Vorlesung
Advanced Topics in HCI
(Mensch-Maschine-Interaktion 2)

Ludwig-Maximilians-Universität München
LFE Medieninformatik
Heinrich Hußmann & Albrecht Schmidt
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http://www.medien.informatik.uni-muenchen.de/

Advanced Topics in HCI
Vorlesung Mensch-Maschine-Interaktion 2

Lehr- und Forschungseinheit Medieninformatik

- Prof. Dr. Heinrich Hußmann
  Institut für Informatik
  LFE Medieninformatik
  Amalienstraße 17
  80333 München
  V. Stock, Zimmer 507
  hussmann@informatik.uni-muenchen.de
- Dr. Albrecht Schmidt
  Institut für Informatik
  LFE Medieninformatik
  Amalienstraße 17
  80333 München
  V. Stock, Zimmer 502
  albrecht.schmidt@informatik.uni-muenchen.de

- Vorlesung: Donnerstag, 9-11 Uhr, Theresienstraße, Raum 113
- Übungen: Montag, 14-16 Uhr,
  Theresienstraße, Raum 139 oder Amalienstraße 17, Computerraum EG
  Übungsleitung: Andreas Pleuß
- Informationen zur Vorlesung und Übung:
  http://www.medien.ifi.lmu.de/lehre/ss2004/mmi2/

Inhalt

- Die Vorlesung „Advanced Topics in HCI“ (Mensch-Maschine-Interaktion 2) behandelt weitergehende Aspekte der Interaktion zwischen Mensch und Computer. Prinzipien und Konzepte der Mensch-Maschine-Interaktion werden in konkreten Anwendungsbereichen behandelt.

- Themen
  - Hypertext, Web Design, Web Usability, Accessability
  - Desktopanwendungen, GUI-Toolkits, User Interface Softwareentwicklung
  - Adaptive Benutzerschnittstellen, Intelligente UIs
  - Multimodale Benutzerschnittstellen, Sprachdialog, Gesten, Stifteingabe
  - Tangible User Interfaces
  - UIs für mobile Geräte und Wearable Computer
  - Groupware, CSCW, CSCL
  - Physiologische Fähigkeiten des Menschen, Psychologische Grundlagen

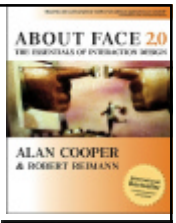
Ablauf und Anforderungen

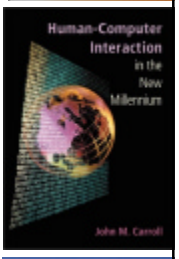
- Vorlesung mit Übung, 2h+2h
- Lesematerial (ca. ein Artikel pro Woche)
- Übungsaufgaben

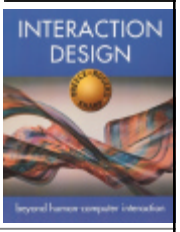
- Scheinkriterien
  - Erfolgreiche Teilnahme an den Übungen (ca. 5 Übungsaufgaben und ein kurzer Aufsatz zu einem vorgegebenen Thema)
  - Schriftliche Zusammenfassung des Lesematerials (ca. 150 Worte pro Artikel)

- Vorkenntnisse
  - Grundstudium Medieninformatik oder Informatik
  - Grundkenntnisse im Bereich Mensch-Maschine-Interaktion
  - Grundkenntnisse in der Programmierung von graphischen Benutzerschnittstellen
  - Englische Sprachkenntnisse

Books







- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale. (2003) Human Computer, Interaction (third edition), Prentice Hall, ISBN 0130461091
- Ben Shneiderman. (1998) Designing the User Interface, 3rd Ed., Addison Wesley; ISBN: 0201694972
- Alan Cooper, Robert M. Reimann. (2003) About Face 2.0: The Essentials of Interaction Design; ISBN: 0764526413.
- John M. Carroll. Human-Computer Interaction in the New Millennium. Addison-Wesley Professional (2001), ISBN: 0201704471
- Jennifer Preece, Yvonne Rogers, Helen Sharp. Interaction Design. John Wiley and Sons Ltd (2002). ISBN: 0471492787

Chapter 1: HCI and the WWW

Table of Content

- Human Computer Interaction (HCI)
  - a quick reminder
- Web Usability
  - Web Technology
  - Web Design
  - Management of Web projects
  - Usability evaluation of Web sites and applications
- Web Accessibility, Universal Access to Information
- Usability Report

