

DB2 on IBM Power Advantages



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Power Systems and DB2 – Tight Integration

■ Performance of POWER7 and DB2

- More cores and threads – 32 chips, 8 cores/chip, 4 threads/core
 - Exploited by DB2 better than any other DBMS
- Full SSD support in Power 750, 755, 770, 780 system units
 - DB2 can use SSD for both permanent objects (tables/indexes) as well as temporary objects (not supported in Exadata)

■ Consolidation of DB2 on POWER7

- PowerVM virtualization second to none
 - Active Memory Sharing exploited by DB2 self tuning memory manager
 - When peak demand hits, DB2 can immediately leverage additional resources
 - Workload management integrated between AIX and DB2
 - DB2 able to meet customers SLAs more easily

■ Reliability of Power Systems and DB2

- Power 3x – 4x more reliable than Linux on x86
- 99.997% availability with Power and AIX
 - DB2 tightly integrated with PowerHA and other HA features of AIX

Power Systems and DB2 – Easy to Move To

■ Higher productivity = lower TCO

- “We have shifted our resources from 70% on maintaining old systems to 70% deploying new solutions” – customer switched from Sun to IBM
- “We have been pretty pleased with the performance, compression savings and things like the self-tuning memory with DB2, but now the DBAs doing the work have a lot more time to focus on SAP issues rather than Oracle issues.” - Andrew Juarez, Coca-Cola Bottling Co moved from Oracle to DB2

■ Moving to Power and DB2 from Sun and Oracle is easy

- “Moving form Solaris to AIX was a non event” - Transplace
- “With IBM DB2 9.7 and the new IBM Optim Development Studio, we completed our recent data migration project from Oracle to DB2 in 80 percent less time than we originally estimated, saving about two and a half months.” - Gene Ostrovsky, VP Research and Development, ExactCost

Power Systems Value



Virtualization without Limits

- ✓ Drive over 90% utilization
- ✓ Dynamically scale per demand



- Dynamic Energy Optimization
- ✓ 70-90% energy cost reduction
 - ✓ EnergyScale™ technologies

*Workload-Optimizing
Computing*



AIX - The Future of UNIX

Total Integration with i

*Scalable Linux ready for
x86 Consolidation*



Resiliency without Downtime

- ✓ Roadmap to Continuous Availability
- ✓ High availability systems & scaling



Management with Automation

- ✓ VMControl to manage virtualization
- ✓ Automation to reduce task time

Power Systems Value Enhanced by DB2



Virtualization without Limits

- ✓ Drive over 90% utilization
- ✓ Dynamically scale per demand

Dynamic memory and processor changes exploited by DB2 immediately

Large numbers of threads exploited by DB2 extreme parallelism capabilities

PowerHA a key component of DB2 pureScale

AIX HA capabilities exploited by DB2 (storage keys, cluster manager, heartbeat, etc.)



Resiliency without Downtime

- ✓ Roadmap to Continuous Availability
- ✓ High availability systems & scaling



Dynamic Energy Optimization

- ✓ 70-90% energy cost reduction
- ✓ EnergyScale™ technologies

DB2 storage compression further reduces energy requirements

Scan sharing reduces I/O bandwidth further reducing energy requirements

DB2 workload management and STMM to exploit consolidation and virtualization

ISAS lifecycle management

Management with Automation

- ✓ VMControl to manage virtualization
- ✓ Automation to reduce task time



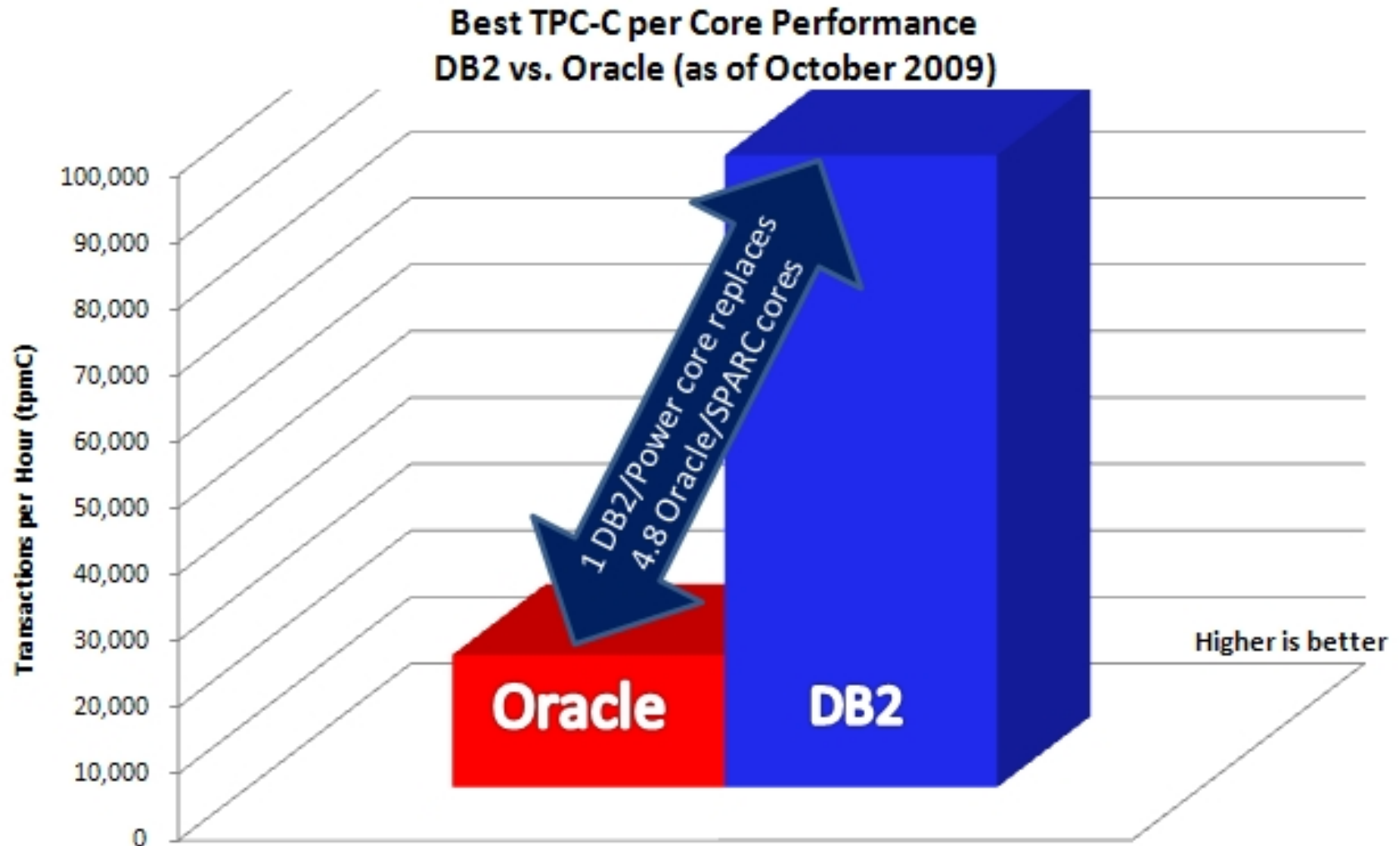
DB2 Architecture Maps to POWER7 Capabilities

- **POWER7 – massive number of threads per server**
 - Requires sophisticated software to **exploit**
 - DB2 threaded engine built to scale on large multi core servers
 - Requires sophisticated **virtualization** to consolidate
 - DB2 autonomics “play nice” and “react quickly” in virtualized, dynamic environments
 - Requires advanced **workload management** to meet SLAs
 - DB2 and AIX tightly integrated WLM to deliver the resources where they are needed most
 - Requires **advanced diagnostics** to help lower administration costs for customers with massive levels of concurrency
 - The blue stack helps resolve problems faster with integrated diagnostics
 - Requires integrated **high availability**
 - If any part of the solution fails, DB2 and PowerHA respond more rapidly to provide business continuity

DB2 Performance on IBM Power Systems

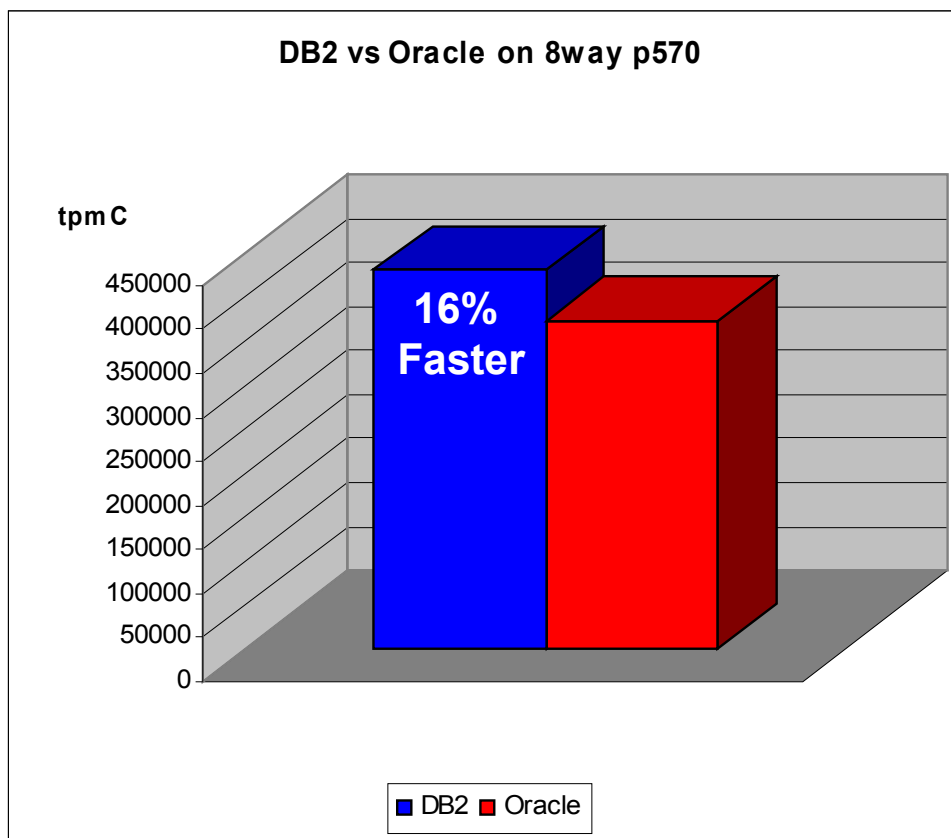


DB2/Power vs. Oracle/SPARC Per Core Performance



DB2 Outperforms Oracle by 16% in Apples to Apples Comparison

- Both on exactly the same server (8way 1.9GHz p5 570)
- DB2 leads in performance by 16% over Oracle



