



EE-6304: Computer Networks

Lecture No. 1
Spring-2014 Semester



Self Introduction

- Ph.D. Electrical Engg.
 - U.E.T. Taxila, 2008
- M.S. Information systems Engg.
 - Osaka university, Japan, 2002
- B.Sc. Electrical Engg.
 - U.E.T. Taxila, 1996
- Phone: 051-9047549(Off)
051-9047508(Res)
- E-mail: gulistan.raja@uettaxila.edu.pk



Course Webpage

- Course Homepage contains information:
 - All Lecture slides presented in the class
 - Pointer to supplementary material
 - All course related announcements
- Highly recommended to check page at least once in a week.



Salient Course Objectives

- Knowledge of the Internet structure
- Analysis of Network layer services
- Routing Algorithms and routing in Internet
- Analysis of services provided by the Transport Layer as well as TCP and UDP protocols
- Multimedia communication
- How to do Computer Networks research



Text Books

- Computer Networks, Andrew S. Tanenbaum
- Computer Networking: A Top Down Approach , 4th edition, Jim Kurose, Keith Ross, Addison-Wesley



Reference Book

- ***Internetworking with TCP/IP***
Principles, Protocols, and Architecture
by Douglas Comer



Tentative Lecture Schedule (1/2)

Week #	Date	Topics
Week # 1	23 Jan 14	Course Intro, Grading Criteria, Internet History, Standards, Internet Administration
Week # 2	30 Jan 14	Review of OSI & TCP/IP model, Ethernet
Week # 3	6 Feb 14	Wireless LANs
Week # 4	13 Feb 14	Broadband Wireless, Quiz-1
Week # 5	20 Feb 14	Network Layer Intro, Routing Algorithms-I
Week # 6	27 Feb 14	Routing Algorithms-II, Quiz-2
Week # 7	6 Mar 14	Congestion Control, Seminar-1 (Group-A)
Week # 8	13 Mar 14	Quality of Service, Seminar-1 (Group-B)
Week # 9	20 Mar 14	Mid-Sem Exam

Tentative Lecture Schedule (2/2)

Week # 10	27 Mar 14	Internetworking
Week # 11	3 Apr 14	Network Layer in Internet - I
Week # 12	10 Apr 14	Network Layer in Internet - II, Quiz-3
Week # 13	17 Apr 14	Transport Layer Services, Transport Protocol Elements
Week # 14	24 Apr 14	UDP and TCP, Quiz-4
Week # 15	1 May 14*	Multimedia Communication - I
Week # 16	8 May 14	Multimedia Communication - II, Seminar-2 (Group-A)
Week # 17	15 May 14	Network Security, Seminar-2 (Group-B)
Week # 18	22 May 14	Revision, Project Viva, Make-up Quiz

* Make-up class will be arranged due to public holiday



Course Grading

- Sessionals 20%
- Mid-Semester Exam 20%
- Course Project 20%
- End-Semester Exam 40%



Sessionals – 20 Marks

- Sessionals marks description
 - Quizzes -> 10 marks
 - Best 4 out of 5 will be considered
 - Assignments -> 10 marks
 - Assignment (s) -> 4 marks
 - TWO Seminars (Research Paper Presentation)
-> Each of 6 marks
 - Average marks of 2 seminars will be considered



Significance of Research Paper Reading

- Most information of importance is in
 - Research papers
- Ability to rapidly scan and understand research papers is
 - Key to research
- Method – presentation in class by students
 - Select any paper of your choice on prescribed topic using
 - Digital Library/Web



Research Paper – How to Read and Present*

- When reading papers
 - Think about the main problem a paper is addressing,
 - Paper's main technical approach,
 - The strengths and weaknesses of the paper's technical approach and execution



Research Paper – How to Read and Present

- When presenting papers in class, prepare slides for a 12 minutes presentation that includes:
 - Paper name, author/institution, venue (conference) /journal title
 - "Descriptive" part
 - Problem statement
 - Core idea(s)
 - Descriptive summary of technical design, including illustrations/animations
 - Summary of evaluation
 - "Opinion" part
 - Strengths
 - Weaknesses/limitations



Paper Reading – Reference Papers

- For more detailed understanding, read following research paper
 - **How to Read a Paper**
 - Author: S. Keshav
 - Affiliation David R. Cheriton School of Computer Science, University of Waterloo, Waterloo, ON, Canada
- The paper can be downloaded from tutorial section of course page



Course Project – 20 Marks

- Course Project
 - 2 students/group (maximum)
- Course Project Proposal
 - Topic selection by giving 3 proposals of your choice on prescribed date
- Course Project Submission
 - Formulation of work in form of research paper
 - Submission in the form of hard copy
 - Viva from project on prescribed date
- TWO options
 - Deign based using NS-2/SUMO/Network Simulator (Possibility of bonus marks)
 - Review based analysis (No bonus marks)



M.Sc. Spring 2014 – Schedule

20-01-2014	Classes Start
31.01.2014	Change of Courses
17.03.2014 to 21.03.2014	Mid Semester Examination
21.04.2014	Withdrawal of Courses
23.05.2014	Classes Terminate
26.05.2014 to 30.05.2014	Make-up Classes
02-06-2014	Final Examinations



