

Internet i verkligheten

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Finns Internet?

Vad är Internet?

- Internet ägs ej av en enskild organisation.
- Styrs till viss del av Internet Society (ISOC).
- Består av ett antal sammankopplade nät som utbyter data enligt egna trafikavtal.
- Alla nät använder protokollsviten TCP/IP.
- Det finns allt från små lokala nät till stora så kallade Internet Service Providers (ISP).

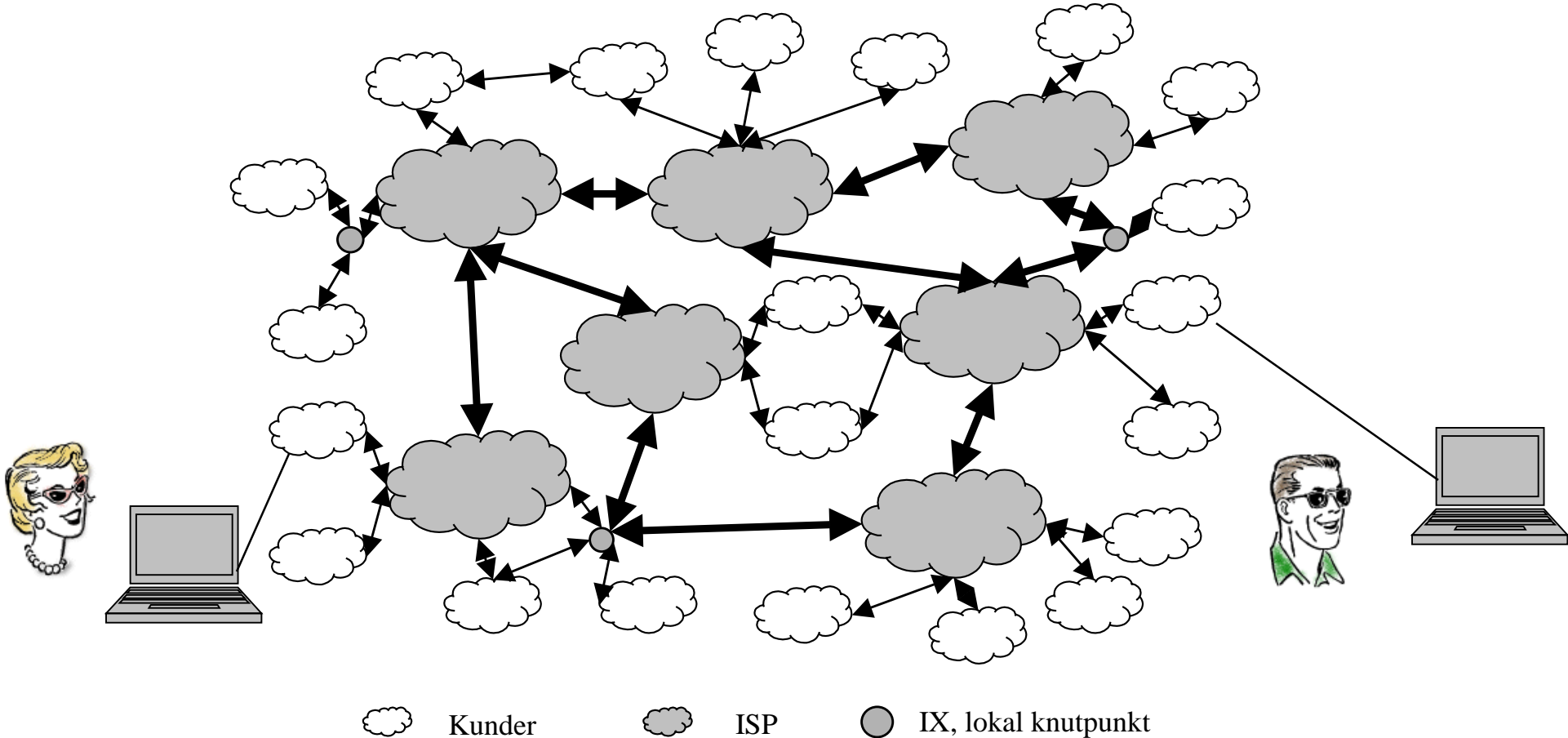
Vad har näten gemensamt?

Alla delnät som utgör Internet har en gemensam nämnare:

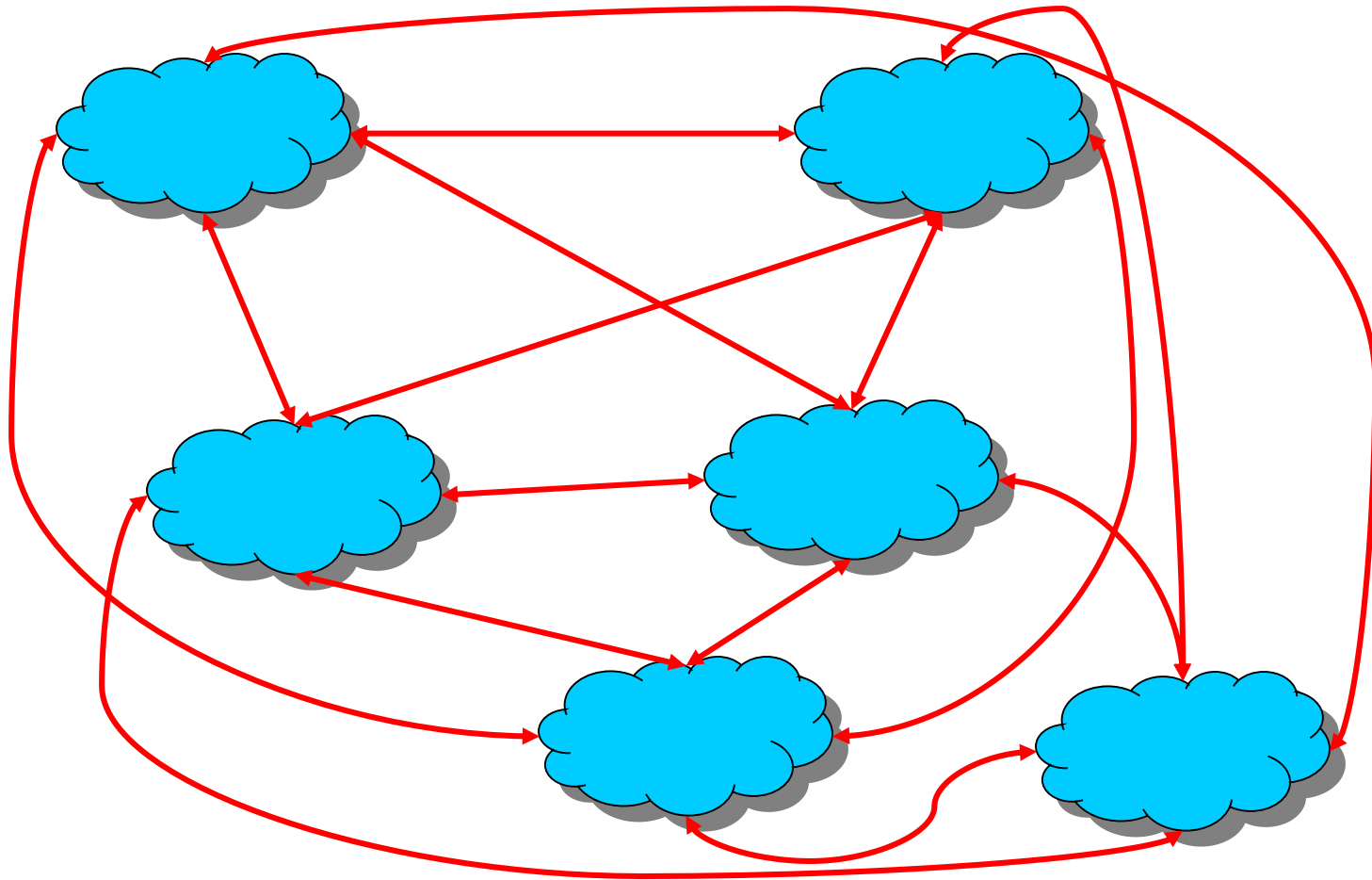
Alla använder samma nätprotokoll, **Internet Protocol (IP)**!

Däremot behöver näten inte använda samma länkprotokoll, vilket gör att en mängd olika slags nät kan kopplas samman.

