

# Internet Engineering

241-461

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## Course Information

- Course conducted in English
- Everything in English

**But: This is NOT an English class**

- The quality of student's English is not relevant to the course, or to the student's results.

### Interactive Classes

- Students **MUST** talk!

**Do not attempt to copy down the contents of the slides,**

- Everything will eventually appear on the Web.
  - > Ignore earlier years - this year is different.

## Class Times

- ◊ Monday 15:00 - 16:00 Room A200 (-> CNR)
- ◊ Wednesday 15:00 - 16:00 Room A202 (-> CNR)
- ◊ Friday 15:00 - 16:00 Room A200 (-> CNR)

### ◊ COME TO CLASS

- Some material you will not get other ways

◊ **Tell me - IMMEDIATELY - if you do not understand**

- It is important to understand what I say

## Course Outline (trivia)

### ◇ Introduction to the Subject

- Teaching Methods
- Lectures
- Books
- Assignments
- Exams

## Teaching

### ◇ Learning about the Internet

- how it works
- how to control & fix it

### ◇ Start with requirements

- Work down to implementation
- Satisfy the requirements

### ◇ See how the Internet does that

- And why

### ◇ From Internet Layer

- Work back up to Applications
- Add some technical details
- And extra facilities

## Books

### ◇ James F. Kurose & Keith W. Ross

- ◇ Computer Networking - A Top-Down Approach ...
  - (2nd / 3rd / 4th edition)

### ◇ W. Richard Stevens

#### ◇ TCP/IP Illustrated

- (3 Volumes, Vols 1 & 3 most relevant)

### ◇ Douglas Comer

#### ◇ Internetworking with TCP/IP, Vol 1

- (Also Vol 2 - variants for
  - ▷ ANSI C, BSD, Linux, SvR4, AT&T TLI, Windows, ...)

## Books

- ◊ Christian Huitema
- ◊ IPv6, The New Internet Protocol
- ◊ Cheswick & Bellovin
- ◊ Firewalls and Internet Security
- ◊ Kaufman, Perlman & Speciner
- ◊ Network Security:
  - Private Communication in a Public World

## Assessment

- ◊ To be advised later
  - Mid-semester Test
  - Final Exam
  - Assignment
  - Quiz
  - Participation
  - ???
- ◊ Exams are OPEN BOOK
  - You can take books, notes, ... into the exam
  - No point memorising material
    - You could just copy it from the book
    - So no exam questions will ask for that
  - You must understand instead

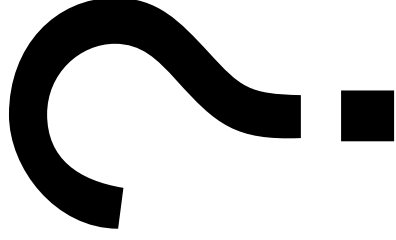
## Applications

- ◊ The work the users do
  - Work or play...
- ◊ Sets the requirements
  - What Internet must achieve
- ◊ Familiar Applications
  - The Web (WWW)
  - E-Mail
- ◊ What do they require?

## Before Wednesday

- ◇ Think about
  - E-Mail
  - The Web
    - ▷ (with all of its applications)
  - File Sharing
- ◇ How do they work
  - What do they need to work properly
- ◇ Be prepared to talk about it all

## Application Protocol Requirements



## Application Protocols

- ◇ All the work that seems useful
  - transport just moves data
- ◇ Determining
  - what data to transfer
  - how to transfer it
  - from where
- ◇ Usually Client / Server
  - Server
    - ▷ continually running
    - ▷ takes requests
    - ▷ processes & returns replies
  - Client
    - ▷ dynamic - runs when needed
    - ▷ initiates connections
    - ▷ decides what needs to be done

## Client / Server

- ◇ **Client/Server**
  - Refers to role in a particular connection
  - Sometimes to particular processes
  - Less accurately to systems running processes
- ◇ **Client**
  - The system that initiates the connection
- ◇ **Server**
  - The system that receives the connection
- ◇ **Client Today, Server Tomorrow**
  - Or in 5 minutes
- ◇ **Client for one application**
  - Server for Another
- ◇ **Client & Server for same application**
  - At the same time
  - Different connections

## The Web

- ◇ **Large distributed data collection**
  - With links between elements
- ◇ **Thousands of web servers**
  - Provide access to data
    - ▷ web pages
    - ▷ content
- ◇ **Millions of web clients**
  - ▷ browsers
  - ▷ & others
  - Retrieve web pages from servers
  - Display to user
- ◇ **HyperText Markup Language HTML**
  - Defines web content
  - Allows browser to layout web pages
  - Provides links to other pages
    - ▷ Outside scope of this course

## Browsing the Web

- ◇ **Need to identify web location**
  - Uniform Resource Locator
    - ▷ Identifier of a resource
    - ▷ A web page
      - Or part of a web page
      - Or almost anything
    - ▷ Provides the address of the page
  - Also
    - ▷ URL - Uniform Resource Identifier
    - ▷ URN - Uniform Resource Name
- ◇ **Uniform**
  - Common, Standard
  - The same for everything
- ◇ **Resource**
  - Anything needed to be identified
  - Anything that may need to be accessed
- ◇ **Locator**
  - Address - provides location information

# Browsing the Web (2)

- ◊ **Browser needs to**
  - fetch data identified by URL
  - build data into web page
  - display
- ◊ **Only data fetch relevant here**
  - need a protocol to fetch data
- ◊ **Several protocols exist**
  - FTP
    - complicated
  - TFTP
    - too simple & restricted
  - ...
- ◊ **HTTP**
  - new file transfer protocol
  - suited to URL fetch

## HTTP Model

- ◊ **HyperText Transfer Protocol**
  - Protocol for transferring HyperText
    - text containing links
  - Originally HyperText
    - Now transfers anything
- ◊ **Operation**
  - Client connects to server
  - Client requests a web page from server
  - Server sends web page
    - plus some status information
  - Connection closed
- ◊ **Issues**
  - How to request file ?
  - How to receive file & status ?
  - How to discover type of file ?

◦ very simple protocol

## HTTP

- ◊ **Application Protocols**
  - Text based
    - commands & replies are all words
  - Binary
    - commands & replies are numbers (not digits)
- ◊ **HTTP is text based**
  - Easy to debug
    - Can connect to server and type
      - And read responses
  - Easy to extend
    - Define meanings for new words
  - Compatible with other protocols
    - FTP, SMTP, ... all text based