IBM SAP International Competence Center

Städtische Werke Magdeburg cuts storage costs by 50 percent per gigabyte with integrated IBM solution

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CIO

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Photo: Oliver Schlicht, Volksstimme

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About this paper

This paper describes the IT infrastructure of Städtische Werke Magdeburg GmbH and how the company managed to drive down its storage costs by 50 percent per gigabyte by using IBM XIV Storage System technology. The company now operates an easy-to-manage, high-availability storage area network (SAN) spanning across two sites. IBM Power Systems servers running AIX, and IBM System x servers running Microsoft Windows Server and Linux operating systems on a VMware virtualization layer, both access the XIV high-availability storage solution.

Customer Objectives

- *Optimize storage infrastructure with up-to-date technology to make administration easier and the storage system more reliable.*
- *Reduce operating costs for data storage space, and bring down the cost per gigabyte as storage volumes increase.*

IBM Solution

- *Implemented IBM XIV Storage System as the core storage solution throughout Städtische Werke Magdeburg, replacing traditional SAN architecture*
- *Deployed IBM Power 740 Express with POWER7 processors and IBM Power 550 Express servers with POWER6 processors, both running IBM AIX*
- *Introduced IBM PowerVM Enterprise Edition to provide virtualization capabilities on the Power 740 Express and Power 550 Express servers*
- *Deployed IBM Tivoli Storage Manager and IBM Tivoli FlashCopy Manager to provide secure, reliable data management and high-speed data copying services to an IBM System Storage TS3320 Tape Library*

IBM Business Partner

- *SVA System Vertrieb Alexander GmbH*

Customer Benefits

- *Reduced total storage costs including depreciation and maintenance costs by approximately 50 percent per gigabyte with IBM XIV systems.*
- *Faster backup and restore times thanks to IBM Tivoli FlashCopy Manager supported by IBM XIV technology.*
- *Clustered SAN solution for improved reliability, high-availability, scalability, and performance.*
- *Easier administration with up-to-date components and technology and IBM XIV's user-friendly graphical interface.*

Background, starting point and objectives

Städtische Werke Magdeburg GmbH is a utilities company, which supplies the city of Magdeburg and its surroundings with electricity, water, gas and heating, as well as providing waste water disposal services. The company employs around 662 people and serves more than 270,000 customers. Städtische Werke Magdeburg generates sales of more than €400 million and operates 2,732 km of power lines, 756 km of gas lines, 797 km of water mains with 326 km of connecting pipes, and a 119 km district heating grid with 1,876 heat transfer stations. Städtische Werke Magdeburg is also active in the field of renewable energy.

Initial IT environment

Before Städtische Werke Magdeburg upgraded to POWER7 technology, it operated its SAP ERP application environment on six IBM Power Systems servers with POWER5+ processors running IBM AIX 5.3, supported by two IBM System Storage DS4400 devices. Each of the two IBM DS4400 systems provided 30 TB of data storage capacity, set up individually and not configured as a cluster. For backup, archive and recovery, data was copied to tape at regular intervals.

Business challenges and project objectives

Many of the activities at Städtische Werke Magdeburg depend on decisions made by regulatory authorities such as the German Federal Network Agency. Changes in requirements caused by political decisions beyond the company's influence sometimes result in significantly increased data storage needs or processing power demands. For Dr. Frank Schmidt, CIO at Städtische Werke Magdeburg, it is a major requirement that any solution must be flexible and easy to expand to cope with the regulatory authorities' frequently changing demands. The IT infrastructure needs to be able to manage the current workload, and be flexible enough to adapt to almost any future workload.

As well as core processing tasks, Städtische Werke Magdeburg also operates a very popular customer service help-desk, where customers can come with their bills and ask for explanations. For the customer service help-desk to operate successfully, it needs always-on access to customer data. If access fails, customers soon become frustrated if their requests for information are not answered rapidly.

Underlying the general business applications and customer service help-desk, Städtische Werke Magdeburg stores very large amounts of data, and storage administration costs were rising. It was important to reduce the workload on the administration teams, and increase storage administration productivity.