The Internet

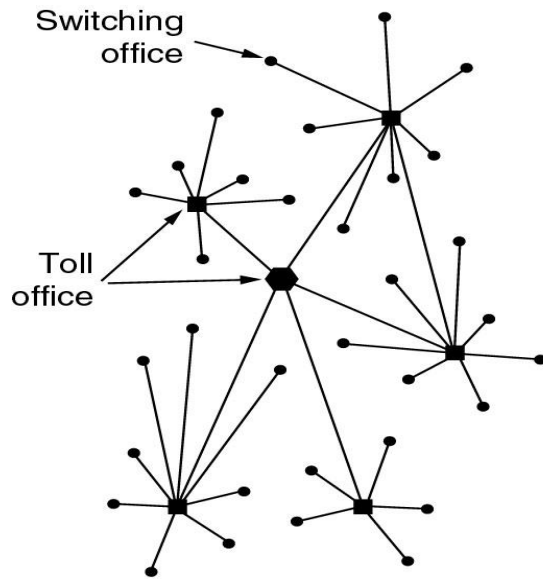
- A vast collection of different networks
 - Use certain protocols & provide certain services
 - Not planned by anyone & not controlled by anyone
- For detailed history of Internet
 - Naughton, J. : "A brief history of future," Woodstock, NY: Overlook press, 2000



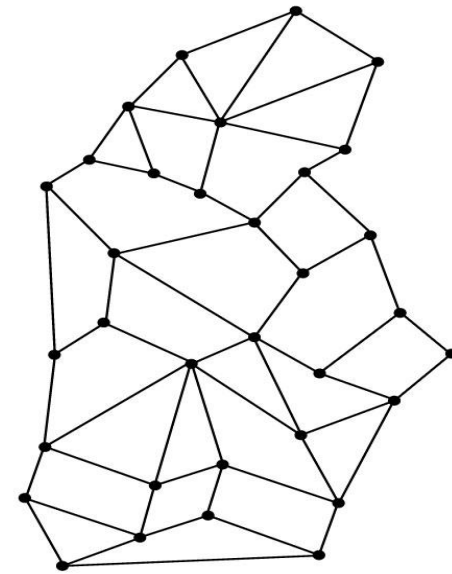
History of Internet

- Late 1950's at height of cold war
 - DoD: command & control network to survive cold war
 - Vulnerable PSTN used by military at that time. Ref: Fig. next slide (a)
- 1960s, RAND awarded a contract by DoD to find solution
- DoD's P. Baran: Distributed & fault tolerant design. Ref: Fig. next slide (b)
- Pentagon asked AT&T: AT&T dismissed idea
- Several years later: ARPA was created

Telephone System Vs. Distributed Switching System



(a)

