



IBM Ubiquitous Computing Lab

SSME

— Propelling the Innovation of Contemporary Service Industry

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IBM Ubiquitous Computing Lab
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 [...]”

Stephen L. Vargo & Robert F. Lusch, “Evolving to a New Dominant Logic for Marketing”, *Journal of Marketing*, Vol. 68 (January 2004), 1–17

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)

1. $\nabla \cdot \mathbf{D} = \rho$
2. $\nabla \times \mathbf{H} = \mathbf{J} + (\partial \mathbf{D} / \partial t)$
3. $\nabla \cdot \mathbf{B} = 0$
4. $\nabla \times \mathbf{E} = -(\partial \mathbf{B} / \partial t)$

where

- \mathbf{D} = electric displacement
- ρ = electric charge density
- \mathbf{H} = magnetic field strength
- \mathbf{J} = electric current density
- \mathbf{B} = magnetic flux density
- \mathbf{E} = electric field strength

Mature

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



Can there really be a science of service?

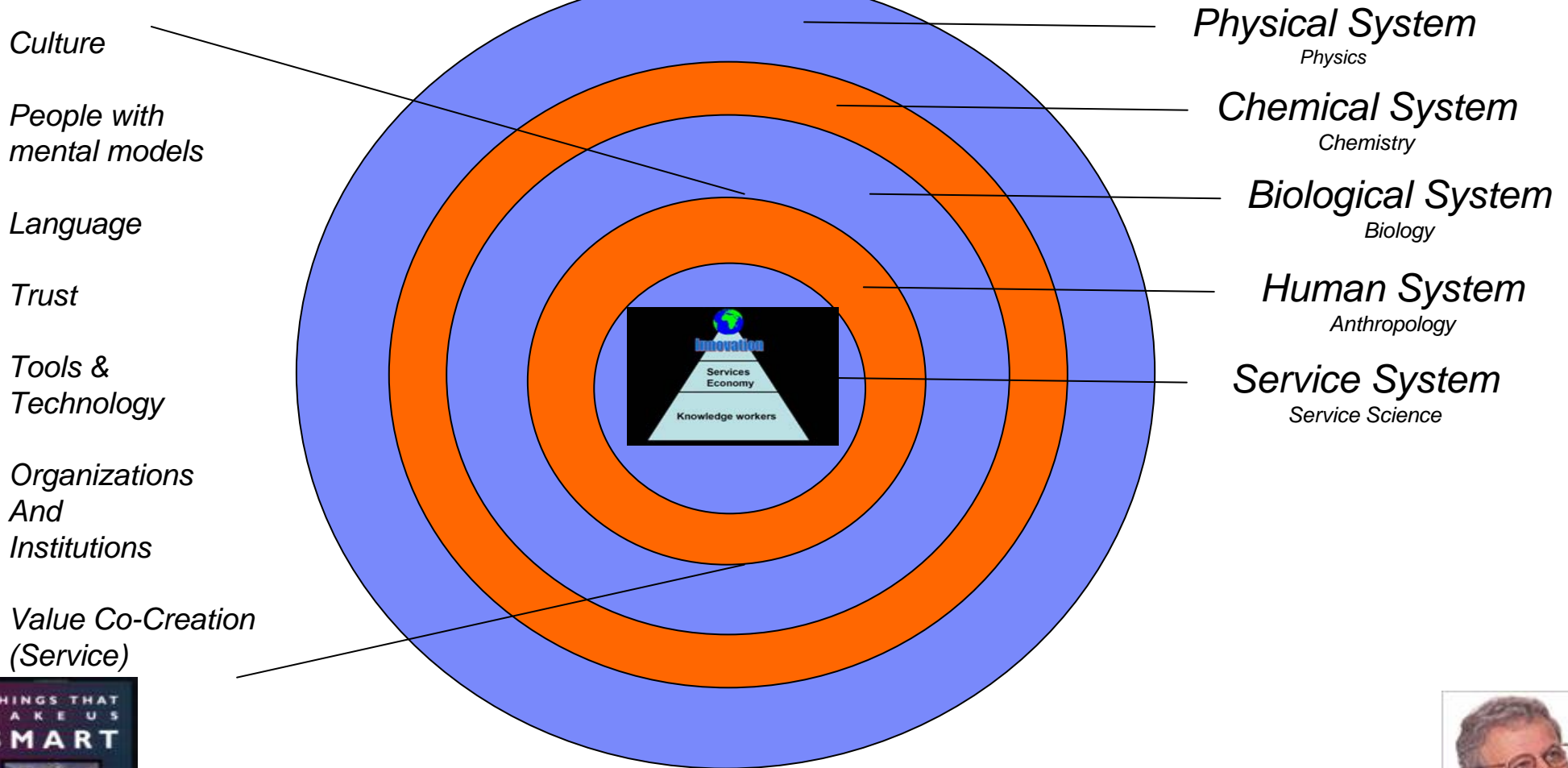
“Wherever there are phenomena, there can be a science to describe and explain those phenomena. Thus, the simplest (and correct) answer to “What is botany?” is, “Botany is the study of plants.” And zoology is the study of animals, astronomy the study of stars, and so on. Phenomena breed sciences.”

**- Newell, A., Perlis, A. & Simon, H. A. (1967).
Computer Science, *Science*, 157, 1373-1374.**

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



Things That Make Us Smart by [Donald A. Norman](#)

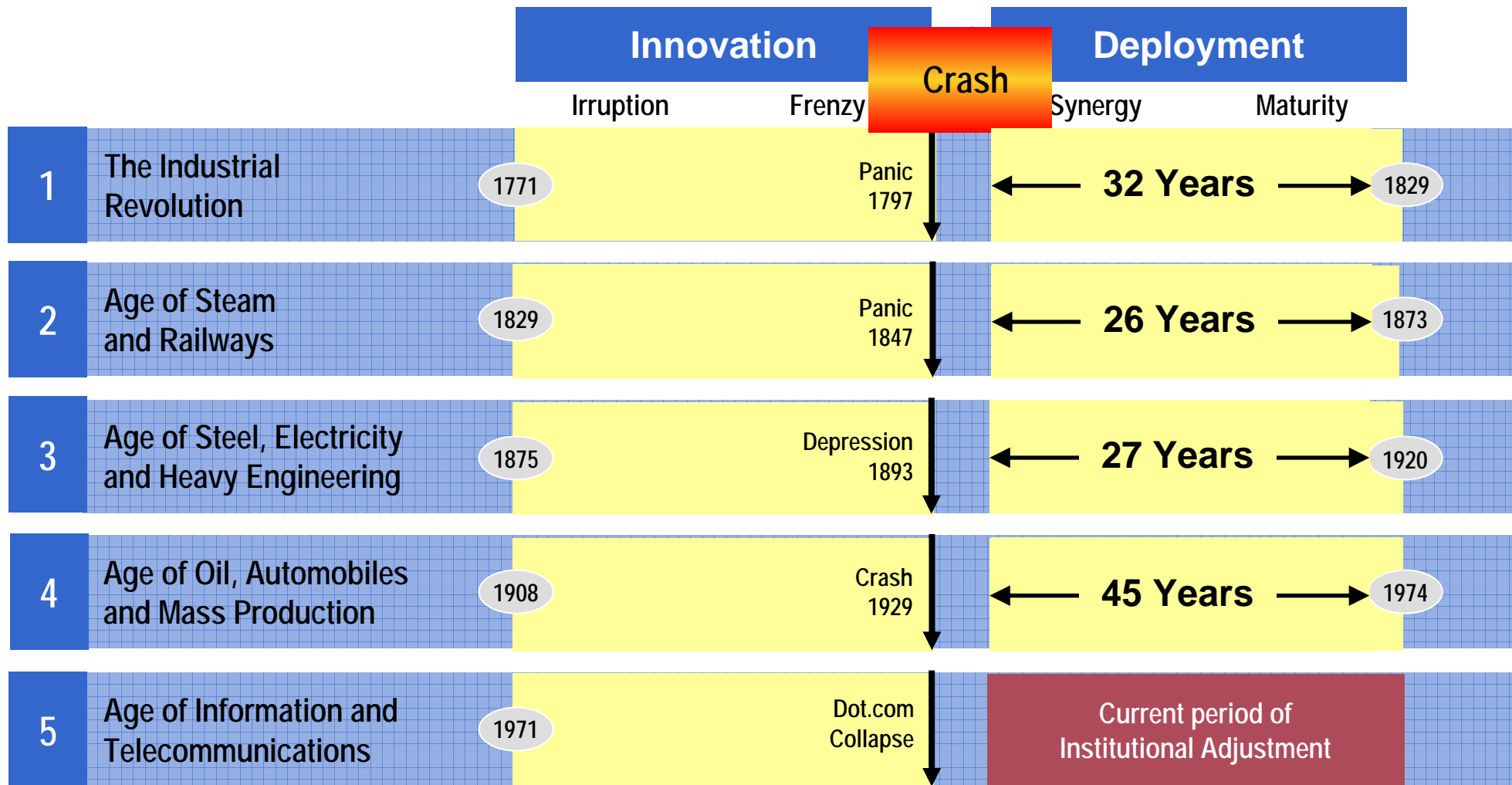


Service systems or “value co-creation systems” as complex systems
An intellectually deep, integrative area of great economic significance

