

ETSF15

What its all about

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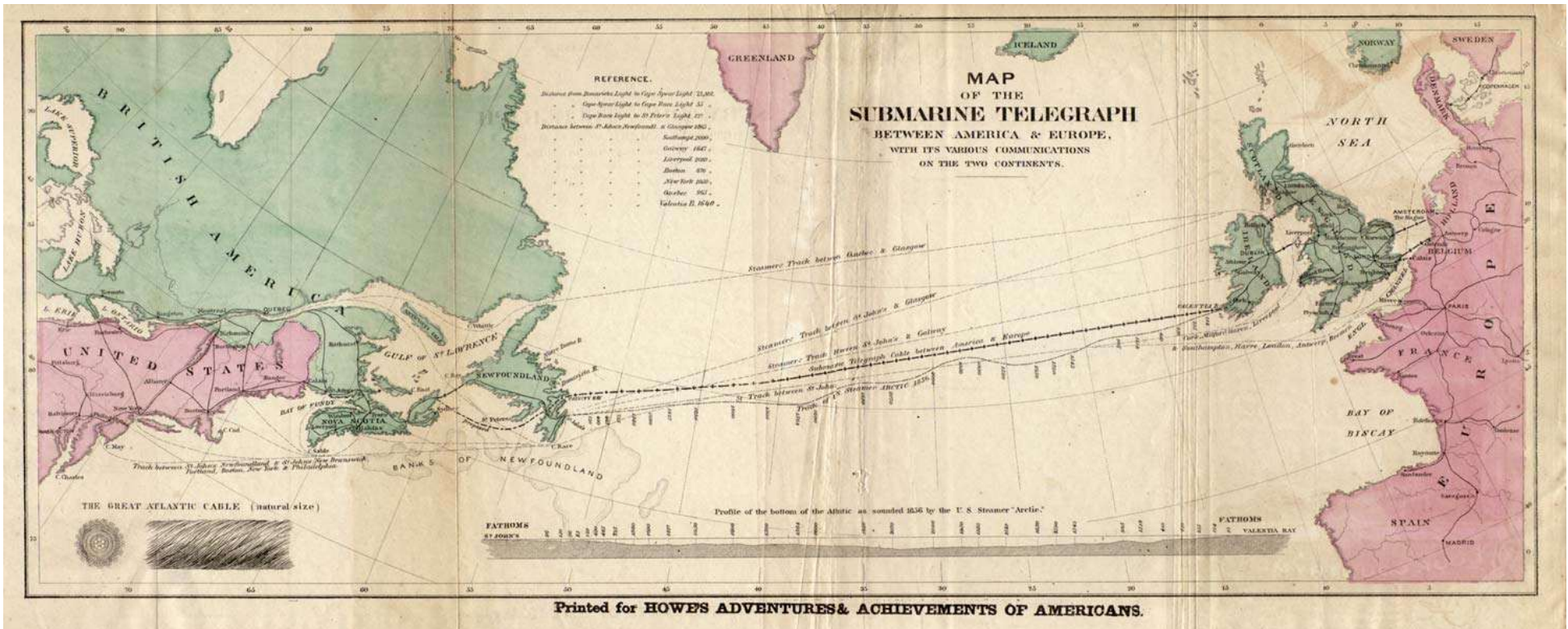
Data communication not new

Optical telegraph system from end of the 18th century.



Electric telegraph

Initial deployment beginning of 19th century.



Networks for telephony

The telephone was patented 1876. Requirements for telephone networks arose quickly.



Radio communication

Maxwell, Hertz and Marconi founders.

