SSME
— Propelling the Innovation of Contemporary Service Industry

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August 29, 2008
Agenda

- Service Science, Management and Engineering
- An architecture of services
- Service value
- Service based in knowledge
- Transforming Transformation
We are in the era of services

- **Evolving to new dominant logic – services-centered**
  - Away from goods exchange
  - Toward exchange of intangibles
    - Skills (S) specialization
    - Knowledge (K)
    - Processes
  - Customers buy offerings rendering services that create value

- **Service:** “[the] application of specialized competences (S & K) through deeds, processes, and performances for benefit of another entity or the entity itself […]”

Some might say it has *always been* the era of services

“The great economic law is this: *Services are exchanged for services*. … It is trivial, very commonplace; it is, nonetheless, the beginning, the middle, and the end of economic science.”

Frederic Bastiat, 1860
What is science?

- Data (Observation)
- Model (Theory)
- Analytics (Testing Validity)
- Take Action (Utility)

Scientific Method (Standards of Rigor)
Scientific Community (Body of Knowledge)
Scientific Instrumentation (Tools & Math)
Value of Science (Professional Relevance)

1. \( \psi \cdot D = \rho \)
2. \( \psi \times H = J + (\nabla \times B) / \mu_0 \)
3. \( \psi \times B = 0 \)
4. \( \psi \times E = -(\nabla \times B) / \mu_0 \)

where

- \( D \) = electric displacement
- \( \rho \) = electric charge density
- \( H \) = magnetic field strength
- \( J \) = electric current density
- \( B \) = magnetic flux density
- \( E \) = electric field strength
Can there really be a science of service?

“Wherever there are phenomena, there can be a science to describe and explain those phenomena. Thus, the simplest (and correct) answer to “What is botany?” is, “Botany is the study of plants.” And zoology is the study of animals, astronomy the study of stars, and so on. Phenomena breed sciences.”

The U.S. National Innovation Investment Act

- US House and Senate voted to approve on August 2nd, 2007; President has signed.

- **SEC. 1106. STUDY OF SERVICE SCIENCE.**
  - (a) Sense of Congress—It is the sense of Congress that, in order to strengthen the competitiveness of United States enterprises and institutions and to prepare the people of the United States for high-wage, high-skill employment, the Federal Government should better understand and respond strategically to the emerging management and learning discipline known as service science.
  - (b) Study—Not later than 270 days after the date of enactment of this Act, the Director of the Office of Science and Technology Policy, through the National Academy of Sciences, shall conduct a study and report to Congress regarding how the Federal Government should support, through research, education, and training, the emerging management and learning discipline known as service science.
  - (c) Outside Resources—In conducting the study under subsection (b), the National Academy of Sciences shall consult with leaders from 2- and 4-year institutions of higher education, as defined in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)), leaders from corporations, and other relevant parties.
  - (d) Service Science Defined—In this section, the term ‘service science’ means curricula, training, and research programs that are designed to teach individuals to apply scientific, engineering, and management disciplines that integrate elements of computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in how organizations create value for customers and shareholders that could not be achieved through such disciplines working in isolation.
Progression of phenomena: Emergence of Complex Systems

- Physical System
  - Physics
- Chemical System
  - Chemistry
- Biological System
  - Biology
- Human System
  - Anthropology
- Service System
  - Service Science

Culture
People with mental models
Language
Trust
Tools & Technology
Organizations And Institutions
Value Co-Creation (Service)

Things That Make Us Smart by Donald A. Norman
Service systems or “value co-creation systems” as complex systems
An intellectually deep, integrative area of great economic significance
As called out in this National Academy of Engineering, 2003 report:

- “The studies suggest that services industries represent a significant source of opportunity for university-industry interaction. Services account for more than 80 percent of the U.S. gross domestic product, employ a large and growing share of the science and engineering workforce, and are the primary users of information technology. In most manufacturing industries, service functions (such as logistics, distribution, and customer service) are now leading areas of competitive advantage. Innovation and increased productivity in the services infrastructure (e.g., finance, transportation, communication, health care) have an enormous impact on productivity and performance in all other segments of the economy. Nevertheless, the academic research enterprise has not focused on or been organized to meet the needs of service businesses. Major challenges to services industries that could be taken up by universities include: (1) the adaptation and application of systems and industrial engineering concepts, methodologies, and quality-control processes to service functions and businesses; (2) the integration of technological research and social science, management, and policy research; and the (3) the education and training of engineering and science graduates prepared to deal with management, policy, and social issues.”

