

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

Ludwig-Maximilians-Universität München
LFE Medieninformatik
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SS2006
<http://www.medien.ifi.lmu.de/>

Advanced Topics in HCI Vorlesung Mensch-Maschine-Interaktion 2

Lehr- und Forschungseinheit Medieninformatik

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- Vorlesung: Donnerstag, 12-14 Uhr, Theresienstraße, Raum 112
- Übungen: Mittwoch, 12.00 bis 14.00 oder Donnerstag, 14.00 bis 16.00,
Amalienstraße 17, Raum 105/107 oder Computerraum EG
Übungsleitung: Richard Atterer, Paul Holleis, Heiko Drewes
- Informationen zur Vorlesung und Übung:
<http://www.medien.ifi.lmu.de/lehre/ss2006/mmi2/>

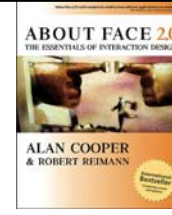
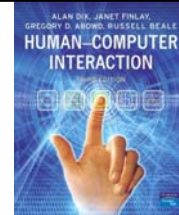
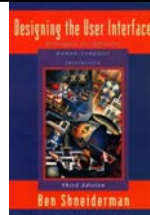
Inhalt

- 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, Accessibility
 - Visualisierung von Information
 - UIs für mobile Geräte
 - Benutzerschnittstellen für Spiele
 - Weitere Themen:
 - User Interface Softwareentwicklung
 - Adaptive Benutzerschnittstellen und Intelligente UIs
 - Multimodale Benutzerschnittstellen
 - Tangible User Interfaces
 - Groupware, CSCW, CACL

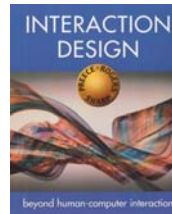
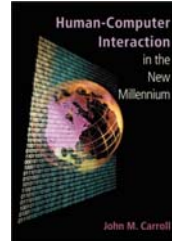
Ablauf und Anforderungen

- Vorlesung mit Übung, 2h+2h
- Lesematerial (ca. ein Artikel pro Woche)
- Übungsaufgaben
- Scheinkriterien
 - Erfolgreiche, termingerechte Abgabe aller Übungsaufgaben (oder aller bis auf eine)
 - Die abgegebenen Lösungen müssen von ausreichender Qualität sein.
 - Zusammenfassung der Pflichtlektüre (ca. 100 Worte pro Artikel)
 - Analyse von verschiedenen Web Anwendungen
- 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



Structure

- Chapter 1:
HCI and the WWW
- Chapter 2:
Information Visualization
- Chapter 3:
Mobile and Ubiquitous User Interfaces



Chapter 1: HCI and the WWW

Table of Content

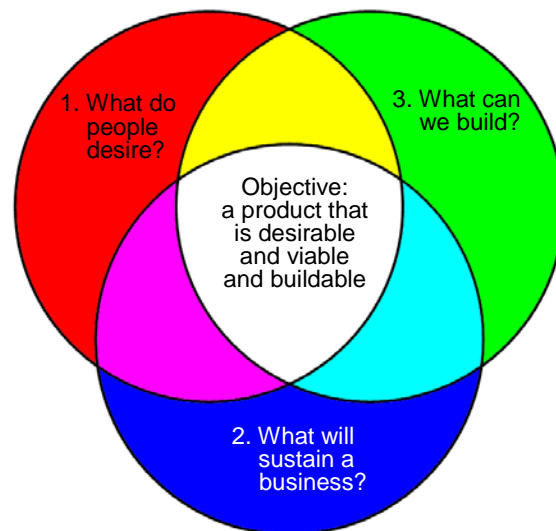
- 1.1 Human Computer Interaction (HCI)
 - a quick reminder
- 1.2 Web Usability
 - Web Technology
 - Web Design
 - Management of Web projects
 - Usability evaluation of Web sites and applications
- 1.3 Web Accessibility, Universal Access to Information
- 1.4 Usability Report

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 Nielsen)
- “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

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11

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!

