Engineering Management
Field Project

Process Development and Analysis of SHA and Procurement of Servers for XYZ Organization

By

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An EMGT Field Project report submitted to the Engineering Management Program and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Masters of Science

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List of Abbreviation and Nomenclature

BIOS – Basic Input Output System

DCA – Data Center Asset

DRAC – Dell Remote Access Controller

FS – Fiscal Services

FSP – Floor Space Planning

MTTR – Mean Time to Recover

NAS – Network Attached Storage

NCPI – Network Critical Physical Infrastructure

NIC – Network Interface Card

OS – Operating System

PXE – Pre-boot Execution Environment

RFP – Request for Proposal

RFQ – Request for Quote

SAN – Storage Area Network

SHA – Server Hosting Agreement

SLA – Service Level Agreement

SME – Subject Matter Expert

USC – Unified Server Configurator

Executive Summary

The "ABC" – Datacenter at the XYZ organization is the central repository for more than 1000 servers that provide information technology to the XYZ staff and students at its different campuses. It houses servers, network devices, storage devices, unique applications, databases, multivendor servers and the necessary expertise to provide availability of information technology to the staff and students throughout the year.

Figure 1 – A typical data center (Michael Graham Richard, 2008)

The business services are provided through procurement of servers and, either by only SHA (Server Hosting Agreement) or SHA with SME (subject matter expert) support to different departments of XYZ. The Network Operations Center is a department that acts as the central point of contact for all the other departments to ensure its 24 / 7 functioning and availability of devices, automated scheduled jobs, data backups, network and monitoring servers.. While working there, I had the opportunity to work on a process analysis project. It becomes cumbersome and expensive to maintain such a complex and diverse environment due to various management tools required to support the information

technology. In addition, there is always a cost of training and replacement of labor that drives information technology. This business process simplifies the complexity of service agreement projects and creates a standardized guideline to fulfill the clients' requirements of reducing the cost and increasing the profitability of the project.

CHAPTER 1

Introduction

Business services provided by procurement of servers' support the hardware, software, applications, databases, network devices owned by XYZ. Whereas, business services provided by SHA (Server Hosting Agreement) are solely based on the server related resources procured by the clients and being housed in the environment of XYZ that provides physical security. If this agreement is made with a SME (Subject Matter Expert) support then XYZ takes the responsibility of maintaining the health of client systems. XYZ has two different processes in place for both the projects. Thus, the objective of creating an efficient reference process is to quickly react to any RFP (Request for Proposal) by the client in the least amount of time. This project serves as a standardized process that keeps the business objectives and goals in mind and creates a value to the organization by providing high level of availability and reducing the total cost of ownership.

The business service agreement for SHA project documents what either party expects from the project.

One such document contains the following fields:

1) Purpose – What other hosting services are provided to the client along with additional services such as monitoring, managed services, backup service, managed firewall services and Operating system maintenance?
2) Term and Renewal – The term of the agreement begins when the agreement is in effect and the term of the agreement until it is terminated, changed or canceled and the renewal conditions for the agreement.

3) Production Servers and its use – This section mentions the requirements for the use of the servers in the data center environment. These include bandwidth restriction limits. In addition, it addresses restrictions on unsolicited e-mail (spamming) or spreading of viruses and Security and firewall requirements. The system should have strong security and a firewall so that hackers should not use those servers as hop servers to hack different machines in the existing environment.
4) Client responsibilities – The client is responsible for all the activities, stability and operations of their applications and servers unless they contract for SME support services. The agreement even states that the service provider is not responsible for loss of data or server by failure of the server, or by any act, by any party, whether accidental or intentional. The client should give all the relevant information about the equipment and the application requirements to the service provider. All the resources installed by the client in the environment should be insured against any type of loss.
5) Payment and Charges – Client should be responsible for all the fixed and accumulative charges for their account as defined in the service providers price list. The initial charges are specified and then an agreement can be signed on a monthly or yearly basis. The client must be notified at least 90 days in advance of price increases.
6) Limitation of Liability – Any information passing through the network is not controlled by the Data center and there is not a warranty of any kind for the services that it provides. The liability of the data center is limited to the amount

paid by the client to data center for products and services ordered hereunder for a single billing period only and the data center will not be liable for any lost profits or for any claim or demand against the client. In no event shall data center be liable for consequential damages even if data center has been advised of the possibility of such damages.

7) Compliance with Laws: The client should comply with all applicable laws and regulations of the United States of America and all other governmental entities governing, restricting or otherwise pertaining to the use, distribution, exporting or import of data, products, services and/or technical data. Compliance with laws will build trust between the two parties, which would be beneficial for future transactions. In addition, the service providers' network should only be used for lawful purposes.

8) Termination – Data center shall have the right to immediately suspend or terminate the agreement during any investigation of Acceptable use policy or agreement violations or misinterpretation of the service offered by client's servers, inappropriate use, and use of excessive system or network resources this adversely affects the performance, security or reliability of data center network, or non-payment of the service fees. Data center can also terminate this agreement for any reason by providing a written notice to the client.

9) Miscellaneous provisions – The client agreement is being executed by client at the address provided for herein and by data center in the state of Kansas, USA. It is governed by and shall be construed an accordance with the laws of state of Kansas. In the event litigation is required to force compliance with, or address

any breach in the agreement, the parties agree that the prevailing party shall be entitled to attorney's fees and costs actually incurred. (Dynamic Concepts, 2008) This is an example of a standard document structure that is used as a reference document for most of the SHA agreements.

Current Process and its Challenges

The client needs to benefit from the services provided by the data center. The current process is disorganized and lacks a logical structure of activities to optimize resource utilization. When the client submits a RFQ to the prospective vendors, the business analyst at the data center replies with a RFP for the procurement, SHA and SHA with SME support option based on the clients' requirements. An initial evaluation of the project based on budget is the most difficult part considered by the client. These initial decisions take time to evaluate whether they want the data center to use their servers or if the client wants to have their own resources running in the environment of the data center. After the proposal is accepted, a SLA document is generated, which brings about consensus between the two parties concerning the project deliverables. Once the process is initiated with any of the options, and if he changes his mind later, it is difficult to switch back to the other service options. The activities to carry out the project are not optimized to employ the resources to their fullest and considerable time is wasted in figuring out the stage of the project and the next actions to be implemented. Due to the absence of a standardized process, if a critical change is made, the process has to start all over again. This causes wastage of time, resources, money, delays in the project and much inconvenience to the data center as well as the client. Thus, to streamline the

process and accommodate changes, selecting the right service options is very important to make the project flexible. Due to the nature of the current process, the costs incurred are higher and the profits are lower.

By merging the existing SHA process with procurement, a RFP (Request for Proposal) can be processed quickly. In order to add value to the organization by gaining profits, this project was developed and analyzed to streamline the process of switching between the projects. There is a generic reference standardized process that can be applied to all the service options offered by XYZ. The workflow of this new standardized process reduces the time required to complete the project, utilizes minimum resources and creates efficient activities for the project. With the introduction of the Asset Management database, the process also makes sure that the information is updated regularly for the project. Asset Management Database is a web based central repository of network devices, power units and server information that is secured by UAC (User Access Control). This helps in availability of accurate information for all the servers, network devices, storage devices as and when required.

The FSP department plays a major role in the process. They are required to coordinate with different departments and perform various tasks in order to provide complete information to the system administration department for process completion. First, they have to go through the entire data floor and analyze different rack positions available to place servers based on the power supply units. Then, they are involved in receiving equipment from the warehouse and performing preliminary check-ups on the servers. They are also involved in different tasks that require an addition of peripherals to non-standardized machines in order to comply with the client requirements.

To achieve the scope of this project, a study was conducted that included personal observations and interviews with different people from different departments. While the meetings were arranged with different department heads and the technical staff, a brief agenda was given to the heads on what information is expected and the information that they possess. Usually, due to the unorganized nature of the process, the delay in system provisioning is prominent. Thus, to deliver all the results, they have to work over-time to keep the project on time. This creates a situation where some available information is not routed to the relevant departments, leading to miscommunication within departments and eventually to incorrect or incomplete information in the Asset Management database. Another concern is the large amount of time spent by the FSP staff to add several additional components due to lack of attention from Fiscal services department while placing an order. This occurs due to lack of communication, unavailability or incompatibility with the vendor. These problems will be resolved with the introduction of Asset Management Database into the new process.

