ADVANCED COMPUTER NETWORKS

Lecture 1: Introduction to Course

Time and Place

Lecture: TuTh 10:30-12:00, Fr 9:30-10:30
Discussion: after paper discussion on Tue and/or Thu
- Room:1690 BBB

Instructor: Sugih Jamin
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Office hours: Tu 12-12:30, Fr 12:30-1 and by appointment
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Course Web Site

Course Web site:
http://www.eecs.umich.edu/~sugih/courses/eecs589/
- Syllabus and reading list
- Course grade composition and grading policy
- Project milestones and deadlines

Web site is "required reading"
- including Announcements page

Prerequisites: EECS 489
Review lecture notes and/or recommended papers on
http://www.eecs.umich.edu/~sugih/courses/eecs489/syllabus.html
Suggested co-requisite: an introductory probability and statistics

Grading Policy

Paper presentations and reviews: 40%
Project: 50%
Class participation: 10%
(for both paper and project discussions)

Typical class:
- 40 minutes presentation and Q&A per paper (x2 on Tue or Thu)
- 40 minutes project discussion (on Tue or Thu)
  - progress report and issue resolution

Project Timeline

Week 2&3:
Tue, 9/13: Project Proposal Presentation
Thu, 9/20: Project Proposal Due

Week 7:
Thu, 10/20: Prototype Report and Presentation Due

Week 14&15:
Thu, 12/8: Final Presentation Due
Tue, 12/13: Final Report and Poster Due
Poster presentation at noon in Tishman Hall

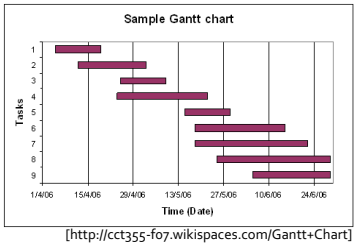
Project Proposal

Description and scope

Team members (no limit)

Task assignments (substantial)

Schedule with milestones, task assignments, and a Gantt chart



[http://cct355-f07.wikispaces.com/Gantt+Chart]

Group weekly meeting time

Grading scale

Proposal is a signed contract

Turn in hard copy in class and upload to Canvas

5-min presentation

Project Prototype

Include project proposal with my markup

Draft of final project report (see next slide)
- any changes to contract and/or grading scale
- initial set of data
- experimental setup
- initial set of performance figures
- a signed attestation of each member's contributions

10-min presentation of prototype

Turn in hard copy in class and upload to Canvas

Online copy of code or scripts uploaded to Canvas

Final Report

In hard copy and uploaded to Canvas:
- problem motivation
- design goals or performance questions
- design architecture or performance metrics
- description of code or scripts: data structures and control flows
- challenges and obstacles encountered and overcome (or not)
- data showing correctness of implementation
- description of experimental setup
- performance evaluation
- future work
- related work and references
- a signed attestation of each team member's contributions
- proposal and prototype reports with my markup

Online copy of code or scripts uploaded to Canvas

Final Presentation and Poster

Final presentation on Thu, 12/8 and Fri 12/9

- presentation due on Thu 12/8 in hard copy and online
- 20-min final project presentation (+ 10-min optional demo)

Poster session on Tue, 12/13 at noon in Tishman Hall

Poster can simply be copy of your presentation slides laid out in poster form (40x60)

- or you can print out a single-piece poster ($50-60?)
- dept. will provide easel and poster board
- upload a copy (photo) to Canvas

Show demo if you have one

Project Ideas

Scan through the latest proceedings of workshops and conferences (see Project page for urls)

Reproduce published research
(see Project page for links to similar projects)

Anything about current Internet, Web, or Wireless networks that is particularly frustrating to you

Analytical works also acceptable, not just empirical ones

Project Ideas

QUIC over Mobile

Mobile video streaming

Network aspects of augmented or virtual realities

Internet of Things

Use of machine learning

Joint project with another course or PhD research requires the other instructor's or research advisor approval and delineation of tasks

Paper Topics

Classic/Core
Internet Topology
Internet Routing and Addressing
CDN Architecture
Client Location and Performance
Random Sampling
SDN and Data-Center Architecture
The Cloud
NFV
Data-Center Transport
Data-Center OSes
Transport: TCP and Rate Adaptation
Mobile
Security

See Syllabus

Paper Presentation and Review

Papers accessible from Syllabus page

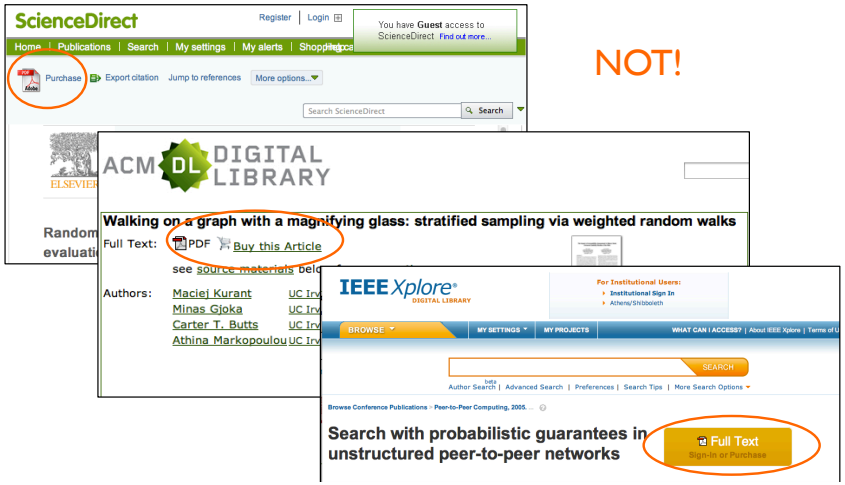
Assume familiarity with 489 materials (self-review):

