

Higher Education ERP: A Framework to Reduce the Pain

Kris T. Pegah, M.S.
Ringling School of Art and Design
2700 North Tamiami Trail
Sarasota, FL 34234
941-359-7633
kpegah@ringling.edu

Mahmoud Pegah, Ph.D.
Ringling School of Art and Design
2700 North Tamiami Trail
Sarasota, FL 34234
941-359-7625
mpegah@ringling.edu

Terry M. Dillow
TMD Corp.
One Main Street
Le Roy, NY 14482
585-768-7082
tdillow@tmdcorp.net

ABSTRACT

Higher Education Institutions are now spending a significant portion of their budget to implement and maintain modern Enterprise Resource Planning (ERP) solutions. ERP is a software solution that integrates information and business processes to enable information entered once into the system to be available across the information technology infrastructure.

In this report, we provide our framework to implement a secure infrastructure for ERP systems which is scalable, robust, easy to maintain, and has the potential to save Higher Education institutions considerable amounts of money and manpower. We will be addressing cost-effective and efficient deployment of applications using Citrix® MetaFrame™ and NFuse™ structure. Moreover, we will discuss the issues we had to address and the lessons we learned during and after the implementation phase.

Categories and Subject Descriptors

H.2.7. [Database Management]: Database Administration --- *Security, integrity, and protection*; K.6.1 [Management of Computing and Information Systems]: Project and People Management - *Strategic information systems planning, Systems analysis and design*; Installation Management - *Computing equipment management*; Security and Protection - *Invasive software, Unauthorized access*; J.1 [Administrative Data Processing]: *Education*

General Terms

Management, Economics, Reliability, Security.

Keywords

Administrative Systems Infrastructure, ERP, Best of Breed, Security, Isolated Network.

1. INTRODUCTION

When Ringling School of Art and Design embarked on its Enterprise Resource Planning (ERP) System implementation five years ago, Ringling was faced with the decision whether to go with an integrated solution or to go with “Best of Breed”. ERP is

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a software solution that integrates information and business processes to enable information entered once into the system to be available across the information technology infrastructure. [1] At the time, several Higher Education ERP systems were considered, including solutions from SCT, Datatel, PeopleSoft, etc. With the assistance of TMD, Inc., a consulting firm in higher education, a full analysis of Ringling School was performed. After analyzing the administrative staff, their needs, the institution’s size and budget, and supporting IT staff, the “best of breed” methodology was chosen for implementing a Higher Education ERP at Ringling School. Once this paradigm was chosen and the various applications identified, the IT department was faced with the intriguing challenge of designing an administrative systems infrastructure to deploy these applications. In planning for the new administrative systems infrastructure, many criteria were identified that needed to be met by our administrative systems computing infrastructure. These included the following:

- Secure data from the top security risks
- Unlimited access to authorized users
- Low “Total Cost of Ownership”
- Maintainability of the system
- High performance/High reliability
- Scalability/Adaptability

2. THE BEST OF BREED APPROACH

The primary benefit of the “best of breed” model is that it gives the end users the best applications for their specific roles. However, from the perspective of technology support, there are numerous challenges. Because of the lack of integration, interfaces must be created and maintained for the applications to communicate with one another. Furthermore, in the “best of breed” model, the number of client applications and servers is quite high. Keeping on top of updates on both the clients and servers is a tedious and time-consuming task.

Another problem we faced is most staff members require access to several applications. However, since the applications come from various vendors, there may be incompatibilities in the software components. Thus the client applications may not live in harmony on the same workstation. For example, many of the best of breed applications use Crystal Reports for their underlying reporting tool. The problem arises when these applications use different versions of Crystal Reports, MS Access, and other software components. Since you normally cannot install the two

different versions on the same workstation, you are left with a dilemma of which application to provide the user.

By leveraging the advantages of thin client/application server based computing [2], we addressed these issues and provided a total solution for our Best of Breed Higher Education ERP System Infrastructure.

3. OUR SOLUTION

Our solution is based on the principle that information is the most important asset on campus, and therefore providing easy access to the information in a secure environment is crucial. We started with the idea that the ultimate security can only be provided if the administrative systems were on a separate network, completely isolated from the rest of the campus network and the Internet. Of course, this solution is not practical, but it provided the framework for our solution.

