Chapter XVIII
A Network-Based View of Enterprise Architecture

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ABSTRACT

Traditional notions of architecture have focused on the components and (or domains of interest—process, data, and infrastructure) aspects of architecture. Their goal is to separate concerns into modules and provide interfaces between modules. This view helps designers understand the ideal or espoused view of architecture. In our work, we view architecture from a dependency perspective. These dependencies evolve over time, creating an emergent architecture. The emergence is influenced by both technical and social factors. Dependencies occur during the design, production, and use of enterprise components. This leads us to use network-based analysis techniques in order to understand the emerging dependency networks.In order to provide architects with support tools to communicate and make decisions about architecture, we describe the data requirements and algorithms that can be used to build a decision support system that enable enterprises to incorporate a network perspective in their decision-making process. We present our approach and methods in the context of a case study

INTRODUCTION

A fundamental assumption behind this work is that reasoning with architecture is a key determinant of successful information systems design, maintenance, and evolution. Stakeholders need architectural representations in order to make resource allocation decisions and perform risk assessment. In addition, we believe that current techniques fall short in providing stakeholders

with a vehicle that help them make informed decisions about information system design. Part of the problem is that IS architecture has no universally accepted definition in either the research arena or in the practitioner world (Ross, 2003). Architecture has been viewed strategically (Henderson & Venkatraman, 1993; McKay & Brockway, 1989; Morris & Ferguson, 1993; Ross, 2003; Sauer & Willcocks, 2002), organizationally (Byrd & Turner, 2000; Dreyfus & Iyer, 2006; Duncan, 1995; Iyer & Gottlieb, 2004; Richardson, Jackson, & Dickson, 1990; Weill & Broadbent, 1998), and technologically (Malone & Crowston, 1994; Messerschmitt & Szyperski, 2003; Nezlek, Jain, & Nazareth, 1999; Parnas, 1972). These perspectives, while individually interesting, do not provide the integrated view of architecture that is required to analyze risk and make resource allocation decisions. Another part of the problem is that these perspectives often focus on the idealized system and not the system in use.

Previous studies have summarized that an IS architecture includes a group of shared, tangible IT resources (i.e., hardware, software, data, training, management, etc.) that provide a platform to launch present and future business applications (Duncan, 1995; Kayworth, Chatterjee, & Sambamurthy, 2001; McKay et al., 1989; Weill et al., 1998). Architecture, as implemented through its IT infrastructure, should be flexible, reliable, robust, scalable, and adaptable (Byrd et al., 2000; Duncan, 1995; Kayworth et al., 2001). It should support the reuse of business components within a firm while supporting firm responsiveness, innovativeness, and economies of scope (Kayworth et al., 2001). A review of these and other articles clearly illustrate that when the given definition for architecture is translated into action, the concept becomes very complicated.

Architecture implementation also involves learning effects. As researchers have explored organizations making changes to architecture, they have identified two strategies: localized exploitation or enterprise-wide integration (Allen, 1977). Most techniques seem to support the former and there are many tools that support the latter. These techniques and tools, however, focus on the system at a point in time. Changes to the system, on the other hand, do not occur in one step, they occur in stages (Ross, 2003). Although seemingly obvious, these insights don't seem to have been translated into tools or techniques.

Architecture is more than technology. It reflects and supports business strategy. Architecture is not just concerned with the allocation of resources at the physical level, but also with the support of strategic business goals. The architectural challenge is not just cost minimization in the allocation of task to computational device, but the alignment of the task structure (Gasser, 1986) supported by the information system with the business objectives of the organization. Thus, the approach we take to architecture must enable communication and decision making between and by business and technology stakeholders.

Zachman provides a useful framework that identifies the components of an IT architecture as well as the various perspectives taken during the design and implementation of an architecture by the different stakeholders (Zachman, 1987). According to Zachman, there is no such thing as a single information architecture; there are many. Separate architectures exist for scope/objectives, business model, information system description, technology model, detailed description, and machine language description. For these six categories, there are also the descriptions for *who, what, how, where, when,* and *why.* Altogether, there are 36 possible architectures. This insight liberates us from the constraint of a single architectural perspective.

D'Souza and Wills (1999) describe the architecture of a system as the set of design decisions that constrain its implementation and maintenance. They discuss the need for many different architectural views of a system, each using a different set of elements (abstractions) and each conveying significant design decisions. Some