Course: IT556, Service-Oriented Computing

Introduction

Service-oriented Computing (SOC) is the new promising cross-disciplinary area of distributed computing that represent heterogeneous distributed software applications as collection of services or software agents which can communicate freely with each other. Service-oriented computing has become an important paradigm for information technology architectures and applications. Services are platform and language independent, loosely coupled and are able to publish, discover, and orchestrate using standard protocols. SOC provides a new way to design, develop, architect and consume software applications or components. SOC aims to support interoperability and integration of enterprise applications with the help of technologies like Web Services, Service-oriented architecture, Grid and Utility computing.

Software or software components are represented as services using core Web Services standards (SOAP, WSDL, and UDDI) to achieve interoperability across highly disparate software systems. As a result, new Web services standards and specifications have been proposed for improving and supporting features like addressing, messaging, reliability, transaction, security, metadata management, orchestration and choreography of Web services. With the help of XML and Web services, service-oriented architecture (SOA) has become widely accepted in the world of Information Technology because it facilitates the composition of heterogeneous enterprise-wide or inter-enterprise services, and also supports integration and access with legacy systems, mainframes, mid-tier, PCs and mobile devices.

Course Objectives

This course discusses the basic concepts, theories, and techniques for service-oriented computing. The course discusses standards related to Web services, approaches for the description, discovery, and composition of Web services. The course includes introduction of techniques for information and process semantics, specifically, conceptual modeling, ontologies, matchmaking, messaging, transactions, and processes. The course aims to formulate the foundational concepts of services, to evaluate existing approaches, and to present existing techniques from other areas that can be adopted for services. The course introduces emerging techniques for addressing challenges that are unique to services.

Prerequisite

Courses on: Computer Programming, Data and File Structures, Operating System, Computer Networks, and Distributed Computing

Instructor

Sanjay Chaudhary
**Course Content**

**Introduction**
- Brief history of information technology
- Distributed computing in the large
- Motivations for composition
- Challenges for composition
- Web Services Architectures and Standards

**Basic concepts**
- Directory services
- SOAP
- WSDL
- UDDI

**Enterprise architectures**
- Integration versus interoperation
- J2EE
- .NET
- Model Driven Architecture
- Legacy systems

**Principles of Service-Oriented Computing**
- Use cases: Intra-enterprise and Inter-enterprise Interoperation, Application Configuration, Dynamic Selection, Software Fault Tolerance, Grid, and Utility Computing
- Elements of Service-Oriented Architectures, RPC versus Document Orientation, Composing Services

**Description: Modeling and representation**
- XML primer
- Conceptual modeling
- Ontologies and knowledge sharing
- Relevant standards: RDF, RDFS, and OWL
- Inferencing and tools
- Matchmaking

**Engagement**
- Execution Models: Messaging, CORBA, Peer to peer computing, Jini, Grid Computing
- Transactions: ACID Properties, Schedules, Locking, Distributed Transactions
- Transactions over Composed Services: Architecture, Properties, Compositional Serializability
- Relevant standards: BPEL4WS, WSCI, WS-C, ebXML
- Relaxed transactions
- Exception handling
Collaboration
- Describing collaborations
- Agents
- Multiagent systems
- Agent communication languages
- Protocols
- Commitments and contracts
- Planning
- Consistency maintenance
- Relevant standards: FIPA, OWL-S
- Economic models
- Organizational models

Selection
- Quality of service
- Application-level trust
- Reputation mechanisms
- Referral systems

Engineering
- Engineering composed services
- Compliance
- Trust
- Privacy

Synthesis
- Common threads
- Open problems
- Status and trends

**Evaluation Scheme**

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term theory examination</td>
<td>20%</td>
</tr>
<tr>
<td>Final theory examination</td>
<td>40%</td>
</tr>
<tr>
<td>Research paper presentation</td>
<td>20%</td>
</tr>
<tr>
<td>Project work or home assignments</td>
<td>20%</td>
</tr>
</tbody>
</table>

**Text Book**

*Service-Oriented Computing: Semantics, Processes, Agents*
by Munindar P. Singh and Michael N. Huhns
John Wiley & Sons, Ltd., 2005
ISBN: 0-470-09148-7