



Computer Networks

컴퓨터네트워크

(Ch 1. Introduction)

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Chapter I

Introduction

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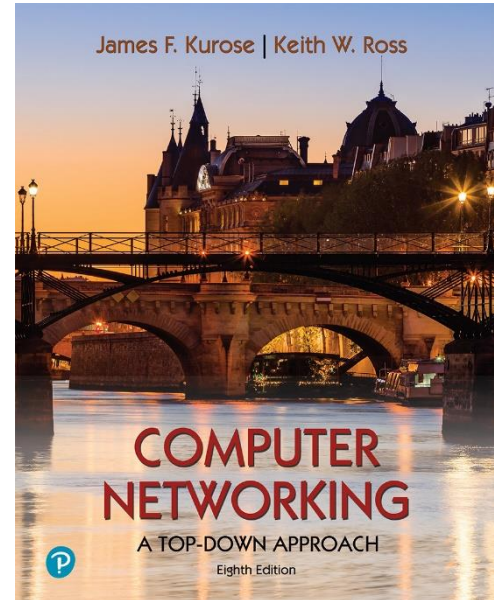
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Computer Networking: A Top-Down Approach

8th edition

Jim Kurose, Keith Ross
Pearson, 2020

Chapter I: roadmap

- What *is* the Internet?
- What *is* a protocol?
- Network edge: hosts, access network, physical media
- Network core: packet/circuit switching, internet structure
- Performance: loss, delay, throughput
- Security
- Protocol layers, service models
- History



*Who was the inventor of the
World Wide Web?*



Vint Cerf



Tim Berners-Lee

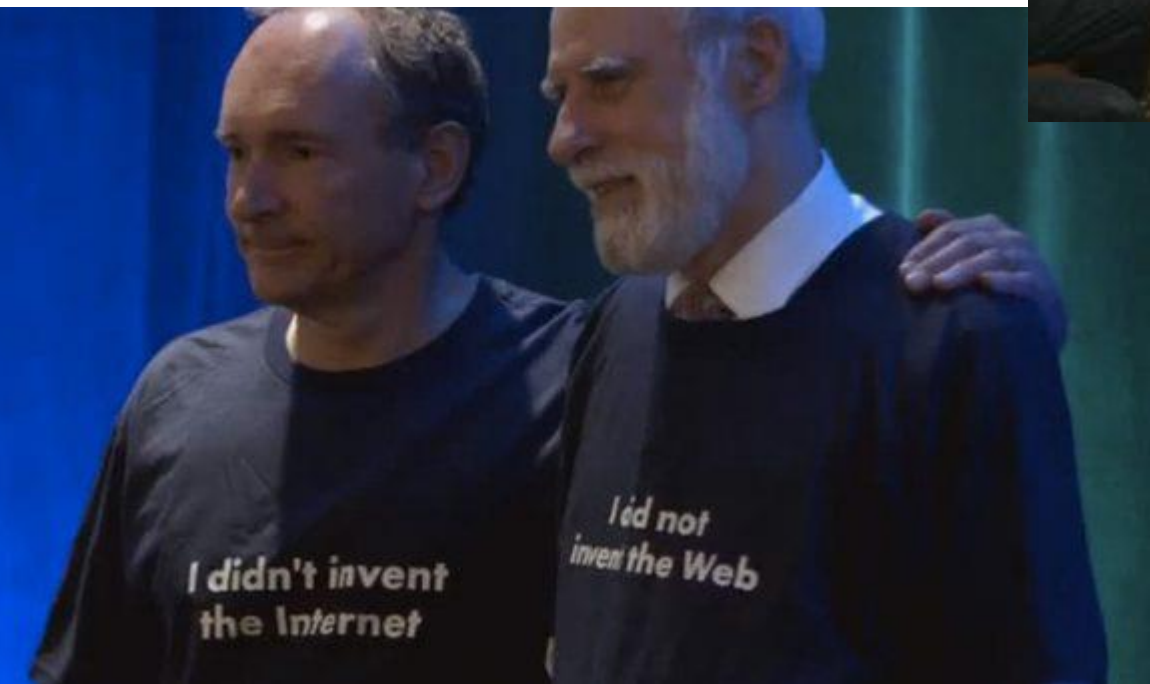


Larry Page



Alan Turing

2B



What is Computer Network(ing)?