Finally, since the current process does not maintain other department requirements, it prolongs the time required to get the servers ready for the test and production environment. Thus, updating the asset management database at a strategically decided stage of the project phase is very critical. It is a challenge to plan the entire process in order to remove obsolete and redundant data and provide all the departments with the current information at any given point of time. Having achieved this, labor expenses would decrease and current information will help the data center to reduce time in meeting client requirements.

Chapter 2

Literature Review

A literature review was performed to research the topic of business process analysis in a data center environment. There was a great deal of general information available regarding Business Analysis, Business Process Management and how systems provisioning can be automated using IBM Tivoli Storage Manager. Included with all of that information were the numerous references to the APC's project management in a data center, Intel's data center strategy and Symantec's data center transformation. As there were hundreds of books and articles on the topic of Business Analysis and Business Process Management, the search was narrowed down to standardized business process for systems provisioning in a data center environment.

An extensive research was performed regarding standardized process in a data center environment. Surprisingly, there was no detailed information that supported the systems provisioning process framework, there are few articles that support systems provisioning structured according to the organization requirements. Thus, this paper provides additional information to these existing articles that are customized to meet the needs of the Data center at XYZ.

During the research on the process analysis in a data center environment, the author had to ensure that the journals, articles, books were written in last 4-5 years. Due to the drastic changes in technology for data centers, the size of data centers and the number of servers it houses have reduced significantly. Each year technology has brought something faster and more reliable to the table. Data centers are implementing

these technologies every year in order to increase their efficiency and reduce the cost of operation.

Despite the absence of generalized information about systems provisioning in a data center, there were several journal entries and articles supporting it. Below describes the general process. After a RFQ is sent to the data center, an estimate is given to the client for different services provided by data center. This response is based on the labor expenses and the service charges that are involved in the project depending on the requirements of number of servers and the supported application. After the particular type of project is accepted by the client, the process is initiated. In case of a procurement project, the purchasing of servers is evaluated by the Floor Space Planning department and initiated by the Administrative and Fiscal services department as per the requirements submitted by the business analyst. This purchasing is followed by receiving the servers from vendors at the warehouse and setting the servers on the data center floor.

The following literature reference discusses different aspects of the process for server provisioning in different organizations. Along with the summary of these references is the organization's position on the topic.

"*Standardization and Modularity in Network-Critical Physical Infrastructure", White paper # 116 by Suzanne Niles, Senior research analyst, APC Data Center Science Center, 07th February 2005*

The author of this white paper describes the research study on implementation of standardized process for Network-Critical physical infrastructure (NCPI) and conveys that NCPI is the foundation upon which IT and telecommunication networks reside. It

includes different aspects (power, cooling, cabling, management systems, services, racks, physical security and fire protection), which are necessary to consider while evaluating the service charges to the client.

This article focuses on the network with which the systems are connected. The standardization of NCPI helps implement the modular building-block architecture and increases human learning. With these two fundamental characteristics come an array of benefits that spread through the entire infrastructure and touches nearly every aspect of it. This standardization drives the NCPI business value by increasing the availability and agility and decreasing the total cost of ownership. Availability is increased by increasing the reliability of equipment, decreasing Mean Time to Recover (MTTR) and decreasing human error whereas, agility is increased by increasing the speed of deployment, ability to scale and reconfigure. The total cost of ownership is decreased by decreasing the capital cost, decreasing the non-energy operating cost and decreasing the energy cost.

"STRATEGY and PLANNING: Data center facility requirements estimations" by Info-Tech Advisor Premium – Strategies, 13th August 2009

This white paper lays out the strategy and planning to approach a data center project from business perspective and make a decision of either building a server in house or buying it from a vendor. It supports the above paper and defines critical components, decisions and actions surrounding successful adoption of specific technology, tool or process.

According to the article, the decision makers should have a 360- degree view of requirements and costs involved in a data center which includes correct estimation of

different attributes like power, cooling, standby power, fire protection, sizing and architectural space layout.

This explains the importance of those aspects, who is involved at what stage of the project and possible key considerations while evaluating the cost involved in different phases. The planning flow chart in the article provides organization of the process.

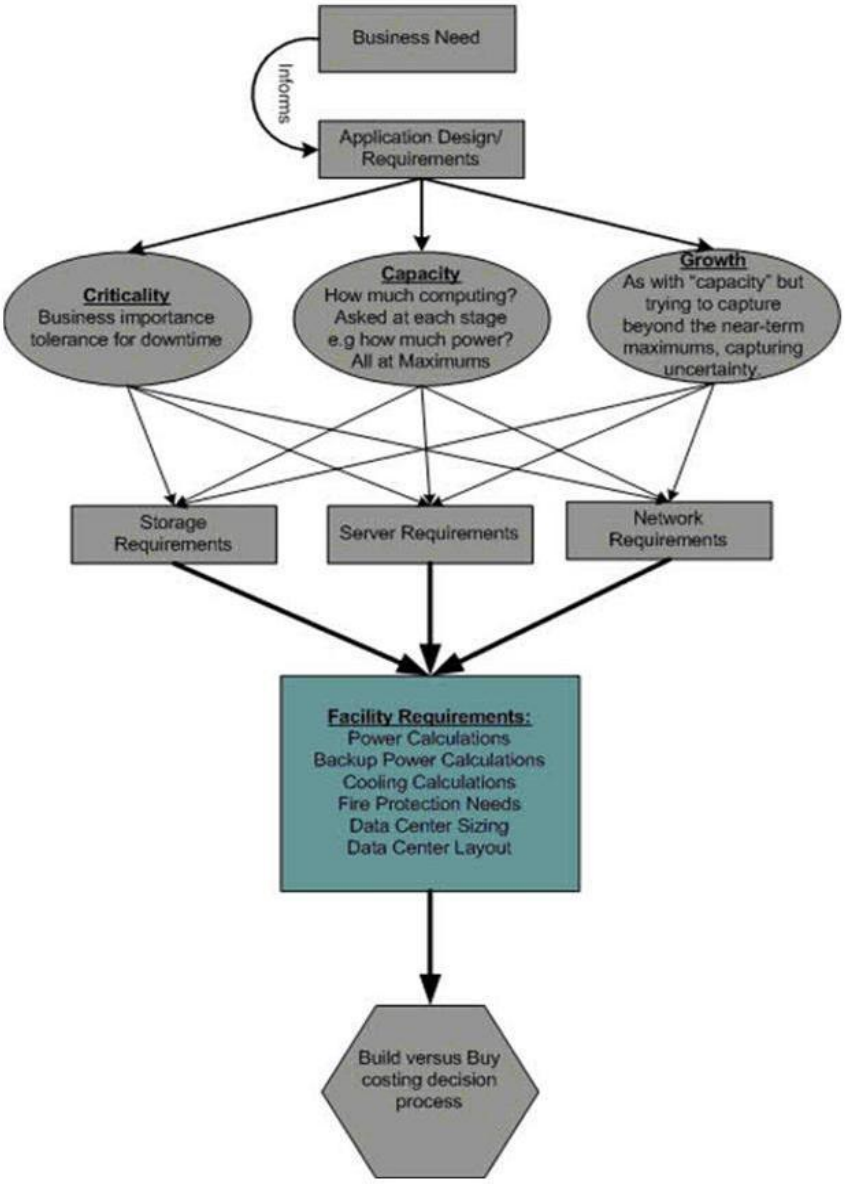


Figure 2 – Data Center Planning Flow Chart (Info-Tech Advisor, 13th August 2009)

"Data Center Projects: Project Management", White paper # 141 by Neil Rasmussen (Chief Technical Officer) APC and by Suzanne Niles (Senior Research Analyst) APC, APC Data Center Science Center, April 2009

Neil and Suzanne describe the project management aspect to the data center projects in this white paper. After optimizing the technical aspects and increasing the business value in white paper # 116, the focus turned towards the project management of data center. This paper describes how the flaws in project management and coordination are common and cause unnecessary delays, expense and frustration. It is recommended to keep a common language, pellucid terminology, clear depiction of responsibilities and complete coverage of necessary activities.

