SERVICES COMPUTING
A New Thinking Style of Education and Engineering

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Contents

• Landscape of Services Computing

• SOA: Architecture Innovation in Services Computing

• Disciplined Approach of Driving Services Innovation Agenda: Services Computing Curriculum
• Services now account for more than half of the U.S. economy. Services Computing (SVC), as a new cross discipline, addresses how to enable IT technology to help people perform business services more efficiently and effectively.

• From a technology foundation perspective, Services Computing has become a foundational discipline in the modern services industry.
SVC In Action: Services Modernization through new business models and IT solutions is the way to build the net-generation value chain for different services industries.
Services Computing Landscape

- Enterprise Modeling
- Business Consulting
- Services Management
- Solution Creation
- Services Delivery
- Services Orchestration
- Services Optimization
- Services Marketing

Service-Oriented Architecture (SOA)

- Business process standards (OASIS)
- Web Services standards (W3C)
- Internet standards (IETF)

- Parallel & Distributed System
- Software Engineering
- Database

- Grid Computing
- UML & XML
- HTTP
- Internet (WWW) & Networking

Application Domains

- E-Commerce
- Manufacturing
- Finance

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SOA Foundations and Applications

Middleware & Tools

Software

(Middleware, Applications)

Software As A Service

Service As Software

Business Solutions

Services

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SOA Solution Reference Architecture: SOA Solution Stack (S3)

It is Logical Reference Architecture that describes SOA.

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Source: IEEE IT Professional, May/June, 2007
SOA Method: SOA DESIGN PROCESS

- Covers all phases of the SOA solution life cycle, can be customized for different application domains
The SOMA Modeling Environment (SOMA-ME) enhances RSA/RSM with SOMA guidance and automation to accelerate design and dev., and encourages high-quality reusable asset dev. through consistent architectural building blocks, patterns and model validation. 

- **Automatic Generation of Deliverables**
- **Normative Guidance and Labor Acceleration**
- **SOA Patterns & Transformations**
- **RSA/RSM 7**
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- **10**
- **Automation for model creation**
- **Model Validation**
- **Definition and Generation of Downstream Work Products**
- **Lifecycle Acceleration**

- **SOMA Steps Enablers**
- **Work Product Generation**
- **Enhanced SLT**
- **SOMA Process Guidance & Artifact Capture**
- **GSM Work Products**
- **SCA/WBSF Code Artifacts**

**Labor Acceleration**

- Automatic Generation of Deliverables
- Normative Guidance and automation for model creation
- Model Validation
- Definition and Generation of Downstream Work Products
Business Trends of SOA

• Industry Standards Are Moving to SOA (Standardization)
• Industry Solutions Are Moving to SOA (Business)
• Device Level SOA (e.g. Mobile, home electronics)
• Business Cloud = SOA + Cloud Computing
Foundational Research Directions for SOA

• **Theoretical Foundation**: Mathematical Formalization and Analysis of SOA (Model)

• **Analytic SOA**: SOA Analytics (Data)
Monetizing The Combined Power of SOA and Cloud Computing
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• Disciplined Approach of Driving Services Innovation Agenda: Services Computing Curriculum
CREATING A NEW COMPUTING CURRICULUM TO COVER SERVICES INNOVATIONS
Services Computing Curriculum Initiative (SCCI)

- Architectural Framework
- Definitions of Knowledge Areas
- Guidelines
- Recommended Methods for Course Composition
- Case Studies
- Discussions on Future Directions of SCCI
SERVICES COMPUTING CURRICULUM INITIATIVE (SCCI)

• SCCI an attempt to systematically integrate the best practices and result in the creation of Services Computing degree programs that are suitable for accreditation processes.

ARCHITECTURE OF SERVICES COMPUTING CURRICULUM (SC2007)

- An **SOA-based solution reference architecture** that defines the architectural thinking of the proposed Services Computing Curriculum.
- Two views for the Services Computing Curriculum: **Services Consumer view** and **Services Provider view**. (The users include educators, students, and practitioners.)

![Diagram showing degree programs and services computing courses]

**Presentation** | **Integration & Standardization**
--- | ---
**Processes** | **QoS**
**Services** | **Data Architecture**
**Service Components** | **Governance**
**Operational Environment** | **Repository**

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Principles of SC2007

• Mindset of cross discipline
• New career oriented education
• Change on demand
• Reusable learning blocks
• Foundational knowledge landscape
• Multi-level degrees programs in co-design
• Globalization in mind
Learning Outcomes of SC2007

• Multi-source requirements handling
• Basic consulting skills
• Hands-on skills
• Innovation skills
• Leadership skills
• Proactive learning skills
SERVICES COMPUTING KNOWLEDGE AREAS