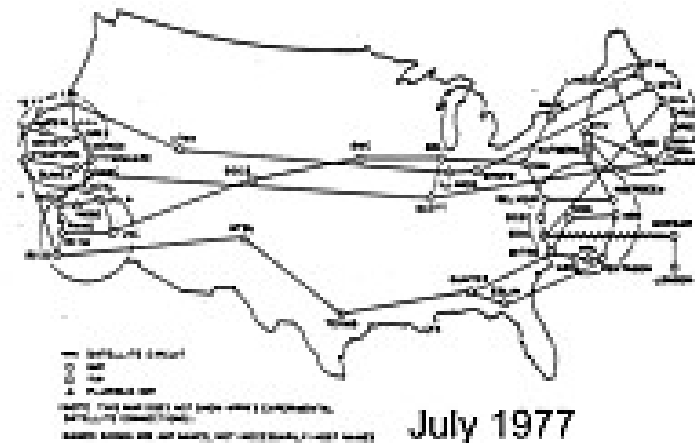
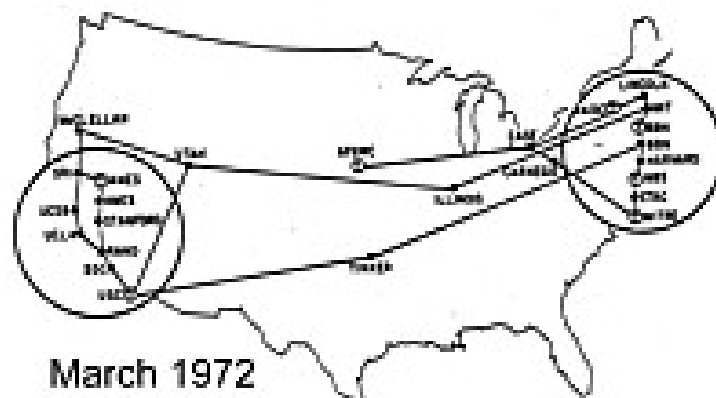
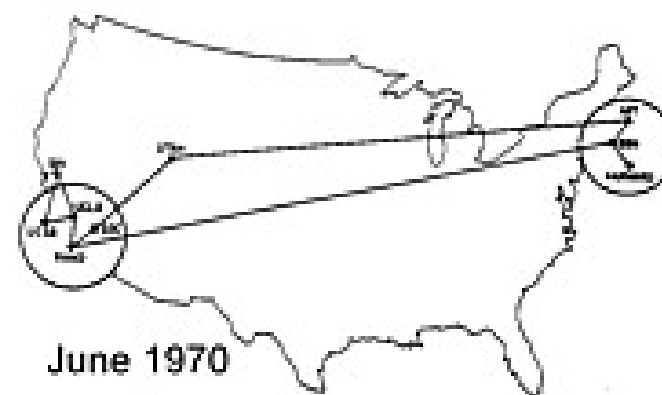


Television

John L Baird demonstrated mechanical television sets
1926



ARPAnet evolution



From data access to exchange of information



Next step: Converged network

One network for everything:

- Data communication
- IPTV, Video on Demand
- Broadcast radio
- Telephony
- *Mobile backhaul & fronthaul (baseband signals)*

Protocols

- Describes
 - how
 - when
 - were
- to do what, so all can communicate with each other
- Other names are standard or Request for Comment (rfc)

Dialog independent of communication media



Hi!

Hi!

Dialog start

Buy milk, please.

Will do!

