Critical Success Factors for Enterprise Architecture Engineering

This paper describes critical success factors for developing, implementing, and managing enterprise architectures for strategic information management, enterprise information quality, and effective software component development and management.

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Introduction

Linking an enterprise's strategic plan and performance plans ("business architecture") with its enterprise data architecture, enterprise service component (applications and systems) architecture and enterprise technical architecture results in enterprise architecture. A well-documented architecture is a logical organization of information pertaining to the following corporate-level, enterprise-wide elements:

- Strategic goals, objectives, and strategies
- Business rules and measures
- Information requirements
- Processes, systems and applications
- Relationships architecture elements
- Technology infrastructure

Enterprise architecture also establishes guidelines, standards, and operational services that define the enterprise's software engineering environment. When an enterprise's architecture is so documented, it can be used to accomplish the following:

- Facilitate change management by linking strategic requirements to systems that support them and by linking the business model to application designs
- Enable strategic information to be consistently and accurately derived from operational data
- Promote data sharing, thus reducing data redundancy and reducing maintenance costs
- Improve productivity through component development, management and reuse
- Reduce software development cycle time
- Evaluate commercial products and services
- Integrate enterprise applications
- Re-engineer applications

Every enterprise has an architecture. Most organizations simply let their architecture grow and evolve uncontrolled. It is always undocumented and is most often characterized by high maintenance costs, long development cycles, poor quality software, non-interoperable applications, lack of data sharing, limited strategic information, and difficult change management.

Those organizations that *engineer* their enterprise architecture are able to avoid and/or overcome the problems experienced by organizations that are controlled by their out-of-control architectures. Enterprise architecture engineering means adopting rigorous and disciplined processes for effectively defining, documenting, and managing the enterprise architecture. Effectively accomplishing enterprise architecture engineering requires that the following critical success factors be addressed.

Critical Success Factors (CSF)

The critical success factors for Enterprise Architecture engineering are:

- Sponsorship and Involvement
- Business Requirements
- Enterprise Architecture Models
- Development Environment

CSF: Sponsorship and Involvement

Enterprise executives and managers must sponsor enterprise architecture engineering. Equally important, all potential users of the applications and systems based upon the architecture must be involved in the process. Without both management sponsorship and near universal involvement, enterprise-wide architecture engineering projects usually fail.

Management

Enterprise **management** must fully sponsor enterprise architecture development and usage. Sponsorship includes ensuring sufficient resources are available. Sponsorship also means consistent commitment to implementing the architecture so that is the single source for corporate management, measurement and decision support requirements and is used as the base for all applications and systems.

Enterprise architecture development and usage often requires significant culture change. This cannot happen without management commitment. Managing internal change, particularly culture change, requires three things: management commitment, universal approval, and appropriate measures and rewards.

Management Commitment: In order for anything to happen in an enterprise, including change, executives and managers must be *consistently* committed to making it happen. Only enterprise leaders can ensure that resources necessary to effect the change are available. Consistent commitment means that the change becomes both an enterprise strategy and an enterprise goal that leaders continuously and obviously support. The visibility of leadership support is a primary factor in achieving universal approval for change.

Universal Approval: Change is successful only when the people involved approve of the change. They understand the need for the change. They believe the change is good for the enterprise and good for them. They agree that the change being undertaken is the right change. Peter Senge, in his book *The Fifth Discipline,* describes the need for universal approval in order to implement systemic change: *"People want change, they don't want to be changed."*

Measures and Rewards: Getting everyone to want change is difficult. It requires a level and degree of communication and cooperation not found in most enterprises. Maintaining universal approval is even more difficult. The best way to achieve and maintain universal approval is to ensure that the process and results of change are measured appropriately and accurately and communicated enterprise-wide. Good results and changed behavior must be rewarded. At the same time, unchanged behavior and poor results should not be rewarded. Employees will not work toward change if they continue to be rewarded for old practices.

Potential Users

All **potential users** of the applications and systems based upon the enterprise architecture, even executives, from every organizational unit and level, must be actively involved in architecture development and management. These users will have the most influence on acceptance of the architecture, so it is imperative that their needs are addressed. They are also the "owners" and "stewards" of operational data and thus are the best source for subject matter expertise.