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.”**
- **From "The Impact of Academic Research on Industrial Performance" (<http://newton.nap.edu/catalog/10805.html>)**

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

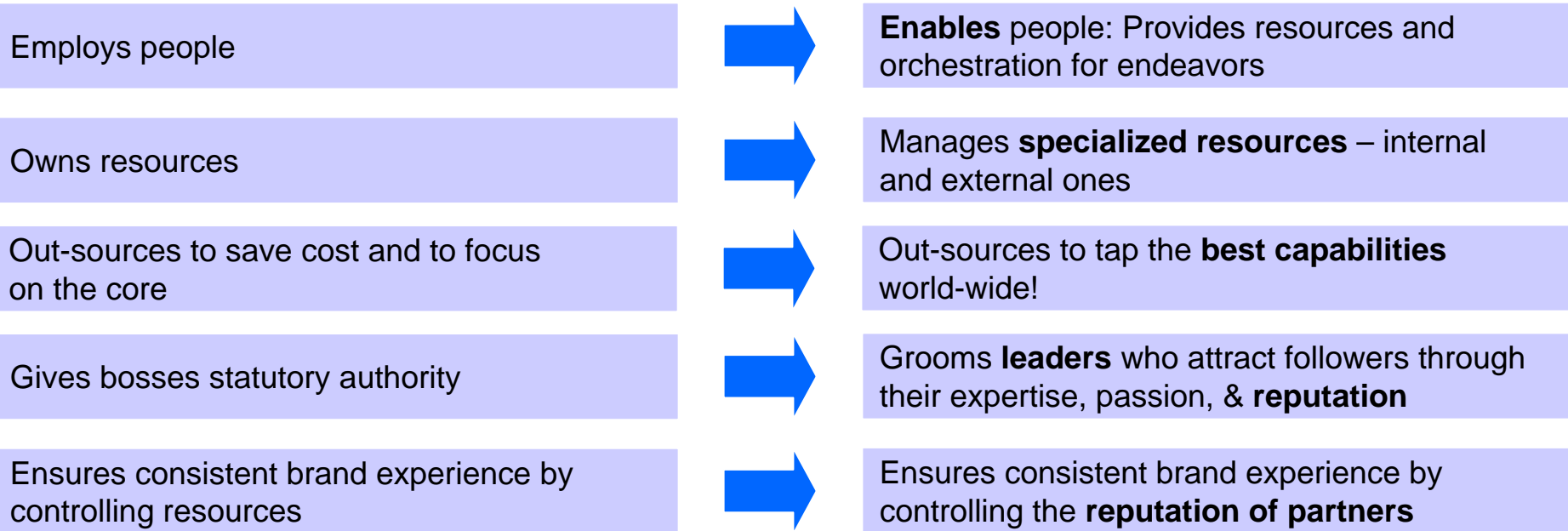


Source: "Technological Revolutions and Financial Capital, Carlota Perez, 2002

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.”

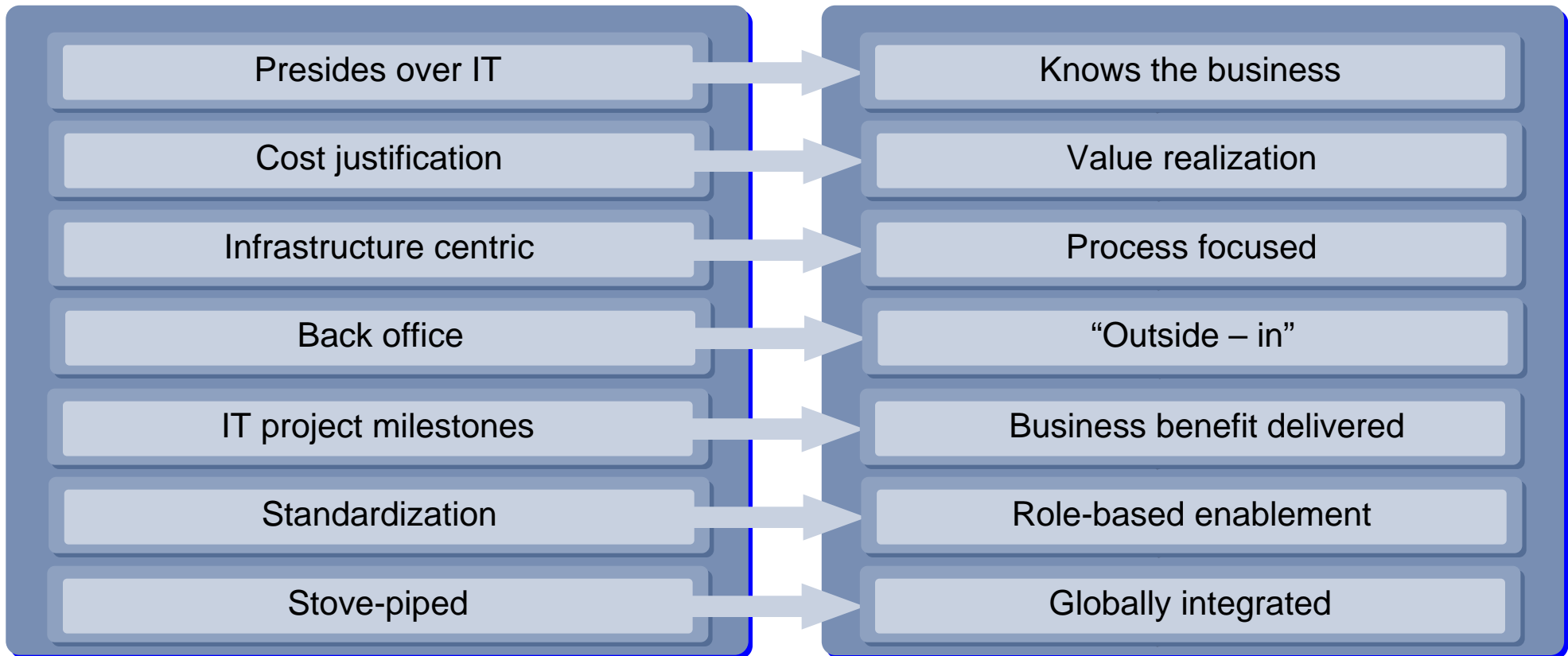
GIO insight: Transformation of the nature of business



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”