The team knew from reports generated by the built-in monitoring system that there were some performance issues to be solved. Refreshing the aging IT infrastructure by consolidating and simplifying the architecture would be the ideal moment to address these challenges.

As an additional requirement, Städtische Werke Magdeburg was looking for a new, more reliable virtualization environment for its non-SAP related Intel servers. The infrastructure and support services that the company runs on Intel processor-based servers are essential in their own way, and these applications also needed a more stable and reliable IT infrastructure.

Städtische Werke Magdeburg is a relatively traditional organization, and looked for proven technology that offers reliable, dependable operations. The company had already been working with IBM for approximately ten years, and a joint team from Städtische Werke Magdeburg and IBM continuously worked on improving the infrastructure, in order to quickly and reliably operate the SAP landscapes.

Technical solution

Working with IBM Business Partner System Vertrieb Alexander GmbH (SVA), Städtische Werke Magdeburg implemented a high-availability storage solution to support the company's SAP applications and other systems. SVA helped Städtische Werke Magdeburg analyze the design of the target situation and draft the solution architecture, and worked on the implementation itself. The various hardware components were placed in different fire zones for improved business continuity.

IBM installed the new storage and server systems, while SVA configured the systems and planned and performed the actual data migration. This included optimization tasks after the migration was complete, working with the technical team lead by Michael Frank, Data Center Manager at Städtische Werke Magdeburg.

To ensure that the new systems were exploited to their full potential, the SVA team provided training sessions alongside the performance tuning and related work.

Städtische Werke Magdeburg uses a range of SAP solutions to support its business processes. At the center is the SAP for Utilities solution, with additional SAP ERP 6.0 components supporting business processes in financials (FI), controlling (CO), human resources (HCM), materials management (MM), assets accounting (FI-AA), and plant maintenance (PM). All financial processes are managed with SAP, and in addition to that Städtische Werke Magdeburg also uses SAP for its plant maintenance management and integration of suppliers.

Furthermore, the company operates SAP Basis release 7, SAP NetWeaver 7, SAP NetWeaver Business Warehouse (BW), SAP NetWeaver Portal, SAP NetWeaver Process Integration (PI) and SAP Solution Manager.

Städtische Werke Magdeburg also implemented self-service features for its customers to enable them to change addresses, receive invoices and more based on SAP solutions. These applications are supported by Oracle databases. On the ten SAP production systems there are about 500 named users in total, of whom roughly 250 work concurrently.

To migrate the SAP applications, the new XIV Storage Systems were first incorporated into the existing storage area network (SAN). Data was then transferred from IBM System Storage DS4400 devices to the IBM XIV systems, using the standard IBM XIV migration tools. The IBM DS4400 devices were subsequently retired from production usage.

Städtische Werke Magdeburg operates two data centers. One IBM Power 740 Express and one IBM Power 550 server host the production (PROD), quality assurance (QA) and development (Dev) SAP systems in different logical partitions (LPARs). The IBM Virtual I/O Server (VIO) connects the virtualized systems to the physical interfaces of the servers. SAP data is stored redundantly on two IBM XIV Storage Systems. Four SAN switches ensure high availability of the storage area network. At the moment, Städtische Werke Magdeburg is evaluating the implementation of PowerHA to improve the business continuity of the solution further.

After the storage infrastructure upgrade was complete, the server hardware was refreshed. New IBM POWER7 processor-based servers were installed at the primary and secondary data centers to promote business continuity and create a viable disaster recovery strategy. Städtische Werke Magdeburg consolidated its SAP server landscape from six physical systems to two servers, which raised the efficiency of its server operations by increasing processor utilization while decreasing floor space and energy consumption.

Städtische Werke Magdeburg is using the advanced virtualization features of the IBM POWER7 processors to allow a larger number of SAP application instances to run greater workload. For logical partitions running database servers, the system automatically assigns processor resources; for other logical partitions, the system also automatically adjusts memory and network resources flexibly to ensure each application can handle its transaction workload within agreed service levels, delivering excellent application response in the most efficient manner.

