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Chapter 2

The Application Layer

Internet evolution

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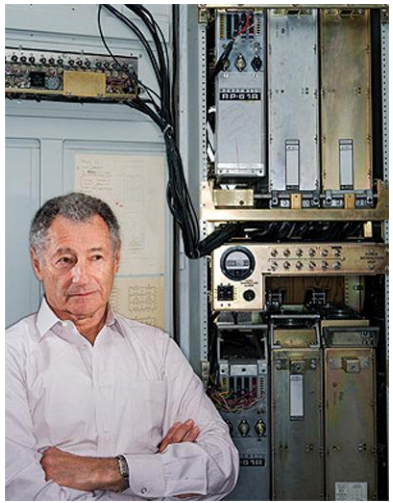
Circuit switched nets

Inefficient with bursty traffic

Packet switched nets

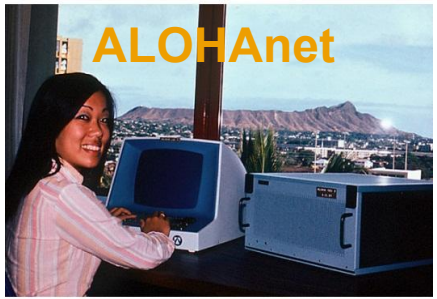


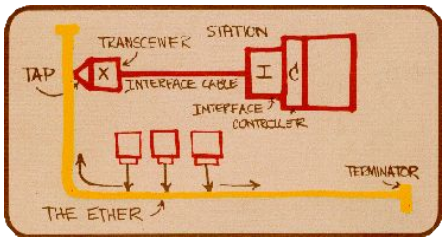
Leonard Kleinrock

ARPAnet runs NCP (RFC001)

First email

Proprietary nets and internetworking





Internetting network of networks

pre 1960

1961

1969
4 nodes

1972
15 nodes

1980
100 000 nodes

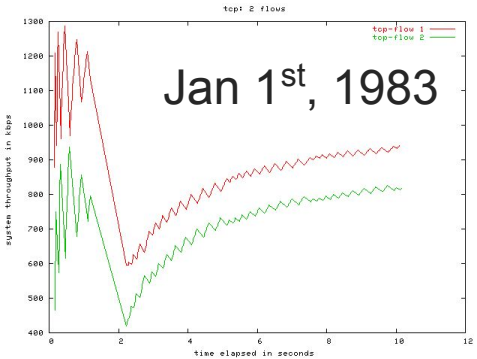
Internet evolution cont.

Proliferation of networks

ARPAnet
BITNET
CSNET
NSFNET

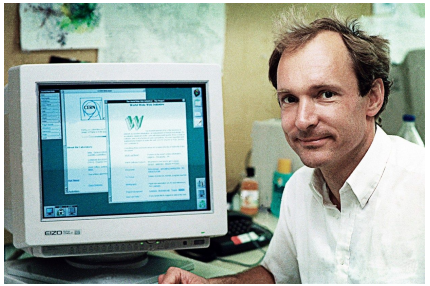
} TCP/IP

DNS

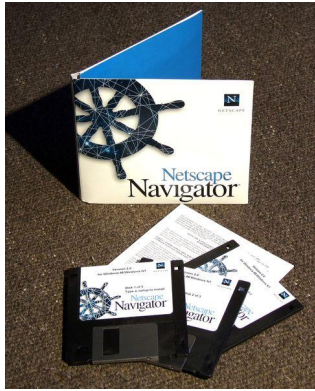


Public Internet - 1991

The Internet Explosion



Tim Berners-Lee



Hypertext and the Web

E-mail, IM, peer-to-peer

1980 1990

Internet evolution cont.

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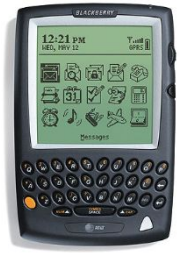
Devices:



hulu

Network:

Time period: 1980’s 1990’s Now Near future

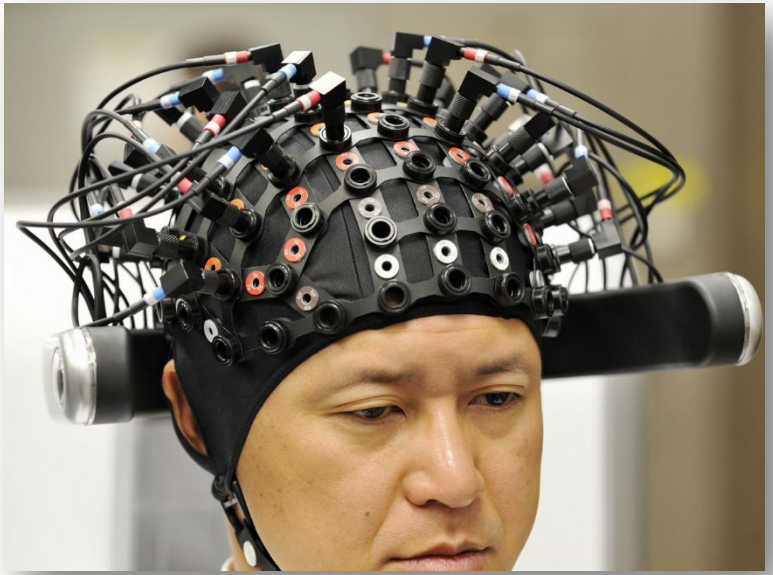
Internet evolution cont.

- What types of applications have revolutionized Internet functionality?

1980's	1990's	2000's	NOW
			
E-mail, newsgroups, remote access	Web, e-commerce	Peer-to-peer (P2P), voice-over-IP (VoIP), YouTube, Netflix	Mobile data, social nets and location services, other?

Modern Internet

- What technologies or developments to do see changing the Internet today?
  - Fiber to home
    - Unlimited bandwidth?
  - 5G - ultra-low latency
  - Autonomous devices
    - So much traffic!
  - Brain to brain communication



http://www.independent.co.uk/news/science/hola-at-your-brain-first-braintobrain-interface-is-a-step-towards-digital-telepathy-9714486.html

Network application architectures

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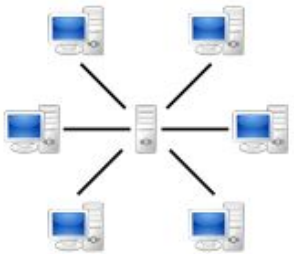
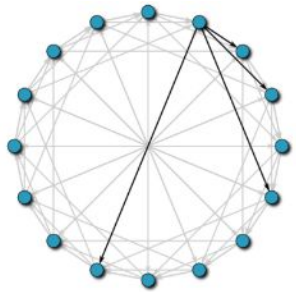
Client-Server



Hybrids

Peer-to-Peer



System Scalability →

System Complexity →

+ Control
− Scalability
− Availability

+ Control
+ Scalability
− Cost

+ Scalability
+ Cost
+ Availability
− Control
− ISP friendliness
− Security

Application requirements

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What types of services do different applications need from the network?

Application	**Data loss**	**Throughput**	**Time sensitive**
	no loss/loss-tolerant?	elastic/inelastic	yes/no
file transfer	no loss	elastic	no
e-mail	no loss	elastic	no
Web browsing	no loss	elastic	no → yes
real-time audio	loss-tolerant	inelastic	yes
stored video	loss-tolerant	elastic	no
interactive games	loss-tolerant	inelastic	yes
text messaging	no loss	elastic	no


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