The Future of e-Tourism Research

From Computer Science to Web Science and Services Science

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Outline

- Information Society (Introduction)
- From Computer Science to
- Web Science
- Services Science
- E-Tourism and Conclusions

Information Society

- In 2006 160 exabytes (10^{18}) of information was created or replicated worldwide – more than in the previous 5.000 years
- Technical information doubles every 2 years
- Acceleration: 3 major technologies of mankind (hunting, agriculture, industry) grew 100 times faster than resp. predecessor
- Virtualization: „value “ of companies like Google, ebay, or Skype based on information and user network (not infrastructure)
- Changes in society (e,g., Wiener 48, Drucker 69 or Bell 76):
  - Move to service industry and importance of information work
  - New technologies and sectors – and their convergence (of both)
  - „Informatisation“ of work, services, products and value chains
  - Increasing differentiation of society with complex interdependencies and interactions, in parallel to ongoing globalization

Basis: From Numbers to Media

- Miniaturization and digitalization
- Global infrastructure and transparent access – Internet / Web
- Mobile computing
- *From calculator to media machine*

Evolution:

- Automaton: Manipulation of well formalized and mathematical models
- Tool: Modeling of data and work processes
- Medium: Representation and processing of unstructured information

Computer Science

- Computer Science: Science of processing of information, especially automatic processing using computers – (German Duden)
- Computer Science / Informatics is the science that has as its domain information processes and related phenomena in artifacts, society and nature – Nygaard (already in the 60s)

- From pure “programming“ and a set of tools to discovering information structures and algorithmic processes in different (scientific) fields

Computer Science (2)

- Computer Science (and computer as general purpose „self-referencing programmable” automaton): all-encompassing and pervasive
- Tackles all areas of economy, society and life
- Thus, it is not only „technology“

Examples

- **Web Science**
- **Services Science**

Web

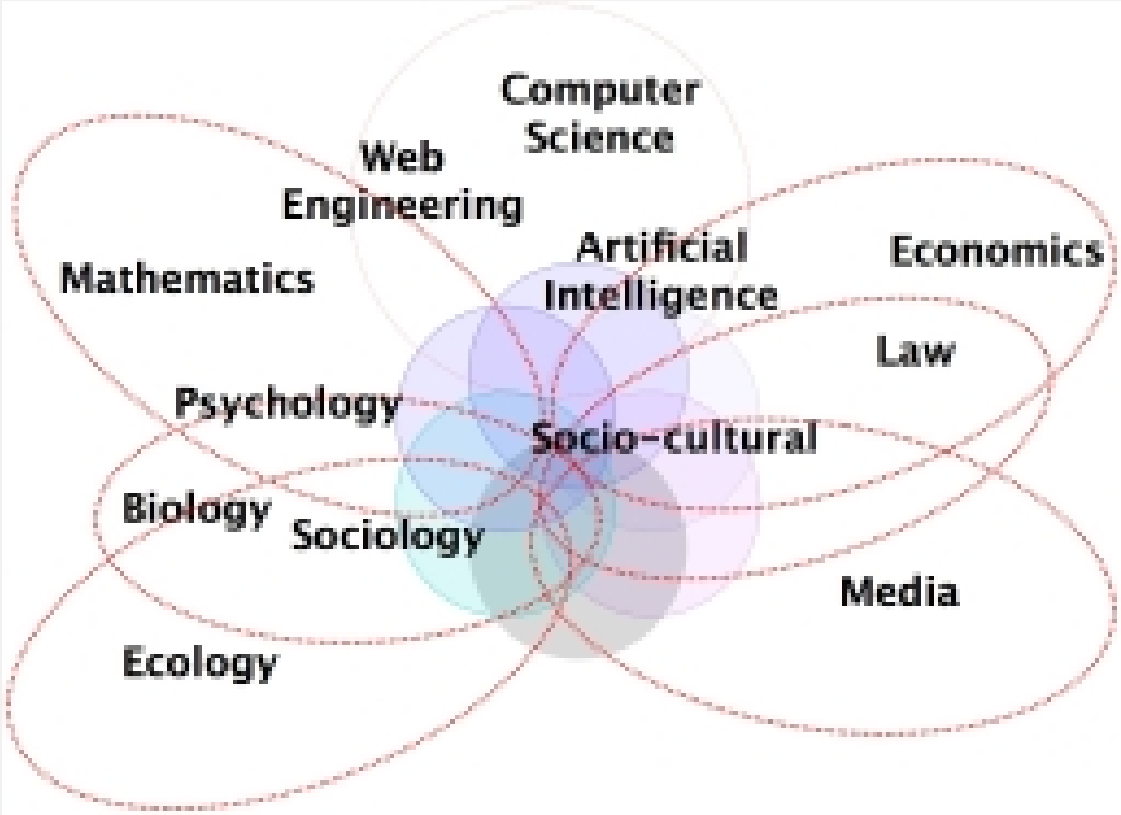
- The Web has …
  109 million distinct web sites
  29.7 billion web pages
- The Internet has …
  0.5 billion hosts (IP addresses)
  1.17 billion users (or 17.8% of the world's population)