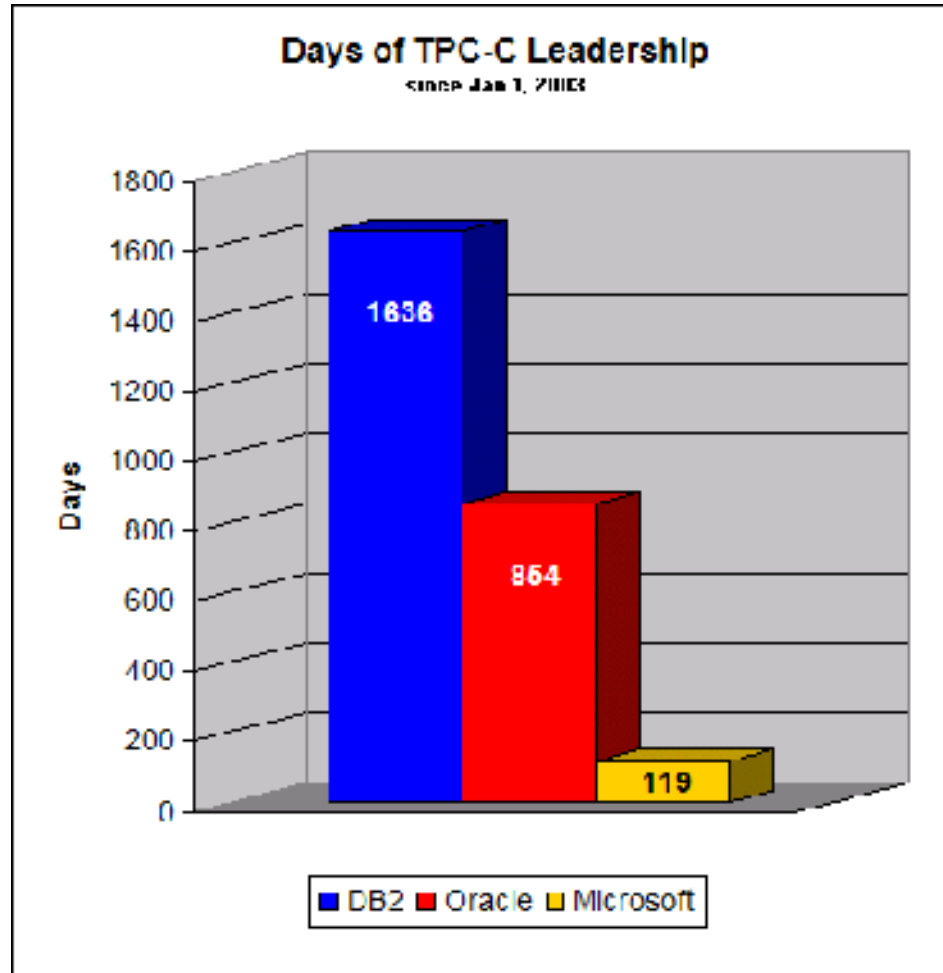
Results current as of June 28 10,2011
Check <http://www.tpc.org> for latest results

DB2 on 8way p5 570: 429,899 tpmC, \$4.99 /tpmC, Availability 09/30/2004
Oracle on 8way p5 570; 371,044 tpmC, \$5.26 /tpmC, Availability

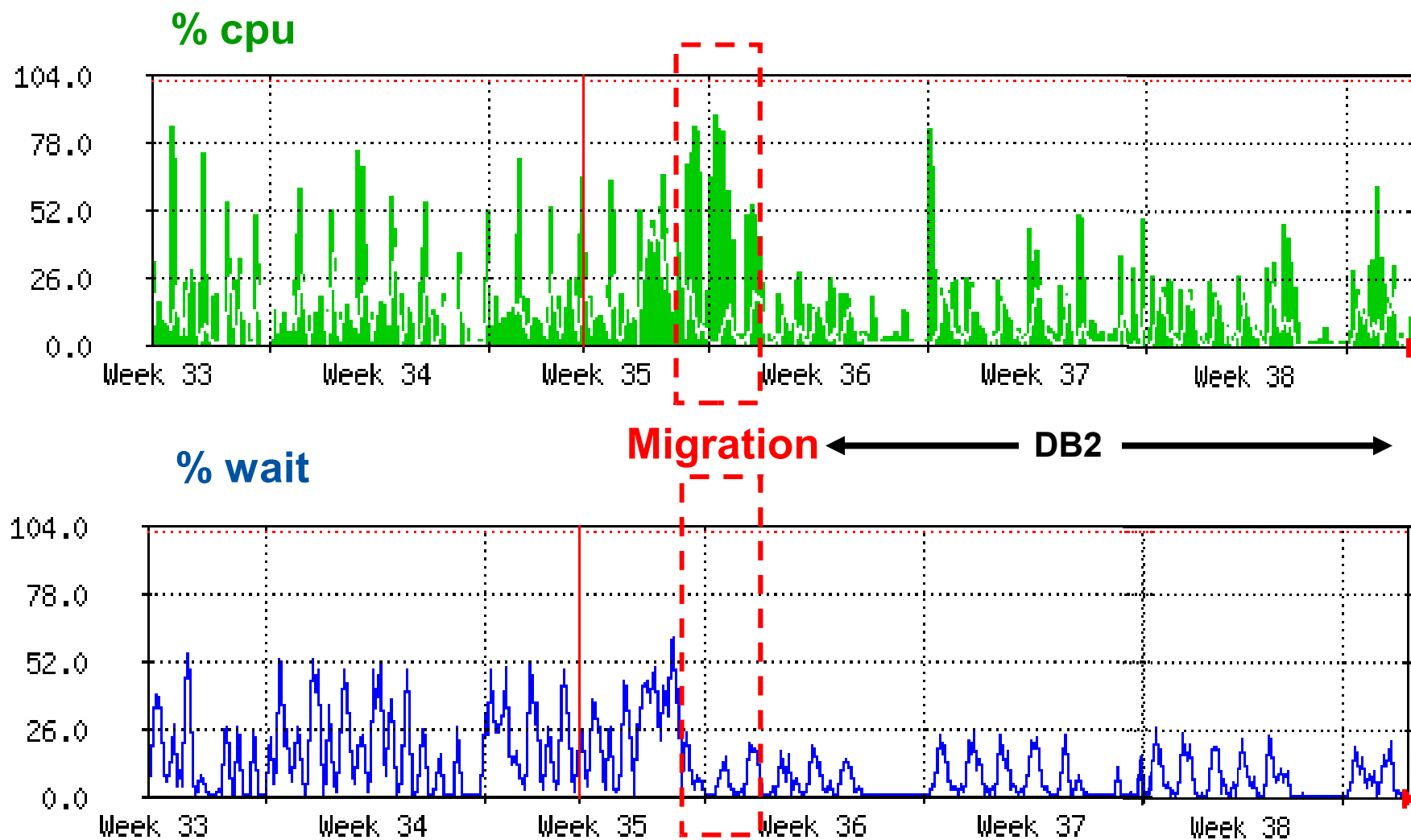
09/30/2004

Longevity in Transaction Processing Performance

- Benchmarks are often a game of leapfrog
- However, DB2 has demonstrated sustained superiority over competitors



Database Server Load Post Migration for Real Customer



Efficient I/O

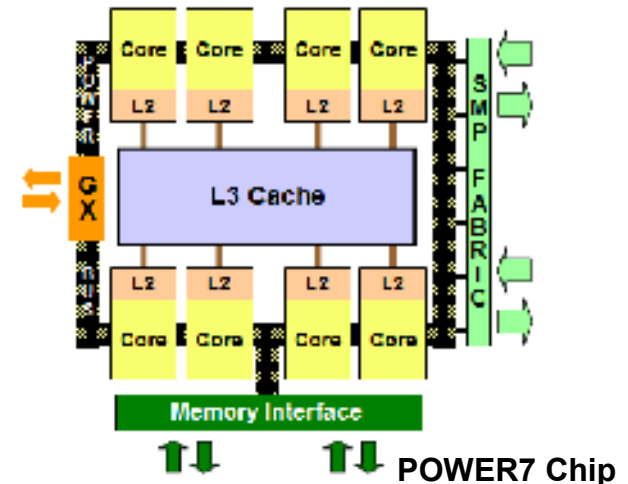
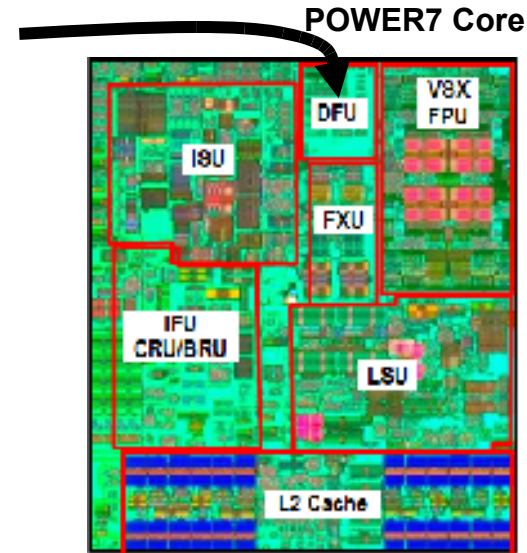
- Logging is the **most critical** factor in high volume OLTP
- TPC-C proves that DB2 has a more efficient logger
 - DB2 logged less than ½ that of Oracle and SQL Server
 - DB2 logged 1/8th the amount of Oracle RAC
 - DB2 9 = 2.4KB of log per transaction
 - Oracle 11gR2 = 4.9KB of log per transaction
 - **Oracle 11gR2 RAC = 19KB of log per transaction**
 - SQL Server 2005 = 6.0KB of log per transaction
- Reduced logging = increased performance

Technology Driving Performance Advances

- **Process Exploitation**
 - Deep exploitation of Simultaneous Multi Threading (SMT)
 - Fully threaded DB2 engine
 - NUMAtization of DB2 resources to align with system architecture
- **Memory Exploitation**
 - Autonomic exploitation of POWER features such as larger page sizes
 - Support for AIX multi page support that includes 64KB, 16MB and 16GB AIX page sizes
 - Co-operative Caching
- **Storage Exploitation**
 - Exploits Asynchronous I/O and Scatter / Gather I/O, as well as AIX CIO and DIO interfaces
 - End-to-End I/O Priorities
 - Atomic Logical Volumes
- **Enablement for POWER6 features (Decimal Floating Point, Storage Keys)**
- **Deep integration with AIX APIs**
- **Exploits xLC capabilities for optimal performance using Profile Directed Feedback**
- **And many, many more ...**

Unique Features of POWER Core Only DB2 Exploits

- **POWER7 on core Decimal Floating Point Unit**
- **DB2 is the only DBMS vendor to natively support DECFLOAT data type**
 - Performance advantage for retail and finance
 - 40% performance gain in SAP BW
 - Have seen up to 6x faster performance
- **POWER7 chip has on-chip L2/L3 cache with eDRAM L3 Cache**
 - DB2 is cache aware
 - Optimizes power of the core



