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Networks 3: History

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接下来讲的是一些关于以太网的结构，如何将move packets around

LANs and WANs

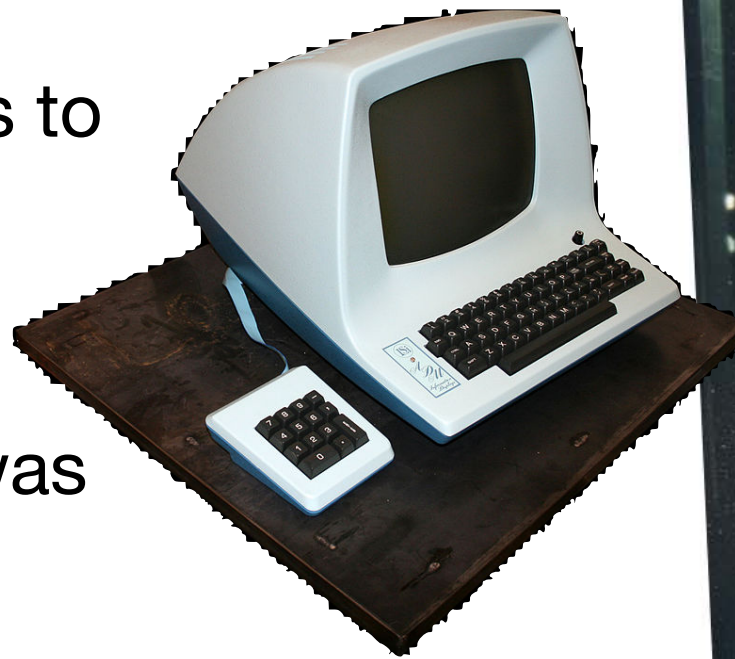
MANs 介于LANs (1mile) 和WANs(worldwide)之间 5miles左右，到市中心建筑的连接也许可以跨城市，但现在已经没有了

- Historically, Local Area and Wide Area networks were different in technology, purpose and protocols.
LANs很早的时候就已经很快了，这两个是不同的技术
- In Europe, telco monopolies limited what WANs could do.
但是WANs却是非常非常的慢
有很多限制，比如不允许你私人的挖洞布光纤，只有大型电信公司可以
局域网发展得很快，因为你可以自己布线，你的建筑你的地盘你做主
- And the requirements for LANs were quite simple.

LANs

LANs刚刚出现时同样很慢，不足10Kb/s，

- Mostly connected terminals to timeshare computers.
- No need for anything more than 9600 baud (and that was luxury!). “Serial lines”, “RS232”.
- No need to transmit much more than terminal keystrokes and screen updates



WANs

- Used to connect computers together, between buildings
- Main applications:
 - File transfer (lots of problems of format conversion, as even byte-size varied)
 - Job transfer (for use of national facilities for super computers; batch mode)
 - Remote login (but you rarely had interactive access to remote systems).
- UUCP very influential and STILL SHIPPED ON MAC!
- ARPANet in the US restricted only to people with military contracts

简单提了一下UUCP和ARPANet，在以太网出现以前

Vendor Networks

供应商网络

可能上百Gb/s

- There were also options to connect computers together that were provided by one particular manufacturer.
- Fast networks within “machine rooms” (ie, data centres)
- Provided file transfer, job transfer and remote login

Workstations

很快掠过

- Game changer is arrival of workstations, starting with Xerox in 1970s, moving wider in 1980s.
- PCs were mostly only used as terminals to timeshare systems, and filetransfer was done with protocols like Kermit which ran over serial lines.
- But Xerox, Symbolics LispM, and later Unix workstations need more performance
 - And concept of “mainframe” gets less clear



So, fast LAN technology

- Ethernet comes from Xerox, originally 3Mbps, later 10. Developments continue with 100Mbps, 1000Mbps (1Gbps), 10Gbps, 40Gbps all now standardised and 100Gbps in draft.
- Other LAN technologies emerge (token ring, slotted ring).
- But they are **distinct** from the WAN.

