

Advanced Computer Networks

Internet Design 2

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Feedback on A0

- More “networks” courses CSC
 - **Advanced Communication Networks**
 - **Wireless and Mobile Networks**
 - multimedia networking in **Multimedia Systems**
 - network computing in **Distributed Systems**
 - Network Security and Testing
 - the course focuses on layer 3+ and the control plane
- More “networks” courses from ECE
 - **Design and Analysis of Computer Communication Networks (CENG461/ELEC514)**
 - Topics in **Wireless Networks**

Discussion board

- Get help and help others
 - <http://groups.google.com/group/csc485>
- Ways to get help
 - most importantly, attend lectures and participate in reading, presentation and discussion
 - use Google group as much as possible
 - also for your project web page
 - write to lecture instructor
 - meet during course office hours
 - arrange for extra help

Course schedule

- Week 1~2: Intro, Internet 1/2, architectures (2)
- Week 3~5: P2P networking (5)
- Week 6~7: Congestion control (4)
- Week 8~9: Network routing (3)
- Week 10~11: Traffic management (4)
- Week 12: Extra topics, project presentation
- Week 13: Project presentation

Reading groups

- Three reading groups (A, B, C)
 - by now, we have 16 students registered in class
 - may still see fluctuation
 - 5~6 students in each group
- Reading summaries start from the next lecture
 - 18 lectures in total (plus 3 for project presentation)
 - each student has 6 reading summaries and one paper presentation
- Will match your presentation interest as much as possible, but no guarantee

Internet Design 1

- What do we have so far (in early 90's)?
 - Internet Protocol Suite
 - store-and-forward packet switching
 - end-to-end arguments
 - TCP/IP designed, implemented and deployed
 - a growing Internet
 - connected machines, users, coverage
 - Web
 - in addition to remote login, file transfer, electronic mail

“What's next?”

- [She95] S. Shenker, "Fundamental Design Issues for the Future Internet". IEEE Journal on Selected Areas in Communications, Vol. 13, No. 7, September 1995, p p. 1176-1188.
- [CWRB02] D. Clark, J. Wroclawski, K. Sollins, and R. Braden, Tussle in Cyberspace: Defining Tomorrow's Internet , Proceedings of ACM SIGCOMM '2002. [tussle]

“The current Internet”

- Best-effort [BE] data service
 - no admission control
 - no service assurance
 - no guarantee on delivery
 - reliability achieved end-to-end (mostly by TCP)
 - still mostly true TODAY!
- Well-suited for elastic applications
 - adaptive to available bandwidth, delay, loss, etc
 - adaptive to network congestion

What's new?

- Multimedia “real-time” applications
 - voice over IP (VoIP)
 - delay, jitter
 - IP television (IPTV)
 - bandwidth, delay
 - massive multi-player online gaming (MMOG)
 - delay, many users
- The problems
 - fit into the BE architecture
 - coexist with existing applications

The goal of network design

- Network is an infrastructure
 - to make user/application “happy”
 - the applications just get diversified
 - so do the application requirement
- How to measure the user “happiness”?
 - utility function
 - as a function of performance measures
 - e.g., throughput, delay, loss
 - proportional to how much the user is willing to pay
- The network efficacy: the sum of utilities

How to increase network efficacy

- Throw in more resources
 - e.g., overprovisioning
 - when resources are really cheap
 - no extra mechanisms necessary
- Service differentiation
 - example: priority queue
 - M/M/1 queue
 - different utility functions
 - increase system complexity
- Integrated or separate networks?

This lecture

- Design issues for the future Internet
 - beyond best-effort
 - integrated networks
 - data, voice, video
 - service differentiation
 - utility function
 - goal: increase network efficacy
- Explore further
 - [CWRB02] D. Clark, J. Wroclawski, K. Sollins, and R. Braden, Tussle in Cyberspace: Defining Tomorrow's Internet , Proceedings of ACM SIGCOMM '2002. [tussle]

One more message...

- Considering graduate school?
 - there is a lot of financial support you can use!
 - needs-based, merits-based, ...
 - NSERC Postgraduate Scholarship (PGS)
 - Canada Graduate Scholarship (CGS)
 - Provincial Government of BC
 - 2,500 more graduate seats in three years
 - new Pacific Century Graduate Scholarship!
 - UVic Fellowship
 - Teaching Assistantship, Research Assistantship

Next lecture

- (some new) network architectures
 - required reading
 - [FG01] P. Francis and R. Gummadi. "IPNL: A NAT-extended Internet architecture." In Proceedings of ACM SIGCOMM, San Diego, CA, Aug. 2001. [IPNL]
 - [SAZSS04] I. Stoica, D. Adkins, S. Zhuang, S. Shenker, S. Surana, "Internet indirection infrastructure," IEEE/ACM Trans. Networking, Vol. 12, No. 2, pp. 205- 218. [I3]