Thomas Jefferson University: Enhancing IT Operations with an Outsourced Data Center

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Preface

The EDUCAUSE Center for Applied Research (ECAR) produces research to promote effective decisions regarding the selection, development, deployment, management, socialization, and use of information technologies in higher education. ECAR research includes

- research bulletins—short summary analyses of key information technology (IT) issues;
- research studies—in-depth applied research on complex and consequential technologies and practices;
- case studies—institution-specific reports designed to exemplify important themes, trends, and experiences in the management of IT investments and activities;
- roadmaps—designed to help senior executives quickly grasp the core of important technology issues; and
- key findings—brief high-level summaries on the scope of an ECAR research study.

As part of ECAR’s 2009 research agenda, the ECAR study Alternative IT Sourcing Strategies: From the Campus to the Cloud, by Philip J. Goldstein,1 examines the factors IT leaders consider when making sourcing decisions and the state of adoption of a variety of sourcing options for technology services. These options include both on-site services and services available via the Internet (e.g., cloud computing). The research includes a detailed look at the drivers and lessons learned from two particular examples of outsourcing: third-party hosted e-mail and the use of contract labor in the IT workforce.

Literature Review

The literature review helped identify and clarify issues, suggest hypotheses for testing, and provide supportive secondary evidence. Besides examining articles and studies from journalistic, academic, and IT practitioner sources, ECAR consulted with practicing CIOs to develop study objectives and survey questions.

Online Survey

ECAR designed and administered a web-based survey that was distributed to institutional representatives (mostly senior IT leaders) at 1,738 EDUCAUSE member institutions in November 2008. We received 372 responses (a 21.4% response rate).

Interviews

ECAR conducted follow-up telephone interviews with 20 senior IT leaders from a mix of institutions to gain deeper insights into findings from the quantitative analysis and to capture additional ideas and viewpoints.

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Case Study

ECAR researchers conducted this in-depth case study to complement the core study. We assume readers of this case study will also read the primary study, which provides a general context for the individual case study findings. We undertook this case study of Thomas Jefferson University (TJU) in Philadelphia to study the transition of its centralized data center to an outsourced facility and its impact on IT operations.

ECAR owes a debt of gratitude for their time and insights to Chris Campbell, Associate Director of Technology Support; John Gallagher, Vice President of Business Development, DBSi Inc.; Jim Hauck, Electronic Medical Records Director; Doug Herrick, Senior Director of Infrastructure Services; John Hoffler, Senior Director of Enterprise and Web Applications; Jack London, Director, Informatics Shared Resources, Kimmel Cancer Center; Andrea Mancaruso, Associate Director of Client Solutions; Bruce Metz, Chief Information Officer; David Reis, Director of IT Security and Policy; and George Valko, Gustave and Valla Amsterdam Associate Professor and Vice Chair for Clinical Programs, Department of Family and Community Medicine/Medical Director of Jefferson Family Medicine Associates.

Introduction

The data center is a higher education central IT organization’s infrastructure nerve center, housing IT systems, applications, service, and data storage components, as well as security controls and the environmental equipment required to keep it all operational. Today, keeping this critical resource operating at optimal levels is an increasingly challenging undertaking. As an institution’s IT needs grow, so does the data center’s need for capacity, reliability, and 24 × 7 operations. With electronic components and servers shrinking in size and footprint, the density of equipment per square foot keeps increasing.

The net result is the generation of more heat in a given space, making the need for high-capacity, fault-tolerant air-conditioning more critical than in the past. Unless these facilities, along with all other environmental support systems and electrical capacity, are properly maintained, data center outages are likely to increase. System performance and availability are also likely to degrade.

With these issues in mind, higher education central IT organizations may investigate the feasibility of upgrading their data centers. As ECAR’s Alternative IT Sourcing Strategies: From the Campus to the Cloud research study reveals, 93.8% of survey respondents self-operated their primary data centers. Even among those institutions actively using multiple forms of alternative IT sourcing strategies, only 7.4% reported that their primary data center is provided by a third party. If an institution does consider a data center upgrade, the capital outlays required for renovation or building can make the project a daunting proposition.

When faced with these challenges in 2007, Thomas Jefferson University chose a different approach. Rather than spend an estimated $6–$8 million to upgrade its current data center, the university opted to outsource its data center management and operations by relocating to a specialized facility and maintaining its hardware and software remotely. The TJU IT organization (Jeff IT) completed the project by June 30, 2009, on time and on budget.

In addition to addressing the project’s technical and logistical issues, Jeff IT faced another challenge. Situated as it is within a major academic medical center that includes a health science and research institution, Jeff IT had to overcome user concerns about data security and confidentiality of patient information as well as ensure the business continuity of critical patient care and electronic medical records systems. As this case study will show, Jeff IT is not
only meeting this challenge, but it has also used this initiative to enhance its regulatory compliance and security standards while upgrading project management skills, client outreach programs, and its IT infrastructure robustness. CIO Bruce Metz's main takeaway from the experience is “If the economics are attractive enough, get out of the data center management business. You can then strategically put your efforts into your primary role, which in our case is to provide IT user services while improving data center security and reliability. Some CIOs may think data center outsourcing is prohibitively expensive, but in our case, that is not so.”