WAN Technology

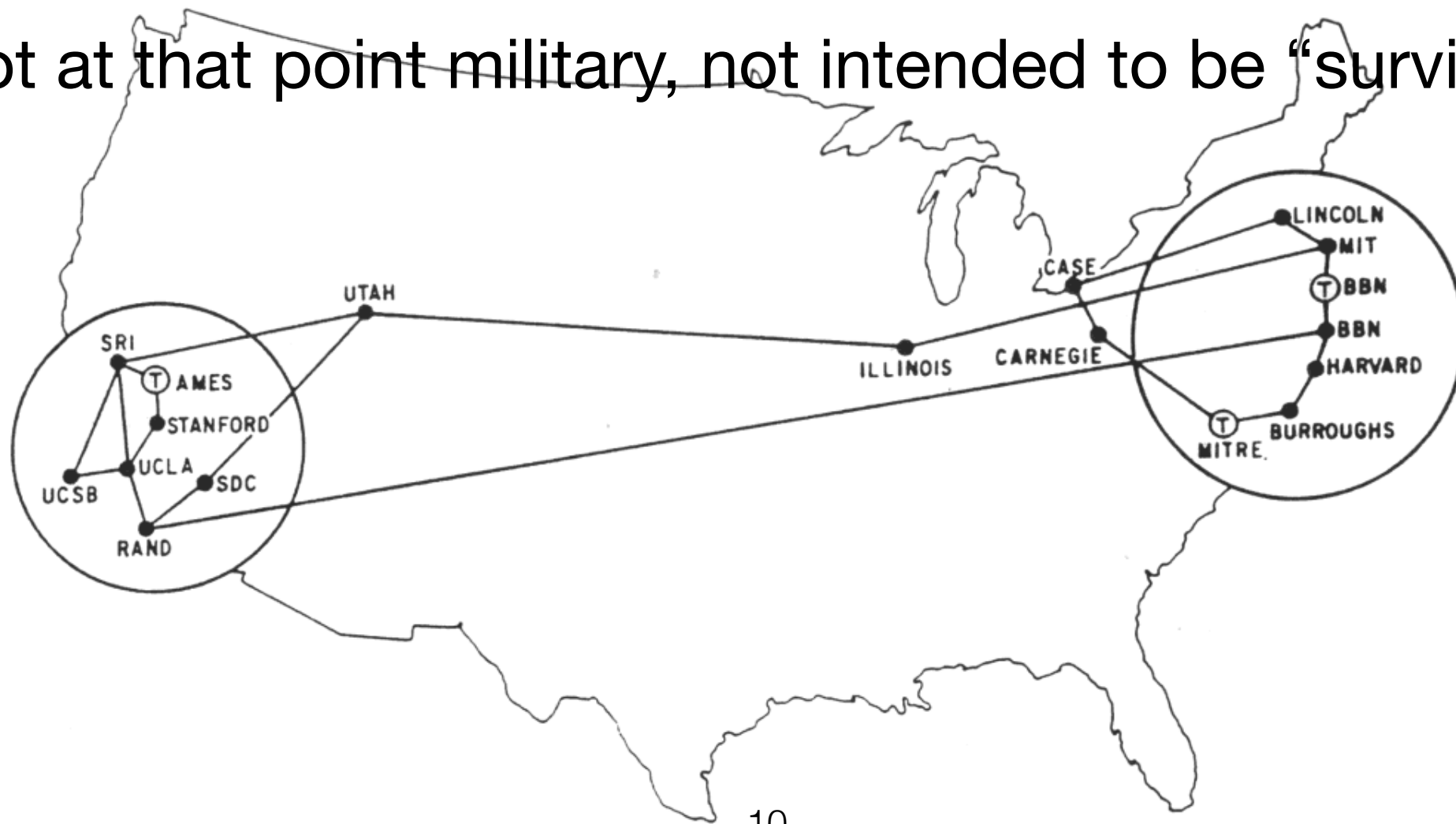
- The key point about the WAN is that for most of its history it is slow.
- Very slow.
- UofB JANET connection 1985: 64Kbps. cs.bham.ac.uk
JANET connection 1987: 9.6Kbps. US/UK ARPAnet connection 1986: 2.4Kbps (yes, seriously).
- ARPA/NSFNet backbone 1987: 64Kbps
- 2Mbps links emerge (for most of this) by about 1990.

WAN Technology

- This means that efficiency is very important: wasting tens of bytes is a significant performance problem
- So the protocols in use on the LAN need to consider working over slow-speed, lossy links as well.

The ARPANet

- Develops in the US to link large organisations with defence research contracts together to share computing power.
- Not at that point military, not intended to be “survivable”.



ARPA Technology

- Originally not TCP/IP: a protocol suite based around NCP (Network Control Protocol) running on IMPs (Interface Message Processors).
- If you look hard enough in Unix/Linux header files, you can find references to “Host on IMP” and the like.
- But TCP starts to be designed from 1974 onwards:
- <https://www.cs.princeton.edu/courses/archive/fall06/cos561/papers/cerf74.pdf>
- and the ARPANet finally switches to TCP/IP on Jan 1 1983.
- DNS arrives in '83, NSFNet in '86, and by about 1990 the modern Internet is starting to develop.