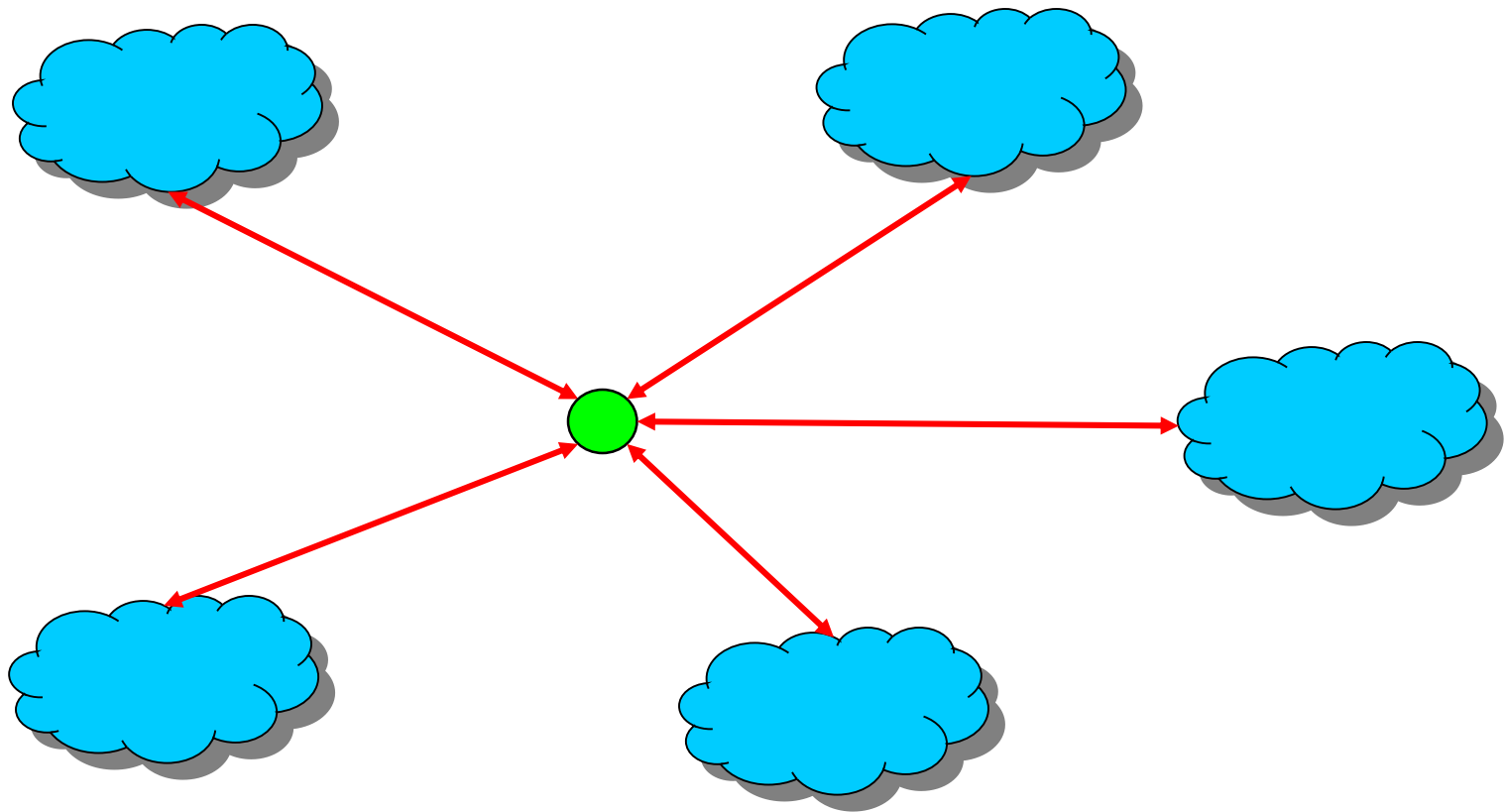
Internets struktur



Trafikutbyte, två och två



Trafikutbyte, knutpunkt



Knutpunkter

- Finns på olika nivåer
 - Lokal
 - Regional
 - Nationell
 - Global
- 4 stycken nationella i Sverige

Världens största distribuerade system?

Global internet routing

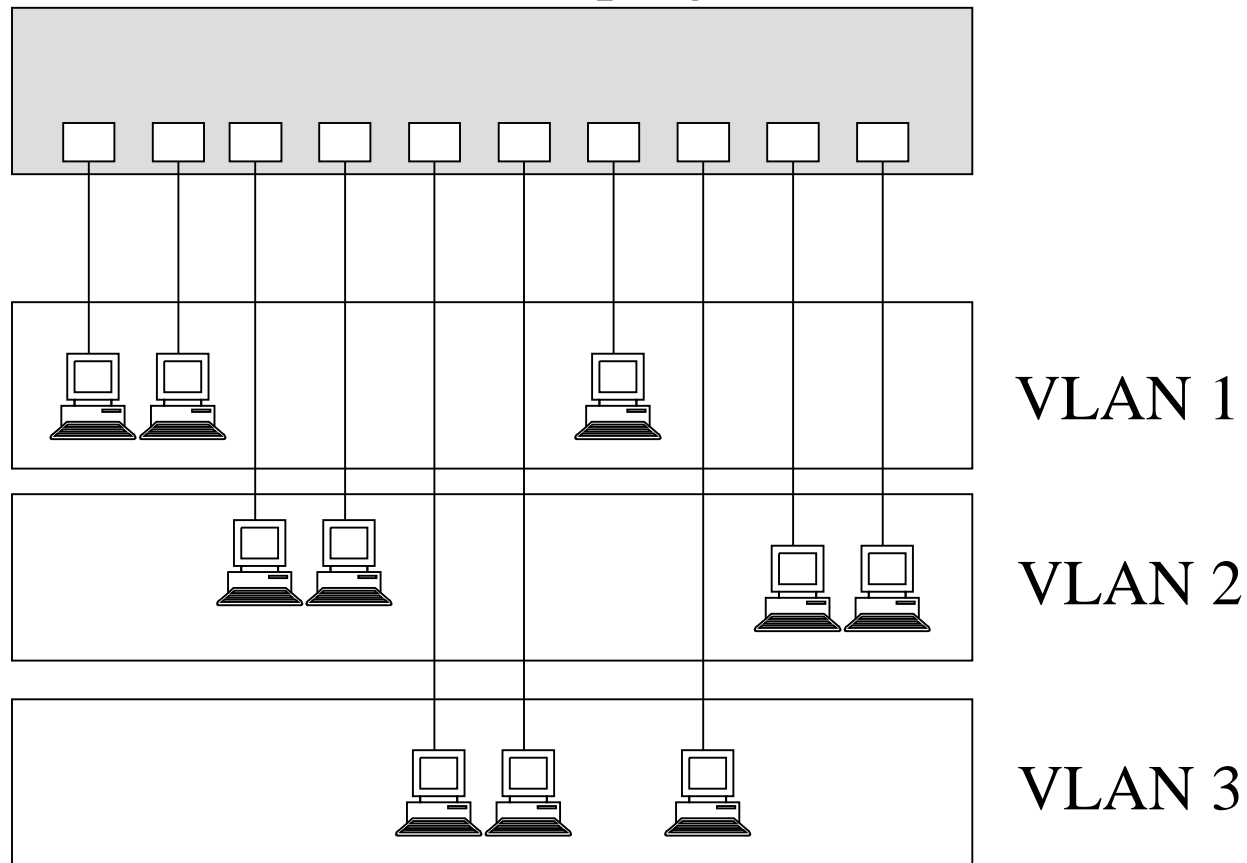
DNS

Lokala nät (repetition)

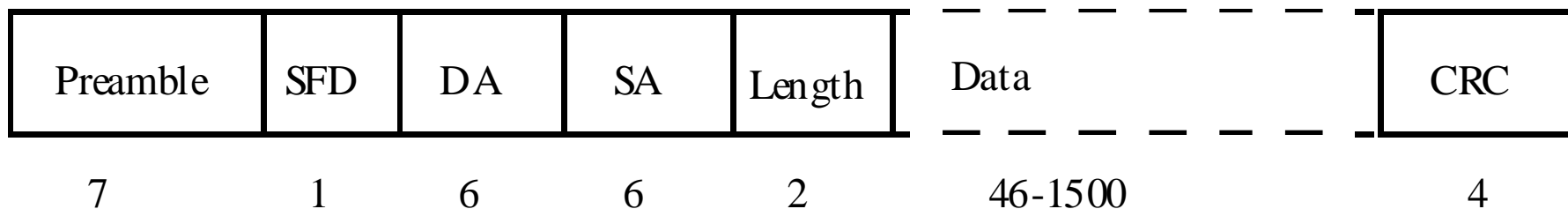
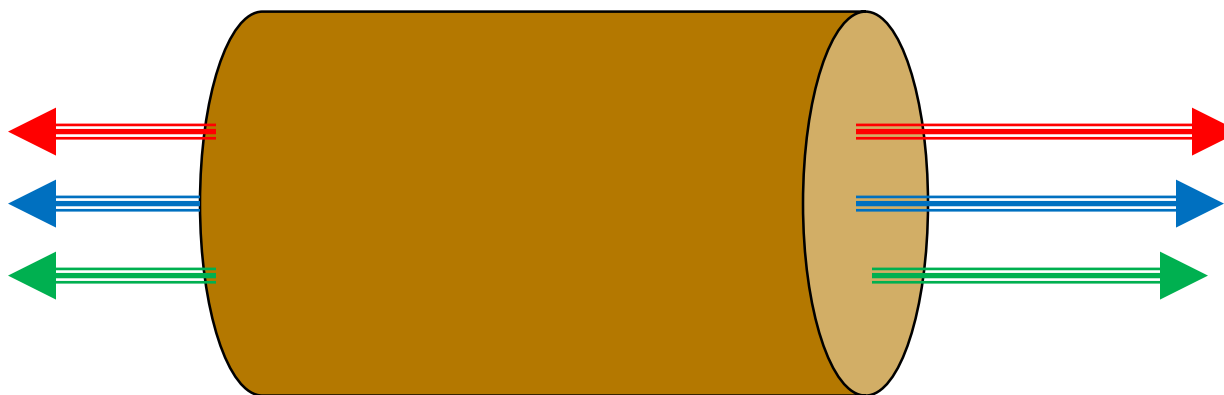
- Ett lokalt nät (Local Area Network, LAN) är ett datanät med en begränsad storlek.
- Ett LAN kan i sin enklaste form bestå av endast *en* länk som flera datorer är kopplade till.
- På ett LAN använder alla samma **länkprotokoll** för att kunna kommunicera med varandra *lokalt*.
- Mellan LAN måste man ha ett nätprotokoll

