



Virtualization: Healthcare's Cure for the Common Cost?

Healthcare Provider IT Strategies

TECHNOLOGY ASSESSMENT #HI205033

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HEALTH INDUSTRY INSIGHTS OPINION

U.S. healthcare providers are facing enormous, and opposing, pressures to simultaneously control costs and improve quality and access to care. The rate of inflation in healthcare costs consistently outstrips inflation in general, while the country's insatiable appetite for healthcare services, as evidenced by the percentage of the GDP devoted to healthcare, keeps growing. Mounting pressure to control costs is coming from the government and employers, who pay more than two-thirds of the nation's healthcare bill. At the same time, payers, the government, employers, and consumers alike are demanding better quality of care and improvements in patient safety and service quality. This, combined with the Bush administration's full court press to bring the U.S. healthcare industry into the digital age, has accelerated the adoption of IT in almost every aspect of healthcare delivery. But while IT is seen as a critical element of change, the chronic capital shortages and intense intraorganizational competition for capital that have plagued the industry for years are major limiting factors on the rate of IT investment. In light of these factors:

- Server consolidation and virtualization represents an important new technology for controlling the proliferation of the infrastructure costs that accompany the implementation of these new applications, allowing more of IT's limited capital to be allocated to additional initiatives.
- Despite its growing popularity in corporate IT environments, healthcare organizations have been slow to adopt.
- One leading provider organization, University of Pittsburgh Medical Center (UPMC), has made a significant and highly visible commitment to this technology. Although it is early in the adoption cycle, savings to date are approaching \$20 million.
- UPMC's experience is demonstrating the value of this technology and represents an effort that other provider organizations should closely monitor.



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IN THIS REPORT

Health Industry Insights recently completed the first phase of a four-phase, three-year longitudinal "benchmark" study of the University of Pittsburgh Medical Center's (UPMC) Information Technology Service Transformation Program (ITSTP). The intent of the program is to reengineer UPMC's information technology (IT) infrastructure from three broad but interrelated aspects: people, process, and technology, with the goal of building a stable, flexible, and cost-efficient foundation for future IT innovation. ITSTP involves consolidating, standardizing, and virtualizing the UPMC server environment and implementing an organizational and operational environment modeled around the IT Infrastructure Library (ITIL). Health Industry Insights' role throughout this effort is to provide objective, third-party oversight of the program, monitoring its progress and assessing its success.

This report presents Health Industry Insights' Phase 1 findings and describes the subsequent phases of our assessment of the program.

Health Industry Insights' principal goals for Phase 1 were twofold. The first was to define metrics that would provide effective measurement of the program's progress in the technology area throughout the course of the project. The second goal was to develop initial baseline values of those metrics for 3Q05, the time period which coincided with the completion of the initial planning phase of the program but was prior to the implementation of the planned changes.

These baseline measures will serve as the foundation from which to analyze progress at the conclusion of each of three subsequent phases. Future reports will not only focus on the progress of the technology transformation aspects of the program but will also focus on the organizational and process improvement components of the program, as the emphasis of the work plan in Phases 2 through 4 shifts from technology to these other areas.

SITUATION OVERVIEW

About UPMC

UPMC is the largest health system in western Pennsylvania and is one of the major academic medical centers in the United States. During the past decade, through multiple acquisitions of unrelated healthcare provider organizations, UPMC has reshaped the healthcare landscape in western Pennsylvania. As a \$6 billion organization and the region's largest employer, it has transformed the economic landscape as well. It has become one of the largest not-for-profit integrated delivery networks (IDN) in the United States, and it is currently the largest employer in western Pennsylvania, with almost 43,000 employees.

UPMC is composed of 19 hospitals and a network of other care sites across western Pennsylvania and throughout the world: doctors' offices, cancer centers, outpatient treatment centers, specialized imaging and surgery facilities, in-home care, rehabilitation sites, behavioral healthcare, and nursing homes. It also owns one of the largest health plans in Pennsylvania, with almost 800,000 members. An extensive, world-famous research program complements the healthcare delivery organization.

