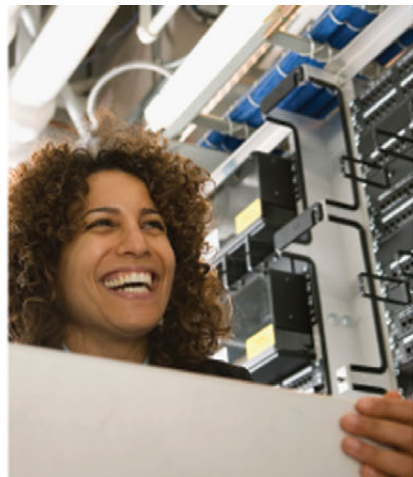


Extending the life of your existing data centers.

Smart execution helps IBM Lexington data center double IT capacity in the same footprint



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Data centers are at a tipping point

Data centers are getting old. A recent survey conducted by IDC reported that the average age of data centers in the United States is 12 years.¹ That means they were built before the dot-com era. And in our experience, this is typical of data centers around the world. But with data centers having an expected life of 20 years or more, data center managers still have an opportunity to extend the life of their existing data centers as they reach their capacity and capability limits. Data center managers can avoid having to make major investments for new data center capacity if they address the many challenges presented by older data centers.

For one thing, clients face increasing demand for IT capacity in their data centers to support business growth. IBM and consultant studies project that the server installed base will multiply by a factor of six between 2000 and 2010, while storage is expected to grow by a factor of 69.²

In our experience, servers account for 50 to 75 percent of a typical data center's total floor space, but we've seen the average utilization rate for those assets at only between 10 and 15 percent. Their requirements for physical space, power and cooling preempt the deployment of new capacity. And the inefficiencies of older data centers make it difficult to respond quickly to the opportunities and demands created by new information technologies.

Clients are also under increasing cost pressures. In a recent survey of nearly 500 North American and Western European senior IT professionals, Enterprise Strategy Group (ESG) found, "Cost reduction—and cost avoidance—rule the day for business and IT decision makers. Faced with a global economic recession, corporate cost reduction initiatives were viewed by survey respondents as the most important factor in deciding what, if any, IT investments are to be made in 2009."³

Highlights

Get more from your existing data centers

Built with the expectation that they would last 20 to 30 years, many older data centers are struggling to keep up with the demands of new IT technologies, which have power densities we project to grow by a factor of 20 in this decade.

Because lead times for upgrading or building a new data center can be as long as 12 to 24 months, we need to look at solutions and approaches that help extend the life of existing data centers and provide near-term financial payback, allowing organizations to do more with less, keep costs under control, quickly deploy new technologies and support continuous business change.

Virtualization leads a series of integrated actions that cut costs and support growth

Proven solutions—especially virtualization—are available to boost server utilization in existing data centers. The ESG study above found that 45 percent of respondents indicated that they will increase their spending on virtualization “as organizations look to reduce costs by consolidating server infrastructure and maximizing utilization of existing assets.”⁴

Virtualization is only part of a series of integrated actions that can help you buy time to plan for a major expansion while deferring significant capital costs. Integrating IT and data center facilities planning and execution solutions enables continued capacity growth—potentially doubling IT capacity or reducing operational expenses by as much as 50 percent.

A position paper recently issued by Digital Realty Trust noted, “... the contemporary datacenter can be described, now more than ever, as a dynamic environment which must constantly be recalibrated to maximize its effectiveness.”⁵

Let’s take a look at how an actual data center employed integrated IT and facilities solutions to improve its own performance and better support business growth.

“ ... [T]he contemporary datacenter can be described, now more than ever, as a dynamic environment which must constantly be recalibrated to maximize its effectiveness.”

— Digital Realty Trust

Highlights

IBM Lexington shows what can be done with an older data center

The IBM data center in Lexington, Kentucky, is typical of many older data centers. It was originally built in the 1980s and retrofitted in the past five years. The problems the IBM data center team had to solve there are the same problems that many of our clients—not only those with large data centers but also those with just a small server room—are trying to solve.

“We were at 98 percent of our capacity, so essentially the data center was full,” said Boyd Novak, director, IBM Americas Data Centers, who heads all IBM outsourcing centers. “We needed to support our business growth but were constrained in every area. So we had to look at a number of improvements to meet our capacity growth. We didn’t have the time to wait to build a new facility.”

“We needed to support our business growth but were constrained in every area.”