For a standardized process the project management forms a broad foundation for the oversight activity that occurs throughout the project to provide clear communication, planning, coordination and problem resolution. According to the authors, the layer of project management can start at the end of preparation phase for small projects whereas; it can start in the preparation phase for projects with larger scope. This paper describes different phases of project management related to the clients' and APC's responsibilities towards the activities performed during the entire process. The initial project management at the client-side needs to be taken care by the client who can coordinate with vendors, negotiate contracts and release payments. APC takes charge of all the other phases of project management like Project Commitment Management, Engineered Project Management, Planning Management and Installation Management.

Thus according to the authors, the role of project management is to always support and direct the project's activity. These responsibilities and interrelationships of project management cannot be left to assumption or chance, but must be explicitly mentioned, assigned and tracked. The paper gives a very good detailed overview of what characteristics are essential and should be considered in any implementation of a standardized project process.

"Data Center: System Planning", White paper # 142 by Neil Rasmussen (Chief Technical Officer) APC and by Suzanne Niles (Senior Research Analyst) APC, APC Data Center Science Center, 03rd February 2009

These authors have described the planning phase of the system provisioning in this white paper. For them, the mistakes that people make during the planning stage greatly magnify the scope and propagate through later deployment stages as well, resulting in unnecessary delays, cost overruns, wasted time and ultimately a compromised system. They tried to view the planning stage as a data flow model that undergoes an orderly sequence of tasks that progressively transform and refine information from initial concept to final design.

The authors propose that the planning phase comprise of Preparation and Design that consist of activities from Assessing business/client needs to submitting purchase order. Thus, it should follow a logical flow of thought, activity and data that can be transformed from initial project idea into a detailed installation plan. They follow Requirement analysis procedure from Business Analysis Body of Knowledge book to

understand the user requirements and generate specifications to the most precise manner in order to develop the system as per their needs.

The paper concludes that the system planning has always been unstructured and difficult which leaves it open to opportunities for missteps, wrong assumptions and miscommunication that can have a serious impact on the later phases of the project. With the help of standardized data flow, transparency is created with the user requirements and the generated specification so that the appropriate stakeholders are aware of their roles and responsibilities eliminating assumptions and miscommunication. This process is progressively elaborated in order to make it less abstract and more informative.

"Data Center: Standardized Process" White paper # 140 by Neil Rasmussen (Chief Technical Officer) APC and by Suzanne Niles (Senior Research Analyst) APC, APC Data Center Science Center, March 2009

The authors provide a systematic process methodology that can be adopted within any data center environment to suit their requirements. They believe that the process that is repeated frequently delivers the system more quickly, with less expense and fewer defects. Such a process frees up time and resources quickly so that the system design and implementation can increase the scalability of the service providers core competency. The goal of this white paper is not to minimize system expertise, but to facilitate it. According to them the project process phases are – prepare, design, acquire and implement.

They describe planning as the most critical phase; it can help prevent scope creep. The implementation and acquire phases include the shipment of the purchase order and

the assembly with integration of the system with the existing servers that is carried out by subcontractors respectively.

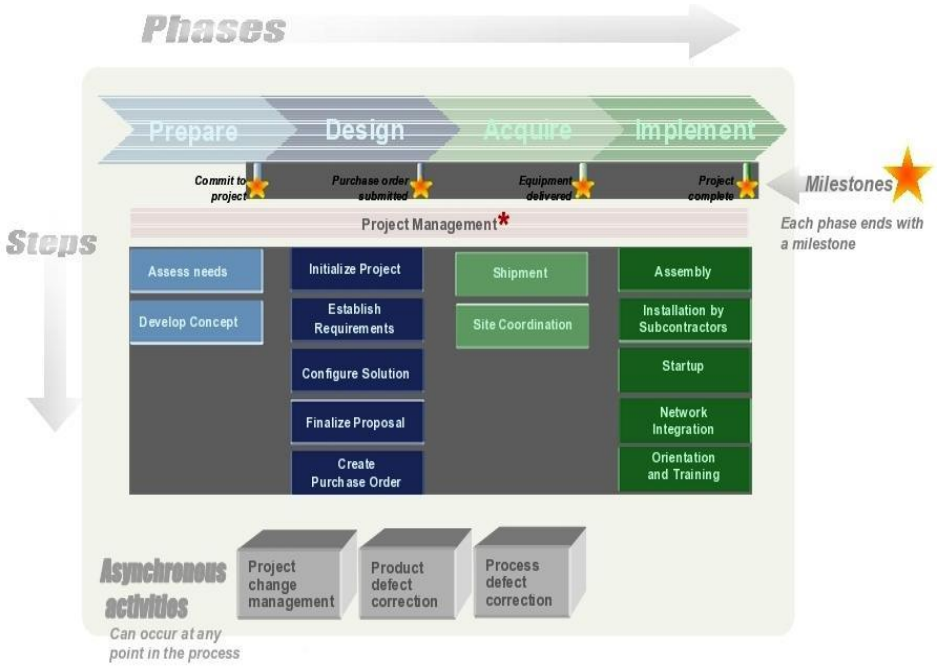


Figure 3: Standardized process (Neil Rasmussen and Suzanne Niles, March 2009)

The authors take milestones, asynchronous activities and customized ordering of the servers into consideration and map the entire process. They even used the tracking responsibility table (equivalent to RACI matrix) to track the responsibilities of the respective stakeholders at different stages of the project.

"Symantec Data Center Transformation: A holistic framework for IT evolution", Data sheet by, Symantec Consulting Services, 6th November 2007

The consulting services at Symantec started implementing the standardized process along with automation in the IT field, which they call Data Center Transformation framework. It provides optimization in IT resources, aligns IT with

business objective and delivers improves IT service levels, agility, and value to the organization. This transformation is known as reengineering.

While standardizing the process, this framework considers the cost of training and replacing staff members who operate the data center. These attributes of standardization help them reduce complexity and cost of managing nonstandard system configurations. They take pride to improve the quality, affordability and portability of applications and data by standardizing storage and server configuration along with backup, clustering and replication of data. Thus, the simplified process greatly enhances the operational efficiency and results in fewer errors and unscheduled downtimes.

Literature Review Summary

The introduction to standardization followed by APC and the case study of Symantec consulting services justifies the need of a standardized process in the data center environment so that everybody is responsible for their own work and there is a sense of transparency among everybody regarding the requirements of the client. The lack of a standardized process leads to unscheduled downtimes, improper process, high cost of ownership, scope creep etc. To take the next step towards eliminating all these defects from the process, data center will have to implement the standardized process. This will help them reduce the cost incurred and the time required to finish the project achieving an efficient process.

Chapter 3

The New Process

The disorganized structure of the current process leads to an inefficient resource utilization that increases time and the budget constraints of the project. Thus, a new process is designed and analyzed to follow a logical standardized structure. The breakdowns of activities involved in the systems provisioning process are divided in five phases as below:

Phases	Major Activities	Responsibility
Phase I – Design	➢ Client sends a quote ➢ Business Analyst evaluates resources and replies with RFP ➢ If accepted, a SLA is signed	Business Analyst FSP System Administration, Application Administration and IT Security Office
Phase II – Purchasing	➢ Space and Network ports reserved by FSP ➢ Information is updated in Asset Management database ➢ Purchasing of equipment is initiated by Fiscal Services	FSP Asset Management Fiscal Services
Phase III – Receiving	➢ Order received at warehouse and checked against PO ➢ Fill paperwork after receiving	Warehouse FSP

Phase IV – Staging	➢ Verification of standard equipment build ➢ Add/Remove components and move to build bench ➢ Connect to power, DRAC/Management port and Install Network	FSP
Phase V - Implementation	➢ System Administration performs imaging equipment ➢ Install Monitoring and Backup software ➢ Notification sent to DL for an update and next stage	System Administration FSP Asset Management

The new process involves streamlining the existing process to make it more efficient with the introduction of an asset management module. Introducing the Asset Management database during the right phase of the project is very crucial in order to eliminate all the discrepancy of the available information and maintaining a consistent data throughout and after the life of the project.

