Indiana University

INDIANA UNIVERSITY

"With the help of House of Brick and VMware Professional Services, we have been able to virtualize our most demanding Oracle Databases on x86 servers. Where initially we believed that these databases would be too demanding for a virtual machine, we now have the confidence that vSphere can handle our largest transaction-processing databases with ease."

— Rob Lowden,
   Director of IT at
   Indiana University

KEY HIGHLIGHTS

Challenge

Indiana University wanted to migrate its largest databases from an IBM AIX pSeries platform to a virtualized Linux environment on VMware vSphere. The objective was to move from a more expensive proprietary platform to a more efficient industry-standard x86 platform, while increasing the flexibility and agility of their Oracle databases.

Solution

VMware Professional Services, in partnership with House of Brick, helped Indiana University migrate its largest transaction processing database to VMware vSphere, and demonstrated that the platform outperformed the IBM AIX platform.

Results

• Provided Oracle architecture recommendations which reduced the application footprint from 100 percent of nine physical Power 5 cores on the existing pSeries physical environment to 50 percent of eight x86 cores in a virtual production environment

• Demonstrated that the VMware platform was able to comfortably handle the peak loads encountered by their Oracle databases

• Built confidence among Indiana University's end-user community about the performance of larger workloads on Linux and VMware®.

Indiana University Virtualizes Mission-Critical Oracle Databases

With the help of VMware and House of Brick, University IT Department Increases Flexibility and Reduces Costs for Large, Mission-Critical Oracle Databases

Background

Indiana University is internationally known for the quality of its academic programs and attracts students from all over the world. With eight campuses throughout the state, including the IU Medical Center in Indianapolis, IU has more than 101,000 students, 18,500 employees and 200 research centers and institutes. Consistently ranked as one of America's most-wired universities, IU leads the way in providing the IT tools, infrastructure and support that enable students, faculty and staff to integrate information technology into the research, teaching and learning process.

University Information Technology Services (UITS) at Indiana University develops and maintains a modern information technology environment throughout the university in support of IU's vision for excellence in research, teaching, outreach and lifelong learning. UITS provides tools and services to support the academic and administrative work of the university, including a high-speed campus network with wireless access, central Web hosting, a rich selection of free and low-cost software for personal use, tools and support for instruction and research, and supercomputers for data analysis and visualization.

One of the key IT initiatives at IU is to virtualize as much of this complex IT infrastructure as possible to achieve maximum flexibility and scalability, and tremendous cost savings. IU's estimates suggested a 70 percent possible savings from reducing the use of x86 hardware, and from greater flexibility to deploy new systems and applications quickly and without purchasing new hardware. Virtualization also takes capacity planning to a new level. IU's IT team can size up and size down virtual machines to ensure service levels under variable load.

"Being able to create virtual machines to partition and make the most use of our physical resources is a tremendous benefit," said Rob Lowden, Director of IT at IU. "With a pool of standard systems in a virtualized environment, we can move and implement new systems within a day's timeframe. We can't do this in the same timeframe or with the same efficiency using proprietary Unix hardware."

Challenge

With 1,000 servers—nearly 90 percent— already virtualized on VMware vSphere, the next step for IU was to virtualize 100 percent of its Oracle database servers. According to Lowden, virtualizing key Oracle systems would provide substantial benefits. "Most organizations would site high availability as a driver for adopting virtualization, but that

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was not our main goal," said Lowden. "We already had five-nines availability. Flexibility was more of a prominent motivator, such as the ability to migrate databases between hosts, and plan capacity at the datacenter level instead of on a "per app" basis. We wanted to be able to easily migrate systems from proprietary hardware and AIX to Red Hat Linux, and capitalize on the other advantages of virtualization, namely, cost savings."

