The role of data center personnel in the development of a large-scale business system

by DAVID A. COX
Selective Service System
Washington, D.C.

ABSTRACT

The purpose of this paper is to identify the role that data center personnel should play in the early phases of the development cycle and to highlight special areas of concern in the later phases of the development cycles. In order to provide a framework which will encompass the majority of situations, I have chosen to describe the role of data center personnel in the context of the systems life cycle of a large-scale, complex business system. It is hoped that the result of this paper will be to define a role for operations personnel that is as visible and influential in the early stages of the systems development life cycle as it is during the implementation stage.
INTRODUCTION

Historically, data center personnel are asked to provide hardware, system software, and personnel support for new systems even though they have not had the opportunity to participate in the early stages of the system development cycle. The lack of participation by data center personnel in the early stages of development can have a significant impact on the implementation stage of the development cycle and can cause project completion dates to slip, costs to escalate, and the quality of the final product to be reduced.

The purpose of this paper is to identify the role that data center personnel should play in the early phases of the development cycle and to highlight special areas of concern in the later phases of the development cycles. In order to provide a framework which will encompass the majority of situations, I have chosen to describe the role of data center personnel in the context of the systems life cycle of a large-scale, complex business system. It is hoped that the result of this paper will be to define a role for operations personnel which is as visible and influential in the early stages of the systems development life cycle as it is during the implementation stage.

It is important to note that the system development process, while straightforward by definition, is in practice a very complex iterative process. The best analogy of this process is to compare the solving of a business problem to that of peeling an onion. As each layer of the problem is “peeled” away and examined, it reveals more problems which need to be solved. As each layer of the problem is removed, examined, and solved, the best approach to solving the business problem becomes increasingly apparent.

The continual “peeling” away of the problem means that the same type of analysis must be performed several different times, each at a different level of detail. It is this continual refinement in the analysis process that when properly executed, results in the successful installation of a system that truly solves the business problem.

DEFINITIONS

For purposes of the system development process, the term data center personnel should include the following:

1. Hardware/system software specialist—a person who understands the interrelationships of the hardware/operating system currently in place and those available in the market place today; and, their ability to support new hardware needs.
2. Telecommunications specialist—an individual who can perform the network analysis necessary to determine the optimal telecommunications design and develop a workable design within resource and technology constraints.
3. Procedural specialist—an individual who understands and can identify the processes required to handle exceptions, correct errors, and schedule production efforts.
4. Procurement specialist—an individual who can identify the procurement cycle, lead times and costs for each new system component, and lead the procurement effort.

For purposes of this paper the system life cycle consists of the following five major phases:

1. Concept definition—the model of the system that will solve the stated business problems is developed.
2. System design—the specifications from which the system will be built are prepared.
3. System development—the System Design is transformed into programs and procedures, and it is demonstrated that the system meets the design specifications by working successfully in a controlled environment.
4. System implementation—the system is brought into operation in the production environment.
5. System support—ongoing support is provided for production operations and system modifications, and enhancements are made over time.

Concept Definition

In the Concept definition phase, the basic system framework (its aesthetics, scope, functional capabilities, organization and budgetary constraints, and technology) is developed. Like an architectural model of a building, the system concept document provides an overview of the total system and shows how its various elements fit into a unified, workable solution to the business needs of the organization.

The goals of the system concept are to evaluate the need for a systems solution to a business problem, provide the context in which informed decisions can be made on the numerous policy and procedural issues that must be worked out before the new system can be developed, and provide a “road map” to guide the activities of subsequent development phases.

During this phase there are many activities taking place that as independent activities do not directly affect data center personnel. However, when viewed in the aggregate, these activities have a major impact on the operations area of the data center. The primary mission of data center personnel during this phase is to determine the feasibility of the system concept from a technical standpoint given the real world constraints of available technology (hardware, telecommunications, and software) and the impact of the new system on the support and operation of existing data systems. This role is critical to the long-term viability of the project, since the
system concept described by the user/project manager very rarely exists in a pure form that is either readily available in the existing system or is a transparent addition to existing facilities. Rather, the solution must be molded to fit the technology available to the data center either through adaptation of existing systems or through procurement of new systems. Therefore, the data center personnel must know as much about the goals of the system as the design team if they are to be able to find alternate architectures that can be made to fit the requirements of the new business system.

