

Verteilte Web-basierte Systeme – SS 2006

Verteilte Web-basierte Systeme

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Programm heute & morgen

- Vorbemerkungen
- Kapitel 1-3 (Block 1)

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2

Verteilte Web-basierte Systeme

- Ziele
 - Einführung in das "Phänomen Web"
 - Entwicklung Web-basierter Systeme
 - Evolution – Stetige Weiterentwicklung
- Schwerpunkte
 - Entwicklung von Web-Anwendungen
 - Service-orientierte Architekturen (SOA)
 - Web Services & Web 2.0 Technologien
 - XML-Familie & Standards



W3C WORLD WIDE WEB
CONSORTIUM

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3

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Historie

- Grundlage Themengebiet Web Engineering
 - WS99/00 und WS00/01 - Fokus auf Technologie
 - Seit WS01/02 komplett neu ausgearbeitet
 - Seit WS02/03 Basis für die Vorlesung Web Engineering an der TU Darmstadt sowie Uni Augsburg, Stanford University, University of San Francisco, University of Hong Kong
 - Seit WS2004/2005 - Erneute Überarbeitung/Aktualisierung
- Feedback berücksichtigt
- Ausgezeichnet durch MSDN AA

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4

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Vorbemerkungen

- Vorlesungsstil
 - Interaktiv
 - Hausaufgaben
 - Reviews
- Sprache
 - Vorlesung in Deutsch
 - Folien in Englisch
- Empfohlen, aber nicht notwendig
 - Grundlagen aus den Bereichen Telematik, Softwaretechnik und Informationssysteme / Datenbanken

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5

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Lecture VWBS

- Art der Veranstaltung: Vorlesung
- Dozent: Dr.-Ing. Martin Gaedke
- Ort und Zeit: Blockveranstaltung, Termine siehe nächste Folie
- Prüfbar: Ja, je nach Zahl der Anmeldungen schriftlich oder mündlich.
Anrechenbar bei Prof. Dr. Lars Wolf im Vertiefungsfach
- SWS: 2+1

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6

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Organisatorisches

- ☉ Block-Vorlesung
 - Jeweils Informatikzentrum, Raum 033
 - Credits 2+1 Stunden und prüfbar
- ☉ Termine
 - Mo 19.06., 13:15-18:15 Uhr
 - Di 20.06., 08:00-11:15 Uhr
 - Do 29.06., 13:15-18:15 Uhr
 - Fr 30.06., 09:45-13:00 Uhr
 - Do 20.07., 13:15-18:15 Uhr
 - Fr 21.07., 09:45-13:00 Uhr

☉ Details zur Vorlesung unter:
<http://www.ibr.cs.tu-bs.de/lehre/ss06/vwbs/>

Block 1

- Einführung
- Techn. Grundlagen
- Lebenszyklus

Block 2

- Vorplanung
- Planung

Block 3

- Realisierung
- Evolution

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Prerequisites

- ☉ No prerequisites
- ☉ Basic knowledge of Internet/Web technologies (HTTP and HTML) is highly recommended
- ☉ Ideally, you have suffered from your Portal or Web Site solution/project – in other words: experienced your own kind of Web Crisis or Lost-In-Hyperspace syndrome
- ☉ Willingness to learn and do homework
 - And to wake up at 8 a.m. tomorrow ;-)

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Lecture Outline

- ☉ **Part 1 - Introduction**
 - Introduction to the business of running Web-based applications, and hypermedia and Web trends that created the need for Web Engineering
- ☉ **Part 2 - Technology: Basics and Principles**
 - Introduction to the ABC of Web technology
- ☉ **Part 3 - Aspects of the Lifecycle**
 - People, Process, Management, Evolution
- ☉ **Part 4 - Pre-Planning**
 - Understanding the problem

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Lecture Outline

- ☉ **Part 5 – Planning**
 - From problem description to plan
- ☉ **Part 6 – Development**
 - Creating the solution
- ☉ **Part 7 – Evolution**
 - From Testing, Deployment, Operation, Maintenance, Agility and other aspects

