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Haluk Demirkan
Arizona State University, haluk@uw.edu

Michael Goul
Arizona State University

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AMCIS 2006 PANEL SUMMARY: TOWARDS THE SERVICE ORIENTED ENTERPRISE VISION: BRIDGING INDUSTRY AND ACADEMICS

Haluk Demirkan
Michael Goul
Department of Information Systems
W.P. Carey School of Business
Arizona State University
haluk.demirkan@asu.edu

ABSTRACT

The complexities and costs of current information architectures, infrastructures, and distributed data and software have provided impetus to emerging conceptualizations of the Service Oriented Enterprise (SOE). The foundations for SOE can be found in current applications of service oriented architecture (SOA), service oriented infrastructure (SOI), business process and workflow, computing resource virtualization, business semantics, service level agreements, increasing standardization, and other areas of applied research. This article reports on a panel held at the 2006 Americas Conference on Information Systems (AMCIS) in Acapulco, Mexico, regarding the impacts of SOE tenets on the IS field. Two organizations that are at the leading edge of the SOE continuum [American Express and Intel] in terms of vision and experiences were represented by Margaret Mitchell and George Brown. In addition, MIS academics were represented on the panel by the authors, researchers from Arizona State University. Both industry and academics brought unique perspectives. American Express' SOE approach addresses organizational structure and business intelligence project workflow issues. The company hosts one of the largest IT infrastructures capable of handling untold numbers of transactions each second. Intel's SOE approach addresses the orchestration of services and workflows in the cross-architecture environments characterizing the modern extended global enterprise. Intel is playing a lead role in establishing the OASIS (the Organization for the Advancement of Structured Information Standards) SOA Reference Model (called 'ebSOA').

Keywords: process and services fusion, reuse, service oriented architecture, infrastructure and enterprise, resource virtualization, service ontology, conceptual modeling

I. INTRODUCTION

Today's business world is becoming more complex every day. Process complexity increases by an order of magnitude whenever new partner network interactions are added. Even within a single enterprise, there are complex intra-organizational relationships. The types and number of interactions and information dependencies in value chain business processes has grown exponentially over the last thirty years (Figure 1). Figure 1 shows encouraging convergence towards common data models and workflow definitions. However, at the same time, process complexity is anticipated to reach very high thresholds for needed integration between functional

applications. While processes are becoming more complex, technology has also evolved through many generations. This technological evolution of information architectures and infrastructures has been mostly aimed at reducing the cost and cycle times of enterprise computing and at increasing productivity. Figure 2 illustrates these process and IT innovation paradigms.

In addition to these complexities and innovations, pressures for agility and virtualization have been increasing exponentially due to mergers and acquisitions, new regulations, rapidly changing technology, increasing competition, and heightened customer expectations (Figure 3). It has been shown that to achieve agility, companies must break down stovepipes into modular services that can be reused dynamically in multiple business processes (Dubray, 2004). Furthermore, the linkages between business processes and those services that source their execution need to be aligned and streamlined in a manner that facilitates taking cost-advantage of the emerging commoditization of hardware, software and business processes (Davenport, 2005; Forbes 2006).

