Enterprise Architecture Modernization
Using the Adaptive Enterprise Framework

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October 2003

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This white paper assumes the reader is generally knowledgeable about enterprise architecture and is familiar with the Federal Enterprise Architecture Framework (www.feapmo.gov). Additionally, the white paper assumes some familiarity with business process engineering, and business and IT strategy techniques.

Background

In 1985, Michael Porter introduced the concept of **value chain analysis,** which formed the basis for leading practices in business strategy through the late eighties and early nineties. In the early nineties, Hammer and Champy introduced us to **business process reengineering (BPR)**. This resulted in the implementation of BPR across just about every major commercial enterprise in the US and elsewhere in the western world. Complementing these movements has been the steady improvements in our ability to obtain predictive types of information and to use **business analytic** approaches that go beyond pure ROI indicators, which are not ideal. Along the way, IT struggled through many paradigm shifts from modular programming, to Case Tools, to Rapid Application Development, to Object Orientation (OO), and so on. While all of these movements and paradigm shifts have solid analytical underpinnings, none have lived up to their promise.

Part of the problem is, of course, the over hype that these movements and paradigm shifts receive. But, more importantly, and especially relevant, are four facts that limit their effectiveness:

1. The inevitable resistance to change that is the hallmark of most large enterprises;
2. The lack of agility within enterprise infrastructure;
3. The fact that none of the movements provide an end-to-end strategy through implementation roadmap. The strategy oriented approaches of the late eighties and early nineties, and the BPR movement of the nineties, did not sufficiently address change management and implementation. The IT based movements were, and are, too IT centric, and do not sufficiently address business alignment;
4. The "all-or-nothing" nature that typically characterized the resulting recommendations, and the inability to manage change and measure progress.

The end result is that none of the movements by themselves were able to address the need for end-to-end business alignment, organizational change management, and infrastructure agility.

Today there are several industry related activities underway that, combined with the elements of the above mentioned movements, provide an opportunity to truly support the implementation of a business-aligned and agile enterprise-using enterprise architecture framework. They include the work being done by The Object Management Group (www.omg.org) on Model Driven Architectures (MDA),and the work being done by The

Business Process Management Initiative (www.bpmi.org) on formalized and implementable business management model based infrastructures. Additionally, renewed interest in component architectures and the fast acceptance of XML and service based architectures as industry standards further add to the potential of achieving enterprise business alignment and infrastructure agility.

Value Proposition Overview

There has been a lot of good work done by both IT centric and business centric schools of thought towards architecting and building a business aligned and agile enterprise. This good work has yet to achieve its promise primarily due to

- The dichotomy that exists between IT and Business, and the lack of synthesis across the two domains;
- The need for a realistic framework for enterprise change management.

This white paper presents what we call the **Adaptive Enterprise Framework (AEF)** as a synthesis of this good work. The premise is that an end-to-end framework, such as AEF, in the context of MDA/BPMI, will provide a roadmap for achieving the elusive goal of business alignment and infrastructure agility. Combining this with the implementation of a service/component oriented architecture and effective change management will result in the realization of the roadmap. As the AEF is, in large part, a synthesis of work done by others, every attempt is made to properly cite the original thinkers for their work. In some cases this is difficult because the body of knowledge has evolved over time through a wide variety of practitioners, e.g., BPR and Value Chain Analysis.

Purpose and Scope

The primary purpose of this white paper is to demonstrate that a business aligned and agile enterprise can be achieved and sustained through the effective across-the-board integration of

1. Model Driven Architecture (MDA)
2. Value Chain Analysis (VCA)
3. Business Process Management (BPM)
4. Business Analytics
5. Service-Component based infrastructures and middleware
6. Organizational change management

In short, the combination of all the above into an integrated and comprehensive framework presents a historic opportunity to make some significant advances in enterprise planning that, here-to-fore, have proved illusive.

We make our case for an "end-to-end" framework by presenting our own framework that we call the **Adaptive Enterprise Framework (AEF)**. AEF is one view of an end-to-end roadmap for enterprise planning. We do not make the case that it is the only view, and we welcome its improvement or integration into other frameworks. We attempt to walk a

fairly fine line and to not be too prescriptive. At the same time, we make the case that, at the very least, synthesizing the concepts presented in the AEF into existing EA frameworks, including the FEA, is required to guide the development of business enterprises that are aligned and agile. We believe that the current frameworks fall short of providing a template for achieving alignment and agility, and could prove to be better tools if informed by the concepts presented herein.

The white paper attempts to cover a broad range of complex material as is required by its scope. This wide scope necessitates that the white paper present only an overview of many of the discussed concepts, some of which have volumes written about them so there is a large body of knowledge readily available on each of the subject areas. We provide references for those who would like further information.

The white paper is organized as follows:

- Background
- White Paper Value Proposition Overview
- Purpose and Scope
- Historical Perspective
- Understanding Process Modeling
- AEF Overview
- MDA Overview
- VCA Overview
- BPM Overview
- Service-Component Architecture Overview
- Business Analytics
- Organization Change Management Maturity Model
- Value Proposition for an Agile Enterprise and AEF

Historical Perspective on Enterprise Level Planning

You say tomato and I say tomahto
Fred Astaire – Ginger Rogers Song

From the early eighties through today, as technology has become an ubiquitous part of the enterprise, there has been a dichotomy between technology centric frameworks for enterprise improvement and business centric frameworks. Unfortunately, to-date, no one framework or school of thought has been successful at bridging the divide between business and technology, whether at the enterprise level, or at the more micro business area– system. Despite the growing dependency of business on technology, there still seems to be almost an *Alice Through the Looking Glass* distortion that divides business from technology.

Federal Enterprise Architecture Framework School

Current efforts centered on the Federal Enterprise Architecture, which has its antecedents in the Zachman framework and Spewak's EAP framework, have made some progress, but have not achieved their overall goal of better business alignment or improved agility and efficiency. In most cases, they are technology centric and overly descriptive. They generally don't provide the required linkage with business imperatives that are required for them to be ["Actionable: "Giving just cause for legal action"] useful at the executive level. It is the view of the Mercator Group that the FEA frameworks rely too heavily on frameworks that were developed to fit into a software development lifecycle paradigm (Zachman and Spewak), and are not sufficiently informed by work done in the late eighties and nineties in business process design and value chain analysis.

The Business Process School

> *Do not confuse strategy with implementation.*
> *- Unfortunate legacy of the Business Process School*

A good place to start a discussion of what we call the business process modeling school of enterprise planning is with business strategy based work exemplified by various business modeling techniques. Practitioners of such techniques include prestigious management consulting firms like McKinsey and the Boston Group in the mid nineteen-eighties through the early nineteen-nineties. Much of the work was based on the seminal work in value chain analysis developed by Michael Porter (*Competitive Advantage*, Schuster & Simon, 1987).   While the basic concepts behind value chain and much of the strategy work are still valid and in use today, their overall popularity in corporate America has waned due to the difficulty in connecting the developed strategies with implementation. In addition, the strategy was typically developed without enough consideration being given to the ability of the enterprise to adjust to change. One problem was that once you developed a strategy using value chain or other analytic tools, there was no clear path to an implementation plan. Another problem was that infrastructure in the enterprise was even more rigid back then than it is today.

The next evolution in the Business Process School was the Business Process Reengineering (BPR) movement of the early nineteen-nineties, which was spurred on by seminal works done by Hammer, Champy, and Davenport. Early on, the efforts focused strictly on business process design with little thought given to technology. Unfortunately for the BPR movement, technology had become such an integral part of business processes that designing processes without taking into account the difficulty in evolving information systems supporting them proved to be a major miscalculation. Most BPR efforts deteriorated into across-the-board personnel cuts with very little nuance resulting from the BPR efforts. BPR became a cover for cutting staff. Realizing their early mistake in not properly considering IT in the BPR mix, Big Five firms began to develop methods that effectively integrated BPR with technology enablement. Their efforts proved promising, but were a little too late. By this time, business was exhausted with BPR and was looking for a quick fix to their process issues.

This, along with the Y2K scare, led to the next revolution: the Enterprise Resource Planning (ERP) revolution.   Large commercial enterprises bought ERP systems from SAP, PeopleSoft, Oracle, and others to the point where virtually every Fortune 2000 Company had, at its application core, an ERP solution by the year 2000. The main selling points for the ERP solutions were that they came with built-in best practice process models that would simplify the messy requirements of the analysis phase of an implementation that was the source of so many system implementation failures. In addition, ERP solutions were to eliminate the integration headaches of a "best of breed" solution mix. The tradeoffs for the lower risk ERP alternative were "vendor lock-in" limits to process flexibility, and high lifecycle costs.

ERP essentially solved several issues that were the bane of BPR. ERP provided an end-to-end comprehensive solution that included "canned" business processes. The problem of how to adapt technology infrastructure to support the new processes was dealt with through wholesale replacement of the existing legacy environment with the ERP technology platform. Organizational change management was simplified by limiting choice. ERP packages live by the Henry Ford motto, "You can have any color car you like, as long as it is black." Organizational entities were forced to pick among a limited set of options.   In the end, it can be argued that ERP has delivered on its promise. While, in many cases, ERP leads to suboptimal solutions and shaky ROI's, the net result has been drastically improved integration across enterprises that have successfully implemented ERP. In hindsight, BPR based programs required that organizations would have to be able to integrate and adopt "best-of-breed" solutions on top of poorly integrated enterprises. This proved to be too difficult a change.