- ◆ What is "Computer Networking"?
- ◆ What is a computer network?

- ◆ **Answer in your own words**

◆ Computer network?

- is a set of [computers](#) sharing resources located on or provided by [network nodes](#). Computers use common [communication protocols](#) over [digital interconnections](#) to communicate with each other. These interconnections are made up of [telecommunication network](#) technologies based on physically wired, [optical](#), and wireless [radio-frequency](#) methods that may be arranged in a variety of [network topologies](#).

◆ Note: There are many other possible answers to this question

Leonard Kleinrock talks to Vint Cerf about DTN

And, if you do so optimize, the
optimal (i.e., minimal) mean
response time will be

$$T(t) = \frac{\bar{n}(t) \left(\sum_{i=1}^M \sqrt{\lambda_i(t)/\mu_i(t)} \right)^2}{\mu C(t) [1 - \bar{n}(t) \rho(t)]} \quad [3]$$

All of this boils down to the problem
you posed, namely, to find a routing
protocol that achieves an
acceptable flow vector $[\lambda(t)]$.

NOTE: EQS [2] and [3] assume M/M/1
queuing behavior in each link
(and which assumes the time
variation of $C_i(t)$ is slow
compared to the settling time
of the flow - this is a
"approximate" statement).

LEN KLEINROCK
10/21/00

Chapter 1: introduction

Chapter goal:

- Get “feel,” “big picture,” introduction to terminology
 - more depth, detail *later* in course
- Approach:
 - use Internet as example



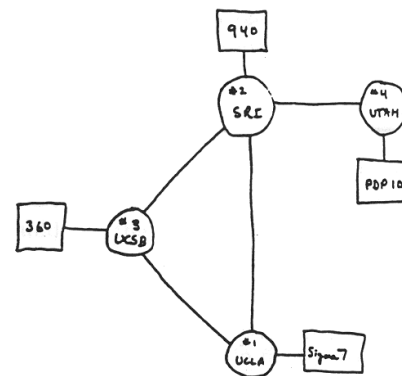
Overview/roadmap:

- What *is* the Internet?
- What *is* a protocol?
- **Network edge**: hosts, access network, physical media
- **Network core**: packet/circuit switching, internet structure
- **Performance**: loss, delay, throughput
- Security
- Protocol layers, service models
- History