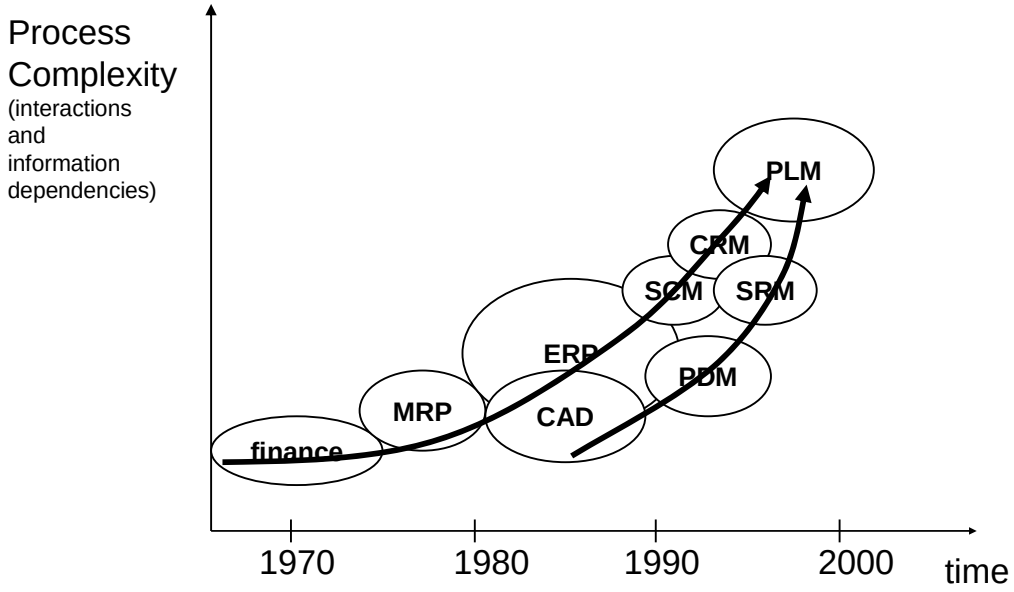

Figure 1. Dramatic Increase in Process Complexity (adapted from Drecun, 2005)

The bottom line is that today's increasing process complexity with relentless technological innovation - with ongoing pressures for agility (and even resource virtualization) - has created a need for new universal IS research agendas. It is time to rethink IT architecture from new organizational and technical vantage points (Cullen and Orlov, 2005). Many researchers believe that if properly applied, 'service oriented' concepts can support the agility organizations are seeking (e.g., Barry, 2003; Bieberstein et al., 2006; Erl, 2004; Erl, 2005; Krafzig et al., 2004; Pulier and Taylor, 2005). But one of today's most pervasive and bedeviling challenges is how does service oriented architecture (SOA) contribute to the delivery of reliable and scalable enterprise processes (Gruman, 2006)? Furthermore, enterprises enabled to expose their business processes through SOA also need to retain and extend the capabilities normally found in tightly integrated vertical applications. We refer to organizations that expose business process throughout an SOA supported extended organization landscape, and the semantics and reference model frameworks that enable process automation within that context, as extended 'Service Oriented Enterprises' (SOEs).

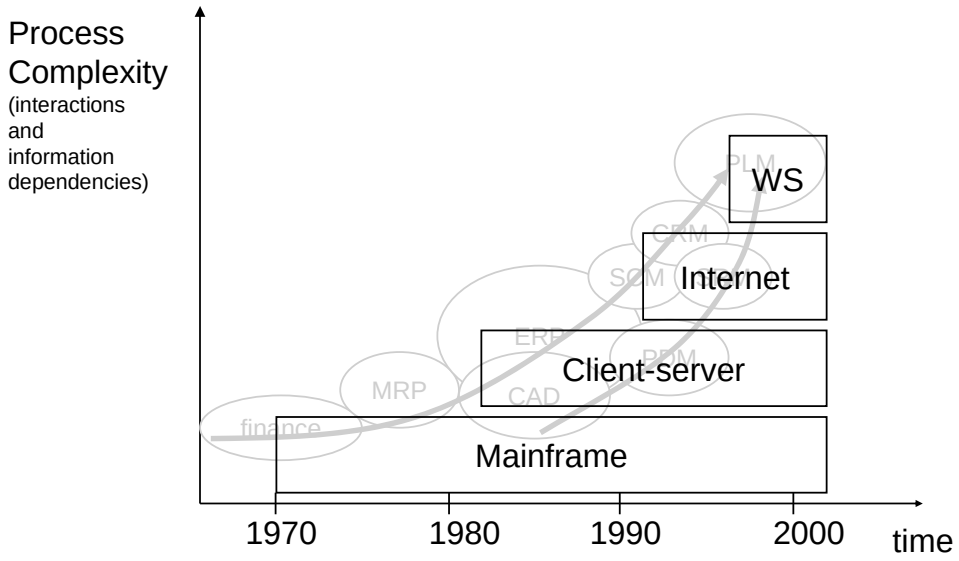

Figure 2. Relentless Technology Innovation (adapted from Drecun, 2005)

