Towards a Service Oriented Engineering Education

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Agenda

- Towards Service-Oriented Science
- Towards Service-Oriented Education
- Social Context of Services Computing
- Services Computing – Coverage and IT perspective
- Services Computing – Aspects for business and IT services
- Service Science Knowledge Environment
- SS-KE – Premises to co-create value [a systemic point of view]
- Value Co-Creation – Semantic technology
- SS-KE –
  - Service Science Library
  - Service Science Concept Library
  - A Conceptual View
- Service Science Ontology-based Data Integration
- SS Curricula – Service Innovation Map, Master Program SEM

Towards Service-Oriented Science

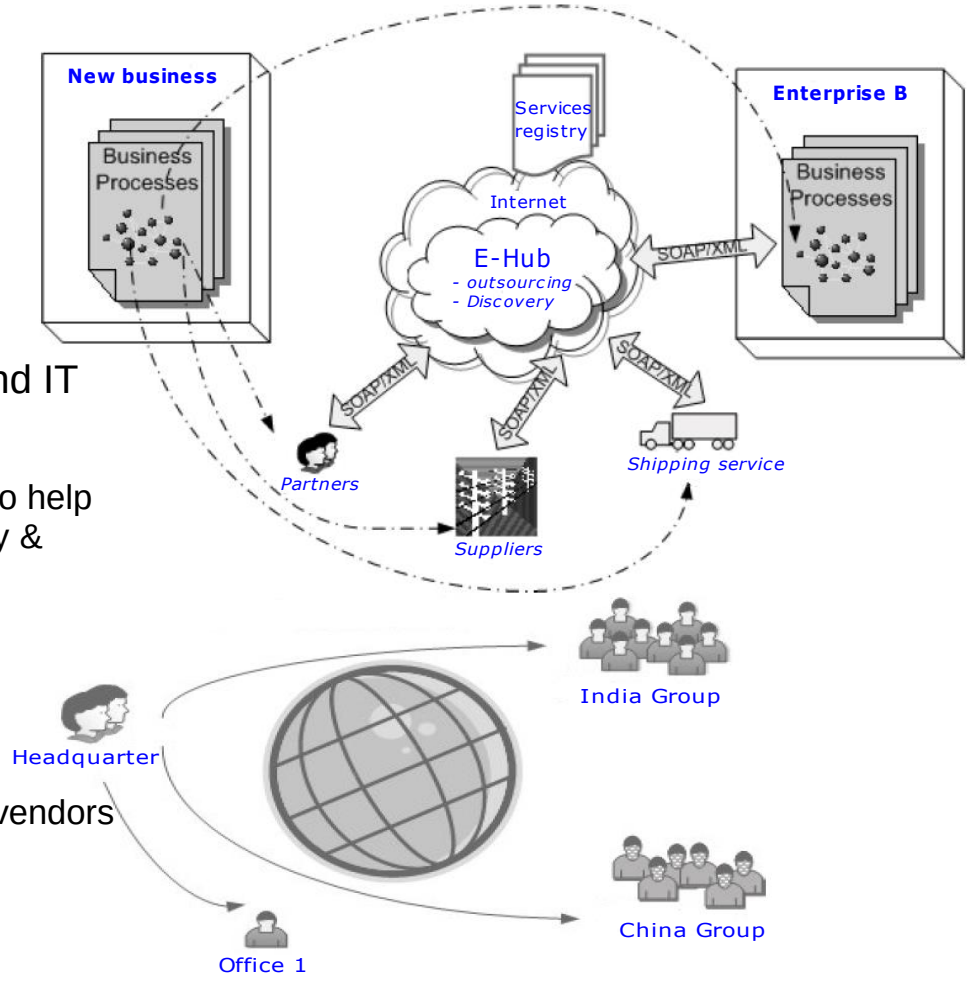
- Advances in Information Technology are changing the way in which data is turned into insight – by *automating time-consuming activities*
  - **Service-Oriented Computing**, i.e. *technology that allows powerful information tools to be made available over the network* – may contribute to that evolution
  - **Service-Oriented Science** ("e-Science") refers to *scientific research enabled by distributed networks of interoperability services*
    - new information architectures
    - new approaches to publishing and accessing valuable data and programs
    - automated access by software programs, data integration from many sources and relationships identification
    - service orientation of processes, resources, activities…

