Web Sites
and
Web Apps

An introduktion to world of

Web-site and Web-App

development

Agenda

- The Basic Web architecture
  - The Origins of the WWW
  - HTML
  - URL
  - HTTP
  - The Web Server
  - The Browser
- Web enhancements
  - Dynamic html generation
  - CSS
  - Java applets
  - Java script
  - Ajax
- Web Dev Tools

The Origins of the WWW

- WWW was invented by Tim Berners-Lee (a physicist) at CERN in 1989-1992

- Main purpose:

Hypertext across the Internet

(replacing FTP)

- Five constituents:

HTML	Mark-up language for hypertext
URL	Notation for locating files on serves
HTTP	High-level protocol for file transfers
Web server	Sends a file as a http response when requested
Browser	Receives HTML documents and render them as visible pages

The Origin of HTML

- HTML is an acronym for Hyper Text Mark-up Language
- HTML 1.0 was a simplification of SGML (Standard Generalized Markup Language) with the addition of the Link element

Year	Version
1991	*HTML Tags*, an informal CERN document was first mentioned in public.
1992	HTML 1.0. First informal draft of the HTML standard. *Tim Berners-Lee proposal.*
1993	HTML+ was published by the IETF as an Internet-Draft .
1995	HTML 2.0 was published as IETF RFC 1866
1996	The HTML standard is now developed by W3C
1997	HTML 3.2 was published as a W3C Recommendation. *The Browser War ends.*
1997/98	HTML 4.0. Style sheets are introduced - CSS.
2000-02	XHTML 1.0 published as a W3C Recommendation. An XML version of HTML 4.01.
2008	HTML5 was published as a Working Draft by the W3C.
2014	HTML5 was published as a W3C Recommendation.
2016	HTML5.1 is expected to be published as a W3C Recommendation.

HTML

- HTML describes the *logical structure* of a document
- HTML uses tags *<tag>* to structure the text

```
<html>
  <head>
    <title>I4GUI</title>
  </head>
  <body>
    <h1>GUI programmering</h1>
    <h2>I4GUI</h2>
    <p>Til Web-applikationer anvendes <b>HTML</b>,
       CSS og Javascript.</p>
  </body>
</html>
```


C:\Users\PoulEjnar   I4GUI

GUI programmering

I4GUI

Til Web-applikationer anvendes **HTML**, CSS og Javascript.

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Uniform Resource Locator - URL

- A Web resource is located by a URL:

  `http://www.iha.dk:1234/path/file.html?x=2&y=7`

  Scheme   Server   Port   Path   Query

  80 is default

- A relative URL:

  `path/file.htm`

- Fragment identifier

  `http://www.iha.dk/path/file.html/#section4`

  Fragment id

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URI

- URLs are a subset of the more general concept of Uniform Resource Identifiers (URIs)

- The general URI syntax is very flexible:

  scheme:*scheme-specific-part*

- Many different schemes are defined besides http:
  ftp, file, mailto, imap, https, dict, geo …

- The official register of schemes is maintained by the Internet Assigned Numbers Authority (IANA):
  http://www.iana.org/assignments/uri-schemes.html

