


A Course on Foundations of  
Peer-to-Peer Systems & Applications

**CS 6/75995**  
**Foundation of Peer-to-Peer** →  
**Applications & Systems**


**Kent State University**  
Dept. of Computer Science  
[www.cs.kent.edu/~javed/class-P2P08/](http://www.cs.kent.edu/~javed/class-P2P08/)

*Today's Topic*



Unit background and administrivia


**Foundations of Peer-to-Peer  
Applications & Systems**



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General Course Information



This course will not teach you how to write  
HTML or Java code. Nor will make you a Web  
Master!

In this course you will learn:

- Current limitations and standing open problems




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**2010 Topics**


- Case study of current architectures
  - Napster
  - Gnutella
  - Iliu-Torrent
  - Freenet
  - Chord,
  - CAN,
  - Pastry
- Theory
  - Internet and web networks
  - Distributed hashing, routing, advanced & special search
  - Self-organization, neighborhood optimization
  - Fault tolerance, stability, churning
- P2P overlay networks
  - Publish/subscribe & event routing overlays
  - Multicast optimization
  - Multimedia and streaming overlays
- Social engineering
  - Security and vulnerabilities
  - Reputation and trust functions.
  - Social engineering
- Sample applications
  - File sharing, distributed storage/caching, backup storage.
  - Social networks.
  - News feed
  - P2P games, online auction.
  - Multimedia streaming, distribution.
  - Anonymity systems
  - Trust Networks



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  - Office Hours: 4:00-5:00pm TTR
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- TA
  - TBA
- Web Page:
  - <http://www.cs.kent.edu/~javed/class-P2P10S/>



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## Reference Books

- **Text:** class note, research papers.
- Special Issue on Foundations of Peer-to-Peer Computing: Elsevier Journal of Computer Communications, Edited by Javed I. Khan & Adam Wierzbicki, Elsevier Journal of Computer Communications, v. 31, Issue 2, February 2008.
- Special Issue on Disruptive Networking and Peer-to-Peer Paradigm: Elsevier Journal of Computer Communications, Edited by Javed I. Khan & Adam Wierzbicki, Elsevier Journal of Computer Communications, v. 31, Issue x, 2008.



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## Course Format

It is a graduate level course. Good amount of independent study will be required from you.

- **Research Paper Reading & Class Presentation**
  - We will study 20 selected papers on the four theme topics.
  - Each student will be assigned two papers.
  - Estimated time required 2x10=20 hours.
- **Term Paper**
  - One survey paper on a special internet topic.
  - Estimated time required 20 hours.
- **Project**
  - One individual class project/experiment.
  - C/C++/Java language can be used.
  - Estimated time requirement 40 hours.



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## What is Expected Out of You?

- About 8 hours per week
- Learning by doing
- Questions and exercises
- Reading the papers and materials
- Taking active part in paper discussions
  - Read/Listen Think Do **Ask**



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## Grading

End Term Exam	1	20%
Mid Term Exam	1	20%
Take Home Assignments	4-5	20%
Class Presentation	2	20%
Survey Paper or Project	1	20%



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## Introduction of Students



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# Why Peer-to-Peer

## Peer-to-Peer

- A new and very interesting paradigm in networked based systems.
- Many ISP is reporting 50%-75% of Internet traffic today is due to P2P.
- Today the conventional client/server based applications are facing tremendous effort and resources to meet the growth of Internet user and usage.



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## Three Challenges

- Scalability:
  - Billions of users,
  - Varied systems,
  - Bandwidth? Storage? Computing?
- Security & Reliability:
  - Security for various domains?
  - Anonymity?
- Flexibility and Quality of Service
  - Quick and easy integration of new service?
  - Asymmetric capabilities?



