Distributed Applications
Verteilte Anwendungen
Module IN 2102

Applied Informatics / Cooperative Systems
Prof. Schlichter, TUM

Organizational (1)

- Course Volume
  - 3 SWS lecture + 1 SWS exercise
  - 5 ECTS

- Lectures
  - Mondays (09:15 – 10:00, MI HS 2) and Tuesdays (14:30 – 16:00, Interim 2; lecture hall change!!)
  - Lecture language: English
  - Recording using TeleTeachingTool (TTT), recordings available via video server

- Lecture material
  - Available on our Web Site: http://www11.in.tum.de/dehr
  - PDF script for print and online use
  - Few modifications compared to material of SS 2011
Organizational (2)

- Written exam – Klausur
  - Will be scheduled soon
  - Registration via TUMOnline; if not possible, then via InfoPoint (or W. Wördi)

- Consultation – Sprechstunde
  - After the lecture
  - Office Hours: Mondays 12 - 13
  - Or via Email: schichter@in.tum.de

- Exercises
  - Goals: supplementary issues and aspects from practical experience
  - 2 hours every 2 weeks;
    - Fridays 14:15 – 15:45, room: MI HS2
  - Scheduled times: 20.04, 04.05, 18.05, 01.06, 15.06, 29.06, 13.07
  - Content of the exercise is part of the exam
  - Tutor: Dr. Frank Schütz, Email: Frank.Schuetz@interface-ag.de
    - Further contact: Dr. W. Wördi, Tel: 18686, Email: woerdi@in.tum.de

Overview

Introduction of basic concepts for the design and implementation of distributed applications.

- Architecture of distributed applications
- Distributed object-based systems
- Distributed shared memory
- Distributed file service
- Web Services

Discussion of various aspects, concepts and mechanisms of distributed applications.

- Basic principles for the design of distributed applications.
  - Terminology, communication mechanisms, client-server model, aspects of remote invocation (RPC, RMI).

- Model for distributed applications.
  - Happend-before relation, clocks for synchronization

- Introduction to distributed transactions and group communication.
  - 2-phase commit; aspects of consistent message delivery ("atomic multicast", virtual synchronization) in groups, group management.

- Information replication and distributed file systems.
  - Consistency of replicated information, concurrency control.

- Designing distributed applications.
  - Web services
  - MDA (Model Driven Architecture)
  - SOA (Service Oriented Architecture)

- Object-oriented distributed systems.
  - Impact of the object-oriented paradigm on design of distributed applications, especially CORBA.

- Secure communication in distributed systems.
The following literature was used to prepare this lecture.

**Course Text Books**
- Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems - Principles and Paradigms", Pearson Studium, 2007 (German)

Further Reading
- G. Alonso, F. Cassati, H. Kuno and V. Machiraju, "Web services: concepts, architectures and applications", Springer-Verlag, 2004
- M. Bell, "Service-Oriented Modeling", John Wiley & Sons, 2008
- K. Birman, "Reliable Distributed Systems", Springer, 2005
- M. Liu, "Distributed Computing - Principles and Applications", Pearson Addison-Wesley, 2004
- Q. Glass, "Web services: building blocks for distributed systems", Prentice-Hall, 2002

**Overview**

- Introduction of basic concepts for the design and implementation of distributed applications.
- Architecture of distributed applications
- Design and Concepts of distributed applications
- Distributed object-based systems
- Distributed shared memory
- Distributed file service
- Distributed applications
- Web Services
- Remote invocation (RPC/RMI)

**API**
- Application Programming Interface

**BPEL4WS**
- Business Process Execution Language for Web Services

**B2B**
- Business-to-Business

**B2C**
- Business-to-Consumer

**CLSID**
- class identifier (in the context of DCOM)

**CORBA**
- Common Object Request Broker Architecture

**CO2W**
- Computer Supported Cooperative Work

**DCE**
- Distributed Computing Environment (OSF)

**DCOM**
- Distributed Component Object Model

**DIT**
- Directory Information Tree (LDAP)

**DME**
- Distributed Management Environment (OSF)

**DNS**
- Domain Naming Service

**DSM**
- Distributed Shared Memory

**EAR**
- Enterprise Archive

**EJB**
- Enterprise Java Beans

**GIOP**
- General Inter-CORB Protocol

**IDL**
- Interface Definition Language

**IETF**
- Internet Engineering Task Force

**IID**
- Interface Identifier (in the context of DCOM)
Introduction

Issues

Issues of the following section
Motivation for distributed systems and distributed applications.
Basic terminology for distributed systems, e.g., terms like distributed applications, and interface.
Introduction to some influential historic distributed systems, such as NFS File system, Mach and Java 2 Platform Enterprise Edition.

Background

Key Characteristics of distributed Systems

Distributed application

Influential distributed systems

Networks of heterogeneous computers, applications using shared resources which are geographically dispersed, information communication (i.e., improved information flow), and activity coordination.

Examples:

• online flight-reservation
• distributed money machines
• audio/video conferencing applications, e.g., Microsoft NetMeeting (see the application domain “Computer-supported Cooperative Work”), Internet telephony (e.g., Skype)
• World Wide Web
• Grid Computing
  use the resources of many separate computers connected by a network to solve large-scale computation problems, e.g., SETI@home; Search for Extraterrestrial Intelligence.
• Social Software
  sharing of private information and collaborative tagging, e.g., Blogs, Flickr, YouTube, Twitter, Facebook