

Voith increases performance and saves license and maintenance costs by introducing IBM DB2 for SAP applications



“IBM Business Partner SVA and the IBM team provided the resources in depth Voith needed to ensure excellent transition services that met and exceeded our business objectives.”

Christoph Krane
Head of Data Center Operations
Voith

“The migration to DB2 proved to be highly successful, achieved within tight timescales and assisted by a knowledgeable IBM team that understood SAP applications, IBM Power servers and Voith’s business requirements.”

Bernd Nagel
Team Leader, UNIX, Storage and DB2
Voith



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About this paper

This technical paper explores how Voith IT Solutions has cut costs and improved system performance by migrating its SAP applications to IBM DB2 on the IBM Power platform. With support from SAP, IBM and IBM Premier Business Partner SVA, Voith has reduced total system administration effort, cut total data storage volumes through the use of IBM DB2 Deep Compression, and introduced Unicode for international working.

Customer Objectives

- *Introduce a stable, reliable solution with high resilience and full disaster recovery*
- *Control costs, reduce license fees and cut operational expenses*
- *Increase efficiency, by reducing database administration workload*
- *Drive return on investment with improved services from within reduced IT budgets*
- *Improve system performance with faster response times for 7,000 SAP users*
- *Simplify the IT landscape for more than 80 SAP instances*
- *Cut data storage volumes and reduce data management costs.*

IBM Solution

- *Extend the existing POWER5 server landscape with POWER6 processor based servers*
- *Migrate to IBM DB2 for Linux, Unix and Windows version 9.5 to support all SAP instances by the end of June 2010, offering lower maintenance and licensing costs*

- *Update IBM AIX from 5.3 to 6.1 TL3 to take advantage of advanced virtualization technologies*
- *Update IBM PowerHA from 5.5 to 6.1, spanning the twin data centers in Heidenheim, to improve resilience*
- *IBM Tivoli Storage Manager and Tivoli FlashCopy Manager will be implemented in Q1 2011 to provide an integrated data management solution.*

Customer Benefits

- *Using IBM InfoSphere Change Data Capture, migration time for a 1.2TB system was less than 11 hours*
- *With IBM DB2 Deep Compression, database performance has improved without requiring additional investment*
- *Total I/O activity is reduced on a proportionate basis to database compression, and application response times have improved (biggest DB size reduction 62 percent)*
- *Simplified database administration through the DB2 Cockpit for SAP with an intuitive user interface*
- *DB2 cache hit rate has increased to more than 99 percent.*

Background, starting point and objectives

About Voith

Voith sets standards in the markets energy, oil & gas, paper, raw materials and transportation & automotive. Founded in 1867, Voith employs almost 40,000 people, generates €5.2 billion in sales, operates in about 50 countries around the world and is today one of the biggest family-owned companies in Europe.



Initial IT environment

Voith IT Solutions operates six data centers, in Germany (two in Heidenheim), Austria (St Pölten), China (Shanghai), Brazil (São Paulo) and USA (Wilson, NC).

The company had been running a wide range of SAP applications on servers running the HP-UX operating system, supported by Oracle databases. Voith was using almost every component of the SAP ERP suite, alongside SAP ERP Human Capital Management, SAP Customer Relationship Management, SAP Global Trade Services, SAP NetWeaver Process Integration, SAP NetWeaver Business Warehouse, SAP NetWeaver Portal, and the SAP Solution Manager.

Early in 2006, Voith chose to migrate to the IBM Power platform, starting with IBM Power Systems 570 servers equipped with POWER5 processors. A total of 60 LPARs ran a wide range of SAP applications, using a high degree of virtualization such as Virtual I/O Servers (VIOS) and micropartitioning, as well as storage virtualization using IBM System Storage SAN Volume Controller.

This configuration ran Oracle 10.2 databases on the IBM AIX 5.3 operating system, with IBM PowerHA (formerly called HACMP) providing clustering services for resilience, IBM VIOS 1.5 and, for backup and recovery services, HP DataProtector.