Engineers in different departments estimate that non-value added work in the entire process would be reduced by at least 40% after the new process has been implemented. There are several reasons for this. Firstly, standardizing the entire process significantly reduces the redundant data and any re-work in the entire process.

Everybody in the organization speaks one language so the communication gap decreases. Secondly, there has been an introduction of Asset Management spreadsheet at different instances to keep the data current, avoid inconsistency and keep the data available updated at all times. Finally, due to executing certain task concurrently, the original time span of the project is reduced by one and half day, which is reduction in 7.14% of the time, required completing the project.

The next challenge the new process engulfs is clear delineation of responsibilities resulting from a mutual understanding of who is doing that clarifies relationships and avoids duplication and conflict. Since, the order is checked at every phase against the order sheet; it is assured that the project is being deployed as expected.

Work Breakdown Structure

The project management framework is used to group activities logically and create work breakdown structure of the process in 5 different phases. These phases are: Design, Purchasing, Receiving, Staging and Execution. In order to execute these phases and overcome the challenges of current process, there were certain action items that need to occur. These action items are listed below in the order in which they should be executed.

Phase I: Design

- RFP initiation by client

  RFP initiation will be conducted from the client's end in order to get a quote for their application requirement. The purpose of this task is to provide detailed documents on what their application needs are and get a quote on procurement as well as SHA contracts. As client must already be having all the requirements upfront for their application, this task is schedule for one hour of clients' time, which is not billable towards the project.

- Check requirements against Availability

  This task is a result of RFP initiated by the client and received by the Business Analyst. In order to evaluate the availability of resources, he contacts the FSP, System Administration, Application Administration and IT Security office in order to verify whether the available resources meet the clients requirements or not. As this task has to deal with communication back and forth with several departments, 16 hrs. i.e. two days are dedicated for this task to get all the requirements from all the departments.

- Document requirements and sent to client

    After receiving the resources availability information from all the departments, a document is prepared that contains all the information regarding the nomenclature of servers that will be offered to the client, copy of a SLA, labor requirements and equipment requirements. Three hours of billable time is dedicated for this task to create this document for the client.

- Project evaluation and approval from client.

    The client receives the document from the Business Analyst and analyzes the project specification to make a decision of procurement or SHA. If the received document does not meet the client requirements, they may ask for further needs, which will go back to the first task. This acts as a decision point for the client and he may take up to 16 hours estimated to get back to Computer center with their evaluation. Once the decision is made, in either case, a SLA is signed between the client and the Computer center to proceed with the project initiation. This is the last task in the phase one of the project.

Phase II: Purchasing

- Reserve floor space and request equipment:

    Once the project is initiated, the FSP department has been notified about the project and they are asked to reserve a floor space for the number of required servers. They make a list of equipment required for the project and this request is sent to the Administrative and Fiscal services. This task is scheduled for four hours of time from FSP department.

- Fiscal services initiates Purchase:

  This request is merged with the existing processes of Administrative and Fiscal services (which are not covered under the scope of this paper) and they place an order for the equipment after receiving several financial approvals. This task is scheduled for six hours of billable time towards the project.

- Post-purchase procedure:

  Once the purchase is approved and placed, a notification is sent to the FSP department to setup and configure the reserved asset labels. There are two types of asset labels that are assigned to every asset – 1) DCA – Data Center Asset and 2) FS labels. Data center departments identify these assets by the DCA labels whereas; the administrative and fiscal services department assigns this incoming data with FS labels so that the fiscal services department can keep on track of their investment as well as maintaining internal records. This is followed by updating the Asset Management spreadsheet with all the information that is available at that instance. This task is carried out by the FSP and they passed on the information to the Asset Management group to update.

Phase III: Receiving

- Delivery to warehouse:

  The order is placed with the vendor by the fiscal services depending on the monetary attributes. This task is the responsibility of the Warehouse department. It has been assumed that it takes five business days for the vendor to deliver the

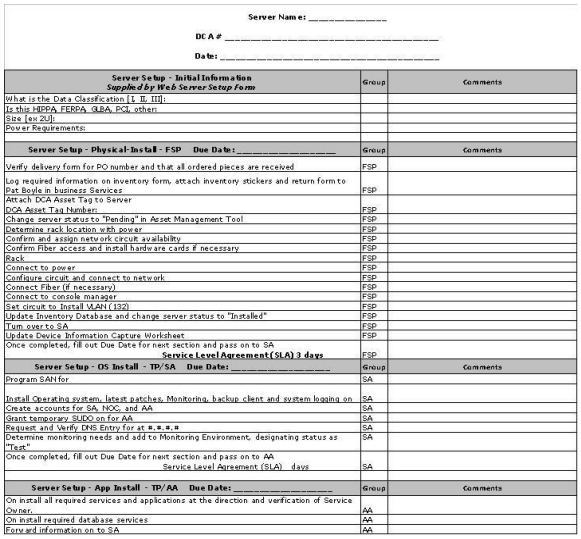
equipment at the Warehouse of the data center and to unload the equipment four hour of billable time is assigned.

- Check against packaging list:

  The received order is checked by the FSP department. This task runs parallel to the above task to reduce the time required to finish the project. This task is a Start-Start type that depends on the predecessor – "Delivery to Warehouse". FSP checks the received equipment against the documentation done by the Fiscal Services group. If these requirements do not match, the process goes back to "Reserve floor space and request equipment" task from the "Purchasing" phase. To check these received equipment, two hours of billable time is assigned.

- Documentation and Notification:

  Warehouse fills up a sheet that is passed on to FSP for the information on the order, after their verification is done. FSP fills out the sheet and stores it with the packaging slip for internal records. Billable time is two hours for this task.



Server Name: _____

DCA # _____

Date: _____

Server Setup - Initial Information *Supplied by Web Server Setup Form*	Group	Comments
What is the Data Classification [I, II, III]:		
Is this HIPPA, FERPA, GLBA, PCI, other:		
Size [ex 2U]:		
Power Requirements:		
Server Setup - Physical-Install - FSP Due Date: _____	Group	Comments
Verify delivery form for PO number and that all ordered pieces are received	FSP	
Log required information on inventory form, attach inventory stickers and return form to Pat Boyle in business Services	FSP	
Attach DCA Asset Tag to Server		
DCA Asset Tag Number:	FSP	
Change server status to "Pending" in Asset Management Tool	FSP	
Determine rack location with power	FSP	
Confirm and assign network circuit availability	FSP	
Confirm Fiber access and install hardware cards if necessary	FSP	
Rack	FSP	
Connect to power	FSP	
Configure circuit and connect to network	FSP	
Connect Fiber (if necessary)	FSP	
Connect to console manager	FSP	
Set circuit to Install VLAN (132)	FSP	
Update Inventory Database and change server status to "Installed"	FSP	
Turn over to SA	FSP	
Update Device Information Capture Worksheet	FSP	
Once completed, fill out Due Date for next section and pass on to SA **Service Level Agreement (SLA) 3 days**	FSP	
Server Setup - OS Install - TP/SA Due Date: _____	Group	Comments
Program SAN for	SA	
Install Operating system, latest patches, Monitoring, backup client and system logging on	SA	
Create accounts for SA, NOC, and AA	SA	
Grant temporary SUDO on for AA	SA	
Request and Verify DNS Entry for at **x.x.x.x**	SA	
Determine monitoring needs and add to Monitoring Environment, designating status as "Test"	SA	
Once completed, fill out Due Date for next section and pass on to AA Service Level Agreement (SLA) days	SA	
Server Setup - App Install - TP/AA Due Date: _____	Group	Comments
On install all required services and applications at the direction and verification of Service Owner.	AA	
On install required database services	AA	
Forward information on to SA	AA	

Fig. 4: Pink Sheet used at Data Center (XYZ, 2004)

Phase IV: Staging

- Verification of Equipment:

  This task is a Start-Start type with a predecessor – "Documentation and Notification" task from the Receiving phase. The verification of equipment is based on the standard build of the servers. FSP takes a print out of the purchase order and affixes labels on the systems. If the servers received are standard build, they are moved on the build bench and unpacked to get started with the next task. This task is carried out by FSP and scheduled by four hours of billable time.

- Install additional components:

  From the above task, if the servers are not a standard build, they are unpacked and additional components are added to the servers so that it complies with the clients' requirement of the applications that will be installed on these servers. This task is assigned for two hours of billable work from the FSP department.