URL Rules

- All URLs follow certain rules:
    - '/' implies a hierarchical structure
    - '?' separates the queryable resource from the query string
    - '#' separates a fragment identifier from the URI
    - Special symbols are escaped with the notation '%NN' (NN is the characters hexadecimal code), e.g. %20 is ' ' (*space*)
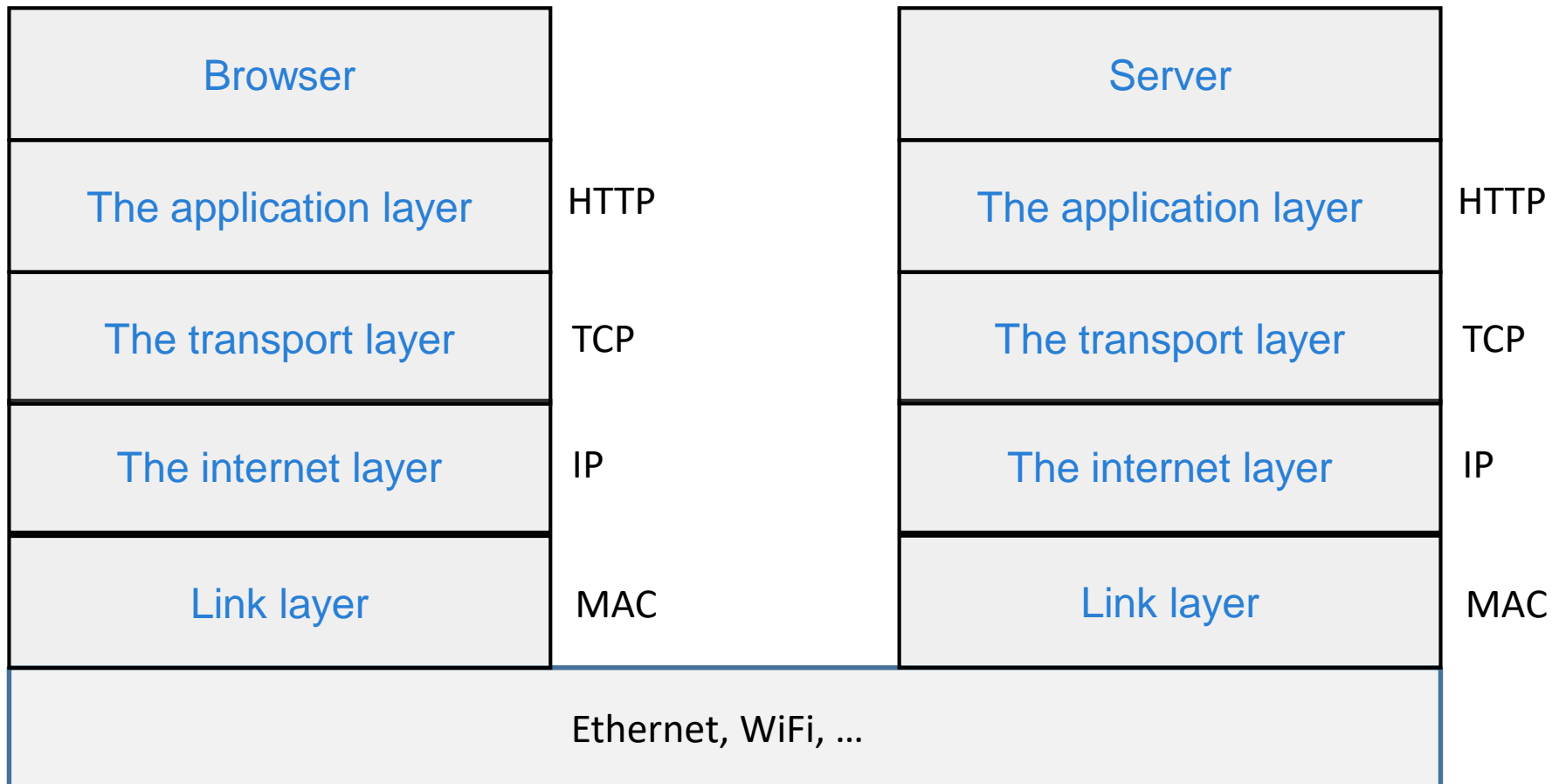
HTTP HyperText Transfer Protocol

- Client-Server model following a **Request-Response** pattern
- Previus version v1.1 (RFC 2068) from 1997
  - Updated in 1999 (RFC 2616)
- Current version is HTTP/2 (RFC 7540) from May 2015

