Future of the Internet

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History
~~Future~~ of the Internet

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30 years ago...

- We had one telco
- They had some services
- They sold the end equipment
- Most fascinating service was call forwarding when there was no answer
- The telco was responsible for everything, and legislation was written to target only them
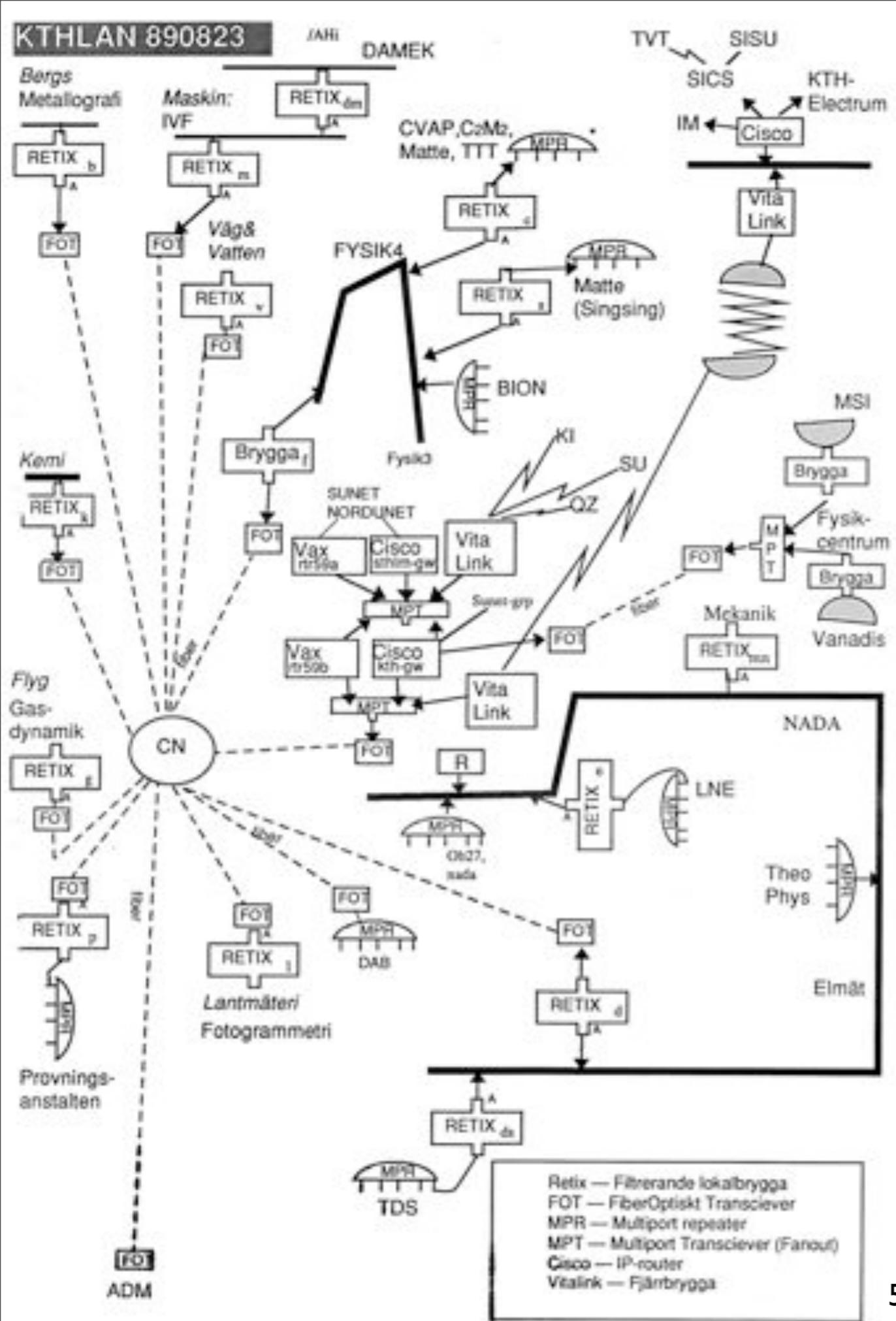- And, they where owned by the government

20 years ago

- Historically, X.25 or similar (today) higher-level technology was used as "layer 2" which other protocols were tunnelled on