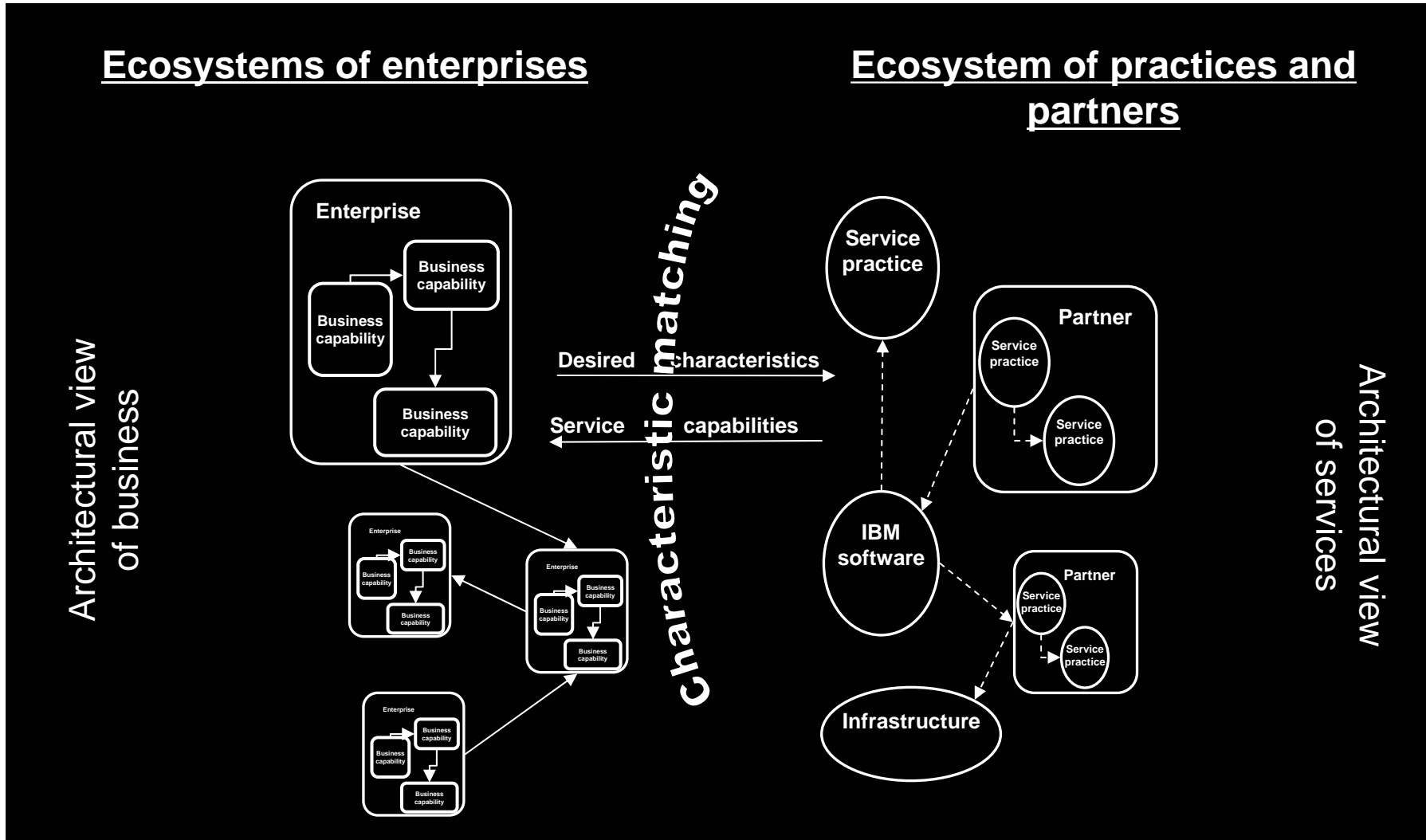


From: Jeanine Cotter, BT/IT: 2006 Goals and Expectations, February, 2006.

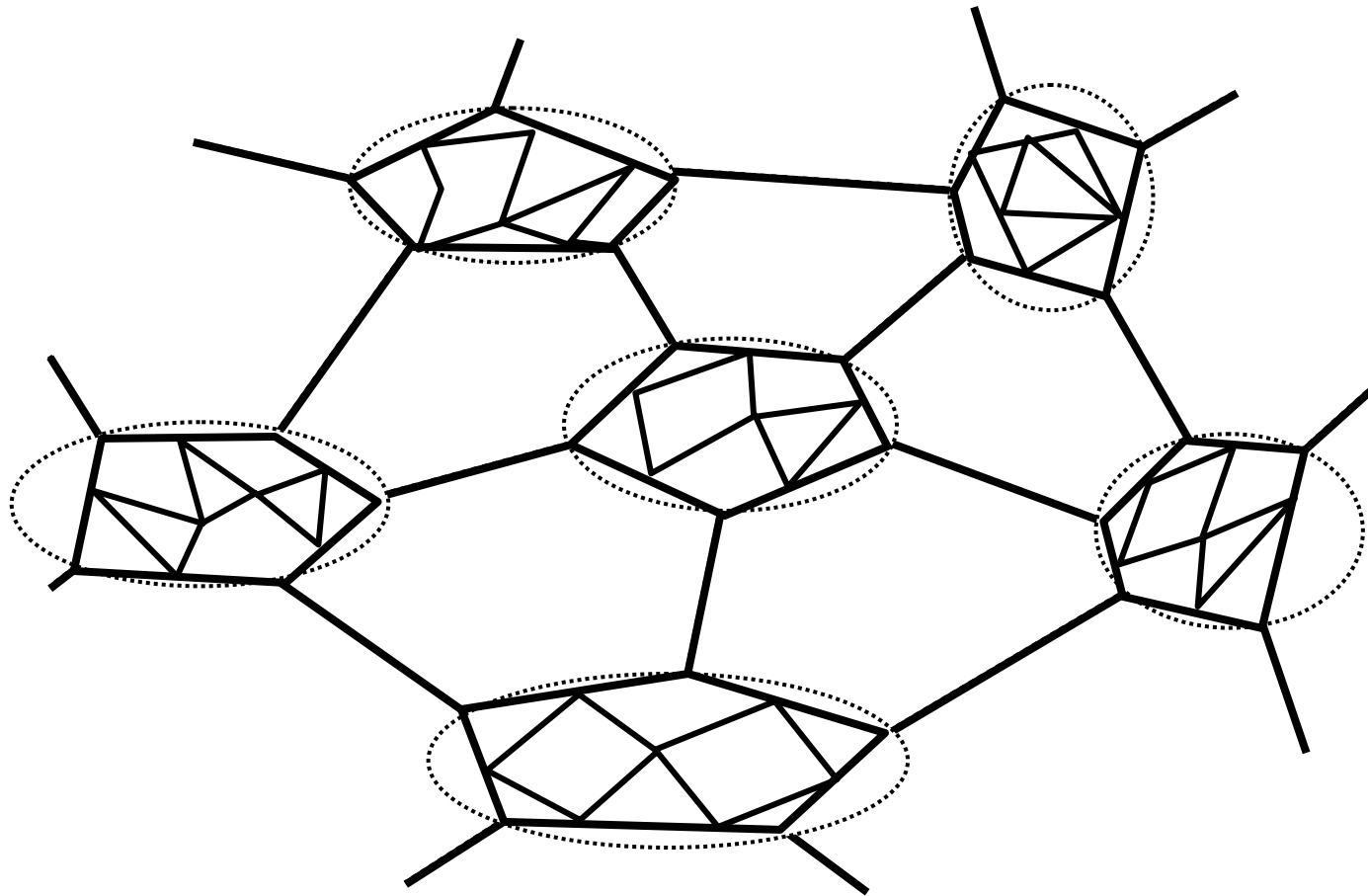
The role of the IT profession is evolving quickly