Towards Service-Oriented Education

- New roles for campus information technology organizations
  - in addition to operating commodity services such as Internet and e-mail, these organizations can host functions and provide resources
  - various functions such as catalogs and ontologies, support a variety of collaborative research programs in different areas
    - all participants can obtain access to large quantities of distributed storage and computational power when they need it
    - e-Science:
      - increase individual and collective scientific productivity by making powerful information tools available to all
      - shared information documented in various databases and programs that represent - and automatically maintain and evolve - a collective knowledge base
    - scientific enterprise: new skills to build / use / host services
      - policies to govern access to services required

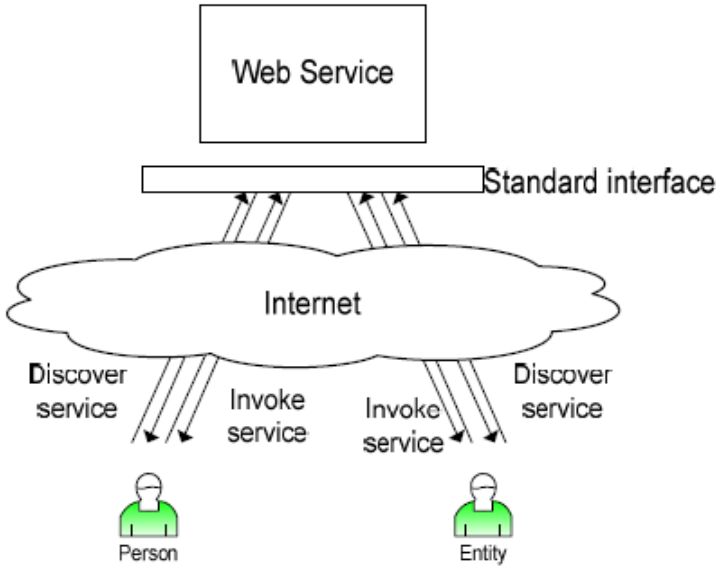
Social Context of Services Computing

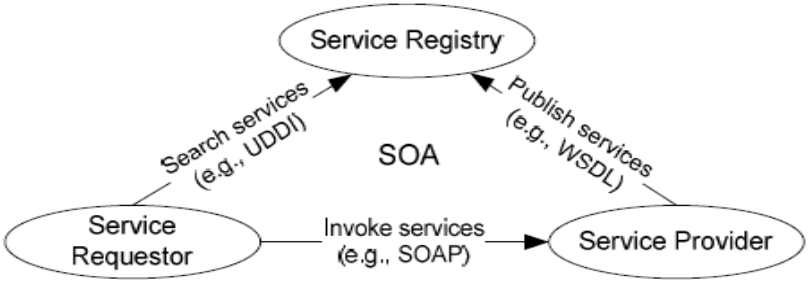
- paradigm reorientation - application development and enterprise IT infrastructure
  - SC – the centrepiece of enterprise IT infrastructure that includes Web services, SOA, SaaS and application service providers (ASPs)
- SC bridges the gap between business and IT
- SC promises to benefit business
  - 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
- Business initiatives
  - Support by major software infrastructure vendors (IBM, SAP, Microsoft, Sun, BEA)



What is Services Computing ?

