

Tennant Company

Tennant Company reduces operational costs and energy usage with consolidated infrastructure



Minneapolis-based Tennant Company is a world leader in designing, manufacturing, and marketing solutions that help create a cleaner, safer world. Its products include equipment for maintaining surfaces in industrial, commercial, and outdoor environments; and coatings for protecting, repairing, and upgrading concrete floors. With sales of \$664 million, Tennant has manufacturing operations in the U.S., the Netherlands, United Kingdom, Brazil, and China and sells its products directly in 15 countries and through distributors in more than 80 countries.

Running out of space in the data center

Traditionally, Tennant ran individual applications on stand-alone servers in a one-to-one ratio. Given the company's rapid rate of growth, however, this approach was quickly consuming all available physical space in its data center. As a result, data center expansion was imminent, which would have resulted in considerable cost and potential business disruption. In addition, ongoing server expansion placed a huge strain on energy resources.

Tennant also faced additional space and energy challenges to manage its remote offices from its primary data center. Typically, each remote office required, at minimum, a file server, domain controller, and process server—all adding to power and cooling demands.

The company's primary data center occupies 1,700 square feet. Construction work to remove walls and open up additional space would have yielded approximately 540 square feet of additional space. However, physical expansion also required additional power and cooling, more wiring, supplemental backup power, and increased administration, driving up expenses significantly. Even with such an expansion, Tennant estimated that the added space would only accommodate one additional year of growth at most.

Transforming the data center from physical to virtual

Recognizing the limitations of remaining on its current path, Tennant decided to consolidate its information infrastructure and take advantage of server virtualization to enable greater energy efficiency, reduce costs, and improve business agility. After exploring other virtualization offerings on the market, Tennant found VMware®, an EMC company, offered the most feature-rich and complete solution to meet its needs.

Design and implementation of Tennant's VMware environment was performed by in-house staff. In addition, the IT staff found the installation to be very smooth and easy. In fact, Tennant's IT administrators continue to find the solution extremely simple to use as it further virtualizes and refines its environment with VMware.

Today, Tennant's virtualized infrastructure runs approximately 210 virtual machines globally, requiring just 22 VMware ESX Server™-based Dell servers. The company's approach is to eliminate physical servers as they reach end of life and virtualize the applications those servers support. The physical servers are configured in clusters for high availability and are located in the company's primary data center and disaster recovery site in Minneapolis, Minnesota, as well as facilities in Japan and China.

Any applications that can be virtualized have been deployed in the VMware ESX Server environment, including selected SAP and Microsoft Exchange modules, file and print servers, identity management and security servers, Web servers, and test and development servers.

“Our goal is to virtualize everything possible. In fact, support for VMware is becoming a prerequisite for all new applications we adopt. While five years ago, you would probably have had to prove to me you could run your application in VMware, today you’ve got to prove to me you can’t. That’s how integral it is to our business.”

Craig Hepburn, Technical Architect

In addition to VMware ESX Server, Tennant implemented several other solutions from the VMware VirtualCenter™ suite to manage its virtualized environment:

- **VMware HA:** A clustered pool of VMware hosts allows virtual machines to move from one host server to another.
- **VMotion:** The entire state of each virtual machine is encapsulated as a set of files stored on EMC® CLARiiON® storage. In this way, multiple VMware ESX Servers have access to these virtual machine files concurrently.
- **VMware DRS:** The automated movement of virtual machines from one physical server to another ensures business continuity in the event of a hardware problem or an application requiring more resources.
- **Storage VMotion™:** Virtual machine disk files are automatically replicated from one storage tier to other shared storage locations to dynamically balance storage workloads and avoid performance bottlenecks.
- **VMware Consolidated Backup (VCB):** Combined with EMC NetWorker®, the VCB solution facilitates centralized backup of virtual machines and file systems to ensure more reliable and cost-effective backup operations. The integrated VCB-NetWorker solution offloads backup operations to a proxy server, preventing any CPU, NIC, and LAN performance degradation on the VMware ESX host server.

Dramatic cost and energy savings

By transforming 60 percent of its server environment from physical to virtual, Tennant has eliminated 210 physical servers so far, and saved in excess of \$1,000,000 in cost avoidance, reduced equipment expenses, and lower energy requirements. (See Figure 1.)

