

# Chinese-Nordic Workshop Trondheim

# SUNET

**April 19-21, 2006**

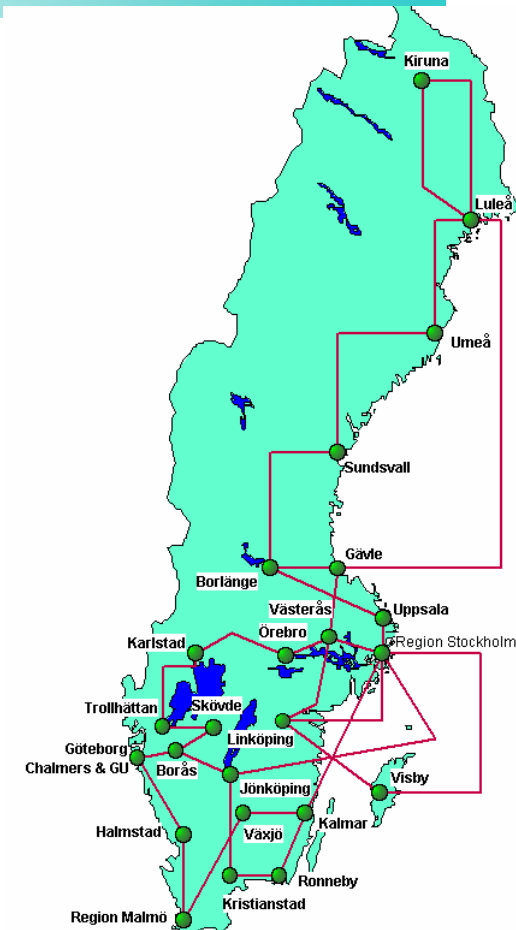
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# SUNET

## The Swedish National Research and Education Network

- **Purpose:**
  - Provide universities with national and international connectivity of high class
  - Provide networking service
- **Key factors:**
  - Availability
  - Capacity
  - No bottleneck



# Users of Sunet

- All universities and university colleges (32), nationwide, connected with 2,5 Gbit/s (redundant)
- Used by all personnel, such as:
  - Researchers
  - Teachers
  - Administrative personnel
  - Technical personnel
  - Students
  - etc.
- Central govt. museums (12) and art schools (17) connected with 100 Mbit/s
- External organizations (25+), such as research councils, with close relations to universities and colleges