Internet history

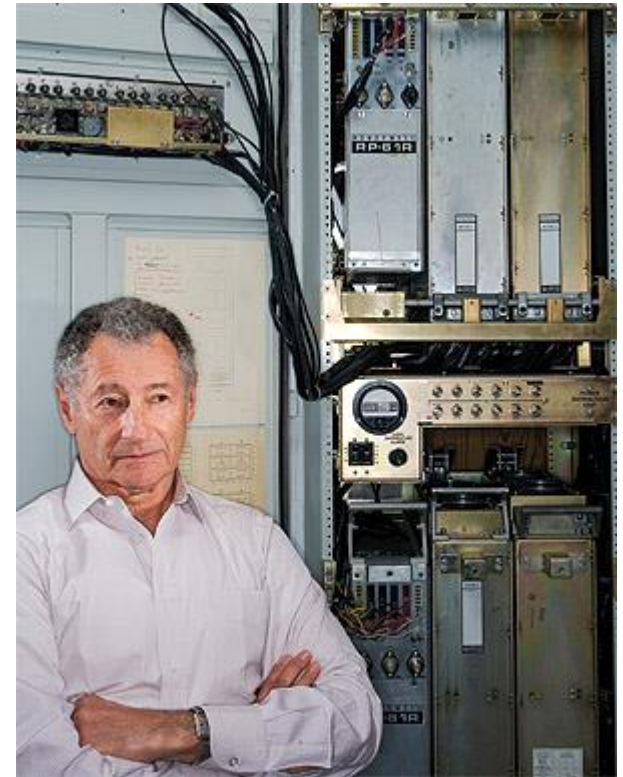
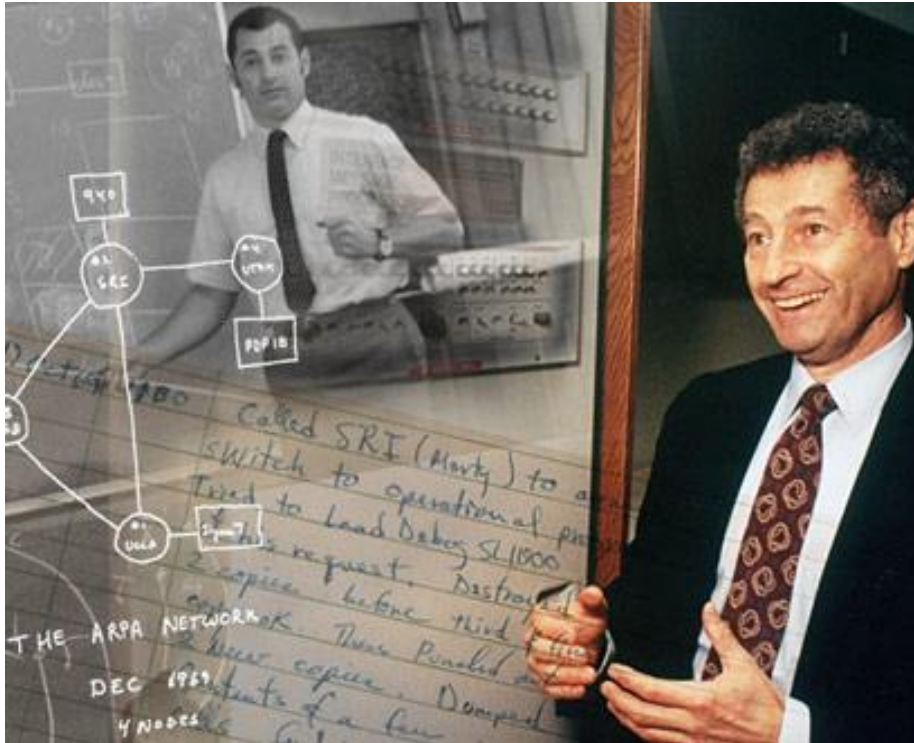
1961-1972: Early packet-switching principles

- **1961:** Kleinrock - queueing theory shows effectiveness of packet-switching
- **1964:** Baran - packet-switching in military nets
- **1967:** ARPAnet conceived by Advanced Research Projects Agency
- **1969:** first ARPAnet node operational
- **1972:**
 - ARPAnet public demo
 - NCP (Network Control Protocol) first host-host protocol
 - first e-mail program
 - ARPAnet has 15 nodes