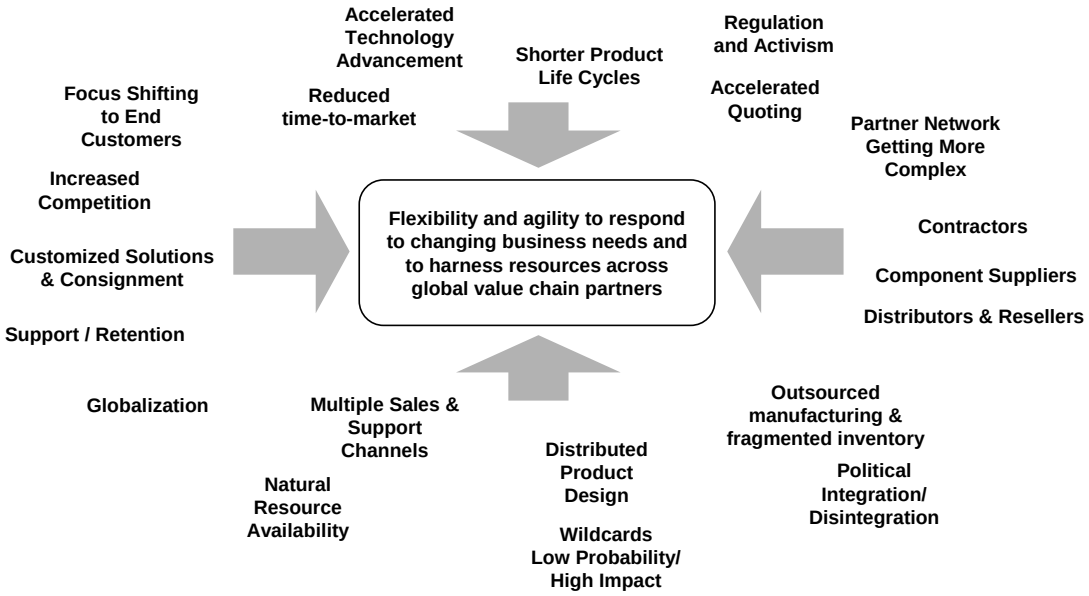

Figure 3: Pressures For Agility and Virtualization (adapted from Brown, 2006)

A panel was convened at the 2006 Americas Conference on Information Systems (AMCIS) to discuss service oriented enterprises. The panel was made up of two MIS academics, the authors, and two representatives from industry: Margaret Mitchell from American Express, and George Brown from Intel. The panel addressed how a company should begin assessing the impacts of this paradigm shift - from traditional IT to modular services - and panel members presented lessons learned from these two organizations that happen to be deeply involved in managing this transformation.

This paper is divided into five sections. Section Two reviews what is referred to as a "Process and Services Fusion Impact Assessment" (P&SFIA). Section Three presents American Express' SOE approach, which addresses their organizational structure and business intelligence project

workflow issues. Section Four discusses Intel's SOE approach of addressing the orchestration of services and workflows in the cross-architecture environments characterizing the modern extended global enterprise. Finally, in Section Five, we draw conclusions based on common findings from research relevant to P&SFIA and suggest managerial guidelines relevant to taking the first steps in addressing this dramatic paradigm shift.

II. PROCESS AND SERVICES FUSION IMPACT ASSESSMENT

Process and Services Fusion Impact Assessment (P&SFIA) is an enterprise-directed, exploration process for creating an organizational roadmap to deliver reliable, scalable enterprise processes built upon SOA. It provides a meaningful analysis of business needs and IT constraints by involving stakeholders from throughout the organization. This focus allows individuals and teams to innovate agendas that are closely aligned with a common vision and a definitive strategic direction; all while taking into account competitive strategy and the immediate requirements of customers, other stakeholders and potential external suppliers. It also reflects emerging trends in reference frameworks, semantics, and IT resource commoditization. Finally, it concludes that the capability to leverage external partners at each SOE vantage point is a necessity.

For clarity, we use definitions of SOA and SOE from OASIS (the Organization for the Advancement of Structured Information Standards) and Intel. OASIS defines SOA as the following: "A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations" (OASIS, 2006). Basically, SOA does not mean only web services or architecture or technology. However, it is a new way of thinking about processes that reinforces the value of reuse and commoditization. At Intel, Brown and Carpenter (2004) have defined an SOE is as, "An enterprise that implements and exposes its business processes through an SOA and that provides frameworks for managing its business processes across an SOA landscape." P&SFIA provides a roadmap to increase the value of SOE in the context of these definitions.

