Service Oriented Computing

Monica Drăgoicea

Universitatea "Politehnica" din Bucuresti
Facultatea Automatica si Calculatoare

Seminar INSEED – *Education, Skills and Human Capital for the Service Sector*

Bucuresti, 9 iunie 2011

Agenda

- Service innovation

  - how to design complex systems that serve customers, increasingly enabled by advanced ICT

- Service Oriented Computing and the lifecycle of the service innovation process

- A Service Science perspective on Service Oriented Computing

- Conclusions - Teaching Strategies Shift for SOC

# Service System Innovations improves Quality-of-Life

A. Systems that focus on flow of things that humans need

1. <u>Transportation</u> & supply chain
2. <u>Water</u> & waste recycling/Climate & Environment
3. <u>Food</u> & products manufacturing
4. <u>Energy</u> & electricity grid/Clean Tech
5. <u>Information</u> and Communication Technologies (ICT access)

B. Systems that focus on human activity and development

6. <u>Buildings</u> & construction (smart spaces)
7. <u>Retail</u> & hospitality/Media & entertainment/Tourism & sports
8. <u>Banking</u> & finance/Business & consulting (wealthy)
9. <u>Healthcare</u> & family life (healthy)
10. <u>Education</u> & work life/Professions & entrepreneurship (wise)

James Spohrer, "Service Science Progress & Directions", ICSOC (Service-Oriented Computing) 2010 , San Francisco, December 8, 2010

Major types of demand
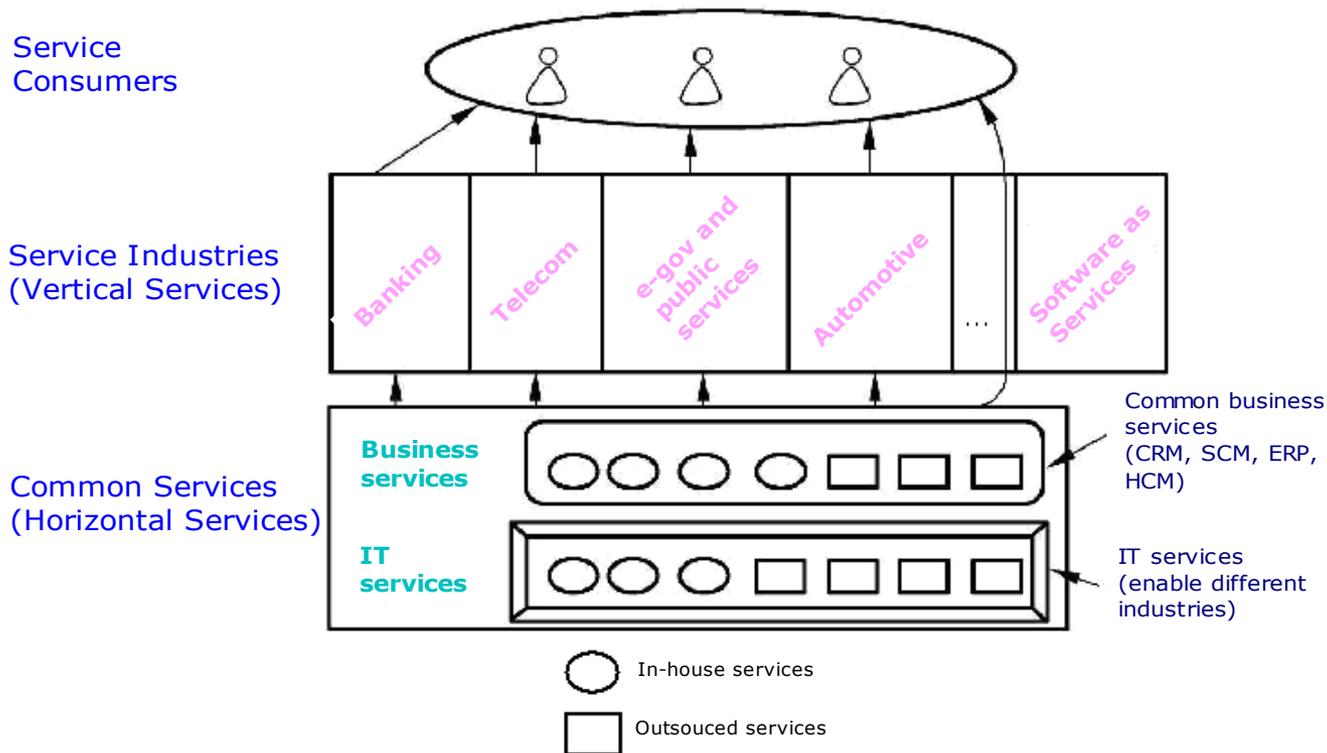
Major Types of Expertise/Knowledge
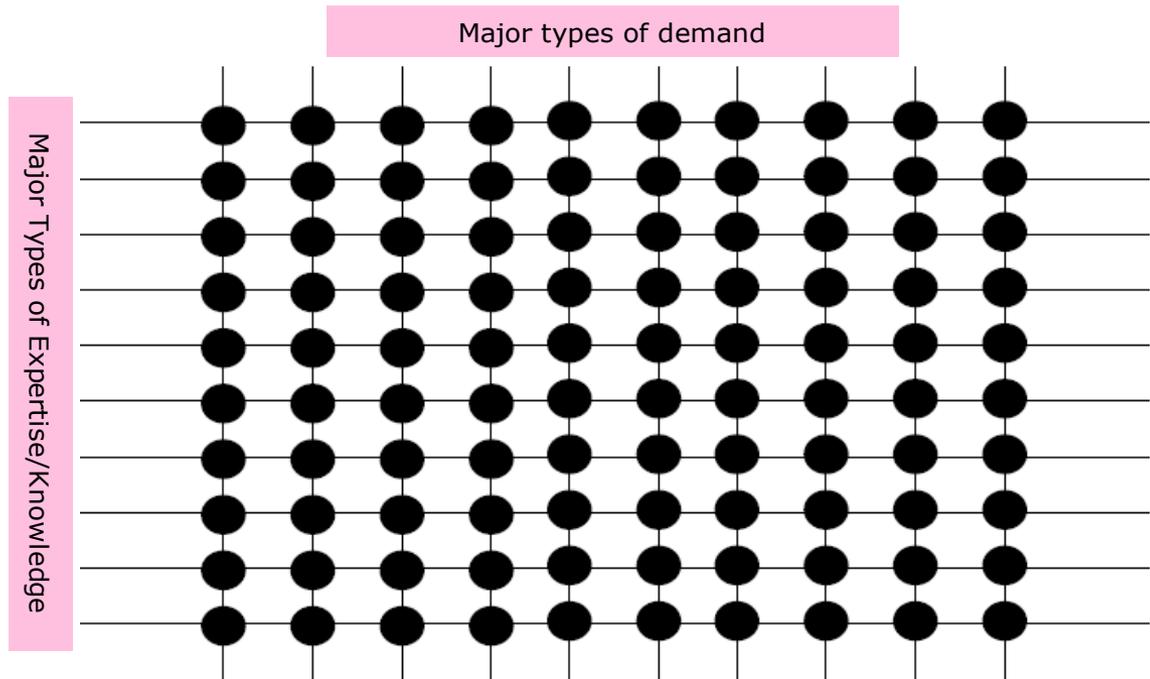
C. Systems that focus on human governance - security and opportunity