Virtuella lokala nät VLAN

Switch med VLAN-programvara

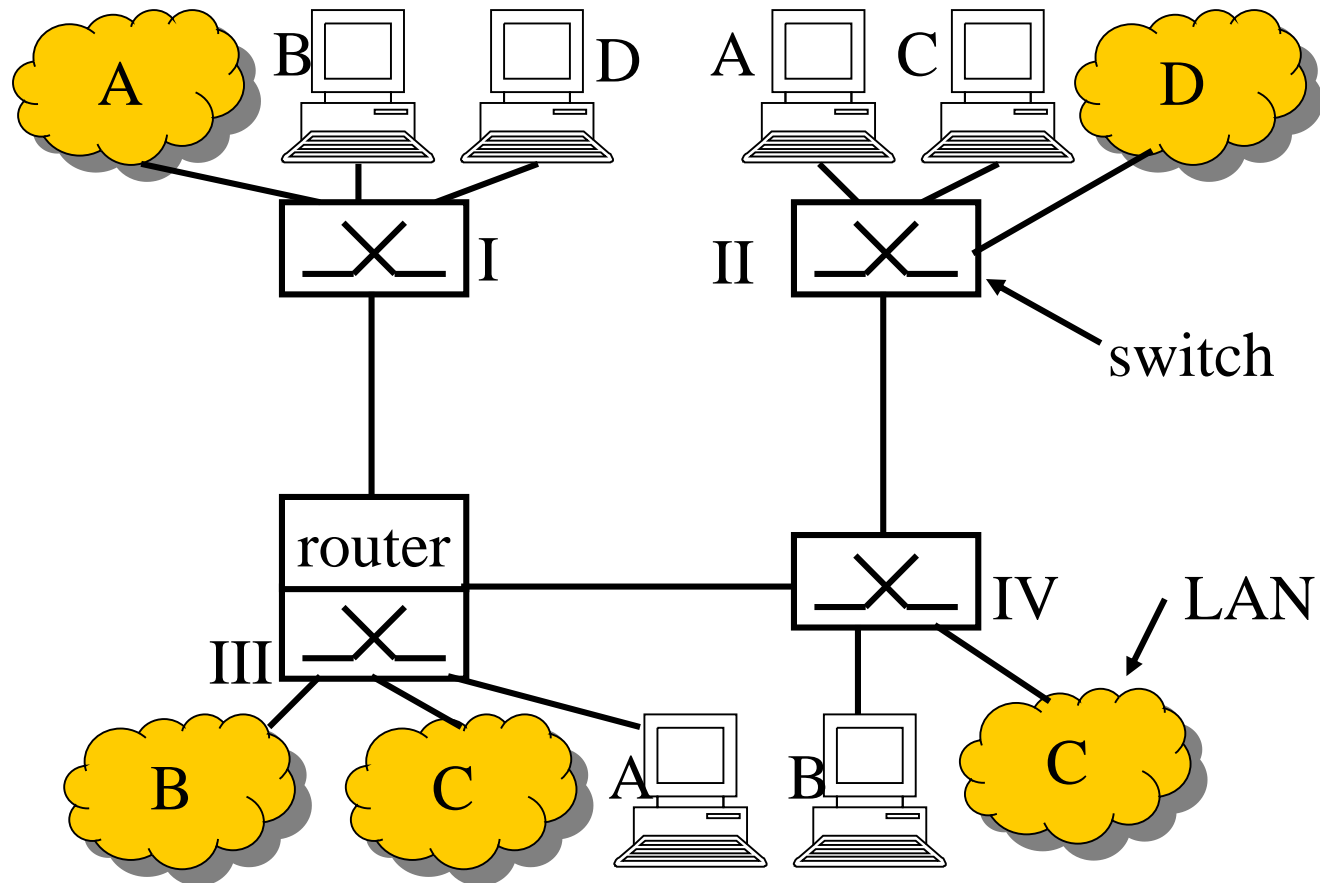


Virtuella lokala nät VLAN: Trunk

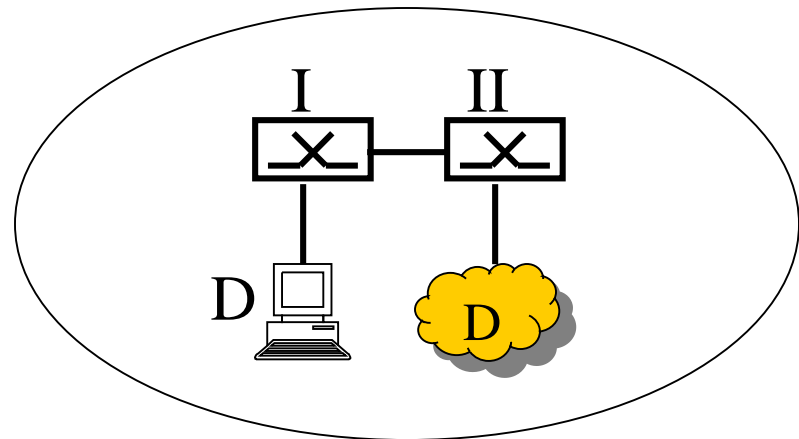
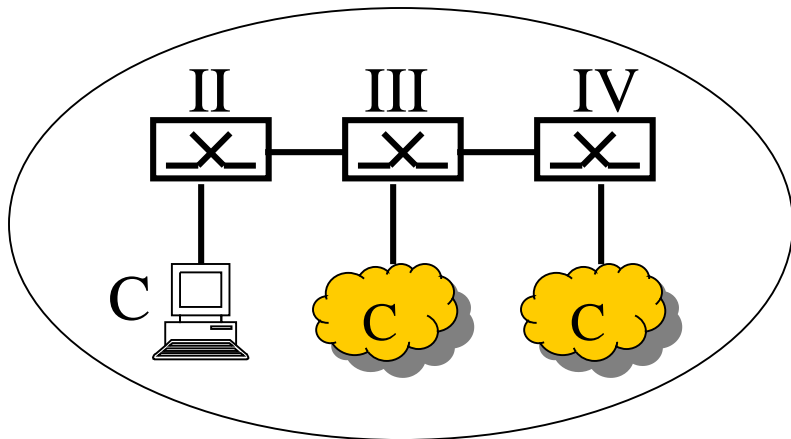
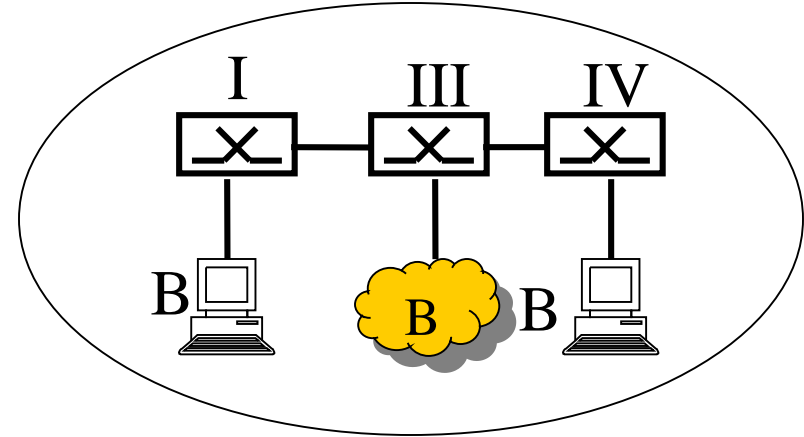
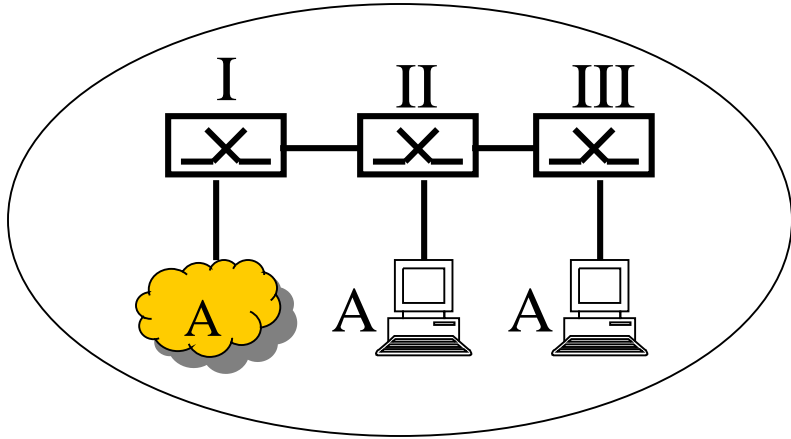


SFD=Start frame delimiter DA=Destination address SA=Source address

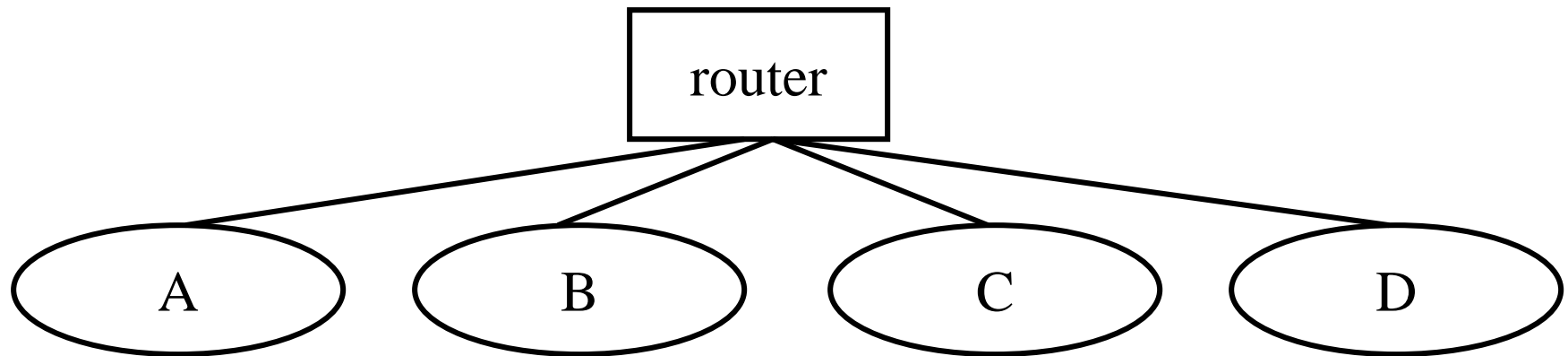
Ett nät på OSI-nivå 1



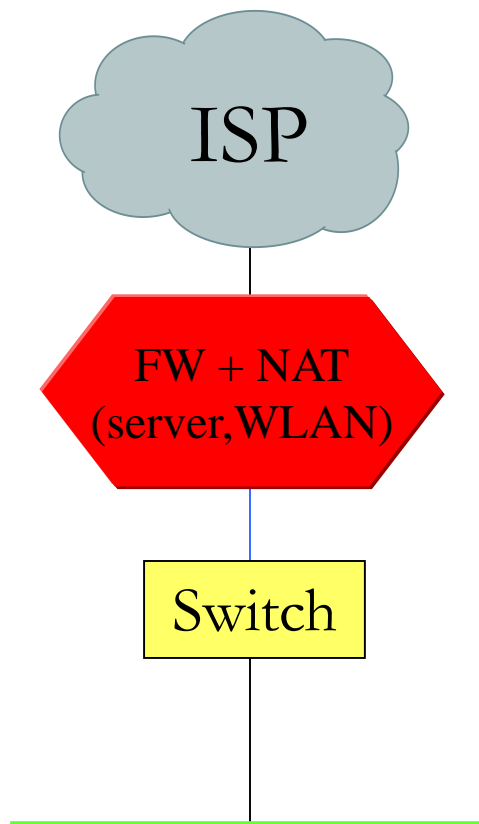
Samma nät med VLAN-teknik på OSI-nivå 2...



Och på OSI-nivå 3...