- Some fundamental basic and simple principles
  - Naming service, protocol and mark up
- Decentralized, no central directory, no central power instance
- Web 2.0: web as platform and user contribution (*read write web* – Ted Nelson) – social networks / collective intelligence
- 3 D virtual worlds
- Evolution of order and un-order

Web Science

- Web documents more and more aspects of human activity and knowledge – *Web as a mirror of world*
- Web Science: research agenda for understanding the scientific, technical and social challenges of the Web and its the growth
- Web needs to be analyzed and understood, and it needs to be engineered as well as governed
- Levels to be distinguished:
  - Web technology (infrastructure, software, tools)
  - Content
  - Users

Web Science - Disciplines and Issues

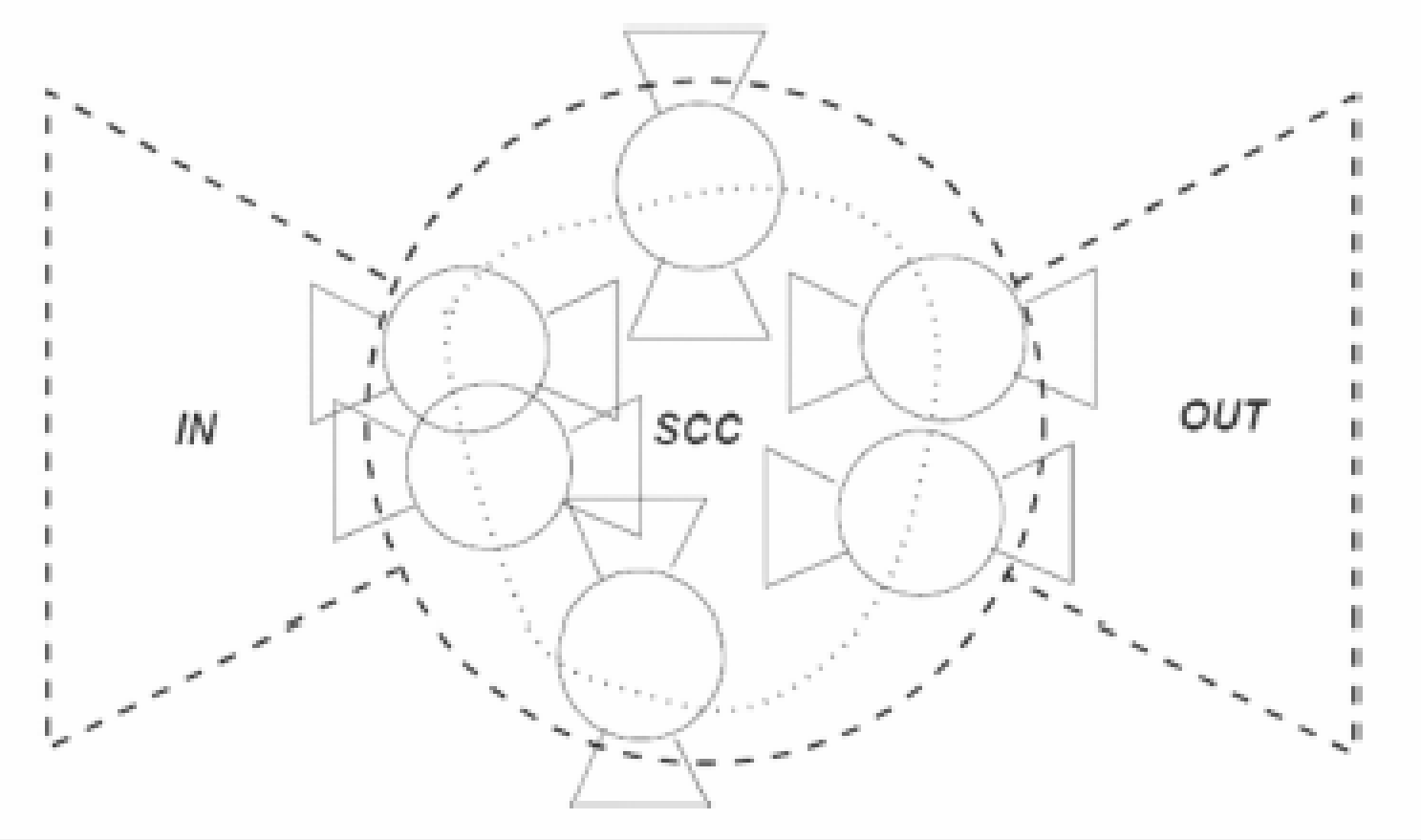


- Sociology
  - Trust, reputation, privacy, study of human behavior (e.g., also in Second Life)
- Topology
- Content and its aggregation

Topology

- Based on network analysis (Erdös & Rény, 1959, 1960; Barabási & Albert 1999)
- Permanently varying size
  - An experiment crawled 150 mio. webpages for 11 weeks, by the 9th week experimenters lost access to over 10% of those pages (and 4% disappeared within the first week)
- Issues regarding completeness and correctness (e.g., query results)