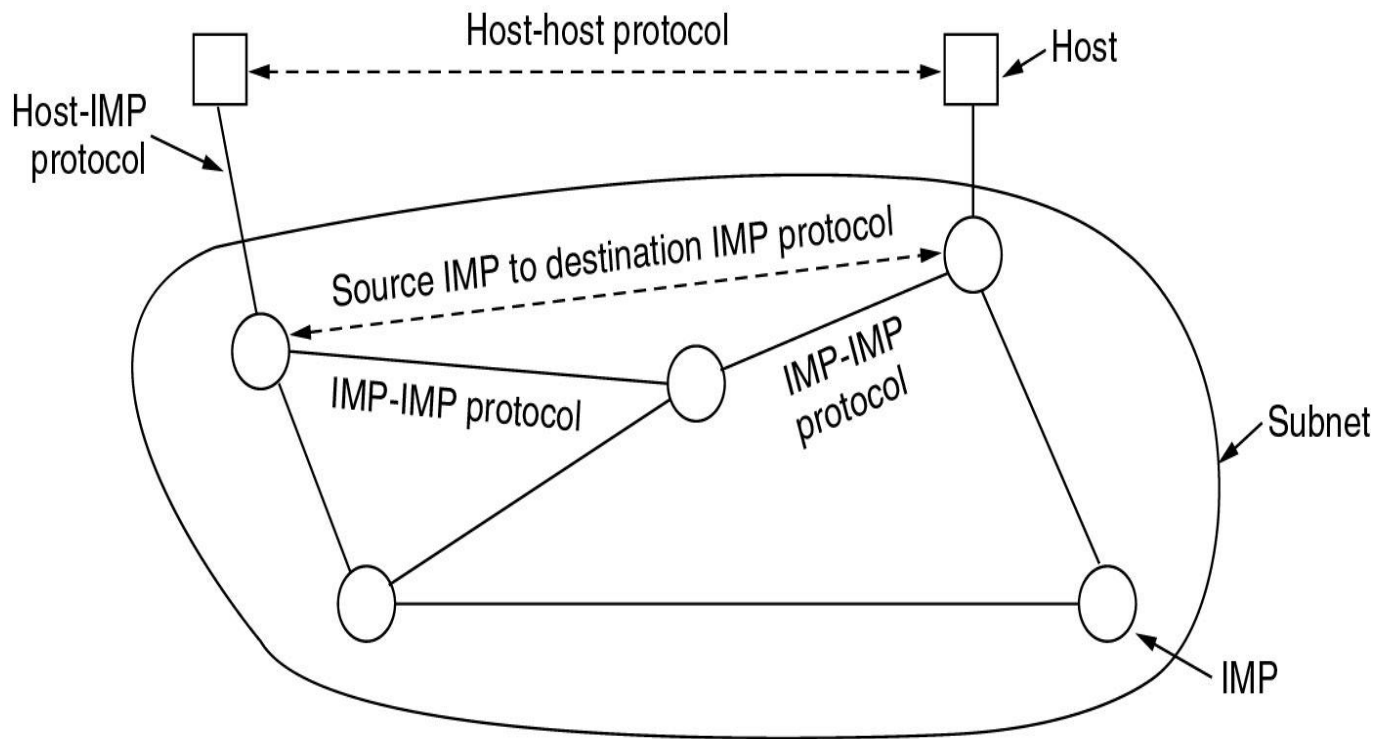


(b)

(a) Structure of the telephone system.