Human Computer Interaction (HCI)

- *"Human-computer interaction is a discipline concerned with the **design**, **evaluation** and **implementation** of interactive computing systems for human use and with the study of major phenomena surrounding them"*
  (working definition in the ACM SIGCHI Curricula for HCI)

- Computer science view point:
  "Interaction between one or more **humans** and one or more **computational machines**"

Building Successful Digital Products

- tension
  - different objectives
  - different design goals
- step by step 1-2-3
- solution
  - Products in the overlapping space

From A. Cooper, About Face 2.0

What is Usability

- “Usability is a quality attribute that assesses how easy user interfaces are to use. The word ‘usability’ also refers to methods for improving ease-of-use during the design process.” (Jakob Nielson)
- “Scientific discipline using observation, measurement and design principles to enhance a site visitor’s ability to perform specific tasks” (Kathy Gill)
- “… the **effectiveness**, **efficiency** and **satisfaction** with which a specified set of users can achieve a specified set of tasks …” (ISO)

Why is Usability Important?

- Improving usability can
  - increase productivity of users
  - reduce costs (support, efficiency)
  - increase sales/revenue (web-shop)
  - enhance customer loyalty
  - win new customers
- Several case studies that show the benefit of usability
- Usability is often considered as sign of quality
- Working with users can create ideas for new products, e.g. "similarities" feature (*people who bought this also bought that*) at amazon.com, see Interview Maryam Mohit

Web Usability

- Usability of Web sites and applications delivered over the WWW
- Dependent on several issues related to
  - Web technology
  - Web design
  - Project Management
  - Usability evaluation
- Web usability is **not** about “adding some fancy graphics, color, and cool styles at the end of the project”
- Web usability can be measured!

Excurse: Web Technology

- Web technology basics
- Heterogeneous distributed systems
- Hypertext and Hypermedia
- Media, Media Types, MIME
- Caching

What do we need for a distributed system to share documents

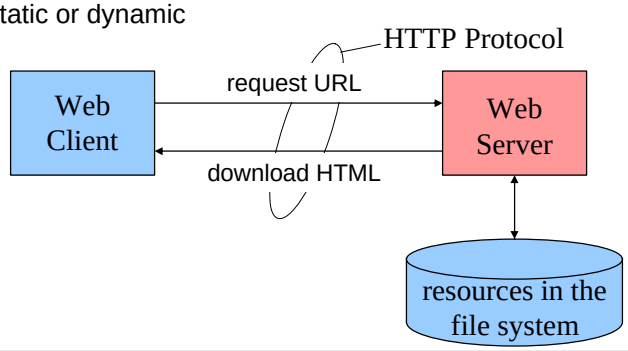
- How are documents encoded?
  - content
  - semantics
  - presentation
- How documents are identified?
  - Where is data held?
  - How can data be accessed?
- How are the documents transmitted/transported to the user?

The WWW Aproach

- Document format
  - Hypertext Markup Language, HTML
    - Document Type Definition (DTD)
      Standardized General Markup Language (SGML)
- Mechanism for identification
  - Uniform Resource Identifier, URI
    - use as Uniform Resource Locator, URL
- Transfer protocol
  - Hypertext Transfer Protocol, HTTP
    - ASCII-coded Request-Reply protocol using TCP/IP

Architecture and Protocol (simplified)

- client-server architecture
- synchronous communication model (request/response)
- resources
  - Unit that is communicated between Client and Server
  - static or dynamic



Resources in the WWW

- Structure of the documents exchanged
  - HTML, images, …
  - MIME-types communicate document type
- Visualization on the screen
  - Client parses HTML und visualizes the content
  - non-HTML is displayed by
    - the browser
    - client extension
    - plug-In
    - helper application

Documents contain Resources I

- reply of the servers

```
HTTP/1.0 200 OK
Content-Type: text/html
Content-Length: 3213

<html>
<head>
<title>Oracle Corporation - Home</title>
...
</head>
<body bgcolor="#ffffff" link="#000000" vlink="#ff0000">
...
<INPUT NAME=q size=10 maxlength=800 VALUE=""><INPUT
TYPE="image" src="/templates/images/search_btn.gif"
width=36 height=18 value="go" border=0>
...
<a href="/html/dev_it.html">
<img src="/images/devit_off.gif" alt="Developers/IT"
   border=0></a>
...
<img src="/images/clear_dot.gif" width=50 height=1>
...
</body>
</html>
```


