



CSE6349

SPECIAL TOPICS IN ADVANCED NETWORKS

Two main objectives

- **Future Networking Challenges**
 - *What are the problems with existing networking and the Internet?*
 - *New/future applications?*
 - *Are we ready?*
 - *Challenges and issues*
- **Research – Creative Thinking and Motivation**
 - *Reading technical articles*
 - *Writing technical articles*
 - *Making technical presentations*



Networking Challenges and Issues

Computing Devices and Networks

- Powerful PCs
- Cellular phones
 - Multi-functional devices
- Multi-core architectures
- Sensors and RFIDs
- MEMS and NEMS
- The Internet
- Cellular networks
- WiFi
- Wireless meshes
- Bluetooth, UWB, Zigbee

Applications

- WWW
- Cellular Telephony
- Amazon
- Travelocity
- Facebook
- Tweeter
- RSS
- ...
- Any where anytime
- Heterogeneous
- Mobile, pervasive
- Dynamic
- Uneven

Fading Distinctions

- **Servers and clients**
 - *Distributed systems, P2P systems*
 - *Cost and time*
- **Producers and consumers of information**
 - *Users are producers as well as consumers of information*
 - **User with a cell phone camera**
 - **SMS, Blogs, Tweets, ..**
- **Service providers and consumers**
 - *Resources on user devices can be shared*
 - **Complementary resources**
- **Resourceful and resource-poor entities**
 - *Servers, desktops, laptops, mobile phones*
 - *Grid computing*
 - *Cyber foraging*

New Paradigms

- **Pervasive computing**
 - *Smart environments*
- **Embedded/Ubiquitous devices**
- **Sensor Systems**
- **RFIDs – active and passive**
- **MEMS and NEMS**
- **Software agents and services**
 - *Proactive, Interactive, reactive*
- **Coexistence**
 - *LANs, WANs, Cellular. PANs, Radio*

Pervasive Computing and the Internet

- **Many devices per person**
 - *Hundred to a thousand to one!!*
 - *Cell phones, PCs, PDAs, heart monitors, brain monitors...*
 - *Sensors*
 - *Embedded devices*
 - *RFIDs*
- **Move to service oriented architectures**
 - *Provide services*
 - *Access services*
 - **Not necessarily computers or devices**
- **Boundary between physical and virtual entities**
 - *Agents*
 - *Network and agent protocols*

Push and Pull - Flow

- Water
- Electricity
- Gas
- Newspapers
- Radio Broadcast
- TV Broadcast
- SPAM
- Pop-up
- Human Communication
- Trains
- Road and air traffic
- telephony
- Supply/Demand flow
- E-mail
- FTP
- HTTP

The Debate [Anderson et al, IEEE Comp, April 2005]

- Internet Purists
 - Single Universal protocol – IP
 - Overlays are necessary evils
 - Architecture will remain in place for a long time – why change something that has been successful?
- Pluralists
 - IP is one of the components
 - Evolving architecture – union of existing overlays and protocols
 - Ability to support multiple coexisting overlays and protocols
- Providing flexibility – a challenge?

Hybrid Approach – centralized high speed architecture at the core and flexible (patch ups) at the edge.

Packet vs. Circuit

- Power, water, gas
- Telephony
- Internet
- Efficiency
- Resource utilization
- Services

Reacheability

Heterogeneity

Reliability

Timeliness

Internet Protocol

- **Future users and applications**
 - *Demand predictability*
 - Availability of service
 - Timely delivery of data
 - *IP is not optimized to provide either?*
- **Best-effort, non-mission critical and non-realtime data communications**
- **Packet switching makes efficient use of bandwidth**
 - *Link utilization of core links of the Internet - 3 to 20%*
 - *Link utilization of long distance phone lines - 33%*
[Odlyzko and Coffman2001]
 - Power line efficiency -60-80%

Problems

- Existing mechanisms --?
 - *Heterogeneity*
 - *Invisibility*
 - *Proactivity*
 - *Context-awareness*
 - *Security, Privacy*
 - *QoS*
 - *Energy*

Facts

- Internet population -2 billion
- PCs/servers – 1 Billion?
- Cell phone population – more than 3 billion
 - *Increasing a much faster rate than Internet users*
- Sensors /RFIDs – Trillions?



