0.1 Digital Communication II

Lecturers: Jon Crowcroft, Dr I.A.Pratt, plus guests (jon.crowcroft@cl.cam.ac.uk
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No. of lectures: 16, 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. Abstraction, layering. The OSI reference model. JAC

- **The Internet: IP.** IP overview/review. Networking in Unix: structures, buffering, sockets, network interfaces. IP addresses and (simple) routing. Subnetting. IP checksum. Fragmentation. JAC


- **The Internet: UDP, TCP** TCP operation, state transitions. Handling loss: acks and retransmissions. Estimating RTT. Basic congestion control. Improving things: TCP vegas, SACKs, ECN. [JAC, 2 lectures]

- **The Internet: network resource management.** Differentiated and Integrated Services. Signaling (RSVP) and Admission Control, Forwarding and Scheduling, Policing and Shaping. The future. JAC

- **The Internet: Applications, Multimedia, NFS & HTTP** RTP operation, Playout adaption; RPC & Network File Systems; HTTP, HTTP 1.1 - making it all work JAC

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

• **ATM case study** Multiplexing and virtual circuits. Signalling. ATM Adaption Layers. Quality of Service CBR, VBR, ABR. IAP

• **Wide Area Networks.** Fibre Technology. Long-haul link design. Dense Wave Division Multiplexing. Sonet/SDH. MPLS. Packet over SONET. Optical switching. IAP

• **Access Networks.** Cable Modems. xDSL. Fixed wireless. Satellite. Firewalls and Network Address Translation. IAP

• **Local Area Networks and System Area Networks.** Fast/Gigabit Ethernet. Optimising latency. Host interface design. User-space protocol processing. IAP

**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**