Today, a convergence of events is leading to renewed interest in business process based enterprise planning. Looking back on the early strategy work based on Value Chain Analysis, and the later BPR work, it is obvious that there is much good there. Businesses, having stabilized their environments with ERP, are looking for opportunities to become more agile in order to respond to the demand of constantly changing market forces and value chains.   There are additional opportunities for achieving success this time around. Technology, while still too complex and difficult to adapt, is becoming much more flexible. Serious work has been done in Service and Component based architectures, and vendors are opening up their products in response to market demand. It is the belief of The Mercator Group that these events and opportunities could finally coalesce into a comprehensive and effective approach to enterprise planning based on the effective stewardship and evolution of work being done by the Business Process Management Initiative (BPMI) and by The Object Management Group on Model Driven Architectures. The concepts inherent in these two initiatives provide the promise for building agile IT infrastructures, independent of technology, and responsive to business needs. Both will be discussed later in the paper and presented as part of the Adaptive Enterprise Framework (AEF).

Software Development Lifecycle (SDLC) School

It is important for technical people to make the technical decisions and business people to make the business decisions.
- Unfortunately necessary, but self evident, statement made as part
of an explanation of Extreme Programming

There has been a steady stream of paradigm shifts in software development over the last twenty years, from structured analysis and design, to modular programming, to object orientation methodologies. However, an honest appraisal of the state of software development is that it is still an art form, not an engineering discipline. This may be fine in the broader scheme of things. However, to be truly successful, this art form requires some level of predictability in implementation timelines and resource requirements, and some level of flexibility and interoperability in the resultant products. This is not, unfortunately, the norm, and this has been the Achilles Heel of achieving an agile enterprise that can respond to changing market demands and business priorities.

Fortunately, there are several recent developments that promise to break the cycle of broken promises.

The work being done by the OMG in Model Driven Architecture (MDA), to provide a framework for using a business modeling approach to defining business logic (dove-tailing into the work being done by The Business Process Management Initiative to define a standard for the unambiguous modeling of business processes), promises to take SDLC as we know it completely out of the critical path of evolving an enterprise. The basic premise of both is that business logic should be maintained in a technology neutral model that is understandable and potentially controllable by the business users. Both MDA and BPMI provide a framework that separates business functionality concerns from implementation time technical concerns, such as scalability, security, and quality of service. Business users, with some support from IT people, could model their business requirements in a fairly straightforward set of semantics dedicated to business requirements. Those requirements could then be instantiated by IT people on IT infrastructure appropriate to the needs of the user community. Business requirements and supporting infrastructure concerns could be managed independently of each other, eliminating an unnecessary linkage between the two, as well as the vendor and technology "lock in" that is the hallmark of legacy environments.
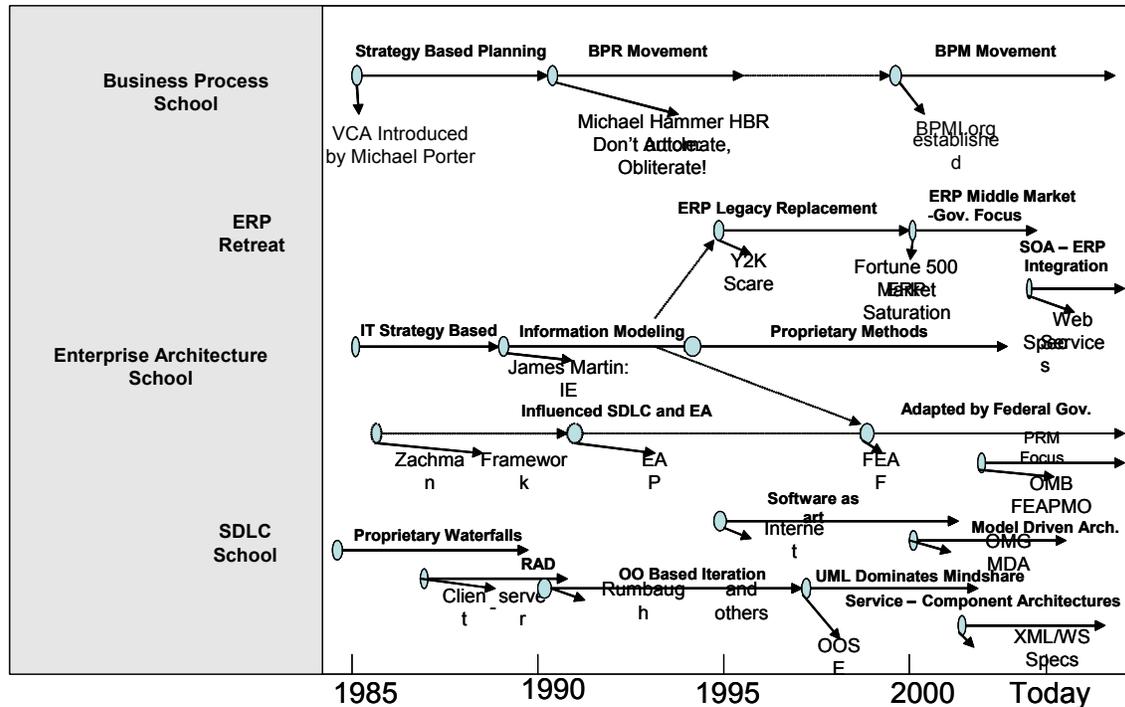
Related advances in developing a standard framework for service and component oriented architectures also contribute to the potential for success. However, this is not a technology issue. What will be required for success is a total rethinking of the way we fund, implement, govern, and manage applications. We start to address this as part of AEF later on in the white paper.

Seizing the Historical Opportunity

Just about anything in business can be either a sinkhole or a competitive advantage if you do it really, really bad or you do it really, really well.
Michael Dell – August 25, 2003 interview in Business Week

In its August 25th, 2003 edition, *Business Week* published a set of articles on the future of technology that included predictions by many IT luminaries on the "next big thing." The predictions included everything from miniature sensors that float in the air to bionic marvels. While all that was mentioned is reasonably interesting, Michael Dell's suggestion that the next big thing in technology is its effective use was the most prescient. We tend to get caught up in the gadgetry of technology and not pay enough attention to the less glamorous issues on how to effectively manage it. Currently, the industry is abuzz with talk about web services and how they will lead to on-demand functionality and componentized service based architectures. The fact is that technology has never been the impediment to achieving componentized service based architectures, or the "plug and play" application environment that they promise. The major impediment has been the fundamental structures of all the software development lifecycle methodologies and supporting tools that result in business logic quickly being enmeshed into cryptic programming languages where it becomes un-malleable and very costly to change and evolve.

MDA and BPM together address the fundamental impediment to achieving a flexible and agile IT infrastructure that can support the ever-changing requirements of quickly evolving business value chains. Value chain analysis provides a proven approach to alignment of business processes and IT infrastructure with business needs. Business analytics and supporting tools provide a mechanism for us to monitor and control change based on forward-looking indicators. ERP has provided us with a reasonably stable platform to evolve from. All of these things represent a historic opportunity to significantly improve the agility and business alignment of enterprises. Below is a timeline of various events and the paradigms they help create:

| | 1985 | 1990 | 1995 | 2000 | Today |

Timeline diagram with rows:

Business Process School
- Strategy Based Planning
- BPR Movement
- BPM Movement
- VCA Introduced by Michael Porter
- Michael Hammer HBR Article Don't Automate, Obliterate!
- BPMI.org established

ERP Retreat
- ERP Legacy Replacement
- ERP Middle Market -Gov. Focus
- Y2K Scare
- Fortune 500 ERP Market Saturation
- SOA – ERP Integration
- Web Services

Enterprise Architecture School
- IT Strategy Based
- Information Modeling
- Proprietary Methods
- James Martin: IE Influenced SDLC and EA
- Zachman Framework
- EAP
- Adapted by Federal Gov.
- FEAF
- PRM Focus
- OMB
- FEAPMO

SDLC School
- Proprietary Waterfalls
- RAD
- Client-server
- OO Based Iteration Rumbaugh and others
- Software as art
- Internet
- Model Driven Arch.
- OMG
- MDA
- UML Dominates Mindshare
- Service – Component Architectures
- OOSE
- XML/WS Specs

Understanding Process Modeling

Business processes are a set of logically related tasks performed to achieve a defined business outcome.
Davenport & Short (1990)

There is a tendency in many practitioners of business process design to confuse business processes with functions. In the worst-case scenario, some practitioners actually deliberately mix functions and processes, seeing one as a further decomposition of the other. It is not that you cannot map or relate functions to processes; it is that they are orthogonal. Designing an enterprise based on processes will result in a vastly different design then one based on functions. It is hard to say and scary to contemplate, the result of a design based on this mixture of functions and processes." This confusion is probably an outcome of the fact that most literature on business process design provides only a cursory definition of business processes; assuming the reader understands all of the nuances. In this section of the white paper, we try to draw a clear distinction between the process and function.

Process and Functions Explained

Both business processes and functions are groupings of one or more activities. The difference is that functions are groupings based on a particular domain of expertise or a defined role. Processes are groupings of measurable units of work whose defined sequence, in a process model, produces something of value.   This can even be seen in the labels that designers typically apply during a design, illustrating a level of intuitive

understanding of the difference between the two. Processes will typically be verb based implying action, e.g., to design, build, and operate. Functions will be noun based as can be seen from some examples from the Federal Enterprise Architecture's Business Reference Model: Law Enforcement, Revenue Collection, and Administrative Management.