Like most U.S. healthcare providers, UPMC is facing multiple challenges that translate into doing more with less. These include finding solutions that:

- Respond to the growing pressure from payers, consumers, employers, and the government to improve care delivery costs, customer service, patient safety, and service quality
- Improve clinical staff productivity and mitigate the effects of shortages of skilled clinical staff — shortages that are expected to dramatically worsen in the next decade
- Facilitate compliance with increasingly complex regulatory and reporting requirements

IT at UPMC

In order to deliver highly integrated, efficient care in the face of this rapid growth and industry pressures, UPMC recognized that enterprisewide IT systems, data integration, and platform standardization were crucial for their quality and business integration goals and to achieve the economies of scale expected to accrue from these acquisitions.

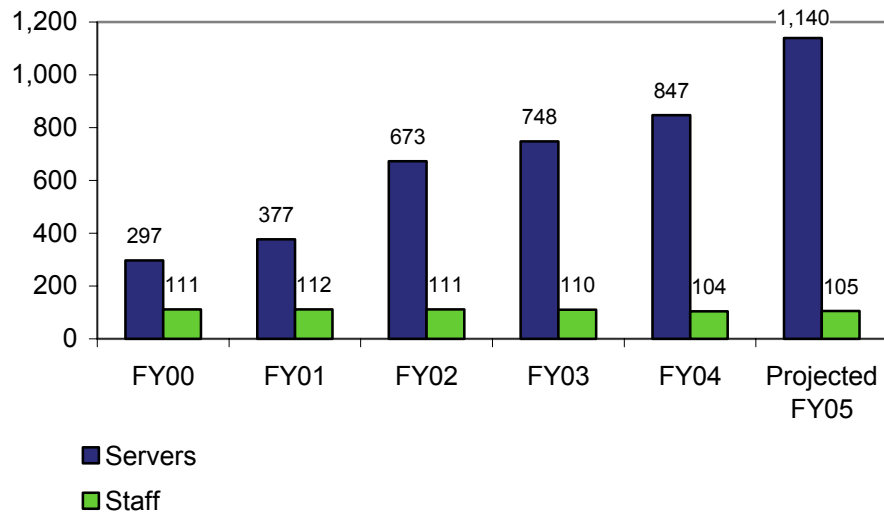
Also, it was clear that to set a high standard of care and apply that consistently across the health system would require the deployment of a sophisticated, and standardized, portfolio of clinical IT at all of the hospitals and ambulatory care sites. Many of these were in financial distress when acquired and had made only limited investments in IT. The key components of UPMC's current applications portfolio includes clinical and ERP software products from Cerner, Epic, Misys, Oracle/PeopleSoft, and GE.

But as these business drivers demand an increased investment in sophisticated IT, particularly in the clinical area, the costs of providing the supporting infrastructure have dramatically risen. For example, in the five-year period from 2000 to 2005, the total number of Wintel and Unix servers had almost quadrupled (see Figure 1). The forecast was for even more dramatic increases in both technology and staff to meet the additional acquisitions and the goal of deploying a standardized, systemwide, highly sophisticated clinical IT environment.

IT management recognized that these infrastructure and staffing costs, though necessary to deliver the services, were relatively "invisible" to the organization and that new approaches were required to maximize service levels while mitigating the expected increases in cost, allowing greater visibility of the value of IT delivered to the end-user community. UPMC also recognized that implementation of this plan would create not only a massive IT environment but a significant IT staff that would require improved management processes and tools to ensure world-class service levels.