11. <u>Cities</u> & security for families and professionals (property tax)
12. <u>States</u>/regions & commercial development opportunities/investments (sales tax)
13. <u>Nations</u>/NGOs & citizens rights/rules/incentives/policies/laws (income tax)

Services Ecosystem

🔹 a culture of service defines new business "spaces" to foster a *"smarter" or sustainable innovation*

🔹 *smarter systems and modern service?*

Service Consumers

Service Industries (Vertical Services)

Banking   Telecom   e-gov and public services   Automotive   ...   Software as Services

Common Services (Horizontal Services)

Business services

IT services

Common business services (CRM, SCM, ERP, HCM)

IT services (enable different industries)

○ In-house services

☐ Outsouced services

🔹 novel approaches to deliver services

🔹 business increasingly depend on IT technologies as a source of innovation and differentiation

🔹 IT is moved to a higher level to align with business needs in the whole service lifecycle

🔹 *one service (service consumer perspective) is provided by multiple service providers and service partners in an agreed approach through a service value chain*

Social Context of Service Oriented Computing

- paradigm reorientation - application development and enterprise IT infrastructure

  - SOC is the centrepiece of enterprise IT infrastructure that includes Web services, SOA, SaaS and application service providers (ASPs)

- SOC bridges the gap between business and IT

- SOC is a new cross discipline aims to enable IT to help perform business services more efficiently & effectively