Documents contain Resources I

- reply of the servers

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   border=0></a>
...
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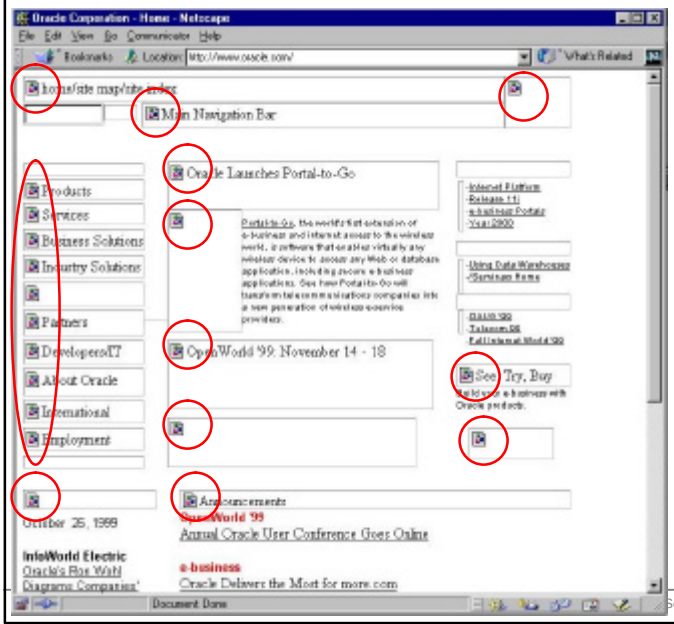
...
</body>
</html>
```

Documents contain Resources II

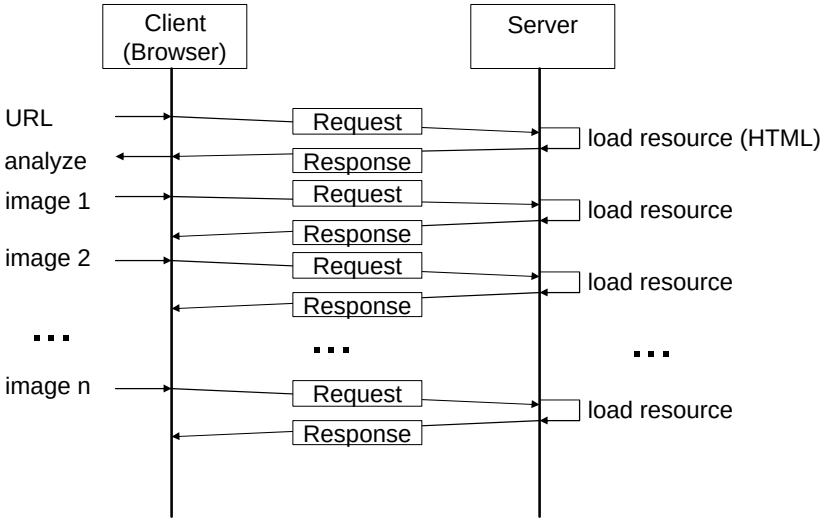


- images
- background
- buttons
- music
- audio

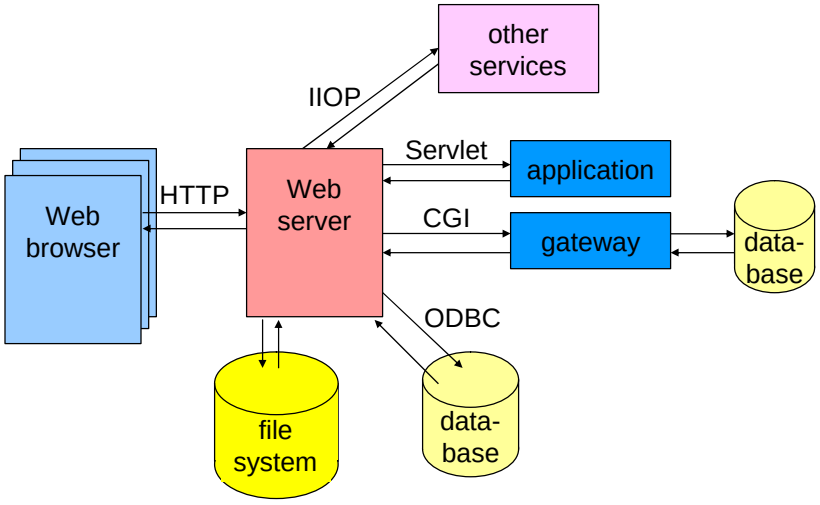
Documents contain Resources III

- images
- background
- buttons
- music
- audio

Documents contain Resources IV



More Realistic Example Architecture



The WWW is a Distributed System

- What is a distributed System?
  - Tanenbaum, A.,S. (from Computer Networks)
    "... in a distributed system, the existence of multiple autonomous computers is transparent (i.e., not visible) to the user."
  - Lamport (?)
    a distributed system is a system that you can not use at a certain moment because a machine is crashed which you even do not know that this exists.

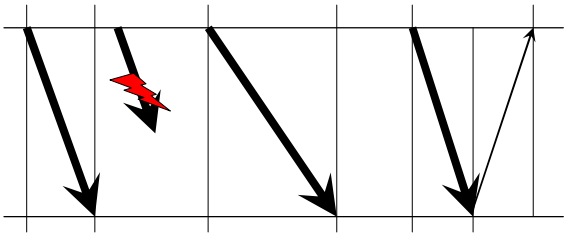
Information Exchange Between Browser and Server

- Obviously the document
- Further information available (e.g. header fields)
  - Browser type and version
  - Operating system (version)
  - Referer
  - Cookies
  - Screen size, window size
  - If Java/JavaScript/VBScript are enabled
  - List of plug-ins installed
  - Network parameter and route
  - …
- Rich source of information
  - Can make applications more usable
  - Information may not be complete or may be wrong

Try it out at:
http://privacy.net/analyze/

The WWW is a Distributed System Usability Issues

- Network
  - Delay
  - Failure
  - Jitter
  - Latency
  - Bandwidth



- Multi-user System
  - Work load, system performance