Another key difference between process and function oriented designs is the separate perspective of each across the enterprise. A functional design is typically part of a hierarchical model that decomposes the enterprise into more granular activities. The functional decomposition does not necessarily have to conform to an organizational hierarchy. A process design usually starts with a customer and tends to go across the enterprise, as you might visualize it, somewhere along the middle. To illustrate, let's look at what would be a reasonable segment of a high-level process model for an automobile manufacturer:

Automobile Company High Level Process Model

Design Car → Build Car → Deliver Car

As you can see, the above model conforms to our definition of business processes. Each process in the model produces a measurable unit of work, e.g., Design Car produces a design. They exist in a logical sequence that together produces something of value.

Now let's look at a functional model of various domains that would support this process:

High Level Functional Decomposition

Car Company

Engineering   Manufacturing   Marketing   Outbound Delivery
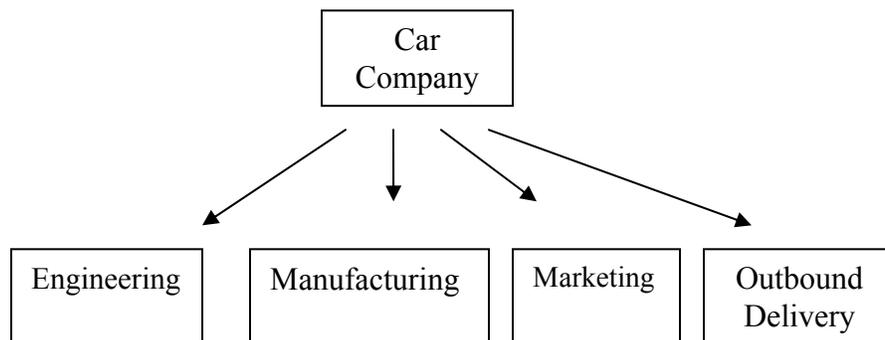
The resultant model better describes groupings based on knowledge domains than sequences of activities with defined work outputs. For example, the Design Car process would surely include elements of Engineering, Manufacturing, and Marketing. It would be difficult to identify workflows with discrete outputs from this form of modeling. Once

again, the decomposition should not be confused with an organizational hierarchy. For example, the marketing activity of surveying users may be performed by the customer service group that is not organizational bound to the marketing department, yet it would be included as a sub function under marketing.

The functional model has value as a descriptive tool. For example, the Business Reference Model is useful to OMB for tracking funds and identifying redundancies as part of its budgeting responsibilities, but is not very useful at the Agency level as a tool for architecting business processes. A business process modeling approach is much superior in that it provides the opportunity to analyze activities based on their inter-relationships, costs, and contributions to the product or services of the enterprise. It also provides the opportunity to extend the model outside the enterprise to include interactions with business partners and the customer, resulting in better alignment with the customer and other participants in the enterprise's value chain.

Another important point is that process modeling better supports Activity Based Costing (ABC) and other performance modeling techniques. ABC models that are based on functional decompositions can collect costs, but it is difficult to associate these costs with revenues.   A process model provides a mechanism for associating activities with both cost and revenue.

Process Modeling Semantics and BPML

A comprehensive discussion of the hundreds of variations on process modeling semantics is beyond the scope of this white paper. Detailed discussions of the Business Process Model Notation (BPMN) endorsed by Adaptive Enterprise Framework (AEF) can be found at www.bpmi.org, along with a download of detailed specifications. Additionally, an effective overview of business process modeling and BPMN can be obtained be reading: *Business Process Management,* by Howard Smith and Peter Fingar, published by Meghan-Kiffer Press, 2003. The white paper limits itself to a brief introduction of BPMN and a discussion of some of the important nuances that one needs to be aware of when modeling processes, including a brief introduction of value chain analysis.

Business Process Modeling Notation (BPMN) is the first attempt at a standards based business process based modeling language that can unambiguously define business logic and information requirements to the extent that the resultant models are executable. Currently, there are several vendors that have a complete environment for modeling business processes and executing them on interpretive platforms.   The net result is that business logic and information requirements are maintained in an end user friendly model that will not become out-of-synch and non-reflective of the actual supporting information systems. Nor will it be completely captured by a rigid and cryptic computer language that is destined to become obsolete. One of the biggest problems facing organizations today is that the primary repository of their intellectual capital is in these legacy systems. BPMN holds out the promise of giving end users management and direct control over their business processes, and the information systems supporting them.

BPMN provides a rich set of semantics that provide a tool for capturing the complexity of an information rich business process model. It must be remembered, however, that materials flow is relatively weak compared to some industrial engineering based models. BPMN contains notations and semantics for capturing

- Workflows or sequences of activities
- Decision points and prerequisites
- Information transformation and flows
- Collaborations among multiple entities and actors

One weak area of BPMN is that it does not directly support some of your standard industrial engineering, such as material flows and assembly/transformations. Additionally, while it can capture process performance data upon execution, it does not provide the ability to directly articulate and capture process performance measures as a notation in the model.
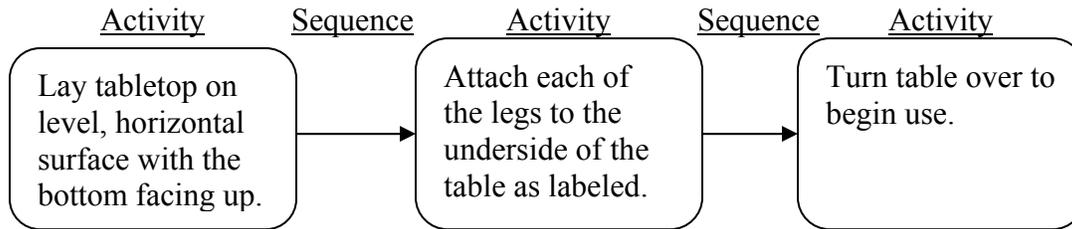
BPMN is, however, a vast improvement over the various flavors of process modeling languages that preceded it, as most were designed primarily as communicative tools for human analysis, and are much more ambiguous. Many of the modeling languages developed from industrial engineering are as rich and structured as BPMN, but their focus is on workflows supporting material assembly and transformation. They are less useful as tools for modeling collaboration and information flow. The Business Process Modeling Language (BPML) developed by The Business Process Management Initiative (www.bpmi.org) is the first comprehensive process modeling language that is based on mathematical proof, and the first to be able to capture detailed business activities, business rules, information flows, and collaborations at an unambiguous level. Using BPML for modeling business processes is a core recommendation of the AEF.

Process Model Variations – Introduction to Value Chains

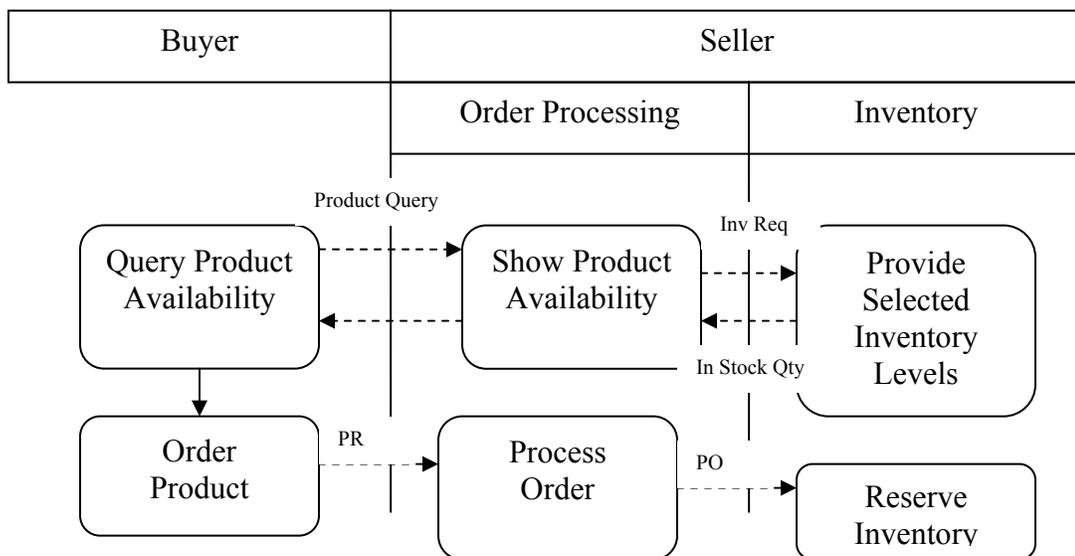*Process model building blocks*

Anyone who has assembled a piece of furniture or child's toy, or at least those who follow instructions, has some familiarity with process models. These are typical workflow models accompanied by pictures of the item in various stages of assembly. They represent the simplest form of process modeling, which is a logical sequence of activities perform by one actor:

Simple Workflow Process Diagram

Activity	Sequence	Activity	Sequence	Activity

Lay tabletop on level, horizontal surface with the bottom facing up. → Attach each of the legs to the underside of the table as labeled. → Turn table over to begin use.

BPMN borrows the concept of pools and swim lanes from IBM LOVeM (Line of Visibility Enterprise Model) to model processes with multiple actors and entities. Each pool or swim lane represents a separate actor or entity. This allows for the modeling of information flows and collaborations among multiple entity-actors:

Complex Process Diagram with Collaboration and Information Flows

Buyer	Seller	
	Order Processing	Inventory

Product Query

Inv Req

Query Product Availability ⇢ Show Product Availability ⇢ Provide Selected Inventory Levels

In Stock Qty

Order Product — PR → Process Order — PO → Reserve Inventory

The addition of swim lanes provides the opportunity to model sophisticated system dynamics that can be defined in further granularity as each process is progressively defined into atomic activities.