  - Global standardization

    - Interactions between existing services
    - Small business go global

- SOC is supported by different business initiatives

  - major software infrastructure vendors (IBM, SAP, Microsoft, Sun, BEA)

Jia Zhang, "Services Computing in Education", Northern Illinois University
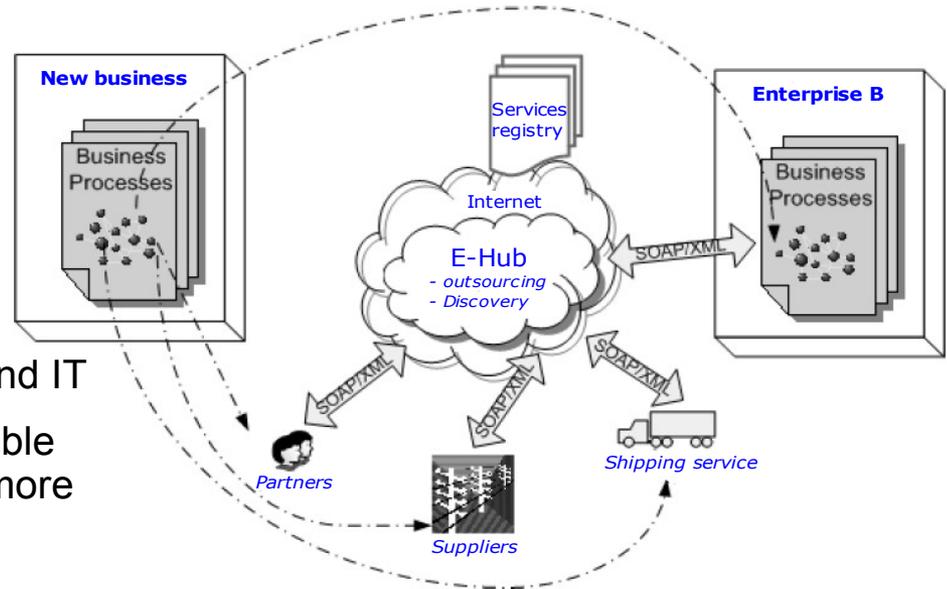
What is Service Oriented Computing ?

- *SOC covers the science and technology of leveraging computing and IT to model, create, operate, and manage business services.*

    - web services - best enabling technology
        - universal accessibility through standard communication protocols
    - Service Oriented Architecture (SOA) - central architectural model
        - application framework facilitating services operations
    - standard support
        - SOAP, WSDL, UDDI
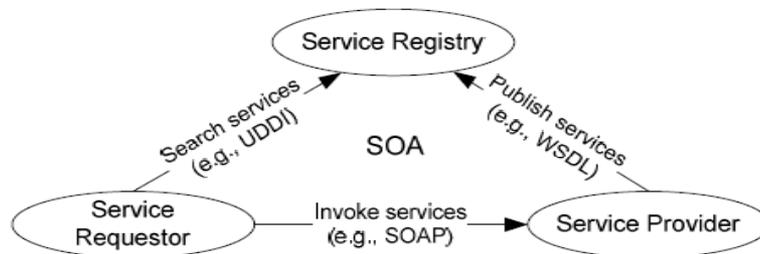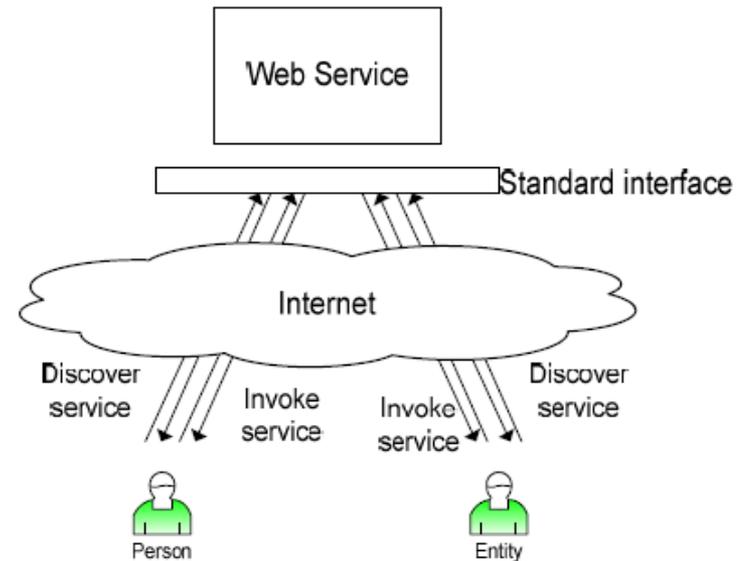
- *techniques developed to facilitate information integration, enable business process automation, and increase the agility of enterprise information architectures*