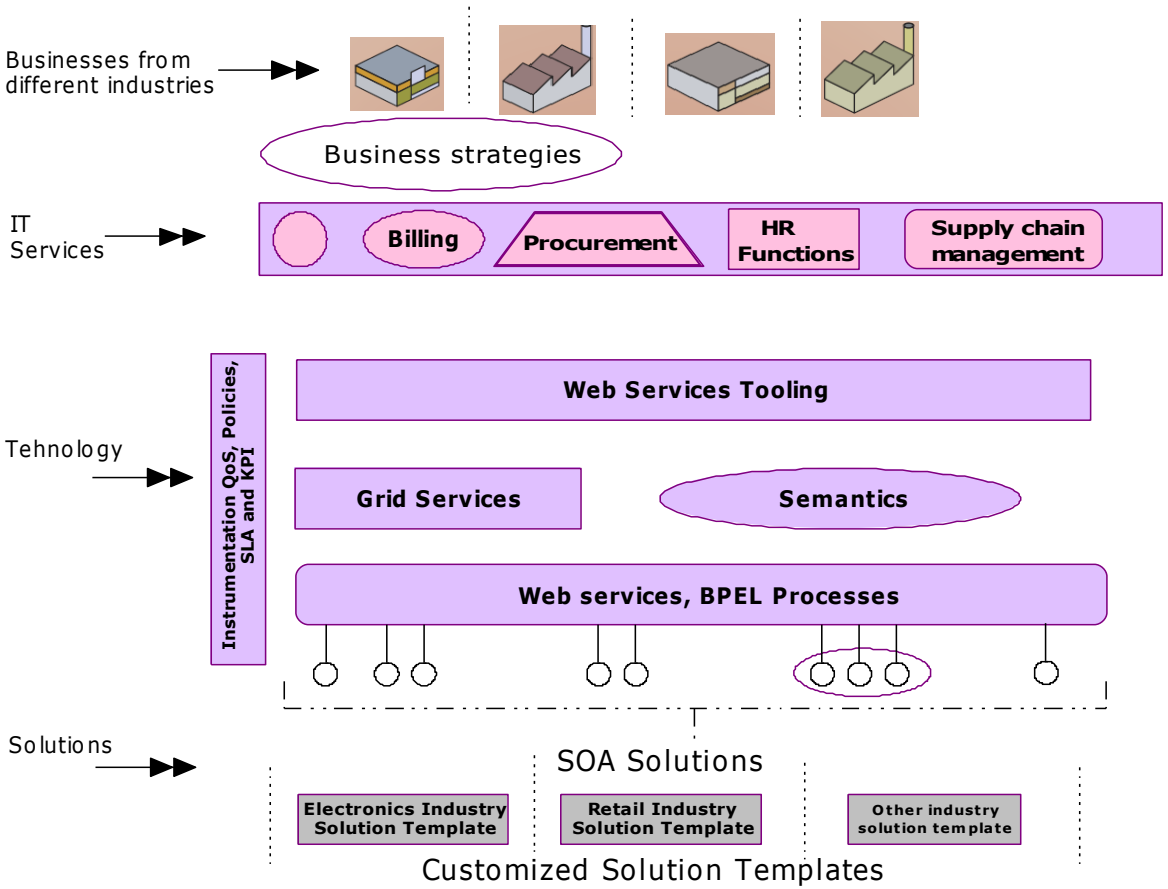
- *SC covers the science and technology of leveraging computing and IT to model, create, operate, and manage business services*.
  - web services - best enabling technology
    - universal accessibility through standard communication protocols
  - Service Oriented Architecture (SOA) - central architectural 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

Services Computing – IT Perspective



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

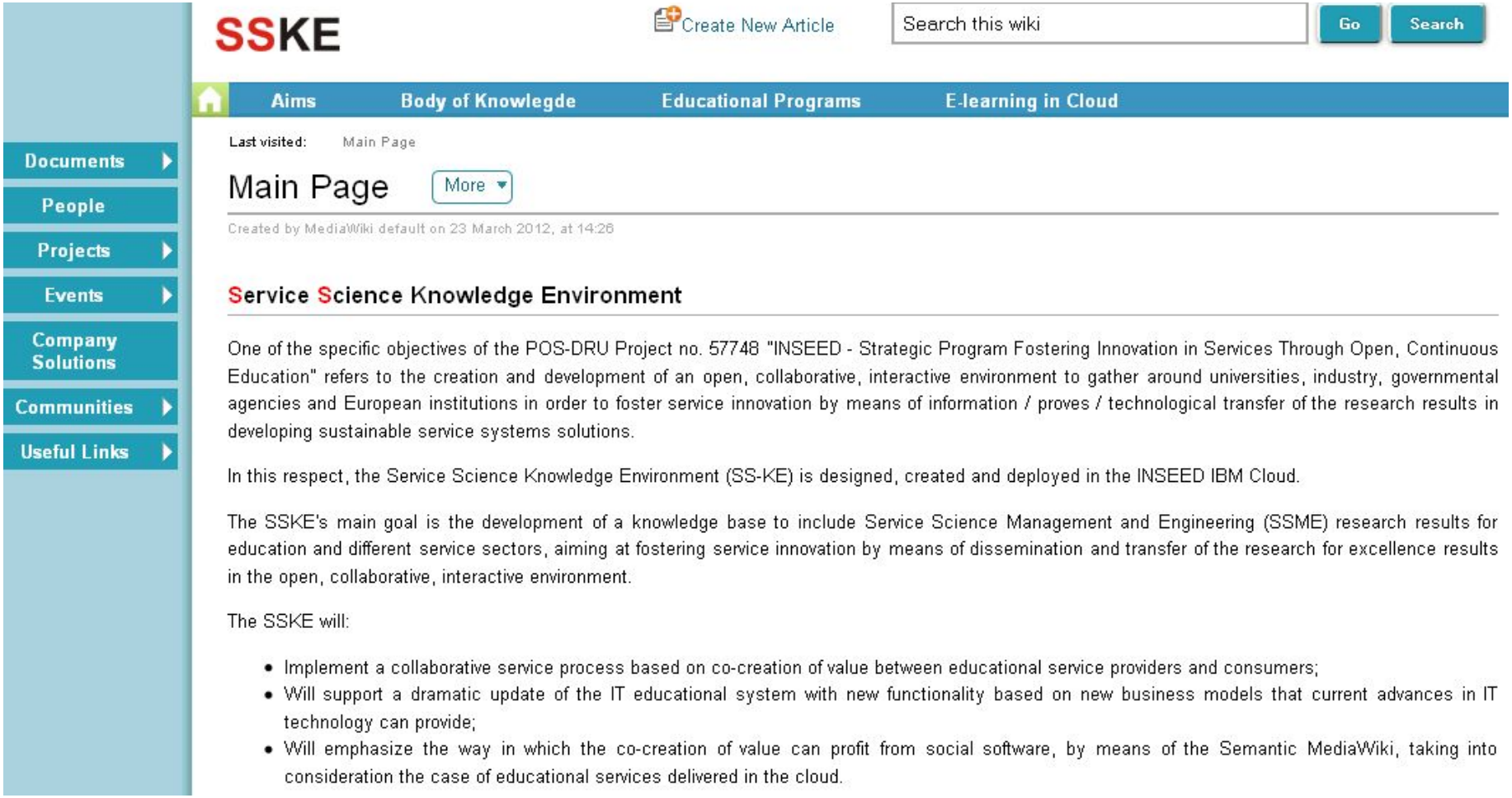
- expose business applications through well-defined interfaces in a platform-independent manner
  - increase interoperability
  - foster the whole business collaboration chain