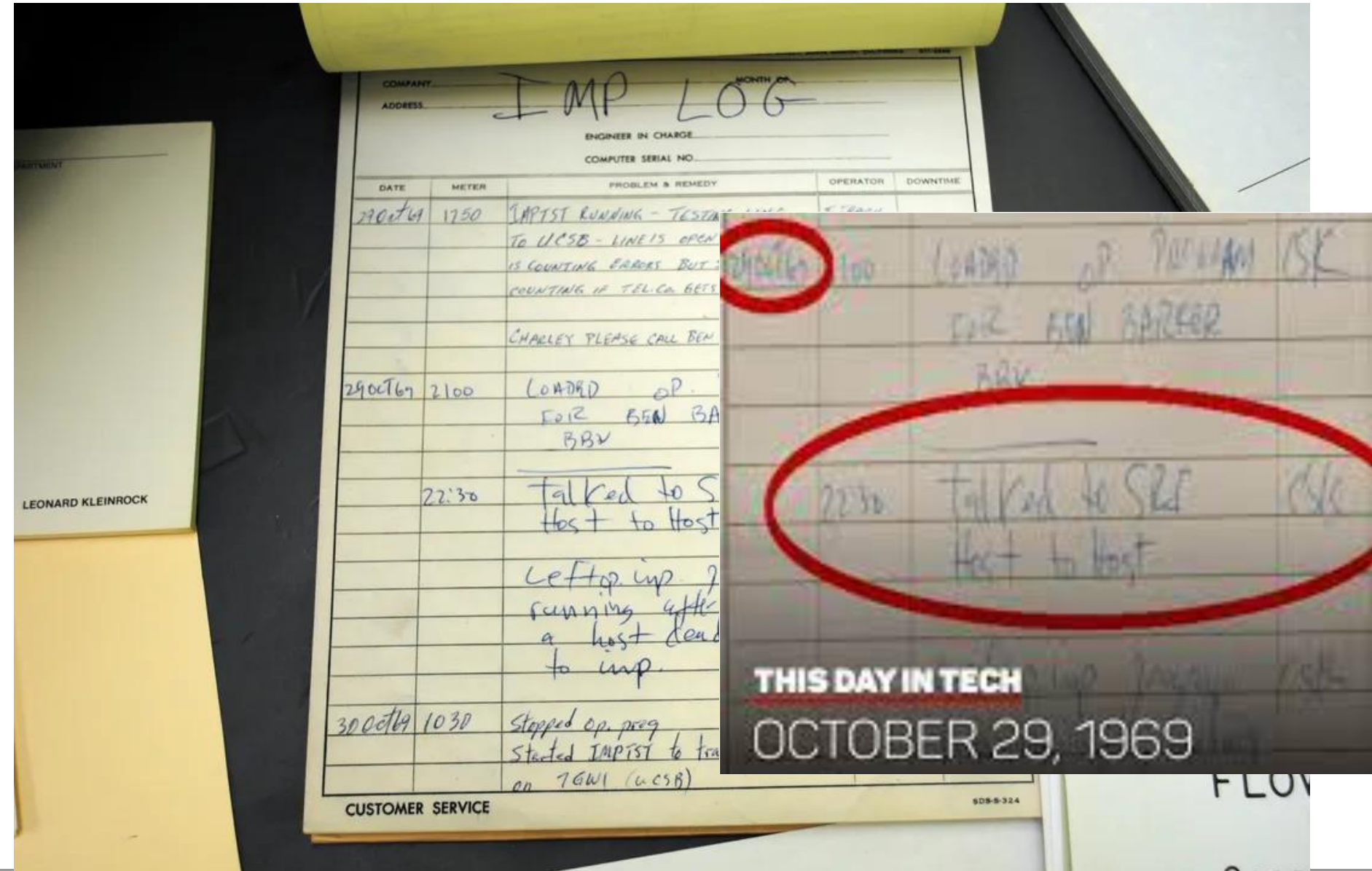
THE ARPA NETWORK

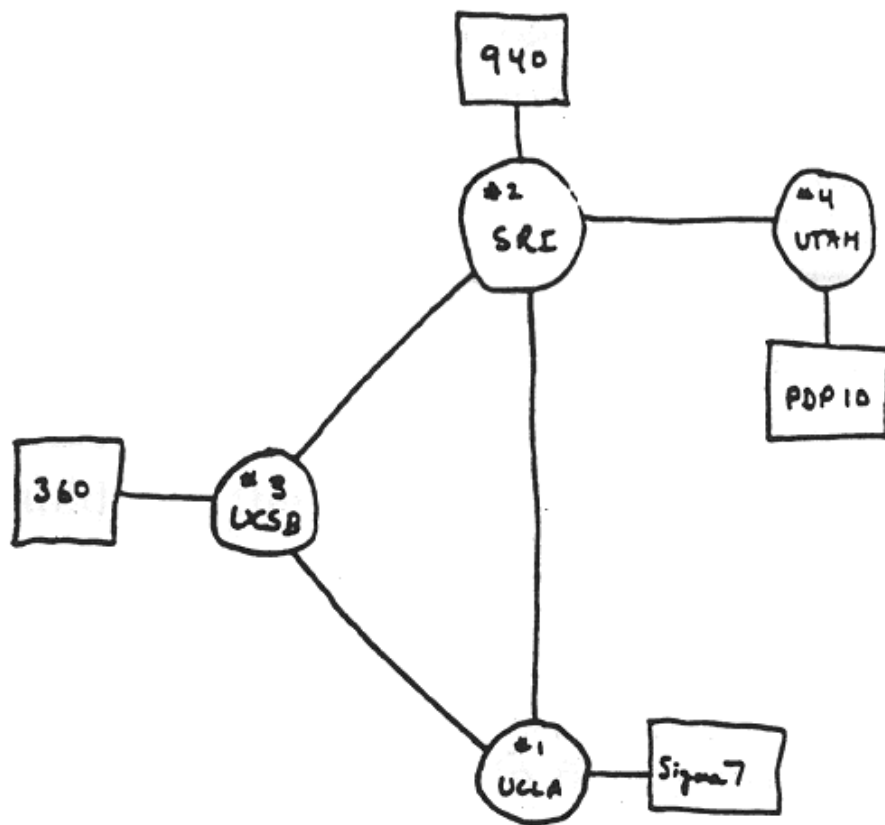
Kleinrock



These Two Small Letters Heralded the Beginning of Online Communication

Their message is far more profound in retrospect than it was at the time





THE ARPA NETWORK



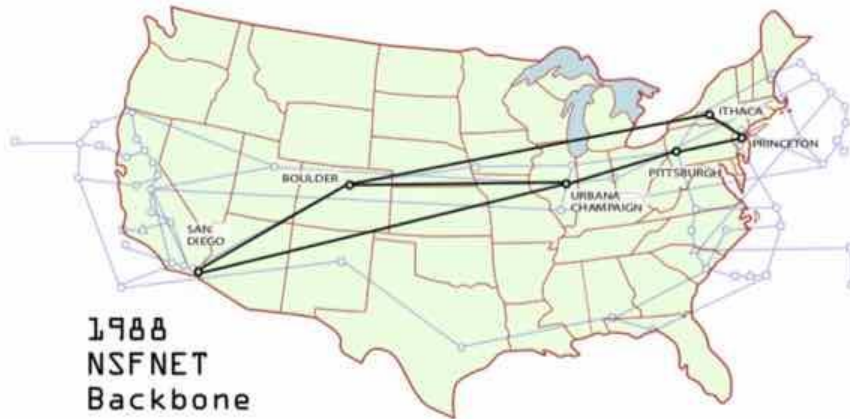
The ARPANET in December 1969



1969
ARPANET



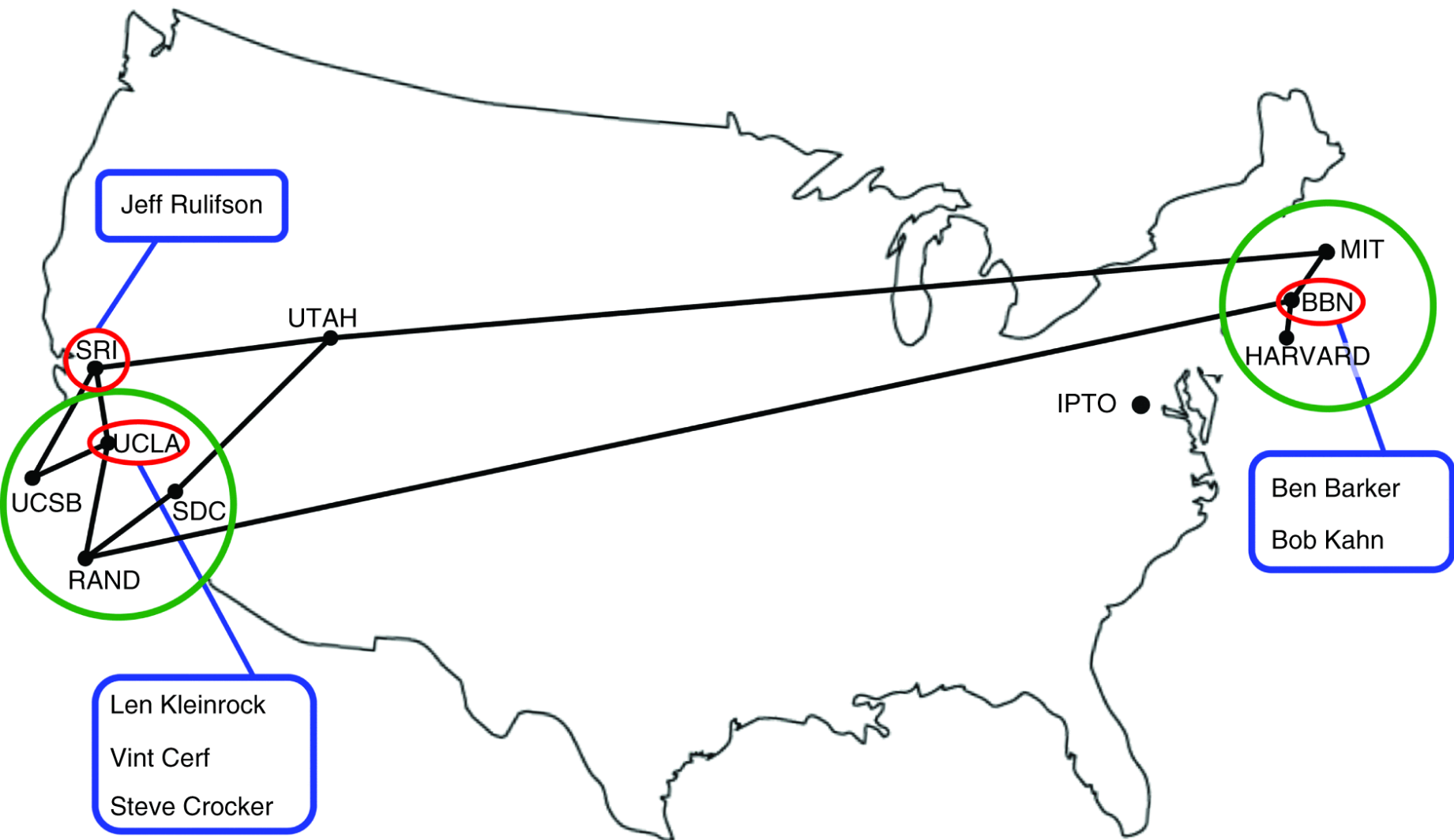
1977
ARPANET



1988
NSFNET
Backbone



1995
NSFNET
T3 Backbone