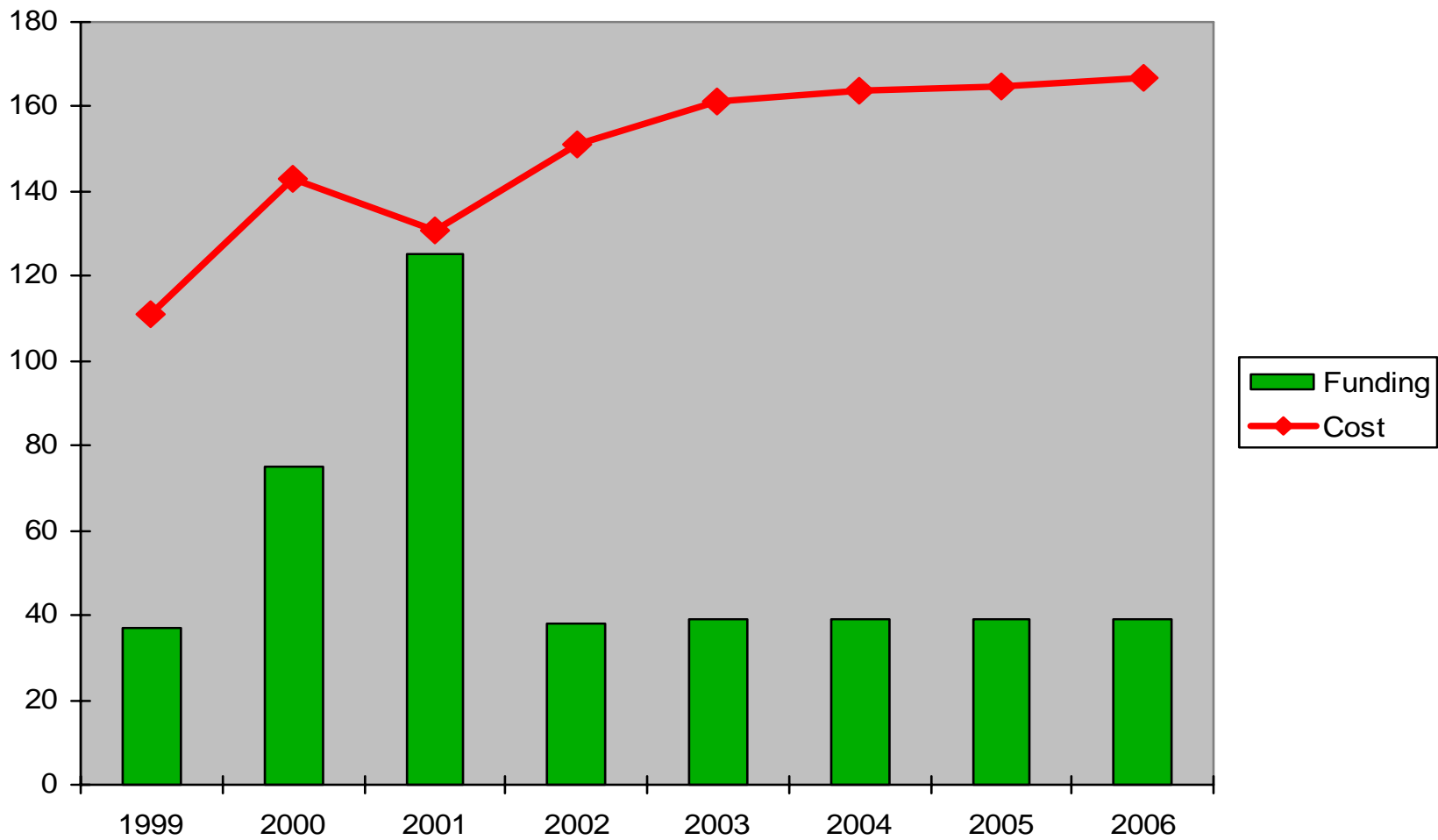
# The Organisational structure of SUNET

- SUNET is administered by the Swedish Research Council
- SUNET does not employ any personnel
- SUNET buys services from universities and other organisations
- SUNET is managed by a Board with representatives from the universities
- The Board is assisted by a technical reference group
- The Royal Institute of Technology (KTH) in Stockholm operates the central part of the network
- The university of Umeå is responsible for co-ordination and development

# Funding of SUNET

- SUNET is partly funded by the Ministry of Education, Research and Culture
- The universities have to pay what the Ministry doesn't pay. That fee is distributed according to the size of the university.
- Other organizations have to pay a fee that is proportional to the capacity of their connection

