Information Management at MUSC:

A Strategy for Tomorrow

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My goal as Associate Provost for Information Technology is to add momentum to the task of making MUSC great. To meet this goal, I have identified several core problems in the information management arena and made some experiments to determine if these core problems can be resolved. From these experiments, I have developed a strategy for information management at MUSC that addresses these problems and will move us further into the internet era.

The core of this strategy revolves around the people at MUSC and their ideas. To be great, we must chase great ideas. Since I cannot identify who will have the next great idea, I must create an environment where students, faculty and staff can chase their curiosity at any time and from anywhere. All of us need access to institutional information resources, and all of us need tools with which to transform information according to our individual needs preferably without the IT infrastructure or IT personnel getting in the way.

I view my position as that of Minister of Transport, where my primary goal is to enable movement of data between resources and your desktop. Our internet connectivity, dial-up access (PPP) and campus communication are the tools I have for enabling you to move information without interference from the IT support team. Our collective focus is information management and not information technology.

I purposely distinguish information management from information technology. Information management refers to the flow of information within the institution, and thus is critically dependent on institutional processes that define the flow of information. Information technology represents the tools that facilitate the flow and manipulation of information.

I formed the IT Lab (http://www.itlab.musc.edu) in order to develop and test a number of ideas that facilitate data transport. After two years, our work-in-progress is visible and a number of MUSC staff can now access institutional resources via a web browser without my getting in their way. We have found that our IT toolbox (http://www.itlab.musc.edu/mytools) enables folks to do their work better, more accurately and more timely and the development of this toolbox is my primary objective. Our successes with the IT toolbox has shown us that it is time to move from the laboratory stage to the pilot stage.

Major Observations:

Over the past several years, I have observed a number of areas within MUSC that caused problems for students, staff and faculty. These areas all had several common denominators, and I believe that if we can develop tools that directly address these common denominators, then we have a foundation on which to build a strong base of IT support for MUSC processes.

1) The same data are being requested from students, faculty and staff for entry in many different systems. In other words, there is little sharing of common data between different institutional data repositories (parking, finance, grants, hr, enrollment services, public safety, etc.)

2) Access to institutional data repositories is limited, in most cases, to individuals in specific service departments, and access often requires that special programs (client programs) be installed on user desktop computers.

3) Many mission critical processes have little structure and in many cases, existing processes have not been reengineered for use within an internet environment. For example, faculty appointment and tracking, personnel status tracking, and credit-card procurement appear to either just happen or are bogged down in very complex forms (PEAR).

4) In many places, operational processes are viewed independently and autonomously from software acquisition. In other words, there is the assumption that processes need not be reengineered in order to embrace the communications flexibility provided by internet connectivity (internet connectivity is the ability to use a browser and visit any desired web site). For example, in the electronic medical record project, >10% of the accounts have an error with the history number / SSN. Software managing the Master Patient Index is being evaluated without parallel investigations into the source of the errors. Similarly, the electronic order entry system has never moved beyond the test phase (for 2 years) in spite of the potential financial gain resulting from being able to dynamically link CPT codes for procedures with ICD9 diagnostic codes.

5) Internet browser skills of faculty and support staff are often behind that of the students.

6) There is very little monitoring of computer and network processes, and consequently, operational problems that could have been identified before they became significant are often only noted after the fact.

Strategy:

Our strategy for building an IT support foundation that allows MUSC to grow with increased productivity is based on 4 principles:

1) We will implement browser-based accessible data entry forms and browser-based access tools for mining institutional databases (http://www.itlab.musc.edu/mysites, http://bfs.itlab.musc.edu/playground/html_pdf_demo.html).

2) We will package data (either from a database or a user) in a portable format (XML objects or tab-delimited records).

3) We will develop workflow managers for routine acquisition, processing, approval and compilation of documents (http://bfs.itlab.musc.edu/workflow/docs/workflow_demo.htm) (http://bfs.itlab.musc.edu/workflow/docs/broadcast_flow.htm).

4) We will exteriorize our major applications through the use of wrapper technology. Changes in tomorrows work are difficult to anticipate today. Traditionally, when work stations were connected directly to a database, the applications (scheduling, finance etc) were embedded in the database system. Changes in these systems are difficult and costly because these programs are often limited to interact only with the database in which they were embedded and only in a predetermined manner. In addition, embedded applications must know about all other applications they interact with thereby increasing the complexity of communications between applications (n applications can possibly interact with n-1 other applications, resulting in n^2 communication complexity. Increased complexity can hide a ripple effect of a simple change in one application.). By taking advantage of internet connectivity, though, we can reduce the maintenance and evolution costs. Workstation programs will use a browser to interact with any of a number of wrapper applications that are established outside of institutional databases like a wrapper around a piece of candy. We will develop user tools to be database wrappers around existing institutional resources. In other words, we will build globally accessible interfaces to legacy (old mainframe) databases that in many respects will immunize applications from upgrades and changes in institutional databases. These wrappers will provide for transporting data from the database to your desktop in any one of several useful formats: HTML for displaying the data, tab delimited records that can be imported into a desktop application and ms-excel that drops the data into an Excel spreadsheet. Because wrappers are external to the databases, they only need to know about the n targets, thus reducing the communication complexity from quadratic to linear. We call this wrapper technology.