SC - aspects for business and IT services

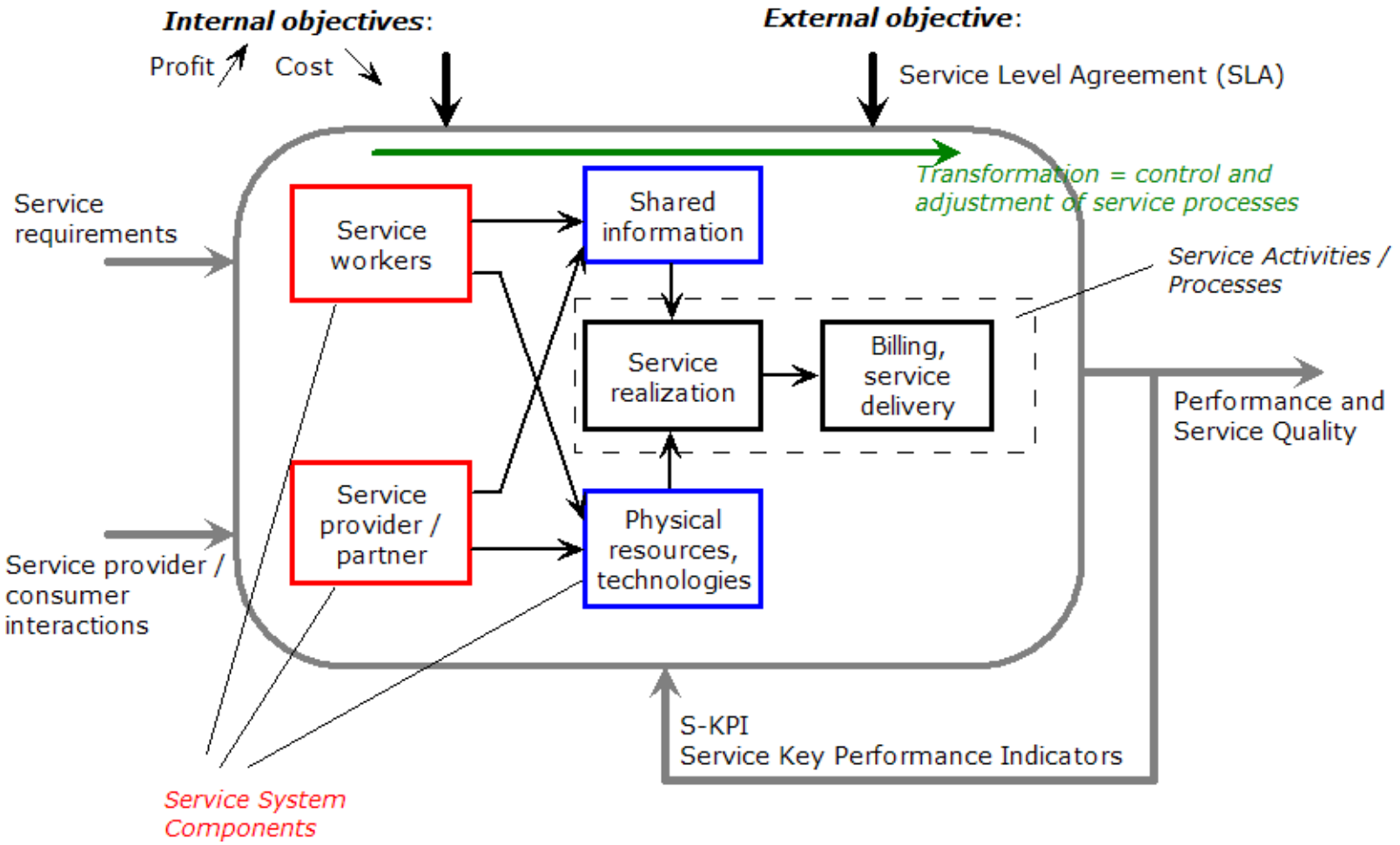
- SC covers various aspects of business and IT services.
  - for business services:
    - service-oriented business consulting methodology and utilities;
    - business process modelling, transformation, integration;
    - business performance management;
    - industry solution patterns.
  - for IT 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.

