Information Systems Department

Server Infrastructure Upgrade Proposal

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Problem
Pasco School District server infrastructure is aging and in need of improvements to support a modern, industry standard virtualization model.

Background
Pasco School District is in the early stages of transforming its server infrastructure model to the emerging industry standard of virtualization, which distributes computing power from a cluster of physical servers among several virtual machines (Figure 1). Virtualization allows greater utilization of computing resources, reduces energy consumption, lessens management complexity, and quickens disaster recovery.

Figure 1. Virtualization Model—Multiple machines on the same hardware

The following are barriers faced by Pasco in the adoption of the virtualization model.

While network demands continue to increase, Pasco’s server infrastructure is aging, with several machines out of warranty and beyond their recommended lifecycle.

Two years ago, Pasco had 86 physical servers. However, in the past two years, Information Systems has retired 29 servers due to hardware failure or inability to perform their job function. 18 of our remaining 56 physical servers are out of warranty and 10 additional servers will be out of warranty by next summer. Currently, 7 servers are exceeding their recommended 5 year lifecycle.
The amount of devices, workstations, email accounts, and user accounts accessing Pasco’s server infrastructure has nearly doubled in the past 4 years with little investment in additional infrastructure. All of the additional traffic is creating an exponential increase in the amount of data stored on the district’s servers; over the past 4 years there has been an increase of 3.5TB data, approximately the same amount of server space needed to store 733 movie DVDs. If trends continue, the district will exceed its non-backup related storage by January 2013.

*Deploying new servers is a lengthy and costly process.*

Under Pasco’s current single-purpose server model, deploying a new server can take up to 8 weeks. Servers cannot be purchased off the shelf, but are custom ordered based on the application they will support. Often, the extended lead time creates delays in deploying new services to the district, as seen in the StudentTrac and Sungard deployments.

Not only does the single-purpose server model reduce the flexibility of deploying new services, but it has a greater cost. An average server costs $4,800-$7,200. However, the average server uses only 5%-10% of its computing capacity, leaving 90% largely wasted. The virtualization model accesses the unused capacity and distributes it among numerous machines, in essence, spreading the cost of the hardware among multiple machines. With virtualization, deploying a new server turns into a marginal, rather than a major, cost proposition.

Information Systems is already realizing the cost-savings benefits of virtualization. In the last year alone, Information Systems has launched 45 virtual servers. These virtual servers both provided new services and replaced aging physical servers that were failing, forgoing the cost of purchasing additional hardware. Using the single-purpose server model, these servers would have cost the district over $250,000 in additional hardware and required installing an additional server rack in the Booth data center.

*Information Systems has used the ‘junkyard’ approach to support its move to a virtualization model, but lacks the necessary foundation to continue its efforts.*

Information Systems has repurposed older, under-utilized, and out-of-warranty equipment to its virtualization project. Currently, Information Systems has 8 physical servers clustered together supporting 45 virtual servers. The 45 virtual servers were ‘easy pickings’, consisting mainly of low maintenance, low load machines. Services such as Successmaker, OPOS, and elementary school file and print services are running on the virtual machines. A few high-profile services like Food Services, Destiny library system, and Sungard email/FAX processing software are loaded as virtual machines. However, because of the weak underlying structure, these servers cannot be fully integrated into the virtual infrastructure.

In order to continue, and sustain, the district’s virtualization efforts, Pasco must invest in hardware designed to support a virtualized infrastructure. To fully realize the benefits, server virtualization
requires modern specialized hardware like the HP, IBM or Cisco Blade Systems, with a dedicated Storage Area Network (SAN) to provide the hard drives. The Blade Systems allow multiple virtual machines to share critical components, like power supplies and network connections, while ensuring high availability because of redundant components. Critical services, such as the System Center Configuration Manager (SCCM), Exchange email, and the U, Q, and P drives, cannot be virtualized without upgrading the foundation of our server infrastructure.

*Pasco’s data and services are not properly protected from disaster.*

Information Systems is constantly processing backups to safeguard against data loss. An entire backup of the district’s data takes approximately 48 hours. The district retains its data for five days and on a typical week, performs 4-5 data recoveries. Within the past four years, the amount of files Information Systems is backing up has increased from 1TB to 12TB. The district will reach its backup capacity of 18TB in approximately 14 months. Once that limit is reached, Information Systems must reduce the frequency and percentage of files that are backed up, exposing the district to potential data loss.

In addition to decreasing backup storage, some of the district’s critical servers, such as those hosting the SCCM and network drives, have a single point of failure; meaning, if the physical server has a hardware failure, the district will lose those services. Depending on the damage to the physical server, restoring a backup may take hours to days. A virtualized model removes single points of failure by providing fail-over ability. So, if a piece of hardware fails, the virtualization software dynamically redistributes computing resources to support the failed piece of hardware. The fail-over feature of the virtualization model turns a lengthy interruption of service into a couple second burp.

**Proposed Solution**

In order to move to a sustainable virtualized platform, Pasco must invest in additional hardware. Information Systems recommends using the Hewlett Packard Blade chassis and server with detached Storage Area Network (SAN).

The Hewlett Packard hardware is compact, power efficient, scalable, and redundant. The Blade system is nearly one-tenth the size of traditional infrastructure, which means no more expansion of the server racks at the Booth data center. Blade servers dynamically adjust their energy consumption based on real-time loads, allowing them to operate with lower power consumption than traditional servers. The Blade system is modular, which gives Information Systems the ability to quickly add additional processing power or replace damaged hardware without affecting service to its customers. Because of its modular and shared resource design, the Blade system eliminates the single point of failure created by traditional server infrastructure.

Not only does the proposed Blade system update our aging infrastructure and remedy our junkyard approach to virtualization, it will also help protect the districts data and services from disaster. Moving
to the SAN storage structure will allow Information Systems to routinely capture ‘snapshots’ of the district data across the entire network. If damage occurs to the district’s data, the snapshot would allow Information Systems to quickly restore data to the point in time of the most recent snapshot. This is more efficient than our current restoration method, which requires that a server be reconfigured and loaded before services can resume.

An additional advantage of the Blade system is that Hewlett Packard is guaranteeing equipment support for 8 years, which is rare in the computer hardware industry. The long range support for the Blade system gives stability to Information Systems long term planning.

It’s recommended that the new infrastructure investment be implemented in two phases over a two year period, beginning during the current school year. See the below table for the ideal investment schedule.

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<th>Part</th>
<th>Part Qty</th>
<th>Unit Cost</th>
<th>Total Cost</th>
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<td>Total Cost of Proposal</td>
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**Future Plans**

Once the updated server infrastructure is fully implemented, the current virtual hardware will be repurposed to the Chiawana data center. The system will act as an emergency backup system in the case of a disaster at the Booth data center. Although the system cannot handle the entire district load, it will allow a few core services to be restored quickly. This is a modified version of site-redundancy, a common practice among organizations to protect against site-oriented disasters. Information Systems long term strategy is to fully replicate services at both the Booth and Chiawana data centers in order to provide continual service to its customers.