Bowtie Structure



Topology – 3

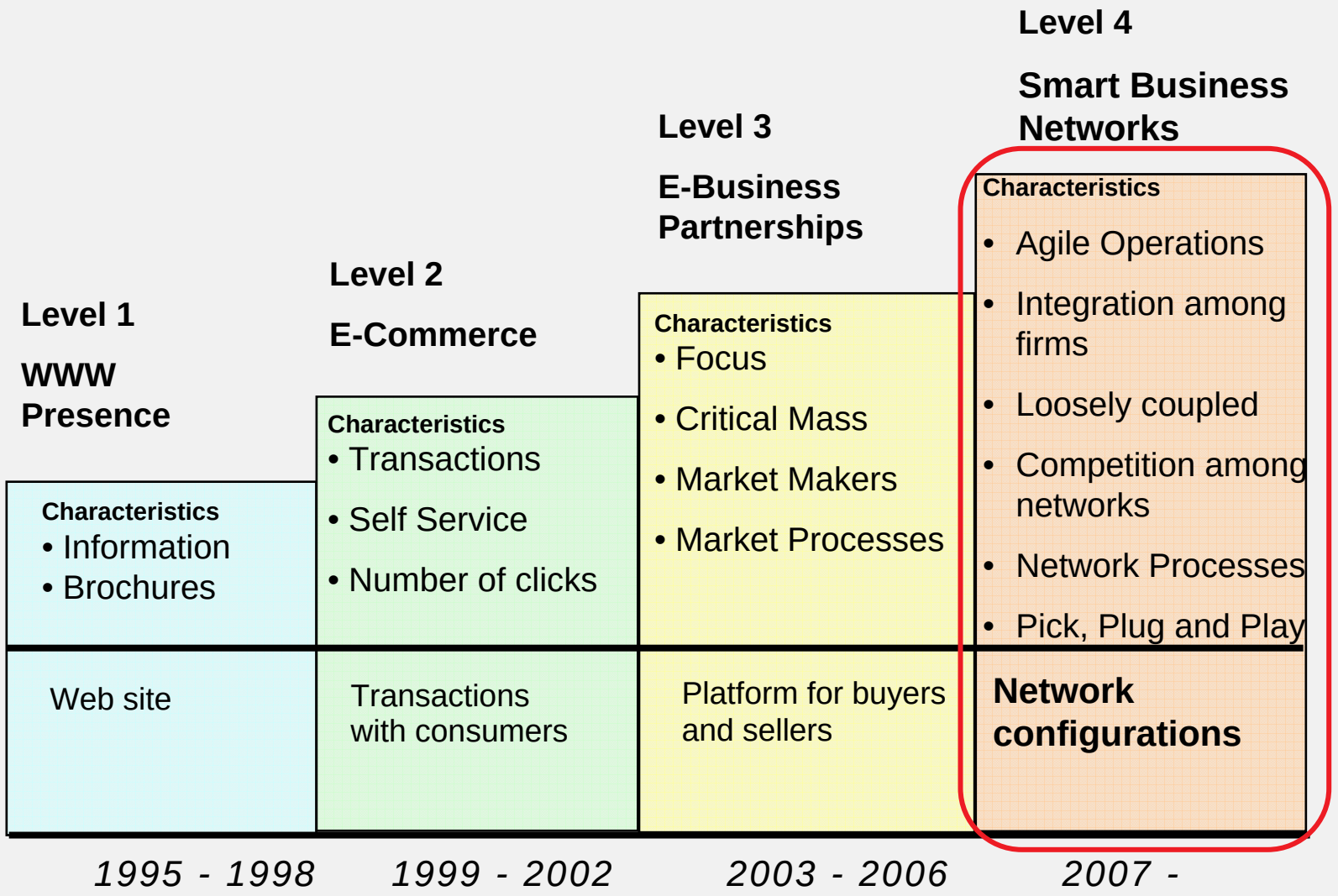
- Bowtie structure prevalent at a variety of scales
- Each TUC (thematically-unified cluster) has its own SCC (strongly connected cluster), IN and OUT; contained within a wider SCC
- More outgoing than incoming links
- Fractal nature of the Web: compromise between stability and diversity:
  - A reasonably number of connections at various levels of scale means more effective communication
    - Too many connections produce a high overhead for communication
    - Too few mean that communications may fail to happen.
- The structure is “hypothesized” as a *small world graph*: the shortest paths between nodes are small
- Links between nodes are not purely random: several studies showed the phenomena of “Winners take it all”
  - Many nodes have few links, and a small but significant number have very many - *Scale free networks*

Content

- Issues: identity – needed for query and / or aggregating content
- But structure of content:
  - 25% original; 75% replicated
  - 95% unstructured and growing
- Questions:
  - When are two objects / pages the same: **content gap**
  - How often do I exist in the Web: **people gap**

- Possible answers: *global object model* and *portable social environment*
- One approach: **semantic web** based on formal ontologies (joint and agreed unified understanding – enables formal representation and reasoning) combined with **social web** (folksonomies)