- SUNET was from the beginning architectured as a multi-protocol network where DECNet, IP, SNA etc could be run in parallel on top of layer 2

- It was one of the first global layer 2 networks
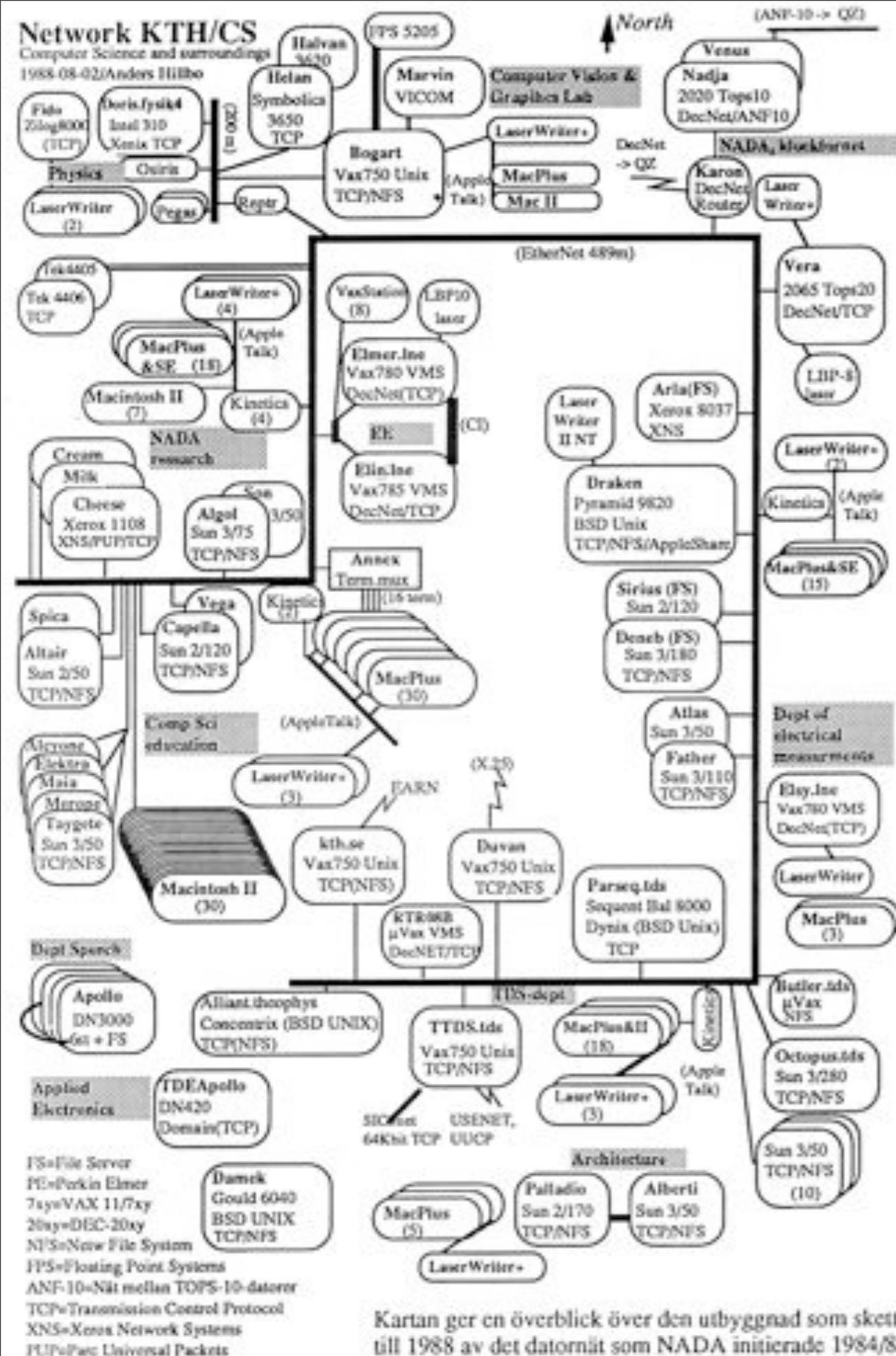
Network at KTH September 1988