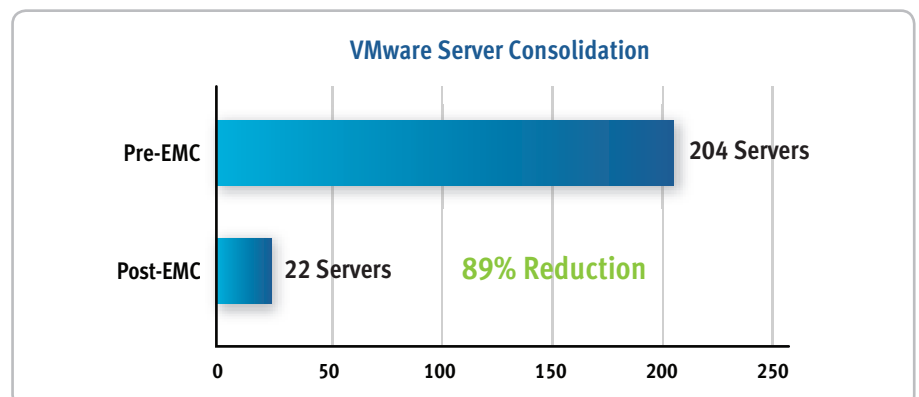


Figure 1

Data center growth has also been contained, allowing Tennant to increase the value of its current investments. Had the company not virtualized, it would have already exceeded available power and forced physical expansion of the existing space. Instead, by reducing the number of servers and the associated power and cooling demand, Tennant has extended the life of its data center by approximately two years, and possibly longer as further virtualization continues.

“By virtualizing our server environment with VMware, we have extended the life of our current data center by two years or more. Plus, we’ve reduced our capital expenditure and maintenance costs dramatically and improved Infrastructure availability to nearly 100 percent.”

Jon Goltz, Manager of Operations

One of the most significant advantages Tennant’s VMware environment provides is rapid provisioning of additional virtual machines to support new or expanding applications. This capability has proved invaluable, enabling IT staff to increase responsiveness to business users dramatically. For example, procuring, deploying, and provisioning a physical server can take four to six weeks. Today, a new virtual machine can be provisioned in less than an hour with no need for capital expenditures. (See Figure 2.)

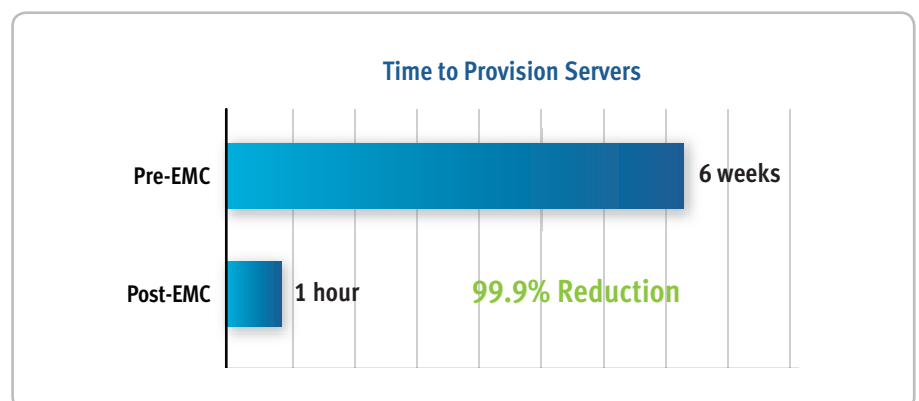


Figure 2

As a result, Tennant can accelerate innovation and move products to market more quickly. Instead of waiting weeks to test out a new idea, engineers and business managers can load their applications and begin testing within a matter of hours. This not only saves time for the business, but also frees IT staff to address more strategic initiatives. And it allows the business to grow while minimizing cost and environmental impact.

Virtualization delivers improved application availability

Tennant has increased availability of applications and information with VMware. For example, remote facilities are each now run on two redundant servers utilizing shared EMC CLARiiON storage rather than the three or four stand-alone servers previously required. This new configuration enables Tennant to increase application availability for its remote users, as well as provide single logons for authentication and more efficient file and print services.

