

## Middleware for Heterogeneous and Distributed Information Systems

<http://www.lgis.informatik.uni-kl.de/cms/index.php?id=210>



### Course Information

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- Presence hours: 4 course, 2 recitations/exercises
  - course hours: Tuesday & Thursday, 10:00 – 11:30, 48-462
  - recitations: Wednesday, 10:00 – 11:30, 48-379, starting Oct. 27<sup>th</sup>
    - backup: Monday, 17:15 – 18:45
- Credit points: 8 ECTS
- Examinations: oral exams, can be scheduled individually
- 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 courses can be attended in the same semester
- Copies of presentation charts
  - as handouts or as pdf downloadable from course website



## "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
  - MfIS, MfIS+EIS, or EIS as master specialization module



## Middleware for Information Systems (Preliminary) 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
- Chapter 4: Web-based Information Systems
  - Web-based DB access architecture
  - Client-side vs. server-side access
  - Session state management
  - SQL/HTML integration



## Course Outline (2)

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- Chapter 5: Remote Procedure Calls and Distributed Transactions
  - RPC concepts
  - Remote Method Invocation
  - Transactional RPCs
  - X/Open DTP
- Chapter 6: Application Server Middleware
  - RPC middleware infrastructure
  - TP Monitors
  - Object Brokers and Object/Component Transaction Monitors
  - Security features and basic concepts
  - Security support in application server middleware
- Chapter 7: Object Persistence, Relationships and Queries
  - Concepts and approaches (explicit, implicit, orthogonal persistence)
  - Support in application server middleware (CORBA persistence, EJB CMP, Java Data Objects)



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## Course Outline (3)

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- Chapter 8: XML
  - Fundamentals
  - XML data processing (XPath, XQuery, SQL/XML)
- Chapter 9: Introduction to Web Services
  - Service Oriented Architecture
  - Invocation (SOAP), Description (WSDL), Discovery (UDDI)
  - Web Services Support in Middleware Platforms
- Chapter 10: Web Services Coordination and Transactions
  - Conversation Routing and Protocol Handlers
  - Coordination and Transactions



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## Enterprise Information Systems (Preliminary) Outline (1)

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- 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



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## Course Outline (2)

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- Chapter 4: Information Integration
  - Forms of heterogeneity
  - Architectures
  - Schema matching and mapping
  - Schema integration
  - Dynamic Information Integration
- Chapter 5: Application Server Middleware and Connectors
  - Accessing Enterprise IS from application servers
- Chapter 6: Message-Oriented Middleware
  - Asynchronous transaction processing
  - Message Queuing
  - Message Brokering
  - Databases and Message Queuing Systems



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## Course Outline (3)

- Chapter 7: Business Process Modeling and Workflow Management
  - Business Engineering
  - Workflow Management Systems
  - WF and Transactions
- Chapter 8: 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 J2EE™ Tutorial, <http://java.sun.com/j2ee/tutorial/index.html>