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## Research Frontier

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- Real Time Applications:
  - Instrument control/interaction over the Internet
- Multimedia Applications:
  - Audio-video delivery
- Security over Shared Network:
  - secured cache/ secured VM/ secured virtual net
- Performance Scalability
  - HTML/HTTP1.1 are severely limited.
  - Cache
  - Virtual Machine. Build your own special purpose VM
- Information Search
  - Multimedia content-based retrieval
- Internetworking over Wireless



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A World Wide Network of  
Millions of Computers



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Internet = Network of  
Computer Networks



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The Internet is a global network of networks enabling computers of all kinds to directly and transparently communicate and share services throughout much of the world. Because the Internet is an enormously valuable, enabling capability for so many people and organizations, it also constitutes a shared global resource of information, knowledge, and means of collaboration, and cooperation among countless diverse communities.

*-Internet Society  
June 1998*



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The Internet is more important in what it enables than what it is; more phenomenon than fact. Yes, the Internet is networks, software, computers and other technologies; but more so, it is a catalyst of change, a new mass medium, a culture, a mind warp, new things never before imagined.

*-J. Neil Weintraut  
Wall Street Technologist*



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### Today's Topics

Structure of Internet  
Who manages Internet & Its Organization.  
History of Internet.  
Growth Rates.



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## Structure of Internet

[Click Here](#)

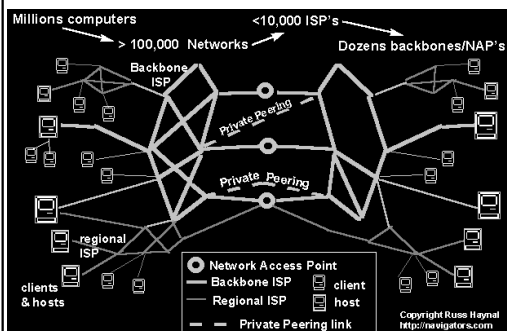
file:///C:/0d-simulated/ajaved/internetbook/overview/internet\_architecture.html



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### Physical Network



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### THE INTERNET

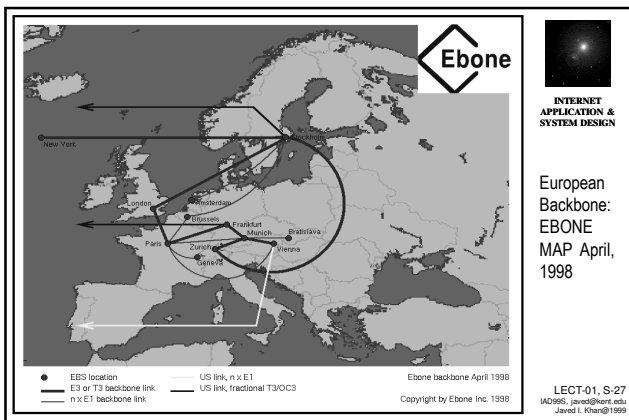
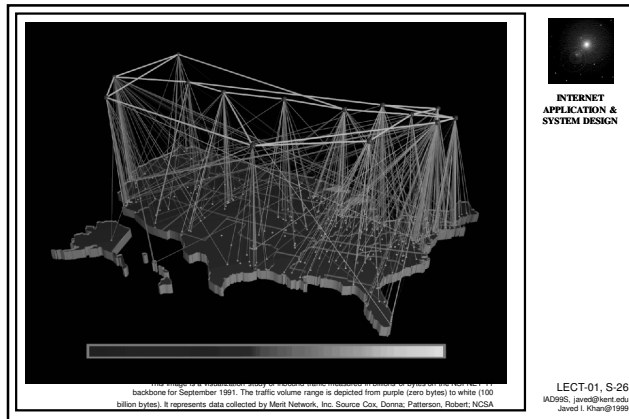
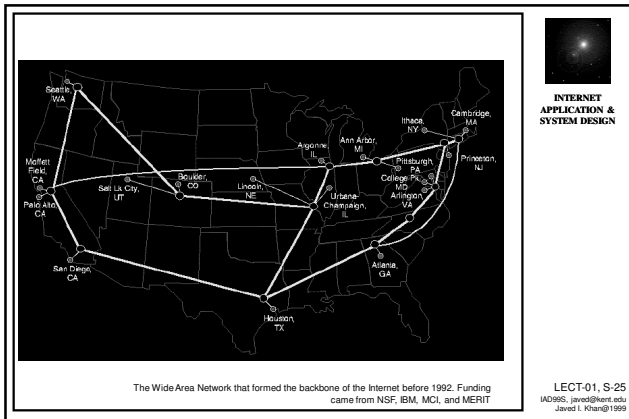