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Further Information I

- ☉ Literature
 - There is NO course textbook, but Web Site (A course textbook is currently under development)
 - However, there are different books, magazines, papers, Web-Sites that cover parts of the course
 - References to Further Readings will be given each lecture
- ☉ Dedicated Material available via Course Web Site

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Further Information II

- ☉ Web Site for this Lecture
 - All information about the lecture available here
 - Ask questions and start discussions
 - Download **easy-to-print** slides in PDF-format
- ☉ **Web Site**
 - **<http://www.ibr.cs.tu-bs.de/lehre/ss05/vwbs/>**

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Part I

Introduction

Part 1 – Overview

1. World Wide Web and the early beginning
2. A look at Resources
3. The Change of Technology
4. Web application production
5. The need for process
6. Further Readings

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14

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Chapter://1

World Wide Web and the early beginning

Part I ► Chapter://1 ► World Wide Web and the early beginning

Vannevar Bush

- ⊗ *As We May Think*. July 1945, Atlantic Monthly
- ⊗ The human mind operates by association
- ⊗ Memex Idea: Selection by association, rather than by indexing, may yet be mechanized.
- ⊗ Device for individual use in which an individual stores all books, records, and communications
→ supplement to user's memory



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16

Part I ► Chapter://1 ► World Wide Web and the early beginning

Supplement to memory

- ⊗ **Documents** – contain artifacts (data), which exists as a vehicle for conveying information
- ↓ *Interpretation in Context*
- ⊗ **Information** – the interpretation of data within a context set by a priori knowledge and the current environment
- ↓ *Integration and Usage*
- ⊗ **Knowledge** – the base of personal information, which is integrated in a fashion that allows it to be used in further interpretation and analysis of data

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17

Part I ► Chapter://1 ► World Wide Web and the early beginning

Ted Nelson on Hypertext



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18

Part I ▶ Chapter://1 ▶ World Wide Web and the early beginning

How to feed your head...

- Sequential Writing
- E.g. Books, Papers (works also for Audios, Movies)

Authoring Linearisation → Document → Reading De-Linearisation

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Part I ▶ Chapter://1 ▶ World Wide Web and the early beginning

How to feed your head...

- Ted Nelson (1965): "By hypertext I mean non-sequential writing"

Authoring Externalisation → Document → Reading Internalisation

Hypertext – An application that allows a user to navigate through an **information space** using associative linking

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Part I ▶ Chapter://1 ▶ World Wide Web and the early beginning

What is Hypertext?

- Concept for organizing knowledge
 - **Hypertext** – An application that allows a user to navigate through an **information space** using associative linking
- Non-linear nodes of information
 - Book and traditional media like audio are linear – one single path through the material
 - Hypertext provides several different ways through the material

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Hypertext-Documents

- Hypertext-Documents inherently maintain the relation between information units
- Graph structure of Hypertext-Documents
 - Node: Unit of information (data)
 - Links: Edges connecting nodes (support interpretation in context)
 - Anchor: Fragment of node dedicated to a link

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Hypermedia?

- The "glorified" definition:

- Hypertext-Community uses Hypertext and Hypermedia term synonymously
- **Hypermedia** – application that uses associative relationships among information contained within multiple media data for the purpose of facilitating access to, and manipulation of, the information encapsulated by the data

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Hypertext History


- 1945: Vannevar Bush – Memex
 - "As we may think"
- 1962-76: Doug Englebart – oN Line System
 - Inventor of the Mouse (used in NLS)
- 1965: Ted Nelson – Xanadu
 - Coined "Hypertext"
- 1985: Bill Atkinson (Apple) – HyperCard
 - First "usable" Hypertext application

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Part I ► Chapter://1 ► World Wide Web and the early beginning