For greater data protection, Städtische Werke Magdeburg uses the Logical Volume Mirroring (LVM) feature of the AIX operating system to mirror SAP data to both XIV Storage System devices. This ensures that there is always a copy of current data available should one of the data centers suffer a catastrophic outage.

To further protect and secure the business and its information, the company implemented an advanced backup solution based on IBM Tivoli Storage Manager and IBM FlashCopy Manager. These tools introduce automated, high-performance backup processes that reduce administrative workload and help to increase backup success rates.

Server architecture

Städtische Werke Magdeburg has used the IBM Power platform and the AIX operating system for some years, and knows the advantages that it offers for SAP applications. The migration from AIX 5.3 to AIX 6.1 was simple, and the changeover was completed using the standard Network Installation Manager (NIM) functionality. Today the company runs its complete SAP application landscape on two IBM Power Systems servers. The company deployed a new IBM Power 740 Express with a total of

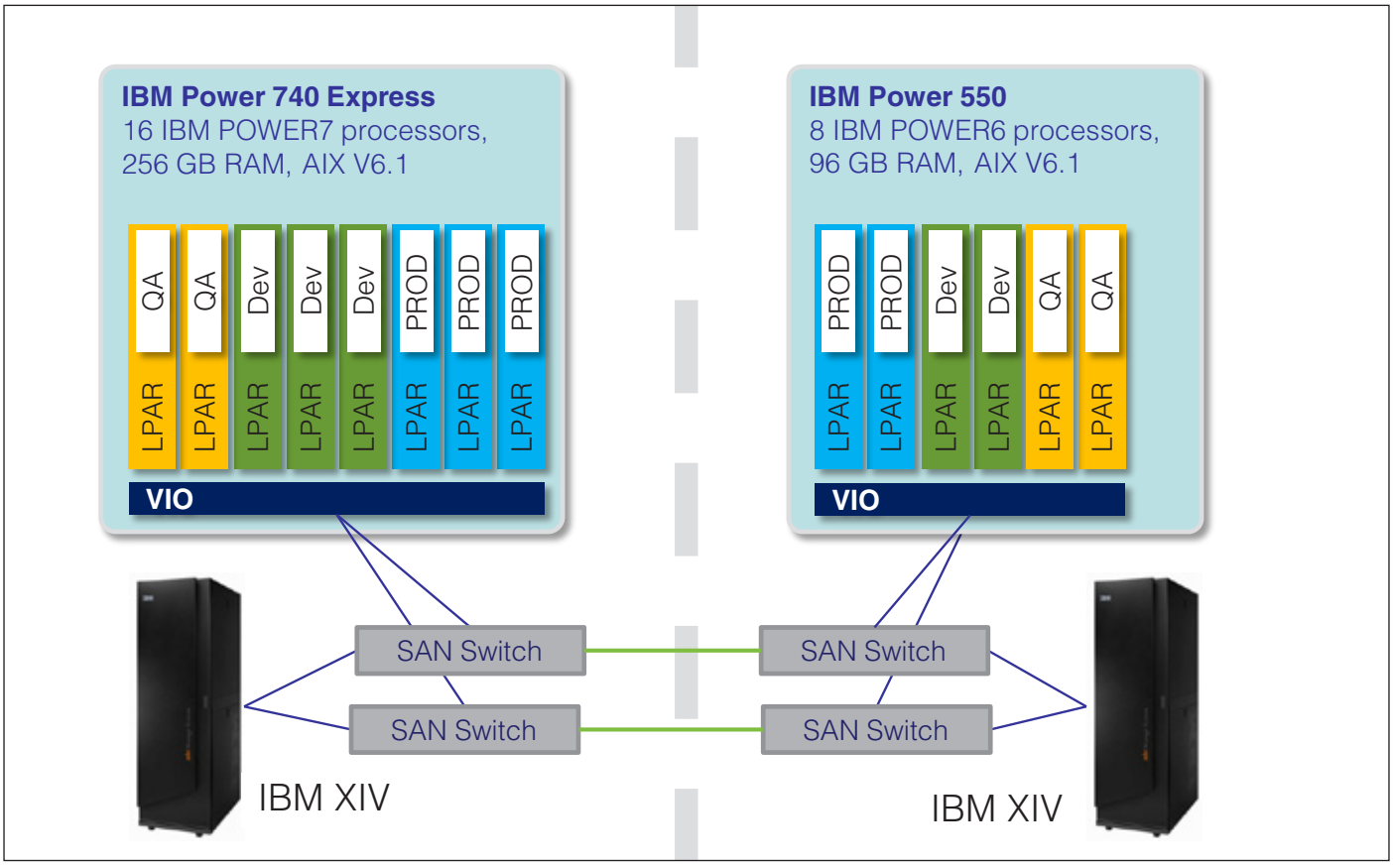

Figure 1: Overview of SAP landscape.

16 POWER7 processor cores running at 3.55 GHz and accessing 256 GB main memory. The second server is an IBM Power 550 equipped with eight POWER6 processor cores and supported by 96 GB of main memory.

Additionally, Städtische Werke Magdeburg operates two Power 550 Express servers, each with 8 POWER5+ cores and 64 GB respectively 48 GB of main memory and one Power 550 with two POWER5 processor cores. These servers are used for various other applications at Städtische Werke Magdeburg, such as portfolio management, legal dunning procedures and geographic information systems.

The company also uses its IBM Power servers to support advanced metering infrastructure, enabling the capability to test Smart Metering in its network. Städtische Werke Magdeburg runs most of its Power Systems on the IBM AIX operating system, with the remainder running Novell SUSE Linux Enterprise Server.

To exploit the full capacity of its new servers, Städtische Werke Magdeburg decided to use advanced virtualization enabled by IBM PowerVM Enterprise Edition to run its AIX 6.1 systems in some 25 logical partitions (LPARs). These LPARs are configured with micro-partitioning, priority driven, and uncapped, which allows flexible and dynamic resource allocation based on virtual CPUs.