Jia Zhang, "Services Computing in Education", Northern Illinois University

Service Oriented Computing – IT Perspective

Businesses from different industries →

Business strategies

IT Services →

Billing | Procurement | HR Functions | Supply chain management

Instrumentation QoS, Policies, SLA and KPI

Tehnology →

Web Services Tooling

Grid Services | **Semantics**

Web services, BPEL Processes

Solutions →

SOA Solutions

Electronics Industry Solution Template | Retail Industry Solution Template | Other industry solution template

Customized Solution Templates

- service systems with higher reusability, flexibility, extensibility and robustness

- expose business applications through well-defined interfaces in a platform-independent manner

  - increase interoperability

  - foster the whole business collaboration chain

Services Computing, INNOVATION MATTERS @ IBM RESEARCH, www.research.ibm.com

SOC - aspects for business and IT services

- SOC covers various aspects of business and IT services.

  - for business services:
    - service-oriented business consulting methodology and utilities;
    - business process modelling, transformation, integration;
    - business performance management;
    - industry solution patterns.

  - for IT services:
    - application integration services;
    - infrastructure services (e.g. utility business services, service-level automation and orchestration, resource virtualization services);
    - IT-level autonomous system management services.

Services Computing BoK

- 14 main knowledge areas of disciplines included in the TSC (Taxonomy of Services Computing)

- Technical Committee for Services Computing (TC-SVC) - four categories that compose the Body of Knowledge (BoK) in Services Computing :

  - Category 1: **Services and Services Systems** - *Principle of Services* (M1) and *Services Lifecycle* (M2);

  - Category 2: **Services Technologies** - *Web Services* (M3), *Service-Oriented Architecture* (M4), *Services Relationships* (M5), *Services Composition* (M6), and *Business Process Management & Integration* (M7);

  - Category 3: **Services Consulting and Delivery** - *Business Grid and Cloud Computing* (M8), *Enterprise Modeling and Management* (M9), *Service-Oriented Consulting Methodology* (M10), and *Services Delivery Platform and Methodology* (M11);

  - Category 4: **Services Solutioning and Management** - *Application Services and Standards* (M12), *Security, Privacy, and Trust in Services Computing* (M13), and *Services Management* (M14).

TSC Taxonomy, IEEE Computer Society,
http://www.computer.org/portal/pages/transactions/tsc/mc/tsc_taxonomy.html, 2008

SOC – detailed taxonomy structure

Services and Services Systems
Principle of Services
Services Lifecycle

Services Technologies
Web Services
Service-Oriented Architecture
Services Relationships
Services Composition
Business Process Management & Integration

Services Consulting and Delivery
Business Grid and Cloud Computing
Enterprise Modelling and Management
Service-Oriented Consulting Methodology
Services Delivery Platform and Methodology

Services Solutioning and Management
Application Services and Standards
Security, Privacy, and Trust in Services Computing
Services Management

TSC Taxonomy, IEEE Computer Society,
http://www.computer.org/portal/pages/transactions/tsc/mc/tsc_taxonomy.html, 2008

SOC – detailed taxonomy structure (I)

- **Services and Services Systems**

1. Principle of Services
 0. General
  a. Services Systems
  b. Services Models
  c. Services Technologies
  d. Services Architectures
  e. Optimization of Services Systems

2. Services Lifecycle
 0. General
  a. Consulting and Strategic Planning
  b. Services Engagement
  c. Services Delivery
  d. Services Operation
  e. Services Billing
  f. Services Management
 1. Key Factors in Services Lifecycle
  a. Data/Information
  b. Processes
  c. People
  d. Resources
  e. Financial Factors
  f. Knowledge and Skills
  g. Innovation and Technology
 2. Service-Oriented Business Models
  a. Services Modernization
  b. Software as a Service
  c. Services As Software

TSC Taxonomy, IEEE Computer Society,
http://www.computer.org/portal/pages/transactions/tsc/mc/tsc_taxonomy.html, 2008

SC – detailed taxonomy structure (II)

- Services Technologies

3. Web Services

0. General
  a. Web Services Modelling
  ...
1. Composite Services
  a. Composite Web Services
  ...
2. Web Services Publishing
  a. Public Services Registry
  ...
3. Web Services Discovery
  a. Services Discovery Language
  ...