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12

Excuse: 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 Approach

- 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

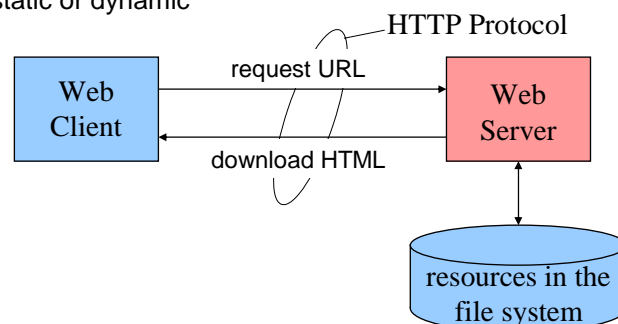
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15

Architecture and Protocol (simplified)

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

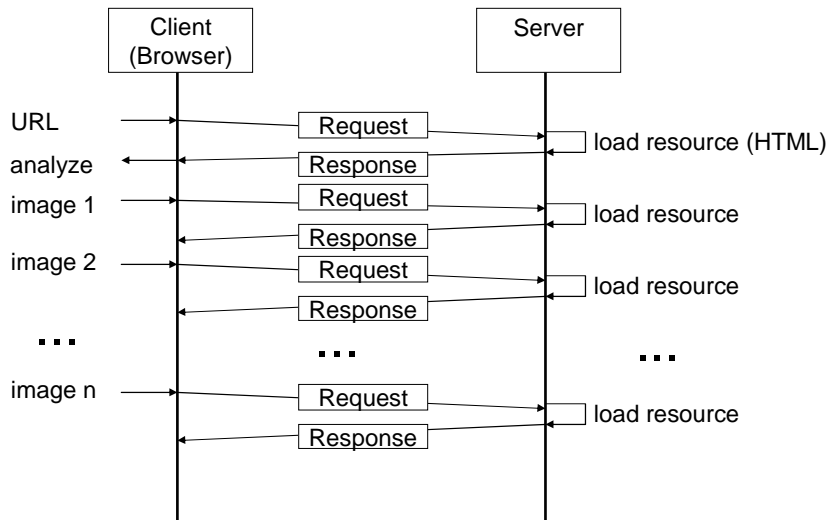


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16

Documents contain Resources IV

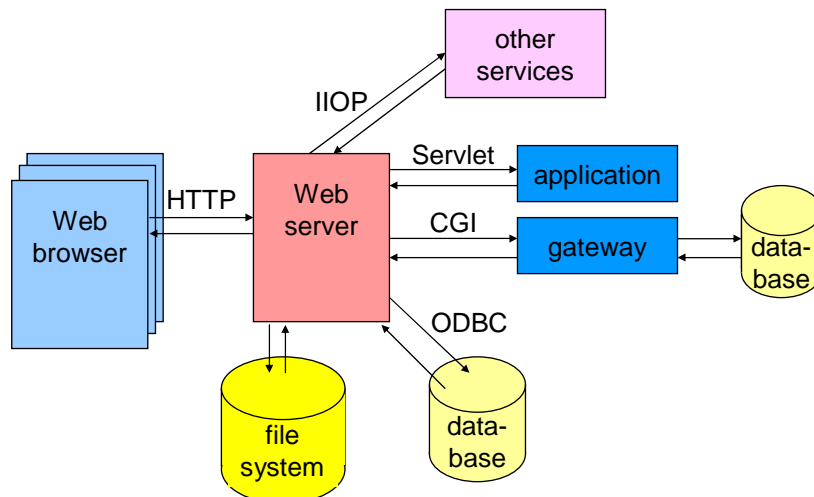


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17

Example Architecture



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18

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

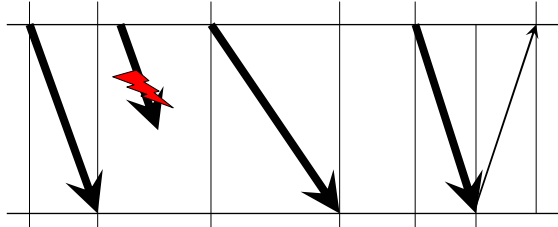
- Obviously the document
- Further information available (e.g. header fields)
 - Browser type and version
 - Operating system (version)
 - Referer
 - Cookies
 - Screen size, window size
 - If Java/JavaScript/VBScript are enabled
 - List of plug-ins installed
 - Network parameter and route
 - ...
- Rich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