Service Science Knowledge Environment

http://sske.cloud.upb.ro/wiki/



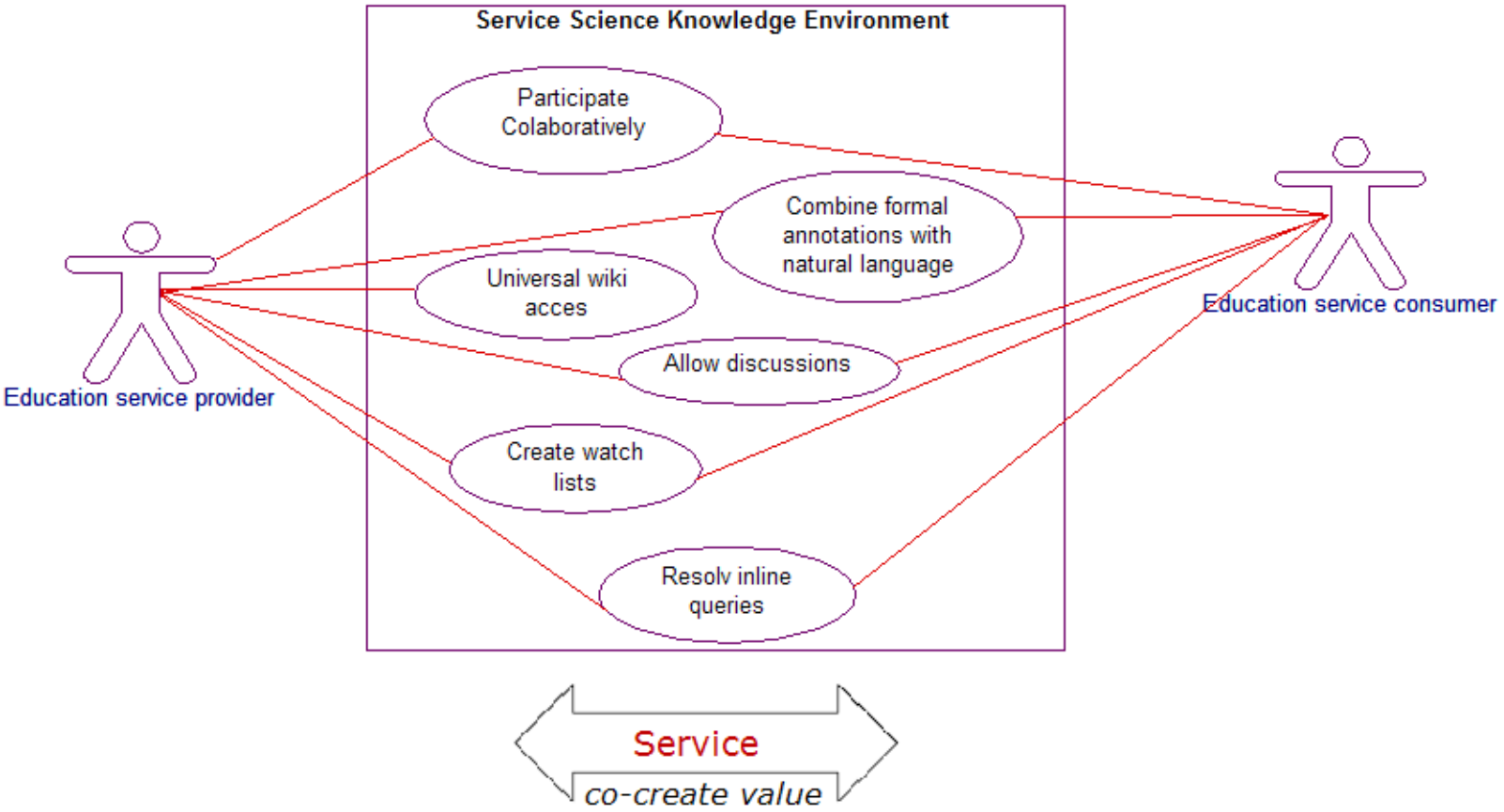
SS-KE – premises to co-create value



Education Service System = {Inputs, Outputs, Goals, Transformation, Components, Feedback}

Value Co-Creation - semantic technology

- approach knowledge-intensive processes and exploit the knowledge that is locked in the content



SS-KE – Service Science Library

- **Knowledge Path on Service Science**
  - Service Science – defining the domain (ontology-based)
  - Point of view on learning needs (*)
  - Service Science Discipline Classification
  - Service Science – a global perspective (*)
- **Innovation Passport**
  - Characteristics of Service Innovation (**)
  - Measuring Innovation (**): Innovation and productivity; Intellectual Property and services; Productivity and growth in services;
  - R&D in Services – roadmap for service innovation (**)
  - European and World wide support to foster innovation
  - Research priorities for the Science of Service (**)
- **Solutions to improve service innovation**
  - Management focused (*)
  - SOC focused (*)

* POS-DRU Project no. 57748 "INSEED - Strategic Program - Fostering Innovation in Services through Open, Continuous Education"

** 207/CPII/2010 Project - Prospective Study in Service Science- "CRIS – Research Strategic Program for Growth and Innovation in Services

SS-KE - Service Science Concept Library

- **Foundations of Service Science**
  - Service Fundamentals
  - Services Computing
  - Service Oriented Computing and enabling technologies
  - etc ...
- **Research projects on services and service innovation**
  - Industry research
  - Education (*)
  - Service Sectors
  - Prospective studies (**)