Background
Thomas Jefferson University was founded in 1824 as Jefferson Medical College. Through the years, the medical school expanded, with an affiliated hospital opening in 1877 and a school of nursing in 1891. In 1969 it became Thomas Jefferson University, comprising Jefferson Medical College (JMC), Jefferson College of Health Professions, Jefferson College of Graduate Studies, and Thomas Jefferson University Hospitals (TJUH). In addition, Jefferson University Physicians (JUP) was formally formed in 1999 as a nonprofit multispecialty outpatient practice and a supporting organization of the university. Since inception, JUP has consisted of the full-time JMC faculty. In 1995 Thomas Jefferson University Hospitals separated from the university to become a founding member of Jefferson Health System. Together the university and hospital make up a single academic medical center that employs 12,800 people and has a combined annual operating budget of approximately $2 billion. TJUH operates its own IT organization (TJUH IS) to manage its needs and the hospital's patient care systems. The hospital IT organization also operates the network shared by all entities as well as the enterprise data center facility in Scott Memorial Library (Scott Building). TJUH IS runs a 24 × 7 IT help desk. Jeff IT runs the enterprise resource planning systems including finance, HR, supply chain management (used by the university and the hospital), and its own help desk. As part of a campus cost allocation system, TJU and TJUH are each charged for IT services delivered by the other entity's IT organization. An academic medical center IT governance structure comprising both TJU and TJUH members facilitates IT alignment, transparency, collaboration, and coordination among the major campus entities and between the two IT organizations.

As university CIO, Metz oversees Jeff IT. Several Jeff IT departments report directly to Metz:

- Electronic Medical Records (EMR) is responsible for the implementation and management of the Jefferson University Physicians EMpoweR EMR system (more details about the EMR system follow in the next section).
- Physician Application Services manages applications that support physicians for practice management—for example, billing, scheduling, and patient registration.
- Physician Systems Support provides specialized IT operations, system administration, database, middleware, and data integration services for the EMR and other JUP clinical applications.
Enterprise and Web Applications handles the campus-wide and university administrative services, academic services, and web development for the university and departments.

IT Infrastructure Services manages core services such as OS, e-mail, storage, networking, research computing, the Jeff IT help desk, IT support, and the outsourced data center.

Security and Policy governs TJU IT security and compliance practices as well as policy issues.

Project Management manages multi-party service and product development endeavors.

Finance and Administration manages the Jeff IT operating and capital budgets and oversees Jeff IT administrative matters, including human resource activities.

**Reaching the Tipping Point**

The Scott Data Center facility is located in the basement of the Scott Building on the TJU campus. Built in 1970 and last renovated in 1989, the facility serves both TJU and the hospital, occupying approximately 6,500 square feet. Several areas make up the facility, including the data center, network operations, printing and copying production services, and the TJUH and TJU technical assistance centers (i.e., the help desks).

Several infrastructure issues currently confront the data center. Its below-ground, below-water-grade location prompts concerns about drainage and flooding. Because the data center was last renovated 20 years ago, many of its facilities and operations infrastructure elements are nearing or past their effective end of life, despite periodic upgrades. The uninterrupted power supply (UPS) system, power distribution systems, and mechanical systems were designed for a more centralized, large-system environment, not the high-density requirements of blade chassis, virtual servers, and high-capacity storage systems that are now in use. In addition, the computer room air conditioners were installed around the periphery of the room and rely on ambient airflow, not the ducted, direct cooling flows required for today’s in-cabinet and hot-spot cooling needs. The need for reinvestment to correct these and other conditions was identified, but other projects seemed always to take precedence in the competition for capital expenditures.

Over time, the data center did receive some upgrades in physical space and electrical capacity. A backup power generator was installed in 2007, and the university has arranged for backup power from another building. Space is at a premium—the facility is currently filled to capacity and there is no room for expansion. Thus, the systems are running very close to maximum capacity. If any environmental unit fails or is down for maintenance, the room environment cannot be maintained, which could result in outages. The situation is compounded by a lack of environmental system redundancy. The lack of a formal process for user access is another issue. Some server owners dislike the indirect access through data center personnel to maintain their servers.

As the data center infrastructure ages, failures are becoming more frequent. During 2005–2008, the data center began to experience capacity, power, and reliability issues. “The first issues we experienced revolved around growth and power,” explained Chris Campbell, associate director of technology support. “As we got into technologies like virtualization and blade servers, the issues evolved from electrical capacity problems to loss of power in the entire data center. That happened about six times within one year. Even today we do not have adequate cooling in one section of the data center.”
“A primary reason for outsourcing is when an organization’s requirements significantly exceed the internal level of service,” stated Jim Hauck, EMR director. This was the case at TJU. The tipping point that prompted a thorough reexamination of the data center was the implementation of the Jefferson University Physicians new electronic medical record system, EMpoweR, which provides a central electronic repository of a patient’s medical history, charts, prescribed medicines, and test results as well as physician schedules—all accessed through a single user interface. EMpoweR replaces paper-based medical records and potentially lost manila file folders. The single source of information provides a comprehensive medical view of a patient and enhances cross-practice communications.

When EMpoweR was in its planning stages in 2007, Hauck and George Valko, Gustave and Valla Amsterdam associate professor and vice chair for Clinical Programs, Department of Family and Community Medicine/medical director of Jefferson Family Medicine Associates—and the EMpoweR project’s physician lead—requested a review of the Scott Data Center’s current performance levels. Patients are treated six days a week, and health care providers need patient data at their fingertips. Any system downtime translates into a delay in patient treatment. “With no hard-copy medical records as a backup, the requirement was for an absolute, bombproof environment that would ensure that the physicians would have all available patient information at the point of care,” stated Hauck. “One of EMpoweR’s big value-adds to physicians is the ability to have all that information as much as possible in one place. The reliability of having the data available is absolutely essential. In the paper world nationally, a physician sees a patient 30% of the time without the proper data or the patient’s whole chart. We did not want to reproduce that in the electronic world, as it would create a physician outcry of dissatisfaction, and it becomes a patient safety issue if the system is down. At that time it was obvious to several of us that the data center on campus in its current state was not adequate to meet these requirements.” An informal review of the current Scott Data Center found it to be deficient in several aspects of infrastructure, operations, and processes to meet EMR systems criticality and required uptime. Others were cognizant of the need for a data center to be off site, redundant, and separated by distance to provide continuity in case of a disaster.