MAJOR U.S. PEER  
INTERCONNECT POINTS



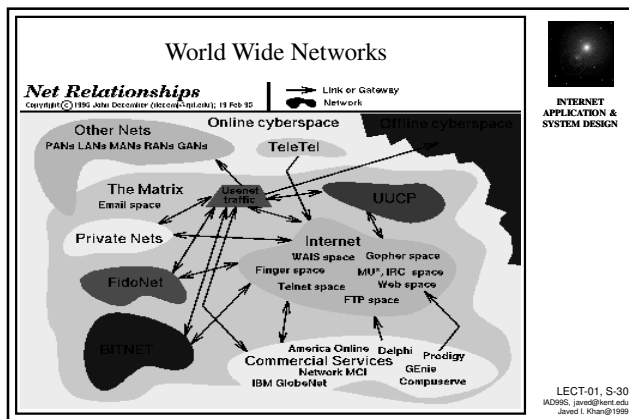
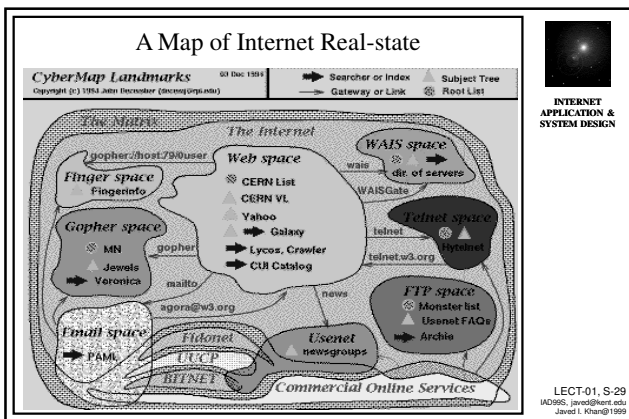
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Demonstration  
Route Tracing

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# Who Manages Internet?



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There is no single body which manages the Internet.

It runs through a host of independent or loosely coupled coordinating organizations.

The organizations below play a major role in the organization, management and development of it:

- Internet Society (IS)
- Internet Architecture Board (IAB)
- Internet Engineering Task Force (IETF)
- Internet Assigned Number Authority (IANA)
- Internet Network Information Center (InterNIC)
- W3C



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## Internet Society (IS)

A nonprofit, non-governmental professional-membership organization of individuals and organizations interested in the development of Internet. More specifically, this is the legal umbrella for other coordinating bodies (such as IAB, IANA) for global cooperation and coordination for the Internet and its internetworking technologies and applications.



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## Internet Architecture Board (IAB)

IAB is a technical advisory group of the Internet Society. Its responsibilities include oversight of IETF, editorship of the RFC document series, administration of Internet assigned numbers, and liaison of the Internet Society in liaison relationships with other organizations concerned with standards.



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## Internet Engineering Task Force (IETF)

Body to address and resolve technical and operational problems on the Internet and to develop Internet standards and protocols.

The membership of IETF is international and completely voluntary. Members consist of network designers, operators, vendors, researchers and other interested individuals.



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## Internet Assigned Numbers Authority (IANA):

Chartered by the ISOC and the Federal Networking Council and operates out of the University of Southern California, is the central coordinator for the assignment IP addresses and manages the Root Domain Name Service.



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## Global Internet Assigned Numbers Authority

Americas and sub-Saharan Africa:  
The American Registry for Internet Numbers (ARIN)

Europe and North Africa:  
Reseais IP Europeens (RIPE) (<http://www.ripe.net>)

Asia and Australia:  
Asian-Pacific Network Information Center (APNIC)  
(<http://www.apnic.net>)



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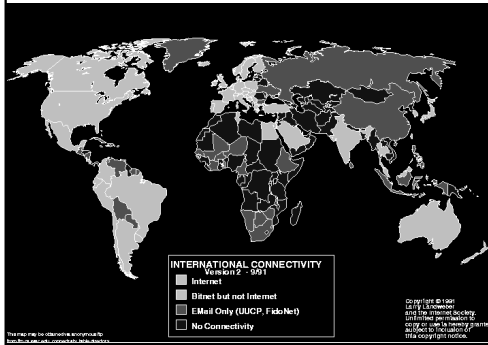
## Global Village