What Customers Say About DB2 OLTP Performance



“The performance of the new IBM Power Systems servers combined with DB2 is clearly significantly greater. For larger tables above 1GB, the data compression functionality within DB2 is delivering up to **70 per cent capacity reductions**. At our data growth rates, the compression performance offers a **considerable current and future saving.**” - Jürgen Fischer



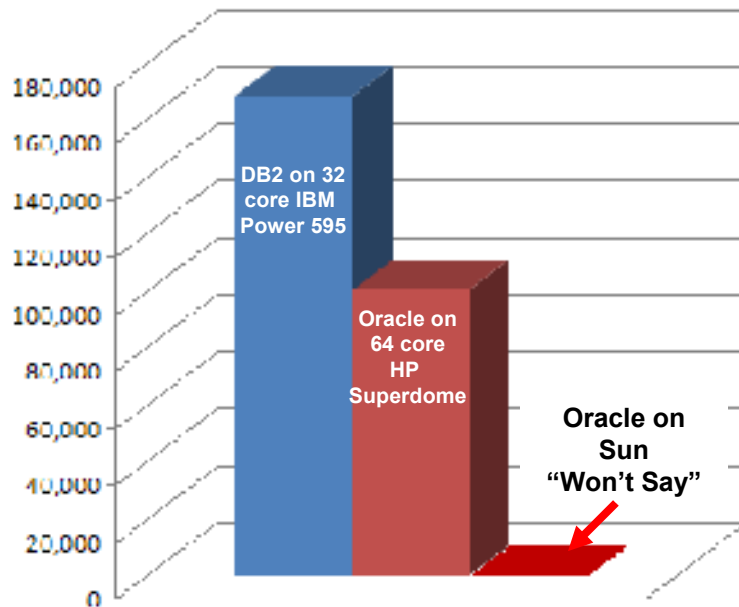
“We measured and compared database solutions, and DB2 was better than other enterprise-class systems we considered, not only in terms of performance metrics, but also concerning handling and management of backups and costs. Database systems differ substantially from each other when it comes to maintenance, and **we found that DB2 offers significant cost savings here. With PowerHA clustering, and the data mirrored to the remote DS4000 systems, we expect SAP application availability to become near-continuous**” - Stefan Förster.

Performance Leadership in SAP with DB2 and Power

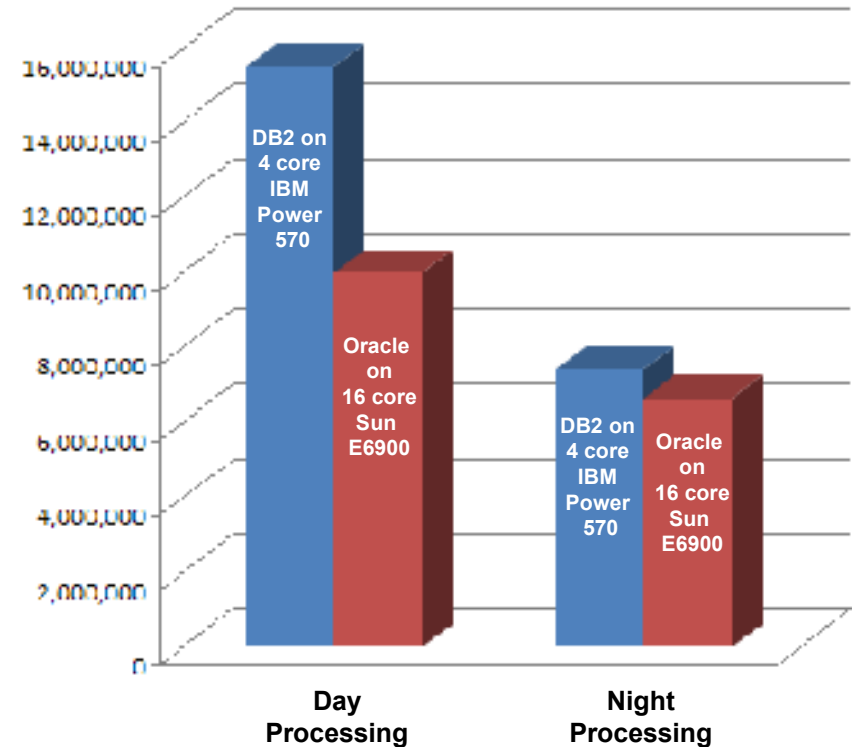
- **The clear leader in SAP Performance**
 - Joint design and development leads to better products

Top SAP 3-Tier SD Results

SD Users

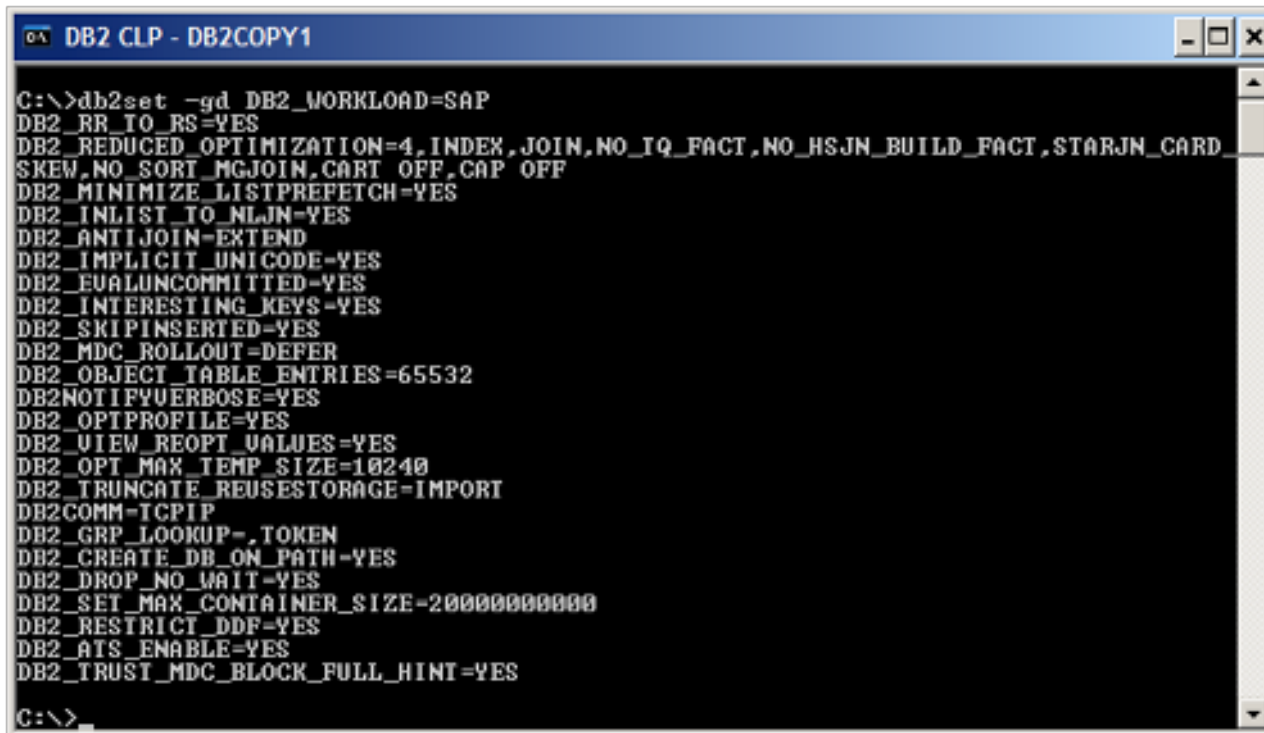


Top SAP Transaction Banking Results



SAP Tuning “Knob”

- **One registry variable optimizes DB2 for SAP**
 - Set DB2_WORKLOAD=SAP and you're done
 - Reduces complexity, improves productivity
 - Adds new optimizations after upgrades or fixpacks



```
DB2 CLP - DB2COPY1

C:\>db2set -gd DB2_WORKLOAD=SAP
DB2_RR_TO_RS=YES
DB2_REDUCED_OPTIMIZATION=4,INDEX,JOIN,NO_IQ_FACT,NO_HSJN_BUILD_FACT,STARJN_CARD_
SKEW,NO_SORT_MGJOIN,CART OFF,CAP OFF
DB2_MINIMIZE_LISTPREFETCH=YES
DB2_INLIST_TO_MLJN=YES
DB2_ANTIJOIN=EXTEND
DB2_IMPLICIT_UNICODE=YES
DB2_EVALUNCOMMITTED=YES
DB2_INTERESTING_KEYS=YES
DB2_SKIPINSERTED=YES
DB2_MDC_ROLLOUT=DEFER
DB2_OBJECT_TABLE_ENTRIES=65532
DB2_NOTIFICATIONS=YES
DB2_OPIPROFILE=YES
DB2_VIEW_REOPT_VALUES=YES
DB2_OPT_MAX_TEMP_SIZE=10240
DB2_TRUNCATE_REUSESTORAGE=IMPORT
DB2COMM=TCPIP
DB2_GRP_LOOKUP=,TOKEN
DB2_CREATE_DB_ON_PATH=YES
DB2_DROP_NO_WAIT=YES
DB2_SET_MAX_CONTAINER_SIZE=2000000000
DB2_RESTRICT_DDF=YES
DB2_ATS_ENABLE=YES
DB2_TRUST_MDC_BLOCK_FULL_HINT=YES

C:\>
```

Unique DB2 Differentiators

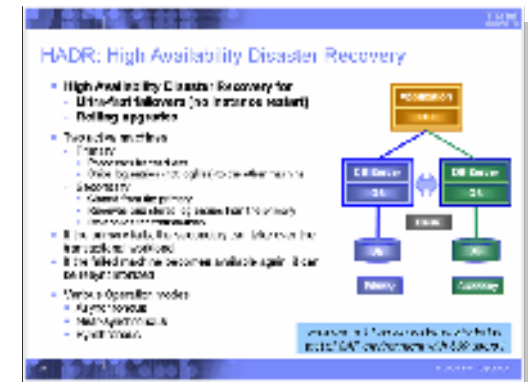
■ DB2 9 Deep Compression

- Fully transparent table data row compression
- Fully exploited index and temp compression
- Up to 80% savings on a table and 50% on indexes
 - Overall database size reduced by 60%
 - Equal savings on TEST, Q/A, DEV, and PROD
- More efficient I/O
- Better utilization of database cache
- Automatic Dictionary Creation (ADC)
- **Available with DB2 only**



■ DB2 HADR

- Integrated HA+DR solution
- Fully Integrated Cluster Manager (TSA) in DB2
 - Easy to configure and manage directly within DB2
- **Available with DB2 only**