World Wide Web

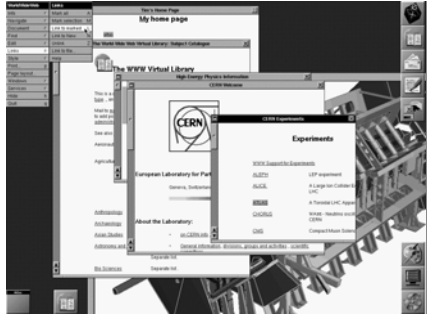
- 1989 initiated by Tim Berners-Lee at CERN
 - Goal:** Support the cooperation of distributed research teams (e.g. to exchange research documents) on top of a heterogeneous system environment
- 1991 originally proposed
- WWW application of the Hypermedia paradigm
- For further information visit: <http://w3.org>



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Part I ► Chapter://1 ► World Wide Web and the early beginning

The Early Beginning




The WorldWideWeb browser (1st Web Browser)

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Part I ► Chapter://1 ► World Wide Web and the early beginning

Concept

- Idea: "Universe of network-accessible information"
 - Everyone may act as Author of Resources
- Uniform Addressing
 - Unique, world-wide addresses
 - Abstracts geographical distribution of information nodes (resources)
- Uniform Access
 - Browser offer uniform access to any resource in the WWW

 **WWW is a collection of resources, software, protocols, standards, and recommendations providing a Hypermedia system**

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Chapter://2

A look at Resources

Part I ► Chapter://2 ► A look at Resources

Where it all starts...

- Markup** – Text that is added to the data of a document in order to convey information about it
 - For further information: <http://www.w3.org/MarkUp/>
- Resource as HTML-Document
 - Markup Language: Hypertext Markup Language (HTML)
 - Can contain links to other resources
 - Images, Documents, and other Pages
 - Tag used to markup: <A>
 - Rendered and viewed in a Web Browser


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Part I ► Chapter://2 ► A look at Resources

Example 1 – Table

```

<html>
  <body>
    <table border="1">
      <tr>
        <td>Water</td>
        <td>1 EUR</td>
      </tr>
      <tr>
        <td>Beer</td>
        <td>1.5 EUR</td>
      </tr>
      <tr>
        <td>Wine</td>
        <td>1.5 EUR</td>
      </tr>
    </table>
  </body>
</html>
    
```




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Part I ▶ Chapter://2 ▶ A look at Resources

Example 2 – Table

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<html>
  <body>
    <table border="1">
      <tr>
        <td>Water</td>
        <td>Beer</td>
        <td>Wine</td>
      </tr>
      <tr>
        <td>1 EUR</td>
        <td>1.5 EUR</td>
        <td>1.5 EUR</td>
      </tr>
    </table>
  </body>
</html>
```



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Part I ▶ Chapter://2 ▶ A look at Resources

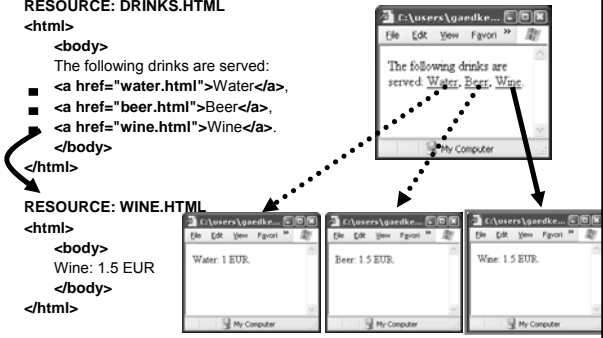
Example 3 – Navigation

RESOURCE: DRINKS.HTML

```
<html>
  <body>
    The following drinks are served:
    ■ <a href="water.html">Water</a>,
    ■ <a href="beer.html">Beer</a>,
    ■ <a href="wine.html">Wine</a>.
  </body>
</html>
```

RESOURCE: WINE.HTML

```
<html>
  <body>
    Wine: 1.5 EUR
  </body>
</html>
```




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Part I ▶ Chapter://2 ▶ A look at Resources

Example 4 – Navigation

RESOURCE: DRINKS.HTML