Similar to many IT paradigms, researchers found that SOE and P&SFIA require a conceptual model to reflect domain knowledge that enables effective stakeholder communication and consensus decision making. At the center of P&SFIA is a conceptual model for representing actual business processes, architecture, and infrastructure services. The conceptual model is an artifact that clearly shows practical and detailed use cases relevant to each stakeholder involved in the P&SFIA process. This artifact clearly shows each stakeholder how their roles fit into the context of SOE, and it reinforces each participant's view and common language.

One of the most important considerations for P&SFIA is reuse at all transformational bridges, from business process to business sub-process, from business process to services, and from services to architecture and virtualized execution infrastructure. Reuse needs to become a culture for all stakeholder and role perspectives, e.g., organizational, business process, service and infrastructure. The reuse process approach involves the stages of Discovery and Instantiation of pattern templates, Scoring resource allocation options, Choreographing processes, Orchestrating (executing) processes and capturing significant (!) findings through post mortem analysis (referred to as the DISCO! model). This general model has the desirable property that reuse can be seen from the perspective of each stakeholder and from a common approach described in a common vocabulary and semantics.

Since semantic frameworks necessarily require achieving commonality and rigor for domain-oriented phrases, words, and concepts, it makes sense that organizations may well need to devise their own semantics; and they need to pay attention to semantics development efforts that can link their business processes and computing capabilities to external communities. We have developed a SOE ontology in an ontology modeling tool for the purposes of encoding enterprise use cases. We have included the following in our SOE ontology and conceptual model: 1) Enterprise business processes, 2) Live and state of construction (or suspended) service entities, 3) Choreography and Orchestration entities, and 4) Engagement models and key resources.

To help explain our ontology entities and properties, Figure 4 provides an architectural view of the building blocks that typically exist in an SOE, ranging from low-level infrastructure layers to a middle-level SOA layer and upwards to business processes and enterprise strategies. Horizontal and vertical layers are linked in meaningful ways so as to support the examining of impacts of changes made in one layer as they ripple through to others. Moving downward, an enterprise strategy is linked to business processes, then a business process is linked to architecture services that support the process, and those services are sourced through infrastructure for IT service execution. One goal of this architecture is to facilitate the acquisition and integration of the best enterprise services that can be obtained from the market with maximum agility. For example, process, software services, and even virtualized infrastructure services can be swapped in and out of the architecture when there are viable business reasons. Another goal is to deliver enterprise services to support business strategy from throughout the extended organization, i.e., a view that the IT architecture is itself a provider of enterprise services.