We designed our infrastructure around an “Isolated Network” to which we connect the database servers. Since the databases needed to be accessed by the client applications, we installed all

the client applications on Application Servers running Citrix® MetaFrame™. There are two Network Interfaces Cards (NICs) installed on each application server. One NIC connects the application server to the “Isolated Network”, and the other NIC connects the application server to the campus network. Figure 1 exhibits a simplified schematic of the resulting network architecture.

The Administrative Staff workstations act as thin clients running the Citrix MetaFrame™ client. Since the applications are no longer installed on the administrative staff workstations, we needed a method for administrative staff to easily access their applications. We utilized Citrix® Systems NFuse™ Application Portal, a web-based application deployment system. The administrative staff launch applications through a web site served by Citrix® NFuse™. The applications run on the MetaFrame™ servers and are seamlessly displayed on the staff’s workstation.

The components of this solution can be best understood by describing what happens when a user wants to launch to an administrative application from our best of breed suite. The user

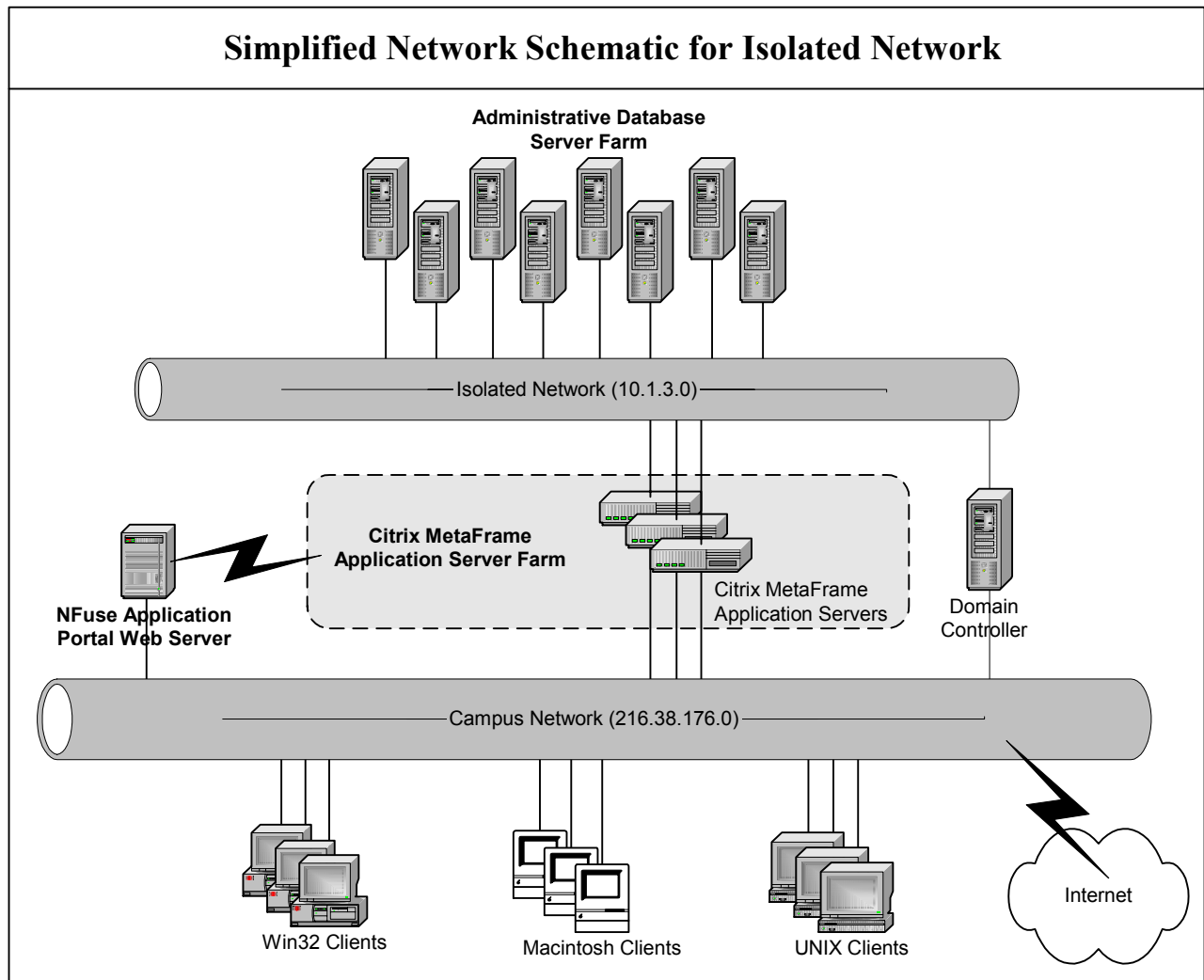


Figure 1: Simplified Network Schematic for Administrative Systems Isolated Network