  - Concurrency problems

Designing Distributed Applications

- Basics
  - applications consist of several parts (e.g. different processes)
  - in general these parts are executed on different machines
  - these parts of the application are executed concurrently or one after another
  - there is communication between these parts

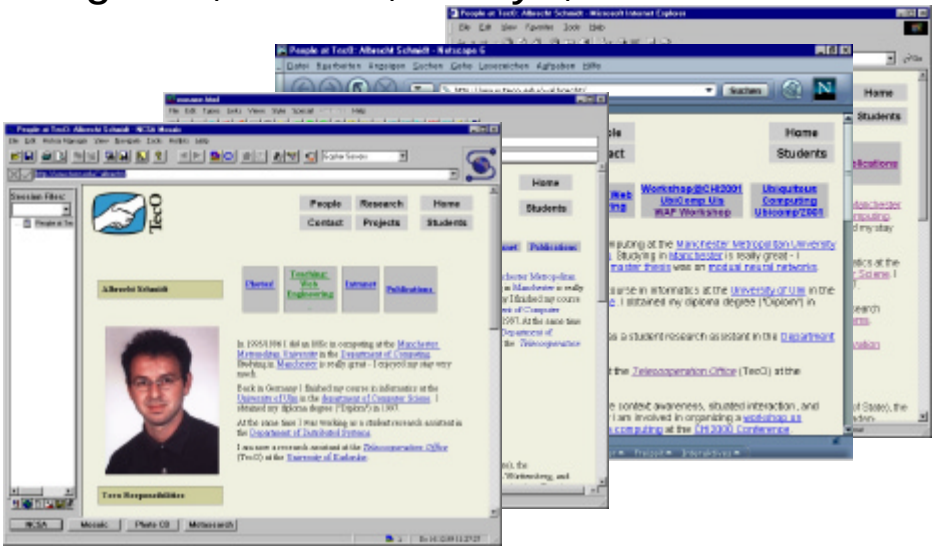
- Software/Application Design Aspects
  - data
    - analyzing data transfer (optimize for minimum)
    - investigate how caching can be supported
    - keep data save (minimize data that is given away)
  - functional
    - execute functions where it is most reasonable
    - regard the infrastructure on that the applications will be executed
  - response time (optimize for minimum)

Systems are Heterogeneous

Platform may vary to a great extent – it still should be usable

- Processing power
  - processor, co-processors, cache
  - RAM
- I/O-performance
  - hard drive speed
  - network
- Input and Output
  - displays
  - keyboard layout
- Additional Hardware and Periphery
  - video and audio (in/out)
  - card reader, printer, scanner
- Operating System

Graphical Browsers, e.g. IE5, Mozilla, Amaya, Mosaic

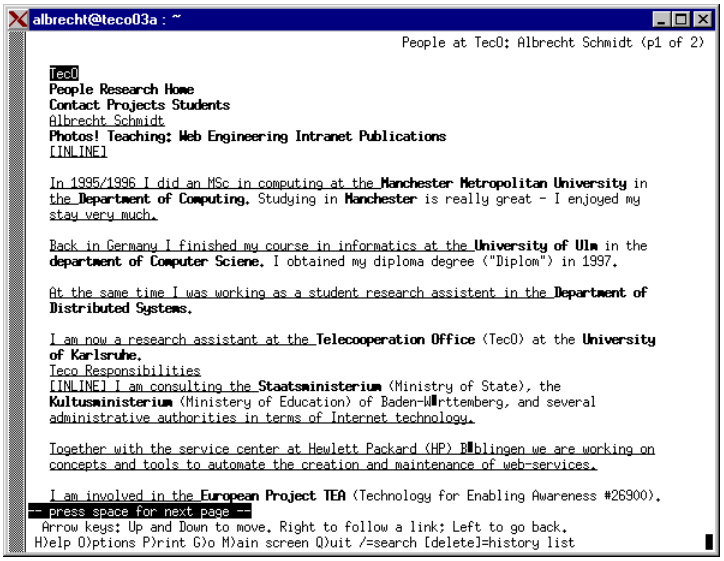


Graphical Browser - WebTV

More on the Viewer & Download **http://developer.webtv.net/**

Other Graphical Browser

Text or Audio Browser, e.g. Lynx



Compatibility

- To ensure usability define systems and environments that are supported (e.g. functional specification)
  - hardware
  - operating system
  - browser
  - network (bandwidth)
- the logfiles of an existing website for this user group can be used to calculate the percentage of compatibility
- Example (logfile 2001)