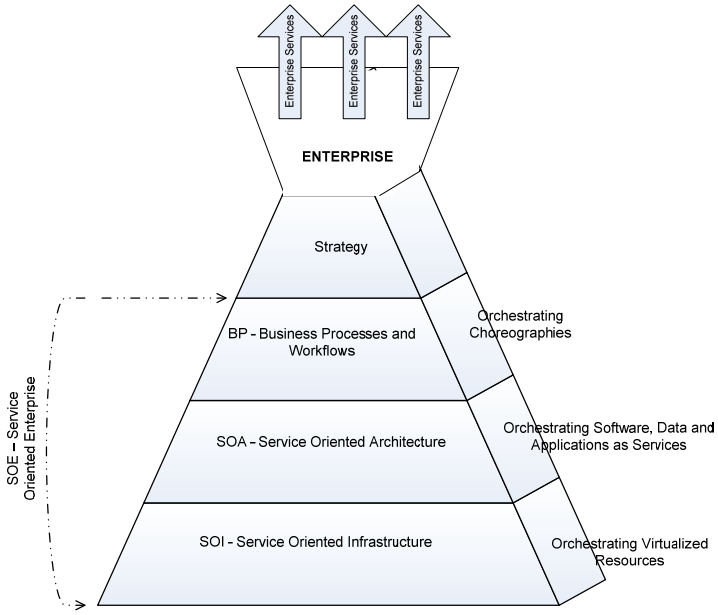

Figure 4. SOE Building Blocks

From a research standpoint, two organizations have engaged in independent P&SFIA processes as part of planning paradigm shifts to SOE. Each organization had different objectives at the onset; the people, processes, and systems were completely different in their orientation, and outcomes were vastly different. Including two subject organizations in this discussion is significant because it provides two data points for other organizations to consider, they each offer P&SFIA ideas for other organizations to think about, and they show how strategically directed assessments necessarily engage multiple stakeholders. What is important is that the same conceptual modeling approach was used in both P&SFIA studies, the DISCO! Paradigm was taught to all stakeholders, and the tools and models associated with the two independent cases enabled findings that are important to others engaging in P&SFIA.

III. AMERICAN EXPRESS' SOE APPROACH

For many years, American Express (Amex) has seen its global services businesses grow dramatically and its IT systems increase in complexity as customers, services, and markets have multiplied (American Express, 2006). The $29 billion company operates in over 130 countries. To meet this change in complexity and demand, Amex decided to embrace an IT infrastructure outsourcing arrangement partly through a flexible services approach with IBM as its partner. Amex's services are divided into separate business units, each of which employs an IT staff that operates autonomously from other business units' IT staffs. Amex is one of the most mature

organizations in the SOA space, and their focus is now on organizational and managerial issues that have manifested subsequent to adopting SOA philosophies.

One AMCIS panelist, Margaret Mitchell - a vice president at American Express - is responsible for leading the Global Corporate Business Intelligence (BI) portfolio team that creates and provides the technology that powers the services offered to corporate card clients. These services help Amex customers ensure compliance with their expense policies, as well as enable them to better manage vendor negotiations. They must deliver BI services to their business customers quickly, with maximized operational efficiency in a continuously changing environment. The team sources its service development business processes both internally and through an external service infrastructure provider (IBM). Internal sourcing involves service project managers, integrators, database administrators, data-warehouse specialists, report developers, testers, change management specialists, and so on. Resources include people, reusable services, hardware, software tool suites, and external services. People are organized into teams befitting of BI project development methodologies. This team has been working on the Service Oriented Architecture for quite some time, resulting in the heavy use of reusable components and utilities. There has been a great benefit to their customers by implementing SOA in the technology that powers their team. It has allowed them to create more innovative global products and flexible functionalities. They realize that today's challenges are related to business processes and organizational issues. As they move into the world of service reuse, teams go from being very centralized and independent to very decentralized and dependent on each other. This results in additional intermediaries getting a service developed through engagement practices where there is a heavy reliance on Subject Matter Experts (SMEs).

The goal of this particular P&SFIA effort was to define a roadmap to align people, organizational structure, reusable services, and business processes in a manner that leveraged factory concepts in order to streamline BI service delivery. In SOE, delivered software is a service, and the teams involved in the processes of delivering those software services are themselves viewed as service delivery organizations. The Amex team views BI service development as a kind of job shop in an extended enterprise information factory. Each utility or reusable service in the factory is needed to produce an end service for customers. Component teams are basically service delivery organizations contributing to BI service development efforts in extended enterprise job shop-like project processes. Choreographies represent the flows of a project through the service organizations, and orchestrations refer to completed choreographies. When looking at these choreography and orchestration orientations, it seemed logical that one could apply industrial engineering concepts to the SOE world to help streamline the organization and its associated processes. In that job shop environment, some people may be subject matter experts, and these subject matter experts may actually be bottlenecks to streamlining services production (Leonhard and Davis, 1995).

There is a major role for reuse of prior project plans (choreographies), resource schedules (orchestrations), and software services in how SOE impacts people issues in a services company. The SME bottleneck was a particularly important challenge that Amex Team faced. Each utility has one or two associated SMEs that are often needed to be involved in every project if choreographies (engagement and execution processes) and interfaces are not well defined. Basically the SMEs could not be scaled. By making the choreographies transparent and well defined, the standardized teams became more empowered to consume utility and component services without having to rely so heavily on SMEs.

Amex also found that in SOE there is a major role for common semantics and ontologies. The common semantics drove the ability to standardize the processes. It also helped them gather metrics. The ontologies provided the artifact needed for continuous improvement, metrics, and the ability to examine execution patterns for future refinement and reuse.