```
<html>
  <body>
    The following drinks are served:
    ■ <a href="#water">Water</a>,
    ■ <a href="#beer">Beer</a>,
    ■ <a href="#wine">Wine</a>.
    <hr>
    <a name="water">Water 1 EUR.</a><br>
    <a name="beer">Beer 1.5 EUR.</a><br>
    <a name="wine">Wine 1.5 EUR.</a><br>
  </body>
</html>
```



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Chapter://3

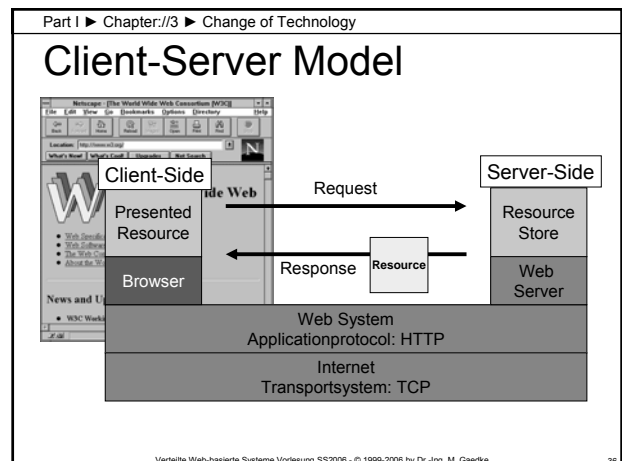
Change of Technology

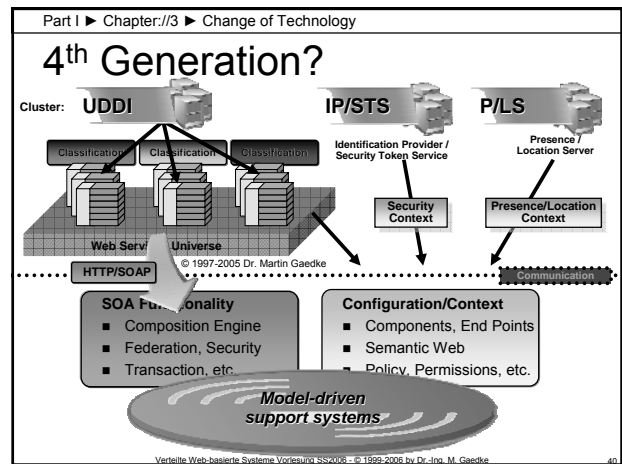
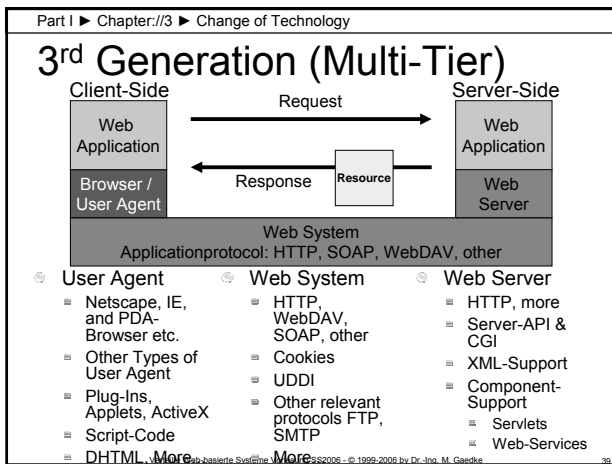
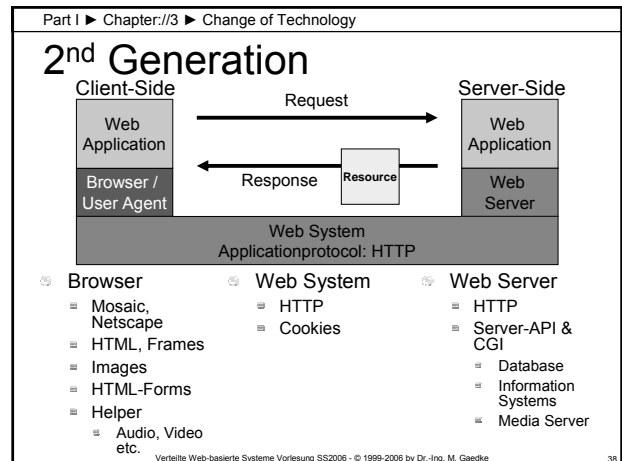
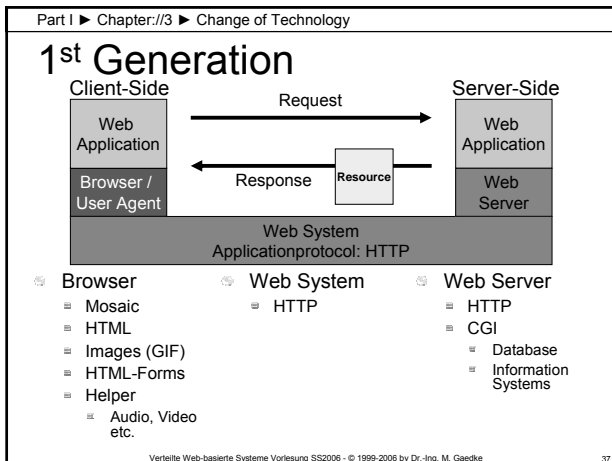
Part I ▶ Chapter://3 ▶ Change of Technology

WWW's Technical Aspects

- WWW is a **distributed System**
 - Based on a **Client-Server architecture**
 - Supporting the **Hypermedia Paradigm**
- Server** provide access to resources
 - E.g. HTML-documents, images, audio, etc.
 - Resources may be created dynamically
- Client (User Agent)** interpret resources
 - Browser present interpretation (Layout, play sound etc.)
 - Other kinds of User Agents may use the resource in other ways (e.g. robots - indexing words)
 - Every request implies a new connection (Stateless)

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Chapter://4

Web Application Production



Part I ▶ Chapter://4 ▶ Web Application Production

Characteristics

Today's focus on large-scale and ubiquitously useable Web Applications

- Many Users – many languages – many cultures
- Different access mechanisms
- Many User Agents

Presents large volume of interrelated information (including different media) and processes

- Appropriate presentation
- Progression through activities – finish one thing before starting another

All Aspects of Heterogeneity

Growing and increasing complexity

- Many product iterations/versions/refinements (calls for Reuse)
- Many developers and operators, complex handling of temporal media (e.g. publishing of company news)
- Customization, Personalization, Security issues

and a lot more...

- E.g. "Up-to-date" by following trends

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Part I ▶ Chapter://4 ▶ Web Application Production

Developing Web Applications

- Still Ad-hoc instead of a disciplined procedure
 - Copy-and-Paste Paradigm
- Lack between design-model and implementation-model
- Design-concepts get lost in the underlying model
- Many short lifecycle of a Web Application: Maintenance and Evolution problems → Reuse Problems

→ Web-Crisis

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Chapter://5

The need for process

Part I ▶ Chapter://5 ▶ The need for process

Need for Process

- Domination of the different requirements calls for a systematic approach