Another View: Smart Business Networks



van Heck, 2005

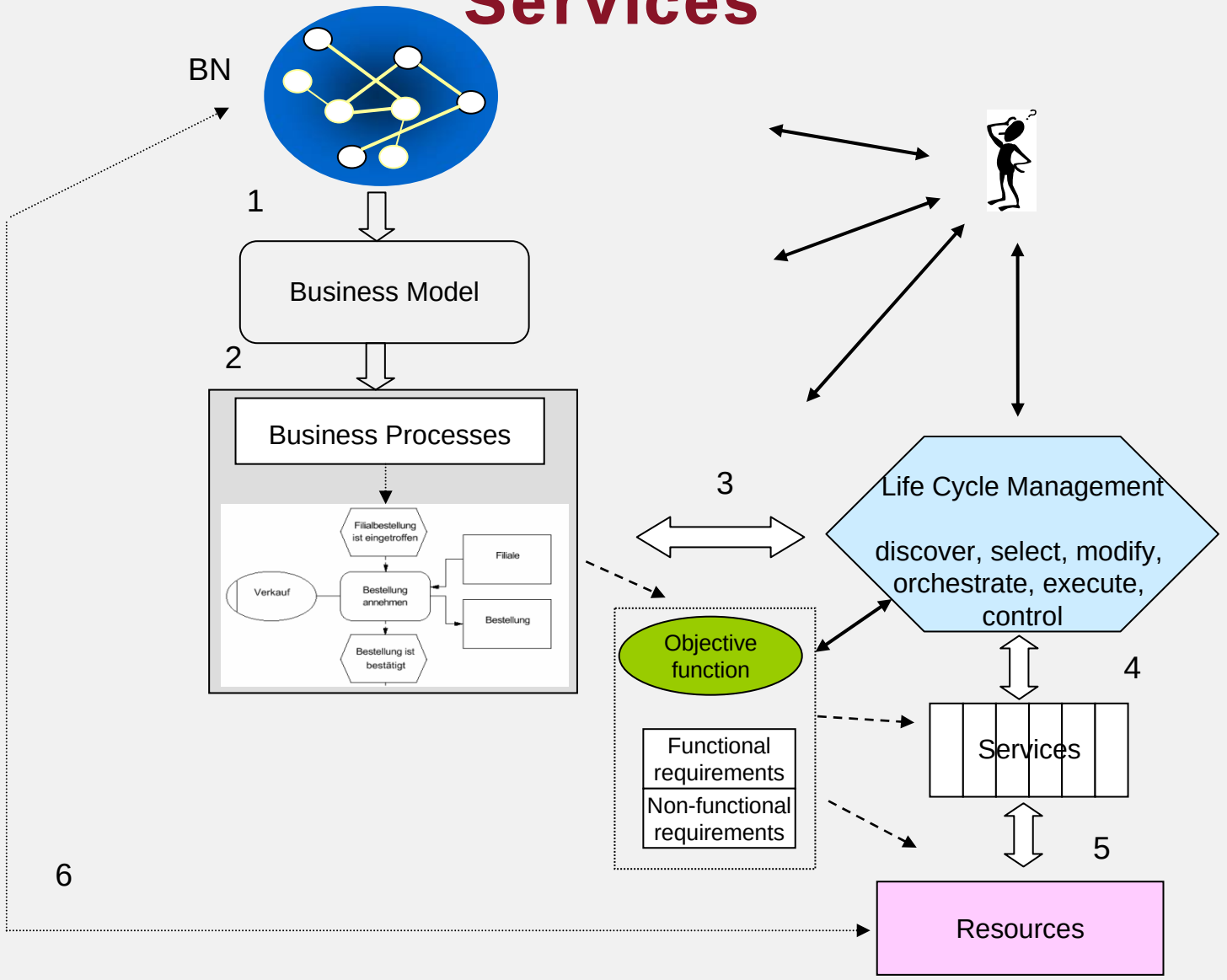
Smart Business Networks

- Flexibly cooperating companies as nodes in an ICT based network
- Quick *Connect* und *Disconnect* – *“Pick, Plug, and Play”*, depending on concrete task to be fulfilled by network participants
- Compatible business objectives
- Important: trust, risk and award management