HTTP - Request

HTTP - Response

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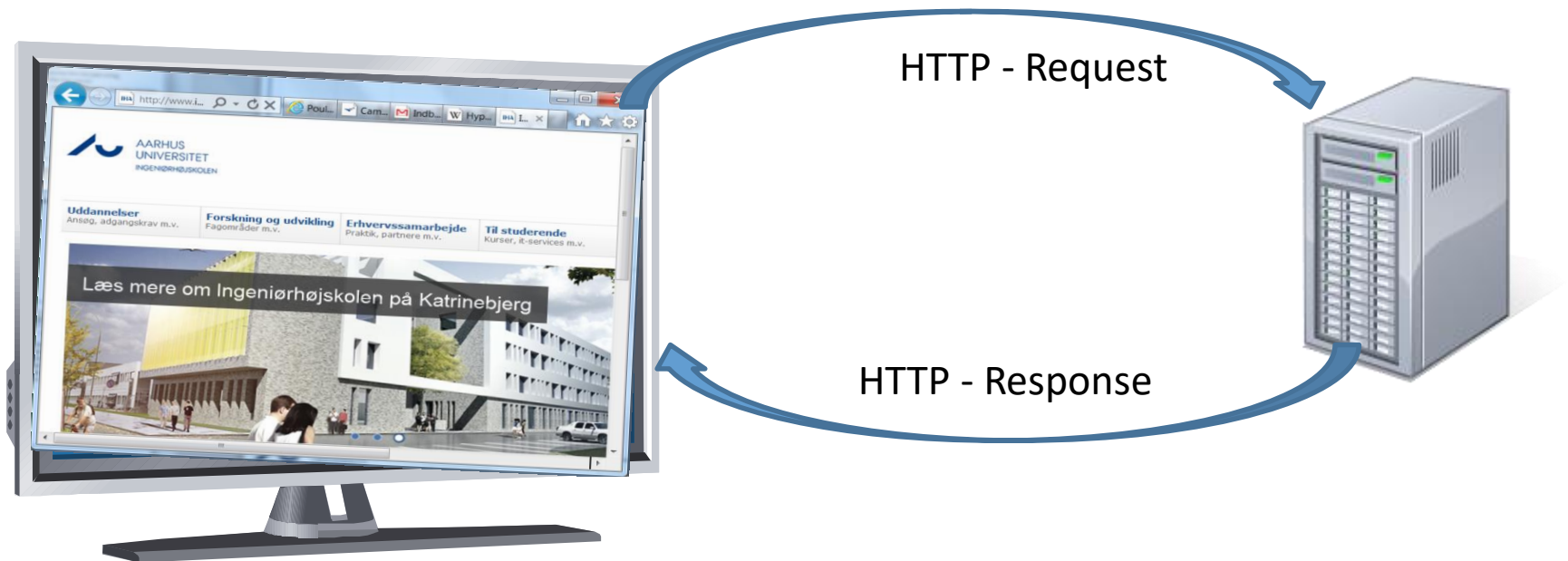
HTTP/2

- The HTTP/2 specification was published as RFC 7540 in May 2015
  - The specification was developed by the Hypertext Transfer Protocol Bis (httpbis) working group of the IETF
- **Goals for HTTP 2.0 include:**
  - **Asynchronous connection multiplexing**
    - One of the bottlenecks of HTTP v1.1 implementations is that HTTP relies on multiple connections for concurrency
  - **Header compression**
    - Reduces overhead
  - **Server push technologies**
    - This allows the server to supply data it knows a web browser will need
- Result:
  - **Page load speedup ranging from 11.81% to 47.7%**
- Is backwards compatibility with the semantics of HTTP 1.1
  - The element that is modified is how the data is framed and transported between the client and the server

Network Layers

Browser		Server	
The application layer	HTTP	The application layer	HTTP
The transport layer	TCP	The transport layer	TCP
The internet layer	IP	The internet layer	IP
Link layer	MAC	Link layer	MAC

Ethernet, WiFi, …

HTTP Verbs

- The client submits an HTTP **request** message to the server
- The server returns a **response** message to the client
- The response contains completion status information about the request and may also contain requested content (e.g. a html document) in its message body

- HTTP is a simple protocol with only few Request methods (verbs):
  - GET   *fetch* an existing ressource
  - POST   *create* a new resource
  - PUT   *update* an existing resource
  - DELETE   *delete* an existing resource
  - *And a few others*

HTTP Status Codes

- The client initiate a requests to the server with URLs and verbs
- In return, the server responds with status codes and message payloads
- Status Codes (extract):
  - 1xx: Informational Messages
  - 2xx: Successful
    - **200 OK**
  - 3xx: Redirection
    - 301 Moved Permanently
  - 4xx: Client Error
    - 400 Bad Request
    - 401 Unauthorized
    - 403 Forbidden
    - 404 Not found
  - 5xx: Server Error
    - 503 Service Unavailable