With EMpoweR’s success riding on a reliable, secure, and redundant data center, the university and hospital IT organizations hired an outside engineering company in 2007 to conduct an engineering facilities assessment of the Scott Data Center and identify the investment needed for it to become a viable hosting and operations site for IT systems and storage. The report reaffirmed common assumptions: lack of best practices, underpowered, inadequate cooling, and inefficient use of space. The Scott Data Center ranked about a tier I.5 on the Uptime Institute metric of data center reliability. The report recommended a tier IV data center facility for Jefferson’s clinical functions and a tier III facility for other functions. (See “The Uptime Institute Data Center Tier Model” sidebar for information about data center tiers.) It also recommended a backup data center or secondary facility.

The price tag to renovate the data center to upgrade operations and to meet new uptime goals ranged $6–$8 million. But even with this investment, the report stressed the ongoing need for investment to maintain the Scott Data Center’s ability to meet rising system needs, and highlighted two unchangeable issues: the lack of expansion ability and its below-ground location.
The Uptime Institute Data Center Tier Model

The Uptime Institute is an organization founded in 1993 to provide education, consulting, certifications, and research for enterprise data centers. (For more information, see http://www.uptimeinstitute.org.) The institute’s tier classification system is an IT industry–recognized means for comparing data center capabilities.

Tier I: Basic Site Infrastructure
- Has nonredundant capacity components and a single nonredundant distribution path serving the computer equipment.
- Acknowledges the desire for dedicated site infrastructure to support IT systems, and provides an improved environment over that of an ordinary office setting, including a dedicated space for IT systems, a UPS, dedicated cooling equipment that does not shut down at the end of the office hours, and an engine generator to protect IT functions from extended power outages.
- Is appropriate for entities wherein IT primarily enhances internal business processes or provides a web presence that is used as a passive marketing tool.

Tier II: Redundant Capacity Components Site Infrastructure
- Employs redundant capacity components in a single nonredundant distribution path serving the computer equipment.
- Includes redundant critical power and cooling capacity components to provide an increased margin of safety against IT process disruptions due to site infrastructure equipment failures.
- Typically includes extra UPS modules, chillers, heat rejection equipment, pumps, cooling units, and engine generators. A malfunction or normal maintenance will result in the loss of a capacity component.
- Is appropriate for entities where multiple sites are available and IT requirements are mostly limited to traditional normal business hours, allowing system shutdown during off hours, and to scientific research, which typically does not have online or real-time service delivery obligations.

Tier III: Concurrently Maintainable Site Infrastructure
- Includes redundant capacity components in multiple, independent distribution paths that serve the computer equipment. Typically, only one distribution path serves the computer equipment at any time.
- Is dual powered by two completely independent electrical systems.
- Adds the concept of concurrent maintenance beyond what is available in tier I and tier II, meaning that each and every capacity or distribution component necessary to support the IT processing environment can be maintained on a planned basis without impact to the IT environment.
- Is appropriate for entities that support internal and external clients 24 × 7 and can’t accept short periods with limited service due to a site failure; IT resources–supported automated business processes so that the impact on clients of system shutdowns is manageable or acceptable; and Internet-based companies or co-location providers that have quality-of-service commitments with serious financial ramifications.

Exploring Data Center Options

With the needs identified, the focus now turned to finding an appropriate solution. Jeff IT’s Doug Herrick, senior director of Infrastructure Services, headed a two-month process in late 2007 to analyze options, working internally with the Infrastructure Services group, the EMR team, and other data center users to discover the least expensive and least disruptive solution. They compared options, and by February 2008 one alternative had already fallen by the wayside: an internally
managed solution. It increasingly became apparent from financial and long-term planning perspectives that renovating the Scott Data Center to handle the EMR system’s reliability and redundancy needs did not make sense, and a recently completed IT planning process placed more strategic claims on Jeff IT’s capital dollars. Building a new data center in the city was financially unfeasible, too. Metz stated, “We decided we would rather put our time into building core competencies and working on strategic opportunities than operating and continually upgrading a data center.”

Tier IV: Fault-Tolerant Site Infrastructure

- Employs multiple, independent, physically isolated systems, each having redundant capacity components, and multiple, independent, diverse, active distribution paths simultaneously serving the computer equipment.
- Is dual powered by two completely independent electrical systems.
- Tier IV site infrastructure builds on tier III, adding the concept of fault tolerance to the site infrastructure topology. Fault tolerance extends to each and every system or component that supports IT operations. Tier IV considers that any one of these systems or components may fail or experience an unscheduled outage at any time.
- Is appropriate for entities that deliver “24 x forever” services in a highly competitive client-facing market space; businesses based on e-commerce, market transactions, or financial settlement processes; and Internet-based companies or co-location companies that have quality-of-service commitments with serious financial ramifications.¹

Tier Similarities and Differences

<table>
<thead>
<tr>
<th>Number of Delivery Paths</th>
<th>Tier I</th>
<th>Tier II</th>
<th>Tier III</th>
<th>Tier IV</th>
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<tr>
<td>Only 1</td>
<td>N</td>
<td>N + 1</td>
<td>N + 1</td>
<td>2 (N + 1) or S + S</td>
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<td>80-90%</td>
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<td>Initial watts/ft²</td>
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<td>50–80</td>
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<td>40–50</td>
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<td>150+</td>
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<td>18”</td>
<td>30–36”</td>
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<td>150+</td>
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<td>Utility voltage</td>
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<td>208, 480</td>
<td>12–15kV</td>
<td>12–15kV</td>
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<tr>
<td>Months to implement</td>
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<td>3 to 6</td>
<td>15 to 20</td>
<td>15 to 20</td>
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<td>Year first deployed</td>
<td>1965</td>
<td>1970</td>
<td>1985</td>
<td>1995</td>
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<td>Construction $/ft² raised floor*</td>
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<td>$600</td>
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<td>99.75%</td>
<td>99.98%</td>
<td>100.00%</td>
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</tbody>
</table>

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*Excludes land and abnormal civil costs. Assumes minimum of 15,000 ft² of raised floor, architecturally plain one-story building fitted out for the initial capacity, but with the backbone designed to reach ultimate capacity with the installation of additional components. Make adjustments for New York City, Chicago, and other high-cost areas.