5. Services Relationships

0. General
  a. Relationships in Services Registries
  ...
2. Service-Oriented Relationship Modelling
  a. Business Services Relationship

TSC Taxonomy, IEEE Computer Society, http://www.computer.org/portal/pages/transactions/tsc/mc/tsc_taxonomy.html, 2008

6. Services Composition

0. General
  a. Aspects of Business Requirements
  ...
1. Services Integration Framework
  ...
2. Services Value Chain Collaboration
...

7. Business Process Management and Integration

0. General
  a. Business Process Modeling
  b. Business Process Management
1. Service-Oriented Business Process Management
...
2. Flexible Business Process Integration
  a. Lifecycle of an Integration Activity
…

4. Service-Oriented Architecture

0. General
  a. Operational Model
  ...
1. Services Invocation
  a. Simple Services Invocation
  ...
2. Bridging Business and IT Architecture
  a. Enterprise Level Transformation
  ...
3. Solution Lifecycle
  a. Solution Modelling
  ...
4. Solution Reference Architectures
  a. Architecture Overview Diagram
  b. User Interaction and Presentation
  c. Processes
  d. Services
  ...

SC – detailed taxonomy structure (III)

- Services Consulting and Delivery

11. Services Delivery Platform and Methodology
0. General
  a. Services Delivery Mechanisms
  b. Services Engineering
1. Service-Oriented Services Delivery Platform
  a. Traditional Services Delivery Platform
  ...
2. Services Delivery Methodology
  a. Services Delivery Readiness Phase
  ...
3. Software as a Service
  a. Web 2.0 and Web X.0
  b. Service Mash-up
  c. New Business Models
4. Services as Software
  a. Asset-based Services Model
  b. Services Software

9. Enterprise Modeling and Management
0. General
  a. Dynamics of Services Ecosystem
  b. Requirements for Enterprise Modeling
1. Methodologies for Enterprise Modeling
  a. Balanced Scorecard and Strategy Map
  b. Component Business Modeling Circle
  c. Enterprise Architecture
  d. Enterprise Transformation
2. Enterprise Performance Management
  a. Enterprise Project Management
  b. Performance Management
  c. Service-Oriented Enterprise Management
  d. Enterprise Portfolio Management

10. Service-Oriented Consulting Methodology
0. General
  a. Consulting Method for Strategic Change
  ...
1. Service-Oriented Business Consulting
  a. ...
  c. Value Chain Analysis
  ...

8. Business Grid and Cloud Computing
0. General
  a. Service-Oriented Grid Computing
  b. Business Grid Solution Framework
  c. Cloud Computing
1. Logical Grid Infrastructure
  ...
  c. Business Process Grid
2. Business Grid Solution Development
  a. Business Grid Service Development
  ...

SOC – detailed taxonomy structure (IV)

- Services Solutioning and Management

12. Application Services and Standards
 0. General
  a. Case Studies in Industry
  ...
 1. Solution-Level Quality of Service
  a. Context-Aware QoS Model
  b. Representation of QoS Model
  ...
 2. Data Architecture Framework
  a. Constructs in Data Architecture
  ...
 3. QoS Management Modeling
  a. Modeling of Resources
  b. Modeling the QoS Assurance Process
 4. Web Services Standard Stack
  a. Transport
  ...
  e. Service Composition
 5. Industry-Specific Standards
  a. Service-Oriented Solution Reference
  Architecture
  ...

13. Security, Privacy, and Trust in Services
 0. General
 a. Security Concerns of Service-Oriented
 Solutions
 ...
 1. Access Control in Services Systems
  a. Role-Based Access Control
  ...
 2. Security Enablement in Services Systems
 a. Service-Oriented Security Enablement
 at Software
 Level
 ...
 3. Privacy Management in Services Systems
  a. Privacy Management in Data
  Collection
  ...