FIGURE 1

UPMC Servers and Staff, 2000–2005



Source: UPMC, 2005

UPMC sought a way to reduce the ratio of IT infrastructure costs to total IT costs and shift the savings to increased end-user services. Also, since each of the acquired hospitals had maintained its own datacenter and the goal was to ultimately provide more centralized IT services, space was another key issue. The plan was to relocate the equipment at each hospital site into the corporate datacenter. However, capacity limitations in the primary datacenter would either prevent the consolidation of local datacenters and the conversion of that space to support revenue-producing patient care activities and/or would necessitate significant capital to construct additional space to accommodate the projected infrastructure growth.

In late 2004 and early 2005, UPMC sought solutions to meet this growth in a more cost-effective way. Consolidation, standardization, and virtualization, combined with the implementation of a comprehensive set of management tools and ITIL processes, were seen as the optimum solutions to these problems. In April 2005, UPMC announced a \$328 million, eight-year contract with IBM to transform the UPMC datacenter into an On Demand Operating Environment (ODOE). The project became known as the Information Technology Service Transformation Program.

ITSTP Project Scope

The scope of this ambitious, multiyear program is to:

- Consolidate and standardize all Wintel and Unix servers
- Convert the majority of server-based services to a virtualized, on-demand environment, with all of its concomitant autonomic load-balancing capabilities, to realize a reduction of more than 60% in the total physical server inventory
- Eliminate all direct-attachment storage and consolidate 40 direct- and network-attached storage systems into two storage area networks (SANs) to reduce operating costs and facilitate backup and recovery procedures
- Refresh all desktop and server hardware within three years and adhere to an ongoing three-year refresh cycle
- Reduce the current equipment footprint in the corporate datacenter by up to two-thirds to accommodate the inward migration and consolidation of equipment from more than a dozen remote datacenters
- Improve customer service through the implementation of new IT management practices based on the worldwide process standards of ITSM and ITIL and reorganize the infrastructure support staff accordingly
- Improve disaster planning and recovery effectiveness

Anticipated Benefits of ITSTP

UPMC anticipates that these initiatives will reduce IT infrastructure operating expenses by as much as 15–20% annually and significantly reduce capital costs when the eight-year project is concluded. These savings are expected to accrue through a combination of platform standardization, reductions in server counts, improved resource

utilization, and the deferral of construction costs associated with the expansion of the corporate datacenter.

In addition, it is expected that autonomic resource sharing will improve system availability and performance by:

- Virtually eliminating unplanned outages
- Providing the ability to dynamically allocate system resources to accommodate peak workload requirements
- Providing the ability to shift workloads to available servers during periods of scheduled downtime

Further, consolidation of local datacenters at hospital sites into space freed up in Forbes Tower datacenter will allow for conversion to revenue-producing activities.

Finally, UPMC anticipates improved customer service in the form of reductions in help desk call volumes and improved first call resolution rates resulting from replacement of aging desktops with new equipment, standardized desktop images, and improved remote desktop support and network management tools. Improved incident management procedures, a focus of the second and third phases of the program, are also expected to reduce problem resolution cycle times.

But to determine if the anticipated benefits were ultimately achieved, UPMC recognized that it was essential to understand where it started from, where it was at each milestone, and how its performance compared to other world-class IT organizations performance. Health Industry Insights was retained to provide objective, third-party oversight and assess the extent to which these benefits are ultimately realized.

Overview of Benchmarking Project Methodology

Health Industry Insights' approach to the project called for the development of a series of metrics that could be used to:

- Compare baseline (precontract) metrics versus planned and actual program achievements
- Calculate the variance accumulated over the contract to date as a measure of the estimated savings
- ID any variance between actual and planned performance to define corrective actions

In subsequent phases, benchmark results will be used not only to compare UPMC's progress against its own baseline data but also to compare it to other high-performance organizations within and outside of the healthcare provider market.