Dr. Frank Schmidt, CIO at Städtische Werke Magdeburg, comments, “The flexible capacity allocation works very well for Städtische Werke Magdeburg. With the advanced virtualization features of the Power architecture, we can use our server capacity more efficiently. This flexibility is important and helps us to provide all systems with optimal performance, even during peak times.”

To improve I/O performance and introduce fault-tolerant I/O operations, Städtische Werke Magdeburg implemented AIX Multipath I/O (MPIO). The AIX Virtual I/O Server (VIOS) in connection with N Port ID Virtualization (NPIV) enables Städtische Werke Magdeburg to implement IBM Tivoli Storage Manager and IBM FlashCopy Manager for backup and recovery.

Städtische Werke Magdeburg has configured 25 LPARs, and runs SAP production systems in ten of these. The production systems are SAP ERP including modules for financials (FI), controlling (CO), human resources (HCM), materials management (MM), assets accounting (FI-AA), and plant maintenance (PM) processes, SAP NetWeaver Business Warehouse (BW), SAP Supply Chain Planning (SCP), SAP NetWeaver Process Integration (PI), and Solution Manager, as well as instances for shadow databases. The other LPARs are used for SAP test systems, IBM Tivoli Storage Management server (run in two LPARs to ensure reliability for storage management services, in case one LPAR fails), SAP archiving, SAP NetWeaver Portal systems, and other non-SAP applications. Additionally, the company operates seven testing and integration systems.

After migrating to Power processor technology, SVA reviewed the overall system configuration (a recommended step for all customers after hardware upgrades) to ensure that the new technology is configured in the best possible way to exploit new features.

Besides the IBM Power servers used for the SAP systems, Städtische Werke Magdeburg also operates four IBM System x3850 X5 servers, powered by Intel processors, for non-SAP workloads. Some of these are used as dedicated servers for infrastructure services such as email and groupware, and are connected to the IBM XIV Storage System units. The VMware cluster is distributed across the two data center locations to provide improved reliability for the virtualized environments.