(b) Baran's proposed distributed switching system

Figure: ARPANET



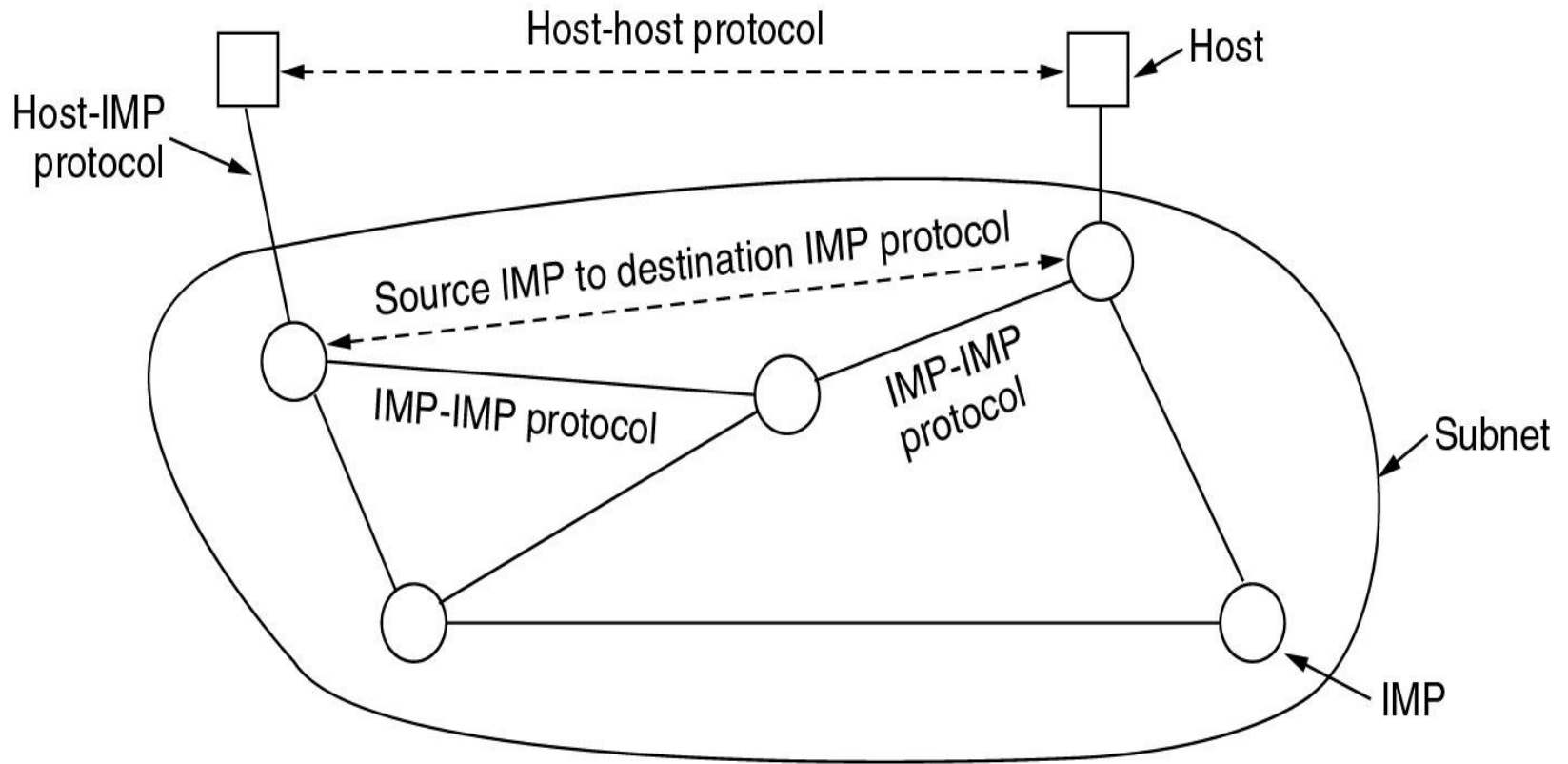
The original ARPANET design



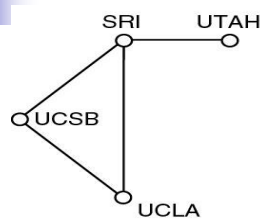
ARPANET

- 1st electronic store and forward packet switching network
- Subnets: IMPs (Interface message processors)
- Contract to BBN to build subnets
 - Honeywell DDP-316 minicomputers with 12K 16-bit words memory
 - 56Kbps leased telephone lines to connect IMPs
- Software
 - Designed by Graduate Students

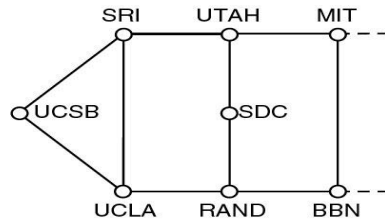
The Original ARPANET Design



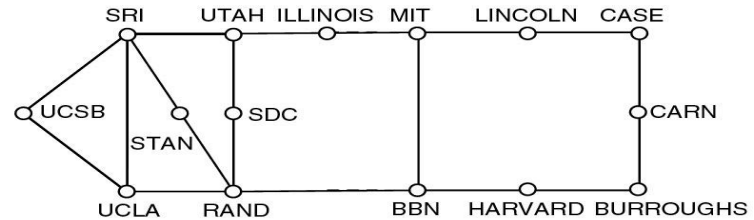
Growth of ARPANET



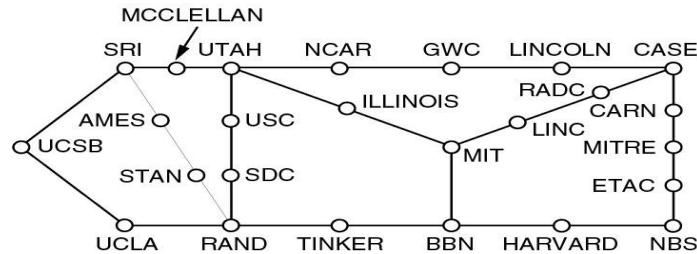
(a)



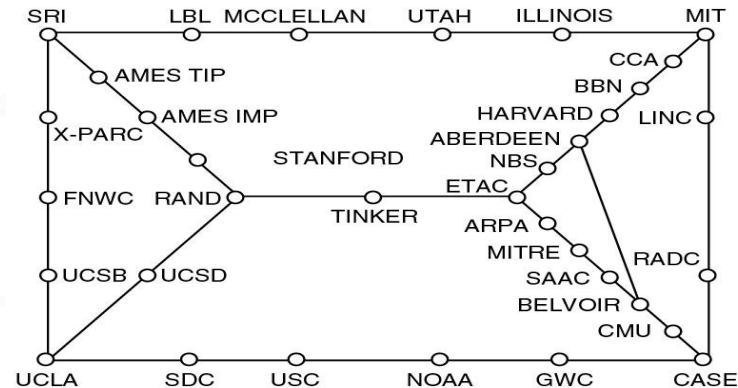
(b)



(c)



(d)