- Connect and Install Network:

  Once the server is ready with all the physical components installed, it is connected to the power and placed on the server rack. The network is designed based on the number of servers and the routing it should take through switches/routers. The Management port and DRAC port of the server is connected to the network and installation of network is initiated on the servers. This designing and installation of network is accounted for eight hours of billable time to the project to the FSP.

Phase V: Implementation:

- Patching system and partitioning:

  Once these servers are set on the server rack and the network is installed, FSP notifies System administration to start with the task of patching the system and partitioning the hard drive as per the application requirements. The firmware and the bios of these servers are patched. After patching the bios, verification and partitioning of hard drive is done by the System Administration. Six hours of billable time is assigned for this task.

- Check against the order sheet:

  All the partitioned servers that are ready with patches are checked against the software requirements of the client. If they meet the software requirements of the client, the pre-installation procedure is initiated by the system administrator. If the software requirements are not met, a notification is sent to the FSP for the task – "Verification of Equipment" task from the staging phase and the process is started again.

- Pre-Installation procedure and Kick start:

  In pre-installation procedure, the system administration department proceeds with configuration of the BIOS, USC (Unified Server Configurator); RAC and RAID controllers. These are important configurations to be done in order to promote a standalone machine to a server. After the configuration is done successfully, which is scheduled for an estimated time of 12 hours, the server is kick started using PXE boot rom. Kick starting the server is schedule for

one hour of billable time so that it can be prepared for the post-installation procedure.

- Post-Installation procedure:

  Once the kick-start procedure is finished, the PXE boot on the NIC cards is disabled. System administrator configures the host networking on the servers that enables them to talk to the allocated SAN/NAS storage area as well as it enables the servers to talk to each other in the network/clusters for redundancy. The operating system is installed and the host name is configured along with the OS profile. After installing the OS, the Legato/Backup software is installed but the backups are not scheduled yet. The post-installation procedure is scheduled for 11 hours of billable time to the System Administration department.

- Configure Monitor and Backup:

  Once the OS profile is created and the backup software is installed, the monitoring software is installed on the server and configured. Thresholds are set in order to mitigate emergency situations resulting from excessive use of data storage on the server. This task is followed by configuring the backup software in order to backup important information in a timely fashion for redundancy and availability of data whenever needed. Information is updated in Asset Management spreadsheet and servers are now ready to be moved to the server rack. This task is scheduled for four hours of billable take to the System Administration.

- System racked and labeled:

  The server is moved to the server rack by the FSP department. As per standards, servers are placed in the racked location, and all the server ports are labeled, cables are labeled, power cables are labeled and installed. This task is accounted for eight hours of billable time to the FSP.

- Update Asset Management spreadsheet and Power-up:

  After the ports and cables are labeled and installed, the information is checked with the Asset Management spreadsheet. If the information matches the spreadsheet, the server is powered on and the systems provisioning process is completed. The Application Administration department takes over the process to install the applications requested by the client on the servers. If the information does not match with the Asset Management spreadsheet, the information is updated and then the servers are powered on to complete the systems provisioning process. This task is accounted for four hours of billable time towards the FSP department and the Asset Management department.

  The entire project is estimated to be completed in 19.5 days. The work breakdown structure was created by using the Microsoft Project. Baselines can be used in the case of discrepancies/delay of the project schedule. An assumption has been made on the average billable per hour wages of different departments that are under consideration. Using these assumed wages, a budget report is created using the Microsoft Budget Report feature in Microsoft Project.

Project Schedule

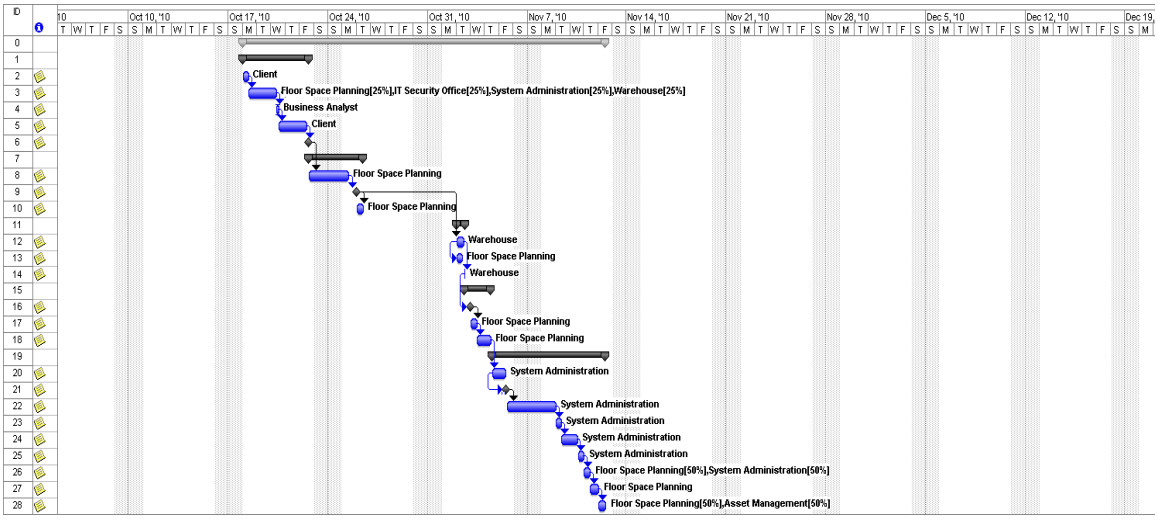
Underlying assumptions:

1) With the level of expertise, the assumed average salary for technical and non-technical staff from different departments is as follows:

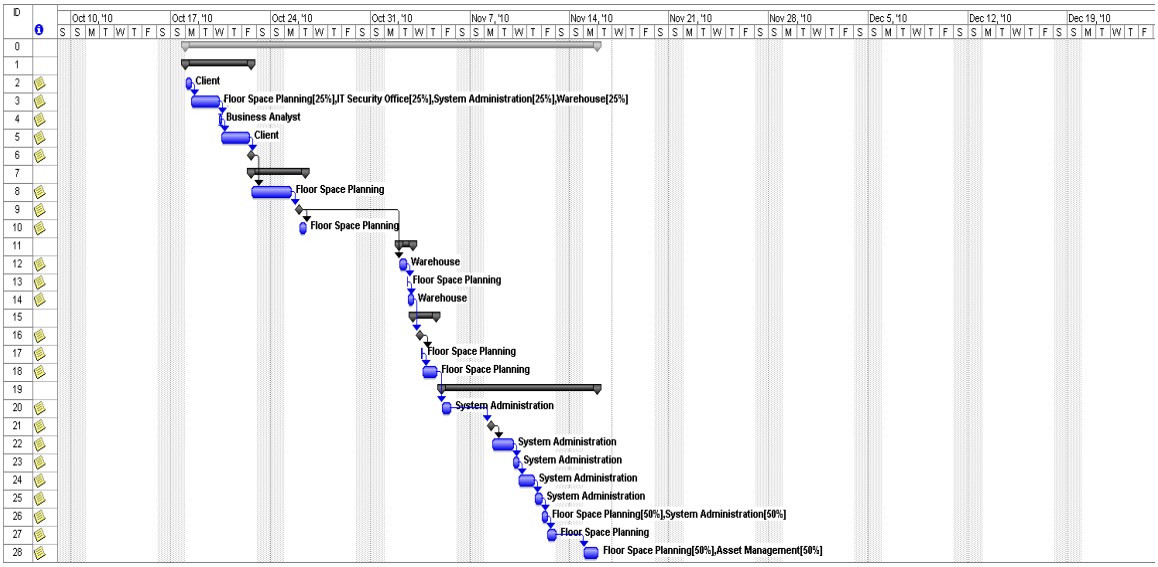
- Business Analyst - $30 per hour
- Fiscal Services - $28 per hour
- Floor Space Planning - $20 per hour
- Asset Management - $20 per hour
- System Administration - $30 per hour
- Application Administration - $30 per hour
- IT Security Office - $30 per hour and
- Warehouse - $20 per hour

2) Efficiency of the technical and non-technical staff to contribute towards the project is assumed to be 90% and non-value added time of 10%.