14. IT Services Management
 0. General
 a. Management of Services
 Design
 ...
 1. Application Management in Services
  a. Application Management
  Services
  ...
 2. Infrastructure Management in Services
  a. Maturity Assessment in
  Services
  ...
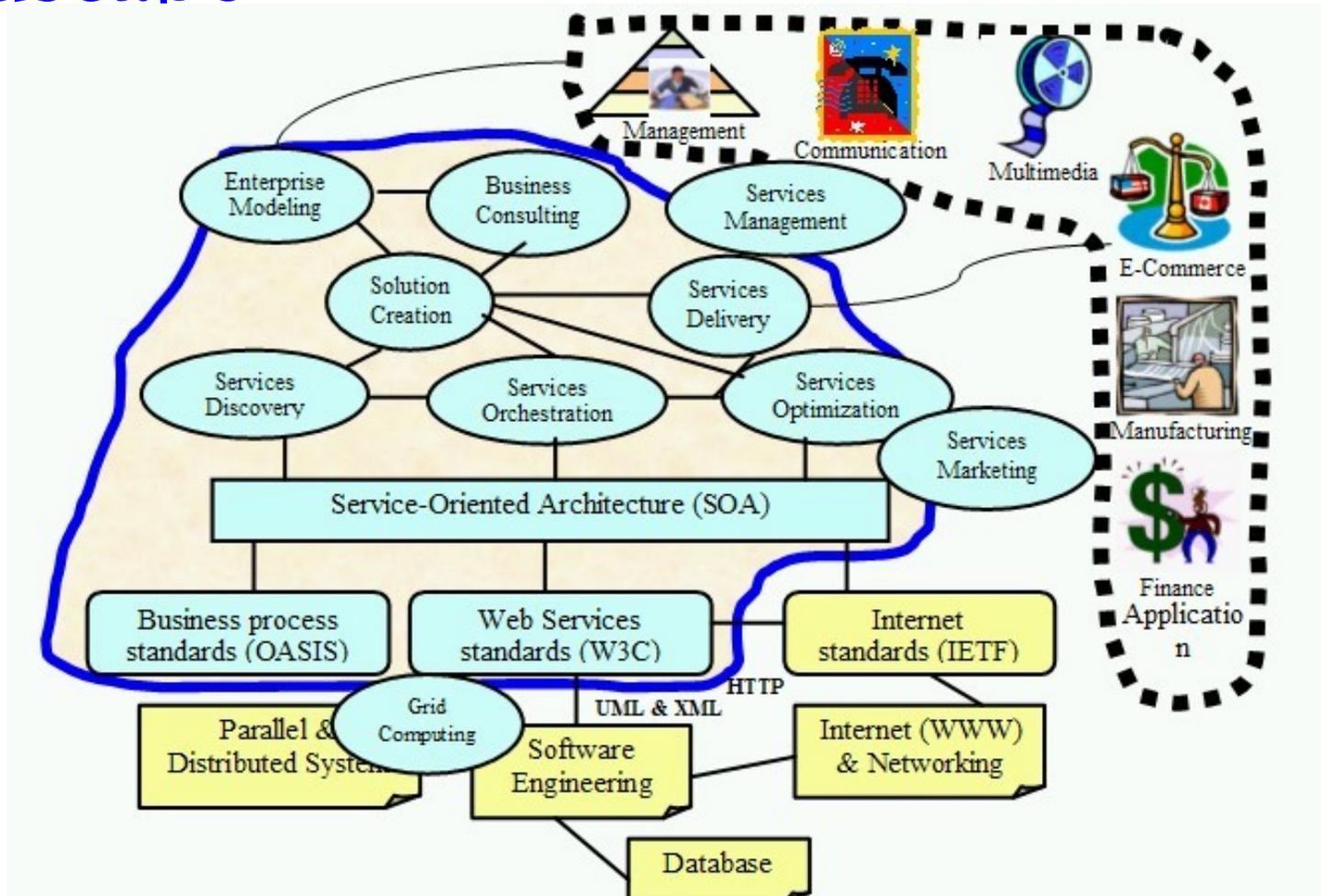 *3. Business and IT Aligned Management Services*
  a. Service-Level Agreement for
  Contracts
  b. Key Performance Indicators
  for Business Processes
  c. Quality of Services for
  Services Offerings
  d. Management Methods and
  Tools for Business and
  IT Alignment