Selecting a hardware and system software architecture which can meet specific requirements with only a conceptual system design in place is a difficult, yet necessary chore. The key issue is to determine if the new application can fit into existing hardware, or whether system upgrades or new computers must be procured to handle the new workload.

The data center team must concentrate on specific tasks that must be performed in parallel with the system concept tasks being performed by the business and system analysts. These tasks are described more fully below.

1. Establish policy guidelines for service levels, system life, and operational requirements.
   In defining the service orientation of the new system, the operation team needs to know if the system is to be user-oriented or production-oriented. A production-oriented system will use as much of the capacity of a machine as possible through prior planning of production workloads, whereas a user-oriented system must be geared to provide a high level of response and service even under unplanned peakload conditions. This difference in service requirements will have a dramatic effect on the sizing of the eventual system, since a user-oriented system will require more resources than a production-oriented system. The level of service must be expressed in quantitative terms, such as transactions per minute in a batch system or response time in seconds in an online system.
   Once the service orientation has been fully defined, the system life and general requirements for an operational window (i.e., 1st year, 1 shift per day; 2nd year, 2 shifts per day; 3rd year, 24 hours per day operation) must be defined. Once these items are defined, the team will have the basic parameters necessary to evaluate the impact of the current and planned production on the current hardware/system software facilities.

2. Identify the present workload.
   Unless the decision has been made to use a new computer system exclusively for the new application, the processing characteristics of the current workload must be fully understood. Quantification of this workload will include physical requirements (i.e., disk space, telecommunications support, etc.) and processing requirements by application type. The analysis should include requirements over the system life of the application, peak load requirements and the service level requirement for each application (i.e., user vs. production).

3. Forecast future workloads.
   Forecasting the workload of the new system is an iterative process and may require the development of several alternative system models and the preparation of workload estimates for each of these production models. At this stage, the models developed will be described at a high level, with general descriptions of cost and capacity requirements. Examples of alternative models may include: (a) a centralized database system with online terminals used for updating and file query and all edits done on the host computer; (b) a centralized database system with remote intelligent terminals accessing the central database on a dial-up basis and most editing done on the terminal; and (c) a distributed database system with remote terminals hooked to distributed processors and high-speed data links to the central computer.

   General workload estimates must be developed for each of these alternative models. These estimates should be detailed enough to identify the following:

   1. Volume of transactions per node in the system model
   2. Volume of mass storage required
   3. Network patterns and approximate cost
   4. Service level required
   5. Production window requirements
   6. Phased growth of transactions over time

   By applying workload levels to each system model, each node (i.e., terminal, CPU, storage, etc.) in the system architecture can be sized and cost with a nominal level of precision (±20%).

   This system workload data will be analyzed and presented to the user/project manager in a report which describes the alternative architectures by their costs, benefits, disadvantages, procurement lead times, and impact on existing systems. The project team must then select the basic system architecture to be used as the basis for subsequent design efforts. The system architecture decision must be made early on in the planning process, since the procurement cycle (specification development, evaluation of bids, delivery time, initial installation, hardware test, system software installation, system software test) for a new system may take anywhere from 6 to 36 months, depending on system complexity and manufacturer lead times. The information regarding lead times for procurement must be incorporated into the system concept so that the concept that is approved by top management can be delivered on time.

4. System Design

   In the system design phase, the system model developed during the concept definition phase is used to produce specifications for the system. This “blueprint” includes not just program designs but all the components of and considerations affecting the new system, such as hardware and software configuration, user and operations procedures, implementation plans, and a detailed work plan for the subsequent phases of the system development effort.

   Specific Activities include the following:

   1. Specify system functions
   2. Design system architecture
3. Define forms, reports, and screens
4. Design software and databases
5. Design conversion software and procedures
6. Design test environment
7. Develop detailed operational concept
8. Prepare detailed project plan
9. Review and revise design
10. Prepare procurement documents for hardware and system software

There are several key activities where the data center personnel must take the lead. These include developing detailed estimates of the system workload, preparing technical specifications for the hardware and systems software required to meet the application needs, identifying the telecommunications network to be used for the system, and preparing the test environment for system development. In order to complete these types of activities, the operations personnel must perform the same type of analysis that was required during the concept definition phase. The primary effort will be to evaluate alternative equipment/system software configurations that will support the system architecture approved in the concept definition phase.

