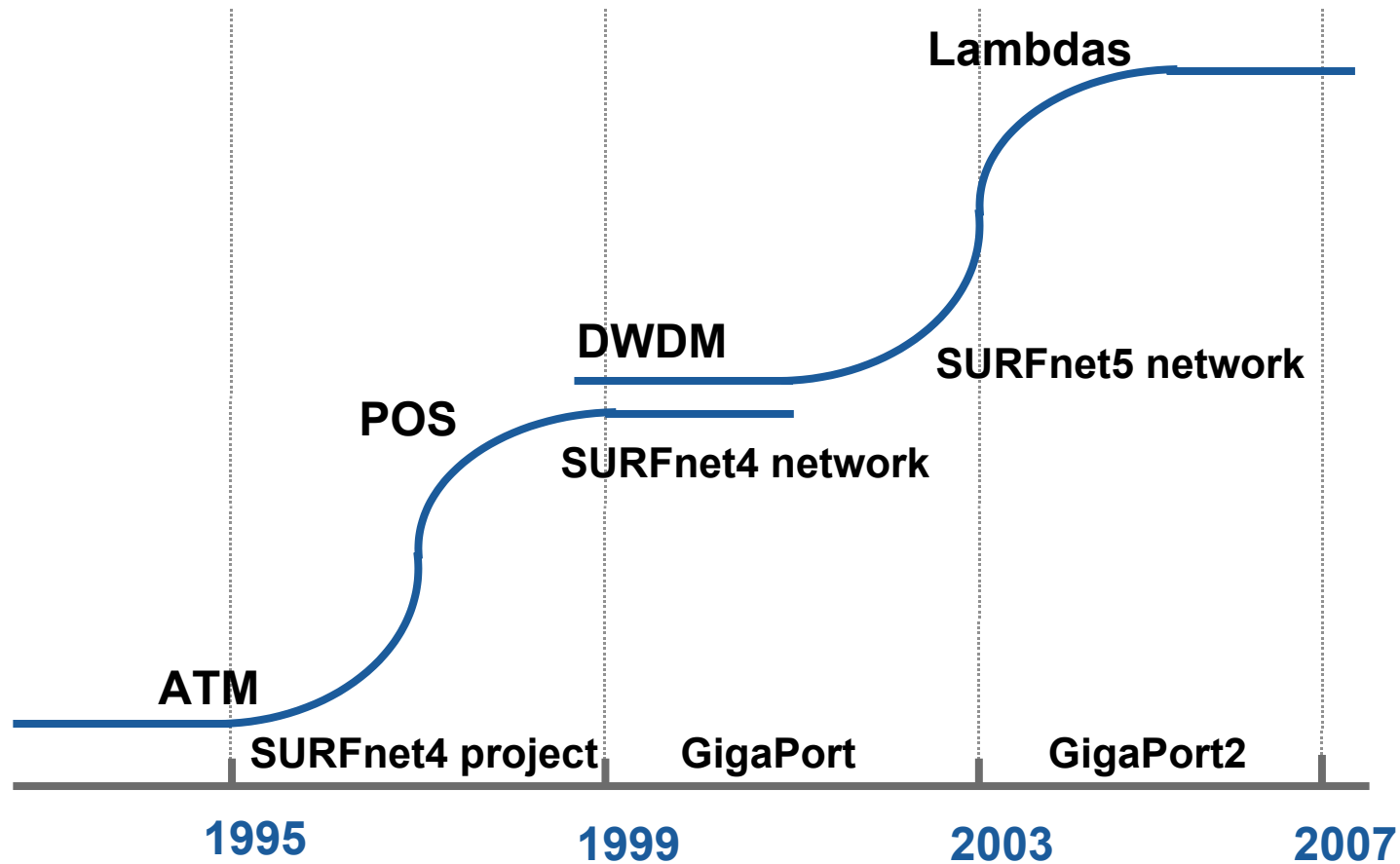
**SURFnet**



- **Dense Wave Division Multiplexing supports many 10 or 40 Gbit/s Lambda's per fiber, so where fiber is available, capacity is virtually unlimited**
- **Optical equipment development is progressing rapidly, despite the economical dip in the telecom market.**
- **Network is now faster than the computer**
- **New network paradigm shift looks unavoidable**