- Backbone was thick (yellow) Ethernet cable, 489 meters long

- Connection via DECNet and IP over X.25

- 2 Vax 750 were main Internet hubs

- DNS work done on Sun 2/120 (upgraded Sun-1) and Pyramid 9820

Network KTH/CS
Computer Science and surroundings
1988-08-02/Anders Hillbo

(EtherNet 489m)

IS=File Server
PE=Perkin Elmer
7xy=VAX 11/7xy
20xy=DEC-20xy
NFS=New File System
FPS=Floating Point Systems
ANF-10=Nät mellan TOPS-10-datorer
TCP=Transmission Control Protocol
XNS=Xerox Network Systems
PUP=Parc Universal Packets

Kartan ger en överblick över den utbyggnad som skett
till 1988 av det datornät som NADA initierade 1984/85
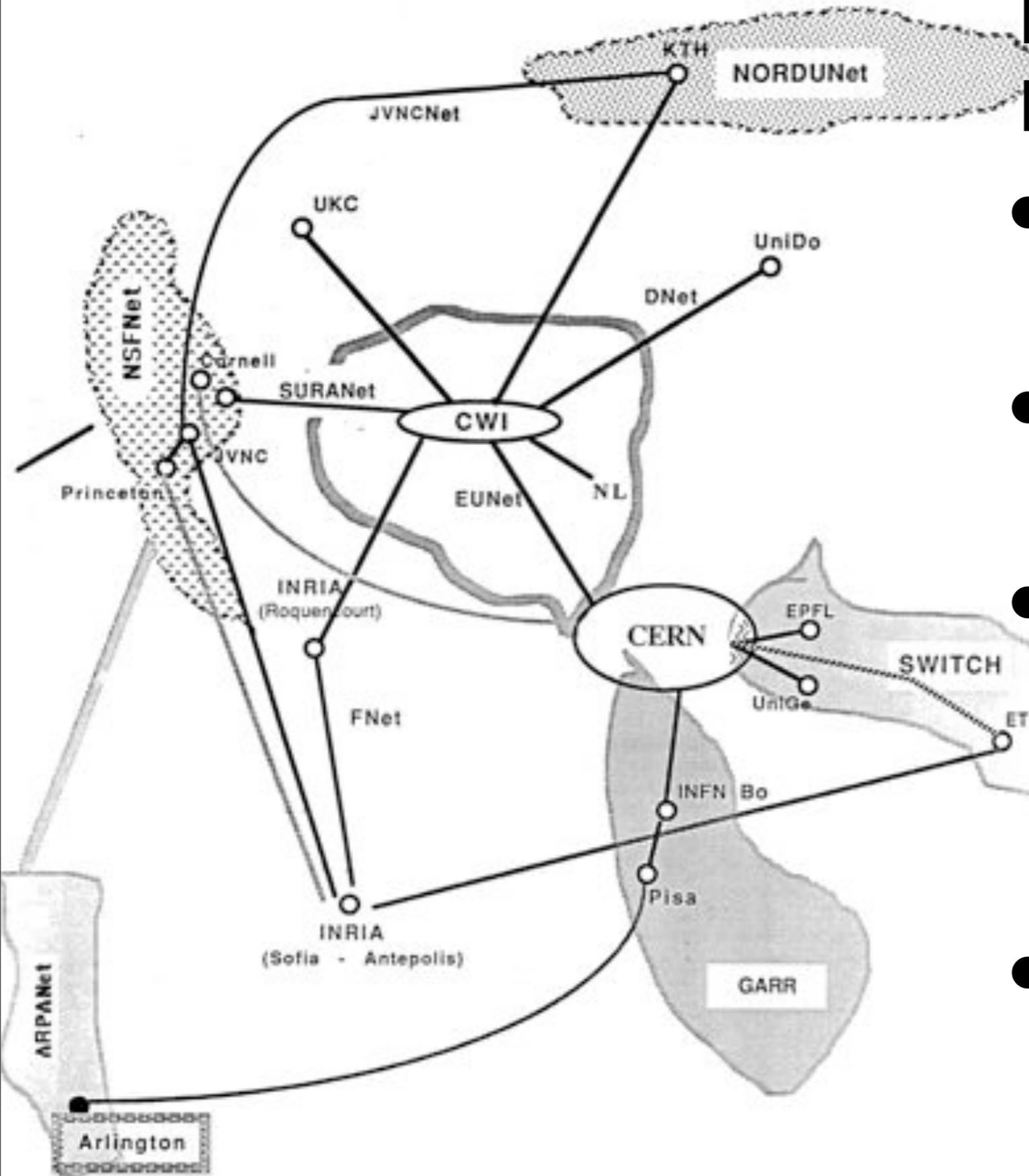
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Network at KTH September 1989