# Funding and Cost Development



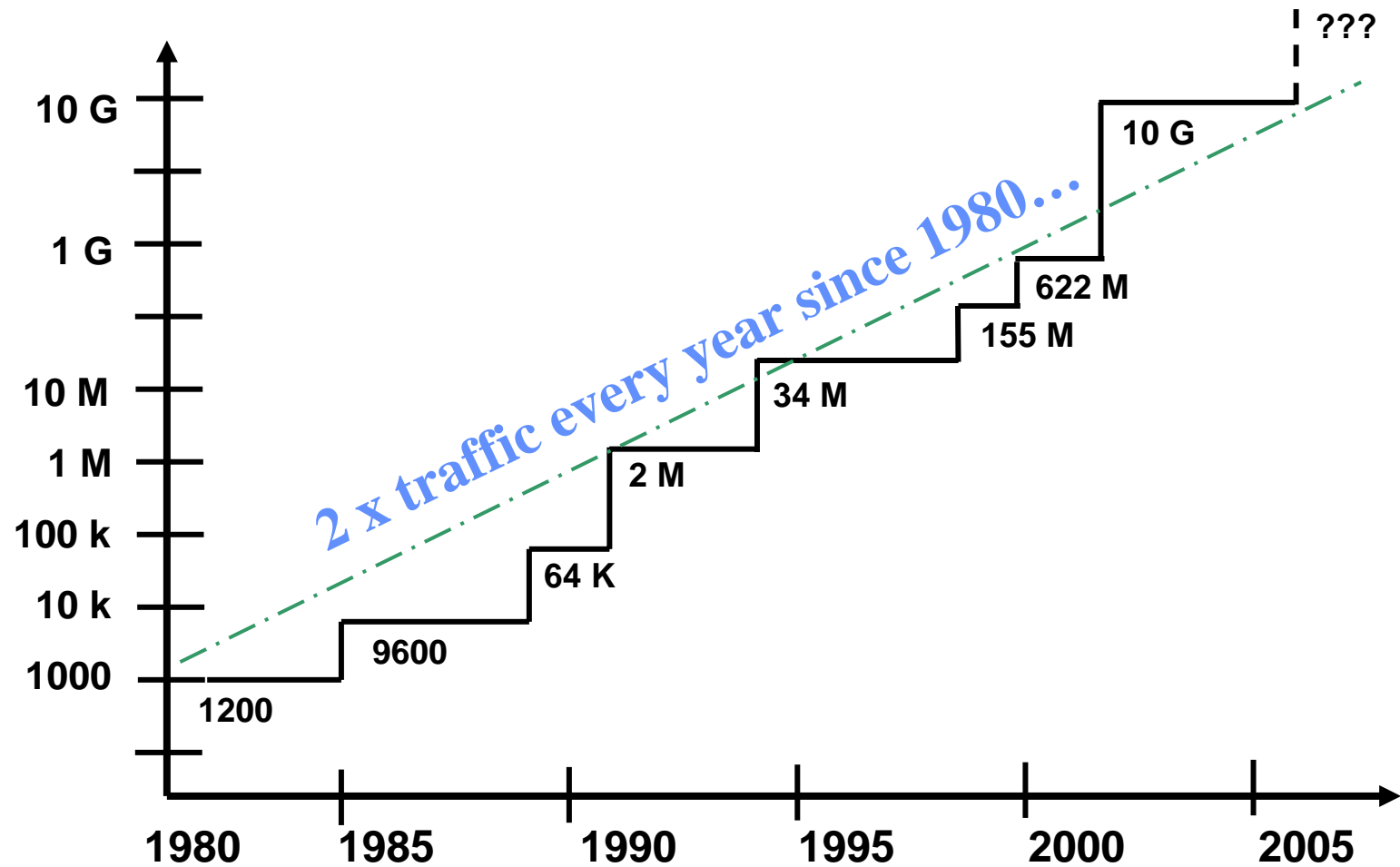
# SUNET services

- Providing Internet access and services for all universities in Sweden
- Access to high performance computing resources in Sweden
- International access via NORDUnet
- Development and operation of the large ftp archive <ftp.sunet.se>
- Providing information systems and information services
- Distribution list services

## SUNET services (contd.)

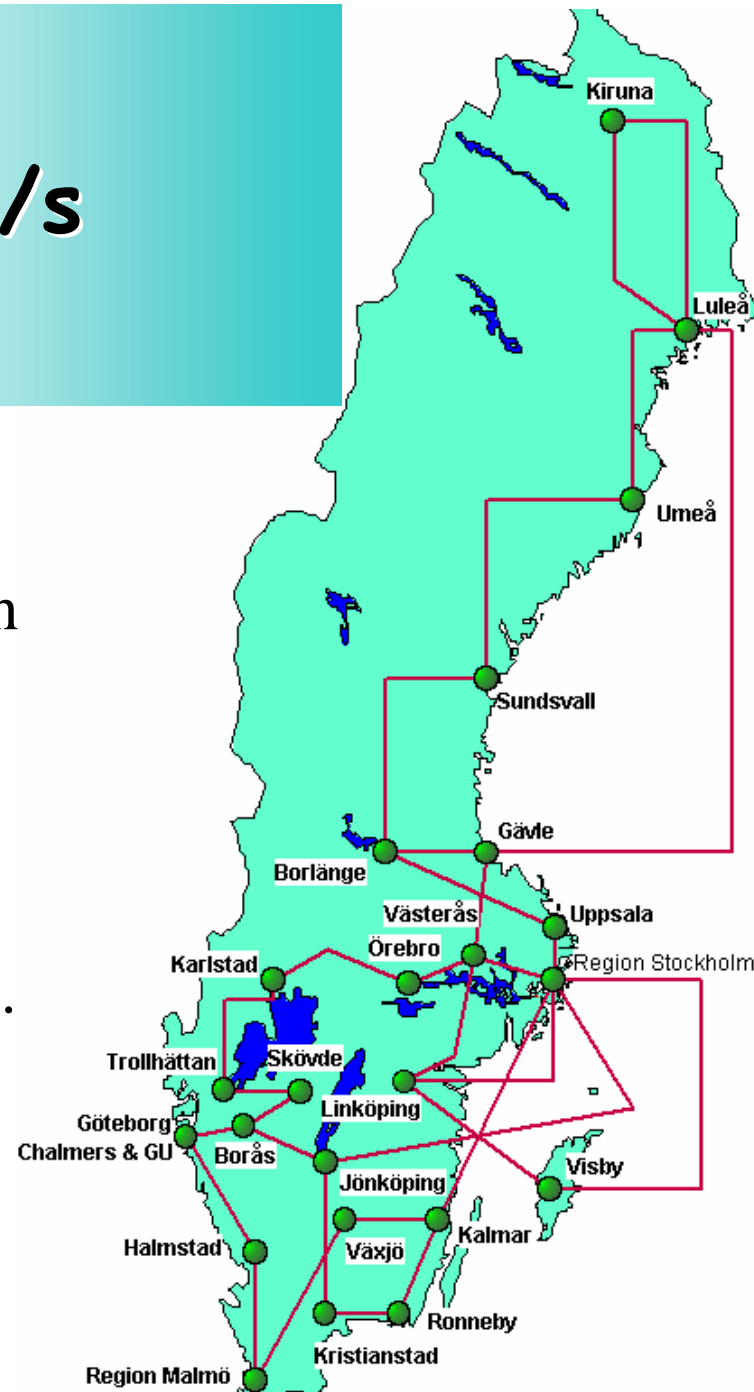
- **CERT**
- **IP telephony**
- **Middleware development**
- **Peering with all Internet Service Providers in Sweden**
- **Initiating and supporting common Swedish Internet functions and services**