One thing that would add to BPMN that currently needs to be addressed outside the notation is better information modeling. For example, it would be useful to know where the product catalogue exists in the above model. Is it in Inventory or Order Processing? Additionally, incorporating the concept of performance measures at the entity-actor or process level, as illustrated below, also would be useful. One of the main tenets of AEF is that all processes need to be measurable.   It would be useful to have a semantic for

identifying the performance metrics for sets of processes. Of course, BPMN is a new standard that will evolve.   This evolution should occur fairly quickly as there are several sophisticated products in use that will provide real world feedback.

Supported Processes	Measurement Factors	Metrics
1.13 Problem Status & Notification (end user notification)	The percentage of time that end user groups affected by a problem are directly notified of a system restoration within the required timeframe	80 % of affected user groups notified within ½ hour of restoration 100% callback
1.8 System Restoration 1.0 Problem Management	Mean Time to Resolve/Repair *Severity Level 1* *Severity Level 2* *Severity Level 3* *Severity Level 4* System Availability Mission Critical Systems: Non-Mission Critical:	 1 hour 1-3 hours 1 day (8 hours) 2-3 days >99.9% (Less than 4 hours of unplanned outages a year) >99.8% (Less than 16 hours of unplanned outages a year)
1.1 Problem Logging 1.9 Problem Resolution 1.13 Problem Status & Notification 1.11Problem Tracking & Analysis	End User Satisfaction	Quarterly Survey Results
1.3 Problem Isolation	Problem Severity Categorization	*Severity1 - 10% *Severity2 - 20% *Severity3 - 50% *Severity4 - 20%
1.2 Problem Logging	Client Support Answer Time	20 sec. Avg, 90% of the time

Context independent process models

Process models can be enterprise wide or limited to a specific business area with very granular activity definitions. For example, one could model the very specific steps for resolving problems in the customer service and maintenance operations of a cable TV company, such as in the following example. This type of process model is context independent in that it focuses strictly on the internal efficiencies of the processes regardless of the business context of their implementation.

The process model that appears on the next page does not, in any way, provide any indication of the business value of the processes. It simply provides an efficient step-by-step model for implementing problem management.

Business context independent models, such as the one above, are useful in the design of business activities. However, in designing an enterprise, the process model must address both the efficiency, time-to-market, and quality issues of context independent models, and the question of value that a value chain based model addresses.

Value Chain Context Sensitive Process Models

The scope of a value chain process model extends beyond the enterprise to include the customer, any customer intermediaries, and suppliers. The economic unit examined for any value chain is the complete market place and supply chain for a like set of products or services. A heterogeneous enterprise that participates in multiple markets will be part of multiple value chains. An enterprise with a single product or service will typically have one value chain (this does not mean there would be only one delivery or supply channel).

The objective of the value chain model is to align an enterprise process structure and supporting assets to profitably deliver products or services of value, and maintain relevance and viability to the market place. To do so, the enterprise value chain model must be developed in the context of the market places they serve, and address long and short-term competitive positioning. Michael Porter, in his book, *Competitive Advantage*, outlines five forces on an enterprise's value chain:

1. Barriers to entering the market;
2. Internal level of competition within the industry;
3. Relative bargaining power of buyers;
4. Relative bargaining power of suppliers;
5. Potential for substitute products or services.

The collective strength of these five forces determines the ability of the enterprise to earn a profit. It should be argued, however, that the internal level of competition within an industry is really a function, in the long run, of the other four factors. The more these factors favor the enterprise, the higher the profit potential. The more they favor the customer, the lower the potential profit margin to the enterprise. Any value chain analysis would start with an understanding of these factors as they drive the range of possibilities. They determine to what extent an enterprise can leverage non-price based differentiators such as quality, speed to market, and extended services. The main point here is that the value chain process is primarily driven by factors external to the enterprise, and by basing an enterprise process model on these external value chain factors, the resultant model will effectively align the enterprise to the primary determinant of its viability, the market.
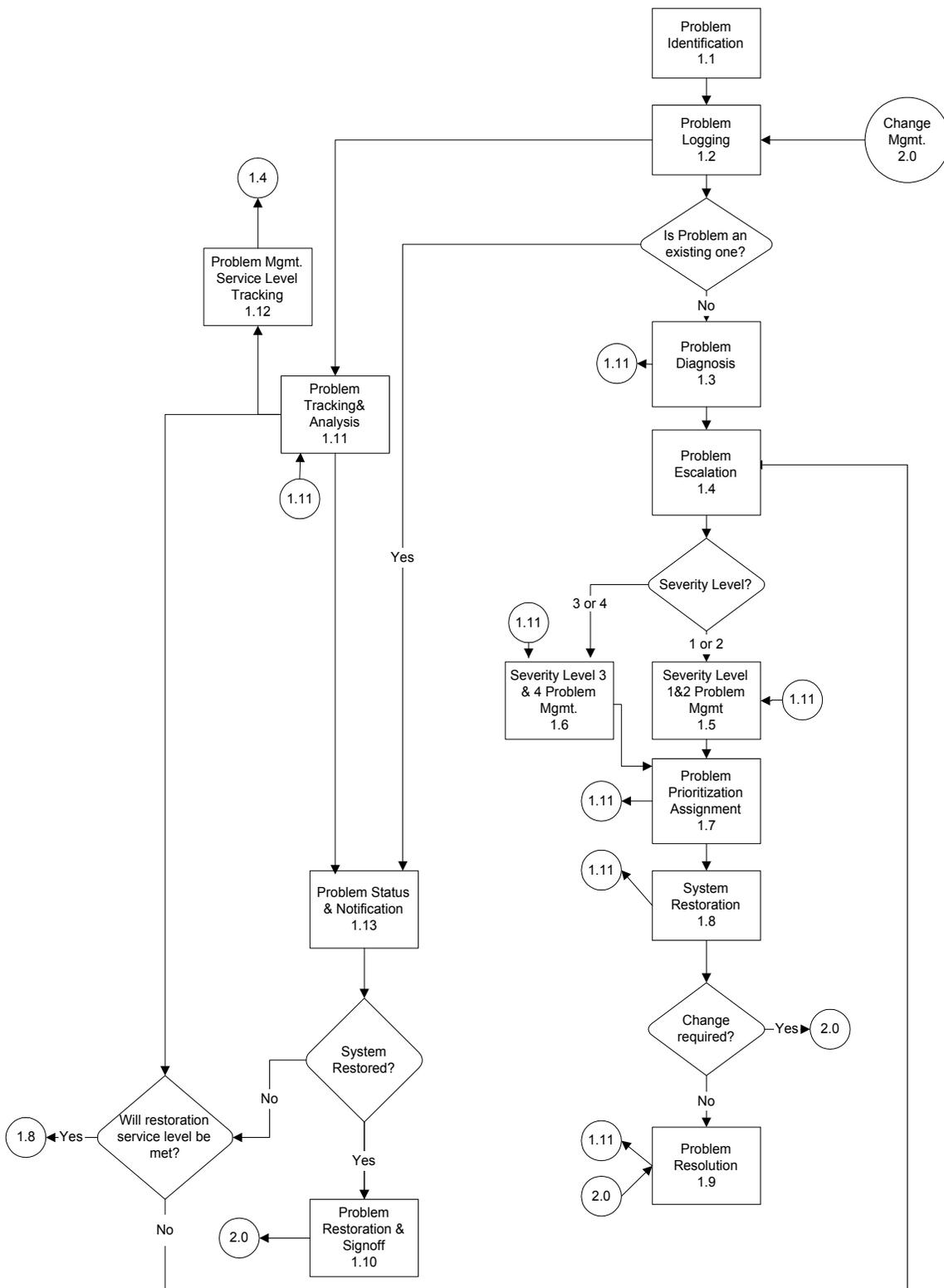
We will discuss value chains further on in the white paper. W e introduced value chains here in order to facilitate the discussion of the Adaptive Enterprise Framework that

follows. For those who would like a comprehensive discussion on value chain analysis, we recommend Mr. Porter's book.

Adaptive Enterprise Framework

It is not an individual act, architecture. You have to consider your client. Only out of that can you produce great architecture. You can't work in the abstract.
I M Pei

The purpose of the Adaptive Enterprise Framework (AEF) is to provide a context for integrating the concepts and ideas presented in this white paper into an implementable framework, and to show how combined, and effectively integrated, value chain analysis, MDA, BPM, Service-Component based architectures, and business analytics create a platform for realizing an agile and business aligned enterprise.

AEF Principles

Unlike other more generic frameworks, AEF assumes an immediate commitment to several key architectural principles:

1.   **Customer Value Driven:** Using value chain analysis to effectively align the enterprise to customer and market place needs and realities;
2.   **Integrated Business Model:** Using BPM to define an integrated business model that includes business processes, application services, and information. This properly positions the definition of application and information logic into the business architecture where it belongs;
3.   **Model Driven Architecture:** Commitment to migrating business logic from legacy bound fragile programming languages to platform independent business modeling languages;
4.   **Performance Based Enterprise Management:** Making performance management an integral part of the enterprise model and using business analytics to provide predictive indicators of future performance or changes to market requirements;
5.   **Service-Component Based Architecture:** Commitment to provisioning business logic as reusable components that can be instantiated to support varying non-functional requirements, i.e., scaleability, security, QoS, reliability, and availability;
6.   **Traceable Service Based Technology Architecture:** Defines technology components as services with traceability to the business process areas supported;
7.   **The Infrastructure is the Architecture:** While it is helpful in most large enterprises to have a documented enterprise architecture, it is far more important to have a working one. Without a doubt, there are many well-documented and elegant architectures that never have been implemented, making them useless.   There are also elegant and effective architectures with no central supporting documentation.