That led to exploring other options, such as leasing space with Jeff IT managing the operations, or outsourcing the whole data center operation completely. Hauck was especially supportive of an outsourced solution. “Having worked for an outsourcer provider previously, I felt very strongly that we would get a better and safer solution than doing something in-house. A tier IV provider would automatically have an acceptable electrical and air-conditioning environment as well as the appropriate backups.” Jeff IT’s leadership liked what it saw, too. “We found that that industry had really matured, so there were good and cost-effective options,” claimed Metz. “With an outsourced vendor, it’s their core business. It was very economically attractive, as they can maintain the data center for three to five years operationally for less than we could with an internal solution. We would not incur the huge capital costs confronting us with an upgrade of the Scott Data Center.”

Outsourcing a data center is not common in higher education, but in the Philadelphia region, a number of health care organizations have outsourced their data centers. During this time period, Jeff IT decided to pursue its own solution separate from the hospital’s data center when it saw the potential for all of its critical systems—not just the EMR system—to be housed at an outsourced data center. This meant physically withdrawing from Scott Data Center and moving all of the university’s systems, storage, and servers under Jeff IT management to a new data center, including equipment for the EMpower EMR system, the academic health center’s enterprise systems, and the academic and research servers. Jeff IT planned to redirect the chargeback expenses from the Scott Data Center to pay for another data center solution. The budgetary implications of this decision meant that Jeff IT had to withdraw totally from the Scott Data Center by the end of the fiscal year, June 30, 2009, in order to allocate the funding to the new data center solution.

After reviewing several vendors, Jeff IT decided at the end of 2008 to outsource its data center to DBSi Inc., a provider of data center services, managed hosting, and disaster recovery services. “If you think of it from the OSI stack, we are a layer-one-through-three company,” states John Gallagher, DBSi’s vice president of business development. “We manage the physical layer through the network layer.” DBSi offers tier IV data center capabilities in a highly secure, totally redundant facility, and it maintains several sites in the mid-Atlantic region. Office space is available for clients to relocate staff to the facility, though most clients manage their data centers remotely. On-site staff are available for resetting servers, accepting equipment deliveries, and racking servers, as designated by clients.

Several factors reinforced Jeff IT’s decision. DBSi already provided services to 25 health care organizations in the Philadelphia area, so it was highly familiar with TJU data security and privacy needs. The facility was located 30 miles away, close enough to be accessible but far enough to function as a backup facility in case of a disaster. “More than any other vendor that we spoke with, we were on the same page as DBSi,” stated Campbell. “If we wanted, we could house an alternate unit in one of their other facilities, creating a primary and secondary site on the network. They had an itemized level of service, and we could take it to our comfort level. That flexibility was very important and continues to be very important to us.” Metz concurred: “DBSi can operate a data center better and more economically than we could over the same period of time. So what is wrong with this picture?”

TJU President Barchi supported the decision, too. The outsourcing option, in addition to providing increased operational benefits, had great appeal because even with an $8 million investment in the Scott Data Center, TJU could not replicate DBSi’s capabilities.
**Preparing the New Data Center**

With the solution chosen, the next step was implementation. Jeff IT addressed several issues in preparation for moving its data center to the DBSi facility. DBSi helped the group get started by providing a checklist of 30 questions about the physical and network logistics of the transition. “It tickles the client about unrecognized issues, to identify physical and logistical processes associated with moving the data center,” stated Gallagher. There were several areas of focus, as discussed next.

**Disaster Recovery/Business Continuity**

To address the EMR system’s failover requirement, Jeff IT is transitioning from a model of “declare disaster and recover systems from tape” to a co-location/failover model. It leased space at a nearby carrier hotel located at the Terminal Commerce Building, a few blocks from the TJU campus, to create a co-location site with redundant hardware. The 14-story building houses co-location providers such as Level 3, Switch and Data, Cross Connect Solutions, SunGard, and Broadview. In the building are MCI, Sprint PCS, Enterprise Networking Solutions, IXC Communications, Hyperion Communications, and Commonwealth Long Distance. An Internet2 connection point operates from this location, too.

The plan is to populate the co-location site with selected systems—the EMR system, the TJU website, JeffMail e-mail service systems, and the main directory servers. The site will eventually be expanded to include all major ERP systems and core services when TJU’s current contract to lease space and equipment at a remote facility to support its former tape-based disaster recovery services expires at the end of 2009. One area of debate was the proximity of the co-location site to the TJU campus. “The literature is conflicting as to whether the site should be far away or not,” explained Metz.

“But the 9/11 terrorism attacks demonstrated to us the importance of being able to get to your co-location site. Physical proximity is more important to our interests.”