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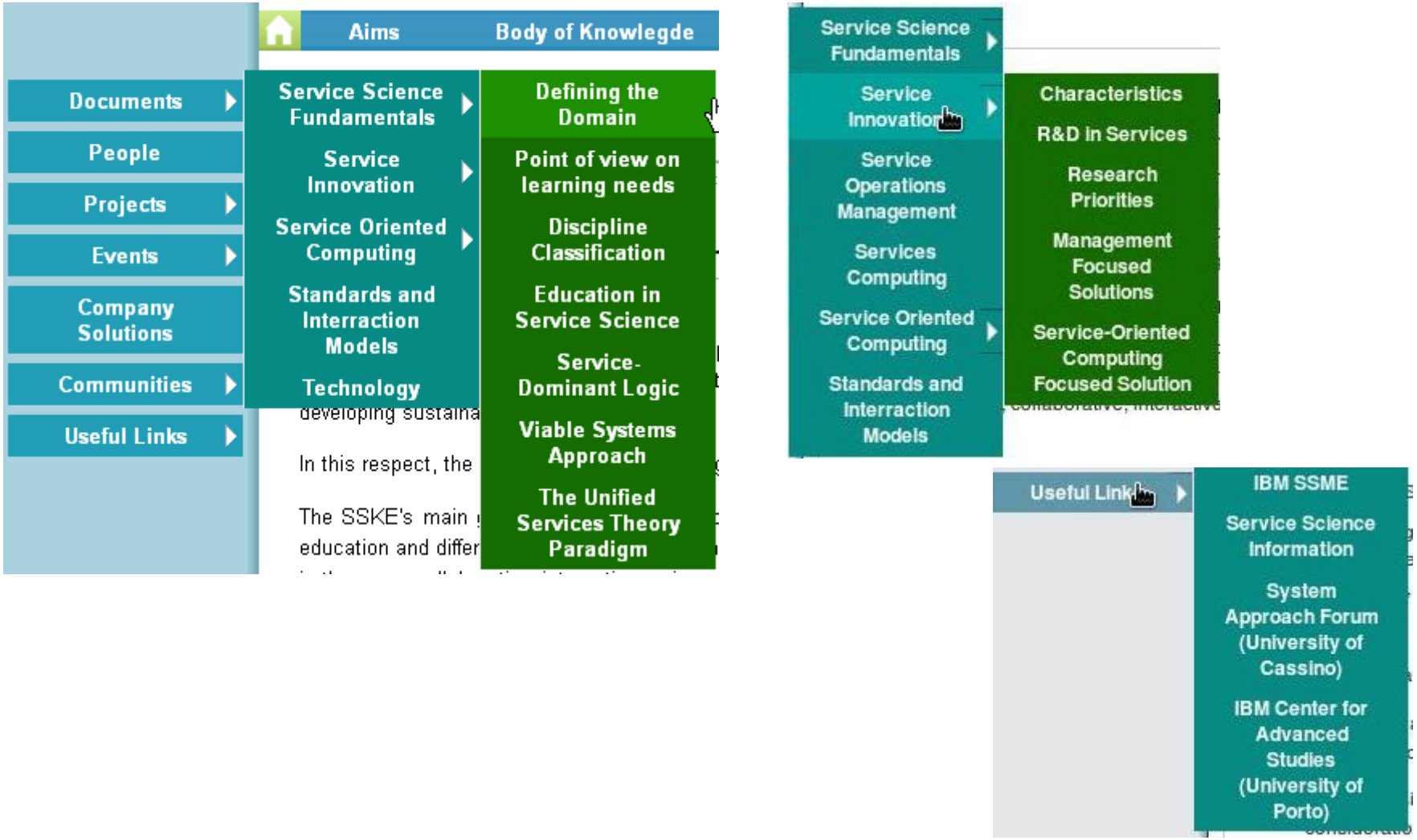