Unique DB2 Differentiators for SAP BI

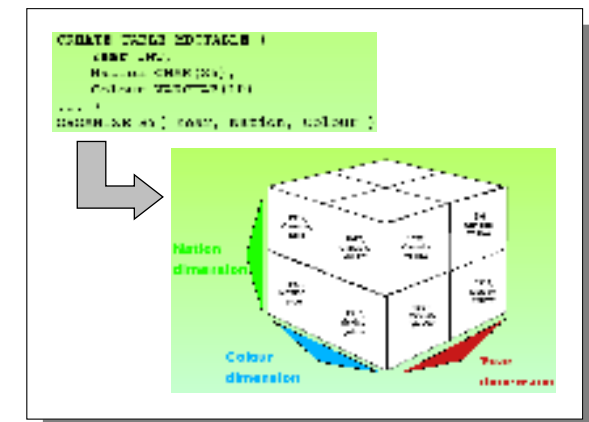
■ DB2 Database Partitioning Feature (DPF)

- Shared-nothing architecture with proven linear scale-out capability
- Mature technology – almost all larger SAP BI customers on DB2 run with DPF
- Fully supported since SAP BW 2.0
- Only certified clustered database for SAP BI
- **Available with DB2 only**



■ DB2 Multi-Dimensional Clustering (MDC)

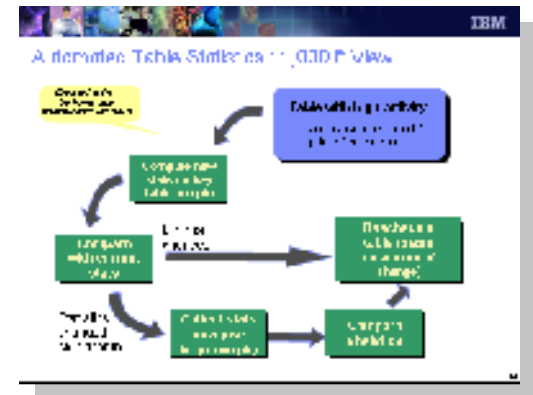
- Boosts SAP BI query performance by up to a factor of 8
- Fast roll-in/roll-out capability
- Zero administration
- 99% compression of dimensional indexes
- **Available with DB2 only**



Other DB2 Strengths with SAP

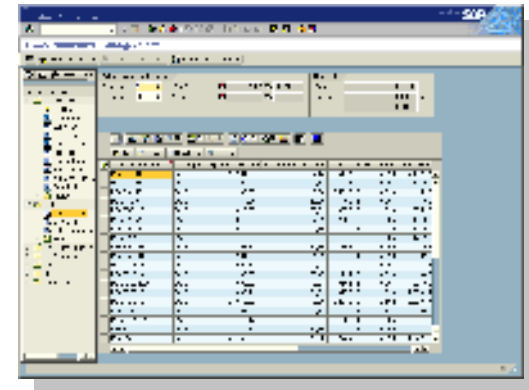
■ Automation of DBA tasks

- DB2 automates most DBA tasks:
 - Maintenance of table and index statistics
 - Table and index reorganization
 - Memory tuning
 - Configuration
 - Virtualized tables for schema simplification (only DB2)
- DB2 will ultimately become “invisible” under SAP
- **Fully certified and supported by SAP**



■ Integration into SAP applications

- New DB2 capabilities integrated into all SAP versions
- Integrated into SAP's DBACOCKPIT:
 - Performance Monitoring
 - Administration
 - Compression
- **Fast adoption of new DB2 features**



Real Customer SAP Performance - DB2 vs. Oracle

Customer rku.it

Performance measurement before and after migration from Oracle to DB2 on same IBM Power hardware:

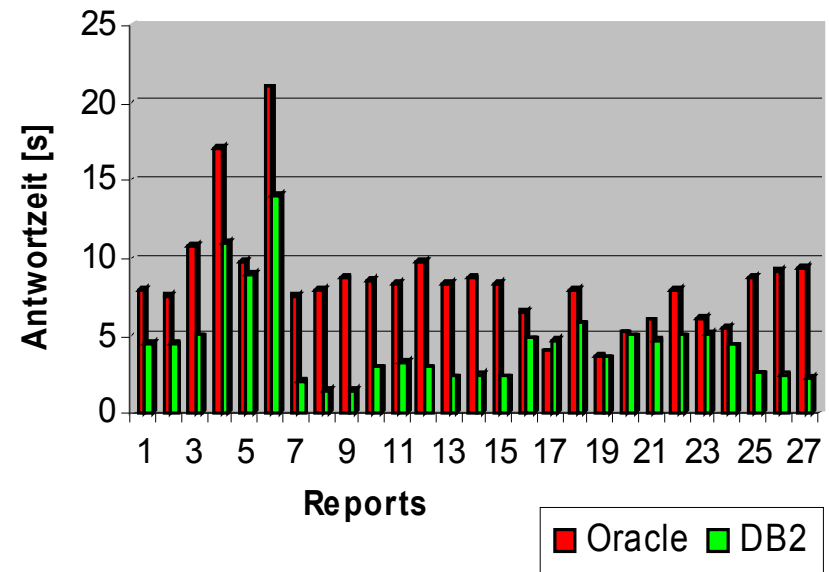
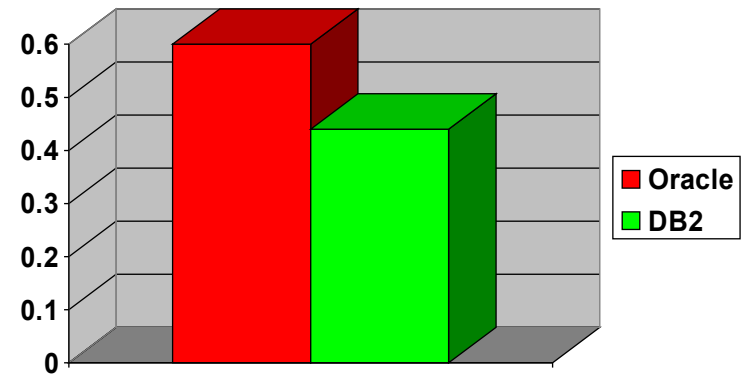
- DB2 40% faster Dialog
- DB2 40% faster Batch processing

DB2 at largest SAP/Oracle customer in Germany

Testcase: Runtime measurement of different BI transactions with SAP BI Queries

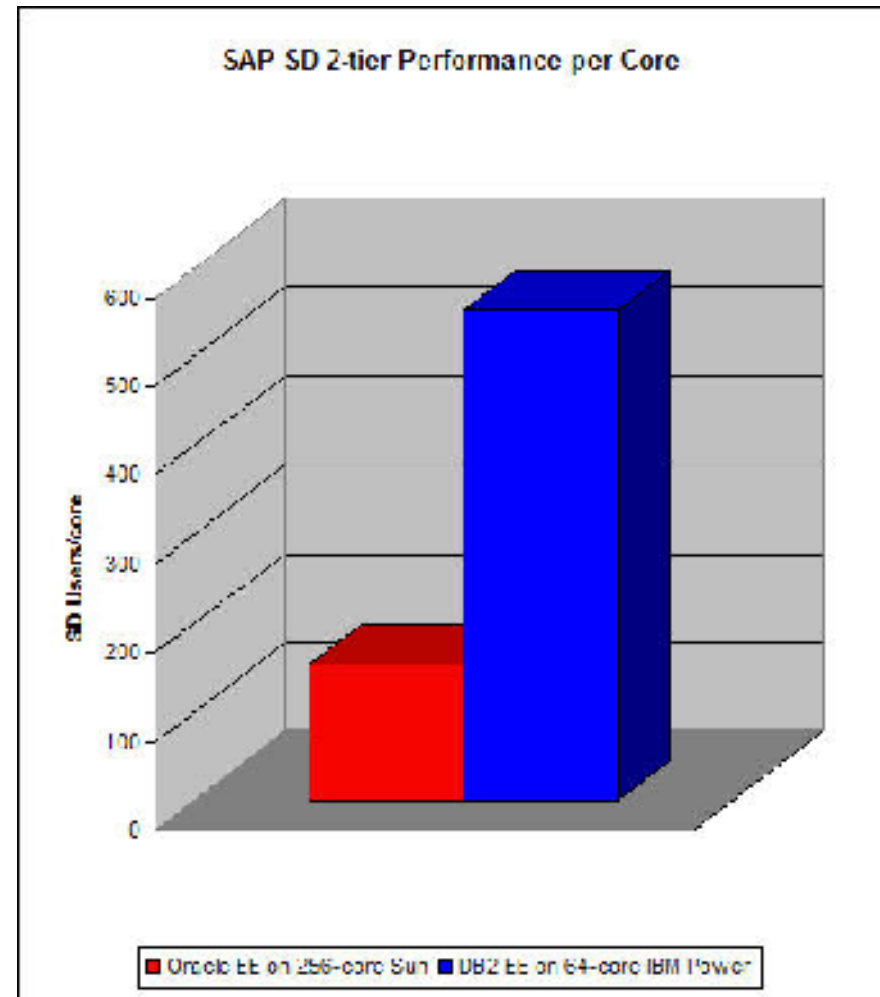
- DB2 up to 9 times faster
- DB2 in average over 40% faster

Responsetime



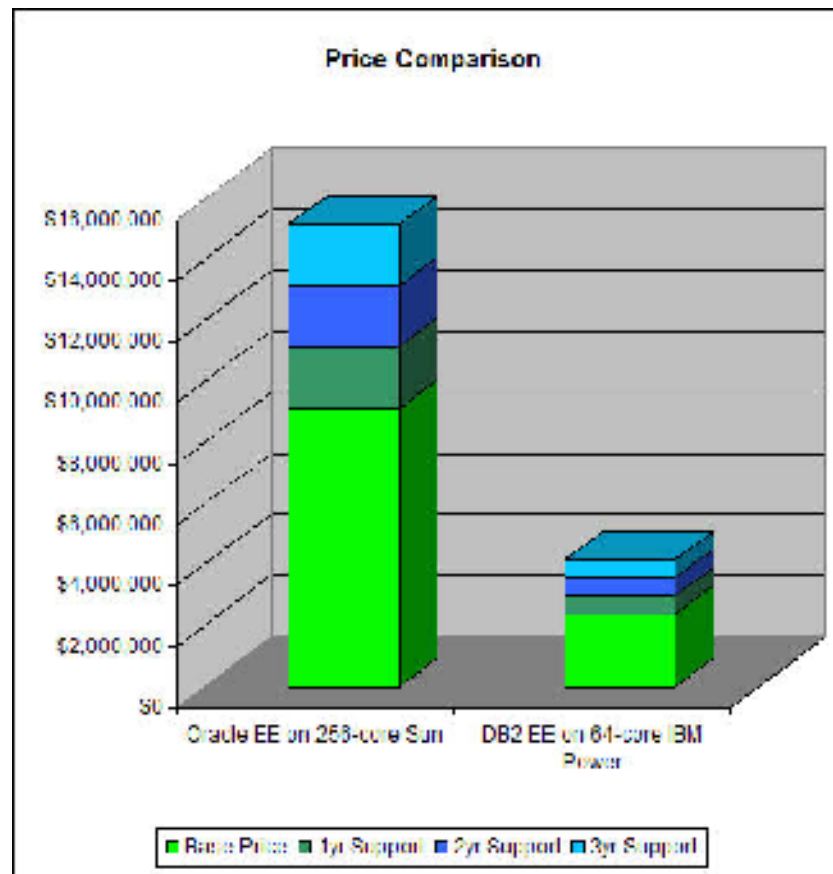
Oracle/Sun 4x cores to top DB2/IBM Power by 10%