Business challenges and project objectives

Voith was faced with the need to operate its SAP systems more cost-efficiently. The Voith team's evaluation was that migrating database systems to DB2 would realize significant cost savings.

The key business challenges were to:

- Maintain a stable, reliable solution with high resilience and full disaster recovery
- Control costs, reduce license fees and cut operational expenses
- Increase efficiency by reducing database administration workload
- Drive return on investment with improved services and reduced IT budgets.

In parallel with the business objectives, the Voith IT Solutions division wished to address technical challenges too:

- Improve system performance with faster response times for 7,000 SAP users
- Simplify the IT landscape and reduce complexity for more than 80 SAP instances
- Cut data storage volumes and reduce data management costs.

Voith set out its project objectives, with cost-savings as the first priority, and drew up a list of the enabling technologies:

- Extend the existing Power server landscape with POWER6 processor-based servers
- Migrate to IBM DB2 for Linux, Unix and Windows version 9.5 to support all SAP instances by the end of June 2010, offering lower maintenance and licensing costs
- Update IBM AIX from 5.3 to 6.1 TL3 to take advantage of advanced virtualization technologies
- Update IBM PowerHA from 5.5 to 6.1, spanning the twin data centers in Heidenheim, to improve resilience
- Currently implementing IBM Tivoli Storage Manager and, in the near future, Tivoli FlashCopy Manager for integrated data management and performing near-instant application-aware snapshot backups with minimal performance impact for SAP.

Migrating the databases presented the largest single challenge, preserving integrity while minimizing the workload, and ensuring that the process would involve the least possible total downtime. Voith selected IBM InfoSphere Change Data Capture (CDC) for one of its systems, which enables real-time data replication to support migrations, greatly accelerating the migration process by eliminating redundant data transfer.

Technical solution

The existing IBM Power architecture was used to support the migration, by using Logical Partitions (LPARs) to provide independent servers for each process.

IBM InfoSphere CDC captures only changed data and transfers it from publisher to subscriber systems. This improves operational efficiency and saves time and resources by eliminating redundant data transfer and saving network bandwidth.