Benchmark Metrics Definitions

Benchmark metrics were defined in seven categories:

- **Baseline reduction goals**, to measure progress against expected goals as quantified in the original "deal" documents and press releases
- **UPMC corporate baseline statistics**, to normalize other metric ratios to account for ongoing corporate growth through measures of enterprise size, such as number of inpatient beds, admissions, employees, total revenue, and corporate capital budget
- **IT financials**, to measure changes in IT value ratios and percentages, such as:
 - IT infrastructure operating budget and capital budget to total IT budget
 - IT capital budget to total enterprise capital budget
 - Total IT costs to enterprise revenue
 - IT infrastructure costs versus total IT costs
- **Help desk services statistics**, to measure the impact of improved desktop management technology and reduced system downtime through such ratios as:
 - First call resolution rates
 - Help desk staffing and volume versus UPMC employee population
 - Average elapsed time to problem resolution
- **Desktop services statistics**, including:
 - Average number of desktops supported per technician
 - Average number of desktops per UPMC employee
- **Server services statistics**, including:
 - Ratios of physical servers, operating system instances, and CPUs per server technician

- Average number of processors per server
- Percent of planned and unplanned system availability
- **Storage services statistics, including:**
 - Number of storage arrays
 - Ratio of SAN storage capacity to total storage capacity
 - Terabytes of storage per storage technician

Some of these metrics will be measured beginning in Phase 2 of the project.

Findings

Our findings to date provide both qualitative and quantitative evidence that UPMC and IBM have successfully initiated the transformation process. The program is not only on schedule but has already begun to accrue its anticipated benefits. UPMC has made substantial progress in the conversion of its traditional IT environment to a more efficient, "on demand" architecture.

Although the program is just one year into its three-year duration and only recently entered the second of four planned stages, UPMC has already realized substantial economic benefits. Health Industry Insights estimates that savings already identified will *conservatively* range from \$18–22 million over the next three years. This estimate is based only on the data developed from efforts completed to date. It should be noted that virtualization had just commenced at the point at which our Phase 1 data collection effort concluded. We fully expect additional savings to accrue in the near term, which will be quantified as part of the next phase of our analysis, due to be completed in 2Q07.

UPMC and IBM have met or exceeded all of the first-year objectives defined in the program charter. Specifically:

- IT has maintained a "flat" infrastructure support staffing model, while the ratio of infrastructure staffing to total IT staffing has declined (see Figure 2).
- IT infrastructure operating costs have decreased as a percentage of the total corporate IT operating budget (see Figure 3).
- Unix server consolidation is off to an excellent start:
 - Despite a significant growth in aggregate Unix-based workloads (principally related to PeopleSoft and Cerner), the

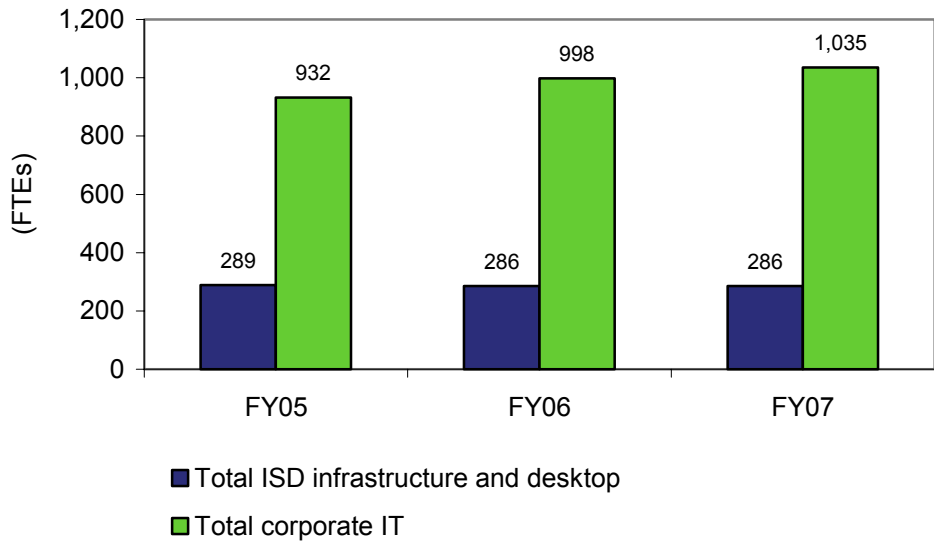
physical number of Unix servers has been reduced by 28% from its 3Q05 peak.