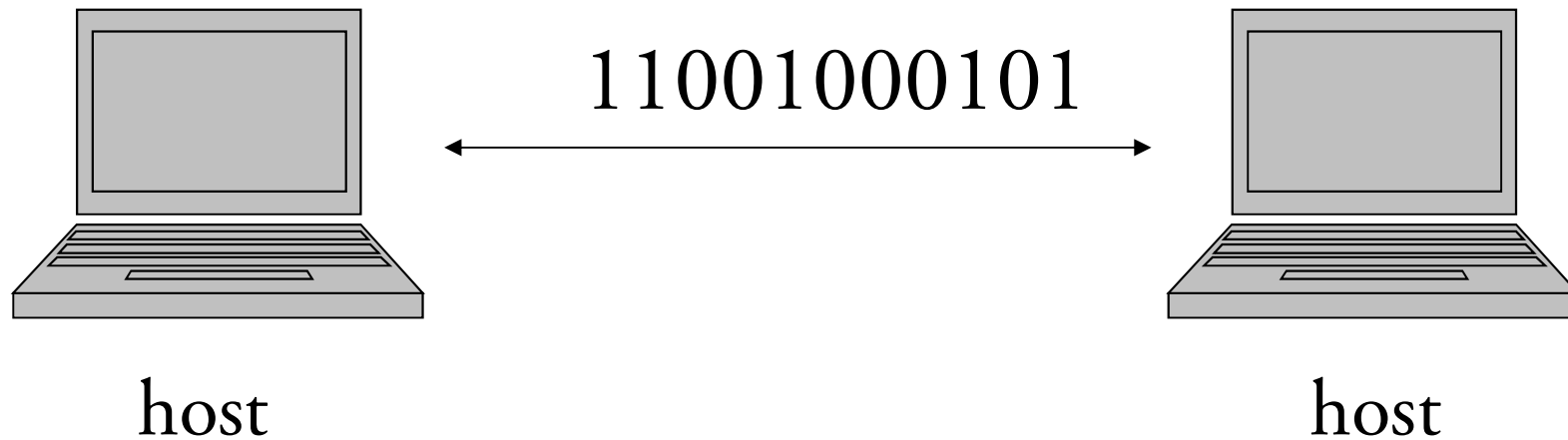
Information exchange

Bye!

Bye!

Dialog finish

This is our main problem!

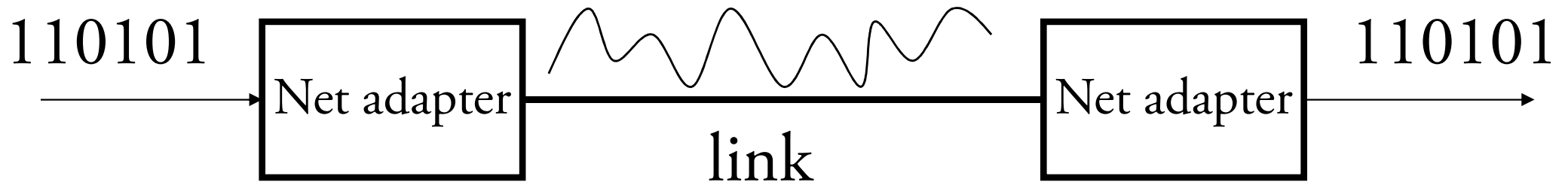


- ◆ Two computers to communicate.
- ◆ Computers can understand only information in digital form, that is combinations of 1 and 0

Layered network models

- Too complicated to solve everything in one application
 - ◆ *Divide and conquer*
 - ◆ Hierarchical
 - ◆ Specialising
 - ◆ Simplifying

Problem 1: Digital communication



- In the transmitter there is an adapter that converts bits into signals that are then sent on the link.
- An adapter in the receiver translates the signals into bits again.

Problem 2 & 3

- How to get access to a shared link?
 - ◆ Only one can send at each given time
- How to send to the correct recipient on a multi-access link?
 - ◆ Addressing is needed

Problem 4

- How to detect transmission errors (and correct)?
 - ◆ Stupid to transfer 1GB only to discover that a bit error occurred