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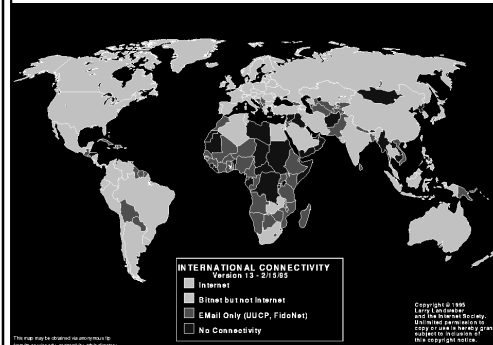
## World Connectivity in 1991



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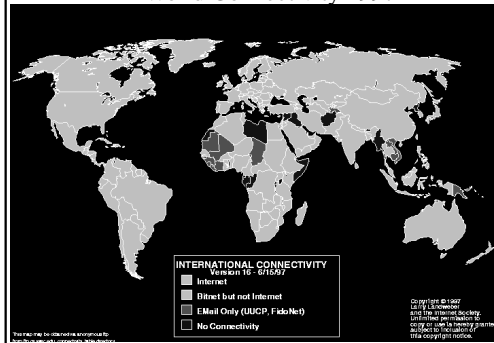
## World Connectivity in 1995



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## World Connectivity 1997



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## Global Village

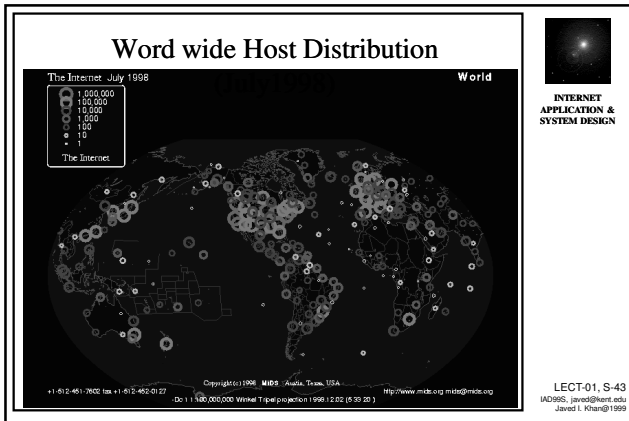
As of January 1998, 205 countries had at least one connection to the Internet. By July this had grown to 212. Only 11 new countries joined the Internet in 1997. This is a diminished Internet spread rate, but it occurs for the simple reason that there aren't many new countries to join.

Matrix Inc.