Try it out at:
<http://network-tools.com/analyze/>

The WWW is a Distributed System Usability Issues

▪ Network

- Delay
- Failure
- Jitter
- Latency
- Bandwidth



▪ Multi-user System

- Work load, system performance
- Concurrency problems

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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)

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22

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
- Software,
 - Browser
 - Operating System

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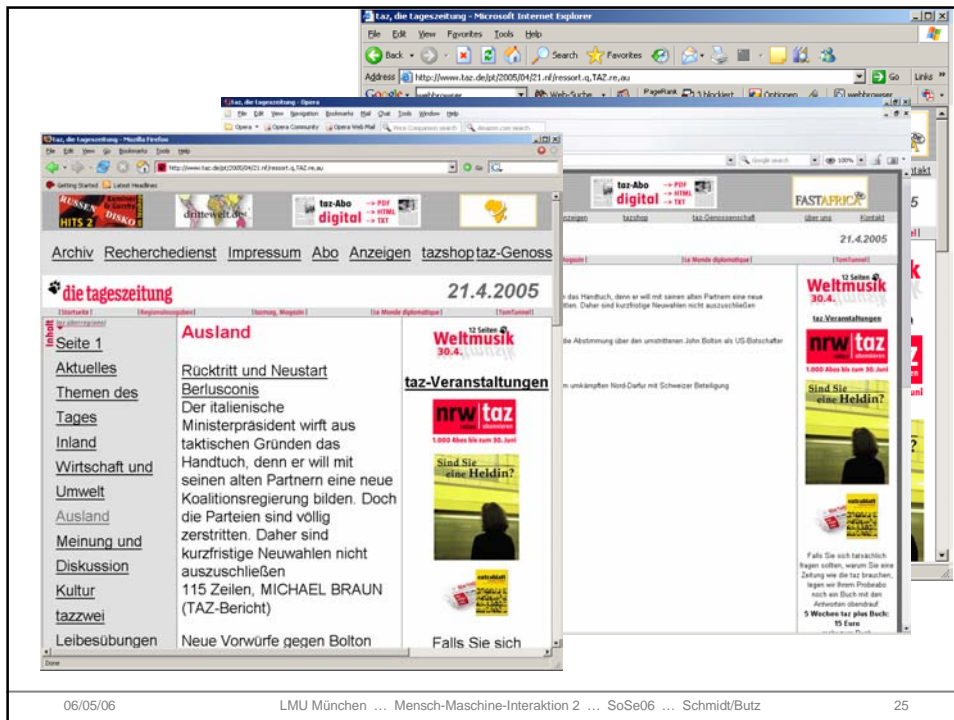
23

The screenshot shows a complex web browser environment. At the top, there are two browser windows: Microsoft Internet Explorer and Opera. The main window is displaying a news website with a large central article titled 'TEUFELSKUCHE' featuring a black background with a red title. To the left, there is a sidebar with various news categories and a 'SHOP' section. To the right, there are several smaller news snippets and advertisements, including one for 'Bakker' and another for 'Teufelsküche'. The browser interface includes address bars, search engines, and various toolbars. The overall layout is dense and multi-layered, illustrating system heterogeneity in user interface design.

