...MAKE YOUR NETWORK SMARTER

Application concepts, WWW and HTTP
Perspectives on (mobile) communications

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Introduction

- Internet and the WWW
  - Perspective and concept
  - Mechanism and acronyms
  - HTTP
- Review of datacomm essentials
- Mobile communications

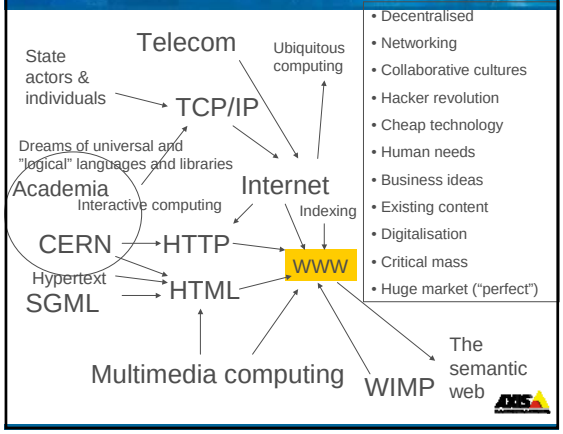
WWW history

- 1983 - Darpa mandates TCP/IP
- FTP & Telnet (Archie, Gopher, Veronica &c)
- 1990 - WWW (Tim Berners-Lee)

WWW success factors

- Universal
  - Universal access
  - Platform independence
  - One information space
- Client-server model (*thin* client!)
- Hypertext
- Decentralized architecture

Origins, concepts and developments



WWW implementation

- Common file protocol
  - HTTP: Hypertext Transfer Protocol
- Common presentation layer
  - HTML: Hypertext Markup Language
- Common addressing scheme
  - URL: Uniform Resource Locator
    - method://host/path/file

And now...

- Alphabet soup

Markup languages

- Structured document content
- HTML
- SGML
- XML
- Separate content, structure and style
- DOM, Document Object Model

HTML example

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 3.2 Final//EN">
<HTML>
<HEAD>
<TITLE>My page</TITLE>
<META HTTP-EQUIV="Content-Type" CONTENT="text/html; charset=windows-1252">
<META NAME="Author" CONTENT="John Doe">
</HEAD>

<BODY>

<H1>Miscellany</H1>

<P>I've got a little black book with my poems in.
Got a bag with a toothbrush and a comb in.</P>

<P>Is this <EM>it</EM>?</P>

<P>I reached the Alps: the soul within me burned,
<I>Italia</I>, my Italia, at thy name:</P>

<P>
    <A HREF="http://validator.w3.org/check/referer"><IMG BORDER="0"
        SRC="http://www.w3.org/Icons/valid-html32"
        ALT="Valid HTML 3.2!" HEIGHT="31" WIDTH="88"></A>
    </P>

</BODY>
</HTML>
```

Miscellany

I've got a little black book with my poems in. Got a bag with a toothbrush and a comb in.

Is this it?

I reached the Alps: the soul within me burned, *Italia*, my Italia, at thy name:

XML DTD example

From http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd:

```
• <!ELEMENT html (head, body)>
• <!ELEMENT table (caption?, (col*|colgroup*), thead?,
tfoot?, (tbody+|tr+))>
• <!ATTLIST table
  %attrs;
  summary     %Text;          #IMPLIED
  width       %Length;        #IMPLIED
  border      %Pixels;        #IMPLIED
  frame       %TFrame;        #IMPLIED
  rules       %TRules;        #IMPLIED
  cellspacing %Length;        #IMPLIED
  cellpadding %Length;        #IMPLIED
  align       %TAlign;        #IMPLIED
  bgcolor     %Color;         #IMPLIED
  >
```

Server programming

- Programs embedded in web pages
  - SSI, PHP, ASP
- Web interfaces to programs
  - CGI
- Web server APIs
  - NSAPI
  - ISAPI
  - mod_perl
  - Java Servlets

Client programming

- Scripts
  - JavaScript (ECMAScript)
  - VBScript
- Binary code
  - ActiveX
  - Plugins
  - Java applets

Component architectures

- CORBA
- DCOM
- Java Beans
- Web services
  - J2EE
  - .NET

Layout

- CSS, Cascading Style Sheets
- XSL, Extensible Style Sheet language

HTTP 1.0

- Stateless
- TCP-compatible flows over the Internet

Commands

- GET
- POST
- HEAD

```
Request or Response-Line CRLF

General-Headers CRLF
Request or Response-Headers CRLF
Entity-Headers CRLF
CRLF

Entity-Data
```

Request - details

```
Request-Line =
Method SP Request-URL SP Version
  CRLF

Full-Request = Request-Line
               *( General-Header
                | Request-Header
                | Entity-Header )
               CRLF
               [ Entity-Body ]
```

Request Header

- Authorization
- If-Modified-Since
- Referer
- User-Agent

Response - details

```
Status-Line =
Version SP Status-code SP Phrase
  CRLF

Full-Response = Status-Line
                *( General-Header
                 | Response-Header
                 | Entity-Header )
                CRLF
                [ Entity-Body ]
```

Status-line

```
Status codes:
- 1xx: Informational
- 2xx: Success
- 3xx: Redirection
- 4xx: Client Error
- 5xx: Server Error

Example:
200 OK
401 Unauthorized
404 Not Found
```

Response Header

- Location
- Server
- WWW-Authenticate

Object - Entity

- Entity-header
- Entity-body

Entity-header

```
Entity-Header = Content-Encoding
              | Content-Length
              | Content-Type
              | Last-Modified
```

Entity-body

- Request
  - Only if required by the method
  - Exists if Content-Length is present
- Response
  - Depending on method
  - Depending on status code

HTTP 1.1

- Caching
- “Persistent” connections
- Sloppy HTTP 1.0 implementations

Communication is (really) hard

- Coordination: end-in-itself, caching
- Flow control
- Lossy channel
- Routing
- Addressing
- Multiplexing
- Node failures, link failures, address changes, load changes
- Performance: bandwidth, latency, jitter, node CPU and memory load
- Security & robustness: malevolence and error
- Quality of service differentiation
- Accounting

Headers and dynamics

- Protocol versions
- Address fields including multiplex fields
- Sequence numbers
- Length/checksum etc.
- Data payload
- Peer-peer control messages

Mobile communications

- Mobile user, wireless communcations
- Physical layer much more complicated
- Security, lossiness, performance
- Dynamic topologies
  - Ad hoc networks
  - Roaming

Mobility in TCP/IP context

- IP address contains topological information
- Caching (DNS in particular)
- TCP connections identified by IP address
- Security: receiver address capture
- Slow start assumes congestion

Wireless typology

- Cellular: NMT, GSM, GPRS, UMTS
- WLAN: 802.11, HIPERLAN
- Cable replacement, PAN: Bluetooth