Logic of value – combine three dimensions:

- ”Techno logic”
- ”Business logic”
- ”Market logic”

Vision: From Business Networks to Web Services



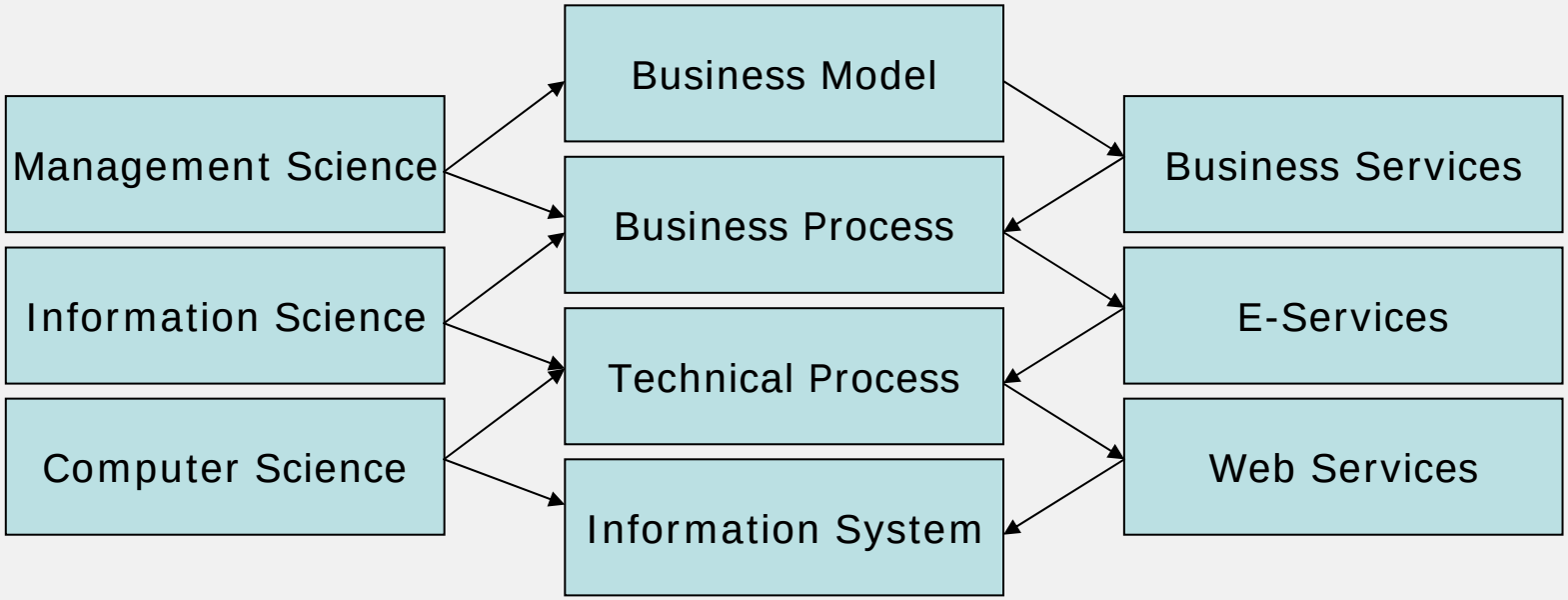
Services Science

- Services as “value exchange” are key / starting point (refers also to importance of service industry)
- Focus is on flexible design, implementation and operations of services, putting the customer at the center
- Technically based on SOA (service oriented architecture) and semantics
- Alignment of strategy with implementation and flexibility
- Link **strategy**, **business models**, **business processes** and implementation (utilizing SOA)
- **From strategy to implementation**
- Also here a set / mix of disciplines