**Network**

As DBSi’s Gallagher points out, “The connection to the data center is important in terms of capacity, latency, and redundancy. You need to look at your current network capabilities and understand your users’ performance expectations. If your users are accustomed to a 100-megabyte internal LAN environment, you have to make sure your outsourced solution provides the same experience.” Gallagher also advises IT organizations to carefully investigate their options, because “the network cost and capacity cost can turn the whole deal upside down if it turns out to be too expensive to connect from your facility to the outsourced provider. If the network costs are too high, then it might make more sense for an institution to maintain its own data center.” Any outsource provider is more than willing to help an IT organization to determine the least expensive network routing option, because it is a competitive component of service providers’ cost estimates. TJU has the advantage of its Philadelphia location, where multiple dark-fiber options push prices down and facilitate optimal network design.

In the end, Jeff IT created a redundant, dedicated, self-healing 10-gigabyte (GB) fiber ring that is distinct from the DBSi network to connect its Philadelphia campus to the outsourced data center. It touches TJU’s failover site, intersects with the hospital fiber backbone, touches the outsourced data center directly at the DBSi facility, and then comes back to the campus. The independent fiber ring addresses capacity and latency issues, along with the health care data security and privacy requirements. All segments are self-healing and redundant.
Server Rack Design

Because outsourced data centers are charged by the occupied square footage, Jeff IT wanted to maximize the efficiency of its space allocation and utilization. To accomplish this, the team consolidated servers through virtualization. Campbell and his team wrote a customized application called RackSpace that models each server rack and its slots; identifies the server in each slot and its line allocation; and lists the total rack height, the number of slots used, the number of free slots, the current wattage, and the current BTUs. This enabled the team to create a highly efficient racked server configuration at the outsourced data center site. Virtualization and use of the modeling application enabled the team to shrink its approximate 1,200-square-foot space in the Scott Data Center facility to a 24-cabinet secured cage at DBSi that had a footprint of about 524 square feet.

Power

“Power is black magic to most CIOs because most have never seen a power bill for their internal data centers,” states Gallagher. “Typically power is rolled into an internal facilities chargeback cost. But with an outsourced data center solution, the CIO is billed for the site’s square footage and power. CIOs tend to significantly over-allocate their data center’s power consumption.” But Campbell’s application described earlier also calculates the wattage and BTUs for every square foot of space in the rack, enabling Jeff IT to understand the outsource data center’s power needs. Jeff IT’s outsourced data center uses 450 watts per square foot.

Security

Given the data security and privacy requirements of health care information, the data center’s security is an important consideration for Jeff IT. However, the organization’s IT Security and Policy area is not an integral part of the core move-planning group. Rather, it provides an external evaluation of Jeff IT’s activities, validating its plans and ensuring their operational integrity, much as an independent auditor would do. The Office of General Counsel fulfilled this role in the project initially until the director of IT Security and Policy position was created and filled.

The group examined security in a number of ways. They first examined the outsource provider itself—DBSi: its financial stability, industry reputation, and relevant hosting experience. For David Reis, director of IT Security and Policy, a pivotal item was an examination of DBSi’s Statement on Auditing Standard 70 (SAS 70) by the AICPA (American Institute of Certified Public Accountants) for data centers to ensure DBSi implements, maintains, and executes a set of internal controls for access control, generator testing, and security measures over a fixed period of time. “Given the cost involved, it is important to ensure that the vendor has planned for these items, has the appropriate processes in place, and, most importantly, that it follows these processes,” explained Reis.

Another concern is the facility’s physical security. Reis described the DBSi facility as essentially “a warehouse, and we lease a section within the warehouse that is a discrete area within the facility.” This includes the facility’s physical security—controlled access to the facility and Jeff IT’s space. The network link to the outsourced data center does not permit cross-connection with other DBSi customers. The physical cage surrounding the TJU data center extends all the way to the roof, not just to drywall ceiling.

IP Addresses

When designing the outsourced data center, Jeff IT originally planned to extend current IP addresses to the new servers in the outsourced data center. However, it
was discovered that the complexities of doing so might jeopardize the stability of the academic health center network. So Jeff IT mapped out new IP addresses and created a procedure to contact all impacted application user areas to work with them to prepare their equipment and schedule a switchover to their new IP addresses. This had to occur in a timely fashion to meet the June 30, 2009, deadline.

Andrea Mancaruso, associate director of Client Solutions, handled this transition. Fortunately, Jeff IT had a log of the several hundred data stewards, data administrators, and their representatives. Jeff IT calls this group “data shareholders” to indicate their integral role in good IT management and practices. The list gave Mancaruso a head start when identifying people to contact about the pending IP address changes. When she found that some of her information was out of date, Mancaruso, who has worked at TJU for several years, used her extensive institutional knowledge and contacts to verify and to revise the data shareholders’ database. Campbell and his team scheduled the IP switchovers to coincide with each server move to the outsourced data center. Mancaruso contacted the application user areas and coordinated the switchovers with them. She stated, “We carefully planned the switchover times for each data share on the server. For example, if an office maintains some shares on server one and some shares on server four, you don’t want to move everything all together and have everything down.”

**Managing the Move’s Intricacies**

Herrick described the actual data center move as “moving a house from one foundation to another, without the people inside knowing about it.” To ensure that this occurs, Jeff IT created numerous organizational bodies and procedures.

**Organizational Bodies**

Jeff IT created three organizational bodies to oversee the data center move.

**DBSi Move Planning Team**

The DBSi Move Planning Team is a high-level, internal Jeff IT group headed up by CIO Metz. It meets monthly to check progress, review budgets, go over scheduling adjustments, discuss dependencies or barriers to success, and raise issues affecting the overall project plan. Its membership, besides Metz, includes the senior director of Infrastructure Services (Doug Herrick), the associate director of Jeff IT Technology Support (Chris Campbell), the associate director of Jeff IT Client Solutions (Andrea Mancaruso), the senior director of Jeff IT Enterprise and Web Applications (John Hoffler), the Jeff IT manager of Finance and Administration (Lisa Brown), the director of Physician Systems Support (Michael Devenney), and the director of IT Security and Policy (David Reis).