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24



Other Graphical Browser



Text or Audio Browser, e.g. Lynx

```

albrecht@teco03a : ~
People at Tec0: Albrecht Schmidt (p1 of 2)

[teco]
People Research Home
Contact Projects Students
Albrecht_Schmidt
Photos! Teaching: Web Engineering Intranet Publications
[INLINE]

In 1995/1996 I did an MSc in computing at the Manchester Metropolitan University in
the Department of Computing. Studying in Manchester is really great - I enjoyed my
stay very much.

Back in Germany I finished my course in informatics at the University of Ulm in the
department of Computer Science. I obtained my diploma degree ("Diplom") in 1997.

At the same time I was working as a student research assistant in the Department of
Distributed Systems.

I am now a research assistant at the Telecooperation Office (Tec0) at the University
of Karlsruhe.
Teco Responsibilities
[INLINE] I am consulting the Staatsministerium (Ministry of State), the
Kultusministerium (Ministry of Education) of Baden-Württemberg, and several
administrative authorities in terms of Internet technology.

Together with the service center at Hewlett Packard (HP) Balingen we are working on
concepts and tools to automate the creation and maintenance of web-services.

I am involved in the European Project TEA (Technology for Enabling Awareness #26900).
-- press space for next page --
Arrow keys: Up and Down to move, Right to follow a link; Left to go back,
Help O)ptions P)rint G)o M)ain screen Q)uit /=search [delete]=history list
    
```

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27

Compatibility

- To ensure usability define systems and environments that are supported (e.g. functional specification)
 - hardware
 - operating system(s)
 - Browser(s)
 - network (bandwidth, latency)
- the logfiles of an existing website for this user group can be used to calculate the percentage of compatibility
- Trade-off compatibility vs. cost
- Try to optimize the design for the "main" visitors and make sure it is still usable for the others.

MSIE 6.0	46%
MSIE 5.0	3%
Firefox 1.5	20%
Firefox 1.0	7%
Bots	15%
Safari	2%
Others	7%

Example figures from last week at hcllab.org

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28

Compatibility

Visitors at hcilab.org

Browser of Visitors at hcilab.org (March 2006)

MSIE	53%
Mozilla/Firefox	29%
Netscape	5%
msnbot	4%
Opera	3%
Safari	2%
googlebot	1%
other	3%

OS of Visitors at hcilab.org (March 2006)

WinXP	65%
Win2000	12%
OS unknown	7%
Robots	5%
Linux	4%
Win98	3%
Mac	2%
Misc	2%

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

One problem...

People structure their knowledge differently.



→ hypertext-documents:

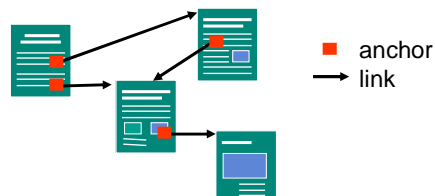
- keep the inherent association of information in a document

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 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

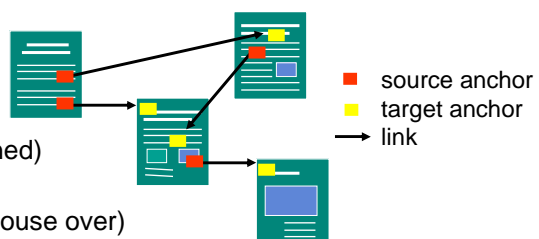
- single media nodes
 - only one media type per node
- mixed media nodes
 - different media types possible per node
 - alternatives, combination
- systems with limited content size
 - no internal navigation
 - e.g. HyperCard
- systems with unlimited content size
 - internal navigation necessary
 - e.g.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

Anchor

- types of anchors
 - source anchor
 - target anchor

- represented as

- button
- icon
- text (e.g. Underlined)
- hidden
- animation (e.g. mouse over)
- ...

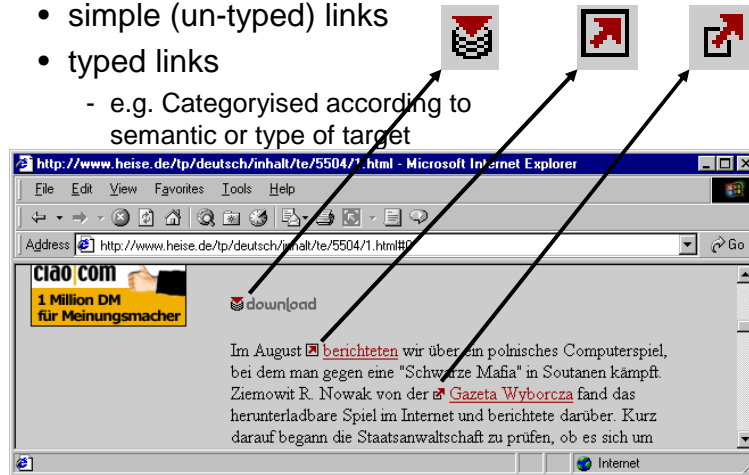


- representation of source anchors as link
- representation of target anchors is often hidden