- Backbone was a star of fiber-optic ethernet network

- Ethernet cable still there

- Cisco and µ-vax together with Vitalink bridges created long distance connections

5
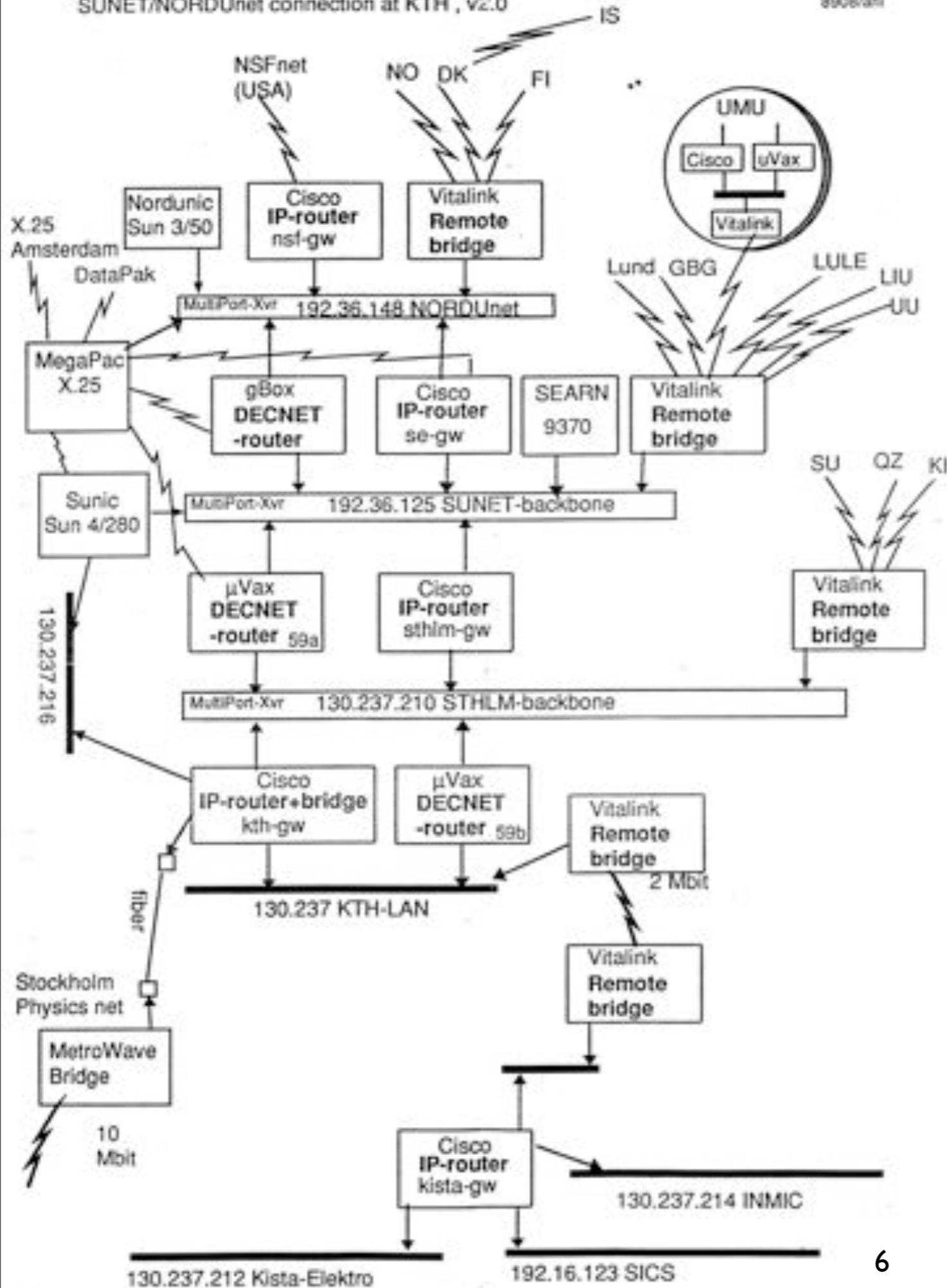
Network in Sweden September 1989

- Cisco and µ-vax together with Vitalink bridges created long distance connections