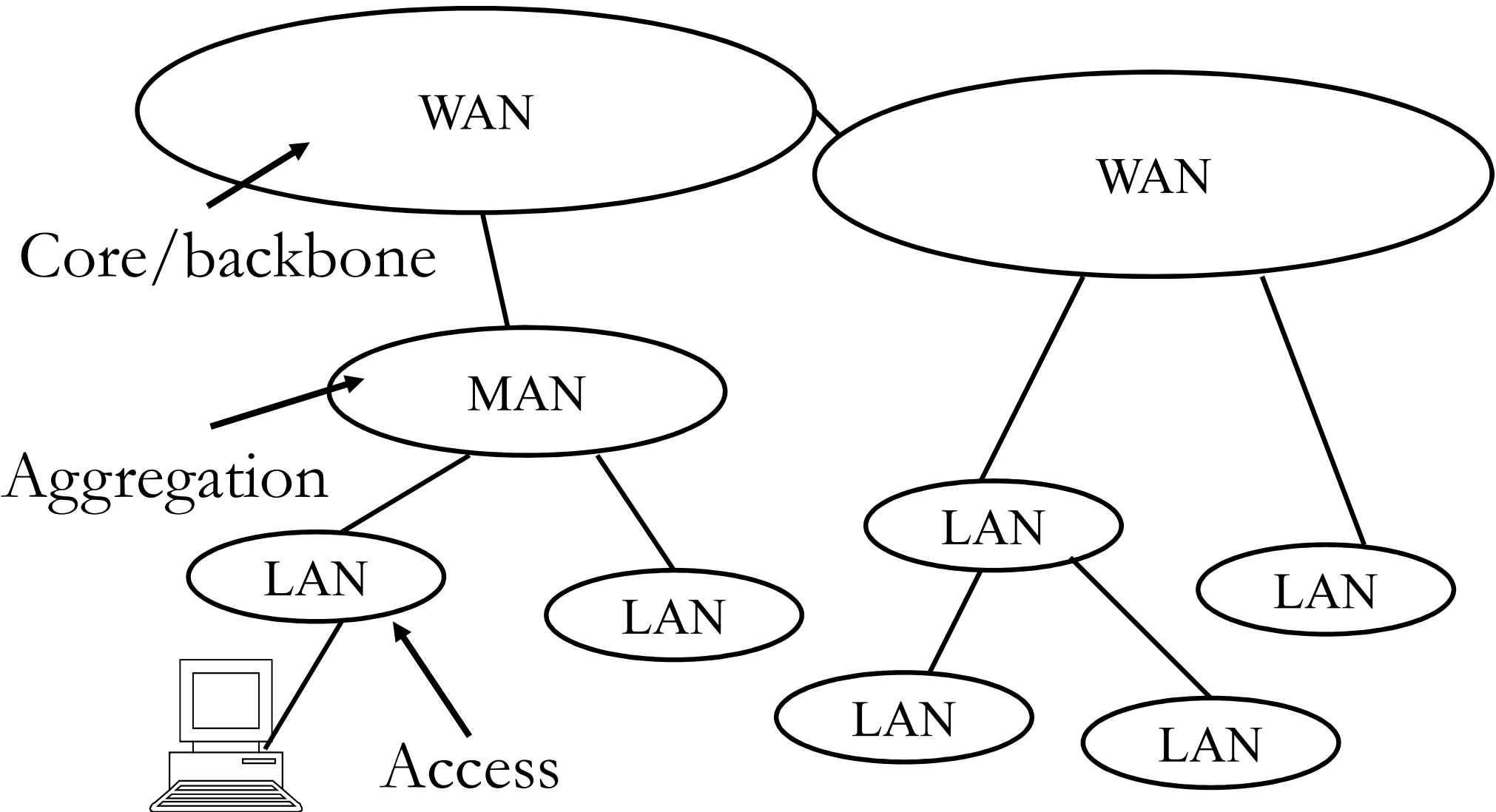
Solution to Problem 4: Frames (*sv. ramar*)

- Divide message in frames
- A frame consists of up to three parts:
 - ◆ header, data och tail



Header and tail contains control information

Problem 5: Connection of networks



Problem 5 continued ...

- ◆ Different propagation medium
- ◆ Different signaling methods
- ◆ Different address format
 - Not used!?
 - Could be relative time

Solution to Problem 5: Network Protocols

- For a package should arrive at the correct destination, there are in each node a network protocol that takes care of e.g. addressing.
- All networks between sender and receiver must use the same network protocol for communications to work.
- Thanks to the network protocol, different links / link protocols can be used between nodes!

One network protocol: IP

- IP = Internet Protocol
- IP is the network protocol used on the Internet.
- Addressing is carried out with the help of IP addresses.
- Data is transmitted in the form of datagrams (IP packets).
- Connectionless data transfer.
- No error handling or verification that the recipient can receive the data.
- Such data transfer is called "best-effort".

Problem 6: End 2 end

- Communication between applications!?
 - ◆ How address applications?
- Even if the error is detected during transmission of frames, errors may occur when transferring between computers.
 - ◆ Datagrams are not guaranteed to be delivered in order
 - ◆ Datagrams can be lost

Two transport protocols: TCP and UDP

- Both TCP and UDP addresses applications
- TCP also contains
 - ◆ Error detection and correction
 - ◆ Flow control

Two layered reference models

OSI model	TCP/IP model
Application	Application
Presentation	
Session	
Transport	Transport
Net	Net
Link	IP carrying nets
Physical	

Actual reference model: Hour glass model