```
29% MSIE 5.X on Win95/Win98/NT
14% MSIE 4.X on Win95/Win98/NT
10% Mozilla4.X on Win95/Win98/NT
15% Mozilla4.X on Unix
3%  Mozilla3.X on Win95/Win98/NT
6%  Mozilla3.X on Unix
17% Robots
5%  others
```

85%

Organizing Information in the WWW

- based on a open hypertext system
- information can be organized in any way
  - partly „real“ hypertext with links based on content
  - partly indexed documents and catalogs
  - Partly simple collections of resources
- information is structured very differently
  - often mixture of linear and hierarchal structure
  - hypertext links are often not associative, but just to build a linear hierarchical navigation structure
    - previous/next
    - up/down/home

Hypertext

- concept to organize information
- motivation
  - “knowledge” is not linear, it is associative
  - authoring a document =
    making knowledge linear
  - reading a document =
    reproduce the non-linear structure of the knowledge ➔ navigation

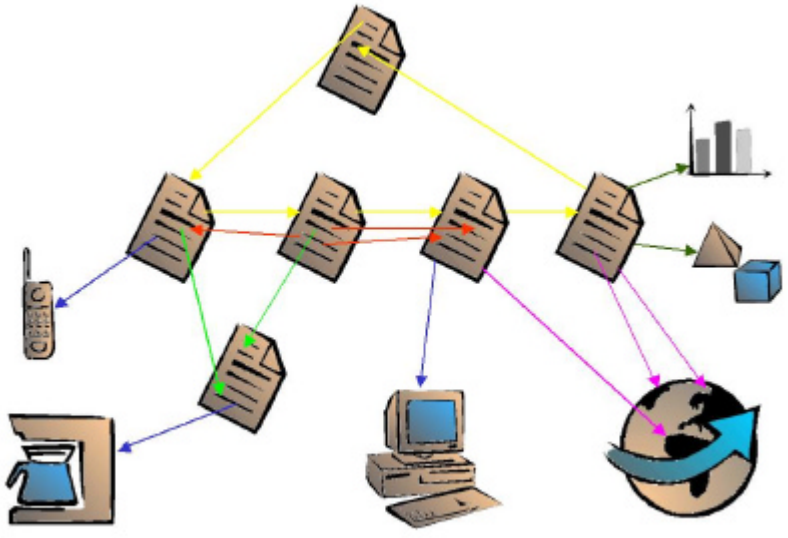
➔ hypertext-documents:

- keep the inherent association of information in a document

Roots of Hypertext

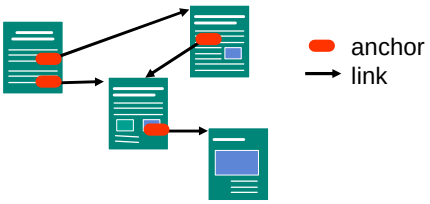
- "Memex"
  - Vannevar Bush: "As we may think", 1945
  - "Memory Expander"-Machine
  - associative storage/access
  - personal annotation linked to documents
- Xanadu
  - Ted Nelson, 1965/1981
  - term Hypertext
  - Docuverse: global hypertext system, Pay per View
- Augment/NLS (oNLine System)
  - Douglas Englebart, 1968
  - Shared Hypertext Document Spaces

Hypertext – Example I



Hypertext Components

- structure
  - hypertext document: directed graph
- components
  - node: information unit
  - anchor: Information chunk within a node, target for a link
  - link: connections between nodes

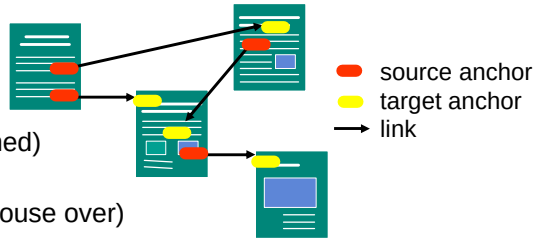


Node

- single media nodes
  - only one media type per node
- mixed media nodes
  - different media types possible per node
  - alternatives, combination
- systems with limited content size
  - no internal navigation
  - e.g. HyperCard
- systems with unlimited content size
  - internal navigation necessary
  - e.g. Scrolling

Anchor

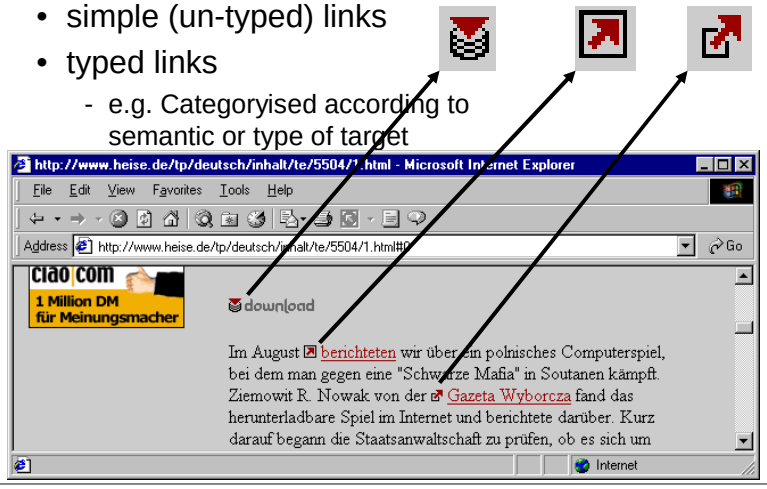
- types of anchors
  - source anchor
  - target anchor
- represented as
  - button
  - icon
  - text (e.g. Underlined)
  - hidden
  - animation (e.g. mouse over)
  - ...



- representation of source anchors as link
- representation of target anchors is often hidden

Links

- information content of a link
  - simple (un-typed) links
  - typed links
    - e.g. Categoryised according to semantic or type of target

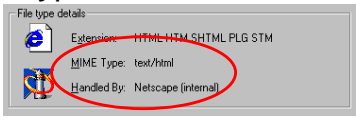


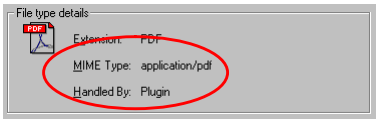
Media Types in the Web

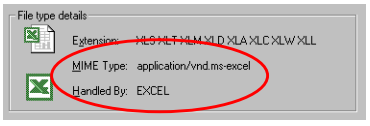
- text / hypertext
- Inline graphics in Hypertext