- Both Cisco and µ-vax was needed because Cisco didn't have support for DECNet

- Same structure between Nordic countries

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IP network in SUNET and surroundings 1.1

Network in Sweden December 1989

- Cisco and μ-vax together with Vitalink bridges created long distance connections

- Star-shaped network (64kbps links), with multi-port transceivers as local "LAN" segments

- Connection via 64kbps satellite to JvNC in US and to Amsterdam

Networks in Europe December 1989

- All connections to NSFNet

- "Default Network" was pointing at NSFNet

- 5 connections over the Atlantic: Stockholm, Amsterdam, Sofi-Antipolis and Pisa

- 4 large networks: NorduNet, EUNet, Switch and Garr

Today a different world

- Many telcos
- Competition regarding new services
- Not only "telephony" uses telco equipment
- Internet has taken off
- With Internet global reach at zero cost
- Globalization is here
- What will happen the next 30 years?

Important issues

- When connecting something to the Internet, that ends up being part of the Internet

- We all share responsibility for the piece of the Internet we run

- Anyone can write software and because of that deploy a service

- Not known anymore what a "television channel" is, even less a "tv station"

- Communication is technically divided in layers, where open standards define the layers

- Competition is possible in a dramatic way

Mobile phones?

- You use your cellphone
  - ...for making telephone calls
  - ...for sending text messages
  - ...for fetching information from Internet
- You use your computer
  - ...for making telephone calls
  - ...for sending text messages
  - ...for fetching information from Internet

Phone

Computer

I think there are issues!

What is a phone?
What is a computer?

Why so much differences in the prices and business models?

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Why so much differences in the prices and business models?

Differences...

- Who is controlling the device?
- Who can build and connect a device?
- Who is deciding on routing?
- Who is deciding on services?
- How are packets routed?
- What are the production costs?
- What standards are used?

What is the need?

- There is a difference between:
  - Open standard
  - Open license
  - Open software
  - Open network

- What is the most important?
  - Depends on your goal?

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World of the mobile phone

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Open standard

- Participation during development
- Access to standard during development
- Ability to decide on the status
- Appeal process
- Explicit or implicit licensing (separate issue)
- Access to information for development

Standards

Inter-Service Provider IP Backbone Guidelines

4.2

30 October 2007

http://www.gsmworld.com/documents/ireg/ir34.pdf

IPX

Interworking

The ability for a service offered to subscribers of one network to communicate with a similar service offered to subscribers of a different network

IPX

IP Packet eXchange. The entity providing the IPX functions. In the interconnection context, IPX is used to mean an interconnection at the service level. Also refers to the collection of all the interconnected IPX Provider's networks