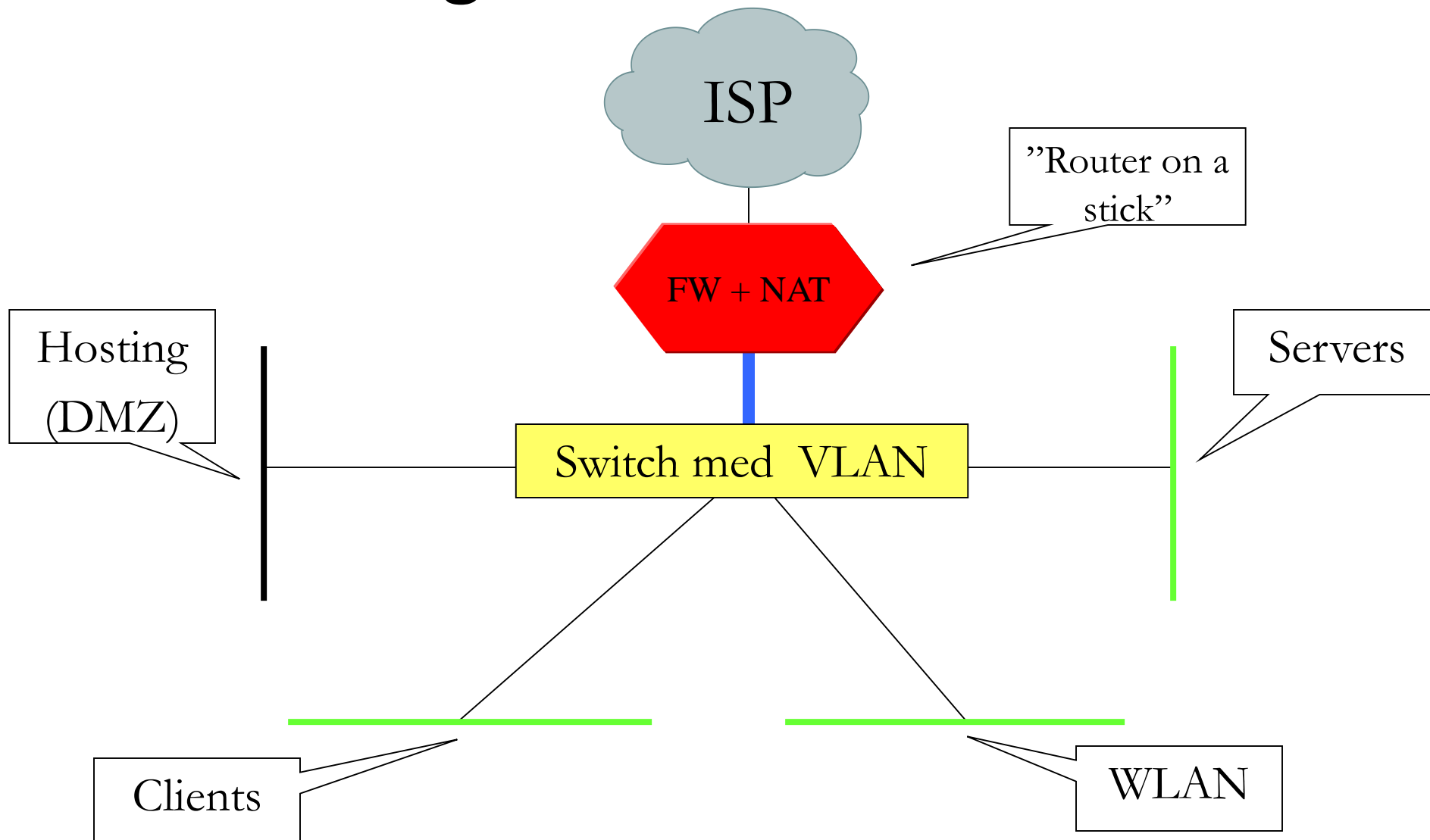


Hemmanätet



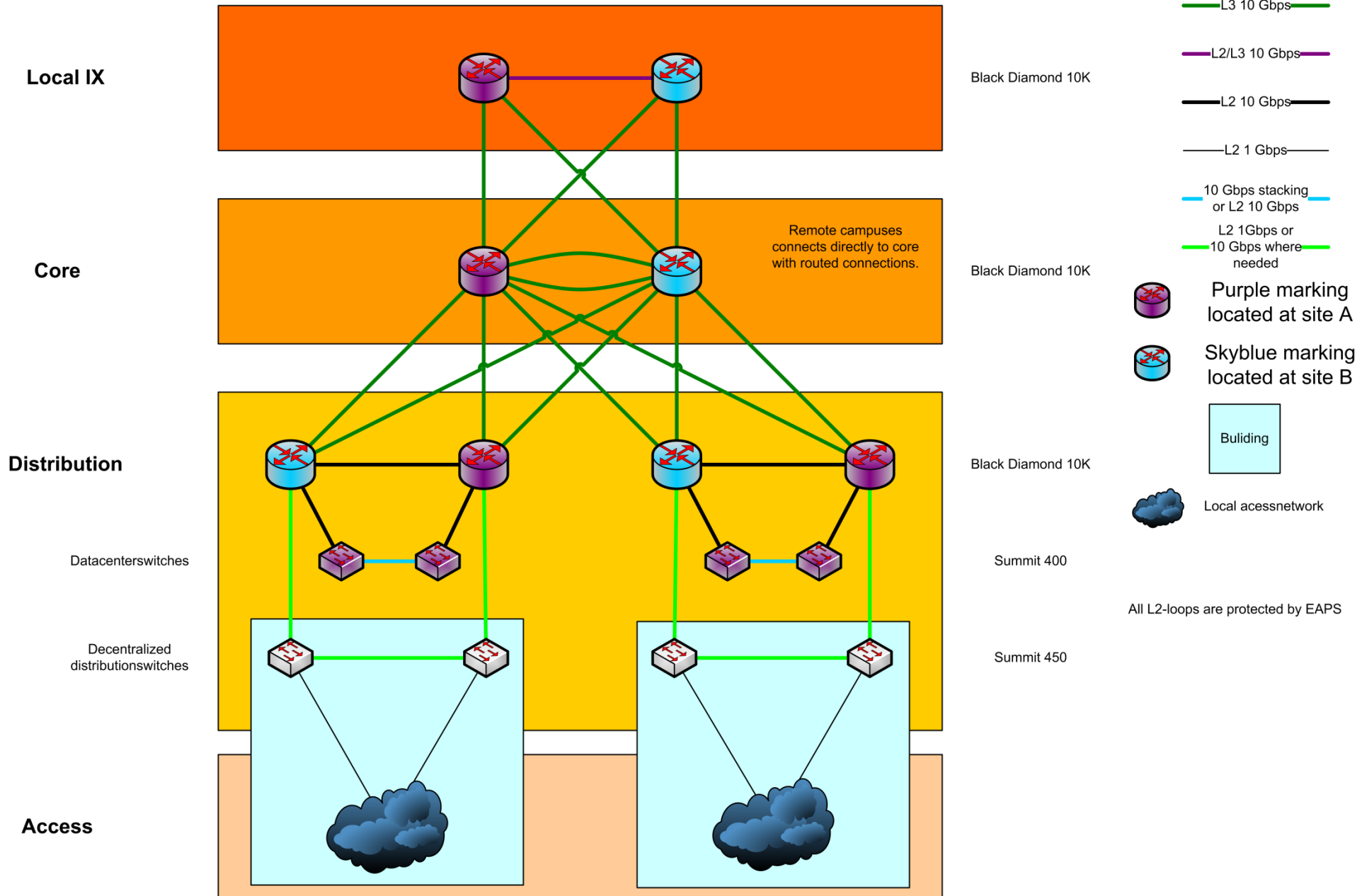
- Bredbandsdelare
- Brandvägg
- Router

Litet företagsnät



GigaLUNET design Campus Lund

2005-08-19 06:30 / mjh



GigaLUNET: I drift sedan ca 2003

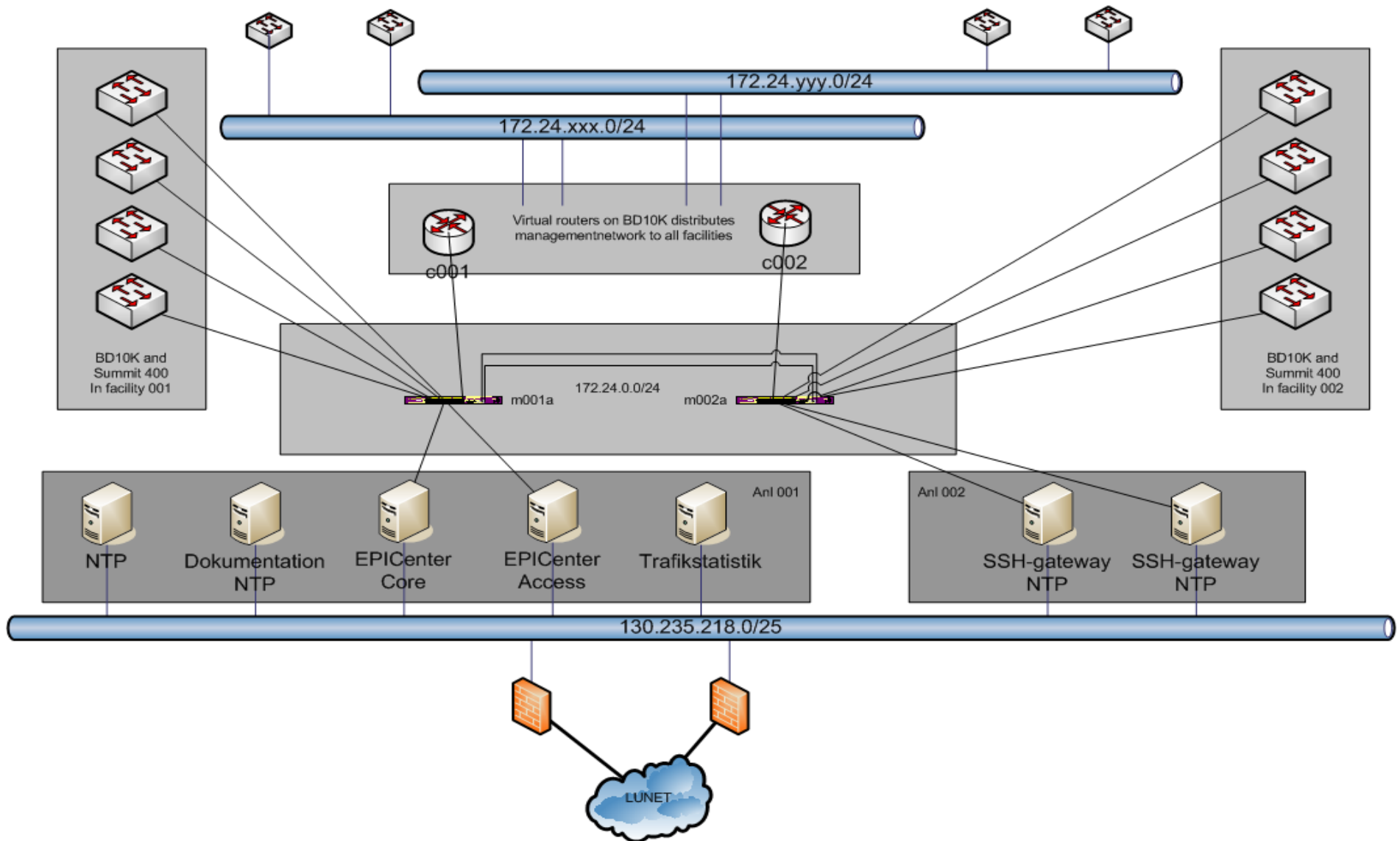
- ◆ 10 Gbps i stamnätet and centrala distributionsnätet
- ◆ 1 – 10 Gbps in utlokaliserade distributions- and accessnäten
- ◆ Single Mode fiber
- ◆ EAPS i L2 (Distribution)
 - Mycket snabb “omkoppling” vid fel; <50ms
- ◆ Equal Path Cost i L3 (Stamnät)
 - Minst två parallella vägar över allt medför dubbel kapacitet
- ◆ Under avveckling/ersättning(?)