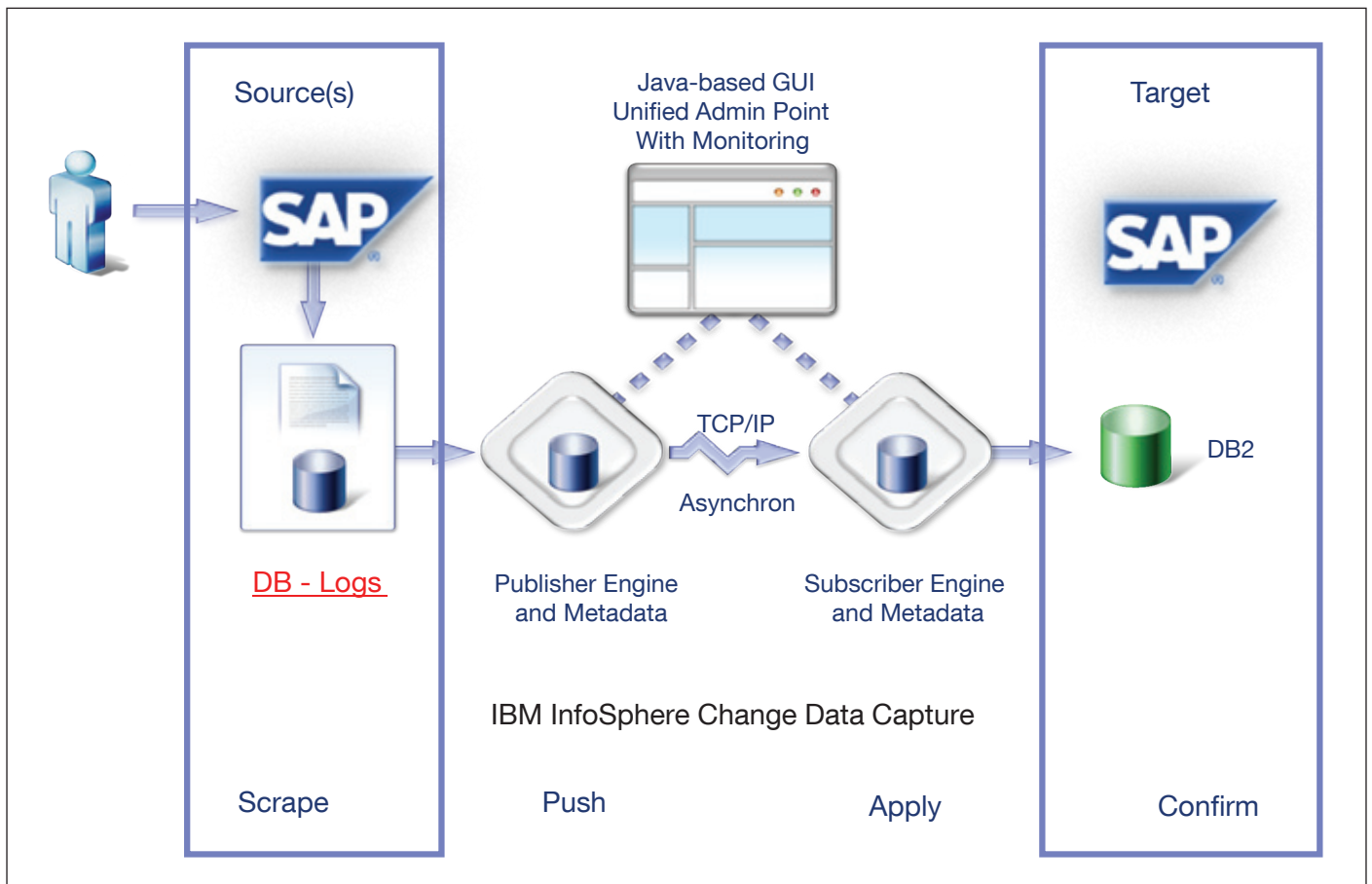


Figure 1: Schematic illustration of the ChangeDataCapture migration method

IBM InfoSphere CDC includes data transformation and filtering, such as translation of values, derivation of new calculated fields, and joining of tables at the source or target. Custom data transformations can be created, stored and retrieved within InfoSphere CDC as macros, and row and column selection makes it possible for users to limit access to sensitive information, or to flow user-specific data to particular sites. Additionally, data stored in various character sets and languages can be seamlessly replicated to disparate platforms.

Voith selected IBM DB2 as the target database because it met the key business criteria of lower operational costs and enhanced business resilience. The close integration provided by the SAP DBA Cockpit for DB2 significantly reduces the database administration workload, and simplifies management of the SAP application databases. Further, SAP's own use of DB2 as its core database choice offered great confidence to Voith that DB2 was a long-term strategic partner for mission-critical applications.

The principal migration steps were:

- Install the SAP migration tools
- Export structural data from the source systems
- Unload source system data in a database-independent format
- Transfer the structures and the data to the central instance of the target system
- Load the structural data in the target system and create the table definitions
- Load data into the newly created tables on the target system (data import)
- Rework with the relevant SAP updates on the target systems
- Post Migration Activities (such as installing new license keys, maintaining new SAP profiles etc)
- Test and documentation.