**DBSi Move Steering Committee**

The DBSi Move Steering Committee is a group of top managers from the university and hospital representing the organizations and staff participating in the move. It consists of the senior director of Infrastructure Services (Doug Herrick), the director of the TJUH Information Services Data Center, the director of the TJUH Information Services Network group, the associate director of Jeff IT Client Solutions (Andrea Mancaruso), the senior director of Jeff IT Enterprise and Web Applications (John Hoffler), and the associate director of Jeff IT Technology Support (Chris Campbell). Originally the group met weekly to set direction, prioritize major tasks, resolve issues, raise concerns from the tactical-level staff, and review progress and deliverables. But as the project procedures have matured, it now meets only when necessary.

**Implementation Team**

The Implementation Team consists of the Jeff IT, TJUH IS, and application user personnel
Moving Phases

Jeff IT envisioned completing the data center move in three discrete phases. As discussed in this section, the team modified its plans after phase I.

Phase I: The EMR System’s Monolithic Move

To move the EMR servers in July 2008, Jeff IT followed a traditional route—hiring movers to transport all original EMR servers and then re-rack them at the DBSi site in a single coordinated move. At this point, the project was not complicated by the requirement to change IP addresses.

Although the servers were moved successfully, the Jeff IT team felt the movers’ inefficiencies slowed down the overall process. “I realized my staff could complete the job in a more timely manner,” stated Campbell. “When we looked at the critical aspects of the other systems to be moved, it was clear we could not have them down for the day and a half the movers took to move them.” This experience, combined with the new requirement to switch the IP addresses for the servers in the outsourced data center, forced the Jeff IT team to spend the remaining part of the summer reconsidering its moving methodology.

Phase II: Infrastructure and Client Application Servers—Many Discrete Moves

The requirement to change IP addresses necessitated the involvement of the application users to redirect their equipment accordingly. “We needed better coordination with their application user areas to synchronize downtimes as needed and to help with any pre- and post-testing,” stated Campbell. So Campbell and his team decided to transform this stage into a series of smaller discrete moves grouped by infrastructure and then client applications. Using the EMR system move as a model, Campbell created a cookie cutter moving process consisting of a series of standardized, repeatable steps. The group further refined the process as they moved the infrastructure servers in a series of moves to the outsourced data center.

Using a now updated IP address contact list, Mancaruso used the previously programmed move itinerary to work with all of the application user areas directly to schedule a date when their server would be moved to the DBSi facility and, hence, their IP addresses switched. The date was entered into a master moving schedule available to all relevant parties. With the date established, a series of move-related processes was set in motion for Jeff IT, the hospital IT organization that manages the academic health center network, and application user areas. The processes are fully documented with an explanation of procedures and/or a checklist of action items; for example, server provisioning, server wiring procedure, meeting data center vendor requirements, and standardized move itinerary. Table 1 illustrates an abridged general server move itinerary to illustrate the standardization procedures and the required coordination and communication among the three organizations.

With such a complex endeavor, any changes to the moving schedule have significant repercussions. Jeff IT implemented three safeguards to manage the project’s timeliness:

- A formal move schedule change process was created that requires the requesting party to fill out a form no later than three days before the move date to state the reason for the postponement. The DBSi Steering Committee reviews and approves the change.
### Table 1. Abridged General Server Move Itinerary

<table>
<thead>
<tr>
<th>Individuals</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Planning (Two Weeks before Move)</strong></td>
<td></td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Finalize server move itinerary to match specific server move</td>
</tr>
<tr>
<td>TJU/TJUH team</td>
<td>Review and finalize move itinerary</td>
</tr>
<tr>
<td></td>
<td>Review architecture of system to be moved</td>
</tr>
<tr>
<td></td>
<td>Review and finalize any architecture changes</td>
</tr>
<tr>
<td>Network team</td>
<td>Start network tasks</td>
</tr>
<tr>
<td></td>
<td>Request IP generation, firewall rules, and DNS changes</td>
</tr>
<tr>
<td><strong>Pre-Move (One Week before Move)</strong></td>
<td></td>
</tr>
<tr>
<td>Network team</td>
<td>Generate IP, modify firewall, and schedule DNS changes</td>
</tr>
<tr>
<td>Backup administrator</td>
<td>Backup</td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Configure load balancer</td>
</tr>
<tr>
<td>Server administrator</td>
<td></td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Change management</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Pre-move port test</td>
</tr>
<tr>
<td></td>
<td>Verify IP</td>
</tr>
<tr>
<td><strong>Move</strong></td>
<td></td>
</tr>
<tr>
<td>Network team</td>
<td>Verify firewall and DNS changes</td>
</tr>
<tr>
<td>Backup administrator</td>
<td>Pre-move function test</td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Verify DNS change schedule</td>
</tr>
<tr>
<td>Server administrator</td>
<td>Shutdown cluster pair</td>
</tr>
<tr>
<td></td>
<td>Unrack and box servers</td>
</tr>
<tr>
<td></td>
<td>Bring servers to DBSi and hand off to DBSi for racking and wiring</td>
</tr>
<tr>
<td>DBSi staff</td>
<td>Racking and wiring</td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Bring up cluster pair with new IP</td>
</tr>
<tr>
<td>Server administrator</td>
<td>Confirm application functionality and add back to cluster</td>
</tr>
<tr>
<td></td>
<td>Confirm cluster functionality</td>
</tr>
<tr>
<td><strong>Post-Move (3–7 Days after Move)</strong></td>
<td></td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Application testing and troubleshooting</td>
</tr>
<tr>
<td>Backup administrator</td>
<td>Backup</td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Confirm backup and restore functionality</td>
</tr>
<tr>
<td>Server administrator</td>
<td></td>
</tr>
<tr>
<td>Application move administrator</td>
<td>Update documentation</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: “General Server Move Itinerary,” Jeff IT Internal Document