— Boyd Novak

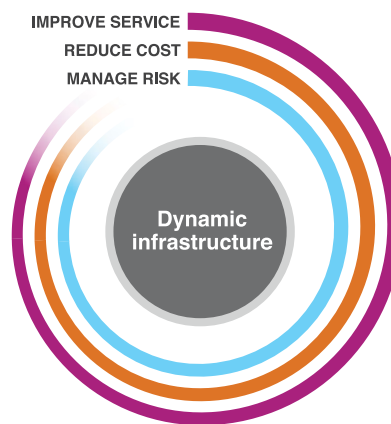
IBM Lexington had to support 6 percent annual growth while maintaining the highest data center availability levels. This meant overcoming constrained power and cooling capacity and improving the resource utilization of its UNIX® servers.

And since the IBM Lexington data center is a production data center, Novak’s team had to evaluate and implement solutions with what they had and without disrupting operations. Moreover, they needed to avoid major capital expenditures and find ways to reduce ongoing operational expenses. As an outsourced data center and a leased facility, Novak had to financially justify all improvements to clients and the landlord. “We needed to do more with less—and faster,” he said.

Highlights

Smart execution enables eight times IT growth in the same physical footprint

By implementing several integrated solutions, IBM Lexington increased its IT capacity by a multiple of eight in the same floor space and energy footprint to reduce costs and improve service.



- Increased IT capacity by **eight times** in the same floor space
- Met **6 percent** annual growth requirement
- Deferred **US\$50 million** in capital costs for a data center upgrade
- Virtualized **70 percent** of the baseline workload
- Avoided **US\$2.4 million** in hardware purchases by redeploying servers
- Saved **US\$162,000** (10 percent annual energy savings) and improved the energy efficiency of the data center
- Reduced the requirement for storage by **20 percent**
- Increased storage utilization **2 to 3 times**

SOURCE: IBM Lexington

Figure 1

IBM Lexington achieved a number of important efficiency goals—and could keep growing capacity.

Fact-based analysis provides the roadmap for improvements.

Analysis leads to action

The key to action is analysis. By including both the IT and facilities infrastructure, Novak’s team could prioritize initiatives, predict outcomes, justify expenditures and track implementation of all actions required. Analysis helped minimize the risks of implementation to achieve the desired growth. When known solutions didn’t yield all that was required, Novak had his team challenge conventional assumptions to find more savings.

Get the facts to diagnose underutilized server assets

In 2006, when this project was started, the IT industry was beginning to realize the need to improve the resource utilization of servers. By analyzing how much the data center’s servers were actually being utilized, the Lexington

Highlights

Proven virtualization solutions can enable a tenfold improvement in server utilization.

Improved resource utilization helps remove constraints, which enables business growth.

team found that the majority—more than 60 percent—were less than 5 percent utilized. This meant that, on average, the data center had 20 times more servers than needed because the client requirement had been to size to peak workloads. Consolidating the number of servers and sharing resources via virtualization could provide significant room to meet business growth objectives.

Consolidate and virtualize to improve resource utilization

Novak's team worked on the business case and plan to consolidate and virtualize the IT environment by framing the solution, planning the workloads to be moved and implementing the plan. The team identified that more than 70 percent of the initial workloads from the data center's five major clients could move to a virtualized environment. Over the next three years, he enabled a tenfold improvement in the UNIX server utilization for mission-critical production workloads—from 3 to 5 percent to 30 to 50 percent. This aggressive virtualization resulted in a dramatic reduction in the underutilization of server assets—now only 12 percent of the servers are less than 5 percent utilized.

While increasing server utilization, Novak's team also began to normalize performance planning. The modeled workloads more closely matched baseline usage, with “capacity on demand” available in reserve. This enabled servers to be redeployed and saved US\$2.4 million in additional hardware costs. Modeling helped the team avoid unnecessary risk and identify additional ways to consolidate and virtualize the data center.

Add IT capacity in an energy-efficient manner

The virtualization success resulted in a 75 percent reduction in the number of physical UNIX servers—from 1,500 to 400 servers. This freed up the necessary floor space, power and cooling to allow the data center to meet the growth required.

As clients needed more IT capacity, the IBM team replaced the older, single CPU servers with newer, multi-CPU processors. These systems improved computing performance in virtualized environments. In addition, they are more energy efficient, requiring less than 50 percent of power per unit of computation. Three years after starting the project, the data center

Highlights

has delivered an eightfold growth in overall IT capacity while doubling the number of servers to approximately 3,000 virtual servers in the same physical floor space.