Ny(?) teknik

- ◆ Ethernet med mycket hög kapacitet (1-10 Gbps)
- ◆ Billigare nätadapttrar för långa distanser
- ◆ Våglängdsmultiplexering över optisk fiber
 - “våglängder” , WDM
- ◆ L3-L4 switchar
- ◆ Centralt placerad routing
 - Tillbaka till framtiden ...

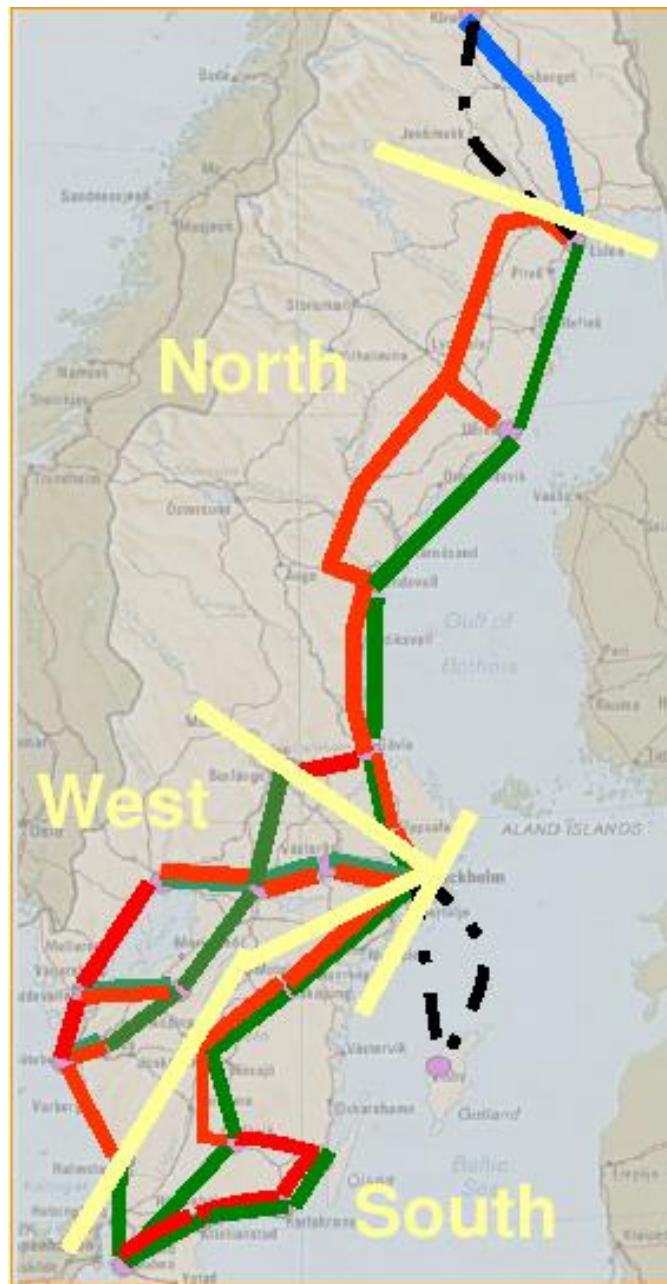
GigaLUNET design Managementnät

2006-01-13 08:30 / mjh



OptoSUNET

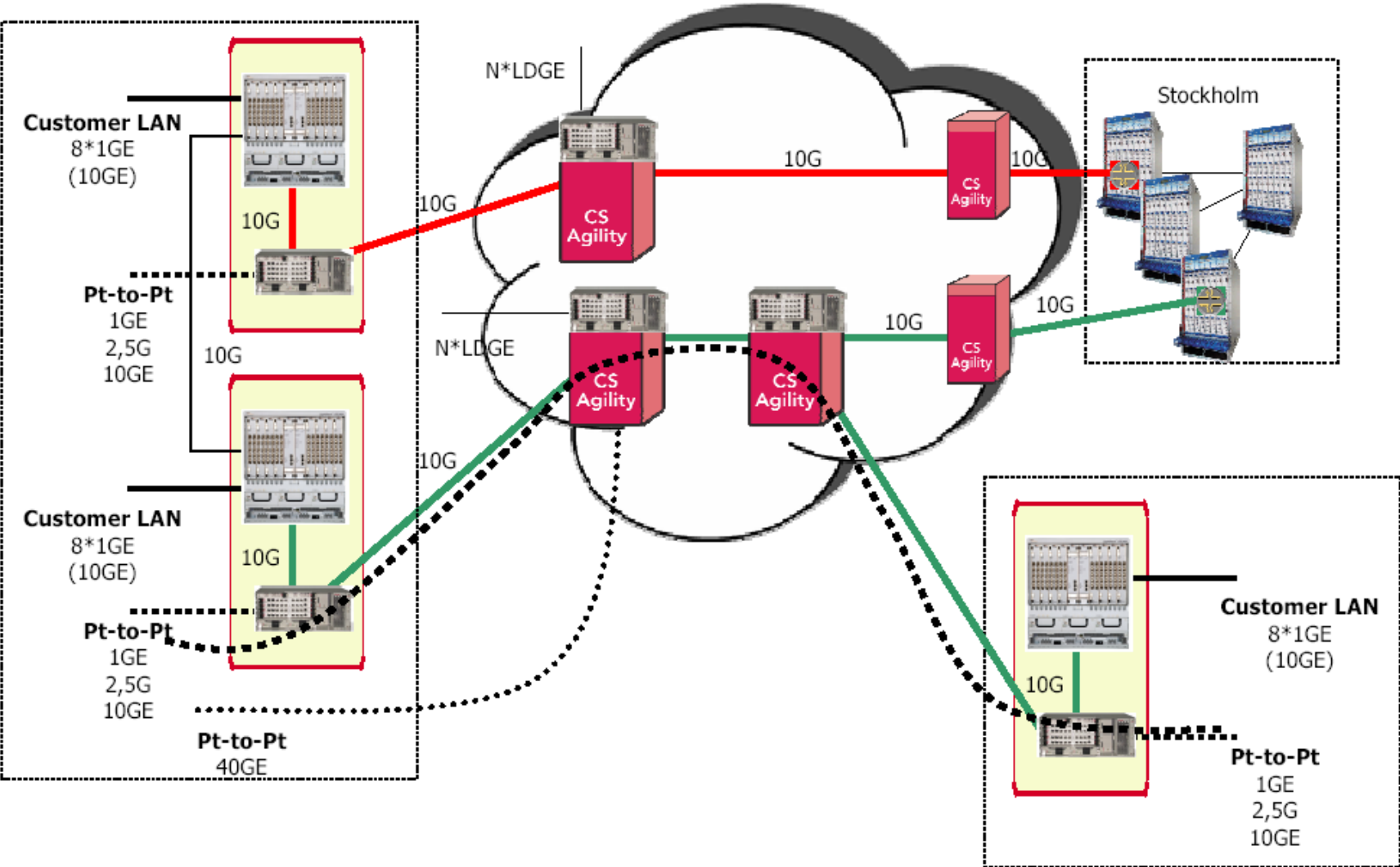
Nu ersatt av SUNET C



OptoSUNET

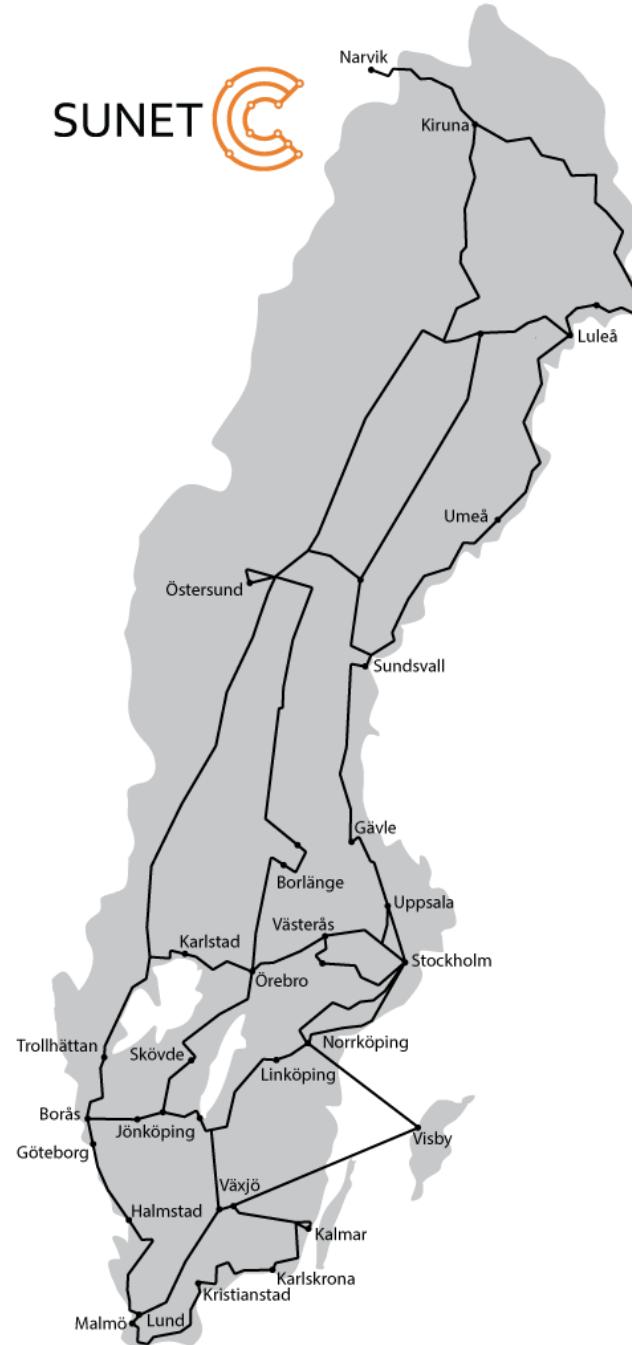
- ◆ 2 * 1 eller 10 Gbps till campusnäten
- ◆ Hybrid-nätverk
 - Vanligt IP/Internet
 - “Våglängder”/”Färger”/DWDM
 - < 40 Gbps/colour)
- ◆ Fiber
 - TDC Song
- ◆ Aktiv utrustning
 - Ägd av SUNET
 - Optisk utrustning från Cienna
 - Routrar från Juniper