Storage architecture

The new storage solution is based on two IBM XIV Storage System devices interconnected via four switches with 8 GBit/s fiber connections, configured using the AIX Logical Volume Manager to ensure high availability of the SAP systems and IBM Metro Mirror functionality for non-SAP systems. Each of the IBM XIV systems has a 43 TB capacity and can be expanded easily. If new storage capacity is needed, the administrator adds more modules, which the XIV Storage System detects and integrates into the existing SAN. This automated facility makes storage expansion quick and easy, and ensures rapid provisioning of new storage capacity as needed.

Independent storage pools on the IBM XIV Storage Systems support both the SAP applications on Power Systems, and the Intel-based System x environments running VMware and Microsoft Windows systems. The applications are kept logically separate, while both environments access the high-availability storage provided by the XIV systems.

The SAP landscapes are mirrored using the Logical Volume Mirroring (LVM) feature of the IBM AIX operating system, and FlashCopy Manager transfers up-to-date copies of the production systems to the second data center location on a regular basis. FlashCopy Manager is highly efficient in storage management terms, because it can use XIV Snapshots to back up the SAP data.

The paired XIV configuration makes it easy for Städtische Werke Magdeburg to transfer data between the two data centers, something that was not possible with the former storage devices. Standard operating system utilities provide reliable remote location mirroring, with very little impact on production services.

Implementation of the new storage infrastructure took around three months, and has resulted in significant savings per gigabyte. In parallel, Städtische Werke Magdeburg and SVA implemented an IBM TS3310 Tape Library for reliable long-term tape backups of all of business-critical systems.

The backup concept for the SAP databases

SAP production systems are backed every two hours during the day and less frequently at night to the IBM XIV Storage Systems using IBM FlashCopy Manager (FCM). All production SAP systems are additionally backed up once a day to tape to an IBM System Storage TS3310 Tape Library, managed by IBM Tivoli Storage Manager (TSM) for ERP. All other storage volumes and filesystems are backed up daily to active-data pools located on the IBM XIV storage system and then subsequently migrated to tape, using IBM Tivoli Storage Manager Backup-Archive clients.

The IBM Tivoli Storage Manager Server run in LPARs running AIX on an IBM Power 550 server with two processors and 20 GB main memory, and which has a storage pool of 10 TB on an IBM XIV system assigned to it.

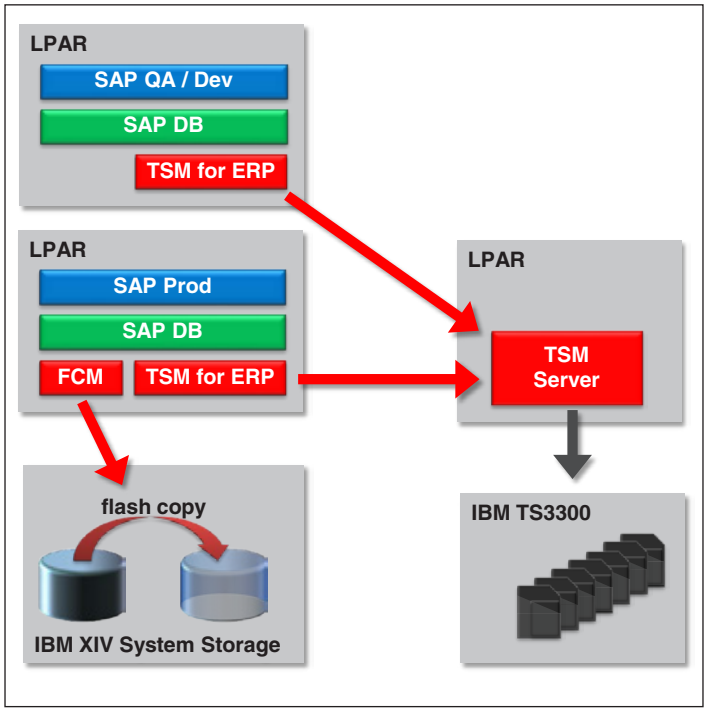

Figure 2: SAP backup concept at Städtische Werke Magdeburg with IBM Tivoli Storage Manager and IBM FlashCopy Manager.