All of the above principles are essential to building an agile and business aligned enterprise, and are integral to the AEF.   Using the wide array of analytical tools that

these various analytical techniques make available in a framework such as AEF will achieve the outcomes implied by these architectural principles.

AEF Strategy through Operate

Model driven architecture creates an opportunity for architecture to become a function embedded across the overall management and analytical value chain of the enterprise. Most architecture frameworks today position enterprise architecture as a function that should be undertaken periodically, typically every two to three years. In effect, architecture becomes a "clean the attic" type of activity. This approach usually leads to disconnects between the on-paper architecture and what is actually occurring in the enterprise. Enterprise architecture needs to be integrated across all activities associated with the long-term viability of the enterprise, from strategy, through design, implementation, and operation. It does no good to commit to a service-component based architecture unless your implementation and operation processes for provisioning applications is consistent with a service-component based approach. If the enterprise continues to fund and field business logic as large monolithic applications tied to functions, that is what the enterprise will wind up with, regardless of any fine words to the contrary.

The BPM School postulates that business people will play a more central role in the development and evolution of information technology by being able to model their enterprises in a BPM modeling tool and directly instantiate robust business logic from the models. In effect, coding becomes less of a component of, and impediment to, the application development value chain, and end users are empowered to manage and evolve their business processes and supporting information system assets. This would be the ultimate in integrating the enterprise architecture into the enterprise. As much as we are supporters of BPMN, and are aware of the sophisticated BPM based tools that can, in fact, interpret BPMN models and run them, we believe the technology has to prove itself before being adopted as a core implementation platform for the enterprise. However, we do believe that the value proposition of BPMN, its sound basis in proven modeling languages, open standards, and the demonstrated ability of some of the early BPM platform providers, position BPMN as the tool of choice for modeling the business architecture of an enterprise.

Service-Component Based Architecture

A key evolutionary step in moving from monolithic legacy systems to agile information systems is evolution into service-component architecture. While there has been a lot of good work around web services technologies that has reinvigorated interest in service-component based architecture, the fact is that the industry success in its long pursuit of service-component based architecture has never been because of technology limitations. The problem has always been the perceived lack of an economic justification at the enterprise level that would change the SDLC paradigm to accommodate service-component based architectures. In fact, where there has been an economic model supporting componentization it has been very successful, both at the business logic and

the infrastructure component levels. One could argue that the market in middleware, that "componentized" logic that was once encapsulated in the business application, has been a great success.   Due to the obvious payback, industries such as the Financial Industry and Video Gaming Industry have been hugely successful at implementing componentized architectures that are service based. However, the majority of enterprises have not been able to break the shackles of functionally driven monolithic applications and SDLCs.

A big problem has been the emphasis on reuse as justification. This comes into direct collision with the funding structure of applications, which is typically business function based. As a "buyer" and "owner" of an application the functional department through which the application was funded wants it to be brand spanking new and doesn't want anyone else using it. This is unfortunate since the concepts behind service-component based architectures are fairly simple, but sound fundamentals that provide benefits outside of reuse. This includes the ability to better adapt to process changes and more efficiently manage the cleaner, better organized code that is the inevitable result of service-component based architectures. This is not to downplay the configuration management complexities that could result from too much zealotry and not enough proper component management. The fact is that the fundamentals of service-component architectures are sound software principles that pay for themselves:

Service Orientation: A well-defined and tightly coupled set of transformations provided by a software component through loosely coupled interfaces with well-defined protocols.

Component: A logical grouping of tightly coupled business logic that can be instantiated to provide services to application choreography. Essentially a component encompasses all the tenets of OO, only at a higher level of granularity.

Protocol: Logical interface definition

Choreography: A layer of software that choreographs a set of service components to solve an instance of a business service.

Contract: An agreement between a service component and the user defining the services, interfaces, and prerequisitesto be provided.

 Service-Component Framework: Agreed upon technology protocols for communicating via protocols, e.g., Web Services/SOAP

Aspects: Non-functional requirements that could be part of a contract, e.g., security, QoS, reliability, availability, scaleability

In the AEF definition of service-component architecture, services are provided by components that expose their abilities through logical protocols. A choreography engine integrates those components to solve a particular business problem. A contract guarantees service delivery and a framework provides the technical underpinnings enabling the choreography of the components. Multiple aspects provide a convenient

mechanism for separating functional requirements, which are integral to the component, from instance-specific non-functional requirements.

Model Driven Architecture (MDA)

Liberal democracy may constitute the "end point of mankind's ideological evolution" and the "final form of human government," and as such constitute the "end of history." Francis Fukuyama

"I examine the evolution of information technology in business and show that it follows a pattern strikingly similar to earlier technologies like railroads and electric power. For a brief period, as they are being built into the infrastructure of commerce, these 'infrastructural technologies,' as I call them, open opportunities for forward-looking companies to gain sustainable competitive advantages. But as their availability increases and their cost decreases--as they become ubiquitous--they become commodity inputs. From a strategic standpoint, they become invisible; they no longer matter. ... In brief, executives need to shift their attention from IT opportunities to IT risks--from offense to defense."   Nicholas Carr May 2003 HBR Article

If it wasn't for the concepts embedded in Model Driven Architecture, technical history may have taken at least a break and become irrelevant as Nicholas Carr argued in his thought provoking article in the Harvard Business Review. To some extent, echoing Mr. Carr, Andy Grove from Intel has postulated that we have solved the transaction processing problem, and can, with the augmentation of data warehousing, make needed business information available on demand. Mr. Grove states that if that is all there is, then technology is a mature industry. We agree with Mr. Grove that the transaction problem has been solved within the current expectations of business, and that data technology provides sophisticated business analysis capabilities. However, the expectations of the business community will change as early adopters of a value chain based business process management framework gain competitive advantage and demonstrate true enterprise agility. Just as the internet changed the expectations of all for ubiquitous access to information, the coalescence of BPM, VCA, Service-Component Architecture, and business analytics into a model driven architecture framework will change end user expectations for agile enterprise systems over the current carved-in-stone infrastructure.

The conceptual underpinning for the adaptive enterprise framework is the Object Management Group (OMG) initiative called Model Driven Architecture (MDA). The fundamental premise behind MDA is that business systems can be unambiguously defined in a model based language that is independent of technology. They call this layer in their model the Platform Independent Model (PIM). The PIM models, which now are technology neutral, can then be instantiated in whatever technology best fits that particular implementation.   As technology changes, business logic can easily be migrated through the PIM, avoiding vendor and technology lock in. Business logic and technology are decoupled and free to evolve according to their own definition of logic. Technology specific implementations of the business logic are defined in Platform Specific Models

(PSMs). An MDA framework would consist of a PIM and potentially multiple PSMs. Business logic defined in the PIM could be translated to a .Net and J2EE PSM to accommodate two different technology environments and possibly different non-functional requirements.

MDA assumes that no one modeling language can support the needs of all modeling domains. It allows for multiple modeling languages to be defined within the MDA framework. To support this desired flexibility, MDA provides a meta modeling language it has labeled the Meta Object Facility (MOF). Platform independent modeling languages defined with MOF can be translated to platform specific PSMs based on their MOF descriptions. MOF provides the formal mechanism for unambiguously defining a modeling language so that MDA Generators can translate models into very precise code based on introspection of the modeling language MOF. The figure below is a high-level depiction of the MDA framework:

Conceptual View of MDA
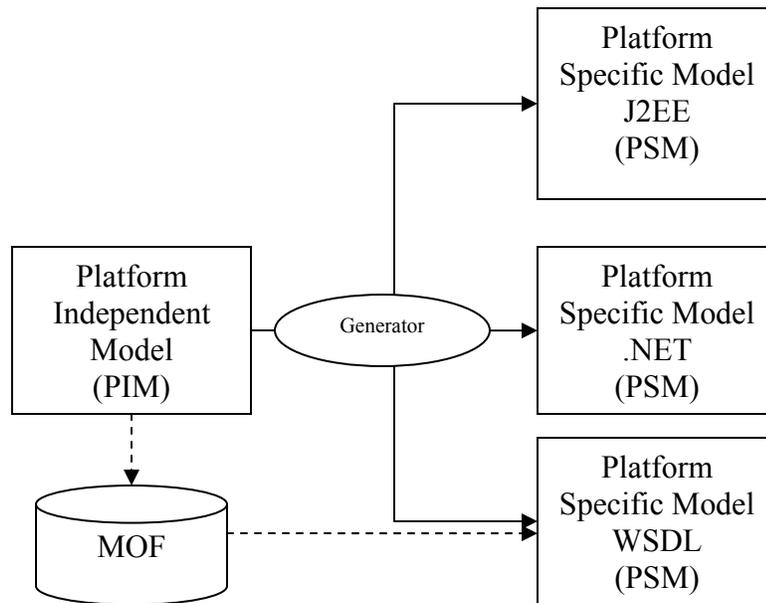
The above is a high level overview of MDA. An excellent book for readers wishing to learn more about MDA is *Model Driven Architecture* by David S. Frankel (Published by Wiley Publishing, 2003).