- ASes, BGP and policy routing, MPLS
- consistent hashing, bloom filter
- PKI and symmetric key
- SDN, Fat-tree/Clos network
- TCP slow start, fast recovery, QUIC
- FEC, rate adaptation
- WFQ, token-bucket filter

Turn in paper reviews and presentation slides (4-up) in hard copy at the start of class and upload to Canvas

Accessing Paper

Some articles are accessible only when signed in with UM



NOT!

Paper Review

Author(s), title, venue and date (see syllabus!)

Summary of paper:

- the big idea
- evaluation and validation methodologies
- main results

What you like about the paper:

- what's novel?
- any "aha!" moment?

How to extend or adopt the work:

- shortcomings and overlooked points?
- advantages not recognized?
- how does it compare to other works in area?
- application to your own work?

Report Format

All reports/contract must be turned in hard copy at the start of class

- 11-point size minimum
- single column
- 1.5 or double spacing
- 1" margin on all sides
- double sided

No page limit, but be concise, don't ramble

A one-page signed attestation to each team member's contribution

Review Grading

Graded Satisfactory/Unsatisfactory

- proof-read your report: any typo, grammatical error, run-on and incomplete/unfinished sentence results in an Unsatisfactory grade

No late review accepted!

Honor Code violation reported to Honor Council:

- any cut-and-paste job in paper review, except for short quote with proper attribution
- copying any online materials
- someone else doing the review for you, either for free or for a fee
- anything else of questionable honesty (ask if in doubt)

Paper Presentation

Content:

- same as review, but put emphasis on paper contents
- as if preparing a long conference talk about the paper

Plan on a 40-minute talk, including Q&A

Presentation must be done by yourself, no video recording

Prefer that you make your own slides

- may use presentation slides found online, with full attribution (name, institution, url) only because I can't enforce a policy prohibiting it
- prefer that you don't look at other people's slides before making your own

Paper Reading Team

Team of 2/paper to present (both must present)

Team of 2/paper to write review report

Tentative assignments posted on Canvas
(self-organized swapping allowed, but please inform me)

eecs589

ADVANCED COMPUTER NETWORKS

[Clark88] Clark, "The Design Philosophy of the DARPA Internet Protocols," *ACM SIGCOMM '88*, 18(4):106-114, Aug. 1988

[SRC84] Saltzer, Reed, and Clark, "End-to-end Arguments in System Design," *ACM ToCS*, 2(4):277-288, Nov. 1984

Design Goals of the Internet

1. Interconnect existing networks
2. Survivability
3. Support multiple types of service
4. Network agnostic
5. Distributed management of resources
6. Cost effective
7. Easy host attachment
8. Accountability

Primary Goal: Interconnection

Lead to fundamental structure of the Internet:

- separately administrated packet-switched networks
- connected together with gateways
- gateways run store-and-forward packet forwarding

Survivability

Architecture must mask completely any transient failure

- conversation state must be protected from loss
- by end-to-end argument, states are kept at the endhosts
- it's ok to lose state if the endhost itself is lost
- gateways are stateless

Survivability is second to interconnection:

- network not assumed to report error
- even at the cost of slower and less specific error detection

End-to-End Argument

Functions placed at low levels of a system may be redundant or of little value compared to their cost

- low-level systems may not have all required information to do the job efficiently and effectively
- not all high-level apps may need the provided functions, e.g., multimedia traffic may not benefit from reliable delivery

Low-level supports are justified only as performance enhancement

- may be too late/expensive to provide a function at the higher-level, e.g., retransmit file instead of packet
- several high-level apps share the required functions

Types of Service

Different apps have different requirements in terms of reliability, delay, bandwidth

- interactive vs. batched
- multimedia vs. text only

Transport service is thus separated from network delivery

- network delivery is best-effort datagram
- intended only as a building block not a service in itself

Network Agnostic

Minimal assumptions about the functions provided by the network:

- can transport a packet or datagram
- reasonable MTU
- reasonable but not perfect reliability
- some suitable form of addressing

Not assumed:

- reliable, sequenced delivery
- network level broadcast or multicast
- priority packets
- multiple types of service
- internal knowledge of failures, speeds, or delays

Other Goals and Difficulties

Distributed management:

- two-tiered routing allows different administrative domains to cooperate without trust

Cost effectiveness:

- delivery overhead too high in some cases
- loss recovery by retransmission could be inefficient

Architecture is not implementation
Policy is not mechanism
Translating one to the other could sometimes be difficult

Non Goals of the Internet

"Flow-based" resource management, with "soft state"
⇒ Integrated-services network
⇒ Traffic engineering and MPLS

Evolvability
+Security ⇒ Content-centric networking
+Network management ⇒ Software-defined networks