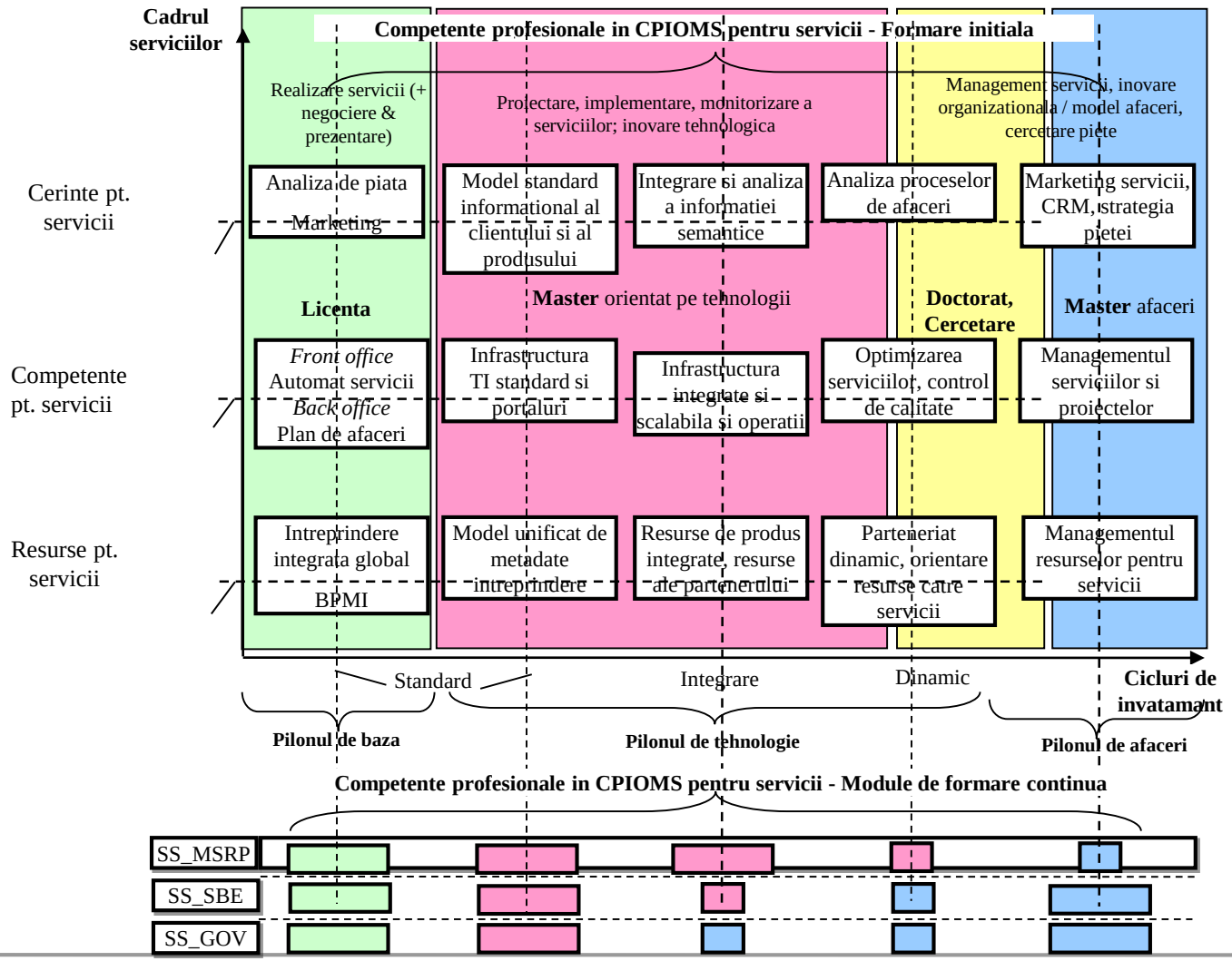
SS-KE – a conceptual view