OptoSUNET

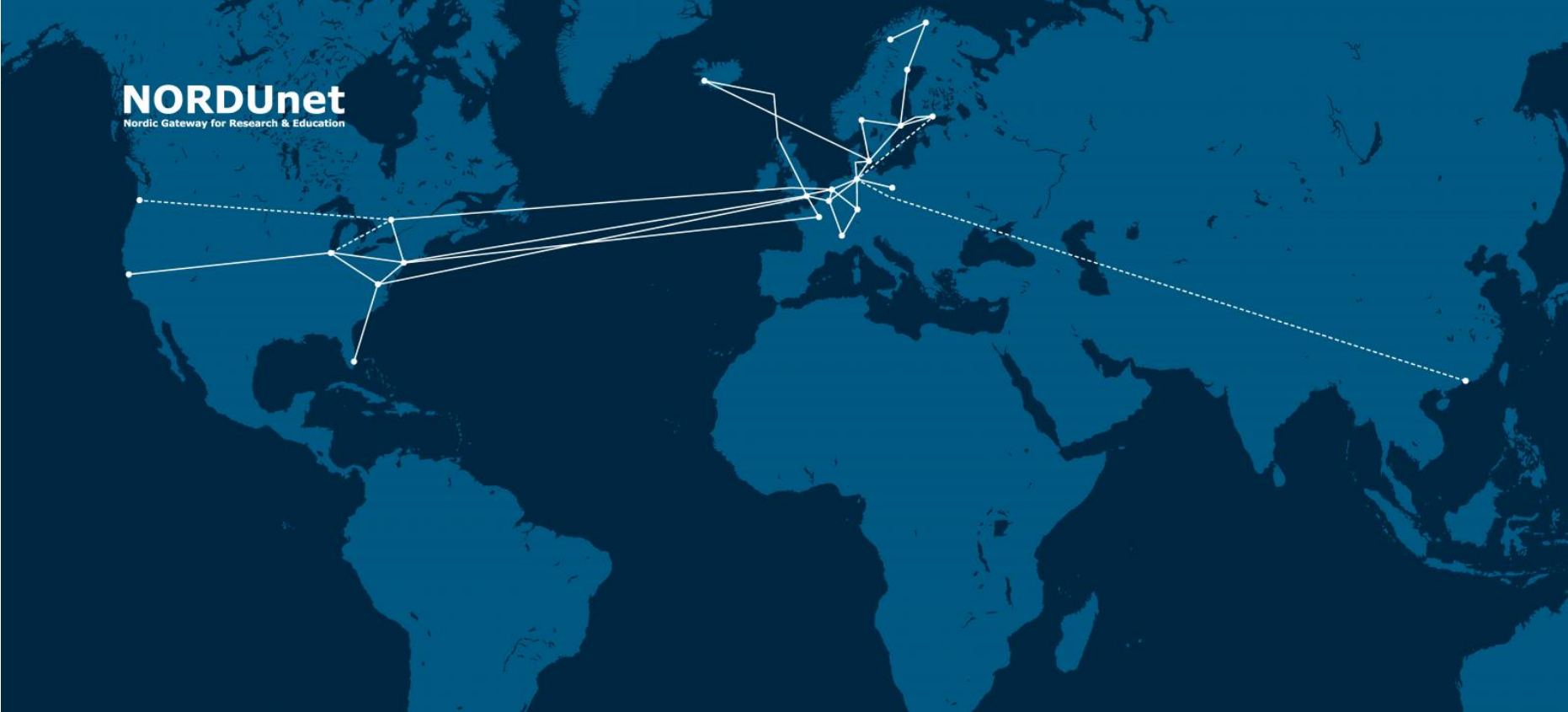


SUNET C

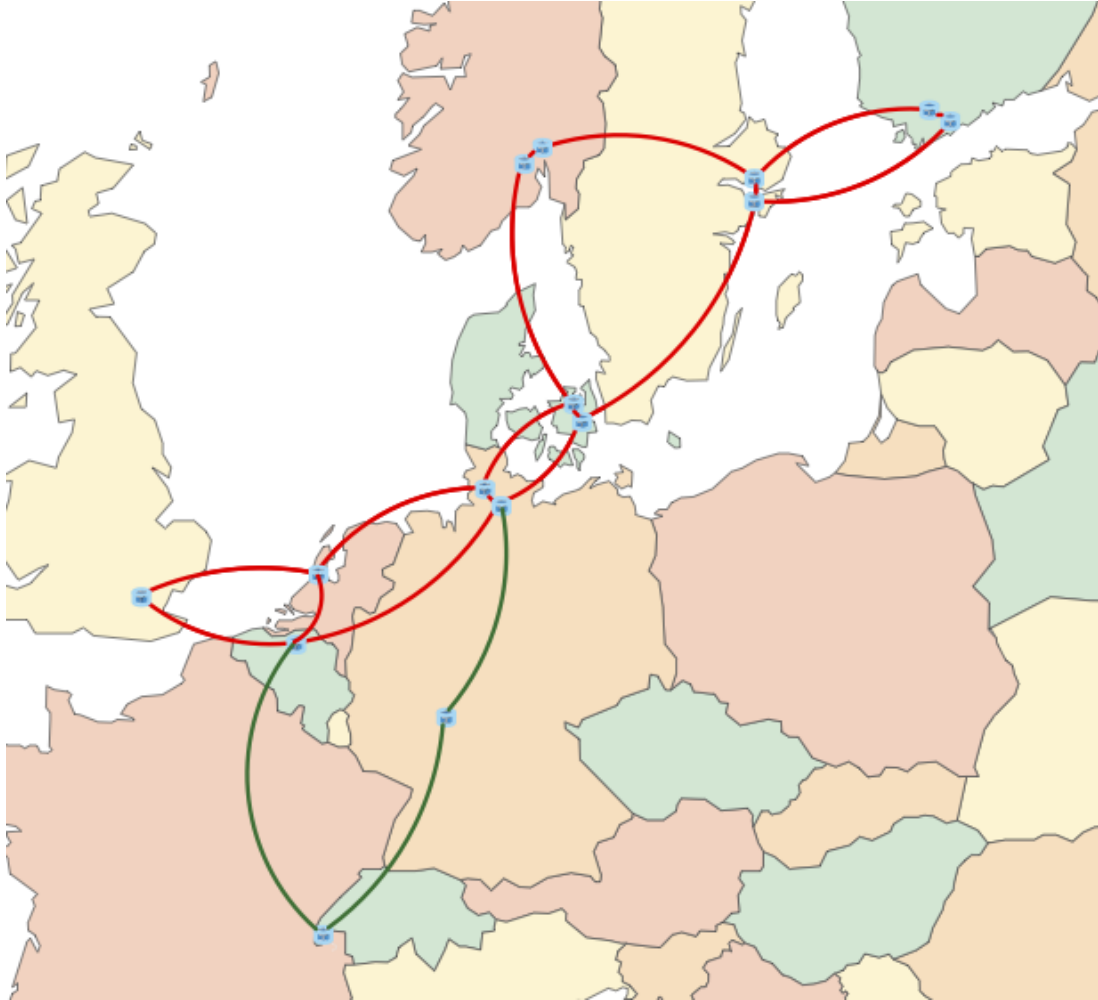
- Invigdes 12/10 2016
- Routat internet
- Egna förbindelser
- Koppla ihop LAN
- 100Ge eller 10Ge i accesspunkterna



NORDUnet



NORDUnet i Europa



GLIF (Global Lambda Integrated Facility)



Virtuella nätverk

- ◆ Logiska overlay-nätverk
- ◆ Byggs med tekniker som VPN, MPLS tunnels
 - Host-to-Host
 - Network-to-Network
 - Kombination

Historia: Internet

1961-69 Forskning packet switching

1969 ARPANET sätts i drift

1971 Email uppfanns

1974 Cerf & Kahn publicera spec för TCP/IP

1978 TCP/IP delas upp i TCP och IP. UDP tillkommer.

1983 Hela ARPANET byter till IP/TCP/UDP 1/1 09.00.

1984 ARPANET delas. MILNET tillkommer. Sammankopplas med router. DNS tas i drift.

1986 NFSNET blir ryggradsnät i USA.

1987 Första INTEROP.

1990 ARPANET upphör.

1991 Berners-Lee skapar WWW.

1993 Webläsaren Mosaic erövrar världen

1995 NFSNET återgår till rent forskningsnät. Tillräckligt med kommersiella ryggradsnät.

1996 Internet2 grundas.

Historia: LUNET och SUNET

1956 SMIL tas i drift

1970 SMIL ersätts med Univac

1981-82 Sverigetäckande nät för terminaler byggs, kallas SUNET.

1982 Terminalväxelnät börjar byggas i Lund, LUNET.

1982-83 Lokala termvxnät ansluts till SUNET. Nu nät för termvxnät.

1984 LDC och Ehuset bygger varsitt Ethernet.

1985 Optofiber förbinder de två ethernet:en. lth.se och lu.se registreras.

1986 SUNET byggs om till DECnet.

1988 Ryggradsnät (ethernet + optofiber) börjar byggas i Lund. **SUNET kör IP. Lund ansluts till Internet.**

1991-92 SUNET uppgraderas.

1992-94 Lunds termvxnät läggs ner.