In addition, the workload estimates will be more detailed and will result in estimates that have a much greater level of precision than those developed during the concept definition phase. The results of this analysis will be used as the basis of the procurement documents that must be developed for the acquisition of the hardware and systems software.

The level of specificity required for procurement documents will vary depending upon the nature of the procurement. If the procurement is to be fully competitive (i.e., any vendor may qualify—IBM, Univac, Honeywell, etc.), the specifications that are prepared must be functional and not vendor-specific. However, if the solicitation is designed to augment existing equipment or be compatible with existing equipment, the specification can, and should be, much more detailed and be system-specific.

In the fully competitive procurement, the analysis that provides system-specific specifications must be performed after the vendor is selected. Because this activity is in the critical path, having to wait for the procurement decision can delay implementation times. Once the system-specific specifications are developed (either before or after the procurement), the balance of the operations activities in the system design phase can be planned by the data center personnel. These activities include developing a test environment and planning the installation of system software for the new system. In the case of augmentation to an existing system, it may also require planning for the conversion of existing systems to new system software and modifying production schedules to accommodate the development efforts of the new system.

System Development

In the System development phase, the specifications developed in the system design phase are used to build a system that performs all of the specified functions, and the completed system is demonstrated to work in a controlled environment.

The activities performed during this phase by data center personnel are classic operations activities. The specific tasks will be driven by the implementation plan but, in general, include the generation of new executive and systems software modules, preparing new operating procedures for test and evaluation, and providing special support for the development team. At the completion of this phase, all developed programs, jobstreams, databases, and user and operations procedures are thoroughly tested by the project team. The computer and telecommunications facilities are installed, and the system is ready for implementation in the user’s operational environment.

System Implementation

In the System implementation phase, the new system is installed for the first time in the user’s operational environment. At the completion of this phase, all personnel will have been trained to operate the new system.

In the case of large network terminal-based systems, the time involved in the physical installation of equipment can be very lengthy, since there are many pieces of equipment to be installed in many different locations. This task is made even more complex because the installation must be coordinated with the vendor, the telephone company, the user, the building managers for electrical connections, and the training team which must train all of the users on the terminals as they are installed.

In addition to the tasks involved in training and equipping users, the new workloads caused by adding new users will have an effect on the data center operation. Invariably, this activity will cause some imbalance in the system that was previously unplanned and that will require modifications to the installation schedule. These variances in schedules and unexpected problems must be fully coordinated with the project team in order to ensure that the implementation effort is continuing on schedule.

The orderly transition to the new system is the most important part of the development cycle from the users viewpoint, and every effort must be made to ensure success. Very often at this stage of the project, the development team is tempted to start working on a new project and ignore the final phase of implementation. As a result, the data center support team is called on to provide an increased level of support to solve start-up problems. It is critical that the data center team have members of the development staff available to catalog and help solve problems as they arise during this stage, since the users can best identify deficiencies which need to be corrected in subsequent release of the system software.

System Support

In the System support phase, ongoing efforts are directed at ensuring that the system meets performance objectives, soft-
ware problems are repaired, and necessary enhancements are made to adapt the system to changing user requirements.

During this phase, which lasts for the system life, a key responsibility of the operations area is to monitor system usage and performance. The statistical data gathered serve two purposes. First, the results should be compared to the performance requirements defined in the system concept and design phase to determine if the original goals are being met. Second, the data should be accumulated to determine the operating characteristics of the system so that in the future, when other “new systems” are proposed, the operating data are available as input into the concept definition phase of the next system.

SUMMARY

If a major automated business system is to be successfully installed, it is imperative that all members of the development team play an active role in all phases of the development cycle. Only through rigorous compliance to the team concept can all members of the development team share the same vision of a system that starts as a “gleam in the eye” of a user and ends up as a complex, highly sophisticated data processing system.

By being involved in the early stages of the development cycle, the data center team can provide the hardware and system software support necessary to turn the user’s idea into a working reality.