

Notes for DigiComm II

CL

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0.1 Digital Communication II

Lecturers: Jon Crowcroft, plus guests (jon.crowcroft@cl.cam.ac.uk)

No. of lectures: 20, or so

Prerequisite course: Digital Communication I

This course is a prerequisite for Security (Part II).

Aims

This course aims to provide a detailed understanding of how computer networks operate, through the examples of the Internet, and presents ways to build such systems. It also covers a selection of topics which relate to recent trends in digital communications systems. The material falls roughly into two halves: Protocols, and Technologies/Performance.

Lectures

- **Introduction.** Course overview. Some example networks. Abstraction, layering. The OSI reference model.
- **The Internet: IP.** IP overview/review. Networking in Unix: structures, buffering, sockets, network interfaces. IP addresses and (simple) routing. Subnetting. IP checksum. Fragmentation.
- **The Internet: routing.** Terminology: AS, IGP, EGP. Routing protocols: distance vector *versus* link state. Examples: RIP, OSPF. AS routing: I-BGP/E-BGP, metrics.
- **The Internet: UDP, TCP** TCP operation, state transitions. Handling loss: acks and retransmissions. Estimating RTT. Basic congestion control. Improving things: TCP vegas, SACKs, ECN.
- **The Internet: network resource management.** Differentiated and Integrated Services. Signaling (RSVP) and Admission Control, Forwarding and Scheduling, Policing and Shaping. The future.
- **The Internet: Applications, Multimedia, NFS & HTTP** RTP operation, Playout adaption;

- **The Internet: multicast and QoS routing.** Other TCP details. Internet multicast model. Applications. Basic implementation. Refinements.
- **Pricing and other Miscellany.** Model and motivation. Practical considerations. The future.

Objectives

At the end of the course students should be able to

- enumerate and explain the layers of the OSI reference model
- compare and contrast connectionless and connection-oriented networks
- explain how IP routing works
- describe the components of the Internet resource management system
- describe how and why TCP attempts to handle congestion in the network

Recommended books

Quite a lot of reference is made to this first book.

Srinivsan Keshav. (1997). *An Engineering Approach to Computer Networking*. Addison-Wesley Pub Co; (1st ed.); ISBN: 0201634422

Alternative to Keshav: Bruce S. Davie & Larry L. Peterson & David Clark (1999). *Computer Networks: A Systems Approach*. Morgan Kaufmann Publishers (2nd ed.); ISBN: 1558605142

This is a really good practical reference:

W. Richard Stevens (1994) *TCP/IP Illustrated, Volume 1: The Protocols*. Addison-Wesley Pub Co, (1st ed.); ISBN: 0201633469

Alternative to Stevens: Douglas Comer (2000). *Internetworking with TCP/IP Vol. I: Principles, Protocols, and Architecture* Prentice Hall (4th ed.); ISBN: 0130183806

This last one is great if you are doing higher level work.

Background: Balachander Krishnamurthy & Jennifer Rexford (2001) *Web Protocols and Practice: HTTP/1.1, Networking Protocols, Caching, and Traffic Measurement*. Addison-Wesley Pub Co (1st ed.); ISBN: 0201710889