logs in to the NFuse™ application portal. The application portal passes the user’s credentials to the MetaFrame™ Application Server Farm, which authenticates the user and tells the application portal which applications the user is allowed to run. The application portal then dynamically generates a web page which lists those applications. [See Figure 2].

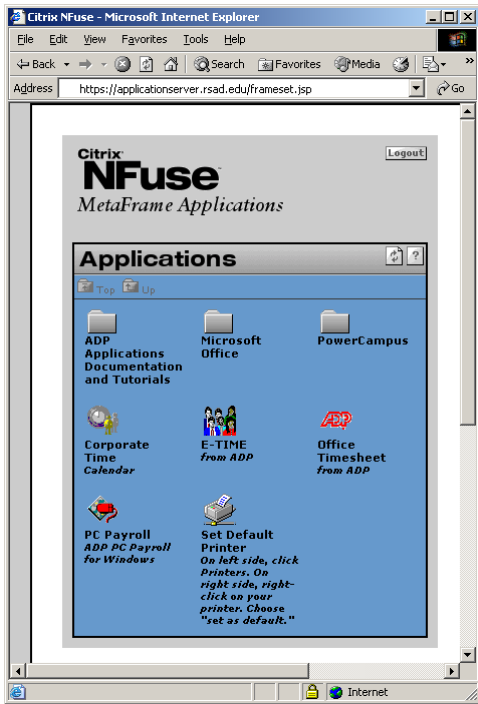


Figure 2: Example list of applications after Human Resource/Payroll staff logs into Application Portal

To launch the desired application, the user simply clicks on the application’s icon. The selected application is then launched by the application server and displayed seamlessly on the user’s desktop. Since the application server has an interface to the Isolated Network, the application is able to access the data, which resides on the database servers connected to the isolated network.

3.1 Benefits of the “Isolated Network”

The above-described infrastructure for administrative systems fulfilled all the criteria that we set out to meet.

3.1.1 Secure Data from the Top Security Risks

Although the application servers are accessible from both on and off campus, the database servers are completely isolated. The only access point to the database servers is through the application servers, and only authorized users have accounts on these servers. Citrix® provides 128-bit encryption of data between the application server and the thin client. Because the network is isolated, sniffer and snoopers cannot detect network traffic between the database client and server.

Adhoc query and reporting tools (e.g., MS Access, Crystal Reports, etc.) are only installed and configured on the application servers. The results of these queries/reports often contain sensitive information. Since these queries/reports are not accessed on the

local workstations, any compromises to the end users local workstation will not affect the security of this information.

Note that Microsoft Outlook is not fully configured on the Application Servers. Therefore, users cannot read their e-mail on our application servers using Outlook. Outlook is only configured to send out e-mail when needed by other applications. This limits our vulnerability to security compromises by e-mail worms. Furthermore, virus protection software is installed on our application servers.

3.1.2 Unlimited Access to Authorized Users

Application servers are running 24/7 and are available from any computer with an Internet connection and the Citrix® MetaFrame™ client or plug-in. These clients and plug-ins are available free of charge from the Citrix Systems, Inc. web site. Citrix® Systems, Inc. provides clients for numerous platforms, so users can access applications from Mac, UNIX or Windows-based platforms using the same web-based application delivery mechanism.

3.1.3 Low Total Cost of Ownership

The Thin-client computing model eliminates the need for high-end desktop workstations for staff, thus saving money on hardware costs. Since our solution does not include the use of a Firewall or VPN, costs compared to these other solutions are lower. Because of the ease of maintenance, a smaller team can maintain the administrative systems on campus, thus saving personnel costs.