However, skepticism among end-users was thick about whether or not VMware vSphere running on Linux could handle larger application workloads, such as those generated by Oracle database applications like OnCourse. One of IU's largest, most critical Oracle databases, OnCourse communicates and tracks assignments and class schedules for the student population. It supports about 125,000 users—12,000 concurrently and heavy activity. Due to the application's large size, CPU utilization was the team's main concern. The existing production AIX environment for OnCourse fully utilized 9-10 IBM Power5 processors, but VMware vSphere has a limitation of eight available virtual CPUs.

To test and demonstrate the feasibility of migrating larger Oracle databases to VMware on Linux, IU contracted VMware Professional Services to do a proof-of-concept using OnCourse as the prototype Oracle workload. VMware partner House of Brick was engaged to bring Oracle and VMware best practices to the table, and assist in the analysis and tuning of the OnCourse application to facilitate large-scale adoption of virtualized Oracle and enterprise workloads across the organization.

Solution

Over a six-week engagement, an OnCourse workload was captured during two of IU's busiest weeks of the year—one of which was the first week of school. Students and teachers were using OnCourse frequently during this time period to register for courses, order books and post descriptions, among other processing-intensive tasks. System performance metrics from the existing AIX production environment were collected simultaneously. Performance data was analyzed to determine bottlenecks in the existing AIX production environment and build a prototype virtual production environment to mitigate them.

Next, data from the captured peak workload was used to emulate the OnCourse production environment in the prototype virtual environment and test results were recorded to determine if there was any performance gain. The test demonstrated that OnCourse could be virtualized with just eight virtual CPUs—with room to spare.

"We were initially concerned that we might have difficulty virtualizing this workload due to the VMware vSphere limitation," said Lowden. "But we found that poor use of system resources in the production AIX environment was causing the bottlenecks. After tuning both Oracle and VMware to reduce CPU utilization, this problem was eliminated."

CPU usage in the prototype virtual production environment was 50 percent of eight virtual cores compared to 100 percent of nine physical cores on the existing physical environment. Allowing for faster CPUs and comparing this with the user CPU time on the AIX environment, the prototype virtual production environment outperformed the Power5 processors significantly. A workload in the AIX environment captured over a 50-minute time period was replayed in the prototype virtual production environment in just 43 minutes.

Materials Management System

"When we walked into IU, their materials management system was experiencing many problems stemming from CPU ready time," said Jim Hannan of VMware partner House of Brick. "They were experiencing up to hundreds of seconds on some of the wait times.

We rebalanced the infrastructure by adding in a few VMware ESX hosts then worked on tuning the Oracle application. One factor on AIX that drove higher than normal CPU utilization appeared to be related to the implementation of Oracle Multi-Threaded server on AIX. The Linux implementation did not appear to be affected by MTS."

Results

By targeting and tuning the prototype environment, VMware Professional Services, in partnership with House of Brick, demonstrated that OnCourse runs more efficiently when virtualized on Linux, providing a scalability margin of about 40 percent. As a result, House of Brick endorses the virtualization of OnCourse and other tier-one applications at IU, without reservations. "If OnCourse represents the biggest challenges to a database environment at IU, we believe that all of the current Oracle workloads at IU should be candidates for virtualization under VMware and Linux," said Jim Ogborn of VMware Partner, House of Brick.

In the near future, IU will be looking to virtualize its PeopleSoft application. "Every student and professor touches OnCourse, but key administrators use PeopleSoft," said Lowden. "It's imperative that the migration of this application to Linux is seamless and problem-free. Now that we know OnCourse can be virtualized with ease and provide substantial performance gains, we are confident that all of our tier-one applications will also run more efficiently on the new platform."

In addition to applying the prototype to other database migrations in the next phase of the rollout, IU plans to promote the prototype tuned by House of Brick to other educational organizations looking to virtualize processing-intensive tier-one applications.

"When you're fine-tuning a tier-one application to run optimally, you need both application and infrastructure expertise," said Lowden. "VMware Professional Services provided their combined expertise and helped us define success criteria for virtualizing our large, mission-critical applications. Now we know what to look for and we have a baseline for comparing performance and CPU ready time so we can be sure we're getting the most of our applications."

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