Service Oriented Computing Landscape

www.ibm.com

Service Otriented Computing - Research

- services delivery and cloud

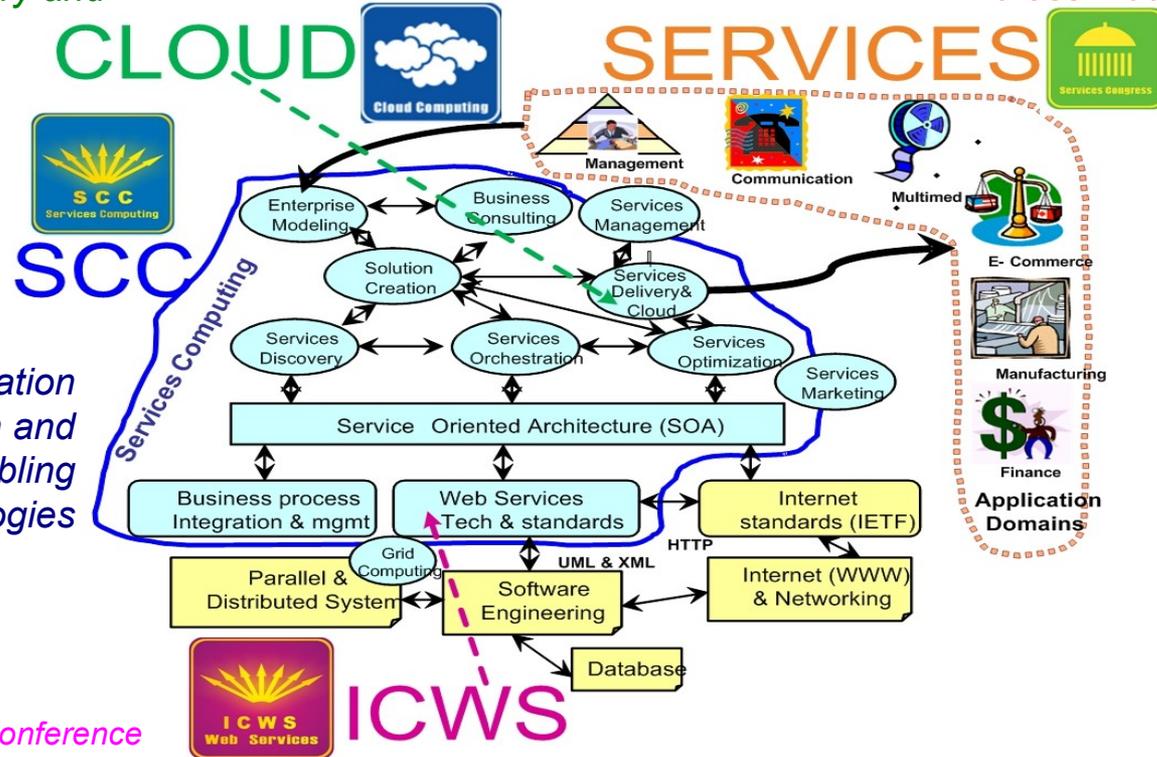4th IEEE 2011 International Conference on Cloud Computing

- business service sectors (vertical industries and cross-industries)