- The number of Unix CPUs has dropped by 19%; simultaneously, the number of Unix operating system (OS) instances increased by 35%, providing more processing capacity.
- There has been no increase in the complement of Unix system engineers and, in fact, hiring plans for three additional employees have been deferred, leading to a 54% increase in OS instances and a 27% increase in database instances supported per Unix engineer (see Figure 4).
- The net impact to date of this initial stage of virtualization was the elimination of one large Unix server complex, resulting in a three-year net cash flow savings of almost \$6 million (see Table 1).
- Planning for the migration of the initial wave of Wintel server virtualization projects a three-year cash-flow savings of \$11 million. This initial wave comprises less than half of the total server inventory targeted for virtualization (see Table 2).
- Migration from distributed direct-attached storage (DAS) to centralized SAN arrays has begun. Disk storage capacity has been increased by almost 30% using lower-cost, higher-density storage technology, while the ratio of NAS grew from 62% to 87% of total storage capacity (see Figure 5). This positions UPMC for conversion to an all-SAN environment during Phase 2 and will allow IT to achieve economies of scale benefits from more effective storage utilization and reduced support cost ratios. Although it is too early to analyze the impact of this migration, the extent of these savings will also be quantified in our next report.
- The procurement and provisioning processes of new equipment has been significantly enhanced, and provisioning time frames have been shortened. Provisioning time will be incorporated into the next phase of metric reporting.
- The deployment of ITIL-based tools and autonomic system control mechanisms has begun.

These accomplishments have positioned UPMC as a leader in the adoption of server virtualization technology among healthcare provider organizations, placing them on the leading edge of a wave of technological change that will fundamentally alter how IT is deployed and managed in the industry.

FIGURE 2

UPMC IT Infrastructure and Total IT Staffing, FY05–FY07

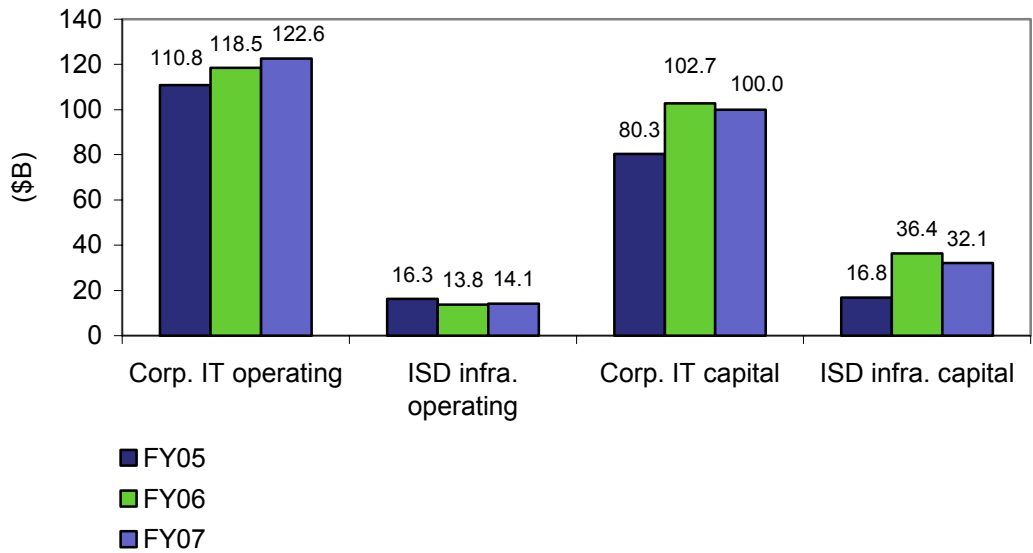


Note: ISD infrastructure FTEs decreased (as a percentage of total corporate and divisional IT FTEs) from 31% (FY05 baseline) to only 28% (per FY07 budget).