3.1.4 Ease of Maintenance and Problem Resolution

By utilizing application servers as a deployment method for administrative software, installation of applications needs to be done in drastically fewer locations, resulting in considerable time saving for installations and upgrades. By deploying our administrative software using application servers, maintenance of administrative workstations is less complicated since all staff workstations can be setup using the same system image.

Use of “shadowing” on the Citrix® MetaFrame™ server allows IT administrators to connect to an end user’s session. Without leaving our offices, we can troubleshoot problems that staff encounter while using the software installed on the application servers. Since we are not using a firewall or VPN, we do not need to worry about the maintenance of these additional products.

3.1.5 High performance/High Reliability

The connection between the application servers and the databases on the isolated network utilizes Gigabit Ethernet technology. The same applies to the connection between application servers and the campus network High-end servers with multiple processors are utilized for our application servers. Citrix System’s Load Balancing software is used to distribute the load across the available servers to ensure optimal performance for each running application.

Critical applications are installed on multiple servers. In the event of a system failure, the Load Balancing software will distribute the user to an available server when the user reconnects.

3.1.6 Scalable/Adaptable

As additional staff utilize the administrative systems, application servers can be added to the existing server farm. Citrix System’s Load Balancing software is used to distribute the load across the

available servers. Additional applications and database servers can also be easily added to the isolated network without any reconfiguration of the existing infrastructure.

4. LESSONS LEARNED

4.1 Deployment Strategy

Our deployment strategy was successful because we chose to migrate administrative staff to the application server environment as we deployed their new software or upgraded their software. We feel the biggest mistake an IT department can make is to move an existing “stable” application from a “fat-client” installation to a “thin-client” installation. In our discussion with administrative staff we sensed resistance and uncertainty toward the migration because end users viewed it as losing control of their application. They also felt they would be negatively impacted by sharing the application server with other users.

We found the best approach for migrating existing applications is to wait until an update/upgrade for the application becomes available. Most updates/upgrades include new features or fixes that end users are anxious to see. We recommend installing the latest version of the application on the Application Server and allow your key administrative staff to test it. The testers will become familiar with the environment and method of accessing the application and you will build the support of these key staff members. When you finally perform the actual upgrade, migrate the application from their workstations to the new environment.

4.2 Which applications to deploy

We choose to make general-purpose applications (e.g. MS Office suite) available both at the client workstation level and through the Citrix server. By making the application available on the Citrix server, users can access the same environment from home or while traveling that they have on campus, including home space and file server access. By installing Office locally, users can still utilize the general-purpose applications in the event of network failure.

4.3 Citrix Administration

Citrix® MetaFrame™ Servers are not difficult to administer. The most important lessons we learned regarding Citrix® MetaFrame™ Administration are related to print drivers. Citrix® recommends that you only install print drivers that are compatible with Terminal Server. They also recommend rebooting your application servers once a day. After taking these words of advice, we rarely experience problems with our application servers.

Most applications run flawlessly in this environment. Occasionally we encounter issues when an application will run as “*administrator*”, but will not run as a normal user. In these

situations, Tools like RegMon and FileMon from SysInternals (www.sysinternals.com) have proven to be very useful in troubleshooting these problems.

4.4 Prototype Servers

We recommend investing in prototype Citrix Servers for testing both new application deployment and application upgrades. Our architecture is scalable, thus adding the additional servers is simple. Furthermore, Citrix® Systems’ new connection-based licensing structure for MetaFrame XP™ allows you to have an unlimited number of servers to handle a set number of connections.

5. CONCLUSION

Our solution for the administrative systems infrastructure can be seen as an alternative to other popular solutions such as firewalls/VPNs. It can also be used in conjunction with these other solutions to provide additional security and the additional advantages listed above. Due to the nature of firewalls and VPNs [3], we feel our solution in many respects is superior to having only a firewall/VPN for several reasons:

- ❑ Our solution is less costly than most VPN/firewall solutions
- ❑ Our off the shelf components are much simpler to install, configure, and maintain
- ❑ Due to their inherent complexity, VPN or firewalls can leave you with a false sense of security. Any mistakes in the configuration can leave you vulnerable to attack.
- ❑ Well known VPNs and firewalls are under constant attack. When exploits are found, they are not immediately published.

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