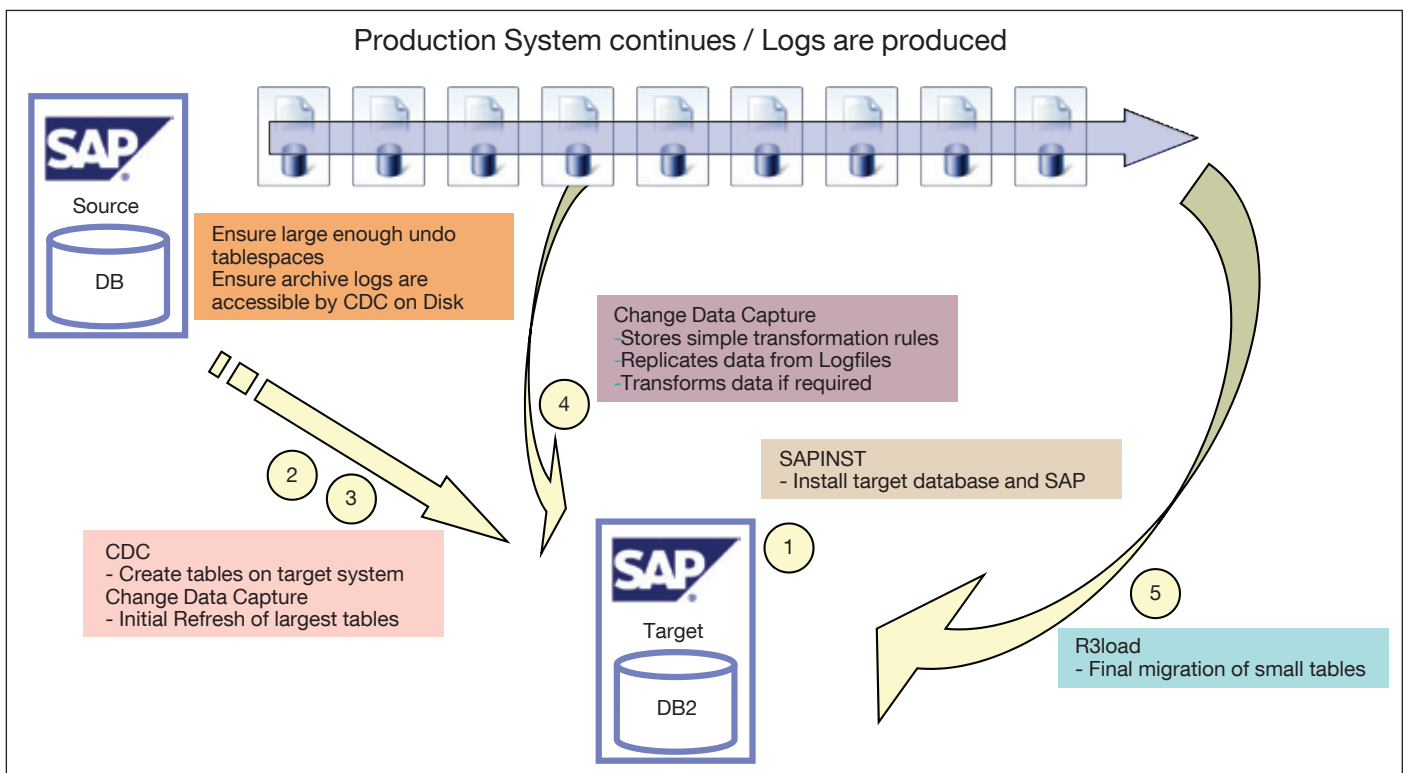


Figure 2: Technical steps of a CDC migration

The figures below show the data volumes, downtime and typical compression rate achieved using DB2 Deep Compression for a typical Oracle to DB2 migration of a larger database in March 2010. Also in this migration, Voith changed the server infrastructure from POWER5 to POWER6 processors:

Source DB size:	1.7 TB
Largest Table:	93 GB
Downtime for migration:	8:50 hours
RUNSTATS:	3:00 hours
Target DB size:	680 GB
Largest table:	27 GB
Database compression rate:	62 percent

The largest tables were moved to two new tablespaces, to achieve smaller tablespaces that would allow improved backup runtime (instance HP1).

The figures below show the data volumes, downtime and typical compression rate for the largest table in the system, achieved using DB2 Deep Compression for an AIX/Oracle migration to a POWER5 server and DB2. This migration was completed in November 2009, and this heterogeneous database migration included a transition to Unicode and from POWER5 to POWER6 processors:

Source DB size:	1.9 TB
Largest Table:	114 GB
Downtime for migration:	15:00 hours
RUNSTATS:	4:00 hours
Target DB size:	800 GB
Largest table:	33 GB
Database compression rate:	58 percent

Compressing only the largest 10 to 100 tables already can shrink the overall database size close to the optimum. The largest tables were moved to three new tablespaces to minimize the backup runtime (instance PP2).