Web Client

- Connected to the Internet when needed
- Usually a web browser
  (*such as Chrome, Edge or Safari*)
- Uses HTTP (Hypertext Transfer Protocol)
- Requests web pages, files or data from server
- Receives web pages and files from server
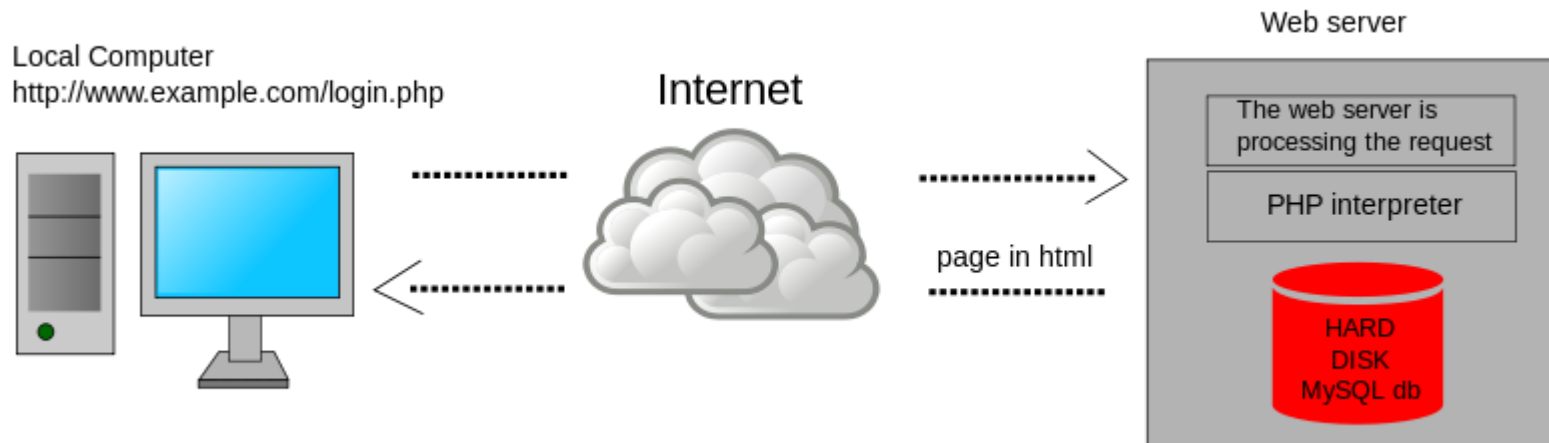- Renders the received html on the screen

Web Server

- Continually connected to the Internet
- Runs web server software
  (such as Apache, Internet Information Server or Node.js)
- Uses HTTP (Hypertext Transfer Protocol)
- Receives request for a web page
- Responds to request and transmits status code, web page, and associated files or data

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WEB ENHANCEMENTS

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Dynamic web pages

- **Dynamic web pages** are web sites that are generated at the time of access by a user or change as a result of interaction with the user

- A program running on the web server (server-side scripting) is used to change the web content on the web pages sent back to the client

- Typical server-side languages are PHP, ASP, JSP, Perl, Ruby, C#, Java, and Javascript

Local Computer
http://www.example.com/login.php

Internet

Web server

The web server is processing the request

PHP interpreter

page in html

HARD DISK MySQL db

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Dynamic Html Generation

- Dynamic web pages usually consist of a static part (HTML) and a dynamic part, which is code that generates HTML

- The code that generates the HTML can do this based on variables in a template, or on code

- The text to be generated can come from a database, thereby making it possible to dramatically reduce the number of pages in a site