MDA and BPM

Most MDA modeling languages are UML or software design centric and can too easily push you back into a standard SDLC. Some would even argue that MDA languages based on UML are not platform independent since they land you into an object-oriented

paradigm tied to a set of platforms. While at this time BPM is not being coordinated with MDA, the Business Process Modeling Notation (BPMN) comes closest to the ideal of a platform independent model from a notational standpoint. It is completely business process centric and designed for the business user, not around a design-development paradigm. BPMN falls short of the MDA paradigm with its tight coupling to XML. The proponents of BPMN believe that, in MDA parlance, the only PSM needed is the XML based Business Process Modeling Language (BPML). However, there is no requirement that you buy into the complete vision of BPML in order to use it. You can use BPMN as a business centric modeling language and choose multiple strategies for translating the BPMN based business logic into provisioning a Platform Specific Model, as we will demonstrate when we discuss the GSA Portman Proof of Concept.

Business Analytics

The final piece of the AEF is performance management through business analytics. Conceptually, this is the simplest component of the AEF, but has proven to be the most difficult to implement. The basic premise is that metrics that predict future enterprise, process and infrastructure performance should be integral to the management of the enterprise. Forward-looking value chain metrics that extend outside the enterprise are needed to ensure continued enterprise alignment with the industry value chain. Operational metrics [advocates?] that define business process performance are needed to maintain internal efficiencies, and infrastructure metrics are required to ensure infrastructure service levels are being met. The basic business analytic framework for AEF is as follows:

Source	Measure	Results - Scope
Across the industry value chain	Enterprise Value Chain Fit Competitive Dynamics	Business alignment and continued viability
Internal BPM statistics	Operations Efficiencies	Local Process efficiencies
Service Agreements Finance	Infrastructure Effectiveness ROI/Profit/Cash Flow Measures	Asset efficiencies Lagging performance indicators

The primary measures for the AEF are ones that ensure alignment to the industry value chain and identify opportunities as well as risks; as recovering from misalignments with the value chain are the most difficult and fatal. Obviously, financial measures are key performance indicators; however, they do not provide much in the way of forward looking intelligence on future performance, and over reliance on them could lead to the starvation of necessary long-term investment for the sake of short-term gain. Operational and asset efficiency measures are important, but should only be used locally and not extrapolated or aggregated at the enterprise level. Over use of localized metrics to measure enterprise level performance can lead to disastrous results, as optimization of local processes or infrastructure could result in the overall sub optimization of the enterprise and promote behavior detrimental to the organization. For an excellent illustration of this, interested readers should read *The Goal*, by Eliyahu M. Goldratt (North River Press, 1984).

Trying to overly complicate measures into integrated hierarchies usually creates false relationships. The most successful measurements have always been the simplest with the least amount of transformations. A case in point is the broadcast industry where revenue in the form of advertising dollars and, more recently, cable fees, are directly correlated to the number of people in a desired demographic who are watching.

Unfortunately, despite the development of sophisticated measure systems, such as balance score card and Six Sigma, most commercial organizations rely on short-term finance related indicators. Typically, miscalculations and misalignment with their industry value chains are not discovered until it is too late or when painful remedies are required. Even further at a disadvantage are government based organizations that have a long way to go before they can effectively measure their contribution to the value chains they support. This, of course, is being addressed as part of "The President's Management Agenda." But it is a difficult change to make. In some sense, performance metrics exist in a Maslow-like hierarchy, with the lowest layer in the hierarchy corresponding to survival, and the highest level corresponding to an enterprise self awareness of the volatility of the market places it exists in. The reality of today's fast changing world is that long-term survival can only be obtained by enterprises in the top tier of the hierarchy. As we have learned in recent years, size is no longer a guarantee of continued viability and relevance. Below is a depiction of the Maslow-like hierarchy of performance metrics:

Enterprise Metric Hierarchy
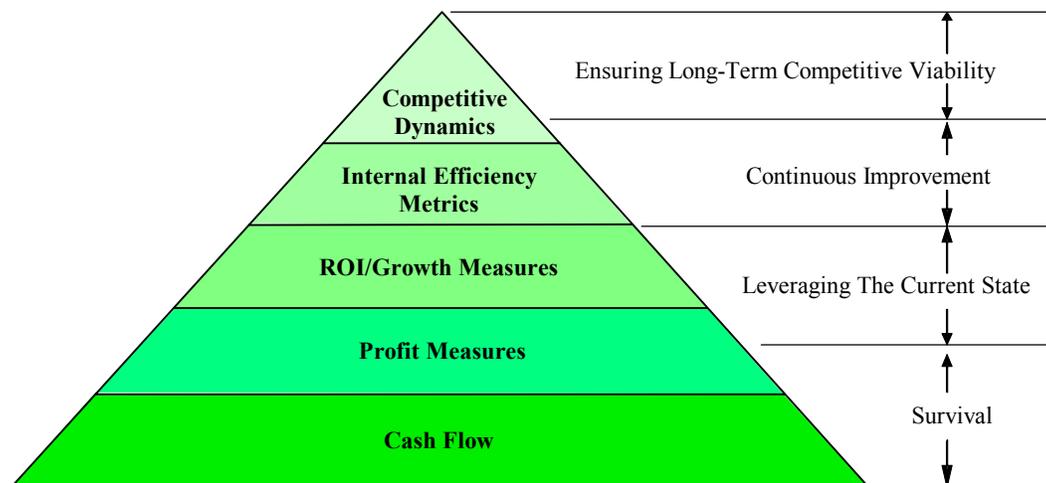
As a process, model value chains are more about performance and competitive dynamics than they are about process definitions. While it is critical to identify the value added processes of the enterprise and properly integrate them into the overall industry value chain, it is just as important to understand what the characteristics of the processes are that result in competitive advantages and what their measures are. Essentially, the key is to determine the right mix of faster, better, and cheaper characteristics that provide a compelling case to the customer, and ensures that all the value chain components are

targeting that particular mix of characteristics. Of course, achieving this competitive mix must be done in the confines of providing an acceptable ROI, in the case of private enterprise, and within the confines of the budget, in the case of Government. The AEF identifies three key components to a value chain model:

Value Producing Process Model	Characteristics	Measures
Identifies activities of value to the market place that the enterprise is positioned to provide at an acceptable rate of return to its stakeholders, or, in the case of Government, at an acceptable cost to the taxpayer.	Identifies the characteristics of the value chain process that *differentiate* the enterprise from competitors.	Identifies achievable and quantifiable measures and targets that can be used to measure current performance and project trends that may dictate adjustments to the enterprise value chain.
Aligns the enterprise value chain to the industry value chain supporting the enterprise's targeted customer base.	Addresses industry-wide market forces that affect the long-term viability of the value chain: - Easy market entry - Available substitutes and potential obsolescence - Relative bargaining power of buyers and suppliers. - Ability of customer base to pay.	Identifies competing trends that affect the viability of the enterprise value chain.
Provides core set of mission critical processes to organize supporting business processes around. Identify opportunities for disintermediation and competitive outsourcing.	Identifies "soft" characteristics that affect competitive advantages, such as brand image projection.	Provides earned value measrues indicating relative performance within the industry.

The value chain process model identifies the mission critical processes that bring value to the enterprise's customers, and aligns them to the overall industry value chain. The value chain process characteristics identify the aspects of the enterprise value chain process that provide competitive advantages and counteract industry structural issues, such as ease of substitution. The value chain measures provide the performance feedback required to effectively manage the value chain.

The activities critical to developing a value chain include

1. Understanding the customers value chain and desired relationship and service/product offerings related to what the enterprise can provide;
2. Understanding the industry structure, its opportunities and threats and competitive nature;
3. Developing an industry wide value chain map based on an understanding of the customer needs and industry competitive dynamics;

4. Identifying the enterprise's value proposition(s) to its customers. Fundamentally, a statement of what is the essential value and role the enterprise can profitably play over the long-term;

There have been many cases where firms have innovated a successful product or service that catapulted them into industry leaders or market makers. Firms that continued to define themselves in terms of the offered product or service have at best struggled as their innovations gained imitators. They never positioned themselves successfully as a key value provider over the long run. An example of a firm that has understood this fatal trap, and has firmly positioned itself in its industry value chain is Microsoft. Although many consumers define Microsoft in terms of the Window product, it is very clear by their actions that Mr. Gates and Mr. Balmer see the world differently.

5. The expression of those value propositions in the form of a process model that identifies the activities that are critical to delivering of that value proposition;
6. Understanding of the relative strength and weakness of the enterprises value chain and its ability to deliver on the value proposition within the cost constraints and enterprise's limitations;
7. Identification of the characteristics and performance targets and measures required to instrument the competitive dynamics of the value chain.

The value chain model becomes the core model for organizing supporting business processes around. All processes within the enterprise should be subordinate and align to the value chain model. This alignment will help ensure that the enterprise is focused on providing value to the customer..

A good value chain model will provide opportunities for disintermediation and competitive outsourcing. Disintermediation provides an opportunity for the enterprise to adopt its services or products to meet a wide-variety of customer needs and

circumstances. If we are to use the straw man value chain model developed to support a value chain analysis effort at GSA we can demonstrate this:

Straw man GSA Value Chain Process Segment

| Make Markets | Manage Acquisitions | Manage Projects |

The GSA value chain could be disinter-mediated to provide only make market services to customer Agencies that require only that service, and want to perform the manage acquisition and manage project value chain activities themselves, expanding the opportunities for GSA to service its customers.