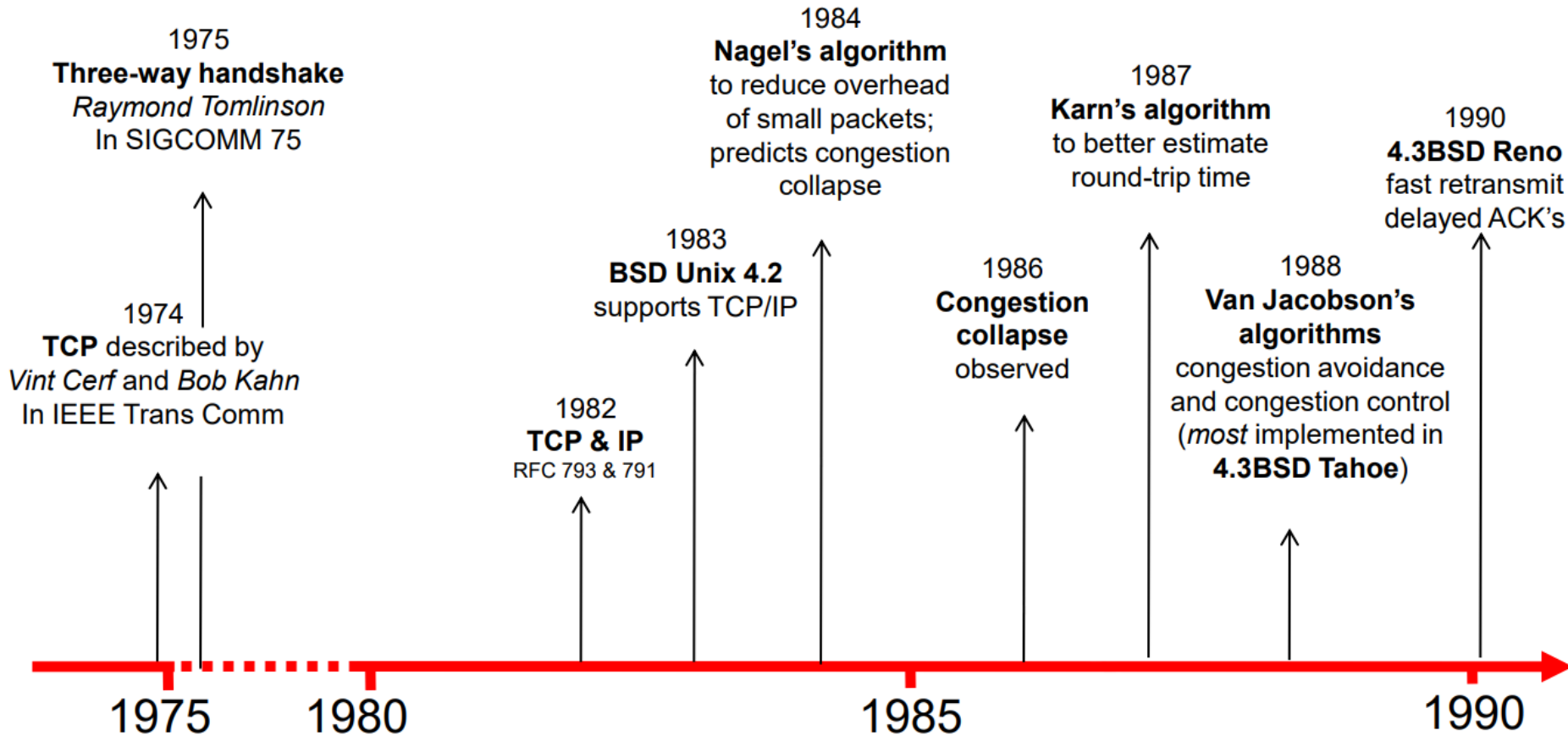


Vint Cerf And Bob Kahn

- Vint Cerf
- Co creators of the TCP/IP protocol
- Cerf is now vice-president of Google while Khan is now chairman CEO and president of the Corporation for National Research Initiatives



Evolution of TCP



Internet history

1973: The C Programming Language

- Designed by Dennis Ritchie
- Developed by Dennis Ritchie and Bell Labs
- Appeared in 1972; almost 50 years ago
- Bell Labs
 - [AT&T](#) (1925-1996)
 - [Lucent](#) (1996-2006)