L.1 Principles of Services
L.2 Services Lifecycle
L.3 Web Services
L.4 Service-Oriented Architecture
L.5 Services Relationships
L.6 Services Composition
L.7 Business Process Management & Integration
L.8 Business Grid
L.9 Enterprise Modeling and Management
L.10 Service-Oriented Consulting Methodology
L.11 Services Delivery Platform and Methodology
L.12 Application Services and Standards
L.13 Security and Privacy in Services Computing
L.14 IT Services Management

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L.11 Services Delivery Platform and Methodology

L.11.0 General
- L.11.0.a Services Delivery Mechanisms
- L.11.0.b Services Engineering

L.11.1 Service-Oriented Services Delivery Platform
- L.11.1.a Services Delivery Platform
- L.11.1.b Collaborative Services Delivery Platform
- L.11.1.c Common Services

L.11.2 Services Delivery Methodology
- L.11.2.a Services Delivery Readiness Phase
- L.11.2.b Services Delivery Creation Phase
- L.11.2.c Services Delivery Operation
- L.11.3.a Web 2.0 and Web X.o
- L.11.3.b Service Mash-up
- L.11.3.c New Business Models

L.11.4 Services as Software
- L.11.4.a Asset-based Services Model
- L.11.4.b Services Software

L.12 Application Services and Standards
- L.12.0 General
- L.12.1 Solution-Level Quality of Service
- L.12.2 Data Architecture Framework
- L.12.3 QoS Management Modeling
- L.12.4 Web Services Standard Stack
- L.12.5 Industry-Specific Standards

L.12.0.a Case Studies in Industry
- L.12.0.b Case Studies in Scientific Applications
- L.12.0.c Case Studies in Government
- L.12.1.a Context-Aware QoS Model
- L.12.1.b Representation of QoS Model
- L.12.1.c QoS Data Management
- L.12.1.d Business Relationship Model
- L.12.1.e Solution-Level QoS Framework
- L.12.2.a Constructs in Data Architecture
- L.12.2.b Relationships Between Constructs
- L.12.3.a Modeling of Resources
- L.12.3.b Modeling the QoS Assurance Process
- L.12.4.a Transport
- L.12.4.b Messaging
- L.12.4.c Description/Publishing/Discovery
- L.12.4.d Quality of Service
- L.12.4.e Service Composition
- L.12.5.a Service-Oriented Solution Reference Architecture
- L.12.5.b New Standards

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An advanced single-sign-on capability has been integrated in this new RSS portal. Only the registered members of the IEEE Services Computing Community can access the IEEE Body of Knowledge on Services Computing Portal.
COURSES COMPOSITION AND DESCRIPTION

- Since all the knowledge areas or sub-areas are reusable learning units in the Services Computing Curriculum, they can be used to compose courses for different programs based on various requirements.

- For illustration purpose, for a course entitled “Introduction of Services System”, we can select L.1, L.2, L.5.0, and L5.5.2 to create this new course for business professionals. We can add L.5.1 to this course for computing professionals.
Example Curriculum for Fall School on Services Computing (Day 1)

- **Session 1**: Landscape and CURRICULUM overview of Services Computing
- **Session 2**: Services and Services Systems
- **Session 3**: SOA (Modeling, Publishing, Invocation, Relationship, & Standards)
- **Session 4**: Business Process Integration & Mgmt, & Business Grid
Example Curriculum for The Fall School on Services Computing (Day 2)

- **Session 5:** Software as a Service (SaaS)
- **Session 6:** Consulting methodology & Enterprise modeling
- **Session 7:** Services Computing Course Offering Best Practices
- **Session 8:** Test, Evaluation, & Certificate Presentation
Related Work and Discussions

- An ideal picture that the SC leaders would envision, which does not exist yet, is to include SC2007 in the current Joint IEEE-CS/ACM model computing curricula structure to co-exist with Computer Science, Information Systems, Software Engineering, Computer Engineering and Information Technology.
- On the other hand, SC2007 can also be used in the field of management of information systems, business schools and other information technology schools.

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Summary

- Services Computing Landscape
- SOA Innovations and Trends
- Definitions of Body of Knowledge Areas and Services Computing Curriculum

*Services Computing: New Thinking Style and New Business Model*

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Related Papers

• Liang-Jie Zhang, Jia Zhang, Ephraim Feig, Design of Body of Knowledge Areas for Services Computing and A Case Study Report, Proceedings of 2008 IEEE Congress on Services (Part II), September, 2008, Beijing, China.


• Liang-Jie Zhang, Jia Zhang, and Hong Cai, Services Computing. 2007: Springer & Tsinghua University Press.

• Zhixiong Chen, Liang-Jie Zhang, A Case Study Based Services Computing Course Delivery Practice, Proceedings of 2008 IEEE Congress on Services (Part II), September, 2008, Beijing, China.