# SUNET transmission capacity development



# Current GigaSunet: Nationwide 10 Gbit/s network

- **Core network (22 cities):**
  - 5.270 km of lambdas
  - 27 inter-city segments with 10 Gbit/sec
  - 49 routers (Cisco 124xx)
- **Access network:**
  - 25 dark fiber rings
  - 4 segments of 2,5 Gbit/sec. lambda
  - 70 routers (Cisco 10720)



# GigaSunet Results

- A very high capacity nationwide network
- True 24x7 production traffic
- Also for advanced usage:
  - Internet Land Speed Record- 123.93 Pbm/s + 79%!
  - Collaborative Video Distribution Project - Sweden/China (CERNET in 2004)

# What about the future?

- **SUNET's intention is to:**
  - **Build a futureproof network with unlimited (!) capacity**
  - **Continue to develop network services such as middleware or infraservices**
    - Mobile (nomadic) researchers and students
    - Grid services
    - Distributed resource sharing
    - Etc.

## What about the network for the future?

- SUNET's intention is to:
  - Build an optical network, called OptoSUNET, based on dark fiber
  - Attach all 32 universities and all the other SUNET users, peering partners etc.
- The network will be a hybrid network:
  - Traditional routed IP services
  - "Dedicated" connections between different researchers (p2p lambdas)
- The network must be fully operational by the end of 2006!!!

# Users 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**
    - Astronomers
    - High Energy Physicists
    - Space Physicists (sensor based networks)
    - Life sciences
    - Grid Computing
  - A few connections
  - Point-to-point
  - Long durations

## What is OptoSunet?

- 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

# OptoSunet Design

- The network topology is a single hub and spoke structure
- A redundant central routing solution
- The central routing solution is used to provide the functions of the customer routers, using “virtual router features”

## OptoSunet Design (cont.d)

- Any wavelength can go to any university
- Should not be limited to 50, 100 or 200 GHz channels
- Should be able to support at least 40 Gbit/s

## OptoSunet Design (cont.d)

- The goal is to have a 10 to 15 year lifetime of the fiber system (including amplifiers etc.) and a 5 to 8 year lifetime of the attached electronics (routers etc.)

# Dark fiber status

- In January 2006 SUNET signed a contract for a 8 to 12 years lease of dark fiber
  - Wide area network - between pops
    - 7 663 km
    - 46 "links"
  - Local "loops" from pops to universities
    - 94 dark fiber connections
  - 3 x 2,5 Gbit/s connections (due to cost constraints)
    - 2xVisby, 1xKiruna