On the other side of the equation, activities that are not integral to the value chain could be candidates for competitive outsourcing.
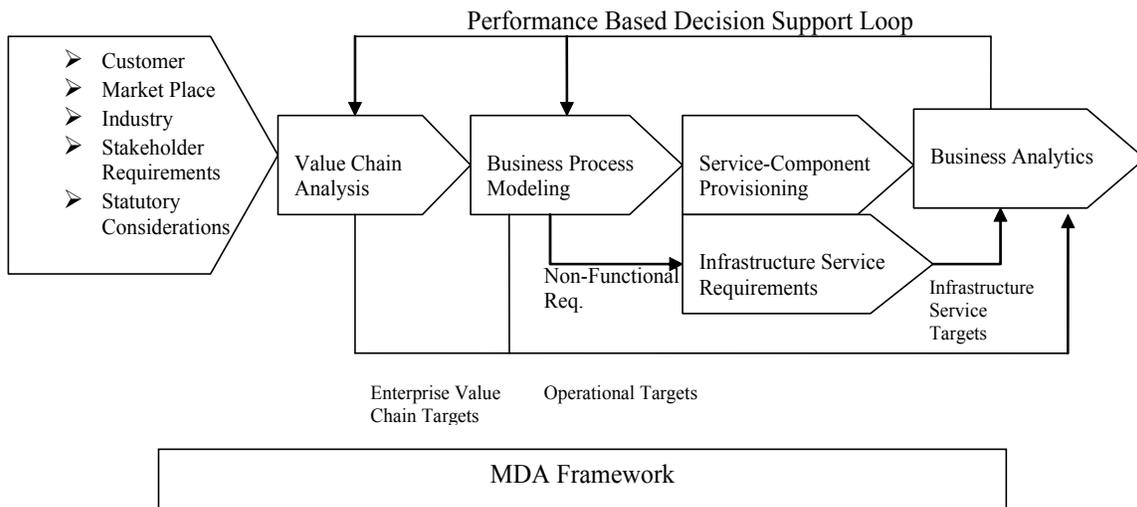
A potential value proposition and characteristic of the GSA value chain could be aggregate buying power, which could be measured based on relevant price comparisons. The identified characteristics and measures would become integral to the management of the make markets. For example, if this was (hypothetically) indeed an identified characteristic of make markets, then it would be appropriate to ask every time a new product was being considered for inclusion in the GSA make markets activities whether or not GSA could provide a more competitive price based on buying power.

Adaptive Enterprise Framework Model

The AEF is focused on the aspects of enterprise architecture that promote business alignment and enterprise agility. It is not meant to be a comprehensive, all-encompassing framework that addresses every perceivable enterprise architecture view. For example, it does not address security or infrastructure service components. However, as far as the authors are aware, it can fit into other frameworks, such as the Federal Enterprise Architecture Framework, and make them more actionable as business tools.

The AEF is an integration of value chain analysis, Business Process Management, Service-Component Based Architecture, and Business Analytics in the context of MDA. Within the AEF enterprise, architecture becomes a function of the analytic processes that guide the enterprise. It is integral to strategy, design, implementation, and operations of a business enterprise. It does not start and stop as a periodic process for "cleaning house," but is an everyday part of enterprise activities. It achieves this status by providing an enterprise modeling environment that can be integrated into ongoing business operations and can become an integral tool for managing the enterprise. In the GSA Portman Proof of Concept, which will be discussed later in the paper, we demonstrate an instance of using AEF to define a portion of an enterprise, and demonstrate how it can become part of the management infrastructure. Below is a model of the AEF:

Adaptive Enterprise Framework

Performance Based Decision Support Loop

Customer
Market Place
Industry
Stakeholder
Requirements
Statutory
Considerations

Value Chain
Analysis

Business Process
Modeling

Service-Component
Provisioning

Business Analytics

Non-Functional
Req.

Infrastructure Service
Requirements

Infrastructure
Service
Targets

Enterprise Value
Chain Targets

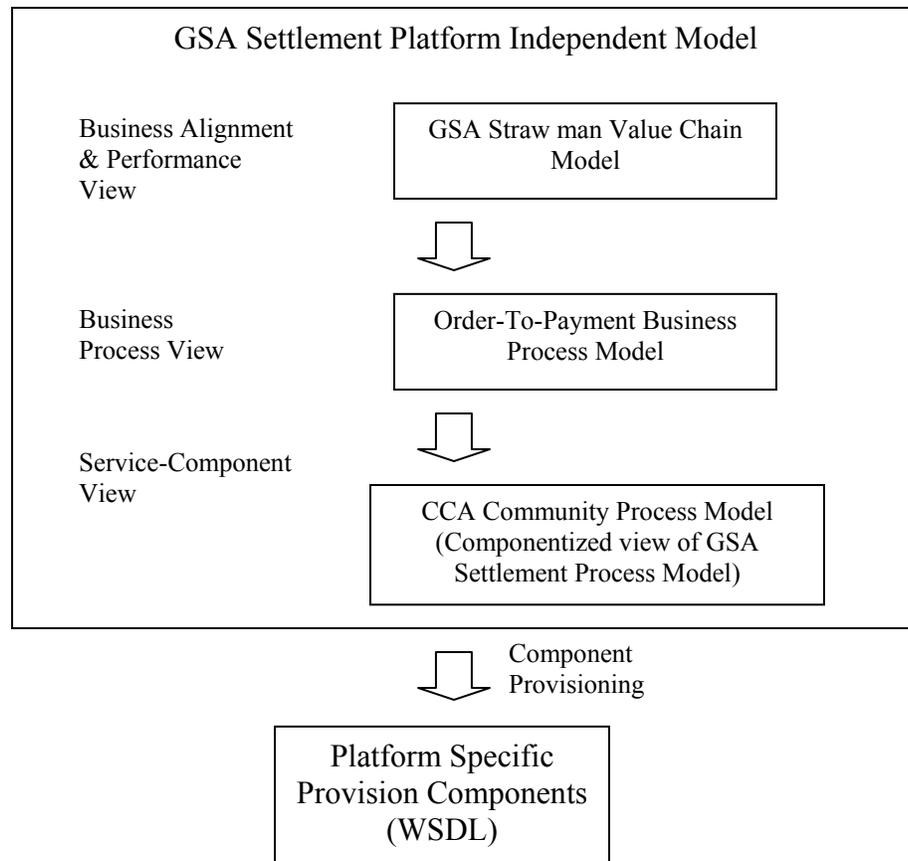Operational Targets

MDA Framework

Portman Proof of Concept

The Portman Proof of Concept grew out of a realization that the current state of Federal Agency Enterprise Architectures could be improved by incorporating both value chain analysis techniques and MDA concepts into the EA process. GSA had completed Phase I of its value chain based enterprise architecture using the order-to-payment (O2P) value chain segment. This proved very successful and identified cross-Agency process and system improvements that, if implemented, will substantially improve GSA's ability to manage the order and payment processes of their customers.

The success of the value chain work led to questions as to how to best move the value chain models from paper to reality. Investigating the state-of-the-art, the core value chain team identified MDA, BPM, and work being done in the area of Service Oriented Architectures as promising pieces to an end-to-end process that could break the hold of traditional SDLCs that have clogged the whole process of turning business needs into working applications.

The team set up a Proof of Concept effort that used, as its basis, the value chain business modeling work done at GSA, which, fortuitously, closely mimics the Business Process Modeling Notation of BPMI. The idea of the Proof of Concept is to take a portion of the GSA O2P model and further decompose and transform it into a community of components that can be provisioned into a well structured and agile service based component architecture. Digital Access Technology's Component X product was used for the Prototype.