CSF: Business Requirements

Developing enterprise architectures without first determining strategic business requirements is a sure recipe for failure. The best source for these requirements is the enterprise **strategic plan**

and the **performance measures** identified in the plan. These become the basis for the architecture models as well as enterprise information systems, decision support systems, and the data warehouses. An enterprise should never undertake system development efforts, particularly engineering a data warehouse, without first determining its strategic business and information requirements and documenting them in their enterprise architecture model.

Strategic Plan

A **strategic plan** outlines an enterprise's mission and purpose, goals, strategies and performance measures (business requirements). Properly used, a strategic plan is the tool with which effective managers guide their organizations and ensure corporate success.

An enterprise's strategic plan not only provides a guide for effective management; it also provides the guiding force for internal change and the guidelines for responding to external change. Through the strategic planning process, the enterprise defines and documents its purpose, goals, and objectives, along with strategies for achieving them. Included in the process is an assessment of external opportunities and threats as well as an assessment of internal strengths and weaknesses.

The most useful strategic plans are multi-dimensional, incorporating the enterprise's overall plan with the subordinate plans of every enterprise element, and including performance measures for every critical outcome.

Performance Measures

Establishing the right performance measures is the key to successful enterprise management. An enterprise must be able to tell whether progress is being made on its critical goals and whether stakeholder expectations are being met.

The most effective and useful performance measures are cross-functional and are linked to the appropriate strategies, objectives, and performance criteria. Management's targets and thresholds for the measures, often based upon external benchmarks, form the structure for an enterprise performance measurement system.

Performance measurement documentation should include not only the content of reports and queries, but also document the path of the data from source to ultimate information recipient. The combination of all the reports of all the performance measures becomes the basis for a data warehouse and a Strategic Information System that is truly tailored to the enterprise's requirements.

Executives and managers use the information produced from the data warehouse to reinforce initiatives, reward behavior and change strategies. Employees use it to adjust operations and respond to strategic needs. Linking timely accurate measures to specific goals and objectives begins to make enterprise management more of a science and less of an art.

All enterprise plans, performance measures and other enterprise business rules make up the enterprise business architecture.

CSF: Enterprise Architecture Models

Linking the **enterprise business architecture (EBA)** with an **enterprise information architecture (EIA), Enterprise service component architecture (ESA)** and **enterprise technical architecture (ETA)** (and potentially many other models) results in enterprise architecture. Ideally this architecture is a logical organization of corporate information requirements, descriptions of application systems that support the enterprise's strategic requirements. It includes the relationships between application systems via shared software components and shared data elements. The enterprise information architecture also establishes

guidelines, standards, and operational services that define the enterprise's computing technology environment.

Before an enterprise can define, design, and implement the architecture for its strategic information management systems, including data warehouse, data mart, decision support, and executive information systems, it must first document the environment in which these systems will be implemented. These enterprise architecture models include:

Enterprise Information Architecture

The EIA is a fully normalized data model that describes all the data necessary to the enterprise. It includes relationships between "business data objects," business rules concerning usage of the data elements, and identification of the "owner" of the data. In addition, it is important for the model to indicate the circumstances (who, when, where, how) for creating, updating, using, and deleting enterprise data. For ease of use, subsets of the enterprise data architecture model should be established. These subsets, or views, can represent functions, organizations, regions, systems, and any other significant grouping of information.

Enterprise Service Component Architecture

The ESA documents all the services and solutions implemented to support the enterprise. These, of course, include information systems used to create, read, update, and delete enterprise data. In order to be useful, the information systems should be linked to appropriate data elements in the Enterprise Information Architecture. Every system should also be linked to appropriate elements of the enterprise technology architecture.

Enterprise Technical Architecture

This segment of the Enterprise Information Architecture documents the enterprise's hardware platforms, operating systems, and telecommunications infrastructure. The ETA is also where guidelines, standards, and operational services that define the enterprise's systems development environment are documented.

CSF: Development Environment

The most ignored critical success factor is the one that can have the greatest impact. In order to consistently design, develop, and implement architecture based systems and applications, an enterprise must have a development environment that uses appropriate practices and techniques. The elements of this environment include **project teams, methodology,** and **tools.**

Project Team(s)

In addition to consistent management commitment and sponsorship and user involvement, there is another critical enterprise culture element. The **teams** that will be actually designing, developing, implementing, and managing the enterprise architecture-based software components and databases must have certain characteristics. They must understand the importance of strategic information. They must be able to analyze and document business requirements in business language. They must be dedicated to the project. They must have sufficient resources. They must practice effective project management. Every team member must have appropriate skills, knowledge and experience (see below), be sufficiently familiar with the enterprise development methodology, and be able to effectively use the enterprise architecture engineering tool set.