This Power Systems server is located at the second data center together with an IBM System Storage TS3310 Tape Library equipped with five LTO5 tape drives and 125 tape slots. This configuration was chosen because it ensures that backups are stored at a different location from production data.

In 2010, IBM Business Partner SVA installed FlashCopy Manager Version 2.2 on one server as a reference implementation. Today, Städtische Werke Magdeburg uses FlashCopy Manager for all SAP production servers.

Städtische Werke Magdeburg implemented two backup solutions:

- FlashCopy through IBM FlashCopy Manager
- Database online backup to tape through IBM Tivoli Storage Manager for ERP

Städtische Werke Magdeburg deployed two backup solutions to allow faster restore and recovery in case logical errors occur. In addition to the regular backups to tape managed by IBM Tivoli Storage Manager, the SAP production servers are backed up every two hours utilizing the space-efficient and fast FlashCopy functionality (SNAP) of the IBM XIV storage systems. All production and non-production SAP systems are protected via IBM Tivoli Storage Manager for ERP.

Based on this advanced backup and recovery solution, Städtische Werke Magdeburg has reduced its tape environment from two to just one tape system, leading to additional cost savings. Based on its experience of the SNAP backup to XIV, Städtische Werke Magdeburg may eliminate tape backup altogether, which will reduce complexity and increase the cost-efficiency.

"The Städtische Werke Magdeburg migration project demonstrated a close and successful collaboration with SVA, IBM and SAP. This project was a very positive experience for us."

Dr. Frank Schmidt
CIO
Städtische Werke Magdeburg

Experience with the new environment and project achievements

The optimized data storage setup and new servers are providing excellent SAP application performance for Städtische Werke Magdeburg. The company now has an up-to-date IT environment with state-of-the-art, reliable technology that improves productivity and makes life easier for system administrators. The new solution is easier to maintain, and storage administration has been improved substantially with the simple-to-use XIV graphical user interface. Dr. Frank Schmidt says: "The new solution is much more straightforward and user-friendly. Our storage administrators can now work much more efficiently and complete maintenance and administration tasks quicker than before. Thanks to IBM XIV's advanced optimization algorithms, there is also no need for manual optimizations, resulting in a reduced workload for our storage administration team."

By consolidating to just two IBM Power Systems servers, the greatly simplified landscape is more energy-efficient, requires less data-room real-estate, and is more reliable with fewer interconnected components.

For both the Power and Intel landscapes, some systems that were previously running without virtualization are now configured in a virtualized environment. One advantage is that these systems now share virtual adapters, with fewer points of physical failure and greater manageability.

Dr. Frank Schmidt comments, "The Städtische Werke Magdeburg migration project demonstrated a close and successful collaboration with SVA, IBM and SAP. This project was a very positive experience for us. From pre-sales, through system engineering to project management, everything was handled very well by SVA. In fact, I wish we had this quality of collaboration in all our IT projects. Most importantly, the financials and cost savings delivered by this project met our expectations.

"The most important achievement of the project is, of course, that Städtische Werke Magdeburg reduced its storage costs by 50 percent per gigabyte. Together with IBM, SVA did really a good job."

Next steps

Städtische Werke Magdeburg is planning to increase storage capacity as demand grows. As processing workload increases, servers may be upgraded with POWER7 processors, which will increase total throughput and make some of the more advanced virtualization features available. For the SAP applications, Städtische Werke Magdeburg is considering IBM PowerHA clustering, which will greatly increase system resilience.

Collectively, these possibilities demonstrate that Städtische Werke Magdeburg has achieved its goals of introducing a long-term, strategic solution for its business-critical SAP and general applications.

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