- 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

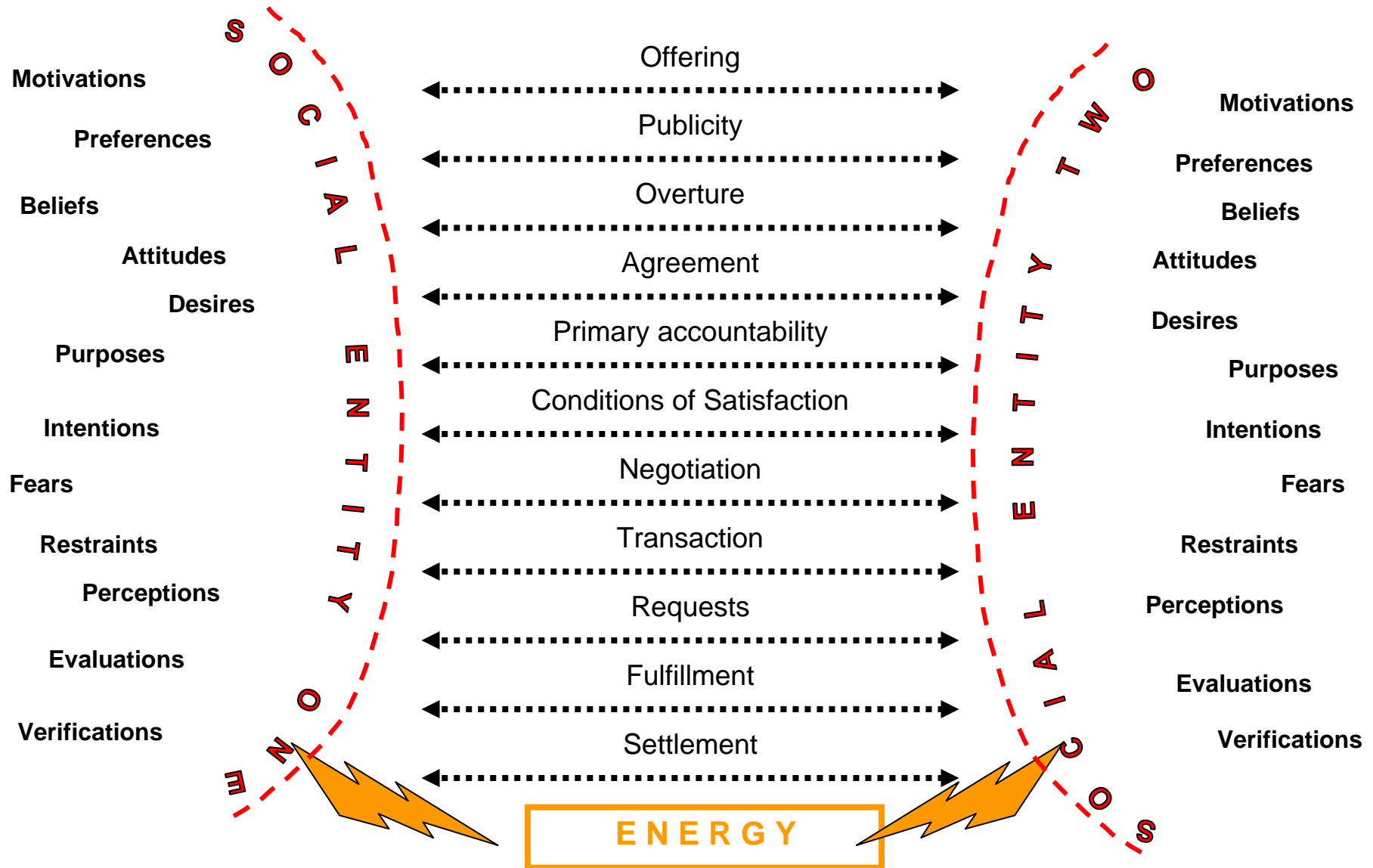


An important figure/ground reversal changes the focus from enterprises to relationships among enterprises

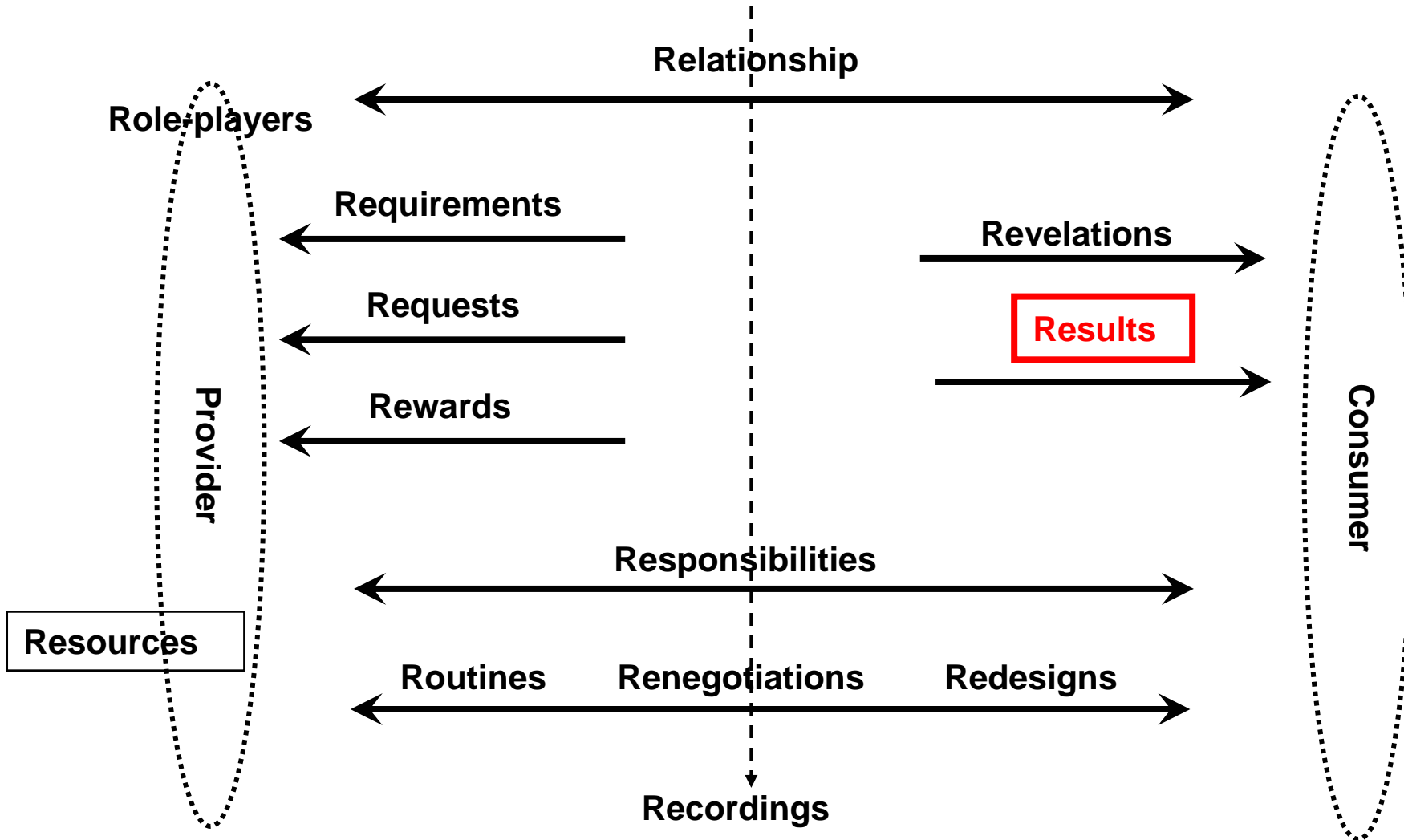


Adapted from Fritjof Capra's *The Web of Life*, 1996

Every actual and potential social relationship has a complex structure



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.

There is a similar litmus test for relevant business services

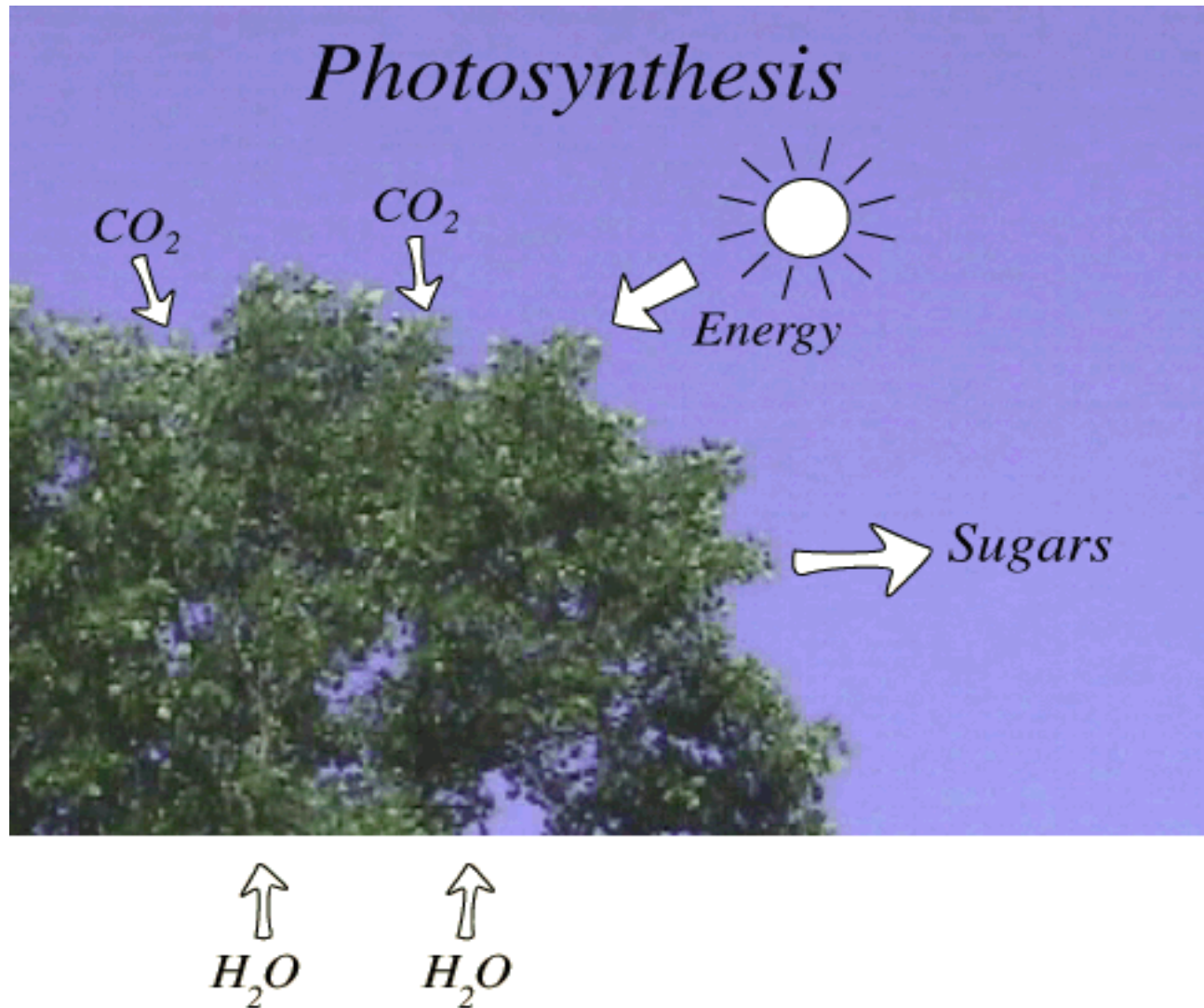
- **Results-oriented**
 - Meaningful to an identifiable role-player
 - Result transcends the boundary of the enterprise
 - Result crosses organizational or differentiated role-player boundaries within the enterprise
- **Composable**
 - Result of one service is input to another service
- **Identifiable**
 - 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

