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Middleware for Heterogeneous and Distributed Information Systems

<http://www.lgis.informatik.uni-kl.de/cms/courses/middleware/>



Course Information

- Presence hours: 4 course, 2 recitations/exercises
 - course hours: Monday, 11:45 – 13:15, 46-260 & Thursday, 15:30 – 17:00, 46-260
 - recitations: Tuesday, 13:45 – 15:15, 48-462, starting November 4th
- Credit points: 8 ECTS
- Examinations: to be decided, most likely written
- Prerequisites
 - Fundamentals of Information Systems and Database Management Systems: Data Models and Database Design, Query Languages (SQL), Transactions (ACID), Host/Programming Language Coupling, Database Architecture, Query Processing Steps, Commit Protocols (2PC)
 - see courses
 - introductory bachelor course on Information Systems
 - specific parts of Data Base Application ("Datenbankanwendung") are desirable, but the course can be attended in the same semester
- Copies of presentation charts
 - as pdf downloadable from course website



Additional Certificate „Software Innovations for Digital Enterprises“



- **Objective:** Prove in depth-knowledge of the next generation of enterprise software by a certificate
- **Requirements:** At least 20 credit points in the four fields of specialisation IT-Security, Software Engineering, Cloud Computing and Mobile Computing
- **Course Catalogue:** More than 200 courses at the universities of Karlsruhe, Kaiserslautern, Saarbrücken und Darmstadt from WS 2012/13 on
- **Coordinator:** Prof. Dr. Dieter Rombach (rombach@informatik.uni-kl.de)
- **For more information and the application tool please see:** <http://master.software-cluster.org>



"MW for Heterogeneous and Distributed IS"

- Consists of two submodules:
 - "Middleware for Information Systems" (2C + 1R)
 - delivered as 4C+2R in the first half of the semester
 - "Enterprise Information Systems" (2C + 1R)
 - delivered as 4C+2R in the second half of the semester
 - builds on "Middleware for Information Systems" (prerequisite!)
 - it is recommended to attend both during the same semester
- Submodules can be examined separately, if desired, to gain flexibility
 - MfIS or MfIS+EIS as bachelor specialization module (oral exam, together with "Database Application" course)
 - MfIS, MfIS+EIS, or EIS as master module



Middleware for Information Systems - Outline (1)

- Chapter 1: Motivation
 - Developing distributed information systems
 - Outlook on Enterprise Information Systems
 - Enterprise Application Integration
 - B2B-Integration
- Chapter 2: Distributed Information Systems
 - Layers, architecture, interaction types
 - Distributed Transactions
- Chapter 3: DB-Gateways
 - ODBC, JDBC, SQLJ



Course Outline (2)

- Chapter 4: Remote Procedure Calls and Distributed Transactions
 - RPC concepts
 - Remote Method Invocation
 - Transactional RPCs
 - X/Open DTP
- Chapter 5: Application Server Middleware
 - RPC middleware infrastructure
 - TP Monitors
 - Object Brokers and Object/Component Transaction Monitors
- Chapter 6: Object Persistence, Relationships and Queries
 - Concepts and approaches (explicit, implicit, orthogonal persistence)
 - Support in application server middleware (CORBA persistence, EJB CMP, Java Data Objects, Java Persistence API)



Course Outline (3)

- Chapter 7: XML
 - Fundamentals
 - XML data processing (XPath, XQuery, SQL/XML)
- Chapter 8: Introduction to Web Services
 - Service Oriented Architecture
 - Invocation (SOAP), Description (WSDL), Discovery (UDDI)
 - Web Services Support in Middleware Platforms
- Chapter 9: Web Services Coordination and Transactions
 - Conversation Routing and Protocol Handlers
 - Coordination and Transactions
- Chapter 10: Web-based Information Systems
 - Web-based DB access architecture
 - Client-side vs. server-side access
 - Session state management
 - SQL/HTML integration



Enterprise Information Systems - Outline (1)

- Chapter 1: Motivation
 - Data Integration
 - Enterprise Application Integration
 - B2B Integration
- Chapter 2: Virtual Integration, Wrappers and External Data
 - Virtual Integration Architectures
 - Wrapper-based data federation (Garlic, SQL/MED)
 - Data-links for managing external data
- Chapter 3: Data Replication and Materialized Integration
 - Replication middleware uses and architecture
 - Change propagation and ownership strategies
 - Data Warehousing and ETL



Course Outline (2)

- Chapter 4: Information Integration
 - Forms of heterogeneity
 - Architectures
 - Schema matching and mapping
 - Schema integration
 - Dynamic Information Integration
- Chapter 5: Message-Oriented Middleware
 - Asynchronous transaction processing
 - Message Queuing
 - Message Brokering
 - Databases and Message Queuing Systems



Course Outline (3)

- Chapter 6: Business Process Modeling and Workflow Management
 - Business Engineering
 - Workflow Management Systems
 - WF and Transactions
- Chapter 7: Web Service Composition
 - Web Services Composition and Choreography
 - BPEL4WS
 - e-Business Coordination, Collaboration and Integration



Books

- **Alonso, G.; Casati, F.; Kuno, H.; Machiraju, V.: Web Services, Springer Verlag, Heidelberg, 2003**
- Allamaraju, S. et. al.: Professional Java Server Programming - J2EE 1.3 Edition, Wrox Press, Birmingham, UK, 2001
- Blakeley, B., Harris, H., Lewis, R.: Messaging & Queuing Using the MQI, McGraw-Hill, New York, 1995
- Bradley, N.: The XML companion (2nd edition), Addison-Wesley, Harlow, UK, 2000
- Geiger, K.: Inside ODBC, Microsoft Press, Washington, 1995
- Gray, J., Reuter, A.: Transaction Processing: Concepts und Techniques, Morgan Kaufmann, San Mateo, Kalifornien, 1993
- Harold, E.R.: The XML 1.1 Bible, Wiley Publishers, 2004
- Leser, U., Naumann, F.: Informationsintegration, dpunkt.verlag, 2007
- Leymann, F., Roller, D.: Production Workflow, Prentice Hall, 2000
- Melton, J., Eisenberg, A.: Understanding SQL and Java Together - A Guide to SQLJ, JDBC, and Related Technologies, Morgan Kaufmann, San Francisco, 2000
- Burke, B., Monson-Haefel, R.: Enterprise JavaBeans 3.0 (5th ed.), O'Reilly, 2006.
- Orfali, R., Harkey, D.: Client/Server Programming with JAVA and CORBA, Wiley Computer Publishing Group (John Wiley & Sons, Inc.), New York, 1997
- Siegel, J.: CORBA 3 Fundamentals and Programming (2nd ed.), Wiley Computer Publishing Group (John Wiley & Sons, Inc.), New York, 2000
- The Java EE™ Tutorial, <http://www.oracle.com/technetwork/java/javaee/documentation/tutorials-137605.html>