Instance	DB Oracle in GB	DB DB2 in GB	Reduction in %	Comment
PK2	1428	796	44.26	COMPRESS_ALL
PP2	1568	872	44.39	FULL_COMPRESS, additionally Unicode migration
HP1	1300	651.4	49.89	COMPRESS_ALL
AP1	2316	1535	33.72	COMPRESS_ALL

Table 1: Achieved compression rate with DB2 Deep Compression

Server architecture

To support the SAP applications and run the DB2 databases, IBM Business Partner SVA worked with Voith to deploy the new AIX LPARs on the four 16-way POWER5 processor-based IBM Power 570 servers, with 256 GB memory, with two servers installed in each data center. Using IBM System Storage SAN Volume Controller (SVC), the servers were connected to two IBM System Storage DS8000 disk systems and several third-party storage devices.

In each data center, each server was divided into multiple Logical Partitions (LPARs), and also acted as its twin’s failover server using PowerHA. For example, Server 1 was divided into 19 LPARs, with allocations ranging from 4CPU to 0.1CPU, and Server 2 supported 20 LPARs with a similar allocation range.

The PowerHA cluster supported the critical applications on the two machines, allowing production to continue even if one server suffered an unplanned outage.

The LPAR technology allows Voith to over-commit its CPU resources by setting maximum allocations that exceed the physical CPU total. As the workload in each LPAR varies, resources are made available as required from the physical processor and memory, allowing each LPAR to maximize throughput.