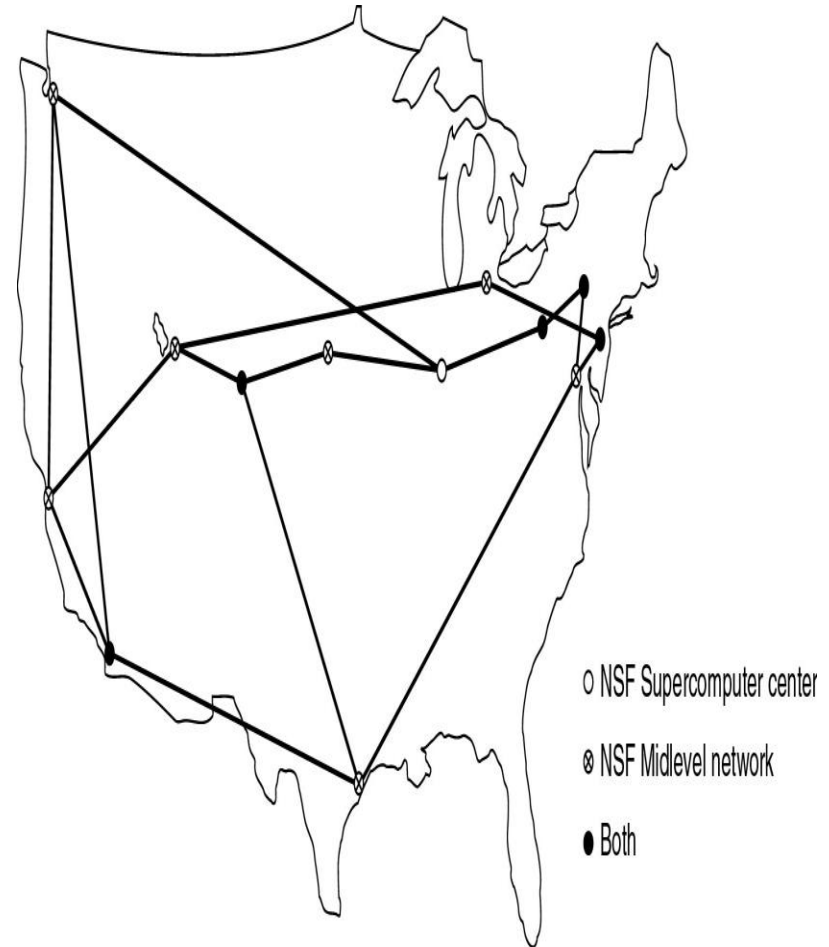


(e)

Growth of the ARPANET (a) December 1969 (b) July 1970
 (c) March 1971 (d) April 1972 (e) September 1972

NSFNET

- Late 1970s US National Science Foundation decided to build a backbone network to connect its six supercomputers at different locations
- 1984: NSFNET opened to university research groups
- Same HW technology as ARPANET: 56 Kbps leased telephone lines
- SW: TCP/IP

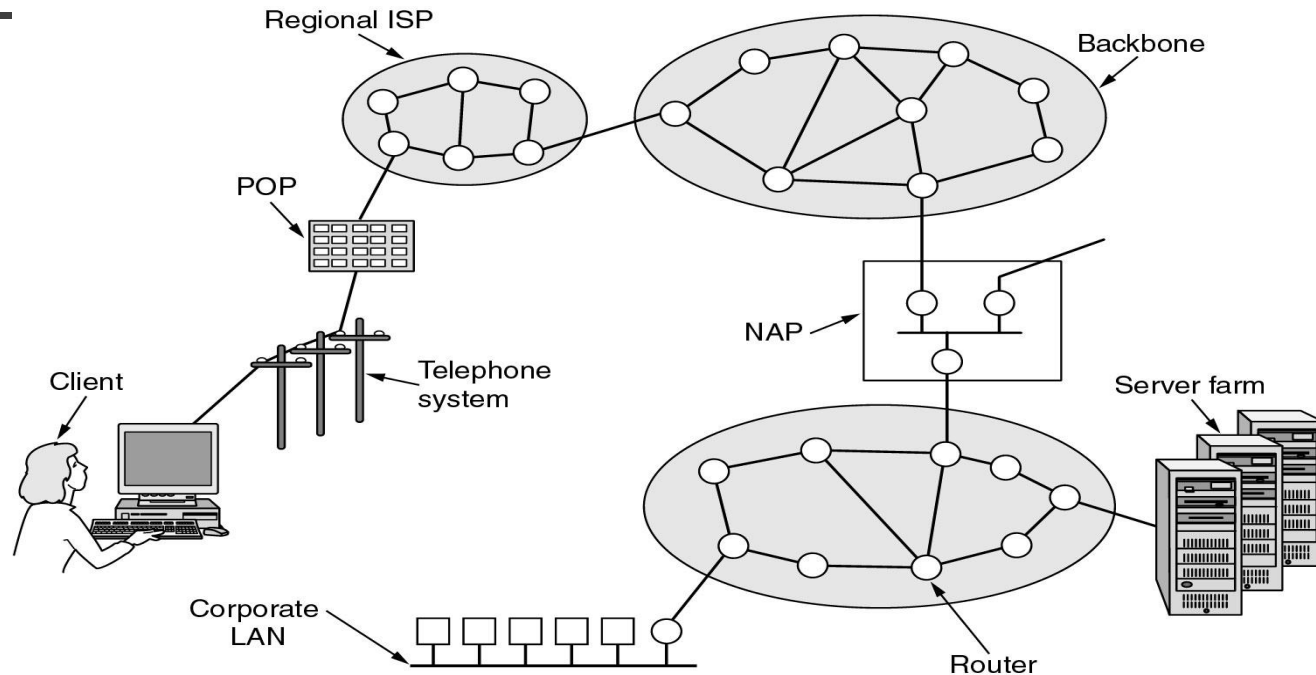




Internet Usage

- TCP/IP official protocol of NSFNET
- NSFNET & ARPANET plus regional networks joined
- Exponential growth —————> Internet
- Glue that hold together: TCP/IP model
- Traditional applications (1970 – 1990)
 - E-mail
 - News
 - Remote login
 - File transfer
- 1990's: CERN's Tim Berners-Lee invented WWW
- Together with Mosaic Browser by Marc Anderson: Possible to set up a pages containing text, pictures, sound & even video
- Much of growth fueled by ISPs

Architecture of Internet

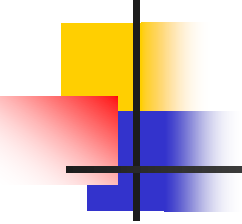


- NAP: Network Access Point
 - Room full of routers: at least one router per backbone
- POP: ISP's Point of Presence
 - data removed from telephone system & injected to ISP's regional network



Internet – Timelines Summary

- **1969.** Four-node ARPANET established.
- **1970.** ARPA hosts implement NCP.
- **1973.** Development of TCP/IP suite begins.
- **1977.** An internet tested using TCP/IP.
- **1978.** UNIX distributed to academic sites.