- At weekly meetings, the DBSi Server Move Planning Team reviews the coming week’s move as well as future moves in two weeks, three weeks, and more than three weeks out.
- Constant and clear contact with application user areas enables Jeff IT to manage their expectations, explain roles, and verify scheduling to ensure that all parties are on the same page.
To minimize downtime, Jeff IT synchronized the server data, set up a virtual machine to represent the new machine, turned off the server temporarily at the Scott Data Center, and turned on the server at the outsourced data center. If the new server didn’t work, the server at the Scott Data Center could be restarted. For example, when moving the e-mail system, Jeff IT temporarily moved primary e-mail service to its failover system at the Terminal Commerce Building. The Jeff IT team then turned off the server at the Scott Data Center, transported it to the outsourced data center, brought it online, and switched the failover server back to failover.

Perhaps the greatest success indicator for each server move is the customer’s lack of awareness that it has occurred. Mancaruso relates one anecdote in which she received an e-mail from an application user two days after his area’s scheduled server move. “He inquired if everything was okay because they hadn’t experienced any disruptions,” she stated. “I responded by saying we moved the server two days ago and if you didn’t notice anything then we did a good job. I thanked him for the compliment.”

**Phase III: ERP Systems**

The final phase involves moving the finance, HR, administration, and student ERP systems. Jeff IT left these servers for last because this move is more complex than the application user moves. One technical challenge is that the ERP systems in the Scott Data Center share an IBM storage area network (SAN) infrastructure with some Thomas Jefferson University Hospital systems. The move entails transitioning to sharing an EMC SAN infrastructure with the EMR system.

Jeff IT moved the enterprise system’s test/development servers first; once they were operating satisfactorily, the production servers were moved.” Hoffler’s Enterprise and Web Applications group also plans to build a new supply chain management application completely at the new data center, leaving the old mainframe-based system at the Scott Data Center until the new system goes live.

**Impacts Ripple through IT and Beyond**

As Herrick reflected, “There is one good thing about moving. It forces you to analyze and look at things. You discover all sorts of things, and it forces you to take inventory of what you have and in some cases question why things are done in a certain way. You communicate with other groups in a way that is helpful. By engaging the hospital and our clients, you have the opportunity to rethink relationships, break old habits, and just optimize things.” Jeff IT utilized the data center move to do just that.

One impact is Jeff IT’s exposure to and experimentation with new technologies to meet the emergent requirements of a new data center. When designing the outsourced data center, Campbell and his team “were very opportunistic and devised new ways of doing things,” stated Herrick. Instead of strictly following Telecommunications Industry Association (TIA)-942 data center cabling specifications in the outsourced data center, they developed a more customized approach of dual-homing server network connections back to redundant cabinet switches and using 10-GB and 1-GB fiber downlinks to the core Cisco 6500 server switch. This was an alternative to the common method of pre-patching Ethernet cables to cabinet patch panels that in turn directly connect to the core switch. This modular approach has also provided an additional benefit: greater scalability for future needs. “You can read about traditional design for data center for ideas, but the traditional data center is monolithic,” stated Campbell. “You need to design a solution that will meet today’s needs, and you have to give a lot of thought to your future requirements in making the design.”
Jeff IT built on its outreach efforts with clients during the data center transition by creating a relationship-based support program called Preferred Support. Through this program, the Client Solutions group actively engages TJU departments, building direct relationships to learn about their plans and working with them to address any emerging IT needs. (See http://www.jefferson.edu/jeffit/preferred_support/about.cfm.) This may entail customizing a service around a new business process or configuring IT equipment and services to support a new faculty member. The goal, as Mancaruso said, is “to eliminate surprises for Jeff IT by proactively understanding the clients’ needs.” To free up resources for this more personal approach, the Client Solutions group enhanced its web-based help desk and self-service tools to enable IT users to troubleshoot and fix more problems themselves. “Much as we off-loaded our data center to an outsourced remote site, we have done the same thing with our help desk by off-loading help desk calls to new web-based applications and tools,” stated Herrick.

The outsourced data center’s improved capabilities reinforce TJU’s IT strategic efforts. “We had a real opportunity to highlight it not as a data center by itself, but to weave its importance into a strategic view of IT for the next three to five years,” stated Metz. “All these initiatives beyond the EMR system—enhancing core services, ERP initiatives, and research activities—will benefit from the new data center.”

As noted earlier, the data center migration forced Jeff IT to reexamine its business continuity and disaster recovery plans. “I am not sure if it is a cause or effect, but the two seem to come up in parallel conversations all the time,” stated Reis. The result is a more robust solution via the Jeff IT new co-location site as well as built-in network and equipment redundancies.

Greater budgetary control is another benefit. “The other advantage of an outsourced data center is that you really know what your costs are for the contract term,” stated Metz. “We can attribute the proportional cost of any new application that goes into the data center and build that right into a total-cost-of-ownership model for any application or system, enabling us to create a sustainable model.”

The outsourced data center’s security and redundancy will assist Jeff IT in its efforts to transfer locally managed data to a centrally managed data center. Few local departments currently use the Scott Data Center to store their data. One exception is the Kimmel Cancer Center, which located a single server, but it plans to expand its presence in the outsourced data center. (See the sidebar “User Vignette: Kimmel Cancer Center.”)

Once the move to the outsourced data center is complete, Jeff IT plans to encourage other TJU groups with internally managed and housed servers to follow suit through a university-wide outreach program. Metz envisions offering incentives to entice new users and using the cost-of-ownership model described earlier to help department managers understand the financial implications of using the outsourced data center. He even foresees a day when Jeff IT may be able to match applications with an appropriate level of disaster recovery, scaling user costs accordingly.