- Producing high-quality Products in a cost-effective way
- Goal – Product should be
 - Maintainable and evolvable
 - Reliable
 - Efficient
 - Appropriate for User Interface (also wrt Hypermedia)
 - Delivered in time with predictable cost

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Part I ▶ Chapter://5 ▶ The need for process

Or simply Software Engineering?

“Fundamental differences [between hypermedia and other disciplines] however, make a pure transposition of techniques both difficult and inadequate. An important part of hypertext design concerns aesthetic and cognitive aspects that software engineering environments do not support.”

(Nanard and Nanard, 1995)

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Part I ▶ Chapter://5 ▶ The need for process

Key Knowledge Areas...

...for the production on top of distributed Web-based Systems

- Software Engineering**
 - Process
 - Design
 - Implementation
 - Test
 - Operation
 - Maintenance
- Hypermedia**
 - Design & Structure
 - Information Space
 - Navigation
 - Visualization
 - Usability
 - Collaboration
- Network Engineering**
 - Physical Layer
 - Internet Layer
 - Transport Layer
 - Performance
- Information Systems**
 - Data Design, ER,...
 - RDBMS
 - Query Languages
 - Strg.Devices: FS,...

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Others...

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Evolution of “WebE”

- ⊗ Web Engineering is a young discipline
- ⊗ Early 1995/1996 notion of *Web Page Design and Web Site Development*
 - = Development suffers from ad hoc processes
 - = Déjà-vu experience of software development in the sixties (cf. Software Engineering, Software Crisis – Workshop 1968)
- ⊗ 1998 Workshop Web Engineering at the 7th World Wide Web Conference, Brisbane
- ⊗ Further activities at conferences and workshops
 - = WWW, ICWE, HICSS, ICSE, IWWOST etc.
- ⊗ Journal of Web Engineering (JWE), Rinton Press
 - = <http://www.rintonpress.com/journals/jwe>

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49

Part I ► Chapter://5 ► The need for process

What is Web Engineering?

- ⊗ Attention, often no common answer
 - = “Web Engineering is concerned with establishment and use of sound scientific, engineering and management principles and disciplined and systematic approaches to the successful development, deployment and maintenance of high quality Web-based systems and applications”, SIGWEB Newsletter
 - = “Web Engineering is a discipline among disciplines, cutting across computer science, information systems, and software engineering, as well as benefiting from several non-IT specializations”, IEEE Multimedia