With the addition of VMware HA, the virtual machines never go down, regardless of server faults or planned maintenance. If a physical server should experience a problem, VMware HA automatically restarts the virtual machines on a different host server with no impact on the end-user experience. As a result, VMware HA has helped Tennant achieve better than 99.9 percent uptime for its virtual hosts.

In addition, the application agility enabled by VMotion and DRS now allows IT staff to deploy new applications or perform maintenance on physical servers during the day without disrupting production operations. Before, someone would have to come into the facility after hours to minimize any impact on users. As a global company with follow-the-sun operations, even this strategy could be disruptive.

Instead, Tennant can move virtual machines from one host to another to allow work on a server while the application remains running. Additionally, DRS scripting in conjunction with VMotion enables Tennant to automatically balance the physical resources allocated to each virtual machine based on the level of criticality associated with each application in the VMware environment.

With Storage VMotion, Tennant gains the added flexibility to move production virtual machines between Fibre Channel and SATA disks within and across arrays to optimize performance, capacity, and cost based on the requirements of each application. The solution is so flexible that Tennant was able to perform a complete SAN migration in the middle of a workday with no impact on business operations.

By deploying VCB, Tennant eliminated the need for separate backup agents on each physical server, saving tens of thousands of dollars. Instead, the company now has a single, centralized backup facility that works in concert with its EMC NetWorker software and EMC Disk Library solutions to protect point-in-time copies of virtual machine drives, reducing potential impact on the performance of production servers, while enabling rapid backup and recovery of applications and data.

“With our EDL-NetWorker solution, we’ve completely automated the backup process from beginning to end. It’s almost a 100-percent completely hands off, lights-out operation—which is remarkable given how much time it used to take us to manage our backups.”

Karl Minkel, Technical Architect

The overall VMware environment provides added flexibility that benefits Tennant developers wishing to test new ideas. For example, a virtual machine can be cloned in a single click, giving developers a real-world environment in which to try out application enhancements. Any changes can be thoroughly tested and proven without degrading production operations. And should any problems result from the development effort, another click restores the virtual machine to its original state. This capability saves the capital expense of providing physical development servers and eliminates countless hours trying to “undo” work in traditional development environments.

Replacing tape with automated disk backup

Tennant used to back up its entire 50-terabyte information infrastructure to a StorageTek tape system using NetWorker. Because of the reliability problems associated with tape, this solution required the company to maintain a dedicated staff of four people working 24 hours a day to handle tape issues—mounting tapes to managing backup functions and addressing media problems.

In addition, Tennant contracted with an outside provider for offsite tape storage. Each week, Tennant’s backup staff packed a crate full of tapes and shipped it to the offsite facility. To recover information from the tapes, Tennant had to contact the outside contractor, which was only available during normal business hours, and then wait for them to locate the appropriate tape and send it back. The total time to recover a file from tape in this process could be several days. Moreover, in addition to its regular fees, the contractor levied additional charges for tape return requests.

With the amount of information requiring backup growing by nearly 70 percent each year, Tennant consulted with EMC Services to assess their environment and identify a more efficient backup solution. After exploring options available from StorageTek and others at the time, Tennant found

that no other offering could match the capabilities of EMC Disk Library (EDL). EDL also provided the ability to replicate data over a wide-area network (WAN) versus relying on trucks to ship tapes to the secondary site.

EMC Services implemented the EDL and provided best-practice recommendations to help Tennant maximize the effectiveness of the disk backup solution. Tennant also had some custom requirements that EMC responded to quickly and effectively, and the company credits EMC Services' backup and recovery expertise in achieving a very successful implementation. In total, the implementation was completed in 30 days.

“With an integrated backup, recovery and archiving solution, EMC has helped us attack the problem of growing backups from many angles. We’ve slashed our backup and restore times by automating our backups with NetWorker.”

Craig Hepburn, Technical Architect

Today, Tennant backs up all production applications from its primary data center across a GeoMax metropolitan area network (MAN) to a remote EDL located in the company's disaster recovery site 10 miles away (see Figure 3) using EMC NetWorker. Both structured and unstructured data are backed up, including Microsoft Exchange 2003 e-mail, file systems from users' home drives, shared data on collaboration drives, data supporting the company's intranet and websites, Oracle and SQL Server 2005 databases, and core SAP financial data, as well as engineering drawings and patent records.