## New s-curve ahead of us





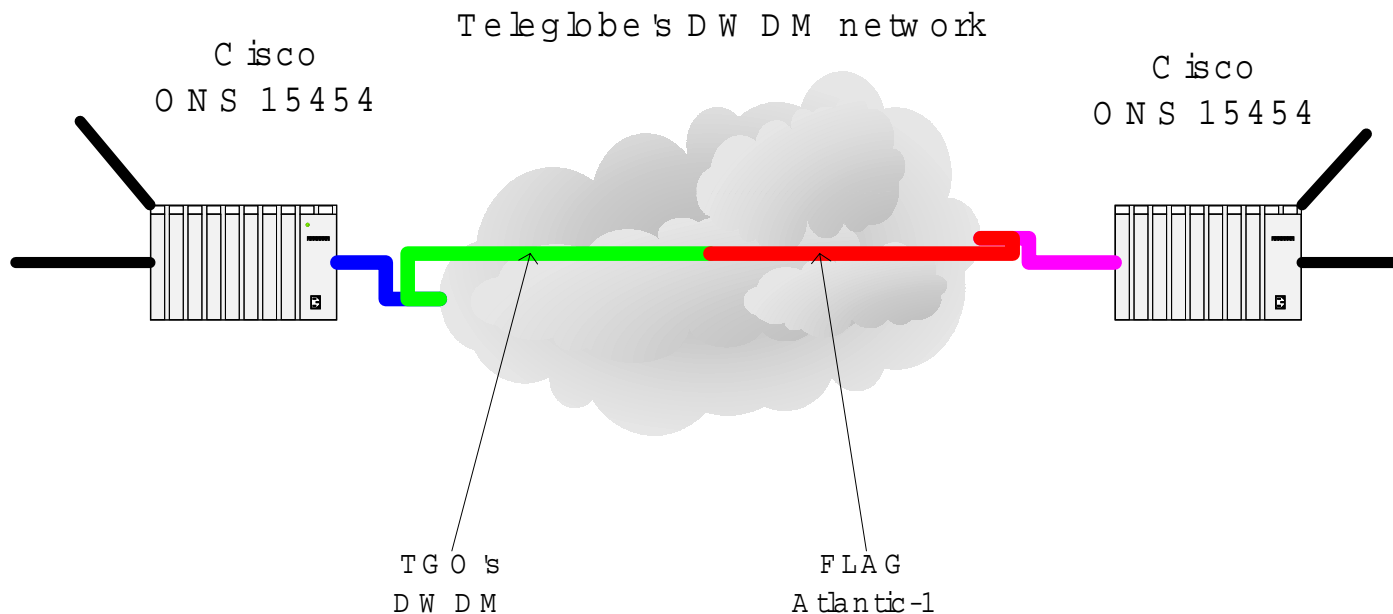
- Next Generation Internet will not be a simple extrapolation of current Internet evolution. Counting on bigger routers and fatter pipes is no longer a realistic option.
- Challenge is how to seamlessly integrate the large amounts of bandwidth that will become available
- International Co-operation is essential
- That's why SURFnet installed a lambda to StarLight as a research facility available for anyone interested in international lambda networking

# SURFnet's lambda Amsterdam-Chicago

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Chicago  
StarLight location

Amsterdam  
NetherLight location



# What/Where is StarLight?

StarLight is an experimental optical infrastructure and proving ground for network services optimized for high-performance applications