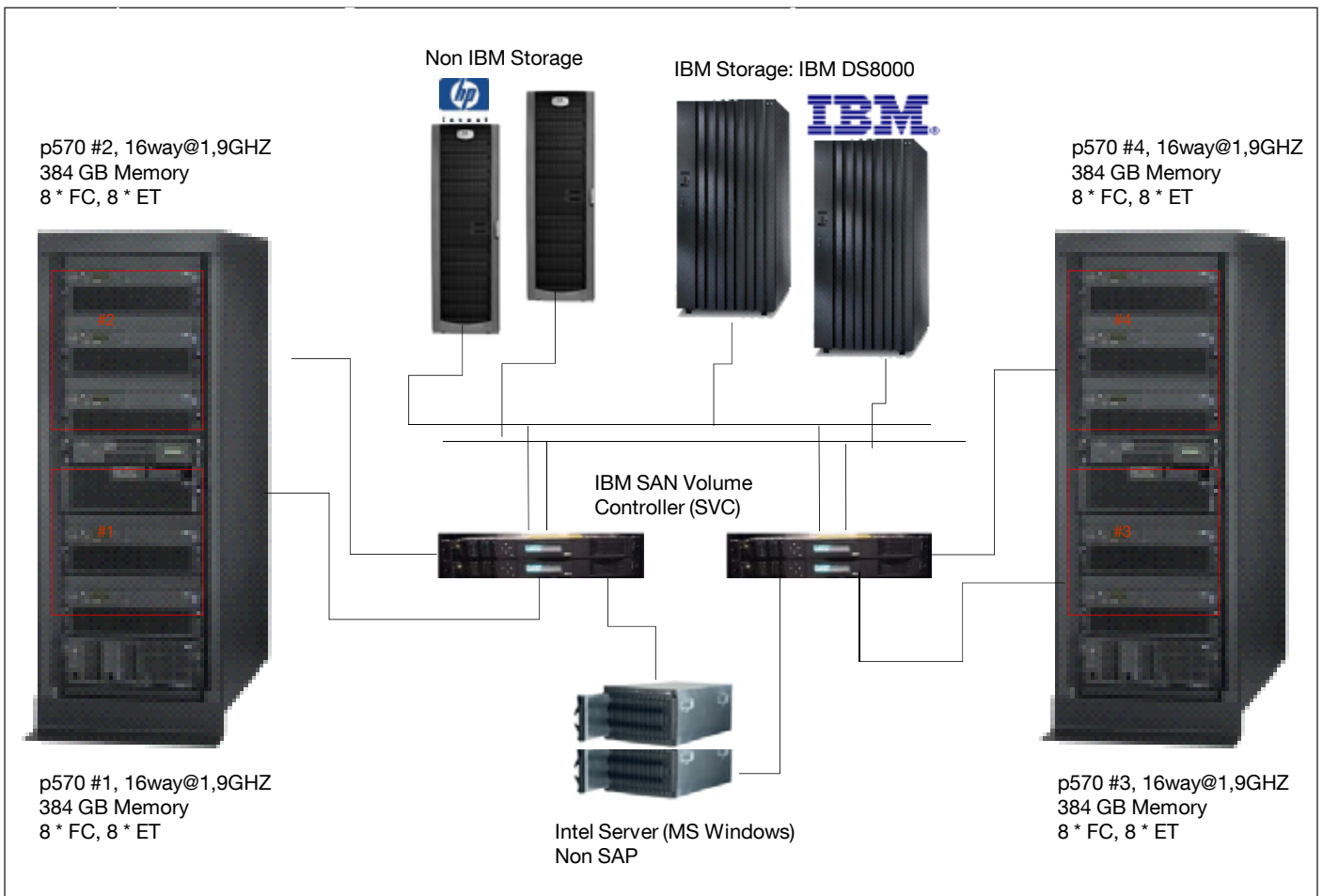


Figure 3: Part of the consolidated hardware topology at Voith

Storage architecture

By implementing IBM SAN Volume Controller, Voith has been able to unify storage systems from multiple vendors, including HP and IBM.

SAN Volume Controller software is delivered pre-installed on SVC Storage Engines, ready for implementation once the engines are attached to the SAN. SVC Storage Engines are based on proven IBM System x® server technology and are deployed in redundant pairs, designed to deliver very high availability.

SVC takes control of existing storage, presenting the data volumes to servers as a single storage pool. Only a single storage driver type is needed for all servers or virtual server images, which simplifies administration by reducing complexity. SVC eases replacing storage or moving data from one storage type to another because these changes do not require changes to storage drivers.

Project achievements

Performance improvements

Following the successful introduction of the Power servers, Voith installed two additional POWER6 processor-based systems prior to the migration to DB2. As the SAP application landscape has expanded, the number of servers and LPARs has also grown. The original four POWER5 servers and the two additional POWER6 servers now support between 80 to 100 LPARs, which is easily possible with the enhanced performance of the POWER processors and PowerVM capabilities such as Virtual I/O Servers and micropartitioning.

The migration of nearly 80 SAP systems from Oracle to DB2 was delivered by IBM service representatives, and was completed in 11 months.

Alongside the technical effects of data compression achieved in the migration to DB2, the database itself also consumes less main memory. Even though the amount of physical main memory has remained unchanged, more main memory can be used per transaction. This allows DB2 to improve performance without requiring additional investment in memory or bandwidth.

The results include:

- Better CPU utilization, and CPU workload reductions for some systems – exploiting current processor investments to the maximum
- Average SAP response time up to 20 percent faster – offering increased productivity for all SAP users
- Better RAM utilization – avoiding the need for additional investments in memory capacity
- Data on disk storage and in RAM is compressed – reducing the need to add storage and memory
- Physical database RAM virtually typically 40 percent larger – more data can be put in memory, offering a better hit ratio and therefore better SAP application response time
- I/O traffic reduced by up to 40 percent – fewer I/O operations mean improved performance.

With data storage savings, total I/O activity is reduced on a proportionate basis. Although the CPU load is similar or slightly higher, the application response times have improved, in part because more data can be put into the cache and memory cache hits are higher.

By comparison, the Oracle databases consumed more database cache with a hit rate of about 97 percent. With DB2 the cache hit rate is more than 99 percent. For databases with up to 100 billion accesses per week, this incremental improvement has produced significant performance gains.

Figures 4, 5 and 6 show how response times have improved over time. The x-axis shows the elapsed project months, the y-axis the average response time in milliseconds.