- icons / graphics (bitmap, vector) / drawings / photos
- interactive graphics: active maps
- animations
- programs (e.g. JavaScript)
- audio clips / video clips (e.g. MP3, MPG)
- audio / video streams
- 3D-scenes (e.g. VRML)
- objects, like Applets, Flash, ---
- any type of media ...

Media Types in the Web - Concept

- open concept to integrate arbitrary media
  - transmitted in the MIME format
- interpretation of different Media types in the WWW
  - browser build-in for most basic types
    - text, HTML hypertext, GIF and JPEG images
  - using browser Plug-Ins
    - e.g. for Acrobat PDF,Real-Audio, RealVideo, Shockwave, Flash
  - using external applications (helper applications)
    - e.g. ghostscript for PostScript, other proprietary formats/applications
  - save files
    - Download of arbitrary formats

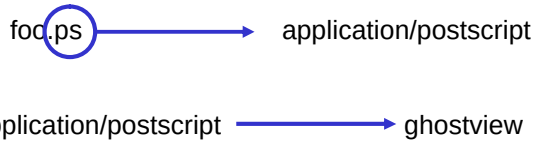






MIME Extension

- mapping of file types (e.g. extensions in the file system, UNIX) onto MIME types
  (on the server)



- mapping of MIME types to applications
  (in the browser)

- … it is open – but this may be a serious usability problem
  - Do the users have the right connection?
  - Does the external program, plug-in work?

Technology Overview Client

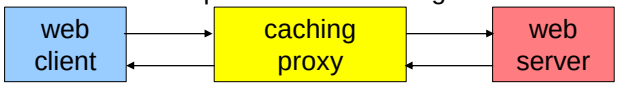
- content that can be displayed/provided
  - text, HTML, images, videos, audio, ...
- content and programs that can be interpret by the browser
  - dynamic HTML
  - browser script: JavaScript, VBScript, SMIL, MathML, ...
- programs that are executed in the context of the browser
  - Java Applets (Byte Code, Virtual Machine)
  - ActiveX (Native Code, executed directly by the operating system)
- programs that are pluged into the browser and executed in the context of the browser for specific data types
  - Plug-Ins
- external programs that are started by the browser to handle data that can not be handled by the browser
  - helper applications

Technology Overview Server

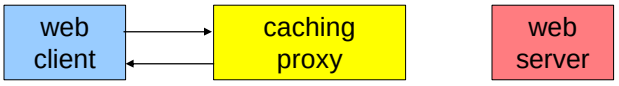
- content (e.g. HTML-pages) that contains statements that can be replaced or executed:
  - SSI, XSSI
  - server side scripting (ASP, PHP, JSP, ...)
- programs that create content
  - additional process: CGI
  - In the context of the servers:Servlets, ...
- extensions of web servers
  - NSAPI, IISAPI, Apache-Modules, ...
- gateways and front-ends for databases
- application server
- dedicated/specific server

Caching-Proxy - Example

- Cache - MISS
  - The requested resource is not stored in the cache
  - The resource is requested from the original server



- Cache - HIT
  - The requested resource is stored in the cache of the proxy and is still valid
  - The resource sent back directly from the caching proxy, it is not requested from the original host



Cache-Control Header