**StarLight Assists \$32M (FY2002-3) in experimental networks (I-WIRE, TeraGrid, OMNIInet, SURFnet, CA\*net4, DataTAG)**



**Chicago view from 710**



**710 N. Lake Shore Drive, Chicago  
Abbott Hall, Northwestern University**

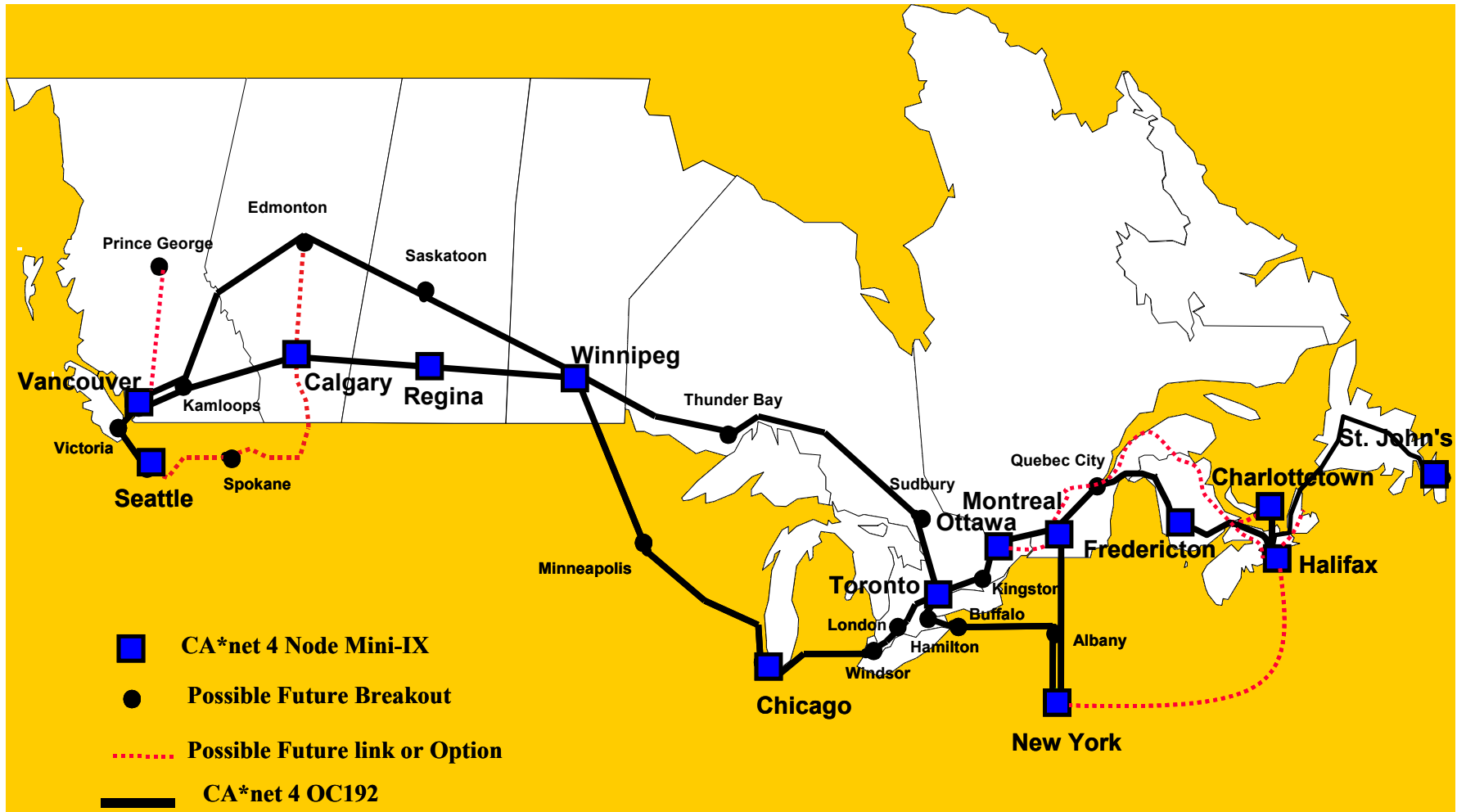


**Cees de Laat, U Amsterdam  
@ StarLight, USA**



**Tom DeFanti, UIC and de Laat  
@ NetherLight, The Netherlands**





# CERN's Coming to StarLight

**GigaPort**

**CISCO SYSTEMS**

CISCO SYSTEMS INC.,  
590 BRENNAN STREET  
SAN JOSE 95131 United States

PACKING SLIP

DATE  
02-JAN-2002

ORDER NUMBER  
41745750

PAYMENT TERMS  
30 NET

F.O.B  
Destination

Ship to: NORTHWESTERN UNIV  
710 NORTH LAKE SHORE DRIVE  
ABBOTT HALL  
CHICAGO, IL 60611  
United States