The action items of the new process will be completed using the following 19.5 days schedule.



Using the current process, the action items were completed in a 21 day schedule as follows:



Organizational Structure

The following organizational structure shows the relationship between all the departments that are involved in this project.

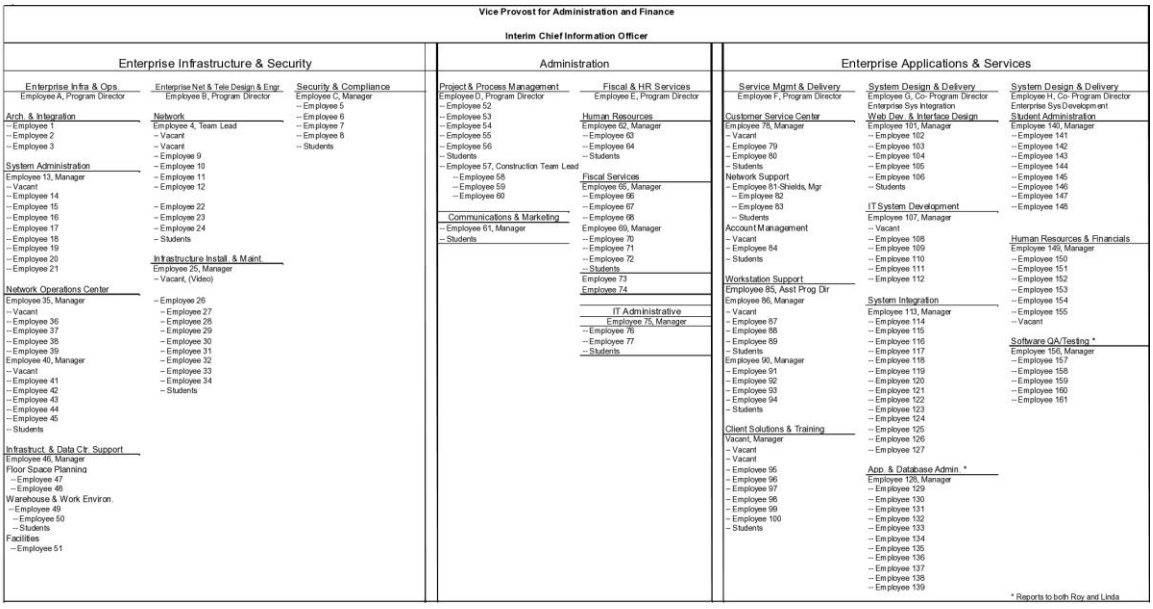


Fig. 5: Organizational Chart, XYZ, updated 15th November 2010

Project Risks

The risks involved in this project are minimal. Below are some of those risks.

1) Understanding client requirements – During the evaluation of the client requirements and stakeholder analysis, the Business Analyst needs to be very careful while creating the scope of the project. The SLA of these projects needs to be carefully designed as well in order to mitigate any liability in case of loss to the client due to compromised data.

2) Placing wrong order – There is a slight chance that the order placed by the Fiscal and Administrative services would be wrong due to lack of communication with Business Analyst or while evaluating the client requirements by Business Analyst.

3) Asset Management Spreadsheet – The asset management spreadsheet needs to be updated manually. This can lead to inconsistent or incorrect data in the spreadsheet due to human errors. Incorrect information is always a risk to any project. In addition, user access to this data sheet is also a risk to the project. This risk is mitigated by implementing a user access control that provides access to restricted number of people and differentiates them based on their role.

4) Vendor selection and services – Selection of vendor is a risky task as it not only involves the cost of equipment but also includes the hardware services provided by the vendor after the servers are deployed in the environment. In addition, the assembly and shipment of the equipment is assumed to be 3-5 business days. A delay in the shipment may lead to a delay in the schedule of the project.

5) The New Process Doesn't Work – If the process does not work the way it is supposed to, it is always an opportunity to do task flexibly and work over-time to keep the schedule of the project on time while compromising on the budget.

Budget

The budget for systems provisioning is evaluated by the Business Analyst and the Project Manager after evaluating the requirements of the client. If money is needed for capital expenditure, a justification is written and presented to the Fiscal and Administrative services department, which gets the proposal approved. All the employees at the Data Center are paid hourly. If the expenditure can pay itself off in less than one year, the expenditure is approved with little or no questions asked.

Some of the tasks in this process are done concurrently, in order to reduce the schedule of the project. This reduces the time of the project thus reduces the billable cost of the project. Major cost incurred in the project is the labor cost. As per the previous estimated schedule of the project, the cost was $2748 (See Appendix C). With performing tasks concurrently, the cost of the project is dropped down to $2348 thus, reduction of 14.5% in the expenses for one project (See Appendix C). Forecasting this saving over the period of one year with as many as 12 projects, saving will go up to $4800 for these 12 projects.

For this project, there are no major expenditures except the labor cost. Time and resources are the only items needed for this project.

Chapter 4

Summary and Conclusion

The systems provisioning at the data center is not standardized and did not involve the asset management as a part of the process. With the ever increasing advancement in technology and the number of servers increasing in the data center, the systems provisioning phase of the project has become a bottleneck for the entire SHA project. Therefore, with well defined; dedicated procedures in place, on-time delivery of the project is ensured for the application administration department. By implementing this process, the delay in the project can be reduced by one and half days (See Appendix B). Clear delineation of responsibilities results due to mutual understanding of who is doing what clarifies relationships and avoids duplication and conflict. The process rules out any communication gap between departments since everybody speaks a common language. Notifications are sent at several milestones during different phases of the project. When all the departments work on the same model, using the same terminology to refer to same things, many problems caused by miscommunication and different viewpoints are eliminated. It also avoids the responsibility gaps and eliminates the duplication of effort, and achieves an efficient process.

This clearly defined process, with phases, logical concurrent steps and milestones reduces the cost incurred in the project. With the underlined assumptions for the labor efficiency and cost, the process saves $400 only in the labor cost of the project (See Appendix C). This is 14.5% reduction in the cost incurred with the current process in place. This is a small saving for a project but considering the number of projects undertaken over the period of one year, it is a considerable amount of saving that adds

value to the organization. Having a standardized systems provisioning process eliminates the defects that might turn up in the later stages of the project, or even if the project is complete. Finally, standardized process will reduce re-work, accelerate cycle time and a system that is deployed as expected.

Chapter 5

Suggestions for Future Research

This process focuses only on the system provisioning of the entire SHA project. The next stage of the project can be designed and implemented in order to cut down on costs incurred in the entire project.

In addition, the assets are currently maintained in a Microsoft Excel spreadsheet. It is hard to find information and the probability of entering wrong information in the respective cell increases due to human errors. Rather than using a spreadsheet, more efficient tools like Microsoft Access, which is free, can be used to develop a database with interactive options to view needed information.

A web-based tracking and status system can be implemented that is accessible to all stakeholders (both the customer and the internal departments of XYZ), for asset information, shared documentation, data, and reports.

To automate the entire project involving all the departments, an Oracle or SAP software can be implemented that will automate the process and give current information on all the steps involved in the project at all time.