* Felix Barber and Rainer Strack, "The Surprising Economics of a 'People Business'", Harvard Business Review, June 2005.

A service focus can provide an endless new source of value



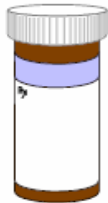
Realization of value depends on value capture – “proportification”



ProPERTIFICATION can occur in surprising places

~~Tomorrow's pharmaceutical products~~ solutions

Today

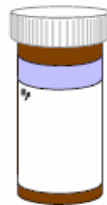


Prescription Drug
(Plus package Insert)

Databases



Rx



20??

Diagnostics



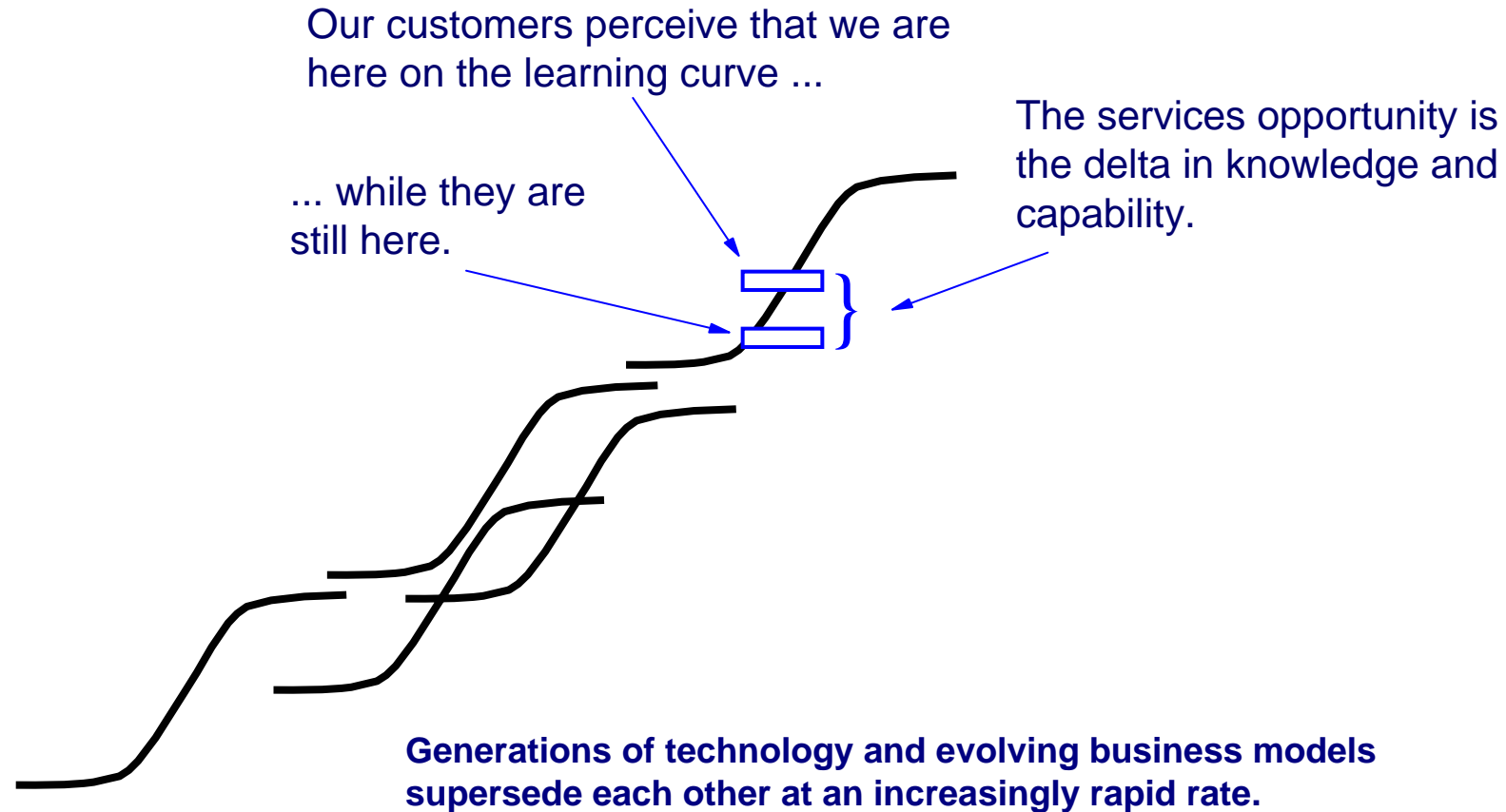
Patient info. & counseling



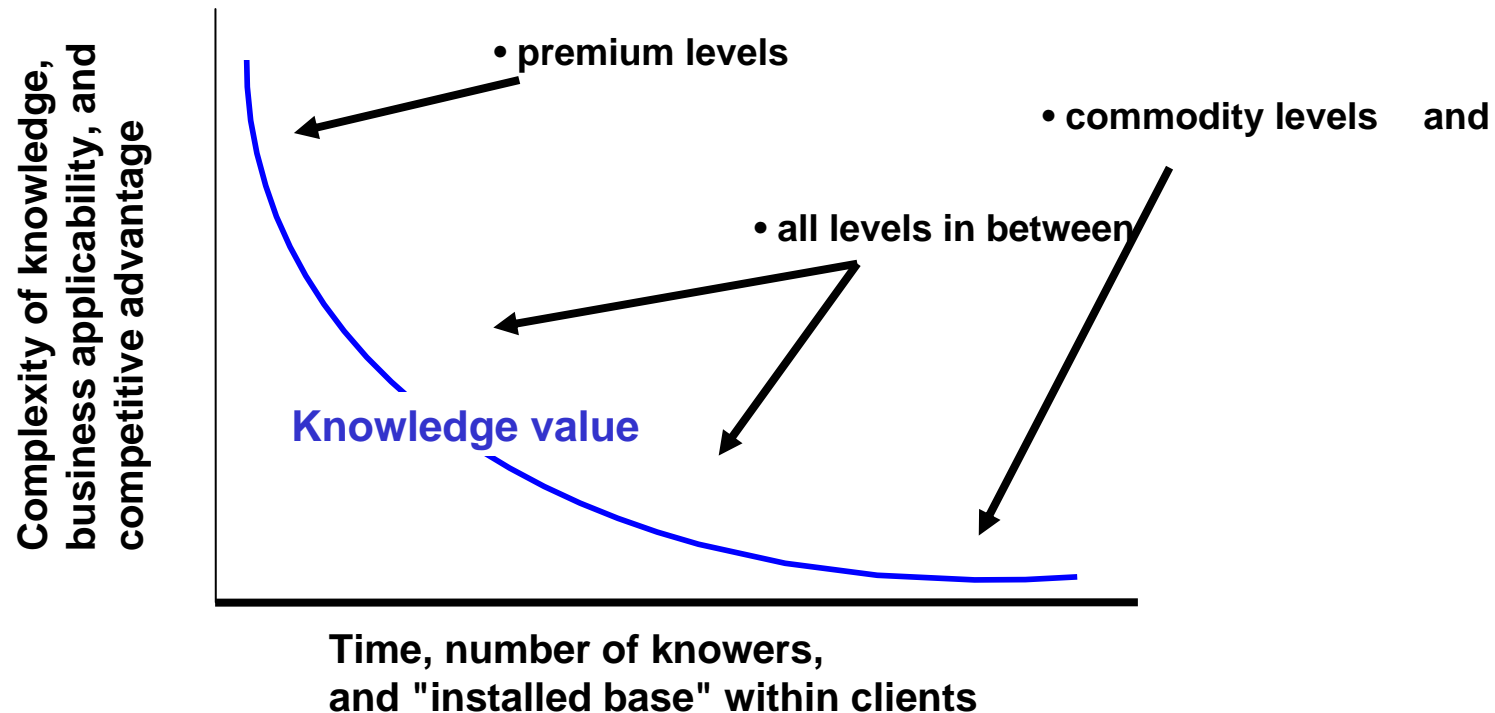
Genetic profiling