Bill to: CALIFORNIA INSTITUTE OF TECHNOLOGY  
1200 EAST CALIFORNIA  
PAYABLES DEPARTMENT  
PASADENA, CA 91125  
United States  
Attn: ATTN <103-6>

END USER:

SHIP VIA:  
EAL2

SHIP DATE:  
02-JAN-2002

CONTRACT NUM

| LINE NUMBER | ITEM DESCRIPTION/PART NUMBER  | QTY | ORD |
|-------------|---|-----|-----|
| 1           | OSR-7609-AC / Cisco 7609, Route Processor, 512MB DRAM, 2500W AC Power | 1   | 1   |

Carton Id: 21329445 Serial No: TBA05510263

WS-CAC-2500W/2 / Catalyst 6000 Second 2500W AC Power 1 1

CAB-AC-2500W-US1 / Power Cord, 250Vac 16A, straight blade NEMA 6-20 plug, 2 2

S6SU222V-12108E / Catalyst 6000 SU22/MSFC2 SERVICE PROVIDER W/VIP 1 1

WS-X6K-S2UMSPC2BUN / Cat6K Sup2 with 256MB DRAM on Sup2 and MSFC2 Bundle 1 1

MEM-C6K-FLC24M / Catalyst 6000 Supervisor PCMCIA Flash Mem Card, 24MB Opt 1 1

MEM-S2UMSPC2-512MB / 512MB DRAM OPTION ON MSFC2 FOR 1 1

WS-X6K-S2U-MSFC2/2 / Redundant WS-X6K-S2U-MSFC2 (In Chassis Only) 1 1

MEM-C6K-FLC24M / Catalyst 6000 Supervisor PCMCIA Flash Mem Card, 24MB Opt 1 1

MEM-S2UMSPC2-512MB / 512MB DRAM OPTION ON MSFC2 FOR 1 1

WS-C6500-SPM / Catalyst 6500 Switch Fabric Module 1 1

OSM-20C12-POS-SI / 2-port OC-12/STM-4 1 1



**Caltech/CERN packing slip for cartons.**

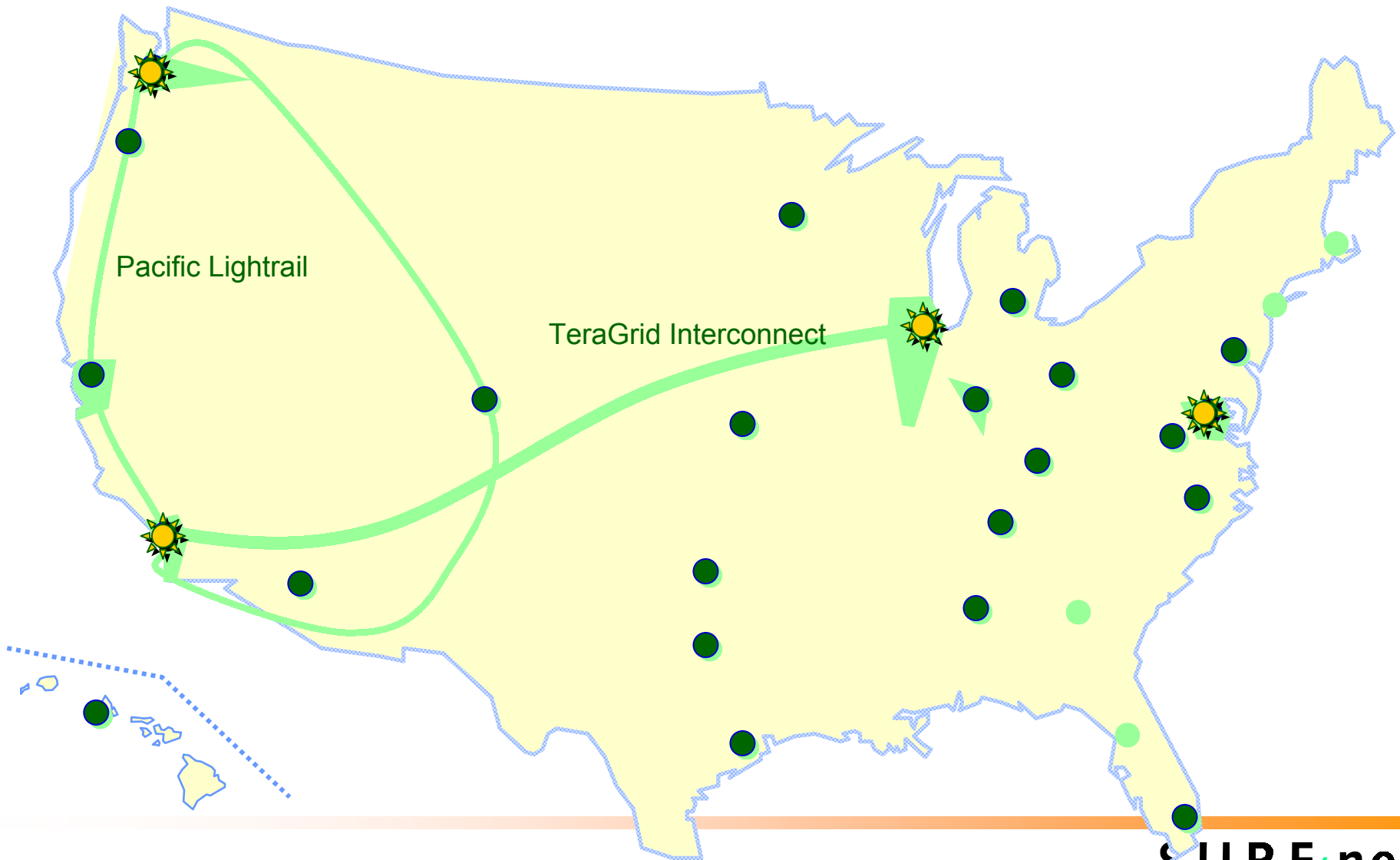
**Olivier Martin (CERN), Tim Ward (NU),  
Richard Hughes-Jones (U Manchester)**



**SURFnet**

# Optical networking in the USA

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GigaPoP locations (green dots) from Internet2, map by Rick Stevens, Charlie Catlett

