From System Development To Information Infrastructure: The Shifting Technical Focus Of Corporate IS Organizations

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Abstract

When Information Systems were first recognized as important organizations in the corporate business structure, their first technical challenge was to convert paper-based business systems to computer-based and later network-based functions. This conversion required extensive development of computer, network, and particularly software systems. System development started out being the primary technical focus of corporate Information Systems organizations. In recent years, the completion of this initial conversion process, the commodification of business software, the emergence of a development-outsourcing industry, and of software frameworks that dramatically reduce the effort needed to develop or customize a business system, have all contributed to a shift in the technical focus of corporate Information Systems organizations. The new primary technical focus, documented in a survey of recent CSU LA IS graduates, is on technical administration of systems, networks, and information security.

INTRODUCTION

System development is the traditional technical focus of corporate Information Systems organizations. In the last decade, systems development has been displaced from this traditional preeminence, its place taken by technical infrastructure work: user support, technical administration of desktop, server, database and website systems, network administration and information security. This paper examines the history of this change; empirical evidence of this change from a recent survey of the alumni of the Department of Computer Information Systems at California State University, Los Angeles; and its implications for academic curricula in Information Systems.

THE RISE AND DECLINE OF SYSTEMS DEVELOPMENT IN CORPORATE IS ORGANIZATIONS

The academic discipline dedicated to the study of business and other organizational Information Systems dates only to the 1980s, when separate Departments of (Computer) Information Systems were established at several universities; or perhaps to 1964, when the College of Business at Colorado State University added "and Information Systems" to the name of its Department of Management Science (Colorado State 2004). However, the systematic use of information processing machines goes back earlier, to the 1890s, when Herman Hollerith left the US Census Bureau and started the Tabulating Machine Company. By 1940, Hollerith's system of 80-column cards, card punches, sorters, tabulators and report printers had made its way into every business and government organization large enough to use statistical data. Relative to manual systems, punched card machines saved labor, reduced errors, and required less skill than was traditionally used to generate management information reports (Heinz Nixdorf Museum 2004a).

While early digital computers were first applied to military, and then to engineering and scientific calculations, their potential as a tool of rational management began to be realized in 1950, when Thomas J. Watson Jr., already familiar with digital computers from his service in the U. S. Army Air Force during World War II, transformed IBM, with its enormous market in business organizations, from a punched card company into a business computer company (Heinz Nixdorf Museum 2004b). The computers of the 1950s, 1960s and even the 1970s were weak and slow by today's standards, and needed to be explicitly programmed for every task. By 1980, however, it became clear that nearly every business process which then used information on paper could be done with less

expense and fewer errors when programmed into a computer. The original mission of Computer Information Systems departments in American universities was to produce software designers, programmers, and system development managers for the gigantic job of converting the world's business information systems from paper to computer-based processing.

In most businesses, the switch-over from paper-based to electronic information systems was effectively completed by the early 1990s. The various systems, however, were often implemented separately; the data printed out from one system was sometimes entered into the next by typists at terminals. In the 1990s, software developers in business organizations were busy developing network connections and data interchange and integration connections. In preparation for potential incompatibilities between older date formats and four-digit year numbering from Year 2000 onward, older systems that were not compatible with new networks and four-digit year numbering were often replaced with new software systems designed and implemented from scratch. Finally, beginning around 1995, businesses started to implement internet-based systems for transactions; communication and information interchange with their suppliers, partners and customers. As recently as five years ago, the continuing technical focus of Information Systems organizations on system development seemed as solidly in place as ever.

In the last five years, that technical focus on system development came to an uncomfortably abrupt ending. The replacement of systems made obsolete by the advent of Year 2000 was a one-time stay of the inevitable. Putting commerce on the World Wide Web, like the earlier transitions from paper to electronic systems, and from separate computers to systems integrated with electronic networks, is now largely a completed milestone for established companies. New business models, new companies and even new industries continue to emerge and need new information systems, but their development no longer demands an effort that would justify a continued primary focus on system development, because of three structural transformations of the field itself.

First, system development gives the same advantages to division of labor and economies of scale as other services and products in a market economy. These advantages are best exploited by specialized enterprises – in the field of business system development, by vendors such as Oracle, SAP, Microsoft, IBM and Sun Microsystems. The resulting commodification of standard business systems has reduced the typical enterprise's need for internal system development to a minimum – mainly macros, customizations, and sometimes specialized add-on and plug-in modules.