- DB2 on 32-core IBM Power delivers just 10% less performance than Oracle on 256-core Sun SPARC
- Looking at the per core performance, DB2 on IBM Power blows Oracle on SPARC out of the water



Price of DB2 9 on 64-core vs. Oracle on 256-core

- DB2 9 on 64-core IBM Power6 w/ 1 yr support = \$2,964,480
- Oracle 10g on 256-core Sun SPARC64 w/ 1yr support = \$11,126,400



What Customers say about DB2/POWER for SAP



“Norkis Group selected the IBM DB2 database, based on its **advanced integration with SAP applications**. DB2 offers **excellent performance** alongside enterprise-strength backup and recovery solutions. It is able to handle the very large data sets that we expect to generate, and gives us room to grow as the business itself expands. What tipped us towards the IBM solution was the **superior virtualization functionality offered by the Power Systems platform**” - Ronald Alfeche



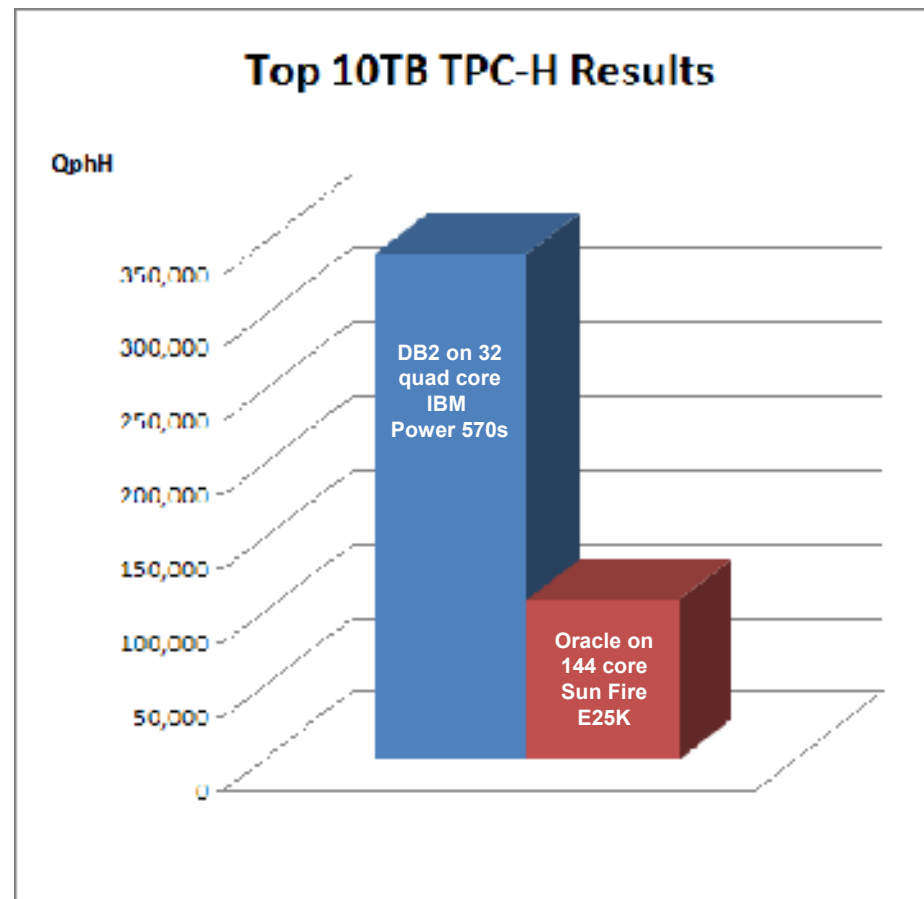
Steelmaker Borçelik has been using SAP ERP applications, initially **with an Oracle database platform**. **Licensing and support costs were rising**, and Borçelik looked for a more efficient solution to help optimize business processes. “**With DB2 on the IBM Power Systems platform, we get great performance and reliability at a low cost of operation** – as well as the potential to leverage the latest advances in database technology.” - Ozcan Soke



“The **integration of DB2 and SAP applications is excellent**, particularly the functionality of the SAP transaction ST04 - system monitor. In our context, for SAP application operations, **IBM DB2 offers massively improved functionalities when compared to Oracle**, and helps to **reduce database administrative workload by around 30 per cent**.” - Iwan Nussbaumer, Industrielle Werke Basel

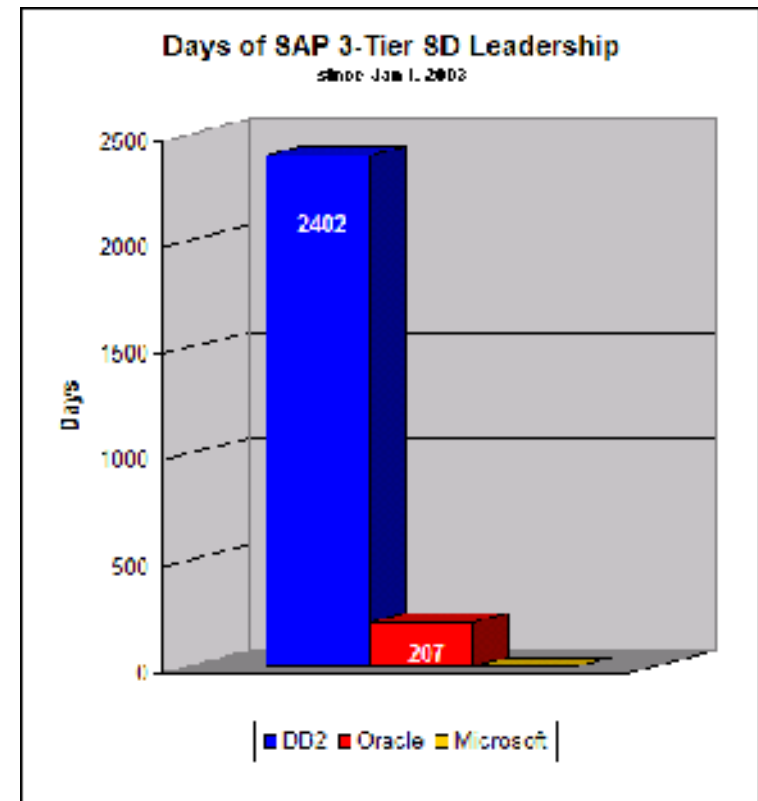
Performance Leadership in Data Warehouse

- **Leading 10TB TPC-H Benchmark**
 - Scale out parallelism on IBM Power delivers superior performance



What's Important for Data Warehousing?

- **Fast data access means fast performance**
 - DB2 with IBM Power lead all vendors in TPC-H days of leadership
- **Intelligent optimizer**
 - At 1TB and above any mistake is a big one
 - DB2 has the most mature optimizer in the business
- **Scalability architecture that delivers linear scalability**
 - The database partitioning feature provides proven near-linear scalability for queries and utility operations such as load



What's Important for Data Warehousing?

■ **Ease of Growth**

- The IBM Balanced Warehouse provides a prescriptive scaling methodology for data warehousing

■ **Balanced I/O throughput**

- IBM InfoSphere Warehouse removes the I/O bottleneck in a data warehouse
- DB2 has a number of cooperating technologies that minimize I/O and eliminate that bottleneck without the need to throw more processors (i.e. more cost) at the problem:
 - Multidimensional Cluster (MDC) tables
 - Storage Optimization Feature (Compression)
 - Database Partitioning Feature (DPF)

■ **Workload Provisioning and Workload Management**

- DB2 has engine-level provisioning and management capabilities linked directly into AIX Workload Manager (WLM)

IBM Data Warehouse Advantages

■ **Faster Time to Value**

- Fast to deploy, less effort to maintain, tooling to speed development
- Delivers business benefits faster

■ **Proven**

- Based on many years of experience, 100's of implementations
- Deploy with complete confidence
- IBM is on 4th generation Warehouse technology
 - Oracle have only just started down this path with HP, then after a few months switched to Sun, theirs is a much less mature and proven technology