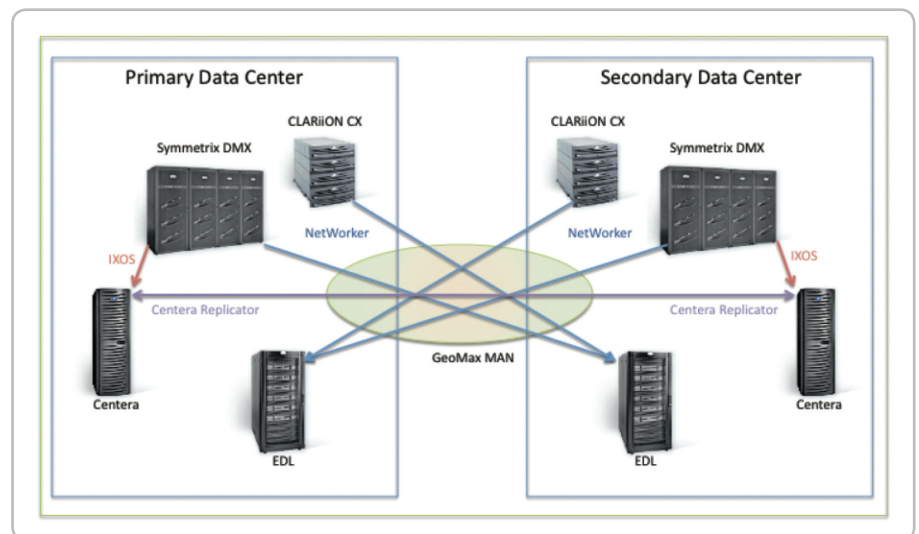


Figure 3

In addition, all data running on development and test systems in the disaster recovery site is backed up across the MAN to a second EDL located in the primary data center. In this way, Tennant achieves offsite backup in two directions for maximum protection and security of all its business information.

Because Tennant was no longer limited by tape size or reliability, it was able to optimize its backup policies to suit the needs of the business. Today, the company performs incremental backups of flat file data during weekdays and full backups on weekends.

To help slow the growth of the amount of data that needs to be backed up, Tennant consulted with EMC Services to replace an aging optical disk jukebox and implement a new archiving solution based on EMC Centera® content-addressed storage. Designed specifically for information archiving, EMC Centera is a self-healing solution that also provides self-management and self-configuration capabilities, saving management resources. EMC Services provided Tennant with end-to-end implementation and configuration of the EMC Centera, including technical expertise and best practices. The result was a very fast and problem-free installation.

Tennant is beginning to archive data directly from production data stored on its EMC Symmetrix® DMX storage area network to EMC Centera using IXOS software. Currently, the company is archiving the Oracle database supporting its SAP enterprise resource planning solution. As the company's business managers determine retention policies for other application data, Tennant expects to archive additional information, including patent documentation and Exchange e-mail.

By replacing tape with EMC disk backup, Tennant has realized as much as a three-fold improvement in backup cycles (see Figure 4). For example, with tape, one of the largest file servers—approximately 2.5 terabytes—took as many as three days to back up. Today, with the EDL-NetWorker solution, this same file server is backed up in less than one day.

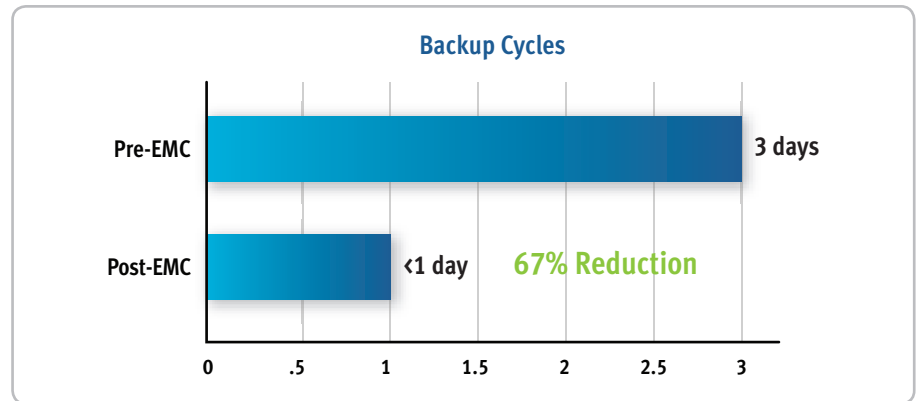


Figure 4

Using NetWorker software, the entire backup process is automated from end to end so that from an administrative standpoint, the operation is hands-off. EMC systems continuously monitor the process and if any issues are detected, Tennant IT staff are notified electronically and can address the issue remotely.