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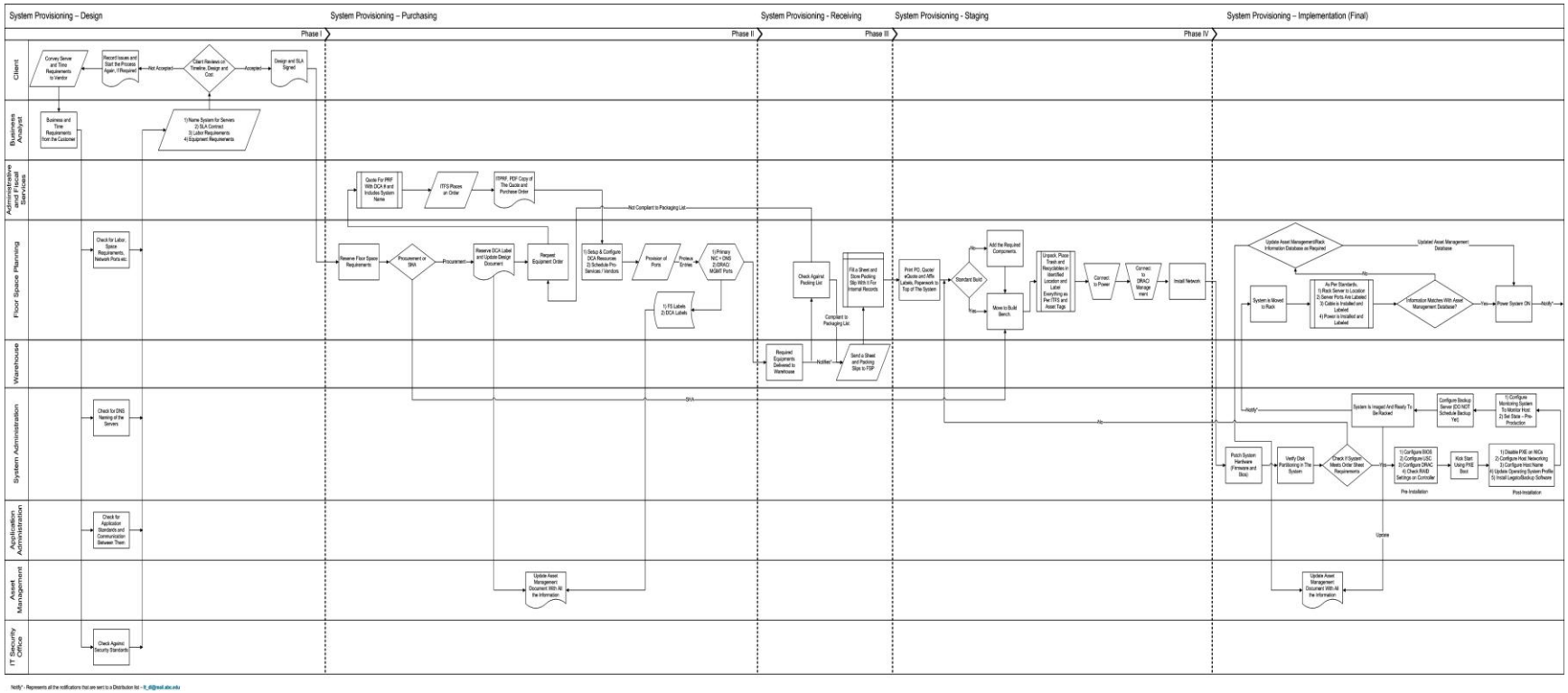
Appendix A – Process Map



Appendix B – Work Breakdown Structure

New Process:

ID	Task Name	Duration	Start	Baseline Deliverable Start	Finish	Baseline Deliverable Finish	Predecessors	Resource Names
0	**Field Project Gantt Chart**	**19.5 days**	**Mon 10/18/10**	**Fri 9/8/17**	**Fri 11/12/10**	**Fri 11/12/10**		
1	**Design**	**4.75 days**	**Mon 10/18/10**	**Mon 10/18/10**	**Fri 10/22/10**	**Fri 10/22/10**		
2	RFP initiated by Client and sent to Vendor	1 hr	Mon 10/18/10	Mon 10/18/10	Mon 10/18/10	Mon 10/18/10		Client
3	Check requirements against availability	16 hrs	Mon 10/18/10	Mon 10/18/10	Wed 10/20/10	Wed 10/20/10	2	Floor Space Planning[25%],IT Security Office[25%],System Administration[25%],Warehouse[25%]
4	Review, verify and sent to customer	3 hrs	Wed 10/20/10	Wed 10/20/10	Wed 10/20/10	Wed 10/20/10	3	Business Analyst
5	Client Reviews and Evaluates	16 hrs	Wed 10/20/10	Wed 10/20/10	Fri 10/22/10	Fri 10/22/10	4	Client
6	SLA signed and Design process initiated	2 hrs	Fri 10/22/10	Fri 10/22/10	Fri 10/22/10	Fri 10/22/10	5	
7	**Purchasing**	**1.5 days**	**Fri 10/22/10**	**Fri 10/22/10**	**Tue 10/26/10**	**Tue 10/26/10**		
8	Reserve floor space and request equipment	4 hrs	Fri 10/22/10	Fri 10/22/10	Mon 10/25/10	Mon 10/25/10	6	Floor Space Planning
9	Fiscal Services initiates Purchase	6 hrs	Mon 10/25/10	Mon 10/25/10	Mon 10/25/10	Mon 10/25/10	8	Fiscal Services
10	Post-purchase confirmation to FSP	2 hrs	Tue 10/26/10	Tue 10/26/10	Tue 10/26/10	Tue 10/26/10	9	Floor Space Planning
11	**Receiving**	**0.75 days**	**Tue 11/2/10**	**Tue 11/2/10**	**Tue 11/2/10**	**Tue 11/2/10**		
12	Delivery to Warehouse	4 hrs	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	9FS+5 days	Warehouse
13	Check against packaging list	2 hrs	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	12SS	Floor Space Planning
14	Documentation and notification	2 hrs	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	12	Warehouse
15	**Staging**	**1.75 days**	**Tue 11/2/10**	**Tue 11/2/10**	**Thu 11/4/10**	**Thu 11/4/10**		
16	Verification of equipments	4 hrs	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	Tue 11/2/10	14SS	Floor Space Planning
17	Install additional hardware components	2 hrs	Wed 11/3/10	Wed 11/3/10	Wed 11/3/10	Wed 11/3/10	16	Floor Space Planning
18	Connect and install network	8 hrs	Wed 11/3/10	Wed 11/3/10	Thu 11/4/10	Thu 11/4/10	17	Floor Space Planning
19	**Implementation**	**6 days**	**Thu 11/4/10**	**Thu 11/4/10**	**Fri 11/12/10**	**Fri 11/12/10**		
20	Patching system and partitioning	6 hrs	Thu 11/4/10	Thu 11/4/10	Fri 11/5/10	Fri 11/5/10	18FS+2 hrs	System Administration
21	Check against the order sheet	6 hrs	Thu 11/4/10	Thu 11/4/10	Fri 11/5/10	Fri 11/5/10	20SS	System Administration
22	Pre-installation procedure	12 hrs	Fri 11/5/10	Fri 11/5/10	Mon 11/8/10	Mon 11/8/10	21	System Administration
23	Kick Start	1 hr	Tue 11/9/10	Tue 11/9/10	Tue 11/9/10	Tue 11/9/10	22	System Administration
24	Post-installation procedure	11 hrs	Tue 11/9/10	Tue 11/9/10	Wed 11/10/10	Wed 11/10/10	23	System Administration
25	Configure Monitoring and Backup server on host	4 hrs	Wed 11/10/10	Wed 11/10/10	Wed 11/10/10	Wed 11/10/10	24	System Administration
26	System ready and moved to Rack	2 hrs	Thu 11/11/10	Thu 11/11/10	Thu 11/11/10	Thu 11/11/10	25	Floor Space Planning[50%],System Administration[50%]
27	Label the equipments physically	6 hrs	Thu 11/11/10	Thu 11/11/10	Thu 11/11/10	Thu 11/11/10	26	Floor Space Planning
28	Update Asset Management database and Power on	4 hrs	Fri 11/12/10	Fri 11/12/10	Fri 11/12/10	Fri 11/12/10	27	Floor Space Planning[50%],Asset Management[50%]

Current Process:

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
0	**Field Project Gantt Chart (Old Process)**	**21 days**	**Mon 10/18/10**	**Mon 11/15/10**		
1	**Design**	**4.75 days**	**Mon 10/18/10**	**Fri 10/22/10**		
2	RFP initiated by Client and sent to Vendor	1 hr	Mon 10/18/10	Mon 10/18/10		Client
3	Check requirements against availability	16 hrs	Mon 10/18/10	Wed 10/20/10	2	Floor Space Planning[25%],IT Security Office[25%],System Administration[25%],Warehouse[25%]
4	Review, verify and sent to customer	3 hrs	Wed 10/20/10	Wed 10/20/10	3	Business Analyst
5	Client Reviews and Evaluates	16 hrs	Wed 10/20/10	Fri 10/22/10	4	Client
6	SLA signed and Design process initiated	2 hrs	Fri 10/22/10	Fri 10/22/10	5	
7	**Purchasing**	**1.5 days**	**Fri 10/22/10**	**Tue 10/26/10**		
8	Reserve floor space and request equipment	4 hrs	Fri 10/22/10	Mon 10/25/10	6	Floor Space Planning
9	Fiscal Services initiates Purchase	6 hrs	Mon 10/25/10	Mon 10/25/10	8	Fiscal Services
10	Post-purchase confirmation to FSP	2 hrs	Tue 10/26/10	Tue 10/26/10	9	Floor Space Planning
11	**Receiving**	**1 day**	**Tue 11/2/10**	**Tue 11/2/10**		
12	Delivery to Warehouse	4 hrs	Tue 11/2/10	Tue 11/2/10	9FS+5 days	Warehouse
13	Check against packaging list	2 hrs	Tue 11/2/10	Tue 11/2/10	12	Floor Space Planning
14	Documentation and notification	2 hrs	Tue 11/2/10	Tue 11/2/10	13	Warehouse
15	**Staging**	**1.75 days**	**Wed 11/3/10**	**Thu 11/4/10**		
16	Verification of equipments	4 hrs	Wed 11/3/10	Wed 11/3/10	14	Floor Space Planning
17	Install additional hardware components	2 hrs	Wed 11/3/10	Wed 11/3/10	16	Floor Space Planning
18	Connect and install network	8 hrs	Wed 11/3/10	Thu 11/4/10	17	Floor Space Planning
19	**Implementation**	**7 days**	**Fri 11/5/10**	**Mon 11/15/10**		
20	Patching system and partitioning	6 hrs	Fri 11/5/10	Fri 11/5/10	18FS+2 hrs	System Administration
21	Check against the order sheet	6 hrs	Fri 11/5/10	Mon 11/8/10	20	System Administration
22	Pre-installation procedure	12 hrs	Mon 11/8/10	Tue 11/9/10	21	System Administration
23	Kick Start	1 hr	Wed 11/10/10	Wed 11/10/10	22	System Administration
24	Post-installation procedure	11 hrs	Wed 11/10/10	Thu 11/11/10	23	System Administration
25	Configure Monitoring and Backup server on host	4 hrs	Thu 11/11/10	Thu 11/11/10	24	System Administration
26	System ready and moved to Rack	2 hrs	Fri 11/12/10	Fri 11/12/10	25	Floor Space Planning[50%],System Administration[50%]
27	Label the equipments physically	6 hrs	Fri 11/12/10	Fri 11/12/10	26	Floor Space Planning
28	Update Asset Management database and Power on	8 hrs	Mon 11/15/10	Mon 11/15/10	27	Floor Space Planning[50%],Asset Management[50%]

Appendix C – Budget Analysis

New Process:

Budget Report as of Wed 11/17/10
Field Project Gantt Chart

ID	Task Name	Fixed Cost	Fixed Cost Accrual	Total Cost	Baseline	Variance	Actual	Remaining
22	Pre-installation procedure	$0.00	Prorated	$360.00	$360.00	$0.00	$0.00	$360.00
24	Post-installation procedure	$0.00	Prorated	$330.00	$330.00	$0.00	$0.00	$330.00
3	Check requirements against availabilit	$0.00	Prorated	$200.00	$200.00	$0.00	$0.00	$200.00
20	Patching system and partitioning	$0.00	Prorated	$180.00	$180.00	$0.00	$0.00	$180.00
21	Check against the order sheet	$0.00	Prorated	$180.00	$180.00	$0.00	$0.00	$180.00
9	Fiscal Services Initiates Purchase	$0.00	Prorated	$168.00	$168.00	$0.00	$0.00	$168.00
18	Connect and install network	$0.00	Prorated	$160.00	$160.00	$0.00	$0.00	$160.00
25	Configure Monitoring and Backup serv	$0.00	Prorated	$120.00	$120.00	$0.00	$0.00	$120.00
27	Label the equipments physically	$0.00	Prorated	$120.00	$120.00	$0.00	$0.00	$120.00
4	Review, verify and sent to customer	$0.00	Prorated	$90.00	$90.00	$0.00	$0.00	$90.00
12	Delivery to Warehouse	$0.00	Prorated	$80.00	$80.00	$0.00	$0.00	$80.00
16	Verification of equipments	$0.00	Prorated	$80.00	$80.00	$0.00	$0.00	$80.00
28	Update Asset Management database :	$0.00	Prorated	$80.00	$80.00	$0.00	$0.00	$80.00
26	System ready and moved to Rack	$0.00	Prorated	$50.00	$50.00	$0.00	$0.00	$50.00
13	Check against packaging list	$0.00	Prorated	$40.00	$40.00	$0.00	$0.00	$40.00
14	Documentation and notification	$0.00	Prorated	$40.00	$40.00	$0.00	$0.00	$40.00
17	Install additional hardware components	$0.00	Prorated	$40.00	$40.00	$0.00	$0.00	$40.00
23	Kick Start	$0.00	Prorated	$30.00	$30.00	$0.00	$0.00	$30.00
2	RFP Initiated by Client and sent to Ven	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
5	Client Reviews and Evaluates	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
6	SLA signed and Design process initia	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
8	Reserve floorspace and request equip	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
10	Post-purchase confirmation to FSP	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00		$2,348.00	$2,348.00	$0.00	$0.00	$2,348.00

Current Process:

Budget Report as of Wed 11/17/10
Field Project Gantt Chart (Old Process)

ID	Task Name	Fixed Cost	Fixed Cost Accrual	Total Cost	Baseline	Variance	Actual	Remaining
3	Check requirements against availabilit	$0.00	Prorated	$400.00	$0.00	$400.00	$0.00	$400.00
22	Pre-installation procedure	$0.00	Prorated	$360.00	$0.00	$360.00	$0.00	$360.00
24	Post-installation procedure	$0.00	Prorated	$330.00	$0.00	$330.00	$0.00	$330.00
20	Patching system and partitioning	$0.00	Prorated	$180.00	$0.00	$180.00	$0.00	$180.00
21	Check against the order sheet	$0.00	Prorated	$180.00	$0.00	$180.00	$0.00	$180.00
9	Fiscal Services Initiates Purchase	$0.00	Prorated	$168.00	$0.00	$168.00	$0.00	$168.00
18	Connect and install network	$0.00	Prorated	$160.00	$0.00	$160.00	$0.00	$160.00
28	Update Asset Management database	$0.00	Prorated	$160.00	$0.00	$160.00	$0.00	$160.00
25	Configure Monitoring and Backup serv	$0.00	Prorated	$120.00	$0.00	$120.00	$0.00	$120.00
27	Label the equipments physically	$0.00	Prorated	$120.00	$0.00	$120.00	$0.00	$120.00
4	Review, verify and sent to customer	$0.00	Prorated	$90.00	$0.00	$90.00	$0.00	$90.00
8	Reserve floorspace and request equip	$0.00	Prorated	$80.00	$0.00	$80.00	$0.00	$80.00
12	Delivery to Warehouse	$0.00	Prorated	$80.00	$0.00	$80.00	$0.00	$80.00
16	Verification of equipments	$0.00	Prorated	$80.00	$0.00	$80.00	$0.00	$80.00
26	System ready and moved to Rack	$0.00	Prorated	$50.00	$0.00	$50.00	$0.00	$50.00
10	Post-purchase confirmation to FSP	$0.00	Prorated	$40.00	$0.00	$40.00	$0.00	$40.00
13	Check against packaging list	$0.00	Prorated	$40.00	$0.00	$40.00	$0.00	$40.00
14	Documentation and notification	$0.00	Prorated	$40.00	$0.00	$40.00	$0.00	$40.00
17	Install additional hardware component	$0.00	Prorated	$40.00	$0.00	$40.00	$0.00	$40.00
23	Kick Start	$0.00	Prorated	$30.00	$0.00	$30.00	$0.00	$30.00
2	RFP Initiated by Client and sent to Ven	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
5	Client Reviews and Evaluates	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
6	SLA signed and Design process initia	$0.00	Prorated	$0.00	$0.00	$0.00	$0.00	$0.00
		$0.00		$2,748.00	$0.00	$2,748.00	$0.00	$2,748.00