The service business depends on rapid acquisition and deployment of knowledge



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**

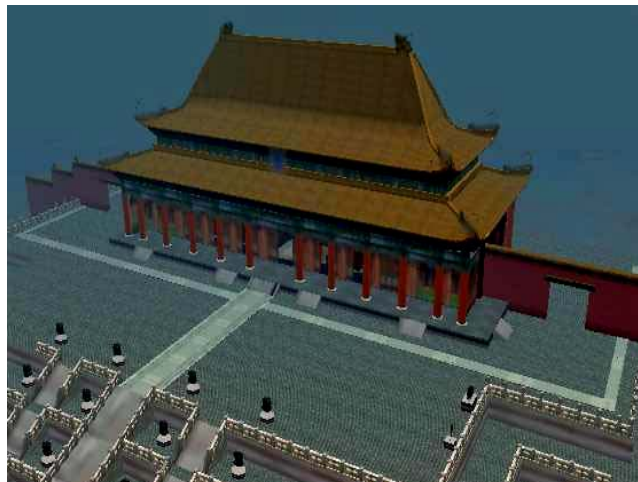
The rehearsal studio promotes co-creation of value and learning by making resources available

- **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

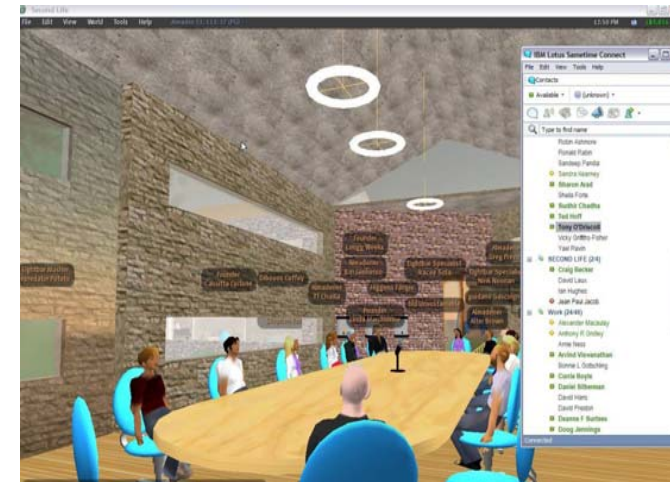
IBM today in the virtual universe



Wimbledon



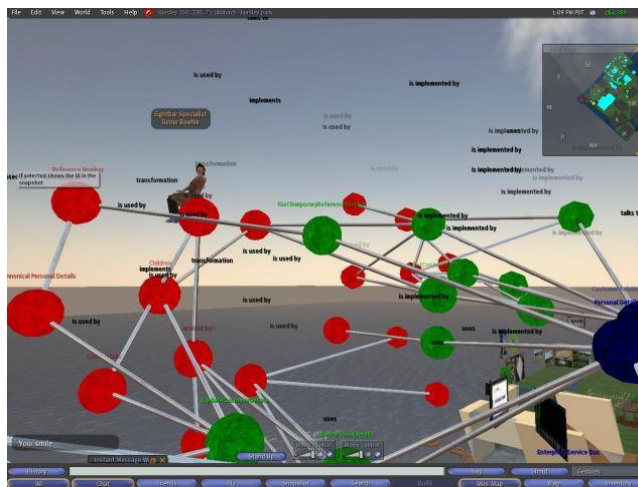
Forbidden City



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

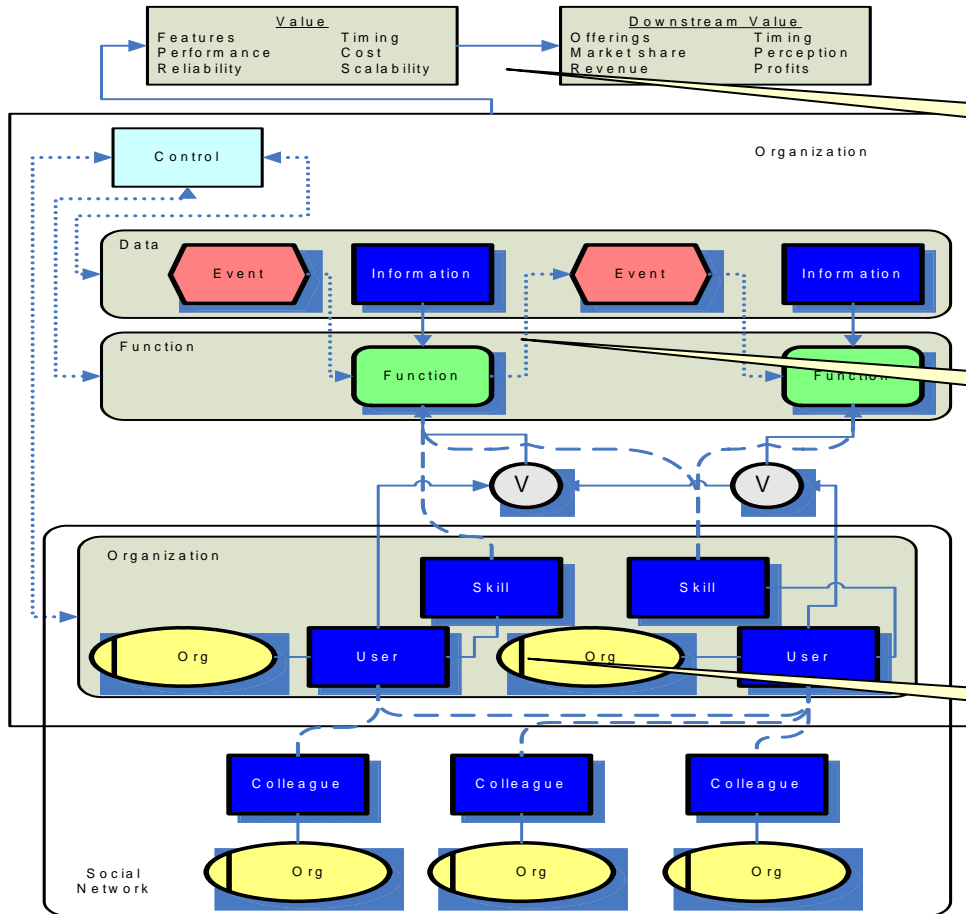
3rd Generation: Organizational Simulation

- **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?