Research – Creative Thinking and Motivation

Research

- **What ?**
 - *In-depth understanding of existing problems and possible solutions*
 - *Solutions to an existing problem*
- **Why?**
 - *New applications*
 - *Improve E.g., health*
 - *Business ... \$\$*
 - *Degrees*
- **How?**
 - *Creative, motivated, persevere*

How?

- **Understand ...**
 - *State of the art*
 - **Technologies**
 - **Ongoing work**
- **Recognize problems and solutions**
 - *Others' contributions*
 - *Unresolved (useful) problems*
 - *Need to solve problems*
 - *Solutions that are already available*
- **Innovate**
 - *New solutions*

Literature review

- **Read research articles in related areas**
 - *Quality, Recent,*
 - **There is a lot of junk out there**
 - **Magazine articles**
 - IEEE Computer, Communications, Internet, Pervasive Computing, Multimedia
 - **Conference articles**
 - ACMs SIGCOMM, Infocomm, Mobicom, Sensys,
 - IEEE PerCom, P2P, IPSN
 - **Transactions**
 - ACM/IEEE Networks, TMC,

Course Prerequisites

- CSE5311 Design and Analysis of Algorithms
- CSE5306 Distributed Systems
- CSE5344 Computer Networks I.
- Motivated

Course Information

- **Instructor:**

- *Mohan Kumar*
 - 333 NH
 - Email: mkumar@uta.edu
 - Phone: (817) 272-3610

- **Class:**

- *Mon/Wed 4:00 to 5:20 PM*
- *311WH*

- **Office Hours:**

- *Mon/Wed - 2:30 to 4:00 PM.*

- **Course site:**

http://crystal.uta.edu/~kumar/cse6349_09FLSTAN

- **GTA: TBA**

Papers

- P. Gupta and P. R. Kumar, "The capacity of wireless networks," IEEE Trans. Inform. Theory, vol. 46, pp. 388–404, Mar. 2000.
- M. Grossglauser and David N. C. Tse, Mobility Increases the Capacity of Ad Hoc Wireless Networks, IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 10, NO. 4, pp. 477-486, AUGUST 2002.
- K-W. Kwong, and D. H. K. Tsang, Building Heterogeneous Peer-to-Peer Networks: Protocol and Analysis, IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 16, NO. 2, pp. 281-292, APRIL 2008.
- F. Le, G. G. Xie, D. Pei, J. Wang, and H. Zhang, Shedding Light on the Glue Logic of the Internet Routing Architecture, ACM SIGCOMM, pp.39-50, Seattle, Washington, Aug. 2008.
- A. Anand, A. Gupta, A. Akella, S. Seshan and S. Shenker, Packet Caches on Routers: The Implications of Universal Redundant Traffic Elimination, ACM SIGCOMM, pp.219-230, Seattle, Washington, Aug. 2008.
- A. Balasubramanian, R. Mahajan, A. Venkataramani, B. N. Levine, and J. Zoharjan, Interactive WiFi Connectivity for Moving Vehicles, ACM SIGCOMM, pp.427-438, Seattle, Washington, Aug. 2008.
- E. F. Nakamura, A.A. Loureiro, and A.C. Frery, Information Fusion for Wireless Sensor Networks: Methods, Models, and Classifications, ACM Computing Surveys, Vol. 39, No. 3, Article 9, August 2007.
- T. Koponen, M. Chawla, B-G. Chun, A. Ermalinskiyi, K.H. Kim, S. Shenker, and I. Stoica, A Data Oriented (and Beyond) Network Architecture, ACM SIGCOMM, pp.281 - 192, Kyoto, Japan, Aug. 2007.
- S. Uludag, K-S, Lui, K. Nahrstedt, and G. Brewster, Analysis of Topology Aggregation Techniques for QoS Routing, ACM Computing Surveys, Vol. 39, No. 3, Article 7, August 2007.
- W. Wang, V. Srinivasan, and K-C. Chua, Extending the Lifetime of Wireless Sensor Networks Through Mobile Relays, IEEE, IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 16, NO. 5, pp. 1108-1120, OCTOBER 2008.
- K-W. Kwong and D.H. K. Tsang, Building Heterogeneous Peer-to-Peer Networks: Protocol and Analysis, IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 16, NO. 2, pp 281-292, APRIL 2008.