7th IEEE 2011 World Congress on Services

8th IEEE 2011 International Conference on Services Computing

- innovation research and enabling technologies

8th IEEE 2011 International Conference on Services Computing

- Web-based services, Web services technologies and standards

Service Oriented Computing for a Smarter World

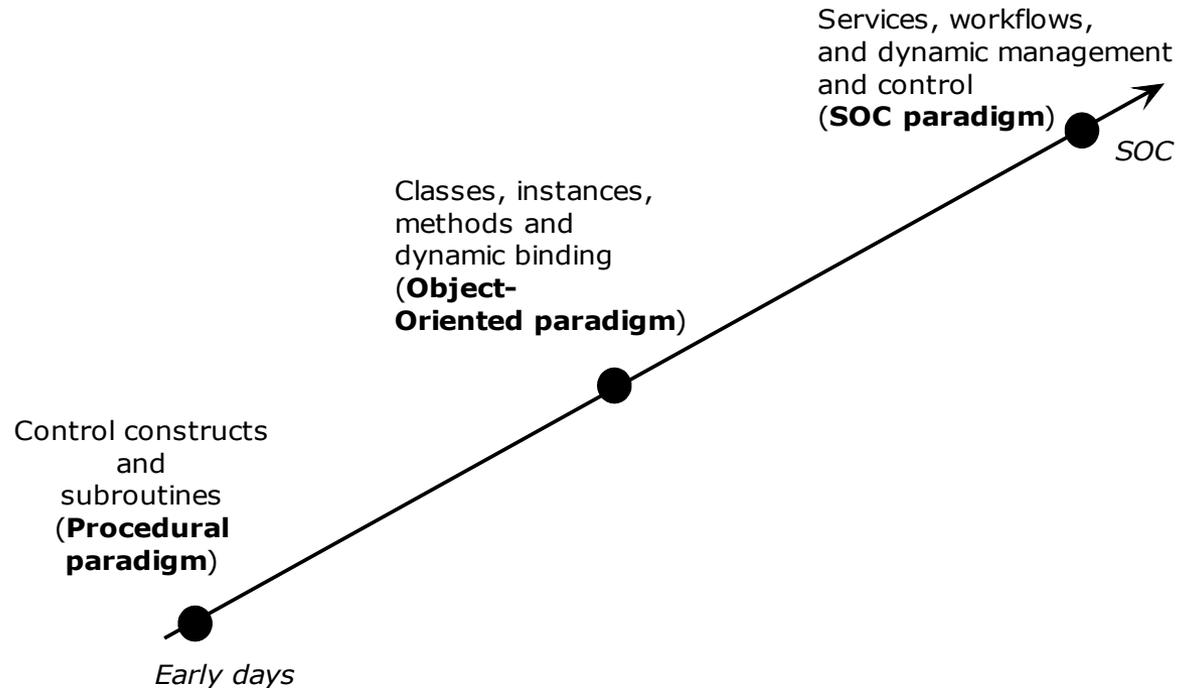
http://www.thesrii.org

SRII Global Conference 2011

- "Future of IT" for Service Verticals:
  - IT for Healthcare
  - IT for Environmental Services
  - IT for e-Government
  - IT for Education Services:
  - IT for Engineering/ Manufacturing Services
  - IT for Agriculture Services

- Cloud Computing & new service models
- Mobile Technology & Service models
- "Intelligent" Services, Knowledge Management, Data mining
- Service Innovation/Quality
- Service Engineering/ Tools/Standards
- Service Marketing/Leadership
- Service System/Human Factor Engineering
- Service Life Cycle: Business Process/Models/Cost
- Service Management & Sustainability

SOC Education

- SOC refers to the set of concepts, principles, and methods that represent computing in a collection of loosely coupled services

  - software applications in SOC are constructed from component services with standard interfaces that make such components reusable

  - specification of services using open standards, discovery of services in repositories using specification only, creation of composite services using existing services, and dynamic application composition, runtime management by policies

Services, workflows, and dynamic management and control (**SOC paradigm**)

SOC

Classes, instances, methods and dynamic binding (**Object-Oriented paradigm**)

Control constructs and subroutines (**Procedural paradigm**)

Early days

SOC and traditional programming education

Strategic Difference	Traditional Programming Education	New SOC Education
Educational Goal	Learn programming language constructs and apply them for problem solving.	Learn the overall application architecture and how to compose applications using existing component services.
Focus	On hardware and software interface, system interaction, low-level programming techniques, and low-level reusability (rather than applications).	On service specification, application composition, human/computer interactions, system interaction, and software modules, applications domains, and high-level reusability.
Curriculum Content	The syntax of the programming language, with an emphasis on the construction of program modules.	The SOC principles and the use of existing services to compose applications.
Order of Curriculum Contents	Learn programming language constructs, followed by architecture design.	Learn software architecture design followed by workflows and services.
First Computing Course	Develop applications from scratch.	Develop applications by composition using existing services in an SOC infrastructure.

W. T. Tsai, Y. Chen, C. Cheng, X. Sun, G. Bitter, M. White, "An Introductory Course on Service-Oriented Computing for High Schools", Journal of Information Technology Education, Volume 7, 2008

SOC Education - Features

Features	Traditional Programming	Service-Oriented Computing
Overall Process	For example, object-oriented design by first identifying data, classes, or associated methods.	Software development by identifying loosely coupled services and composing them into executable applications.
Level of Abstraction and Cooperation	Application development is often delegated to a single team responsible for the entire lifecycle of the application. Developers need to have programming knowledge and some domain knowledge.	Development is delegated to three independent parties: application builder, service provider, and service broker. Builders understand application logic and may not know how services are implemented. Providers develop services but may not know the applications.
Code Sharing and Reuse	Code reuse through inheritance of class members and through library functions. Often these are platform dependent.	Code reuse at service level. Services have standard interfaces and are published on Internet repository. They are platform-independent and can be searched and remotely accessed. Service brokerage enables systematic sharing of services.
Dynamic Binding and Re-composition	Associating a name to a method at runtime. The method must have been linked to the executable code before the application is deployed.	Binding a service request to a service can be done at the design time or at runtime. The services can be discovered after the application has been deployed. This feature allows an application to be composed (and re-composed) at runtime.

W. T. Tsai, Y. Chen, C. Cheng, X. Sun, G. Bitter, M. White, "An Introductory Course on Service-Oriented Computing for High Schools", Journal of Information Technology Education, Volume 7, 2008