Service Science Ontology-based Data Integration

- SS-KE conceptual artifact:
  - *a formal and computerized specification of constructs for Service Science to be used for supporting automated reasoning in the intelligent knowledge management system deployed in the INSEED IBM Cloud*
- SS-KE: we use the ontology to effectively combine data or information from multiple heterogeneous sources
  - specifically, the Service Science ontology is intended to play the following roles:
    - *content explication*: it will enable accurate interpretation of data from multiple sources through the explicit definition of terms and relationships in the ontology
    - *query model*: the query is formulated using the ontology as a global query schema

SS curricula - Service Innovation Map



Master Program – Service Engineering and Management

Code	Discipline	Sem	C	S	L	P	ECTS	Evaluation (E/V/P)
UPB.03.M1.O.17-01	C11: Mathematical Modelling of Economic Processes	I	2		2		6	E
UPB.03.M1.O.17-02	C12: Data Mining and Data Warehousing	I	2		1		6	E
UPB.03.M1.O.17-03	C13: Architecture of Service Oriented Information Systems	I	2			2	6	E
UPB.03.M1.O.17-04	C14: Marketing and Financial Performance of Business	I	2		1		6	V
UPB.03.M1.O.17-05	C15: Network and Systems Security	I	2			2	6	E
	Total didactic activities: **18 hours**		**10**		**4**	**4**	**30**	
	R&D Activities: **10 hours**	I			**10**			
UPB.03.M1.O.17-06	C21: Business Process Modelling	II	2		2		6	E
UPB.03.M2.O.17-07	C22: Supply Chain Management and Logistics	II	2			2	6	E
UPB.03.M2.O.17-08	C23: Communication Management and Cognitive Psychology	II	2	1			6	V
UPB.03.M2.O.17-09	C24: Foundations of Service Science	II	2		2		6	E
UPB.03.M2.O.17-10	C25: Accounting and Financial Management for Services	II	2		1		6	E
	Total didactic activities: **18 hours**		**10**	**1**	**5**	**2**	**30**	
	R&D Activities: **10 hours**	II			**10**			
UPB.03.M3.O.17-11	C31: Enterprise Integration and Management Architectures	III	2		2		6	E
UPB.03.M3.O.17-12	C32: Business Service Integration and Management	III	2			2	6	E
UPB.03.M3.O.17-13	C33: Knowledge Engineering and Services Ecosystem	III	2		1		6	V
UPB.03.M3.O.17-14	C34: Service Operations and Customer Relationship Management	III	2			2	6	E
UPB.03.M3.O.17-15	C35: Intellectual Property and Entrepreneurship	III	2		1		6	V
	Total didactic activities: **18 hours**		**10**		**4**	**4**	**30**	
	R&D Activities: **10 hours**	III			**10**			
	Total didactic activities: **0 hours**	IV						
UPB.03.M4.O.17-16	Development of graduation project: **14 hours**	IV			**14**		**14**	E
UPB.03.M4.O.17-17	R&D Activities: **16 hours**	IV			**16**		**16**	V
Total activities	Total didactic activities: **54 hours x 14 weeks = 756 hours**		**30**	**1**	**13**	**10**	**90**	
	Total R&D activities: **30 hours x 14 weeks = 420 hours**				**30**		**30**	

Conclusions

- From System Science to Service Science
- Service Innovation – a necessity in the global economy
- Service Science Curricula in Engineering education:
  - Lifecycle software development [IT support for complex, KIS systems]
  - From business management to service management [operation M&M]
  - Communication, team work, psychology
- Services Computing – the framework for services design & implementing
- Service Innovation through R&D
- Service Science – Knowledge Environment: bridge the gap between theory and practice
- The Service Ecosystem: 3 society tracks, 13 service sectors