Literature Survey

- **Be focussed**
 - *IEEE, ACM, Elsevier and Wiley ...*
 - *IEEEexplore, ACM Digital Library, Science Direct, scholar.google.com*
- **Visit only reputed sites – universities, research labs**
 - *Google is not always good,*
- **Read, title, abstract, intro/conclusion and then paper**
- **Identify what is of interest,**
 - *Critical reading, fast reading*

Your Paper

- Writing a story
- Sell your idea
- Keep the reader interested
- State your problems and solutions upfront
- Do not claim too much in the abs and intro
- Demonstrate the validity of your solutions

General Problems

- Citations and references
- References, Bibliography
- Contributions of authors of papers,
 - *Be clear about your contribution*
 - *Acknowledge others' work*
 - Liberal
 - *Criticism*
 - **Subtle, do not use harsh words**
 - **Do not criticize for the sake of criticizing**
 - You should know what solution is

General

- **Writing and Organization**
 - *In general good, but needs lot of improvement*
 - *Focus*
 - *Long sentences*
 - *Short paras*
 - *Maths*
 - *Spelling, Grammar*
 - *its --- it's*
 - *Use of 'the'*

General

- Simple and clear presentation
 - *Complex problem*
- Reader's point of view
 - *Interest, flow, nontrivial*
- Sell your product but don't go overboard
 - *Introduction, Conclusion*
 - *Not everywhere*



General

- Flow from Section to Section
- Flow from para to para
- Introduction – intro to work as well as rest of the paper

Technical

- State the problem/issue upfront
- Abstract
 - *Should be intelligible to a CSE person*
- Background – clearly differentiate your work with those of others.
 - *Here, differentiate between work A and Work B.*

Assessment

- Presentations and Discussions: 30%
- Debate: 30%
- Group Project: 40%

Presentations and Discussions

- 8-10 Research Papers will be assigned to the class.
- Each student will be required to complete a thorough review, evaluate and critique at least 4 of these papers.
- Students will be given a chance to give their preference, but the assignment of papers will be made by the instructor.
- The 10 research papers will be posted on the first day of classes.
- Paper assignments will be completed by August 31, 2009.

Each Paper presentation

- **Two Presenters**
 - *Read the paper (and related material) thoroughly*
 - *Jointly prepare PPT slides and a report*
 - *Present the paper on the scheduled day*
 - *Submit the report at most two weeks after the presentation*
- **Critic**
 - *Reads the paper (and related material) thoroughly*
 - *Identify flaws in the work reported*
 - *Must be prepared with several pertinent questions*
- **Scribe**
 - *Reads the paper (and related material) thoroughly*
 - *Scribes the proceedings and submits report at most one week after the presentation*

Presentation and Report

- What is the problem?
- Background to the problem
 - *Example scenario if possible*
- Available solutions to the problem
- What is unique about the authors' solution/methods
 - *Main ideas, concepts*
- Methodologies used
- Results reported
- Critical evaluation of the work reported in the paper
- Presentation is for 50 minutes, followed by 20 minutes questions

Additions to the Report

- Incorporate responses to questions raised by the critique and the audience
- The report should be 6-8 pages.
- More instructions will be provided

Critic

- Evaluate work presented critically
- Read background material
- Read papers with alternative solutions
- Prepare appropriate questions
- Critique objectively

Scribe

- Must have good understanding of the topic of discussion
- Record proceedings
- Prepare a comprehensive report
 - *The topic of discussion and its importance*
 - *Presentation summary*
 - *Objective summary of questions and responses*
 - Note : this is a record of the opinion of the entire class, not your own.

Audience

- Browse through the paper before hand
- Prepare questions
- Ask questions
- Grade the presenters objectively
- Justify your grade
 - *Grading sheet will be provided*
 - *All students except the 2 presenters, the critic and the scribe*
 - *You have to be present*
 - *You will be grading the presenters*
 - your grade reports will be graded too.

Grading

- Presentation and Report (60 %)
- Reports from classmates (20 %)
- Reports for others' presentations (20%)

Debate

- A topic of current interest
- 2 teams (for and against)
 - *3-4 members per team*

Project

- **Group projects**
 - *3-4 members per team*
- **Simulations**
 - *NS2*
- **Implementations**
 - *PDA/Sensors*