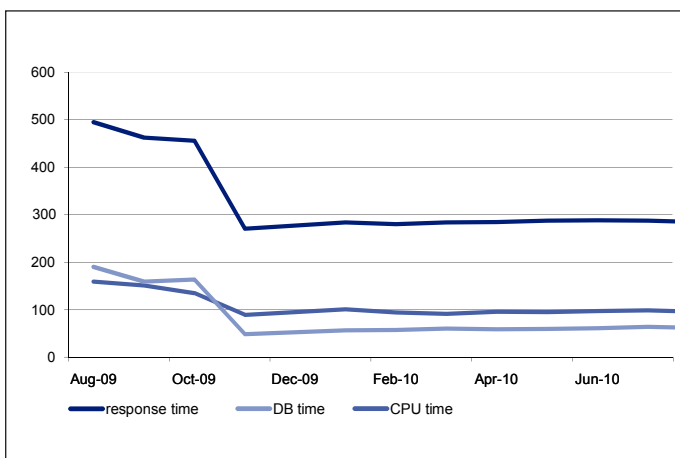
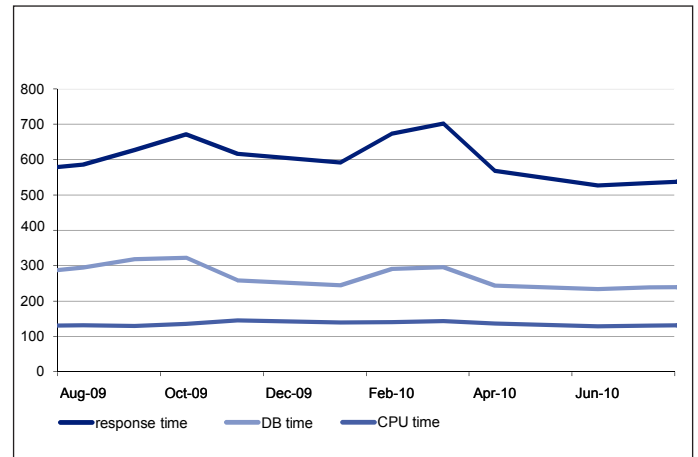
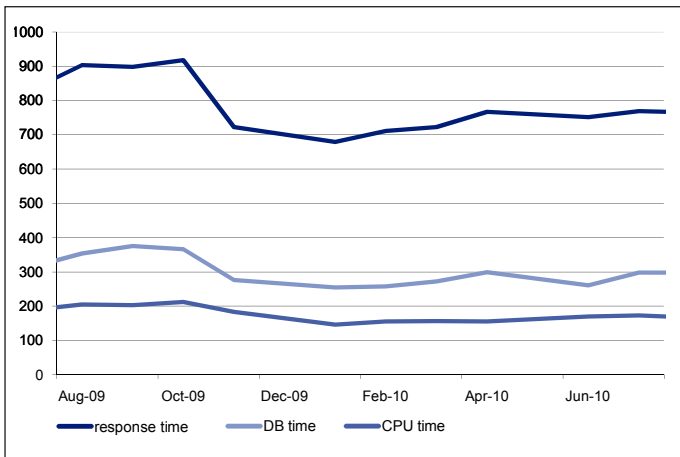


Figure 4, 5 and 6: Response times before and after DB2 migration, illustrated with different examples with different database sizes

Next steps

Voith is considering migrating to DB2 9.7, which includes index compression as well as the current row compression technology (DB2 Deep Compression). This will further reduce data volumes, which will help cut database backup times. It will also offer additional performance improvements.

Voith is planning to implement IBM Tivoli Storage Manager and Tivoli Storage FlashCopy Manager in Q1 2011. This innovative solution for backup, recovery and cloning in virtualized environments includes special extensions for SAP data management. The highly automated Tivoli Storage Management solution provides flexibility, delivers detailed information on cloning, backup and performance status, and will eliminate major repetitive administrative workload efforts.

“With DB2 Deep Compression we have reduced storage requirements by at least 30 percent, and we are delivering enhanced system and SAP application performance at lower operational costs.”

Bernd Nagel
Team Leader, UNIX, Storage and DB2
Voith



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