Putting the model into the context of an MDA layered model results in the following:

```
┌─────────────────────────────────────────────────────────────────┐
│              GSA Settlement Platform Independent Model             │
│                                                                   │
│  Business Alignment        ┌──────────────────────────┐          │
│  & Performance             │   GSA Straw man Value Chain │          │
│  View                      │          Model             │          │
│                            └──────────────────────────┘          │
│                                        ⇓                          │
│  Business                  ┌──────────────────────────┐          │
│  Process View              │  Order-To-Payment Business │          │
│                            │       Process Model        │          │
│                            └──────────────────────────┘          │
│                                        ⇓                          │
│  Service-Component         ┌──────────────────────────┐          │
│  View                      │   CCA Community Process Model │       │
│                            │  (Componentized view of GSA │        │
│                            │    Settlement Process Model) │        │
│                            └──────────────────────────┘          │
└─────────────────────────────────────────────────────────────────┘
                              ⇓        Component
                                       Provisioning
                      ┌──────────────────────────┐
                      │     Platform Specific      │
                      │   Provision Components     │
                      │          (WSDL)            │
                      └──────────────────────────┘
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The final step in the process would be the provisioning of the components into a platform specific implementation environment. Consistent with Service Oriented Architecture (SOA), choreography of the component would be implemented using a business process layer such as BPML or BPEL4WS.

Visio base process models and the Component X MDA tool were selected for use mainly for convenience. An organization looking to implement a MDA-BPM based modeling environment should start by selecting one of the many BPM modeling tools on the market, and augmenting it with a more software development oriented MDA tool of their choosing.

AEF Capability Maturity Model

Once more unto the breach, dear friends, once more,
Or close the wall up with our English dead!
In peace there's nothing so becomes a man
As modest stillness and humility;
But when the blast of war blows in our ears,
Then imitate the action of the tiger:
Stiffen the sinews, summon up the blood.
King Henry V, William Shakespeare

A fundamental truth is that organizational dynamics and culture will always trump architecture. Without a shared sense of purpose and mission, effective governance structure, and executive leadership and commitment, enterprise architecture will only have a minimal impact. Good enterprise architecture is a tool for executive management to improve enterprise efficiency and agility, and to align IT to the business. At the end of the day, it needs to be able to provide management with the ability to make informed decisions about the direction of the enterprise and the expenditure of both management focus and capital assets. I t must at the same time "push-the-envelope" and be grounded in reality.

The state of an enterprises business and technology architecture is always a direct reflection of the corporate culture, governance, and funding structure. A fragmented corporate culture with weak governance will inevitably result in fragmented business processes and IT systems. Adding to the mix, multiple, independent sources of funding, that are not rationalized at the enterprise level, further exasperate the problem. It is no accident that large bureaucratic or conglomerated enterprises in both government and private industry have the most difficulty implementing rationale enterprise architectures, while enterprises such as Dell and Wal-Mart, who focus on a single industry, have the most success. Such wide-breadth and complexity create the largest challenge to inculcating a clear and compelling mission and supporting culture.

One of the problems facing management today is that there is a tremendous amount of pressure on all organizations to reflect the customer service, price efficiencies, product quality, and buying experience of a Dell. Consumers, fresh from purchasing a computer or book over the Internet, expect the same level of service from the Department of Motor Vehicles. The sheer number of alternatives made available to the consumer through globalization, and the ability to easily research options over the Internet, are creating very high expectations for all businesses. Unfortunately, enterprises with the longest way to go to catch up to today's market demands tend to either become paralyzed, or caught up in some unrealistic modernization plan that promises to take them from the proverbial Stone Age to the Space Age overnight.

One of the primary competitive advantages available to any enterprise today is the ability to effectively leverage technology to improve the economic value of their value chain. In a perfect world, where every enterprise is capable of doing an equally good job of leveraging information system technology, the competitive advantage offered by technology may be severely curtailed. As Mr. Carr postulates in the previous sighted Harvard Business Review article. The fact is that there is a wide disparity across enterprises, and those enterprises that can evolve their ability to leverage technologies to improve business processes will be the winners.

Organizations will not be able to catapult overnight into clones of Dell; there is an evolutionary process that must take place. Moving from an organization that implements point solutions in response to problems, to one that is capable of implementing agile business processes, takes a series of steps. Those steps will closely align to the AEF

maturity model which can be used as a guideline to develop a realistic and well-grounded enterprise transition plan. The AEF Capability Maturity Model has five major plateaus:

Level 1 Point Solution Based: The process and information system support infrastructure represent a patch quilt of point solutions to temporal business problems. There is no unifying architecture or end-to-end process design.

Level II Federated Solution Based: Departmentally based processes and individually procured systems are stitched together through ad hoc agreements. This is an improvement over Level I in that the IT department has developed an integration strategy that can accommodate end user needs given some tradeoffs

Level III Central Solution Based: Process and system integration forced on enterprise based on ERP best practice model.

Level IV Service-Component Based Architecture: Highly adaptive and agile process and IT infrastructure. However, to-date, [what] has required commitment to a high percentage of custom software and the associated skills and investment, as most packages software cannot be emended to suit a component architecture.

Level IV Business Process Based: New wave in business process implementation where the business process model can be provisioned into running applications, virtually eliminating major bottlenecks in SDLCs.

Realistic enterprise transition plans need to take into account the across-the-board challenge of maturing an organization.   The AEF CMM acts as a guide post for evolving an enterprise through stages of maturity. Most large bureaucracies are at a Level I and II in the CMM. One of the major challenges for the e Gov initiatives of the federal government will be the implementation of a Level IV like e Gov environment on Level I and II processes and information system infrastructures. Many, if not most, large commercial concerns are at a Level III, having implemented SAP, PeopleSoft, Oracle, etc.   However, while this has moved their organizations out of the quagmire of Level I and Level II, the ERP system tends to be difficult to change and functionally oriented. ["the ERP system," above, is singular, so the "they" following become "it" unless it should have been "the ERP systems" above.] It does not easily adapt to the changing business needs so typical of today's environment. Organizations that are at Level IV typically are there because of the overwhelmingly compelling business case for their being there. Namely, they would not survive in their respective industries without being at Level IV. Most enterprises in the financial services or telecommunication industries can be classified as Level IV. Some leading edge organizations are experimenting with Level V, which the authors of this white paper believe to be the direction of the industry.

AEF Enterprise Maturity Model

Point Solution Based Level 1	Federated Solution Based Level II	Central Solution Based Level III	Service-Component Based Level IV	Business Process Based Level V
Weak organizational governance structure Poor cooperation among enterprise entities – politically driven solutions	United Nations style governance structure Organizational entities have reached a level of accommodation	Effective governance structure Predictable core shared service performance with cross organizational cooperation	Shared enterprise goals driving governance High level of cross organizational cooperation	Shared enterprise goals driving governance High level of cross organizational cooperation
Process and IT redundancies and disconnects	Process and IT redundancies and disconnects are arbitrary	Major reductions in process/IT redundancies and disconnects	Integrated end-to-end adaptive processes – but heavy reliance on IT	Integrated end-to-end adaptive processes – end user controlled
Unreliable and redundant data	Data reconciliation is a primary focus of IT	Reliable operational data with limited business analytics	On demand information with business analytics	On demand information with business analytics
Ineffective performance indicators	Performance indicators tend to be ROI driven	Performance indicators tent to include operational efficiencies along with ROI focus	Instrumentation of competitive dynamics	Instrumentation of competitive dynamics
Crisis management is a staff core competency	Diplomacy is a staff core competency	Process management is a staff core competency	Requires best of class IT staff and cross organizational IT literacy	Less of a role for IT – removal of the SDLC as a change impediment
Erratic service quality – Focus on functional organization objectives vs. customer needs	Standard services tend to be reliable. Disruptions or out-of-the-ordinary	Predictable service quality – sub-optimization of competitive differentiators –	Adaptive and agile customer driven processes	Adaptive and agile customer driven processes – ability to model and simulate

	demand difficult to accommodate	Process change and customer focus is difficult to obtain		change

Building and Maintaining the Agile Enterprise

In his classic *Capitalism, Socialism, and Democracy* the economist Schumpeter argued:

"*Capitalism, then, is by nature a form or method of economic change and not only never is but never can be stationary...The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates.* "

Schumpeter also argued, as a corollary, that capitalism plays the unenviable, but vital task of eliminating obsolete industries and unproductive businesses. Schumpeter called this, "creative destruction." Schumpeter's concept of creative destruction has since become a tenet of capitalism. The argument is that the price of enjoying the benefits that the dynamic capitalist system provides is the dislocation and individual economic loss to those that fail to anticipate and react to the inevitable market changes that are inherent to the capitalist system. The bottom line is that there will be winners and losers in a capitalist system, and the complacent risk becoming road kill.

But is all this destruction necessary? Certainly, at the macro level all attempts to counteract the destruction through various forms of command economies have been dismal failures, both economically and socially. Schumpeter argued that at some point in history the creative processes would become mechanized components of large enterprises, eliminating the role of entrepreneur. While in many industries, and in countries, like Japan, this has become the case, the encapsulation of the creative process has not eliminated the destructive side of the equation. It seems that large enterprises are just as prone as entrepreneurs to make mistakes and suffer the consequences. The impact has been severe. Japan's economy is in a decade long doldrums as the Japanese try to maintain their social pact of guaranteed employment and commitment to highly interdependent long-term stable business relationships as the dominant industry structure. U.S. corporations, even ones who were renowned for their loyalty to their employees, such as Xerox and IBM, have long given up on similar social pacts with their employees. So it can be argued that not only have attempts to stem the destructive forces of capitalism at the Macro level failed, but also at the sub-macro level where major industry players with virtual monopolies have not been able to avoid the forces of creative destruction.

So how does an enterprise avoid becoming road kill or, even better, thrive in the churn that is capitalism? The argument made in this white paper is that there is a coalescing of enterprise architecture techniques that, properly integrated, can provide management with

the information they need to properly guide the enterprise, and can provide IT providers with the capabilities to quickly adapt information system resources to support the quick pace of business change that is today's environment. This is not to say that adopting the AEF will repeal the business cycle's affect on an enterprise. Management will still make mistakes. While some industries are extremely sophisticated in their knowledge of their customer base and what it values, corporate hubris can negate that sophistication. The television broadcasting industry has an incredible level of insight into their customer base, as it's whole revenue stream is tightly coupled to customer-based measures (advertisement revenues are based on the number and demographic of people watching); however, all three major networks missed the impact of cable television and other forms of alternative media. They left the door open for visionaries, such as John Hendricks, an educator who founded The Discovery Channel.

Enterprise architecture cannot eliminate misjudgments and miscalculations by management, but it can be a valuable tool for management to better anticipate and react to changes in the market place. Additionally, implementation of model based approach to information systems design and deployment, along with the true implementation of a service-component based architecture, can result in agile information systems that are adaptable to change. One of the biggest impediments to IT as a source for competitive advantage is the brittleness of today's IT systems. Adoption of ERP in major enterprises has had the positive effect of better integrating processes across the enterprise and improving the ability of organizations to respond to their customer needs. Unfortunately those same systems that span the enterprise are almost impossible to change once in place. It is time for the industry to amortize the gains provided by ERP and evolve a more agile capability.

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