1994 SUNET uppgraderas.

1997 Uppgradering av LUNET påbörjas.

1998 SUNET-155 tas i drift.

2002 Giga-SUNET tas i drift

2006 GigaLUNET och OptoSUNET tas i drift

ARPAnet was developed in 1968

Robert Taylor at ARPA (later DARPA) had three terminals for connecting with different sites:

“For each of these three terminals, I had three different sets of user commands. So if I was talking online with someone at S.D.C. and I wanted to talk to someone I knew at Berkeley or M.I.T. about this, I had to get up from the S.D.C. terminal, go over and log into the other terminal and get in touch with them. I said, oh, man, it's obvious what to do: If you have these three terminals, there ought to be one terminal that goes anywhere you want to go where you have interactive computing. That idea is the ARPAnet.”



ARPAnet

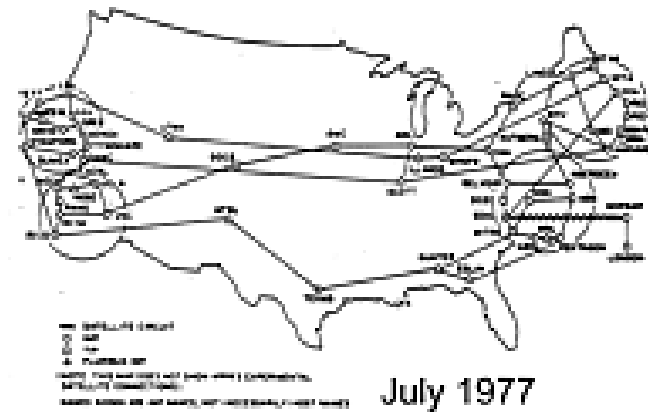
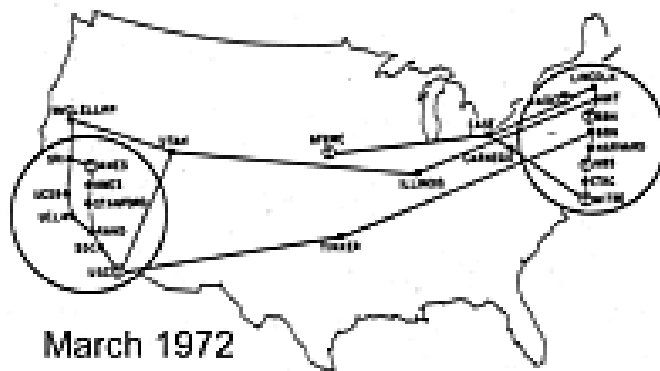
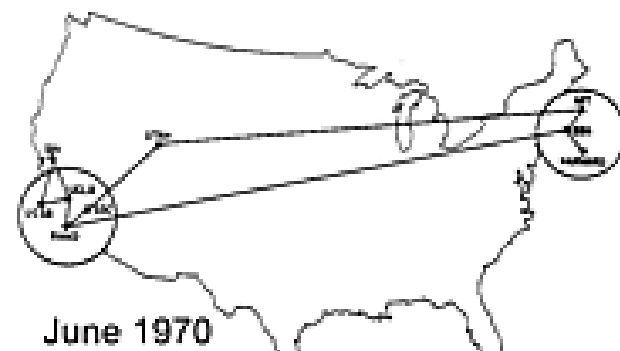
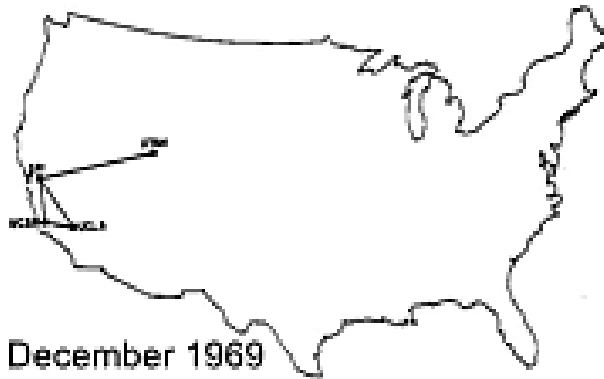
Four Interactive Message Processors (IMP) at four universities connected with leased lines of 50 kbps.

The IMPs could store and forward messages.

The picture shows Leonard Kleinrock with the first IMP at UCLA.

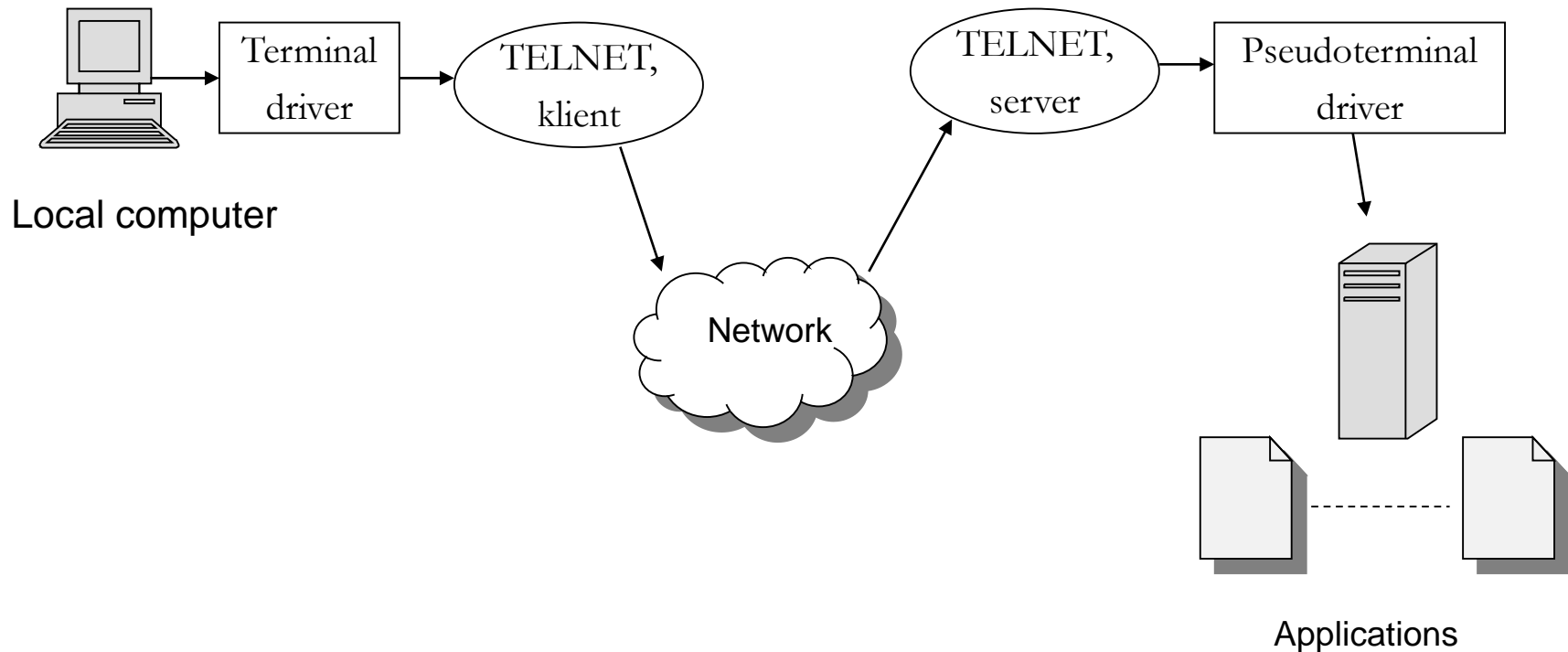


ARPAnet evolution



Telnet

Telnet was invented in 1969, and provided access to a remote terminal.



Email

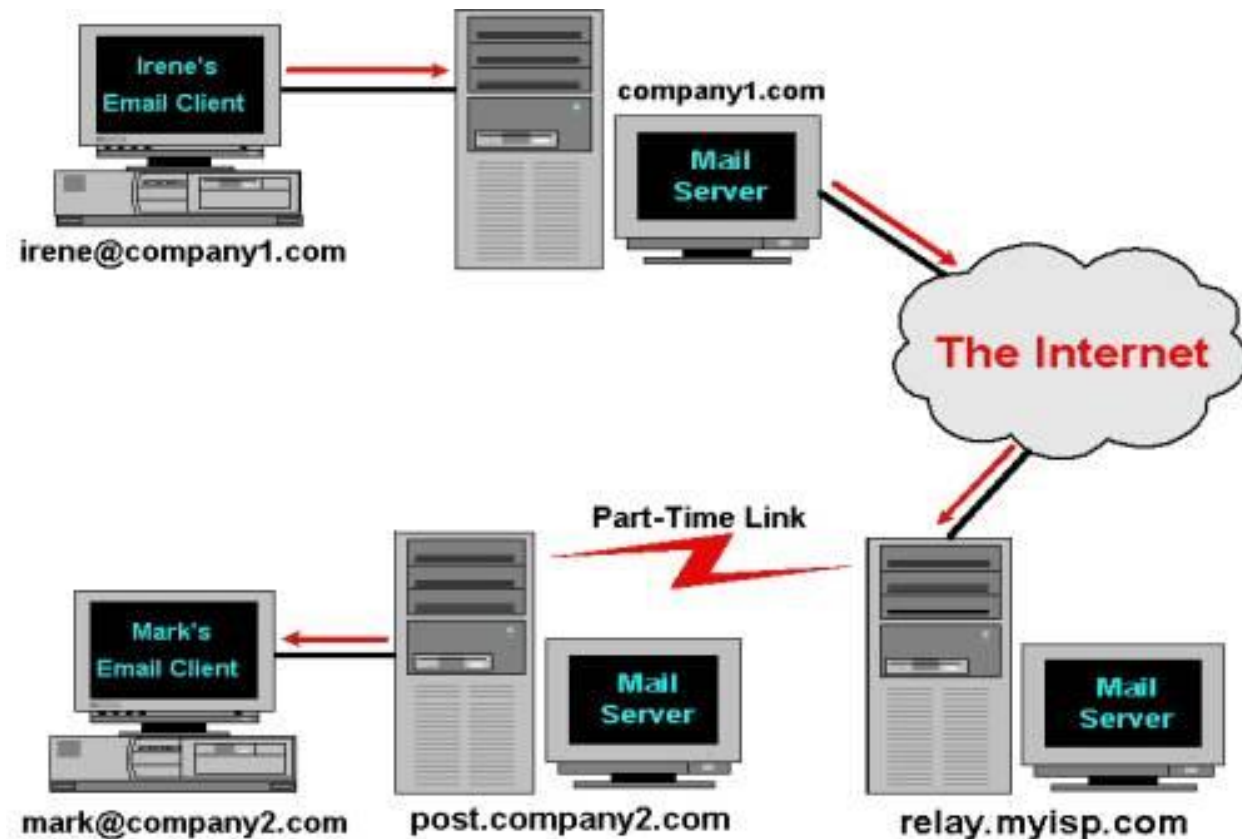
Ray Tomlinson sent the first email in 1971 between two computers in the same room.