Value

- Business processes

- What system supports value delivery (as-is) or should support it (to-be)

Business processes

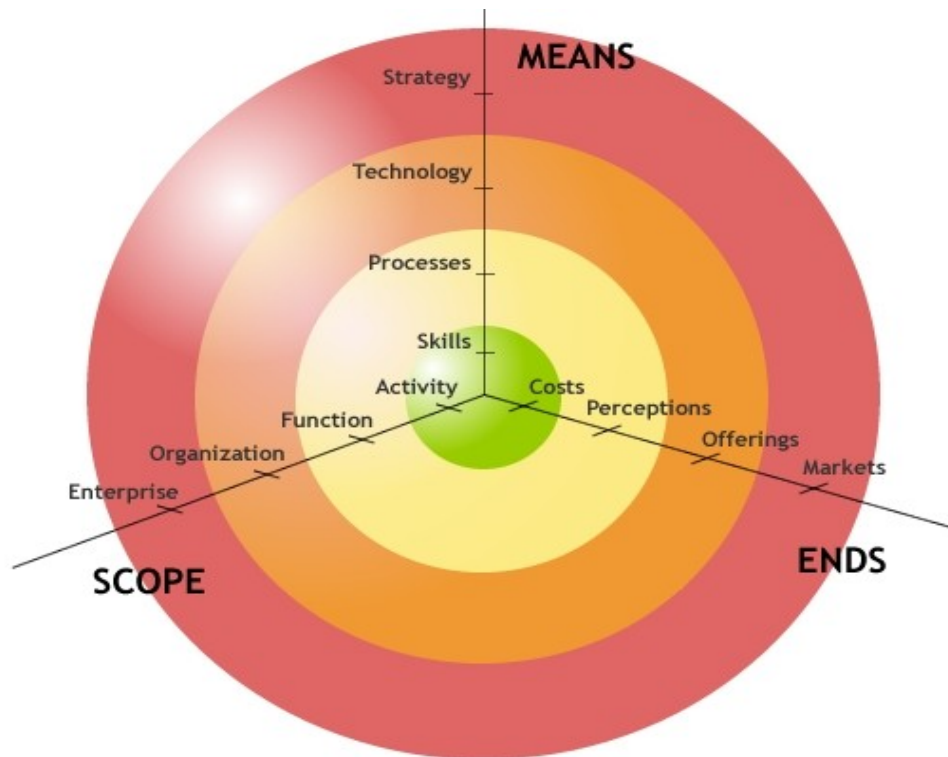
- Resources
- Organizations
- Rules
- Event-driven process chains

Social networks

- Social networks

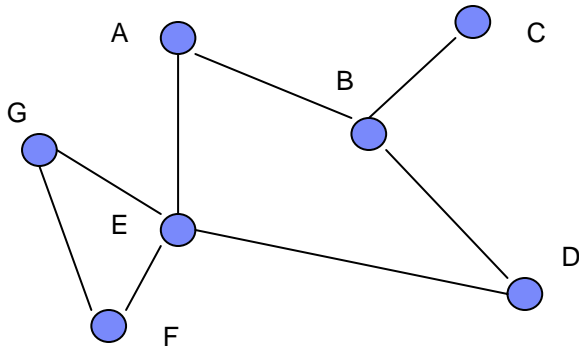
- How does the organization really work
- Who trusts whom, who communicates with whom

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

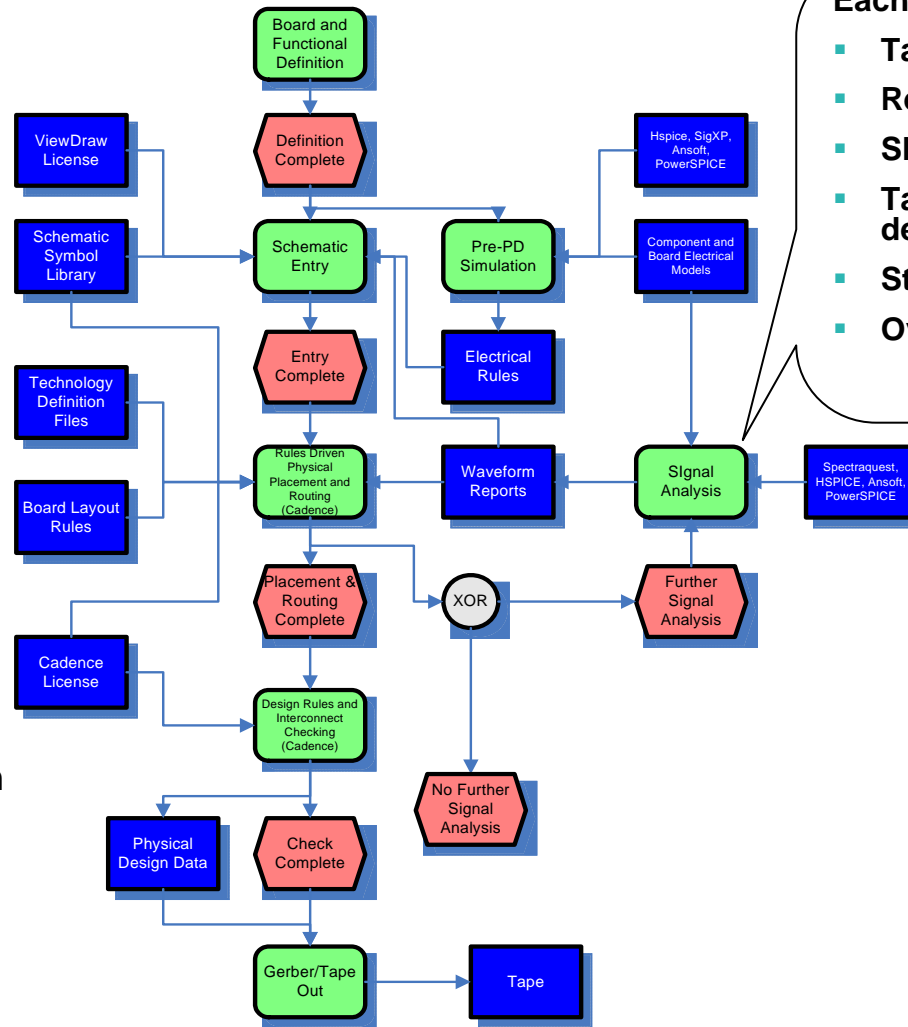


	A	B	C	D	E	F	G
A	-	1	0	0	1	0	0
B	1	-	1	1	0	0	0
C	0	1	-	0	0	0	0
D	0	1	0	-	1	0	0
E	1	0	0	1	-	1	1
F	0	0	0	0	1	-	1
G	0	0	0	0	1	1	-