Results associated with aligning service oriented enterprise concepts with people, reuse, and project streamlining (organizational) issues have been positive. These include throughput via reduction of bottlenecks, SME flexibility, reduced costs, and so on. The most dramatic result was the number of service projects that could be moved through the utilities. By lessening the

dependency on SMEs and with the removal of intermediaries, teams were empowered to do more with the utilities and components they needed to build products. The other impact was reduction of cost. When changes were first implemented, the Amex Team saw a jump in cost as the organization was structured to be aligned by services rather than centralized hierarchy. This allowed the relief of bottlenecks, but resulted in a larger number of intermediaries. This cost then started to fall in line as processes and service utilities became more transparent and agile.

Identifying people who have enterprise development skills was a major issue. The skills to develop services that properly address all the scalability, availability, capability and knowledge of security and privacy issues were very complex. Amex was very capable of developing enterprise applications, but that was more a result of experience and tribal knowledge rather than art. The problem was that it took a long time to get someone to the skill level to tackle the development of large scale systems.

In summary, P&SFIA at American Express' BI group resulted in next step agenda items with significant emphasis on reuse (DISCO!) at all levels (Keith, et al., 2007). The conceptual model provided a solid framework for elaborating reuse agendas between and among teams and sub-teams, even with outsourced contractors.

Examples of next step agenda items made possible through P&SFIA include:

- Align the organizational structure with a job-shop service development team orientation.
- Define standard development processes.
- Streamline engagement models in and between service teams in a way that can result in reduced coordination overhead.
- Educate all stakeholders to the notion of services computing so everyone acts as both service provider and customer.
- Define strategies to reduce bottleneck effects.
- Start to populate a common semantics-based conceptual model.
- Start to store the patterns of project schedules with variances and service component coordination strategies to reduce cycle time and rework.
- Continue to minimize integration costs by enabling the discovery of disconnects and opportunities for model integration.

IV. INTEL'S SOE APPROACH

The technology developed by Intel Corporation has enabled the computer and Internet revolution for many years now. Today, Intel is one of the leading manufacturers of computer, networking, and communications products. Intel must have the flexibility and agility to respond to changing business needs and to harness resources across global outsourced design and supply chains (Intel, 2006). Internet speed is driving change, which implies the need for rapid translation of business ideas into supply chain changes. This requires that as a manufacturer, Intel needs to integrate tools to deliver on optimization and facilitate consistent and timely implementation of changes in information systems supporting product design and the supply chain.

AMCIS panelist, George Brown - Senior Program Manager of the Intel Business Agility Team - is responsible for defining IT strategy, the architecture of business applications, and strategies for applying information technology to improve Intel's competitiveness.

The Intel team involved in the case had begun to envision a response to prevailing process and service-based fusion. Intel's P&SFIA focused on future technology requirements for implementing an information bus infrastructure for inter-application communication and business process automation. The need they expressed was to move from protocols, message exchanges, and so on, associated with SOA, to begin addressing inter- and intra-enterprise impacts, particularly those surrounding supply chain management. The goals of P&SFIA have

been to define strategies that will result in reducing the complexity and costs associated with extensibility of business processes throughout Intel's network of suppliers and customers.

To be able to transform business to SOE, common, and normalized business semantics are needed to define business services. In addition, there are two service design related transitions:

1) *Break functionality into services*. Services must be defined in a format that the business can understand; and,

2) *Assemble services into more complex services*. Loosely coupled, service-oriented architectures improve reuse and adaptability. Composite applications are business service solutions leveraging multiple underlying applications and services that ensure everything integrate.

The research team's ontology-based conceptual model from the Amex research project provided a starting point for rethinking how Intel's SOE pieces should be glued together by using semantics. The model was augmented with representations for SOI and approaches for mapping from SOA to SOI (e.g., semantic matchmaking). The conceptual model helped to unify the SOE visions of the research group, the Intel architecture group, external value chain group partners, and a host of other partners (Brown, 2006). A research agenda, including a proposal for a large-scale international grant resulted from the P&SFIA process.