The time is right for is to be focusing on services.

Source: "Technological Revolutions and Financial Capital, Carlota Perez, 2002"
A key thought as we move deeper into the deployment side of this economic cycle

“The turning point has to do with the balance between individual and social interests within capitalism. It is the swing of the pendulum from the extreme individualism of Frenzy to giving greater attention to collective well-being.”
GIO insight: Transformation of the nature of business

Old “Corporation” vs. New “Enterprise”

- **Employs people**
- **Owns resources**
- **Out-sources to save cost and to focus on the core**
- **Gives bosses statutory authority**
- **Ensures consistent brand experience by controlling resources**

- **Enables people:** Provides resources and orchestration for endeavors
- **Manages specialized resources** – internal and external ones
- **Out-sources to tap the best capabilities world-wide!**
- **Grooms leaders** who attract followers through their expertise, passion, & reputation
- **Ensures consistent brand experience by controlling the reputation of partners**
The role of the CIO is becoming more business focused

- Apply technology to deliver business value
- Enable collaboration and innovation
- Lead enterprise transformation

**“CIO 2.0”**

The role of the IT profession is evolving quickly

- Gartner sees the splintering of the traditional IT domain into four domains of expertise with most new job growth occurring in the latter 3 categories:
  - *Technology infrastructure and services.*
  - *Information design and management.*
  - *Process design and management.*
  - *Relationship and sourcing management.*

- Most analysts predict that IT organizations in midsize and large companies in USA & Europe will shrink by 30% between 2000 – 2010

- This corroborates trends we see emerging from our own workforce statistics and are consistent with US Dept of Labor projections

- Future requirements will be for individuals and corporations who can marshal a broad suite of skills, knowledge, experience & behaviours to drive innovation and deliver business growth.
The trend is toward increasing complexity, both of businesses and service providers.

**Ecosystems of enterprises**

- **Enterprise**
  - Business capability
  - Business capability

**Ecosystem of practices and partners**

- **IBM software**
  - Service practice
    - Partner
      - Service practice
    - Service practice
  - Partner
    - Service practice
  - Infrastructure

**Architectural view of business**

**Architectural view of services**
An important figure/ground reversal changes the focus from enterprises to relationships among enterprises

Adapted from Fritjof Capra's *The Web of Life*, 1996
Every actual and potential social relationship has a complex structure.

- Motivations
- Preferences
- Beliefs
- Attitudes
- Desires
- Purposes
- Intentions
- Fears
- Restraints
- Perceptions
- Evaluations
- Verifications

Primary accountability
Conditions of Satisfaction
Negotiation
Transaction
Requests
Fulfillment
Settlement

Offering
Publicity
Overture
Agreement

ENERGY

2008 SSME Symposium
Many relationships exist to provide business services.
The SOA Litmus Test

- **Business alignment**
  - This refers to the traceability of a service to business goals, i.e., is the service of value to a business?

- **Composability**
  - A service that is composable is self-contained and can participate in a composition or choreography. It is deployed independently but may cooperate with other services at run-time to execute business processes in support of business goals. There are no external dependencies involved that would disallow the service from participating in a composition.

- **Externalized Service Description**
  - A service has an externalized service description, either generated through automated tools or created manually.

- **Redundancy Elimination**
  - This refers to the functionality of a service being provided once and used in multiple business processes.

IBM Global Services, Service-Oriented Modeling and Architecture, Technique Paper (TP), Version 2.0, April 10, 2005
There is a similar litmus test for relevant business services

- **Results-oriented**
  - Meaningful to an identifiable role-player
  - Result transcends the boundary of the enterprise
  - Result crosses organizational or differentiated role-player boundaries within the enterprise

- **Composable**
  - Result of one service is input to another service

- **Identifiable**
  - Enables requests in a sense and respond environment

- **Non-redundant**
  - Worth investing in because it occurs frequently and in different contexts
  - Provides a pattern that can be used for variability innovation
It’s all about people

- IBM is the largest people business on the planet *
- Even the most technical work is really service to people
- The key to success is understanding the client’s dream
- Can we feel their pain? Can we share their joy?
- We need to learn to walk and chew gum at the same time:
  - Yes, we do need to standardize …
  - Yes, we do need to capture and package knowledge …
  - Yes, we do need to drive cost out of service delivery …
  - … but … we also need to be the best at recognizing and deriving value from people and human relationships

A service focus can provide an endless new source of value

Photosynthesis

\[ \text{CO}_2 \rightarrow \text{Energy} \rightarrow \text{Sugars} \]

\[ \text{H}_2\text{O} \rightarrow \]

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Realization of value depends on value capture – “propertification”
Propertification can occur in surprising places

Tomorrow’s pharmaceutical products ***solutions***

Today

Databases

20??