Links

- information content of a link

- simple (un-typed) links
- typed links
 - e.g. Categorised according to semantic or type of target



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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 ...

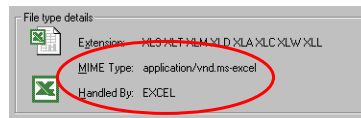
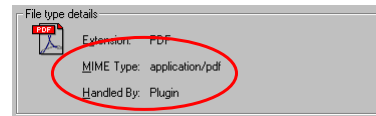
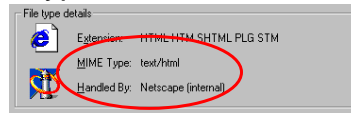
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36

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



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37

MIME Extension

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

foc.**ps** → application/postscript

application/postscript → ghostview

- 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?

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Technology Overview Client

- content that can be displayed/provided
 - text, HTML, images, videos, audio, ...
- content and programs that can be interpreted by the browser
 - HTML
 - browser script: JavaScript, VBScript, SMIL, MathML, ...
- programs that are executed in the context of the browser
 - Java Applets (Byte Code, Virtual Machine)
 - Flash
 - ActiveX (Native Code, executed directly by the operating system)
- programs that are plugged 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

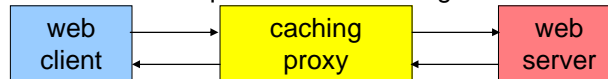
Technology Overview Server

- 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

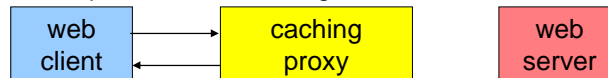
Cache - MISS

- 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



Web Error Messages I

- categories of errors (see HTTP)
 - most often : 404 (file not found)
 - 4xx – error on client side
 - 5xx – error on server side
- errors should be intercepted
 - define useful reaction
 - make specific pages for errors
 - e.g. 404 – file not found
 - possible reasons: file does not exist (anymore), typos, ...
 - some possible solutions
 - a) show an error page – tell the user that the page is not available :-)
 - b) show the main page of the server
 - c) show a search page on the server, tell the user to search
 - d) try to find with the filename and the path the page or a related page in the internal search engine and show this page :-)

Web Error Messages II

- errors should be intercepted!
 - e.g. 500 – server error
 - possible reasons: CGI-program crashed, hard drive full, database down, permission changes, gateway not available, ...
 - some possible solutions
 - a) show CGI/Server error messages :-(
 - b) give the user an alternative: e.g.
„Sorry our WWW online ordering system is currently not available. Please print out your order and send us a fax (0815/007007) or order by email (orders@shop.com). The system will be online in a minute. Sorry for any inconvenience.“

```
SoftArtisans.SAFile.1 error '80020009'  
Error occurred when moving cached file to final destination. Please  
check the NTFS permissions for the directory "C:\WINNT\" and the  
directory containing the file "D:\CMTLibrary\SIGCHIShort\523_admin.pdf".  
These directories require Read, Write and Delete permissions by the  
anonymous user ( NT account: IUSR_computername ) as well as for your  
authenticated users.  
/sigchishort/PaperEditProcess.asp, line 107
```

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43

Excuse: 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

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44

References

- ACM SIGCHI Curricula for Human-Computer Interaction
<http://www.acm.org/sigchi/cdg/>
- Blockvorlesung "Web-Technologien"
<http://www.medien.ifi.lmu.de/lehre/ws0506/pwt.html>
(login and password on request)