Network-Based Information System Model for Research

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INTRODUCTION

Cross-discipline research requires researchers to understand many concepts outside their own discipline. Computing has increased in our everyday lives to the point that "ubiquitous computing" has become an entry in the Wikipedia (Wikepedia). Research is no different. Researchers outside of computer network-related disciplines must account for the effects of network-based information systems on their research. This article presents a model to aid researchers with the tasks of properly identifying the elements and effects of a network-based information system within their studies.

The complexity associated with network-based information systems may be seen by considering a study involving the effectiveness of an Enterprise Resource Planning (ERP) system on a mid-sized company. A study becomes muddled when it fails to recognize the differences between the myriad of people, procedures, data, software, and hardware involved in the development, implementation, security, use, and support of an ERP system. If a researcher confuses network security with ERP configuration limitations, then two important aspects of the information system are obscured. Networks limit access to network resources so that only authorized users have access to their data. ERP applications allow an organization to restrict access to data to safeguard the data (Colt & Yang, 2004). Both aspects relate to the availability of data, but they come from different parts of the system. The two aspects should not be addressed as if both are attributable to the same source. Misidentifying network-based information system elements reflects negatively upon the legitimacy of an entire study.

BACKGROUND

Management information systems, applications systems development, and data communications each have contributed models that may be useful in categorizing network-based information system elements of a study. Kroenke (1981) offered a five-component model for planning business computer systems. Willis, Wilton, Brown, Reynolds, Lane Thomas, Carison, Hasan, Barnaby, Boutquin, Ablan, Harrison, Shlosberg, and Waters (1999) discussed several client/server architectures for network-based applications. Deitel, Deitel, and Steinbuhler (2001) presented a three-tier client/server architecture for network-based applications. The International Organization for Standardization (ISO) created the Open Systems Interconnection (OSI, 1994) Model for network communications. Zachman (2004) proposes a 30-cell matrix for managing an enterprise.

Kroenke's (1981) five components are: people, procedures, data, software, and hardware. Procedures refer to the tasks that people perform. Data includes a wide range of data from users' data to the data necessary for network configuration. Data forms the bridge between procedures and software. Software consists of programs, scripts, utilities, and applications that provide the ordered lists of instructions that direct the operation of the hardware. The hardware is the equipment used by users, applications, and networks. Although Kroenke's five components are decades old, recent publications still cite the model including Pudyastuti, Mulyono, Fayakun, and Sudarman (2000), Wall (2001), Spencer and Johnston (2002), and Kamel (2002).

The three-tiered model presented by Willis et al. (1999) and Deitel, Deitel, and Steinbuhler (2001) (Appendix B) views a network-based application as consisting of a "client" tier, a middleware tier, and a "server" tier. The client tier contains applications that present processed data to the user and receives the user's data entries. The middleware tier processes data using business logic, and the server tier provides the database services. Another variation on the three-tiered model is found in Dean (2002). Dean's three-tiered model refers to client computers in networks. Her model consists of clients, middleware, and servers. In Dean's model, a client is a workstation on a network. The middleware

provides access to applications on servers. Servers are attached to a network accessible by a client.

The ISO's OSI, as described by ISO (1994), is a seven-layer model used to separate the tasks of data communication within a network. The seven layers are Physical, Data Link, Network, Transport, Session, Presentation, and Application. The model describes services necessary for a message to travel from one open system to another open system.

The highest layer of the OSI model, Applications, provides access to the OSI environment. The Application Layer provides services for other programs, operating system, or troubleshooting. For example, HTTP is an Application Layer utility. HTTP provides transfer services for Web browsers. The browser is not in the OSI Application Layer. The browser is above the OSI model.

"The Presentation Layer provides for common representation of the data transferred between application-entities" (ISO, 1994, clause 7.2.2.2). The services provided by the Presentation Layer include agreeing to encoding and encrypting schemes to be used for data being transferred. The Presentation Layer does not refer to formatted displays of a Web browser.

The remaining five layers of the OSI Model pertain to contacting another node on a network, packaging and addressing a message, sending the message, and assuring that the message arrives at its destination. The OSI Model offers a framework for many vendors to provide products that work together in open systems. The OSI Model does not encompass all of the components of a network-based information system.

Zachman's "Enterprise Architecture" (2004) consists of six rows and six columns which form 36 unique cells. The rows represent different levels of abstraction or development of an enterprise. The columns resolve who, what, where, when, why, and how. In order to be used, Zachman's model requires prior knowledge of the elements of network-based information systems, development, and operation.

Each of these models provides an answer to part of the puzzle for classifying the elements of a network-based information system. However, one must be familiar with the different types of personnel, procedures, data, software, and hardware to understand which are client, which are middleware, and which are server. One must be familiar with the different views of a system to determine which level of abstraction to use. If one delves further into the network's function, then the OSI model becomes important in understanding how a message is passed from a sender to a receiver. None of these models were intended to aid researchers outside of computing technologies areas to understand relationships among elements of a network-based information system.

MODEL

To help in understanding the different types of personnel, procedures, data, software, and hardware, and how they work together, the following model is proposed.

Basic Network-Based Information System Model

Let us begin with a three-tiered model. The top tier will represent the people who use the system and the people who benefit from the system's use. These people have procedures to follow in order to use the system or to receive the benefits. Also, the data representing information of interest to the users and beneficiaries would be in this top tier. For ease of reference, this tier needs a name. Let us refer to the top tier as the Specialty Tier.

Table 1. Overview of network-based information system

Specialty Tier People, procedures, and data used to do work
Application Tier Software used to do work; people, procedures, and data used to create, implement, and maintain software
Infrastructure Tier People, procedures, system data, system software, and hardware necessary for the applications and network to operate satisfactorily