- **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

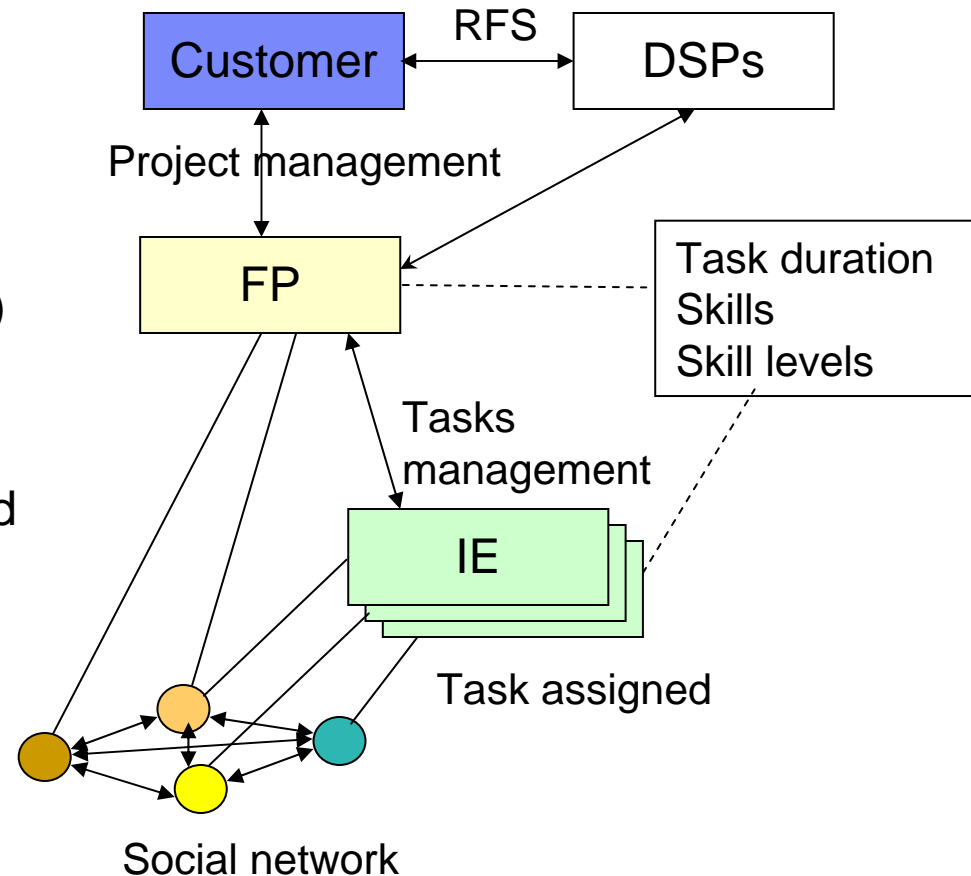
System Electrical Design Flow

Application to Electrical Design Engineering Services

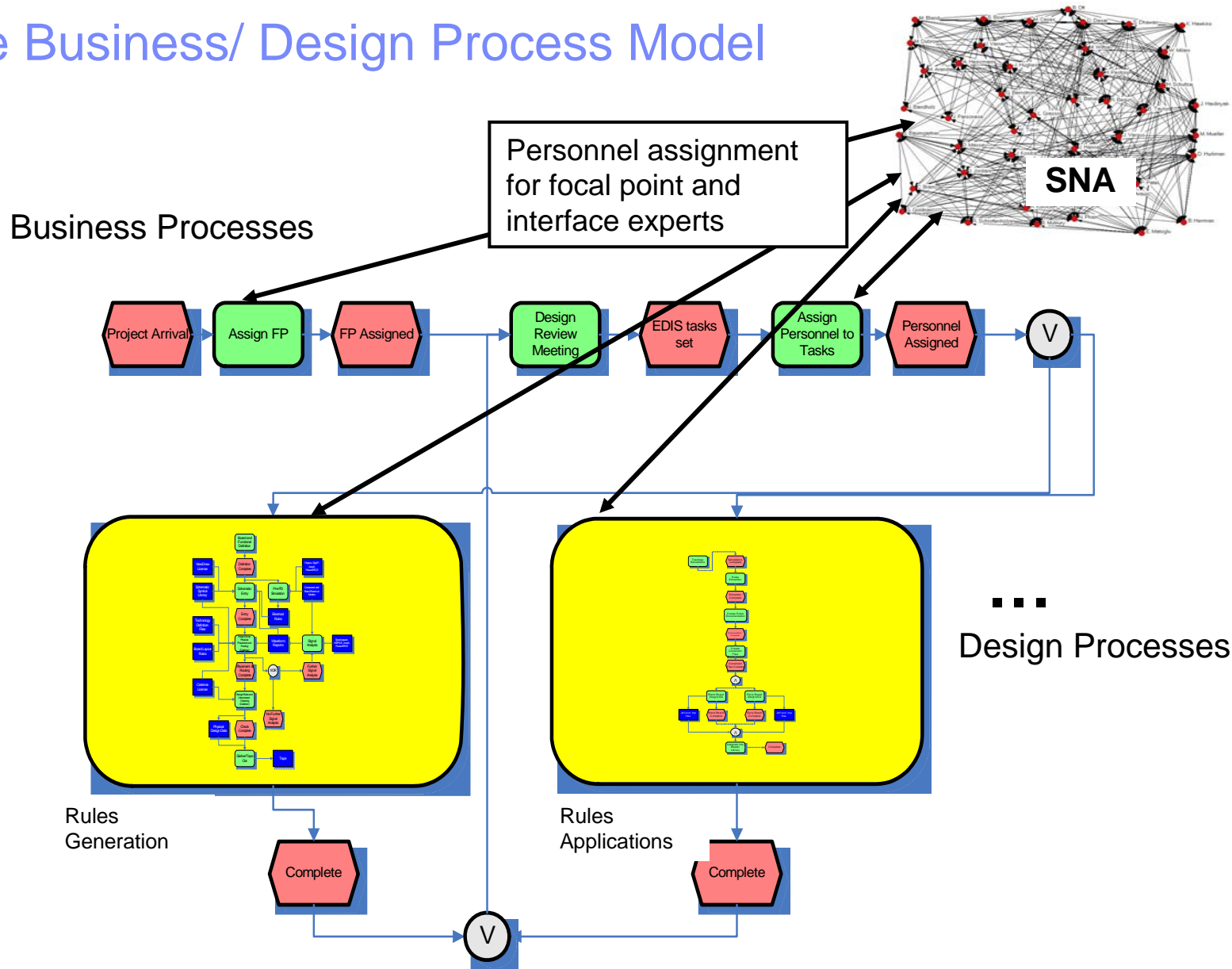
- **Gather** data about the Electrical Design and Integration Services (EDIS) unit using interview templates and other sources to identify:
 - Value proposition
 - Value deficiency
 - Work processes
 - Social networks
- **Build** simulation model with social network integration
 - Identify value levers/ 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.**



EDIS Service Business/ Design Process Model



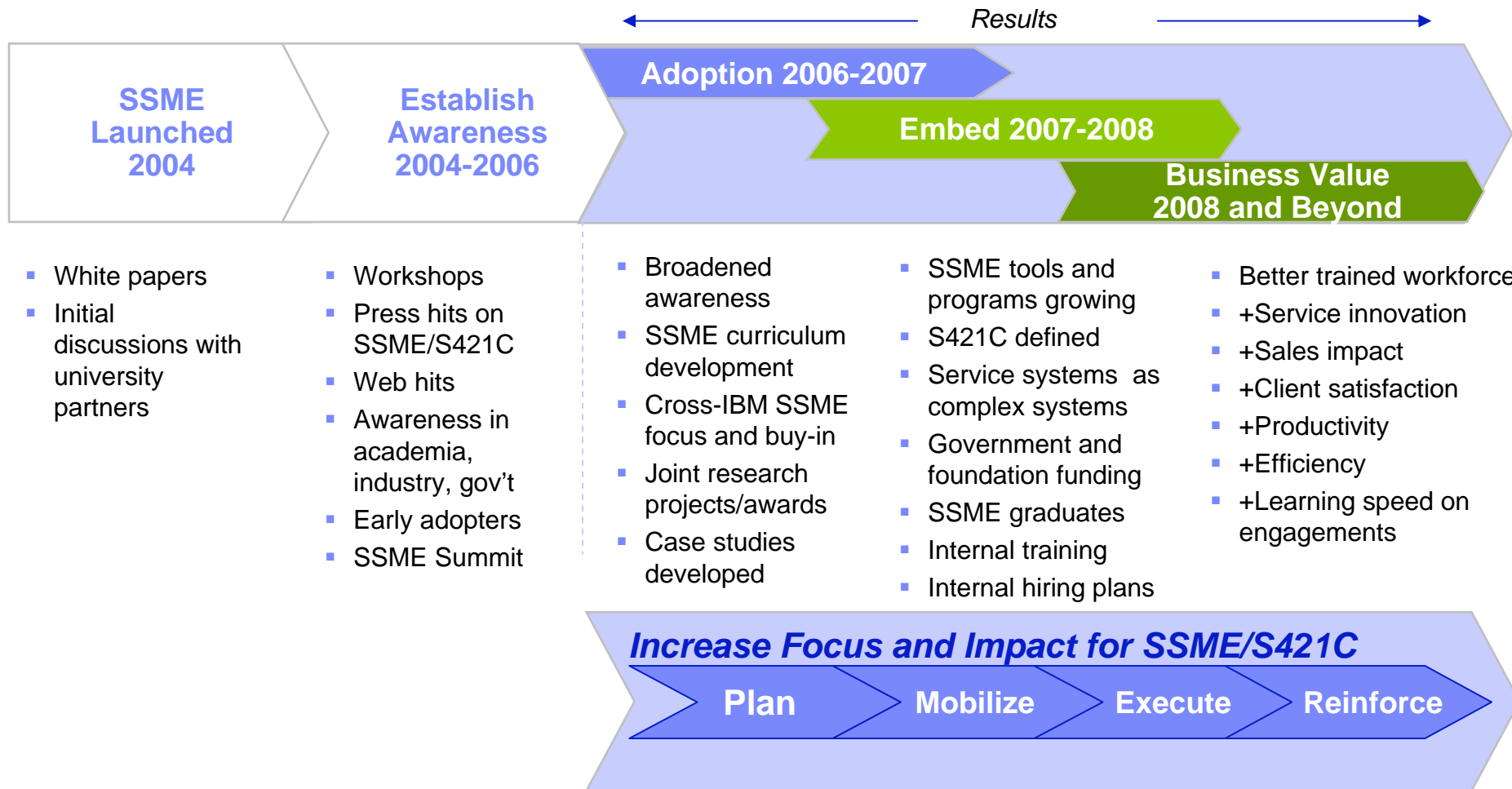
Business and design work processes:

- Structures
- Durations
- Skills

Task assignment is a function of:

- Skill level
- Task duration
- Workload
- Social network

Roadmap - from awareness to IBM business value



THANK YOU



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