In specialized industries, vendor-based commodification was delayed because the adaptation of general-purpose software to unique needs requires modifications that vendors of proprietary products were not equipped to permit. However, a second wave of commodification resulted from the availability of open-source products such as the Apache web server, the Linux operating system and the MySQL relational database engine. Open-source software has many praxeological (von Mises 1949, Raymond 2000) advantages, most of which are beyond the scope of this paper. For specialized industries, open source products can be readily modified to meet unique requirements with a development effort much smaller than a traditional-scope system development project. The residual effort in these industries is still significant, but it no longer consumes the largest share of the technical resources of these industries' corporate IS organizations.

The technical workload that remains after the effects of vendor and open-source commodification is further minimized by a second transformation: the availability of frameworks of high-level components. The first such framework, the Unix Shell Programming Toolkit, is now available in several versions for Microsoft Windows as well as Unix and Linux platforms. Microsoft is distributing a more recent proprietary programming framework, .NET (dot-net); Sun Microsystems provides the platform-independent "Sun Java System" (formerly SUN ONE) framework etc. With these, the system development effort is reduced to scripts that "glue" together the components assembled for the project from one or more high-level frameworks.

The third transformation is the availability of outsourcing vendors who provide complete turn-key development of specialized systems, often for far less than a company would need to spend if it chose to run the corresponding development effort within its own IS organization. These outsourcing companies can provide system development services at lower cost not only because of specialization and economies of scale, but also because they

conduct business internationally, employing programmers in countries with low-tax, low-regulation market environments.

THE GROWTH AREA: INFRASTRUCTURE SUPPORT

The ongoing decline in the technical effort of IS system development has been more than offset by the challenge of operating existing and expanding corporate network and computing infrastructures. The various generic platforms that support and also replace internally developed systems are highly customizable, a feature that readily accommodates innovation and change but requires ongoing, technologically skilled and professional administration.

The Department of Computer Information Systems at California State University recently surveyed graduates who received degrees in Information Systems from our Department in the last six years. Of the 131 recent graduates who responded to our on-line survey, 57 (44%) functioned as Windows server administrators, and 31 (24%) had direct report subordinates whose tasks included Windows server administration. The corresponding numbers were 11 (8%) and 8 (6%) for Unix/Linux server administration; 55 (42%) and 30 (23%) for network administration; and 35 (27%) and 16 (12%) for IS security administration. In total, 73 (56%) of our responding alumni performed or supervised server, network, or security administration. This is in addition to a significant number of IS alumni involved in database administration, web server and e-commerce administration, and user support, the numbers for whom were not available by press time for the present paper.

The infrastructure support function of corporate IS organizations involves the following technical specialists:

- *Server Administrators* configure and optimize server operating systems, monitor and optimize server operations, install and patch system and service software, and monitor data backups and account administration.

- *Database Administrators* configure and optimize relational database engines and monitor their operation; design and define databases; configure and monitor data mirroring and backup operations; and patch and update database software.

- *Webmasters and E-Commerce Administrators* configure, optimize, monitor, patch and update Hyper Text Transfer Protocol software daemons; administer accounts and access restrictions for content owners; backup and update content, and provide server-side application software.

- *Network Administrators* configure, monitor and optimize routers, switches, firewall appliances and proxy servers in the organization's internal data network and its interfaces with Internet service providers; track the layout of physical network links and monitor the network for faults and for congestion and other performance problems.

- *Security Administrators* configure and monitor safeguards against unauthorized access, modification, abuse or sabotage of the organization's information, or of its network and computing resources.

- *User Support Professionals* set up and configure desktop and portable computer systems and their network links; help users with software installation and maintenance, and with problems and questions that need to be resolved to provide employees with computer and network support of their assigned tasks. Some IS organizations also employ support specialists to optimize desktop ergonomics, assure accessibility for employees with disabilities, and write software macros and scripts to maximize the productivity of specialized employees.

By providing information infrastructure support to their companies, today's successful IS organizations are becoming more important – indeed, indispensable – than ever. There IS life *after* system development.

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