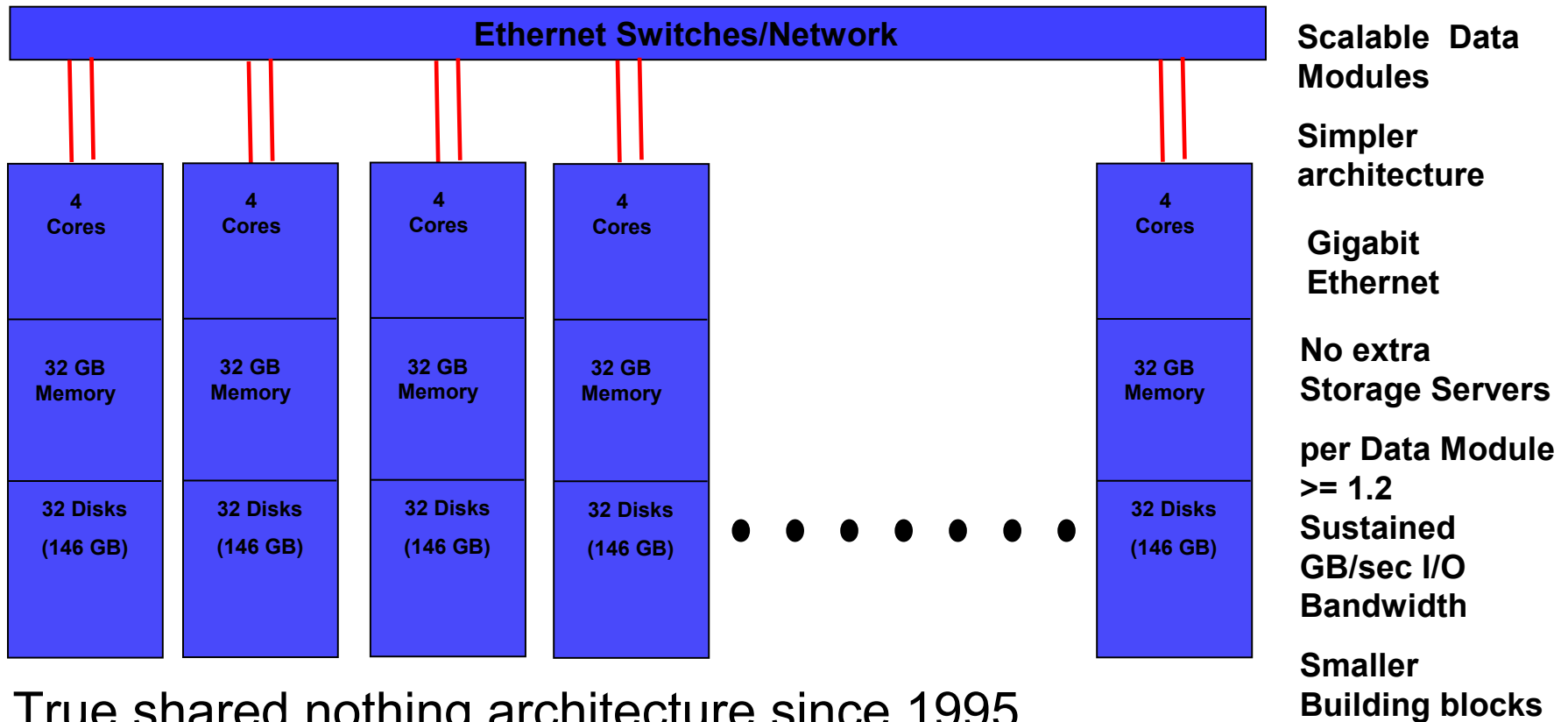
■ **Performance and Scalability**

- Full and mature implementation of massively parallel processing (MPP) for very high performance and unlimited scalability.
- Throwing more hardware at Oracle RAC helps the Oracle solution but is not efficient and simply adds unnecessary cost

IBM Data Warehouse Advantages

- **Suitability for Modern Workloads**
 - Ideal for analytic BI and for Real Time data warehouse
 - High transaction rates, fast response times, low cost per query
 - Structured and unstructured information.
- **All the Data Warehousing features you need**
 - Full set of rich DW features built in
 - Including Data mining, Data modeling, OLAP support, Cubing Services, Performance Management, Workload Management, Data Flow, all in one pre-configured and pretested hardware and software package
- **Less administration effort**
 - Automation and pre-configuration eliminate administration tasks
 - Concentrate resource on business value
- **Low Cost / TCO**
 - Performance, efficiency, economies of scale, and applied R&D combine to provide low cost and low TCO, thus higher ROI
 - Pricing is predictable, no unexpected price hikes

Sample Smart Analytics IBM Configuration



- True shared nothing architecture since 1995
- Much simpler, single tier architecture
- No practical limit in scalability

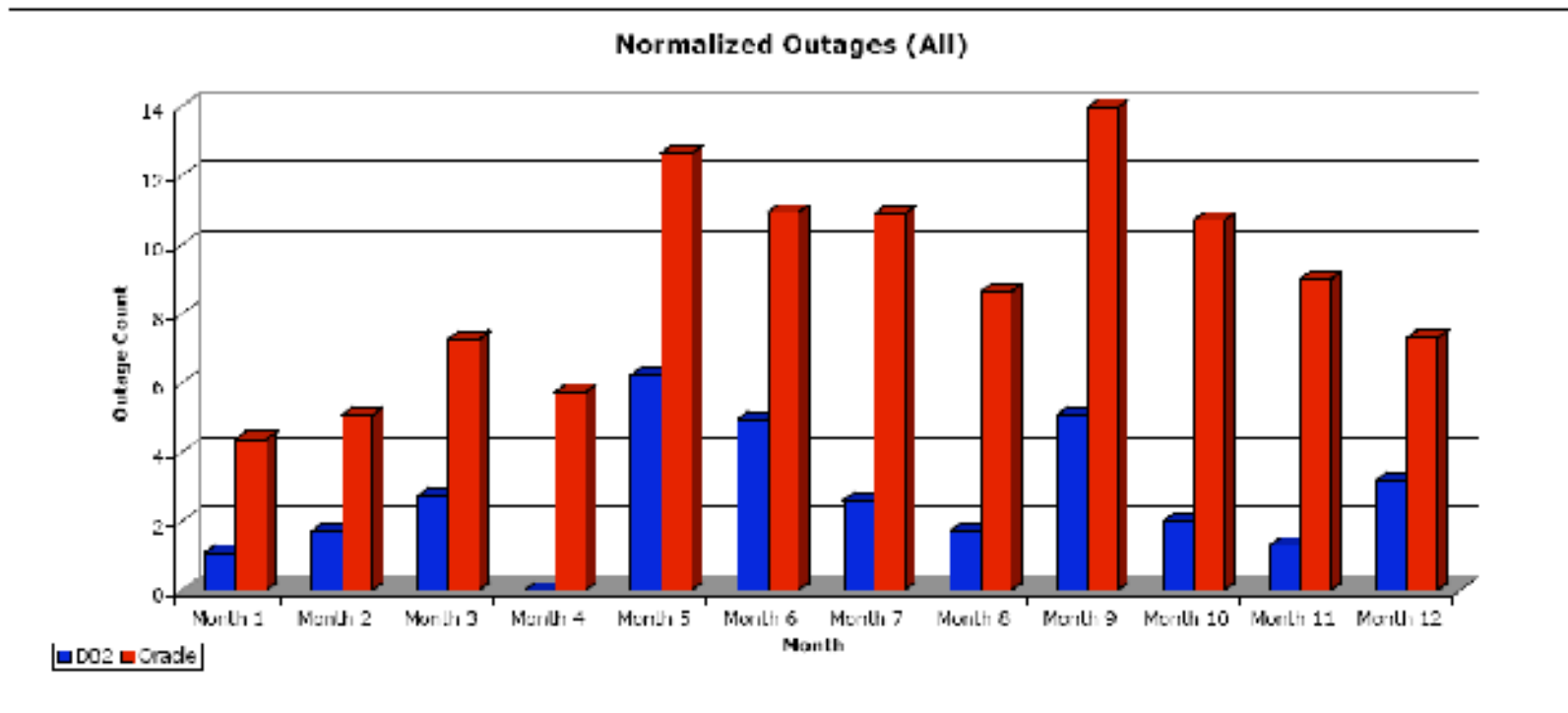
DB2 High Availability on IBM Power



Independent Analysis of Real Customers Proves It

“After extensive review of more than 2,354,000 data points covering over 4,100 closely watched production comparisons, the advantage of running DB2 on IBM System p equipment is strongly supported. The advantages of the synergy between DBMS and platform translate into hard cost savings for each customer, and substantially affect the bottom line cost of ownership.”

-- Solitaire Interglobal Ltd



Solitaire Interglobal Ltd Whitepaper: DB2 Performance on IBM System p® and System x®

DB2 Features to Minimize Planned Outages

- **Query engine: fast and scalable to minimize batch windows**
 - Hot split/mirror snapshots
- **Backup: Fast, scalable, granular**
 - Fully parallel and scalable
 - Partition-level backup
 - Table space-level backup
- **Load: Fast, scalable and granular**
 - Fully parallel and scalable
 - Partition-level
 - Online
- **Automatic log management**
- **Other Utilities**
 - Online rebalance
 - Online stats
 - Online Index create and reorg
 - Online reorg
 - Online inspect
- **Dynamic operations**
 - Configuration parameters
 - Buffer pools operations
 - Container operations
- **Space Management**
 - Online index defragmentation
 - Flexible and tunable space mgt
 - Reorg avoidance - clustering indexes + MDC

DB2 Features to Minimize Unplanned Outages

■ Hardware Failures

- Integration with AIX cluster manager
- Built-in redundancy
- Consistency bits
- Log mirroring
- Automatic mirroring of critical data
- Support for RAID

■ Fast recovery

- Continuous check pointing & parallel recovery
- Tunable recovery
- Parallel recovery
- Filtered recovery
- Dynamic debugging capability - db2trc, memory debug
- Clustering/failover support
- Replicated tables

■ Disaster Recovery

- Log shipping
- Replication
- Remote mirroring

■ Human/App Errors

- PIT recovery
- Drop table recovery
- Delayed log shipping

■ Miscellaneous

- Infinite active logging
- Online container operations

High Availability Options with DB2 on Power

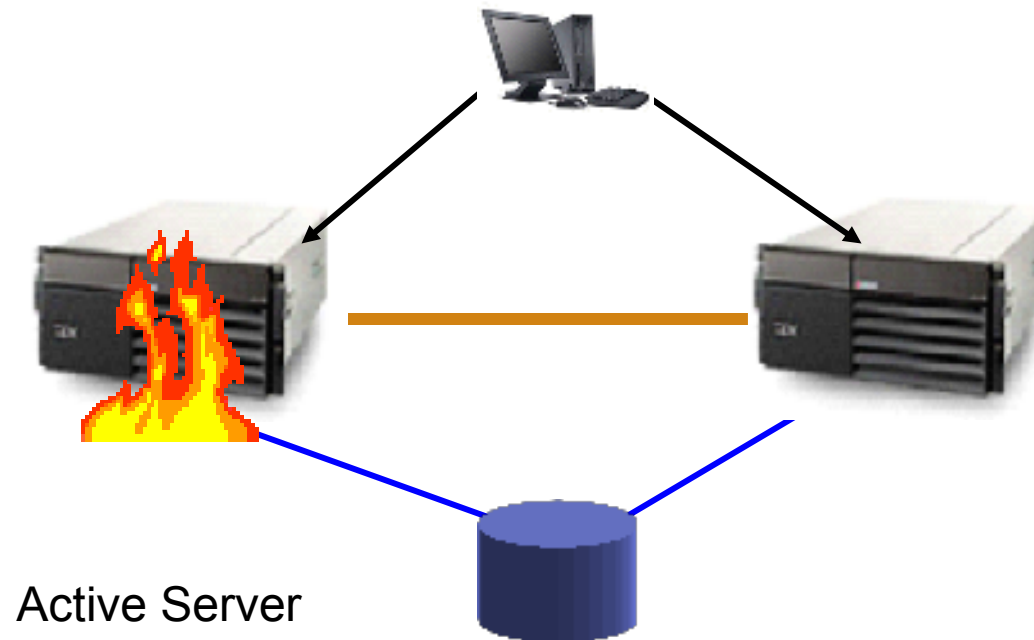
- **Server failover**
 - Shared disk or remote disk mirroring

- **HADR**
 - HA and/or Disaster Recovery
 - Easy to set up and manage
 - Automatic failover with TSA integration
 - Fast failover