Development Methodology

Enterprises that consistently produce quality information systems rigorously use a full life cycle development **methodology**. Such a methodology is characterized by a sequence of interrelated steps beginning with determining business requirements and resulting in system design, development, and implementation. The Software Engineering Institute, which established the industry-standard, software development capability maturity model (CMM), declares that a methodology is an absolute necessity in order to be an effective software developer.

Having a strategically-driven, customer-focused, information-centric, model-based, disciplined, rigorous, and repeatable methodology is absolutely essential for successful enterprise architecture engineering. In fact, such a methodology is critical for engineering anything of sufficient complexity.

Another characteristic of a successful engineering methodology is that it represents a controlled iteration of proven best practices and techniques. Further, it allows short-term projects to be completed and return on investment to be realized "locally" within the context of the enterprise's architecture, which is managed "globally."

Development Tools

An enterprise architecture and the applications and systems based upon the architecture are too complex to be developed using manual methods. **Development tools** such as modeling tools, repositories and fourth/fifth generation programming languages are absolutely essential.

Some combination of these tools is necessary to consistently, quickly, and effectively develop quality software components and databases. Obviously, the specific tool set an enterprise uses will depend upon its unique needs. No matter what tools are used, it is important that the tools work together and that they can be used within the enterprise's chosen technology environment.

Skills and Knowledge

A specialized set of **skills and knowledge** is required to efficiently engineer an enterprise architecture and the related systems. They include experience with online analytical processing (OLAP) tools and systems integration; strong technical background with emphasis on operating systems, data bases, decision support tools, user interfaces and client-server; high conceptual level of relational theory; strong communication (speaking and writing) skills; and the ability to interact with everyone in an organization from office workers to the CEO. The necessary skills and knowledge may be acquired by hiring experienced consultants, or by training internal staff. The most effective approach is for consultants to begin development while helping internal staff become skilled so that the enterprise eventually becomes self-sufficient.

Summary

Enterprise architecture engineering is not like normal application development. Its scope is broader, its visibility is greater, its user community is larger, and it is more prone to failure.

Before beginning an enterprise architecture engineering project, an enterprise should evaluate whether it has adequately addressed the critical success factors described in this paper.

Sponsorship & Involvement

Management
Potential Users

Business Requirements

Strategic Plan
Performance Measures

Enterprise Architecture Models

Enterprise Data
Information Systems
Enterprise Technology

Development Environment

Project Teams
Methodology
Development Tools
Skills & Knowledge

Enterprise architecture engineering will help you deliver effective applications and systems that exactly meets the needs of your enterprise -- public or private, large or small -- to the right people, in the right place, at the right time, in the right format.

Related information can be found in other white papers by the author.

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Mr. Perkins specializes in Enterprise Architecture Engineering. He helps clients quickly engineer enterprise architectures that are actionable and adaptable. His approach results in architectures that enable and facilitate enterprise initiatives such as Corporate Portals, Enterprise Data Warehouses, Enterprise Application Integration, Software Component Engineering, etc.

The following are papers are available at www.visiblesystemscorp.com:

"Enterprise Architecture Engineering"

"Enterprise Architecture Engineering Critical Success Factors"

"*High-Performance* Enterprise Architecture Engineering – Implementing the Zachman Framework for Enterprise Architecture"

"Enterprise Change Management – An Architected Approach"

"Getting Your Acts Together – An Architected Solution for Government Transformation"

"A Strategic Approach to Data Warehouse Engineering"

"Data Warehouse Architecture – A Blueprint For Success"

"Critical Success Factors for Data Warehouse Engineering"

"How to Succeed in the 21st Century – Critical Information Management Success Factors"

"XML Metadata Management – Controlling XML Chaos"

"Business Rules Are Meta-Data"

"Enterprise Application Modernization – Solving IT's Biggest Problem"

"Strategic Enterprise Application Integration"

"e-Engineering – A Unified Method"

"Enterprise Portal Engineering"

"Quality Software [Component] Engineering"

"Software Engineering Process Improvement"