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-
- **1981.** CSNET established.
 - Network by NSF for universities who cannot join ARPANET
 - **1983.** TCP/IP becomes the official protocol
 - **1983.** MILNET was born.
 - **1986.** NSFNET established.
 - **1990.** ARPANET replaced by NSFNET.
 - **1995.** NSFNET became a research network.
 - **1995.** **ISPs** started.



STANDARDS ORGANIZATIONS

International Standards Organization (ISO)

**International Telecommunications Union–
Telecommunication Standards Sector (ITU-T)**

American National Standards Institute (ANSI)

Institute of Electrical and Electronics Engineers (IEEE)

Electronic Industries Association (EIA)



Internet Standards

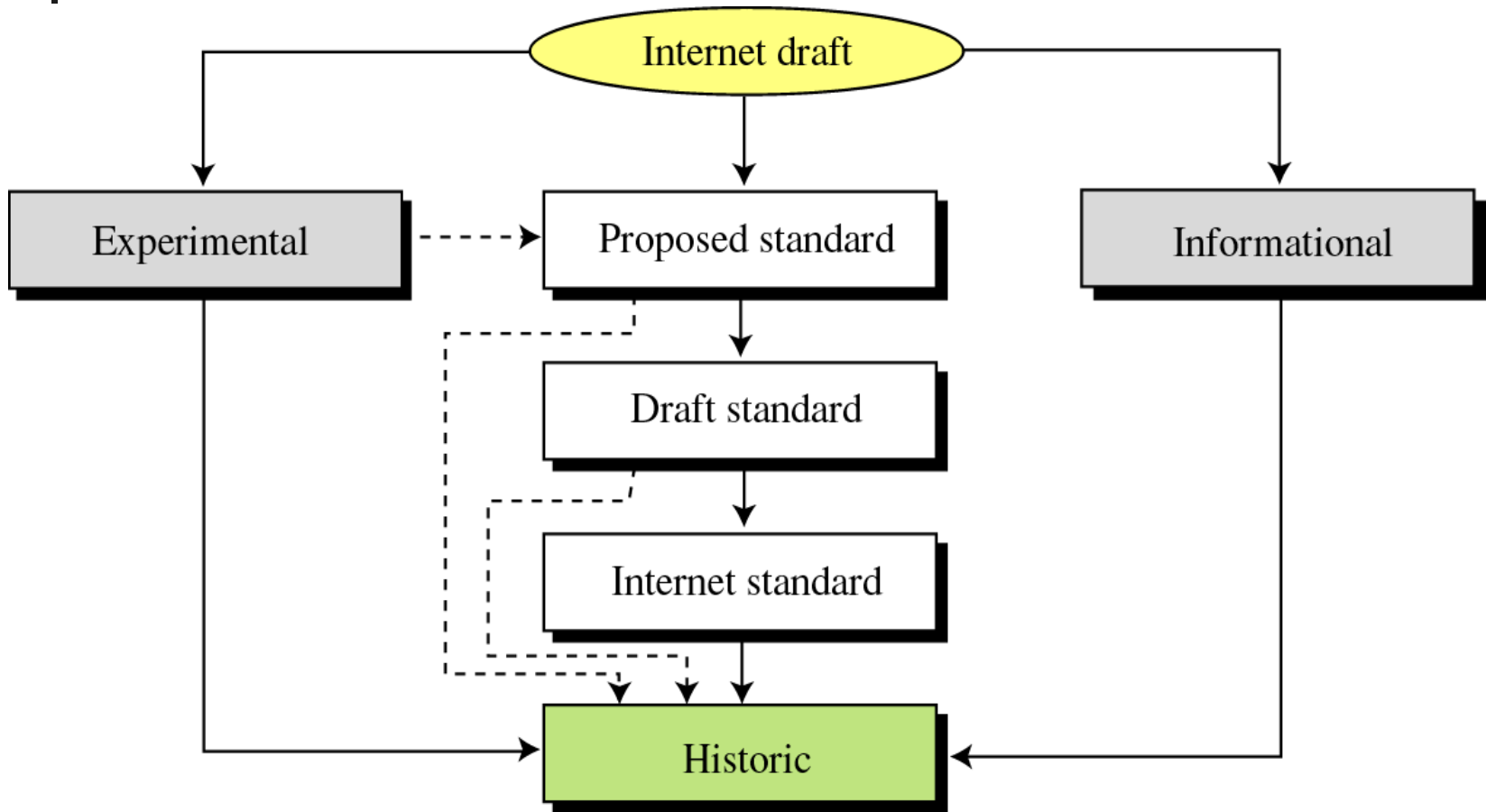
- Internet Standard
 - Thoroughly tested specification
- Internet draft
 - Working document with no official status & six-month life time
 - Upon recommendation from Internet authorities
 - A draft may be published as RFC
 - RFCs go through maturity levels