Source: Health Industry Insights and UPMC, 2006

FIGURE 3

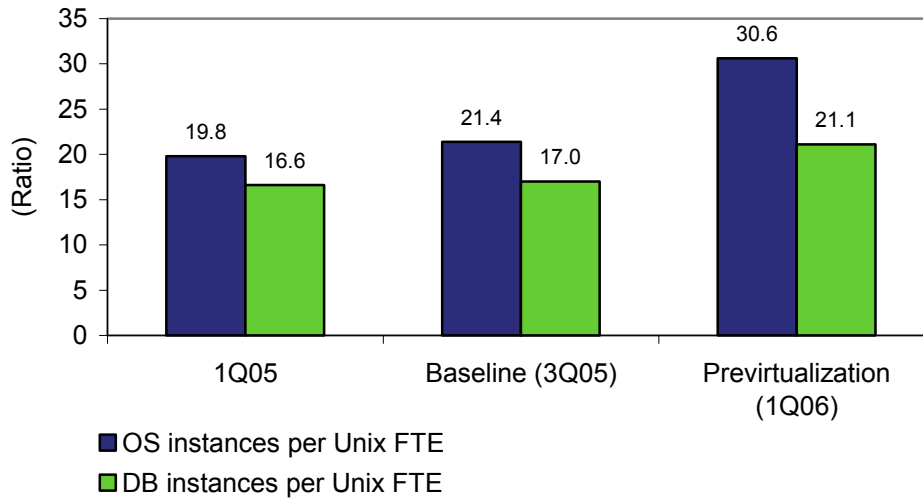
UPMC IT Infrastructure-Related Operating and Capital Costs Versus Total Corporate IT Operating Costs, FY05–FY07



Source: Health Industry Insights and UPMC, 2006

FIGURE 4

UPMC Productivity Ratio per Unix System Engineer,
1Q05, 3Q05, and 1Q06



Notes:

For the period beginning 1Q05 (contract execution) through the baseline measurement period (3Q05) and ending 2Q06, there was no change in number of Unix system engineers ratio (remained at 9), a 54% increase in OS partitions or instances, a 27% increase in database instances, a 40% decrease in the number of Unix cabinets ("boxes") in the Forbes Tower datacenter, and a 24% decrease in the number of Unix CPUs.

Source: Health Industry Insights and UPMC, 2006

TABLE 1

UPMC Three-Year Cash-Flow Savings: Unix Servers (\$)

	One-Time Cost	Annual Cost	Three-Year Recurring Cost	Total Cost (One Time + Recurring)
p595 Unix Server: PeopleSoft				
Hardware (including installation/activation)	3,065,500		–	3,065,500
Floor space (68 sq ft at \$535/sq ft)	36,380		–	36,380
Annual hardware maintenance		325,080	975,240	975,240
Software license fees	1,000,000			1,000,000
Annual software license maintenance		250,000	750,000	750,000
Net savings	4,101,880	575,080	1,725,240	5,827,120
Staffing				
Cost avoidance — 2 AIX system engineers + 1 DBA at \$80,000 each + 27% fringe		304,800	914,400	914,400
Net savings		304,800	914,400	914,400
Total savings				6,741,520

Source: Health Industry Insights and UPMC, 2006

TABLE 2

UPMC Three-Year Cash-Flow Savings: Wintel Servers (\$)