- **DB2 pureScale**
 - Unlimited Capacity
 - Buy only what you need, add capacity as your needs grow
 - Application Transparency
 - Avoid the risk and cost of application changes
 - Continuous Availability
 - Deliver uninterrupted access to your data with consistent performance

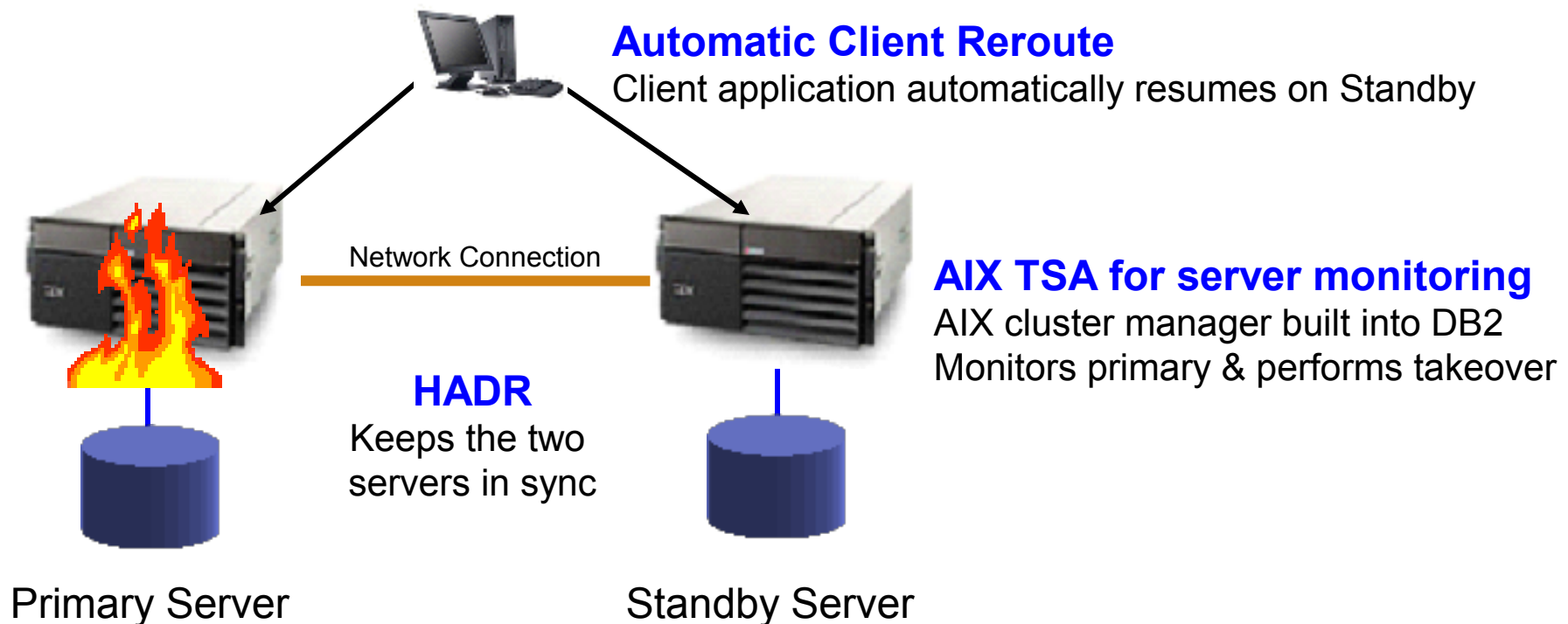
Server Based Failover

- **Integrated with AIX cluster managers**
 - Node Failure Detection
 - Disk takeover
 - IP takeover
 - Restart DB2

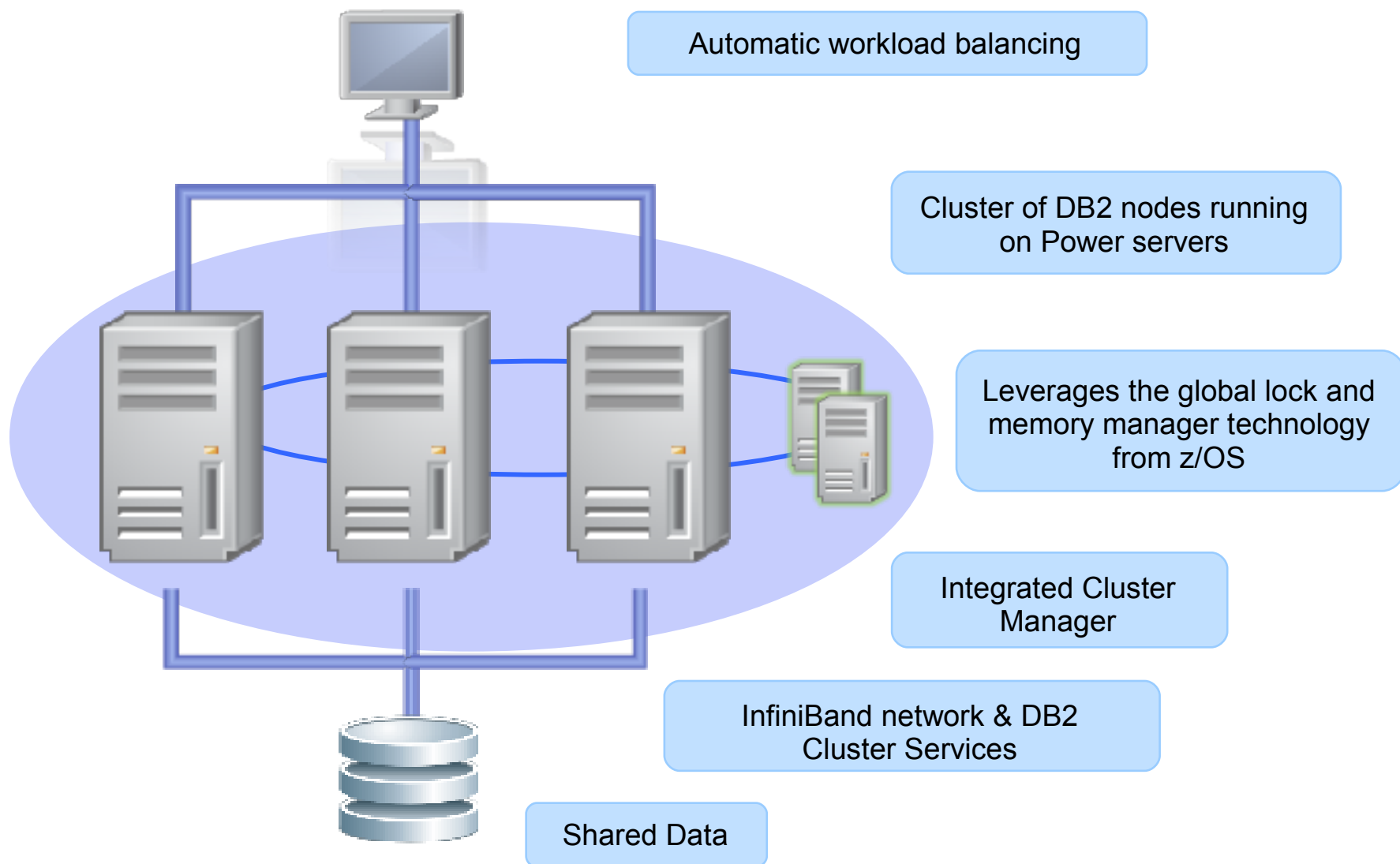


DB2 Delivers Fast Failover at Low Cost

- Redundant copy of the database to protect against site or storage failure
- Support for Rolling Upgrades
- Failover in under 15 seconds
 - Real SAP workload with 600 SAP users – database available in 11 sec.
- 100% performance after primary failure



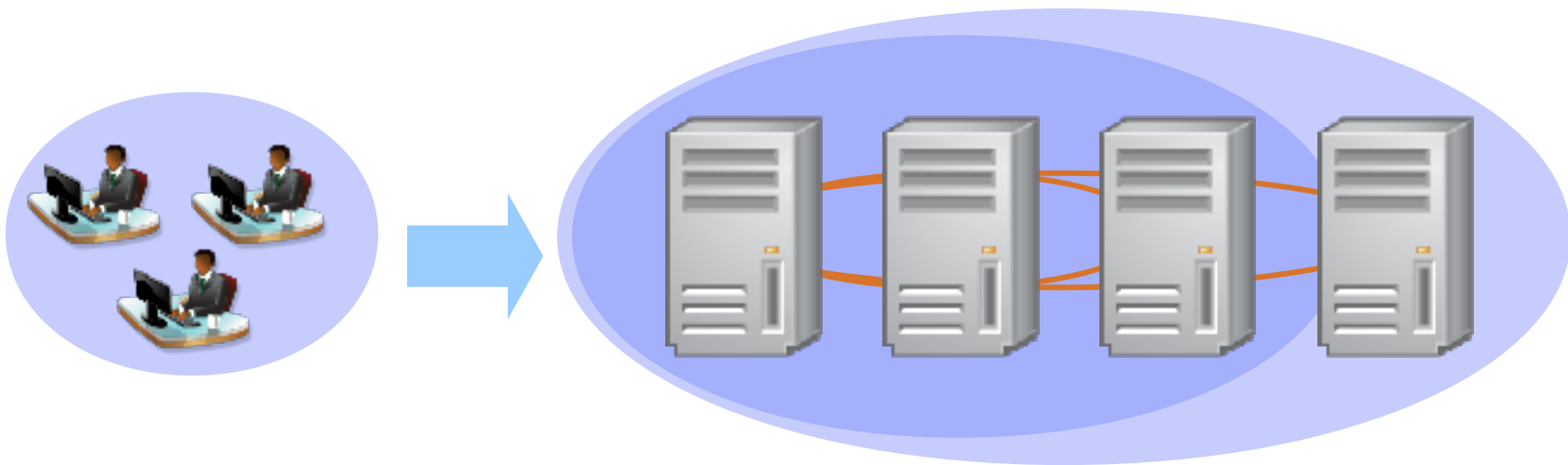
DB2 pureScale Architecture



Application Transparency

Take advantage of extra capacity instantly

- No need to modify your application code
- No need to tune your database infrastructure