Diagnostics

Genetic profiling

Patient info. & counseling

Rx

Prescription Drug (Plus package Insert)
The service business depends on rapid acquisition and deployment of knowledge

Our customers perceive that we are here on the learning curve ...

... while they are still here.

The services opportunity is the delta in knowledge and capability.

Generations of technology and evolving business models supersede each other at an increasingly rapid rate.
There is a time-value of knowledge that decays rapidly to a commodity level.
A rehearsal approach is a time-tested method of individual and organizational learning

- Many types of live operations are well understood
  - Simulated environments, such as flight simulators
  - Scripted operations, such as plays, music concerts, speeches
  - We learn how to handle and manage these operations through practice and repetition. ➔ REHEARSAL

- Many more types of live operations have no scripts and no simulation environments
  - These operations are never repeated exactly
  - Simulations cannot be fully deterministic
  - Human choice and uncontrolled circumstances create contingencies and exceptions
  - Examples:
    - Strategic consulting engagement
    - Technology deployment in a complex client environment
    - Development of new service offering
  - We learn how to handle and manage these operations through co-learning and experimentation. ➔ REHEARSAL
The rehearsal studio promotes co-creation of value and learning by making resources available

- **Existing method repertoire**
  - Right vs. right
  - Experimental economics
- **Engagement histories**
  - Work products
  - Deliverables
  - Project plans
  - Communications with client
  - E-mail
  - Instant messages
- **Rehearsal histories**

- **Technologies**
- **Role-players**
  - Expertise
  - Casting methods
- **Measures**
  - Alternative currencies
- **Practice notations**
  - Social interaction scripts
- **Virtual environments**
  - Games
IBM today in the virtual universe

- Wimbledon
- Forbidden City
- VUC Round Table
- IBM 3D Jam
- Complex 3D Models
- Virtual Contact Center
Transforming Transformation

- Develop an effective and efficient service business modeling method for technology/ engineering services that enables business transformation

- Integrate service science management and engineering (SSME) theory, enterprise transformation theory, and social network theory

- Create an implementation platform for modeling and analysis that uses business process simulation
  - Incorporate uncertainty and risk
  - Utilize statistical techniques to draw conclusions

- Develop and analyze models to understand how organizational structure and critical parameters affect business outcomes and to optimize service business process and throughput
Business Transformation Evolution

- **1st Generation: Experience and expertise**
  - What has worked before
  - Specialized industry sector knowledge
  - Your expert vs. my expert

- **2nd Generation: Structured methodology**
  - Transformation as a repeatable phenomenon
  - Use of performance indicators
  - Your method vs. my method

- **3rd Generation: Organizational simulation**
  - Analytical and statistical business modeling
  - Multiple dimensional analysis and optimization
  - Your numbers vs. my numbers
3rd Generation: Organizational Simulation

- SSME
  - Applying scientific and engineering methods to concept, plan, design, control and assess delivery systems for services

- Enterprise transformation
  - Studying and developing effective methods to transform organizations to address new challenges
  - Analytically measure and optimize business and work processes

- Social network analysis
  - Analyzing the effect of relationships on organizational performance and decision-making
  - Measure, optimize organizational capacity

- Organizational simulation: a computational modeling environment for
  - Transformation analysis
  - Representing business phenomena
  - Enhancing value creation

- That provides functions for:
  - Experimentation and statistical analysis
  - What-if analysis
  - Sensitivity analysis
  - Optimization
  - Quantification

- Your numbers vs. my numbers
Organizational Simulation Modeling Concepts

- **Value and value deficiencies**
  - What value results or should result from enterprise?
  - What threats exist to this value?