With automated disk backup enabling a more efficient, lights-out operation, Tennant has also been able to reallocate staffing resources so that employee time is less consumed with manual backup operations and can provide more direct value to the company (see Figure 5). In addition, there is no longer a need to contract for offsite storage, further reducing costs and lowering the environmental impact of trucking tapes back and forth between facilities.

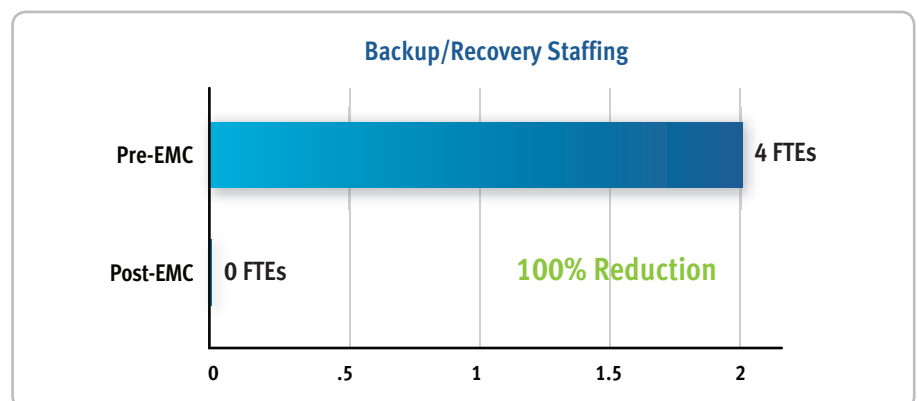


Figure 5

The most dramatic impact of moving to disk backup has been recovery time. In the past, recovering a file from tape could take two days until the tape could be located and shipped back from the offsite facility, then mounted and restored. Now, an average file can be recovered from disk in as little as ten minutes (see Figure 6). Even large files of a gigabyte or more can be restored in 20 minutes or less. This enables business users across the Tennant organization to remain more productive—from the research and development organization to finance to front-line sales and service.

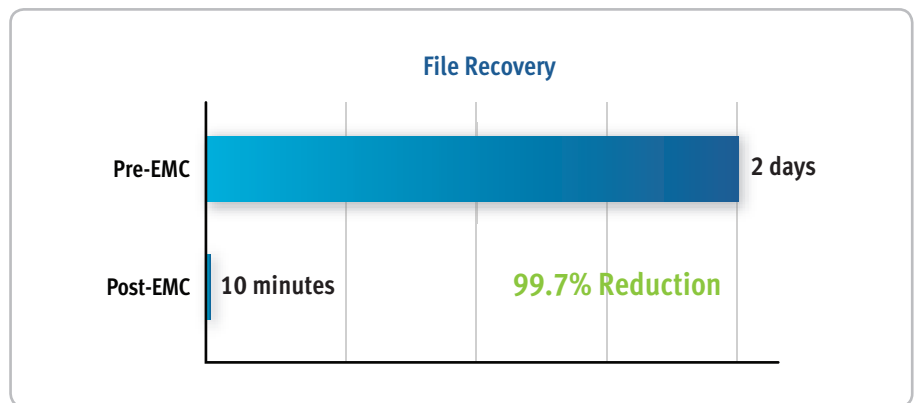


Figure 6

Tennant gains greater flexibility from disk backup compared with tape. Tape has a finite lifespan, whereas disk can typically be used longer and redeployed in other systems as business needs change and newer systems are introduced to the company. Environmentally, instead of filling landfills with defunct tapes, Tennant is helping to reduce waste while increasing the long-term value of its technology investments.

Archiving keeps backup cycles steady

By augmenting its backup solution with data archiving, Tennant is keeping its backup cycles steady even as the amount of information continues to grow. Moreover, archiving with EMC Centera is allowing Tennant to free up data on production storage systems to optimize performance for the company's most critical applications, while still enabling rapid, easy access to archived files.