With P&SFIA, Intel's Group was able to define strategies that will result in reducing the complexity and costs associated with extensibility of business processes throughout a network of suppliers and customers. They are using the results to help influence international SOA standards and to facilitate participation in international research projects. One of the major discoveries from the Intel projects is that the architecture has to share certain information between business process, SOA, and SOI layers to deliver better enterprise business services. If there is a need for a change in any of the layers, this change needs to be reflected on all of the SOE building blocks dynamically; basically, the SOE needs to behave in an ecosystem notion.

Examples of next step agenda items made possible through P&SFIA include:

- Business process mappings to inter-organizational applications and services needed to reflect that partners may be using all types of infrastructures.
- An abstract model was developed to break functionalities into services and to assemble services into more complex services.
- Organizations need to pay attention to semantics development efforts that can link their business process and computing capability to external communities.
- Fundamental business process patterns were aligned with components of the Federated Enterprise Reference Architecture.
- Business processes defined in terms of value chain reference model (VCOR) semantics need to be addressed in next steps.

V. CONCLUSIONS

The complexities and costs of current information architectures, infrastructures, and distributed software have provided impetus to emerging conceptualizations of SOE. P&SFIA has opened a gateway for American Express and Intel to realize new visions of how to deliver reliable, scalable enterprise processes built upon SOA.

Our P&SFIA research experiences reinforce realizing that:

- SOE strategy cannot be based on SOA solutions alone,
- SOA requires principles and guidelines for defining reference architectures,
- Organizational realignments and pattern repositories play major roles for SOE success,

- SOE strategy necessarily fuses processes and services perspectives which likely requires a shock to enterprise stakeholders through a formalized impact assessment, and
- New IT landscape explorations (like P&SFIA) require lenses transcending process management, organizational structure, services-based sourcing strategies, migration of legacy applications to SOAs, and management of virtualized resource approaches.

One overriding lesson from this research and panel is that SOE is about people and a new way of thinking. It is about the ways that people engage with computing to execute processes, and it is about the semantics that put people and machines together in new ways. It is about executable semantics and preparing for commoditization of processes, services, and computing horsepower. It is about how to think and practice reusability from service patterns in the delivery of new services. This paradigm shift – to service oriented computing – is not only about a specific technology or a product. It represents a major cultural change for organizations. A trans-disciplinary education program needs to be developed by utilizing organizational sociology, law, services marketing, business strategy and operations, accounting and finance, information technology, and industrial and computer engineering to provide the knowledge necessary to equip new graduates to lead this culture change. Organizations need to provide industry use cases to analyze research issues, and to allow students to investigate application challenges and globalization issues that cannot easily be replicated in typical university laboratory settings.

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ABOUT THE AUTHORS

Haluk Demirkan is an Assistant Professor in the Department of Information Systems in W. P. Carey School of Business at the Arizona State University. His research interests and expertise are in services science, information supply chain management, and IT outsourcing. His current research focus is on theory advancement and design sciences for the Proactive Services-Oriented Enterprise Computing with agile architectures that enable rapid configuration of collaborative inter- and intra-organizational information and knowledge flows. He has more than ten years of professional experience in the field of information logistics and process reengineering. He has published or is forthcoming, and presented his research in a number of academic/industry journals and conferences. He is also serving as a Co-chair for the Towards the

Service Oriented Enterprise Minitrack in the Decision Technologies and Service Sciences Track at the 40th Hawaii International Conference on System Sciences. He is affiliated with a number of research centers.

Michael Goul is a Professor in the Department of Information Systems in W. P. Carey School of Business at the Arizona State University. His recent research emphasis has been in theory advancement and design sciences associated with agile architectures capable of enabling rapid configuration of collaborative inter- and intra-organizational decision support environments. As one of the pioneers in bridging artificial intelligence and decision support research, Professor Goul is currently focusing on the promises of ontology and semantics within what is being referred to as the "Proactive Services-Oriented Enterprise." His focus on services science extends to public/governmental contexts. He was selected as one of two 2005-06 Distinguished University Fellows in the nation by the Advisory Committee of the newest Presidential School: The Clinton School of Public Service. Dr. Goul has authored or co-authored over fifty refereed journal and proceedings papers, and has supervised many graduate dissertations and theses.

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