> Consider the example of a real estate agent with 500 houses for sale.
> In a static web site, the agent would have to create 500 web pages in order to make the information available.
> In a dynamic website, the agent could potentially connect a single dynamic web page to a database table of 500 records.
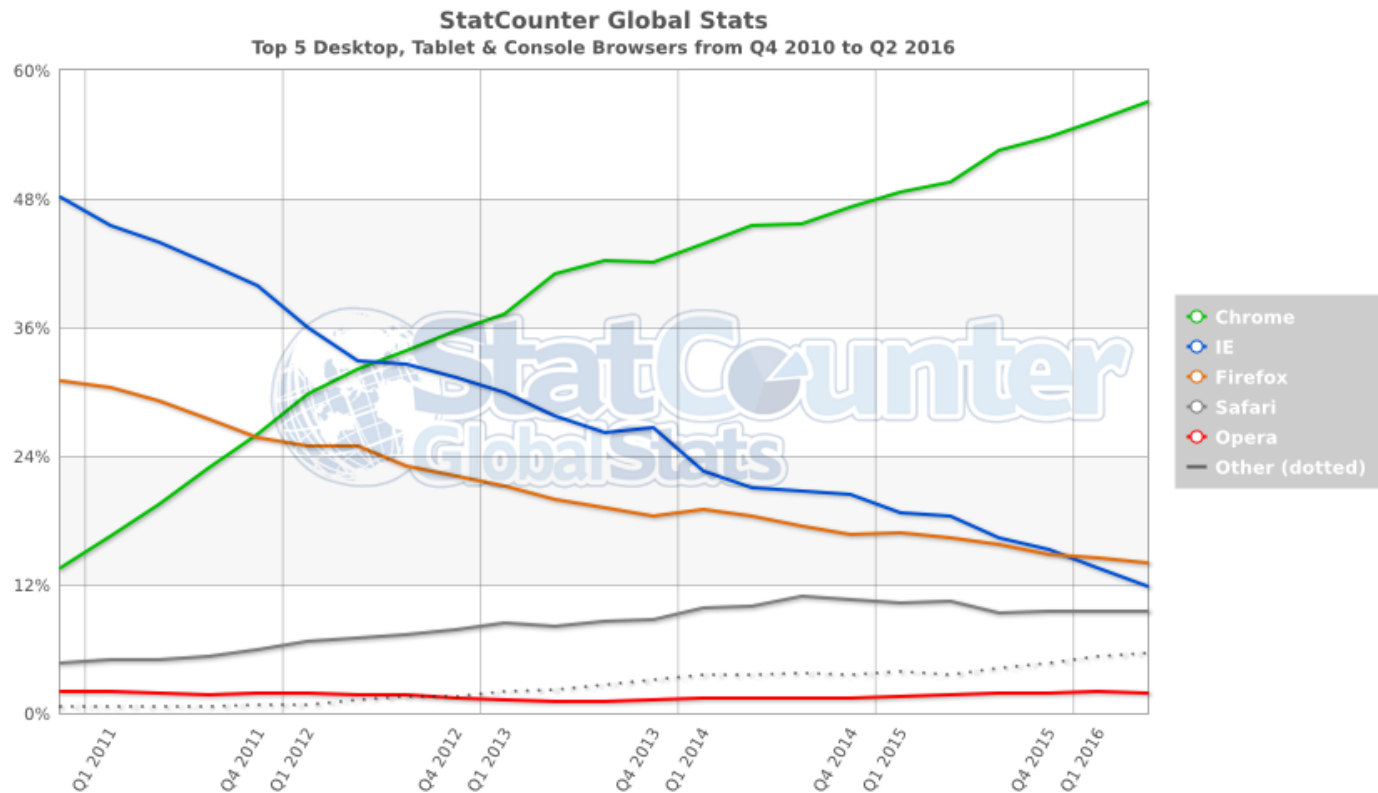
Client Side Scripting

- Client-side scripting is changing interface behaviors within a specific web page in response to mouse or keyboard actions, or at specified timing events

- In this case, the dynamic behavior occurs within the presentation

- The Client-side content is generated on the user's local computer system

- The client-side scripting languages is **JavaScript**
  - But there are alternatives like Flash and Silverlight

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WEB DEV TOOLS

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Browsers

- Web Applications are typical developed to target all/most browsers and on different platforms
- So you have to test your pages / apps in different browsers and on different platforms
- So install all the common browsers on your development machine, and then use services on the Internet to visualize your pages on the remaining browsers and platforms

StatCounter Global Stats
Top 5 Desktop, Tablet & Console Browsers from Q4 2010 to Q2 2016

Legend:
- Chrome
- IE
- Firefox
- Safari
- Opera
- Other (dotted)

Editor or IDE?

- On Windows
  - MS Visual Studio
  - Or just a simple editor like Notepad++

- All Platforms (Windows, Mac, Linux)
  - JetBrains WebStorm
  - Brackets
  - Sublime Text
  - Atom
  - Visual Studio Code
  - ...

Validation

- Some IDEs have integrated validation of HTML and CSS, but if your tools does not include this service you can find it on the Internet

- HTML validation:
  - http://validator.w3.org/
  - http://html5.validator.nu
  - http://lint.brihten.com/html

- CSS validation:
  - http://jigsaw.w3.org/css-validator/

- Javascrit validation:
  - http://www.jslint.com/

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Debugging

- Most browsers have some debugging aid build in
  - Google Chrome is probably the best
    https://developers.google.com/chrome-developer-tools/
    http://www.dotsauce.com/chrome-developer-tools/

- But many web developers also appreciate Firebug (getfirebug.org)
  - The full version is for Firefox, but firebug light is for all browsers

- Or use Internet Explorer/Edge and Visual Studio

- And use Fiddler on Windows or Charles Proxy for OSX:
  http://fiddler2.com/home
  http://www.charlesproxy.com/

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Testing Environment

- For static web pages you only need browsers
- If you use a framework like ASP.Net, PHP etc. you need a local webserver for test and debugging

- If you use Visual Studio it will install IIS express locally

- If you plan to deploy to a Apache server you can install XAMPP locally (http://apachefriends.org)

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References and Links

- Wikipedia

- Web Development and Design Foundations with HTML5
  http://webdevfoundations.net/

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