Similarly the team addressed storage optimization for some of the clients and was able to reduce 20 percent of the storage required while doubling and tripling utilization. This was accomplished by maximizing reuse of unassigned storage, consolidating storage without negatively affecting performance and removing performance hot spots from many applications.

Efficiently dispose of old equipment to make room for upgrades.

Retire and reuse—dispose of the hardware assets responsibly

At the end of a hardware refresh cycle, and after servers have been fully depreciated, the IBM team helped clients retire their hardware assets in an environmentally responsible manner. According to a number of industry sources, fewer than 55 percent of U.S. companies have an IT disposal strategy. More than 85 percent of the machines returned to IBM remanufacturing centers by IBM Global Asset Recovery Services are reused or resold. Less than 1 percent are sent to the landfill.

Don't forget to integrate the facilities actions

Just as IT architects balance the processor, memory and input/output (I/O) resources for optimal IT performance, so the physical data center infrastructure needs to be balanced to the virtualized IT environment.

Integrating the physical infrastructure can improve energy efficiency by 10 percent.

Get the facts—diagnose data center energy use

In an environment where the data center was constrained by power and cooling, all areas needed to be investigated for savings. Novak's team conducted a data center energy-efficiency assessment to evaluate the cooling, electrical and building systems. The Lexington facility had a DCiE (data center infrastructure efficiency) rating of 50. The analysis provided a roadmap of actions with two-year financial paybacks that resulted in a 10 percent improvement, to a DCiE rating of 55. Without these additional savings, the data center's growth would be limited, and no additional servers could be added.

Highlights

Fact-based analysis helps rightsize facilities to avoid the expense of overcooling the data center.

Sophisticated modeling and ongoing energy management can help reduce overallocation of power by 15 to 20 percent.

Eliminate the meat locker—reduce overcooling

Additional diagnoses using innovative sensor technology and software helped identify hot spots and suggest solutions to reduce the overcooling of the data center. Thermal analysis using mobile management technology identified two major actions: add more perforated floor tiles for horizontal cooling and increase set point temperatures.

Rightsize—balance the facilities to the virtualized environment

As is the case with many older data centers, computer room air conditioners (CRACs) had more redundancy than needed based on changes in the technology environment. They had been set up to support a 1980s-era mainframe environment, but as the clients changed, so did the systems in the center—mainly to UNIX servers, which have lower cooling requirements. Virtualizing the IT workloads created an opportunity to balance the facilities workload by turning off redundant CRAC units.

The models provided by mobile management technology indicated which CRACs could be turned off without creating a hot spot. To manage the risk associated with this, Novak was able to turn off 11 underutilized CRACs in three phases without affecting redundancy or load.

Reducing the overcooling and turning off the underutilized CRACs saved 260 kilowatt hours and allowed the power savings to be used to support client growth and implementation of additional servers. In addition, it resulted in 7 percent annual energy savings—US\$116,000 every year—to provide operational cost savings.

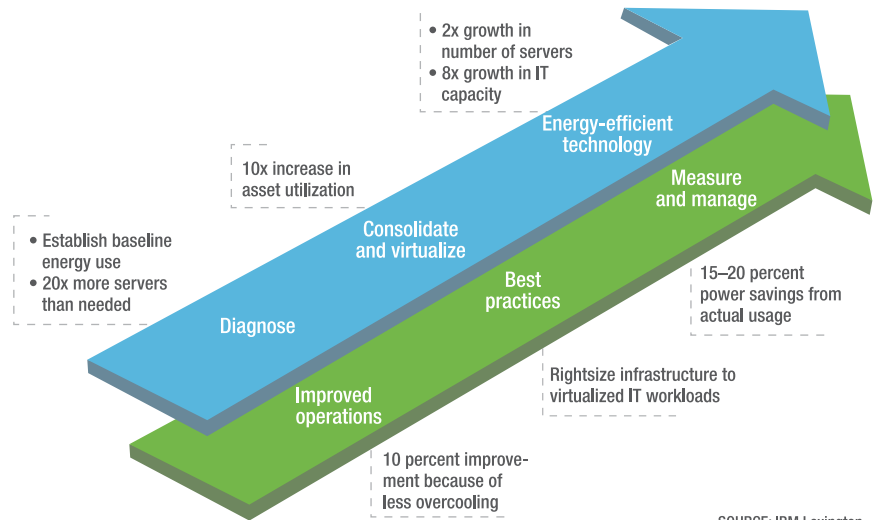
Get the facts—ongoing energy management for continual improvement