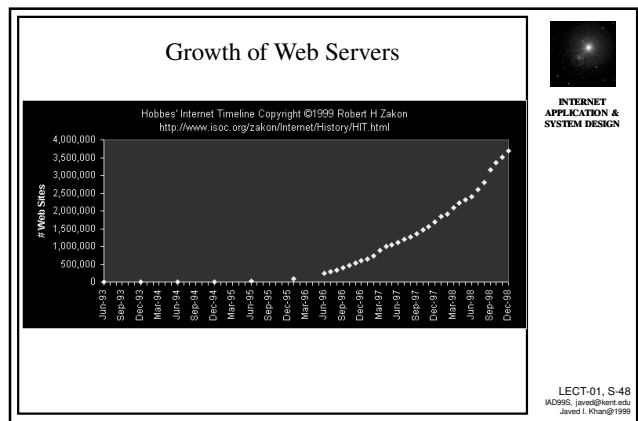
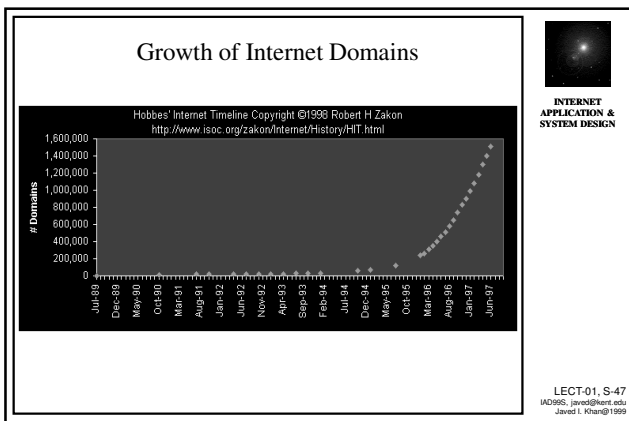
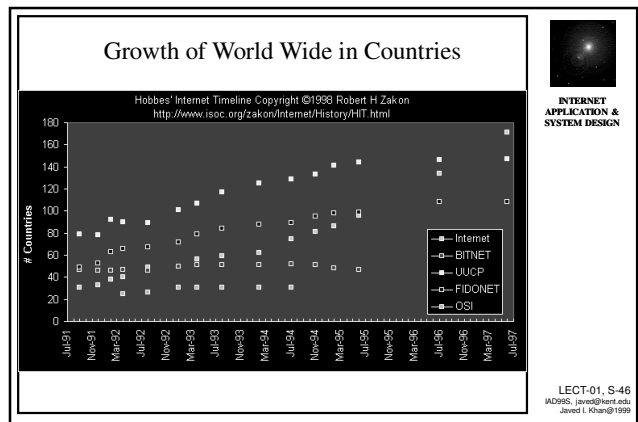
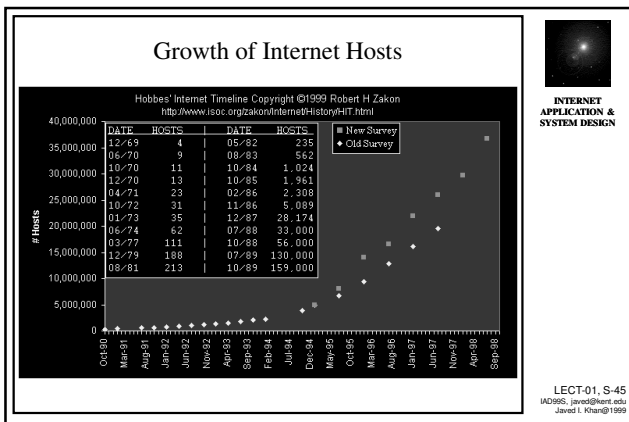
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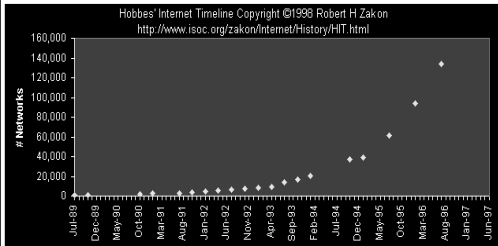
# Growth Rates

44





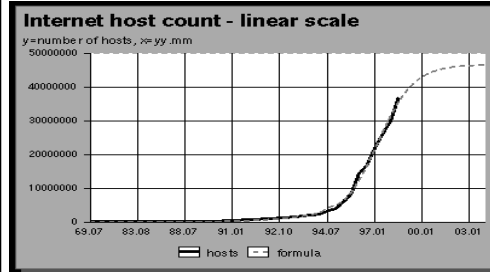
## Growth of Internet Networks



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## Future Growth of Internet Hosts



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The results shows that we have already passed the point of fastest growth in host numbers in 1997, the level-off is due at about 47 (51) million hosts in 2002(3)! (Src: Mario's Scenarios, 1999)

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## S-Curve

- The creative output of talented persons is similar to the growth curve, be it musical compositions, poems or scientific articles.
- The number of sold units of a certain models or types of industrial products follow S-curves. These products are, among others, computer models, car models, structural wood panels, Gothical cathedrals, particle accelerators, railroad tracks and super tankers.
- There are saturation processes. AIDS has already filled its niche in the USA at 0.95 % of all deaths. The decline of deaths by tuberculosis also follows an S-curve. Air freight transport have reached 90 % of its limit value by 2000.



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## History of Internet

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