**sURFnet**

# Internet Educational Equal Access Foundation

- Tyco Global Network and GEO donations will be made available via IEEAF to Research and Education Community
- 622M SDH +10G  $\lambda$  from Groningen NL to New York 60 Hudson
- Dark fiber pair Amsterdam-Groningen-Hamburg
- 622M SDH +10G  $\lambda$  from US West coast to Japan, Singapore
- Collocation space in Carrier Hotels at cable ends
- Many other projects in various stages



Coming.....

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# *i*Grid 2002

The International Virtual  
Laboratory

[www.igrid2002.org](http://www.igrid2002.org)

**24-26 September 2002**

**Amsterdam Science and Technology Centre (WTCW)**

**The Netherlands**

**Maxine Brown**

**University of Illinois at Chicago**

**Cees de Laat**

**University of Amsterdam**

**SURFnet**

# GigaPort



A diagram illustrating a network architecture. A blue line labeled "DWDM" enters a yellow triangular splitter. The splitter has four output lines. One line goes to a blue square labeled "Research GbE". Another line goes to a blue square labeled "Production GbE (from router)". The other two lines are unlabeled.

# Czech Republic?

## Sweden?

**CERN**

## 2.5G

# Lambdas

## UK?

# Control Plane Management System Needed!

# StarLight CA\*net4



- Internet evolution has been tremendous over the last 30 years
- Next wave of innovation is emerging
- Research and Academic community is again driving this evolution, in partnership with ICT industry
- It will be interesting to see the result in 2012

***Join the effort***

**GigaPort**



***“Bring Us Your Lambdas”***

**SURFnet**