IPX Provider

A Provider that offers IPX services and may also offer GRX services

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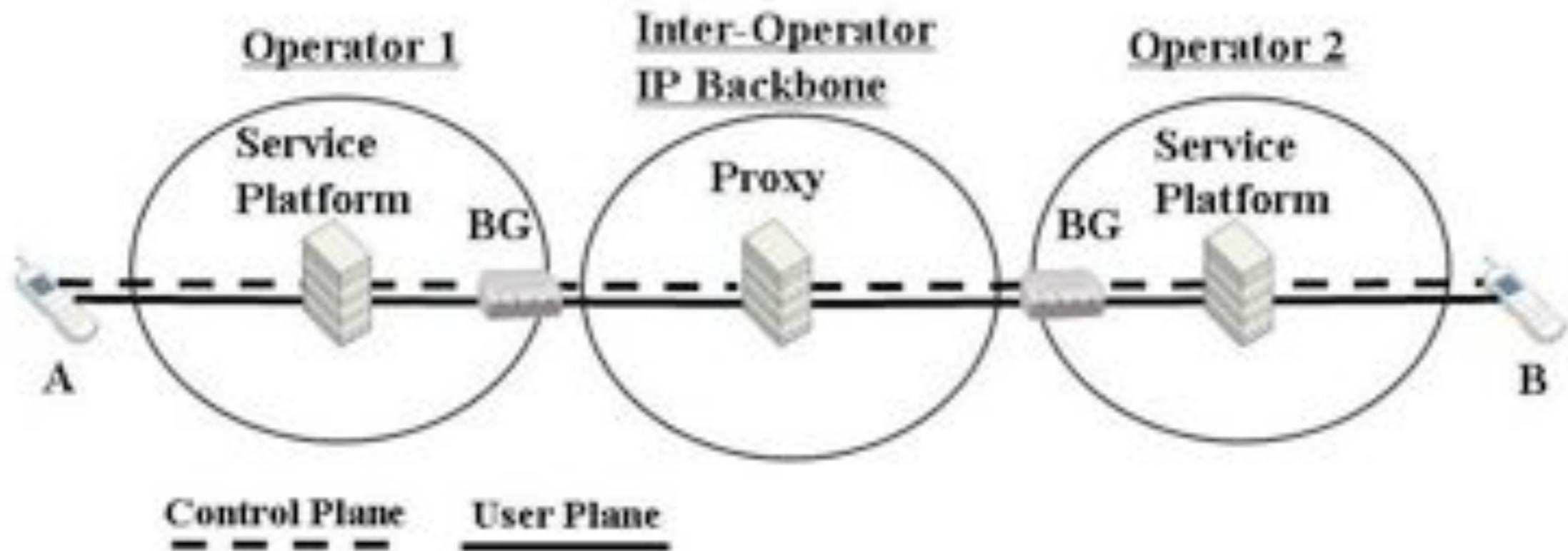
Internals...

Figure 3 - Proxy in Inter-Service Provider IP Backbone
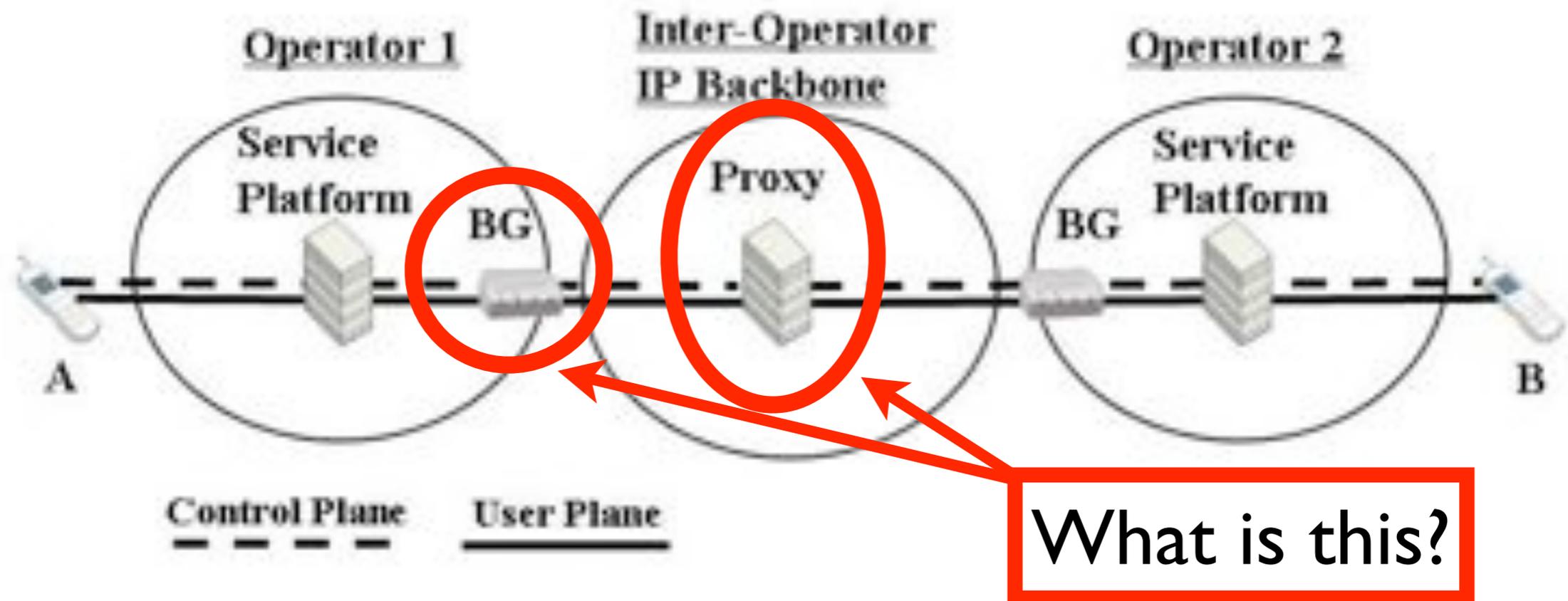
Internals...