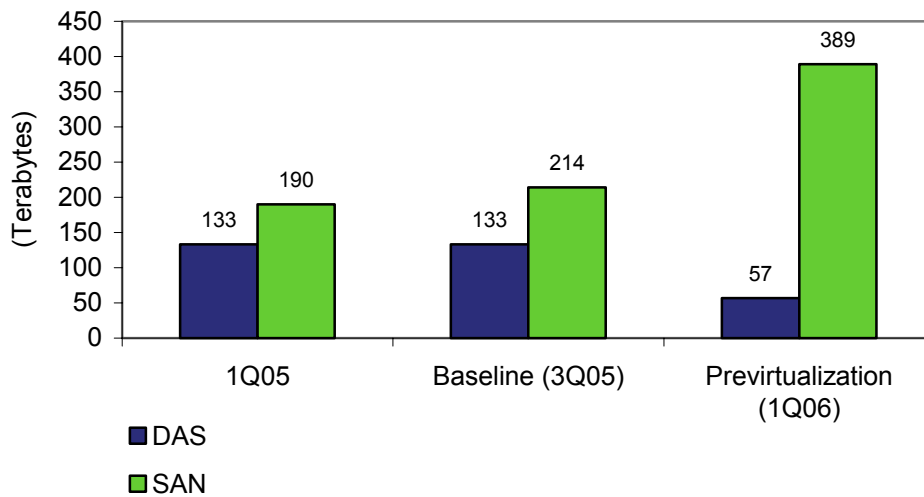
	Savings in One-Time and Recurring Cost (3 Years)
Power	467,400
SAN	3,439,800
Networking	2,044,800
Floor, cooling, and rack space	750,000
Servers	4,340,250
Total	11,042,250

Note: Data represents sample savings based on 450 physical versus virtualized equivalent (72 physical servers). May 2006 ISD baseline Wintel server inventory was 850.

Source: Health Industry Insights and UPMC, 2006

FIGURE 5

UPMC DAS and SAN Storage Capacity, 1Q05, 3Q05, and 1Q06



Notes:

While staffing has increased in this area, (from 1 to 2 FTEs), the ratio of storage supported per employee has dramatically increased.

Source: Health Industry Insights and UPMC, 2006

FUTURE OUTLOOK

The second phase of our assessment will report on the economic and operational results of the virtualization of the balance of the targeted server inventory. It will also provide an analysis of the cost differential between accommodating ongoing growth in a virtualized environment as compared to traditional previrtualization provisioning methods. In addition, we will provide an initial assessment of the impact of the ITIL-based process and organizational changes that are the focus of Phase 2 of the program. Finally, we will be initiating coverage of UPMC benchmark data against a group of other healthcare provider organizations and other high-performance IT organizations from other industry sectors drawn from IDC's benchmark database.

Over the next five years, virtualization of server resources will profoundly change the cost and support paradigms IT has come to rely on in the same way the introduction of virtual operating systems transformed mainframe computing 30 years ago. We believe that the benefits will more than justify the conversion effort. Based on our analysis of the program's results to date, this landmark project will establish UPMC as a leader in the strategic use of IT among healthcare providers and place it on par with leading IT-enabled organizations as well.

ESSENTIAL GUIDANCE

Actions to Consider

Large healthcare provider organizations, many of which are confronted with similar cost and technology challenges, have much to gain from emulating UPMC's approach. Such organizations should begin to develop a strategic plan for virtualization, beginning with an inventory of their server resources and an assessment of the potential economic benefits of standardization, consolidation, and virtualization.

Provider organizations considering such action should also seek to identify other "virtualization pioneers" willing to share their experiences, both good and bad. They would do well to look outside of healthcare to financial services, manufacturing, and banking, as those are some of the industries with the most experience to date. IDC data suggests that in industries other than healthcare, upward of 40–50% of companies have implemented server virtualization beyond simple pilots. Among healthcare provider organizations, that number is well below 10%.

If they have not already done so, healthcare IT (HIT) application software vendors should work with their technology platform partners to assess the ability and benchmark the performance of their products

in a virtualized environment. Those that demonstrate the ability and willingness to operate in a virtualized environment will enjoy a competitive advantage in this increasingly cost-conscious marketplace.

LEARN MORE

Related Research

- *U.S. Health Industry 2007 Top 10 Predictions* (Health Industry Insights #HI204993, December 2006)

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