Maturity levels of an RFC

- Proposed standard
 - Stable specification of sufficient interest to Internet community
- Draft standard
 - Draft status after at least two successful independent implementations
- Internet standard
 - After demonstration of successful implementation
- Historic
 - Either superseded by later specification or never passed necessary maturity levels to become internet standard
- Experimental
 - Describes experimental situation that does not effect the operation of internet
- Informational
 - Contains general, historical or tutorial information related to Internet

Maturity levels of an RFC



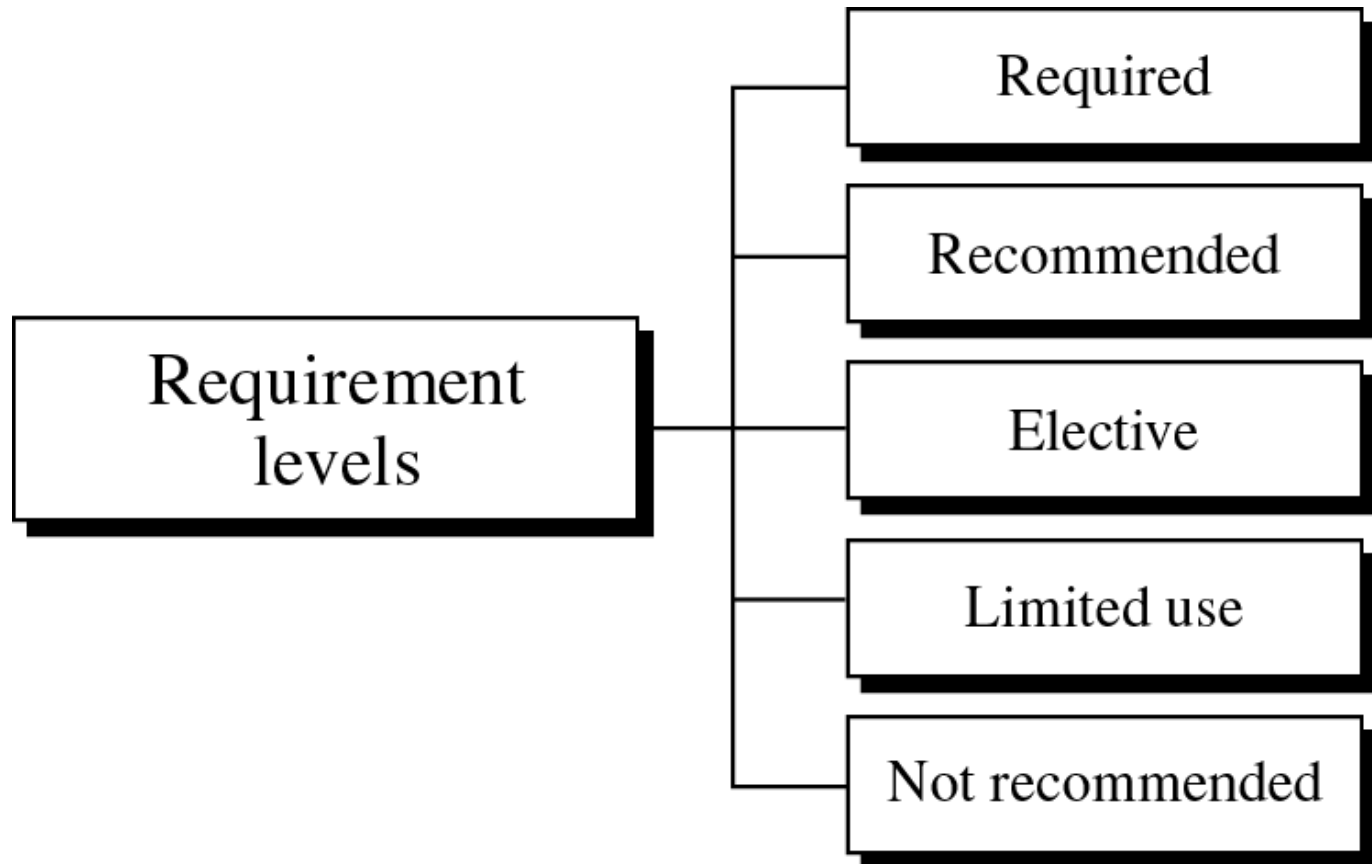


Requirement levels of an RFC

- Required
 - Must be implemented by all internet systems to achieve minimum conformance
- Recommended
 - Not required for minimum conformance
- Elective
 - Not required and not recommended
 - System can use it for own benefits
- Limited Use
 - Can be used only in limited situations
 - Experimental RFCs are example
- Not Recommended
 - Inappropriate for general use
 - Historic (obsolete) RFC fall under this category



Requirement levels of an RFC





Internet Administration

- Internet Society (ISOC)
 - Non profit organization
 - Provide support for internet standards process through other internet administrative bodies such as IAB
- Internet Architecture Board (IAB)
 - Technical advisor to ISOC
 - IAB has two primary components
 - Internet Engineering Task Force (IETF)
 - Internet Research Task Force (IRTF)