Data centers are a constantly changing environment with a need to measure and manage the ongoing usage of energy to be able to respond to business growth. Needing to find additional energy savings, Novak again challenged his team to provide insight on the actual energy used by the servers rather than

Highlights

using rule-of-thumb measurements. Rather than just trying to rely on the nameplate power and cooling specifications to plan a 20 percent reduction, a historical analysis of actual power usage allowed Novak's team to reduce overallocation of power by another 15 to 20 percent. This provided more headroom for the deployment of additional IT equipment.

IBM Lexington used integrated solutions to gain efficiencies from both facilities and IT infrastructure.



SOURCE: IBM Lexington

Figure 2

IBM Lexington used integrated solutions to gain efficiencies from both facilities and IT infrastructure.

Lessons learned

The series of actions executed over three years at IBM Lexington taught us several important lessons:

- *Integrate your IT and data center planning to gain as much savings as possible and extend the life of your data center.*
- *Use proven business cases to provide the financial justification for getting permission to do more.*
- *Execute faster to deliver cost savings sooner.*
- *Leverage the lessons learned in your first data center implementation and apply them to the rest of your portfolio. Knowing what to do and how to do it quickens the pace of capacity growth.*

Highlights

Lessons learned at our Lexington data center are being applied across our portfolio to help maximize cost savings and drive global integration.

Applying lessons across the data center portfolio

What we learned at Lexington is now being leveraged across the top 60 global data centers at IBM. Success leads to success.

- *We set targets for server utilization for the x86 and UNIX platforms, followed by a target for data-center-level energy-efficiency metrics.*
- *We improve resource utilization for more clients in our other data centers. By the end of 2008, we deployed more than 50,000 virtual images, with at least 10,000 more planned for this year. Our virtualization adoption rate is 10 percent over the industry average. Several UNIX systems are able to achieve a 40:1 consolidation ratio and a 70 percent savings in space, power, cooling and equipment costs.*
- *During hardware refresh cycles, we encourage our clients to replace single CPU servers with multiple CPU servers for increased asset utilization and energy efficiency.*
- *At the end of the hardware refresh cycle, we help our clients dispose of the assets. In the United States alone, this amounts to nearly 9,000 pieces of IT equipment annually.*
- *We plan to expand measurement of data center energy usage—the new IT operational metric—and, by implementing innovative technologies, expect annual savings of more than 10 percent, or more than US\$10 million in energy savings.*
- *We make rightsizing CRAC capacity a standard practice tied to virtualization implementations. This has resulted in more than 140 CRAC units being turned off, reducing our power usage by eight million kilowatt hours, which provides an annual savings exceeding US\$600,000.*

We will continue to learn and improve at IBM Lexington to help maximize the benefits and spread the cost of the new learning across our portfolio. What works for us can work for you.

How IBM can help you extend the life of your own data centers

The IBM Lexington data center is part of the 8 million square feet (more than 740,000 square meters) of data center space that IBM owns or manages. IBM has designed and built more than 30 million square feet (nearly 2.8 million square meters) of data center space for clients in more than 40 countries. IBM has 40 years of experience in virtualization and is a leading services vendor.

We have a broad set of products and services to help you achieve similar results in your existing data centers—whether they are as large as IBM Lexington’s or smaller server rooms—including:

- *Server, storage, network and end user virtualization services*
- *Energy-efficient IT equipment*
- *Asset disposal services*
- *Energy assessments for IT and data centers*
- *Energy management software.*

For more information

To learn more about how you can extend the life of your existing data center by doubling IT capacity in the same footprint—or how to deploy the same solutions when designing a new data center—please contact your IBM marketing representative or IBM Business Partner, or visit the following Web site:

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¹ IDC, *Transforming the Datacenter: Consolidation, Pervasive Virtualization and Energy Optimization*, Doc #DR2009_T4_MB, March 2009.

² IBM, *CIO Leadership Exchange*, October 2007.

^{3,4} Enterprise Strategy Group Research Report, *2009 Data Center Spending Intentions Survey*, John McKnight, Bill Lundell and Jennifer Gahm, March 2009.

⁵ Digital Realty Trust, *The Industrialization of the Datacenter*, July 2008.



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