Finally, Jeff IT’s project actions and performance have helped to enhance its institutional reputation. Campbell and his team executed the data center move with minimal user disruption and little downtime; Mancaruso’s outreach during the transition has improved Jeff IT’s relationship with the TJU community. Both, according to Herrick, “have helped to raise IT’s credibility within the university. People see us as strategic and forward-looking in both our service planning as well as our stewardship of these server and application resources. And when you have that credibility,
it just keeps going, with people more open to new initiatives. They want to see what we can do, not just automatically push back.”

The EMpoweR EMR system has already seen evidence of this openness, as the enhanced system reliability is encouraging more clinical departments to join the program. As Valko described, “When I approach practices about adopting EMpoweR, the first question asked is about the system’s reliability. If it goes down once a day, once a week, or once a month, that is all the users will remember. They think about the downtime and wonder when it will happen again. Now I can describe the system’s failover capabilities.” EMpoweR users have experienced the failover system in action; recently all other IT applications went down, with the exception of the EMpoweR system. Such situations improve client satisfaction and make them more willing to develop new applications for the EMR system.

Lessons Learned
The Jeff IT team shared several lessons learned from the data center transition, as described in this section.

Good expectation and scheduling management are essential.

“My biggest concern was irritating your client,” stated Mancaruso. “But if you tell them the transition will take two days to do...
it, they will be fine because they can plan accordingly.” Mancaruso would remind clients about the schedule, to ensure their preparations were on track.

Jeff IT’s institutional reputation rose as it followed through on these expectations with on-time project performance. What contributed to the team’s timeliness was its strict adherence to the moving schedule and the formal procedures instituted to change a moving day. Campbell learned this the hard way. “I should have locked down the schedule a lot sooner,” he said. “Initially we took a very open approach to scheduling, asking areas applications support groups to set a move day that was convenient for them, but we found we often would not receive any dates.” Finally, the team developed a proactive strategy whereby Mancaruso would “strongly recommend” to clients to schedule their server transition on a given day.

Because schedule changes ripple through the entire project—Jeff IT, the hospital IT, DBSi, and other scheduled application users—the formal change procedure ensures that any alterations are not requested lightly. Campbell’s and Mancaruso’s organizations followed a “good cop–good cop model to address scheduling issues,” stated Herrick. “They projected a confident and united front to the application user.”

**Good planning and controls keep project complexities in check.**

As Hoffler stated, “Moving a data center is not an easy project, but it is not as difficult as I first imagined it would be. The reason is good planning. The project remains complex, but it becomes controllable. Good planning not only enables us to make the deadline, but it minimizes the preparations.” Reis concurred: “I was happily surprised at the project planning’s thoroughness and detail. It had an impact on the speedy and trouble-free nature of the move. It lessens the number of surprises you may face.” DBSi’s Gallagher noted the Jeff IT’s planning acumen, observing the team’s methodical and thorough nature compared with that of other clients. “They always ask questions,” he said. “A constant question is, ‘What am I missing?’”

Reis noted that finding the right balance in controls is important, too. “Hiring an armored car to bring up the servers to the facility would be incredibly expensive, but with good planning you can decide to bring them up during slow traffic periods.” Finally, Hoffler advised, “Don’t be afraid to change your plans. Moving a data center is not something that we normally do. You learn things along the way and you alter plans accordingly.” Examples include how the team applied lessons learned from phase I to segment phase II into a series of smaller, discrete moves, and the wisdom of reevaluating options after encountering problems while transporting equipment via a major expressway on a Friday afternoon.

**Standardization should not preclude individualization.**

Checklists and procedures bring order to a complex project, but these could encourage team members to become too complacent. “People get so used to doing the same thing that they may miss things when there are any minor variations to the routine,” stated Campbell. “Most of our moves are done off hours and weekends, but some groups’ downtime occurs during the day. We had issues when team members from the different support groups became accustomed to nighttime implementations and suddenly had to work during the morning. People tend to go on autopilot.”

**Budget for the unexpected.**

A data center transition is a long-term process, and many unexpected things can happen along the way. For example, Gallagher points to the changing prices
and availability of materials. In the last year, demand has pushed copper’s price up more than $1.00 per pound; a UPS battery’s price rose about $75; and the lead time for to purchase a 2-megawatt generator is 400 days. “Nine months can pass by the time you finish the data center’s design and preparation, and you find that your budget may be insufficient. This problem is compounded if the project slips its completion deadline,” Gallagher commented. Obviously, Gallagher advises working closely with your outsource vendor to alert you to price fluctuations and to locate equipment available on the market as a result of other project cancellations.

Stand by your team.

As noted earlier, a data center move is an uncommon and somewhat unpredictable project, and most likely will encounter a few bumps and opportunities along the way. An IT leader sets the tone for his team’s response in these unexpected situations. “You can’t take risks with new technology and approaches unless you have a CIO who is fair and will stand by you during the good times and when you stumble,” stated Herrick.

Conclusion

When an organization is faced with upgrading a data center, outsourcing may not be an immediately considered option. But as TJU’s experience suggests, it warrants serious consideration. Financially, expenditures can be more efficient and predictable. Operationally, outsourcing can open the door for improvements that extend well beyond the project parameters. Not only has data center performance improved, but also methodical project management and extensive client outreach have produced greater institutional respect for Jeff IT. Strategically it frees up valuable resources and capital, enabling an IT organization to focus on more institutionally beneficial support and constructive services. At TJU, outsourcing the data center has raised positive expectations within Jeff IT and among its clients. This bodes well for Jeff IT as it pursues future IT innovation.

Endnotes

2. Ibid.

Citation for This Work