 - = “While Web Engineering adopts and encompasses many software engineering principles, it incorporates many new approaches, methodologies, tools, techniques, and guidelines to meet the unique requirements of Web-based systems. Developing Web-based systems is significantly different from traditional software development and poses many additional challenges”, IEEE Multimedia

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50

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Engineering

- ⊗ Discussing the term in the context of (software) engineering:

“Engineering is about the systematic application of scientific knowledge in creating and building cost-effective solutions to practical problems”,
Berry [Report No. CMU/SEI-92-TR-34]

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51

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Web Engineering

Web Engineering – is the application of systematic, disciplined, and quantifiable approaches to the design, production, deployment, operation, maintenance and evolution of Web-based software products. [Gaedke, 2000]

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52

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Web-based Software Products

- ⊗ **Web System** – a hypermedia infrastructure or system enabling the operation of a Web Application
- ⊗ **Web Application** – a distributed application that accomplishes a certain business need based on technologies of the World Wide Web and that consists of a set of Web-specific resources
- ⊗ **Resource** – an object specified by a MIME-type that is delivered by a Web Server or system using a standardized Protocol as a response of a request from a User Agent (Web Client)

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53

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Chapter://6

Further Readings

Part I ► Chapter://6 ► Further Readings

Literature

- ⑤ Thomas A. Powell, *Web Site Engineering*, Prentice Hall PTR
- ⑤ David Lowe and Wendy Hall, *Hypermedia and the Web – an Engineering Approach*, John Wiley & Sons
- ⑤ San Murugesan, *Web Engineering*, Sigweb Newsletter Vol. 8, No. 3, Oct. 1999, pp. 28-32
- ⑤ San Murugesan und Yogesh Deshpande, *Web Engineering: Managing Diversity and Complexity of Web Application Development*. LNCS 2016, Springer
- ⑤ SELFHTML, cf. Lecture Web Site
- ⑤ Gerti Kappel, Birgit Pröll, Siegfried Reich, Werner Retschitzegger (Hrsg.): *Web Engineering – Systematische Entwicklung von Web-Anwendungen*. dpunkt.verlag
- ⑤ Martin Gaedke: *Komponententechnik für Entwicklung und Evolution im World Wide Web*, Shaker Verlag, 2000, ISBN 3-8265-8059-1

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Further information available at **Lecture Web Site**
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