How does this compare with the way we do things today?

In the mainframe era (before the internet), databases resided on large mainframe computers, and video displays were connected directly to the computer. Consequently, all the logic about managing information were buried within database applications that were tightly bound to a particular database. Data was not readily exportable to desktop applications and there was little interaction between database applications in different databases. If there were m database applications, and all of them interacted with each other, then there were m^2 possible communication paths, with a resulting complexity that was difficult to maintain

(changing one application often required minor alterations in the other applications). By divorcing the data capture process from the data management process we reduce the complexity of communication to m, the number of target databases. By packaging the captured data in a portable format, each program need only know about the portable format and the complexity of software design is dramatically reduced. Moreover, by externalizing the primary data, it is available to be used by applications that we are unable to visualize today.

MUSC management requires acquisition and transformation of information in a manner that facilitates decision making. To facilitate acquisition, transport and processing of information, we have designed a workflow manager which resembles an email system that accepts submitted information and provides a series of actions that can be performed by the manager, (e.g., approving, signing, forwarding, saving, collating and consolidating) (http://bfs.itlab.musc.edu/workflow/docs/workflow_demo.htm). We use browser-accessible forms to capture information, and email-like routing to move the information to a manager who processes the information. We assign unique identifiers to each document, like a FedEx tracking number in order to facilitate monitoring information flow. We timestamp the document so that we can monitor document processing time. We see browser-based workflow management as an important tool for MUSC as we transition from paper to paperless processes.

All of our tool development requires a software design strategy. Our software design strategy is based on a new approach we have developed called inductive software design. The basic idea is to solve one problem for one client. Then when the next instance of a similar problem arises, we extract the common denominator, adapt to the new use and in this manner, successively evolve the solution from 1 to many. By paying careful attention to identifying common threads and by paying careful attention to scaling issues (i.e., designs that will be become prohibitively expensive when we grow from a single user to 1000 users), we can move MUSC from the paper era to the paperless era.

Demonstrations:

For the past 6 months, we have moved systems from the lab stage to the pilot state. We currently have 3 production workflow managers in the Public Relations and Enrollment Services departments. Under development are workflow managers for address changes in the Human Resources Department, building the agenda booklet for the Trustees and building and tracking a proposal for the Institutional Review Board.

Links to our production systems are

1) Bluesheet seminar notices: (http://www.musc.edu/pr/bluesheet)

2) Broadcast email: (http://www.musc.edu/broadcast)

3) Manage new information for incoming students: (http://www.musc.edu/newstudent) (click on News Link)

We have built a web portal to MUSC: (http://my.musc.edu) where you can personalize a home page and display content boxes that range in content from the Bluesheet to library links to newspaper links to computer/technology information (slashdot.org and freshmeat.net). Also included is a web-cam live video of the front horseshoe from one of Chief Wileys cameras. Here, the idea is that departments will contribute content boxes of information so that students, faculty and staff can have as many of these frequently used resources available as they want, only 1 click away.

The next move:

The next moves are complex. We have a major cultural problem a faculty and staff that are unfamiliar with web technology and are unfamiliar with some essential web tools (e.g., http://www.google.com for answering questions about anything, teach yourself tutorial sites (make a google search for HTML tutorial, and note the first entry is http://www.cwru.edu/help/introHTML/toc.html one of many university web sites that offer excellent tutorials for their students), open laboratories (http://bioinformatics.org) and open textbooks (http://www.rrz.uni-hamburg.de/biologie/b_online/e00/default.htm). I believe that our web portal (http://my.musc.edu), workflow manager and our web-database interfaces (http://www.itlab.musc.edu/mysites) will smooth this transition by presenting everyone with a familiar screen, instead of a different displays for different applications. As we move forward, we need to identify strategies to engage the faculty in looking at their teaching strategies and identifying where IT tools might facilitate conveying their ideas and insights into a certain topic.

We need to identify and prioritize institutional processes that require reengineering and then adapt the workflow manager template to that process. In some respects, we must reinvent or reengineer the MUSC management processes. With the support of the Information Management Council, I believe we can redirect our outsource supplier to focus on this new paradigm for managing our institutional information resources.