- **Business processes**
  - What system supports value delivery (as-is) or should support it (to-be)
  - Resources
  - Organizations
  - Rules
  - Event-driven process chains

- **Social networks**
  - How does the organization really work
  - Who trusts whom, who communicates with whom
Enterprise Transformation Theory

- Actual and/or potential value deficiencies drive transformation
- Redesigned work processes enable transformation
- Management decision making (abilities, limitations, inclinations) determines the nature, scope and outcome of the transformation and redesigned work processes
- Social networks influence the nature of the implementation
Social Network Theory

- **Graph-based representation of individuals/actors and relations**
  - Wasserman and Faust [1994]

- **Analysis methods for:**
  - Determining properties of actors and relationships
  - Determining strength of relationships among actors
  - Comparing actors or relationships within a network or between networks
  - Evolution of networks over time

- **Methods and implementation**
  - Non-traditional statistics (observations not independent)
  - Optimization algorithms (Floyd’s, Dijkstra’s, etc.)
  - Software available (UCINET, ORA)

- **Uses**
  - Formal organization chart vs. informal social network
  - Resource planning
  - Task assignment
  - Organizational risk assessment
  - Pandemic planning
  - Terrorist cell analysis
Modeling Work Processes and Value

- Event-driven process chains (EPCs) as the formalism

- Elements represented
  - Tasks
  - Events and triggers
  - Process branching and merging
  - Organizations
  - Resources (people, material, information)

- Maps to process-oriented discrete event simulation

- Value is the output of the processes
  - Average time to service completion
  - Average number of services performed per time unit
  - Revenue/profit from services performed

Each task includes:

- Task duration
- Resources (IT, H/C)
- Skills and skill levels
- Task prerequisites/dependencies
- Statistical variations
- Overlap/decision logic

System Electrical Design Flow

- Pre-PD Simulation
- Electrical Rules
- Waveform Reports
- Signal Analysis
- Component and Board Electrical Models
- Technology Definition Files
- Schematic Symbol Library
- Schematic Entry
- Entry Complete
- Physical Placement and Routing Complete
- Physical Placement and Routing
- Design Rules and Interconnect Checking (Cadence)
- No Further Signal Analysis
- Further Signal Analysis
- XOR
- Hspice, SigXP, Ansoft, PowerSPICE
- Spectraquest, HSPICE, Ansys, PowerSPICE
- Tape
- Gerber/Tape Out
- Check Complete
- Physical Design Data
- Design Rules and Interconnect Checking (Cadence)

ViewDraw License
Schematic Symbol Library
Technology Definition Files
Board Layout Rules
Cadence License
ViewDraw License
Schematic Symbol Library
Technology Definition Files
Board Layout Rules
Cadence License

System Electrical Design Flow
Application to Electrical Design Engineering Services

- **Gather** data about the Electrical Design and Integration Services (EDIS) unit using interview templates and other sources to identify:
  - Value proposition
  - Value deficiency
  - Work processes
  - Social networks

- **Build** simulation model with social network integration
  - Identify value levers/business outcomes

- **Analyze** model for as-is, what-if and to-be organization
EDIS Business Process and Social Network Integration

- **Each project led by a Focal Point (FP)**
  - Customer interaction
  - Project/ tasks management
  - Problem resolution

- **Tasks delegated to Interface Experts (IEs) as needed**
  - Delegated based on skills and workload
  - Performed based on project deadline and availability
  - Use social network analysis

- **Time-to-market and cost critical**

- **Budget managed for personnel, travel, equipment, tools, IT, etc.**
Business and design work processes:
- Structures
- Durations
- Skills

Task assignment is a function of:
- Skill level
- Task duration
- Workload
- Social network

Personnel assignment for focal point and interface experts
# Roadmap - from awareness to IBM business value

## Key Activities/Metrics

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<td>White papers</td>
<td>Workshops</td>
<td>Broadened awareness</td>
<td>SSME tools and programs growing</td>
<td>Better trained workforce</td>
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<td>Initial discussions with university partners</td>
<td>Press hits on SSME/S421C</td>
<td>SSME curriculum development</td>
<td>S421C defined</td>
<td>+Service innovation</td>
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<td>Web hits</td>
<td>Cross-IBM SSME focus and buy-in</td>
<td>Service systems as complex systems</td>
<td>+Sales impact</td>
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<td>Awareness in academia, industry, gov't</td>
<td>Joint research projects/awards</td>
<td>Government and foundation funding</td>
<td>+Client satisfaction</td>
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<td>Early adopters</td>
<td>Case studies developed</td>
<td>SSME graduates</td>
<td>+Productivity</td>
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<td>SSME Summit</td>
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<td>Internal training</td>
<td>+Efficiency</td>
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<td>Internal hiring plans</td>
<td>+Learning speed on engagements</td>
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## Results

- Better trained workforce
- +Service innovation
- +Sales impact
- +Client satisfaction
- +Productivity
- +Efficiency
- +Learning speed on engagements

## Increase Focus and Impact for SSME/S421C

Plan  ➤ Mobilize  ➤ Execute  ➤ Reinforce
THANK YOU

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