Internet Engineering Task Force (IETF)

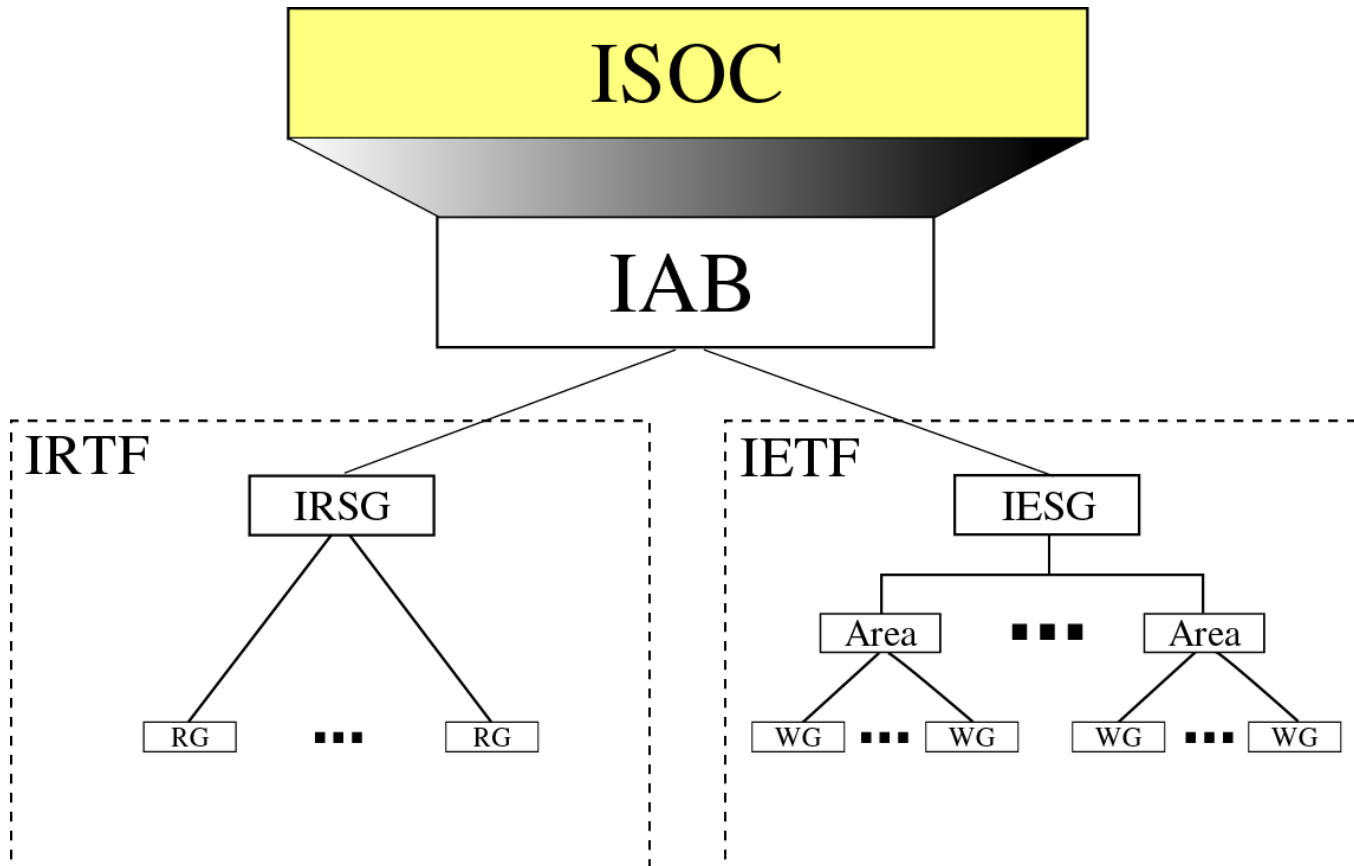
- Forum of working groups managed by Internet Engineering Steering Group (IESG)
- Responsible for identifying operational problems and proposing solutions to these problems
- Working groups are collected into areas and each area concentrates on a specific topic
- Some areas are
 - Applications, internet protocols, routing, operations, transport, security



Internet Research Task Force (IRTF)

- Forum of working groups managed by Internet Research Steering Group (IRSG)
- Focuses on long term research topics related to Internet protocols, applications, architecture and technology

Internet Administration



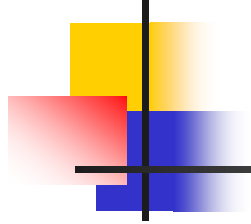


Assignment No 1

- Standardization is very important in the network world. ITU and ISO are the main official standardization organizations. Go to their web sites, www.itu.org, and www.iso.org respectively, and learn about their standardization work.
- Go to ISOC, IAB, IETF, IRTF web sites to see what they are doing. Pick a project you like and write half-page report on the problem and the proposed solution.
- Submission Deadline: 6 Feb 14



Questions?



**END of
LECTURE 1**