To separate a specific user on a host computer, he used the ”@” sign, which was unused on the keyboard.



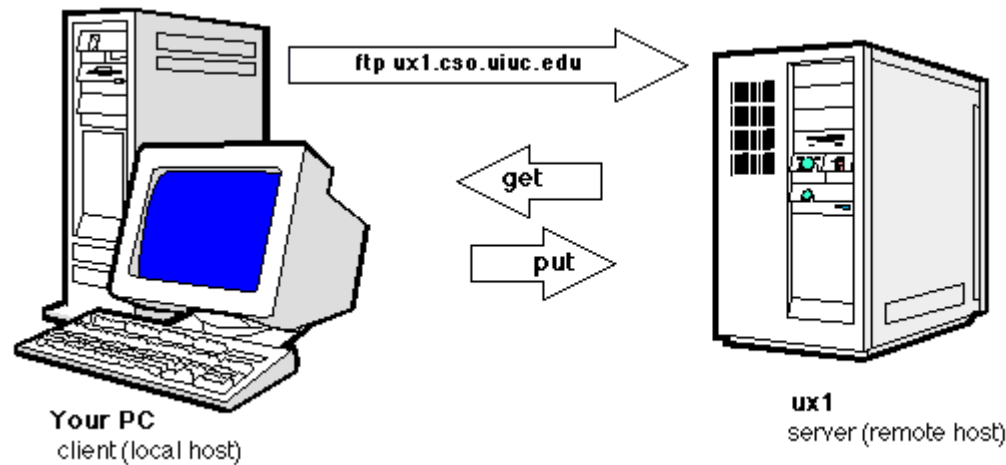
Email

Today, email basically works the same way:



File Transfer Protocol (FTP)

Another original application was FTP, which was developed in 1971, and that enabled file transfer between two host computers.



Internet protocol

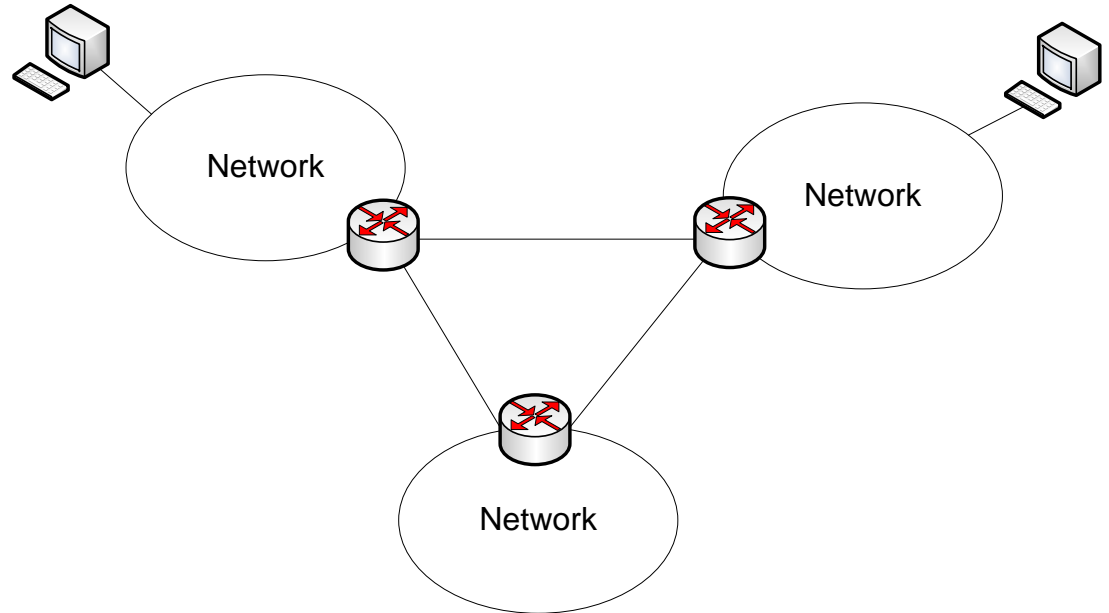
In 1973, Robert E. Kahn and Vincent Cerf at DARPA developed the ideas of an internetwork protocol that made it possible for hosts on different networks to communicate with each other.

The ideas were defined as the Transmission Control Protocol (TCP) protocol in 1974, where the term "Internet" was introduced.

Later, some parts of the TCP protocol were moved to the Internet protocol (IP), creating the TCP/IP protocol suite.

Basic idea of Kahn and Cerf's internetworking

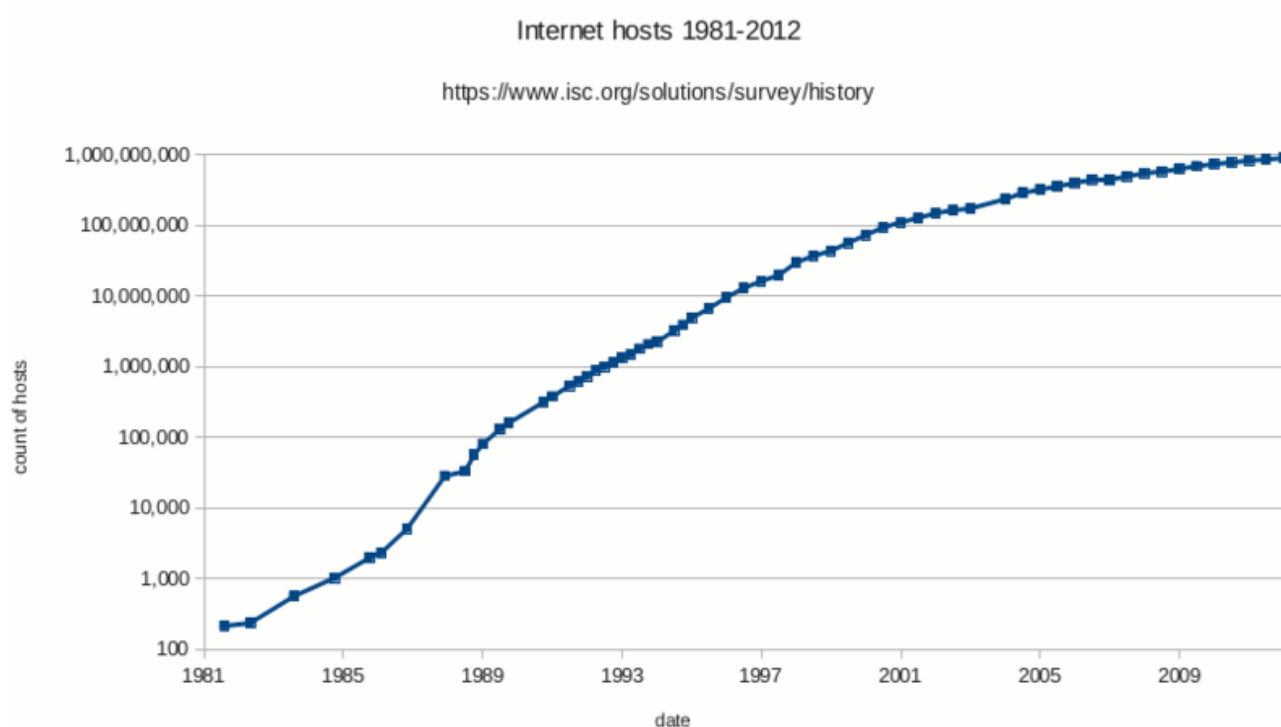
- Host identification (Addresses)
- Forwarding of messages between networks (routing)
- End-to-end reliability (error and flow control)



Internet was born

The Internet protocol suite was formalized in 1982.

Jan 1 1983, all networks connected to the Internet had to use the TCP/IP protocol suite.



1991: World Wide Web (WWW)

1984-1990: Tim Berners-Lee and his group at CERN worked on the ideas of information presentation and sharing.

1990: HyperText Transfer Protocol (HTTP), HyperText Markup Language (HTML), a web browser, and server software were presented at CERN.

1991: WWW goes public

1993: Mosaic, the first public web browser

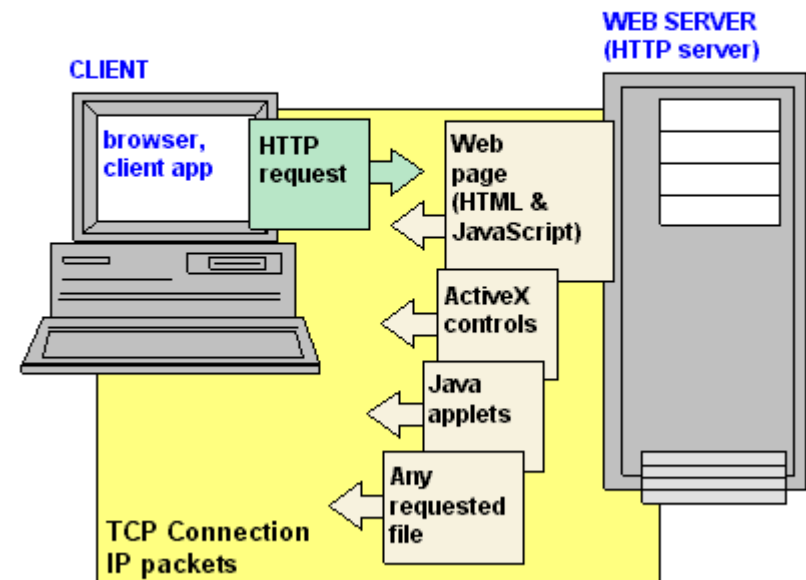


First web site: <http://info.cern.ch>

The first web site is still working.

WWW is based on a simple client/server protocol HTTP, where clients send requests for pages to the server.

From Computer Desktop Encyclopedia
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1991: The Trojan Coffee room pot

The people working at the Computer Laboratory at the University of Cambridge implemented the first real-time Internet video application for their coffee pot.

The application server sent real-time images of the coffee pot to the clients.



The rest is almost not history

1994: Pizza Hut started first online webshop

1997: AOL instant messenger

1997: Sixdegrees.com (first modern social network)

1997: Google.com

1999: Napster

2001: BitTorrent

2003: Skype

2005: YouTube

2005: Facebook.com

2008: Spotify