As the company expands its archiving solution to include patent documentation and other scanned records, it expects additional environmental benefits by reducing the amount of paper currently consuming file drawers all across the company. Paper reduction will also mean decreased trucking to the storage warehouse and reduced dependence on climate control to protect the paper documents, all of which will help Tennant shrink its overall carbon footprint.

“Our EMC consultants offer wide-ranging knowledge and experience across storage and virtualization, as well as backup, recovery, and archiving. With their expertise and assistance, we’ve been able to quickly and successfully implement advanced solutions that optimize our environment for peak performance and cost efficiency.”

Craig Hepburn, Technical Architect

Information lifecycle management strategy optimizes value of infrastructure

To support business applications across its global operation, Tennant relies on a tiered information infrastructure built on EMC networked storage comprised of EMC Symmetrix DMX™, EMC CLARiiON CX3 series model 80, and other CLARiiON CX series systems. With multiple tiers of storage, as well as tiers of disk technologies within systems, Tennant is continually evolving its information lifecycle management (ILM) strategy to optimize performance, availability, and cost efficiencies based on application need and business priorities.

Tennant called upon EMC Services to install both the Symmetrix DMX and CLARiiON systems. Total implementation for each system was approximately one week. EMC Services then worked hand in hand with Tennant's IT staff to evaluate the company's business needs and recommend optimal configurations. In this way, EMC Services played a crucial role in matching the right disk technology for each application.

For example, applications such as Oracle and SAP require high performance, so EMC Services guided Tennant in ways to set up the Fibre Channel disk drives within high-end Symmetrix DMX systems for maximum performance. Tennant has begun virtualizing its SAP and Oracle application environments stored on Symmetrix. Tennant uses EMC SRDF®/Asynchronous software to replicate SAP in real time from the production Symmetrix DMX system in the company's primary data center across the GeoMax MAN to a second Symmetrix DMX in its recovery site 10 miles away. Based on disaster recovery tests performed quarterly, Tennant has reduced recovery time for SAP from days to just hours with zero data loss.

Within the CLARiiON systems, Tennant further optimizes performance and capacity by tiering applications across Fibre Channel and SATA disk technologies. VMware ESX Server, SQL Server 2000 and 2005 databases, Exchange 2003 and selected SAP applications are placed on high-performance CLARiiON Fibre Channel disks, while file, Web, identity management, and other less performance-critical applications run on lower-cost SATA drives. With SATA disks, Tennant is realizing a four-to-one advantage in capacity for its money compared to Fibre Channel disks.

Tennant uses EMC Navisphere® software for CLARiiON and EMC Symmetrix Management Console to centrally and dynamically manage system resources. As a result, quality of service (QoS) and performance of storage and applications are optimized and the time and resources needed to manage and fix performance issues are greatly reduced. Tennant also is using Navisphere in conjunction with VMware DRS to provide similar benefits to its virtualized environment.

Increased focus on “green” IT and information availability

Looking ahead, Tennant will continue to expand its VMware environment, converting physical systems to virtual machines as the stand-alone servers come off warranty. Through this effort, the company hopes to further decrease its power and cooling demand for greater energy efficiency and reduced environmental impact.

The company will also be investigating the use of VMware Site Recovery Manager in conjunction with EMC MirrorView™ replication software to enable business continuity for its VMware ESX Server applications residing on EMC CLARiiON storage. These solutions would enable Tennant to automate and accelerate the recovery process for VMware, while simplifying testing of recovery plans.

As Tennant's ILM strategy continues to evolve, it is considering data classification techniques and additional tiering to support ongoing data growth while remaining within its current data center footprint. For example, Tennant plans to evaluate EMC DiskXtender® and EmailXtender® software, both of which can be run on VMware virtual machines, for archiving additional application data, such as patent documentation and Exchange e-mails, onto the EMC Centera system. The goal is to help Tennant consistently apply and enforce data retention policies to better comply with regulatory requirements such as Sarbanes-Oxley. And by archiving e-mail, the company expects to dramatically reduce the amount of data on production systems, further streamlining backups and improving performance of Exchange.



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