Services Science - 2

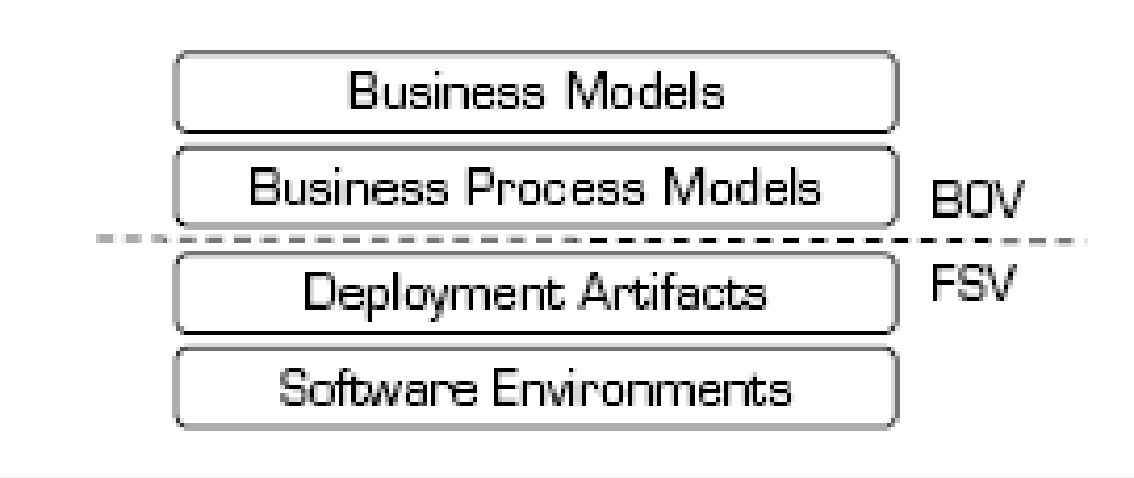
- Service:
  - Close interaction of consumer and supplier
  - Based on information / knowledge created and exchanged
  - Simultaneity of production and consumption
  - Combination of knowledge into useful systems
  - Exploitation of ICT

Service: Different Views



- MS: service is defined as a business economic activity, offered by one party to another to achieve a certain benefit (Zeithaml & Bitner, 1996), or (Kotler, 98)
- IS: a service is a complex (or simple) task executed within an organization on behalf of a customer (O'Sullivan et al., 2002)
- CS/Web services: programmable, self-describing, encapsulated, and loosely coupled functions accessed & invoked over the Internet

Implementation: Open edi Reference Model



- Separation of business / process logic and implementation
- The *business operational view (BOV)* addresses business collaborations and related business information exchanges – (technology independent)
- The *functional service view (FSV)* addresses technical and implementation aspects to support collaborations expressed in BOV related specifications
- Different FSV implementations for BOV may be derived

Back to e-tourism

- Tourism
  - Worldwide networked industry
  - Product is complex (bundle), confidence good and emotional
  - Tourism is a Service Industry / an Information Business
  - Leading in Web / e-commerce
- E-commerce
  - e-commerce favors, in tendency, buyers
  - Network engineering
  - Importance of services (commodities – deconstruction of value chain)
- Services Science: system design
  - Heterogeneous & cooperative systems with autonomous participants
  - Intelligence (network, supply, customer) – cooperation / harmonisation
  - Set of services
  - Scalability and openness
- Web Science: structure, content, behavior
  - Behavior analysis (including “prediction”)
  - Market research (including prediction of structure)
  - Content generation and annotation – awarding, ranking, trust

Conclusions

- Metamorphosis of Computer Science – pervasiveness
- Computer Science, Web and e-commerce transforms economy and society (travel & tourism industry)
- It is not just technology, but we will see further technology waves
- Importance of “services”
- Two developments: specialization together with empowered consumer (freedom of choice and outsourcing to user) vs. total customer care (integrate for the consumer)
- From business engineering to “well-being” engineering
- Increasing complexity (behavior, processes, structures and technology)
- Importance of knowledge
  - Multidisciplinarity: scholarship and research methods: explorative, analytic, constructive

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