 - [Alcatel-Lucent](#) (2006-2016)
 - Nokia (2016 – present)
- Transistor (1947) ➔ 1956 Nobel Prize
- Channon's capacity (1948)
- Unix, C (1973) ➔ 1983 Turing Award
- C++ (1987)

The Protocol Wars

- US nets mainly leased lines, European X.25
- 7 layer OSI vs SNA vs DECNET vs Internet vs CB
 - Each layer generated arguments, including whether layer was at correct place or needed
- Different Groups worked on Standards
 - CCITT improved X.25, X.400, X.500, XXX
 - ISO File, Presentation, Alphabet, Transport
 - IETF worked on Internet Protocols (from 1986)
 - DEC on DECNET protocols
 - IBM/BITNET/EARN on SNA and EARN
 - JNT on Coloured Books
 - Significant amount of cross-filing of standards



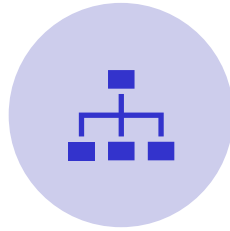
Comparison of Various Network Models to OSI

- ❑ IBM SNA
 - ❑ DECnet DNA
 - ❑ AppleTalk
 - ❑ Xerox XNS
 - ❑ Novell Netware
 - ❑ Banyan Vines
-

review



OSI 7 LAYERS



TOP-DOWN
APPROACH



COMPUTER
NETWORK(S)



INTERNET



ARPANET



READ
CHAPTER I