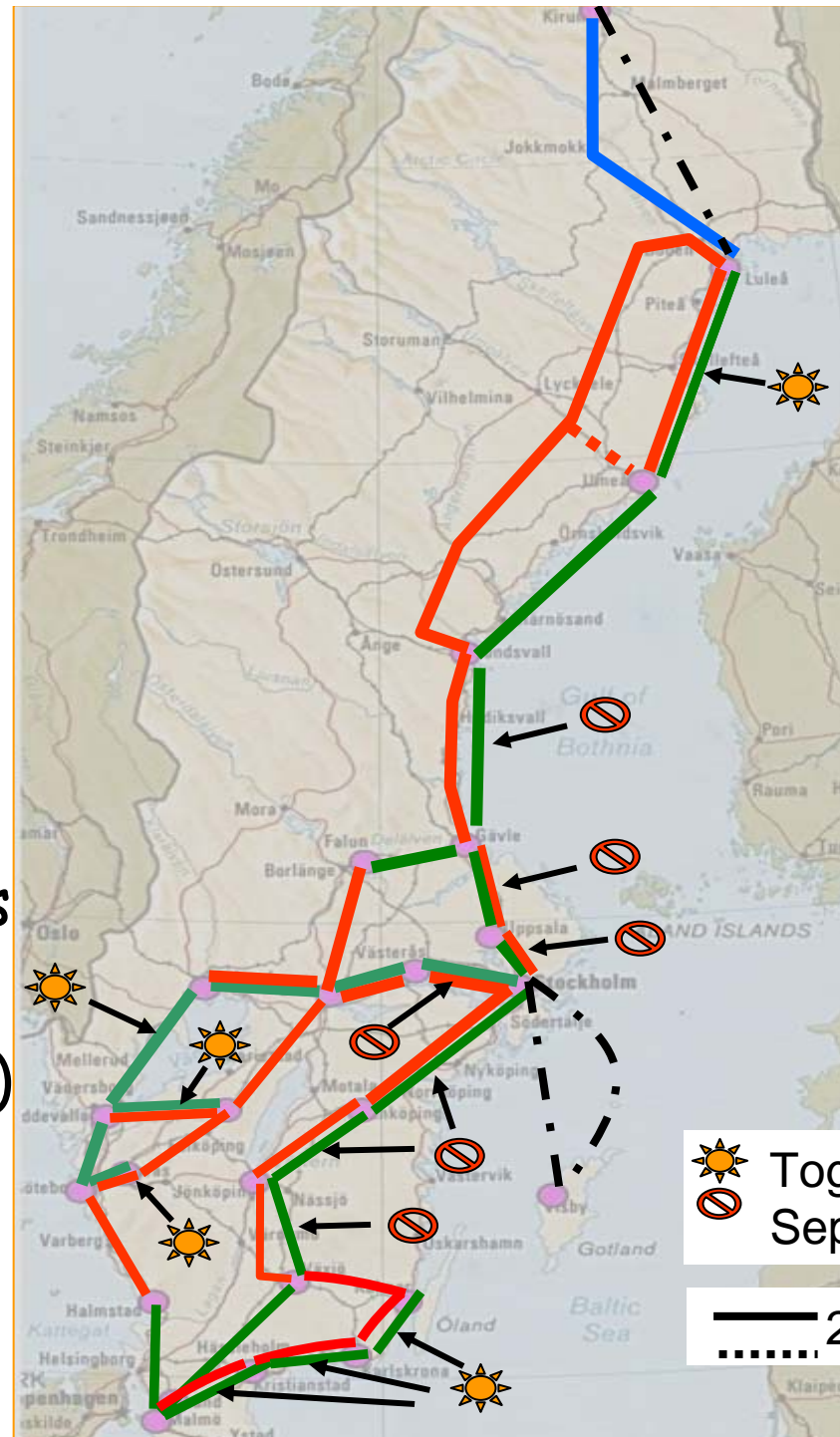
# Network structure TDC Song

Four parts:

- North
- West
- South
- "Kiruna and Visby"

North, west and south consist of two sections each

- Green (short - 40 G+)
- Red (10 G+)



Totalbild

☀ Together  
⊘ Separated

— 2,5 Gbit/s  
- - - 10 Gbit/s



1200 km (745 miles)

# Equipment status

- Just signed a contract with one single company for:
  - DWDM equipment (Ciena)
  - Routers (Juniper)
  - Installation
  - Education
  - Maintenance

# The Role of SUNET

- The foundation for cooperation
  - Between Swedish universities
  - Between Swedish researchers and the researchers in the rest of the world
- Necessary research infrastructure
- Necessary infrastructure for higher education
- Enabling infrastructure for innovation

Questions?