Figure 3 - Proxy in Inter-Service Provider IP Backbone

Internals...

6.5.4   IP Addressing

Internet routers should not be able to route to the IP addresses advertised to the Inter-Service Provider IP Backbone. The IP Backbone Providers and Service Provider networks shall be totally separated from public Internet, from an IP routing perspective.

Currently, Inter-Service Provider IP Backbone networks use IPv4 addressing and there is no plan to introduce native IPv6 addressing in the foreseeable future. It is intended that IPv6 is supported by tunnelling the IPv6 traffic over IPv4 between Service Providers where required.

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What happens?

- Roaming charges for IP is forced to come down by regulation

- Roaming charges for IP is coming down due to mobile phone operators lowering the charge

  - €10 to €1/MByte within Hi3G

- Phones are more modular, and allow 3rd party implementations

- Computers have "telephony functionality"

- Modems are more effective, so high speed UMTS data is competing with (other) broadband services (like DSL)

Mobility

- Swedish government:

  - Ability for the user to access a service from whatever device she wants, whenever and from wherever.

What will happen?

- Regulators will be serious about the need for competition (European version of Network Neutrality)

- People will require better roaming agreements

- Phones will be even more modular, and there will be no difference between phone and computer

- Cellphone networks will be Internet access just like DSL, FTTH or whatever...

The Perfect Storm

- But everyone does not share my view

- Some organisations that like IPX try to push it also to "broadband"

- Many people want to wake up and see the Internet was just a bad dream

- Too many discussions start with the assumption that "Internet is not good enough"

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Good enough for what, and for whom?

What do people want?

- People want Flickr, Flirtomatic, Facebook, MySpace, Google, Jaiku, YouTube,...

- Service providers want to provide **A Service**

- Vodaphone 2007:

  7% increase in voice revenue
  9% increase in SMS revenue
  49% growth in data revenue

  Data is not from Vodaphone walled garden

  http://www.arcchart.com/blueprint/show.asp?id=428

Next 30 years?

- Consumers will choose themselves
- Services must be reachable from everywhere
- We will see fewer service providers, not more
- Internet will carry every information service
- Consumers will pay for Internet access
- New processes will help people "go green"
- All discussions around "NGN" and old business models will (finally) be dead, but it will be a blood bath

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Telepresence has in three months changed peoples thinking of travel

28

Telephony?

- People will always have the interest of "talking" with each other, and the question is only "how they dial"

- When did you dial a phone number last time?

- If Telcos do not let users use E.164 numbers, people will ignore them, and use other kinds of addressing

- And the addresses are in the address book and/or buddy list anyway, so who cares?

TV?

- What is TV anyway?

- "Internet best effort is not good enough for TV distribution"

- Still, people spend days watching YouTube

- Distribution chain will change

- Caching of TV programs is already moving from TV station to peoples homes – will have impact on roles and behaviour

- Live broadcast will still exist, but how much is live?

Internet?

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- Overload of IP addresses resolved?
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- DNS must be more stable?
  - ➡ DNSSEC plus education

Recommendations

- Internet is already a commodity, so ensure your production cost per IP packet is low

- Charge for the IP packets, don't give them away

- Do not fall into the trap of cross subsidizing

- Do not overestimate your customers interests of your services, they will launch their own

- Do not "it-ify" your processes, renew them

- Try to guess what your customers want, and produce that in an as cheap way as possible

- Walled garden is **not** the future

Thanks!

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