```
Cache-Control   = "Cache-Control" ":" 1#cache-directive

cache-directive = cache-request-directive
             | cache-response-directive

cache-request-directive = "no-cache" | "no-store"
   | "max-age" "=" delta-seconds
   | "max-stale" [ "=" delta-seconds ]
   | "min-fresh" "=" delta-seconds
   | "no-transform" | "only-if-cached" | cache-extension

cache-response-directive = "public"
   | "private" [ "=" <"> 1#field-name <"> ]
   | "no-cache" [ "=" <"> 1#field-name <"> ]
   | "no-store" | "no-transform" | "must-revalidate"
   | "proxy-revalidate" | "max-age" "=" delta-seconds
   | "s-maxage" "=" delta-seconds | cache-extension
```


Excurse: Web Technology Essentials

- Be aware that
  - That the web is heterogeneous distributed systems
  - Hypertext and Hypermedia allows complex information architecture
  - That any media type can be used, however there is little control how they are handled at the client
  - There is a mixture of code and content
- Try to minimize technical complexity
- Specify technical requirements
  - Minimal setup
  - Anticipated setup
  - Test under these conditions

References

- ACM SIGCHI Curricula for Human-Computer Interaction
  http://www.acm.org/sigchi/cdg/
- Vorlesung Web Engineering, Uni Karlsruhe
  http://www.teco.edu/lehre/webe/