Your DBAs can add capacity without re-tuning or re-testing

Your developers don't even need to know more nodes are being added

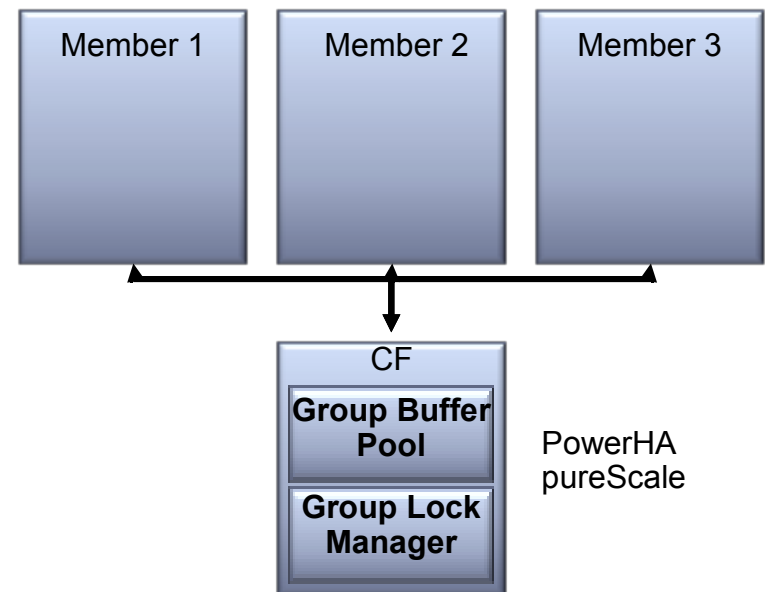
The Key to Scalability and High Availability

■ Efficient Centralized Locking and Caching

- As the cluster grows, DB2 maintains one place to go for locking information and shared pages
- Optimized for very high speed access
 - DB2 pureScale uses Remote Direct Memory Access (RDMA) to communicate with the powerHA pureScale server
 - No IP socket calls, no interrupts, no context switching

■ Results

- Near Linear Scalability to large numbers of servers
- Constant awareness of what each member is doing
 - If one member fails, no need to block I/O from other members
 - Recovery runs at memory speeds



What Customers are Saying about High Availability



*"One of the reasons that we chose DB2 was the built-in HADR database replication, which gives us high availability with **no additional cost or complexity**." – Ron Lim, Operations Manager at Jebsen & Jessen SEA,*



"HADR enables us to offer zero downtime for maintenance and gives us the ability to deal with small problems and local outages automatically." - Jochen Guther, General Manager of IT, Teleflex



*"In addition to price, we chose DB2 over Oracle because the high availability and disaster recovery capability of DB2 is supported for SAP solutions whereas the Oracle RAC high availability functionality is not. One of the major advantages of DB2 is that we get a disaster recovery solution for our SAP system with **HADR at no extra cost**." - Gustav Elias, Austrian Railways*

Lowering Total Cost of Ownership

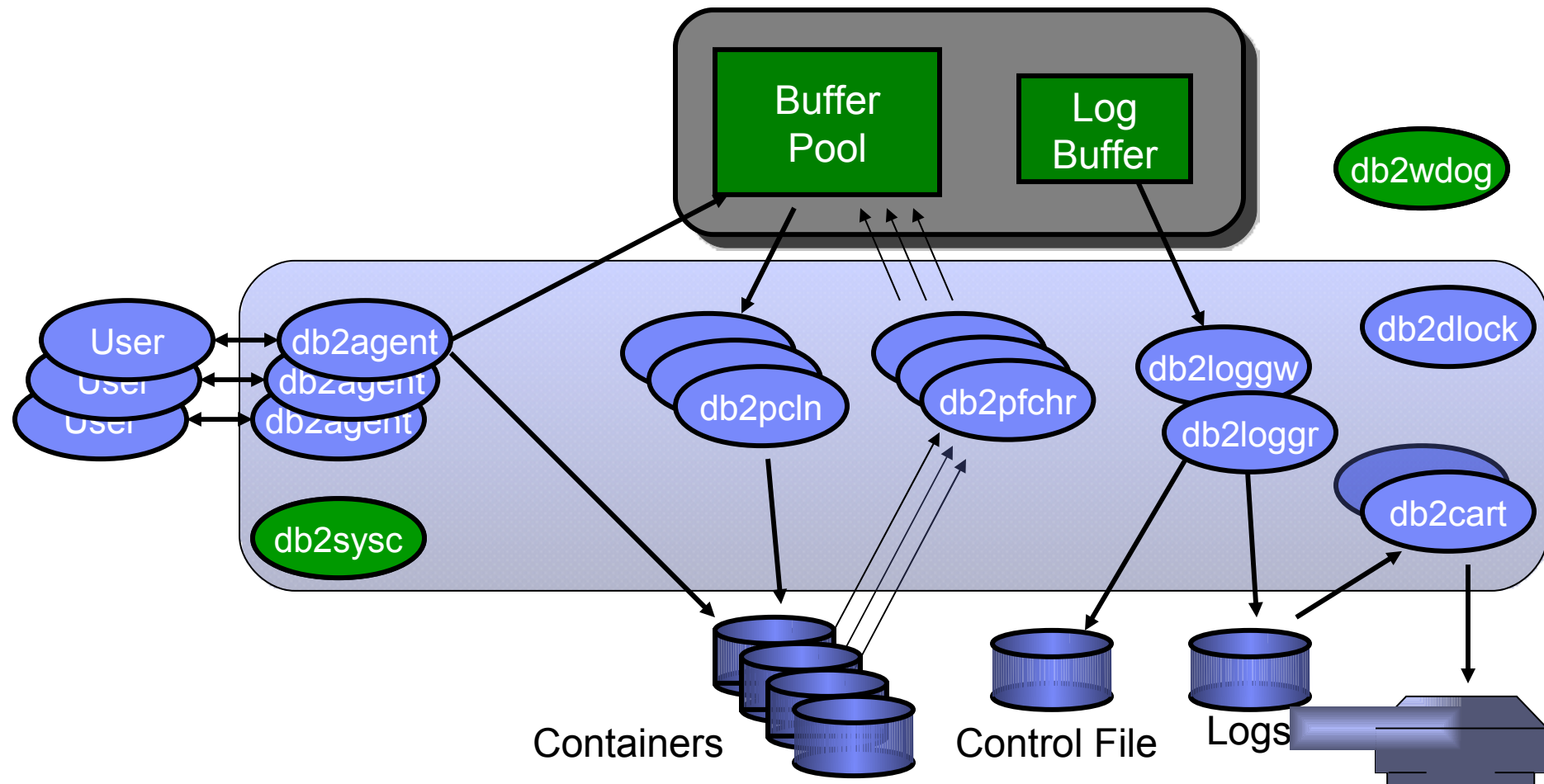


Ease of Manageability

- Automated memory discovery and DB2 configuration
- Automated storage topology discovery and DB2 setup
- Support for AIX “On Demand” dynamic reconfiguration
- Integrated workload management with AIX WLM
- Self Tuning Memory Manager (STMM) monitors both the database and AIX memory consumption
- Enabled and optimized for IBM virtualization

DB2 9.5 - Memory Simplification

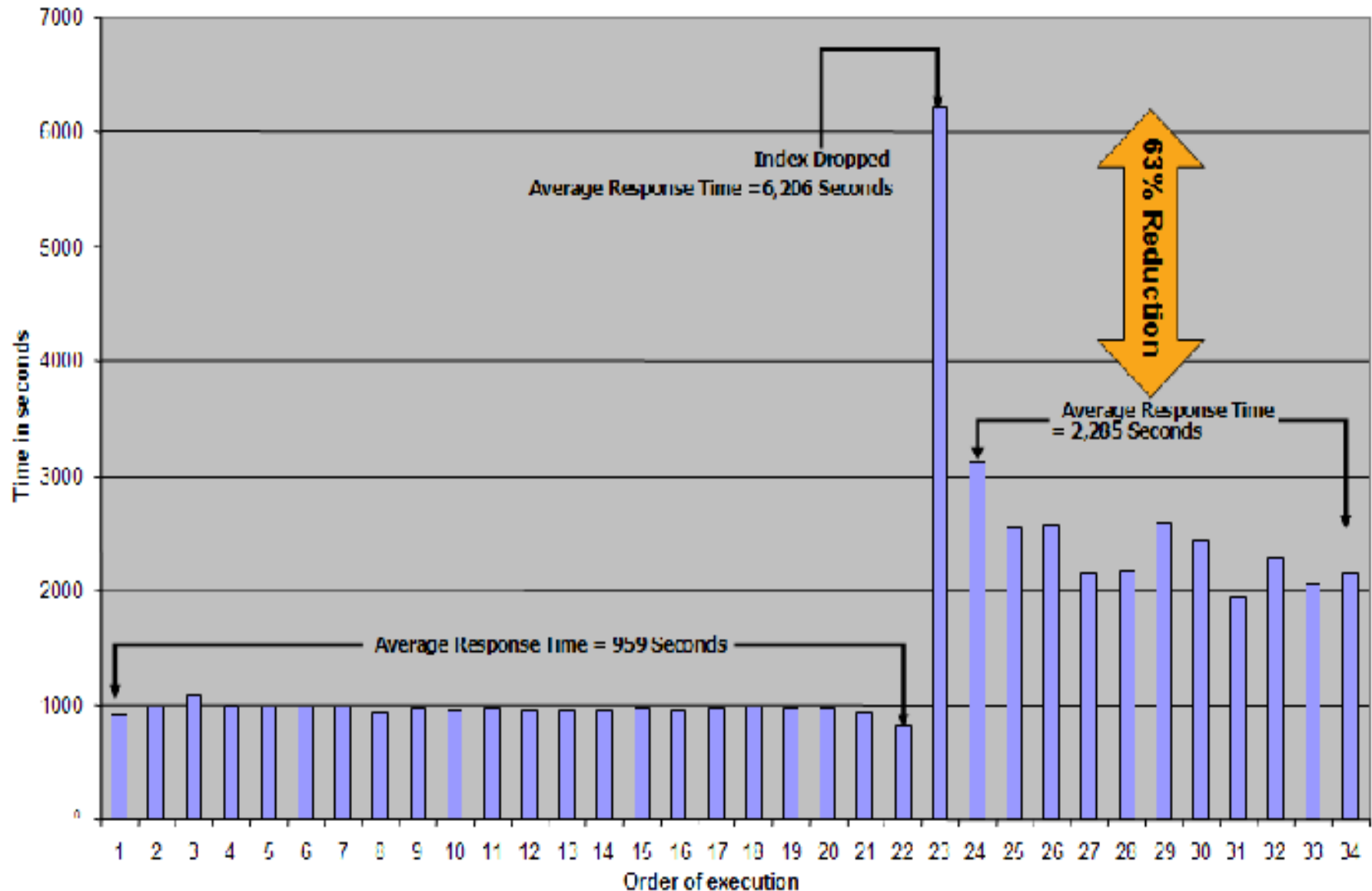
- AIX threading greatly simplifies DB2's memory model – one big flat address space



Self-Tuning Memory Manager

- **Revolutionary memory tuning system**
 - Works on main database memory parameters
 - Sort, locklist, package cache, buffer pools, and total database memory
- **Hands-off online memory tuning**
 - Requires no DBA intervention
 - Senses the underlying workload and tunes the memory based on need
 - Can adapt quickly to workload shifts that require memory redistribution
 - Adapts tuning frequency based on workload

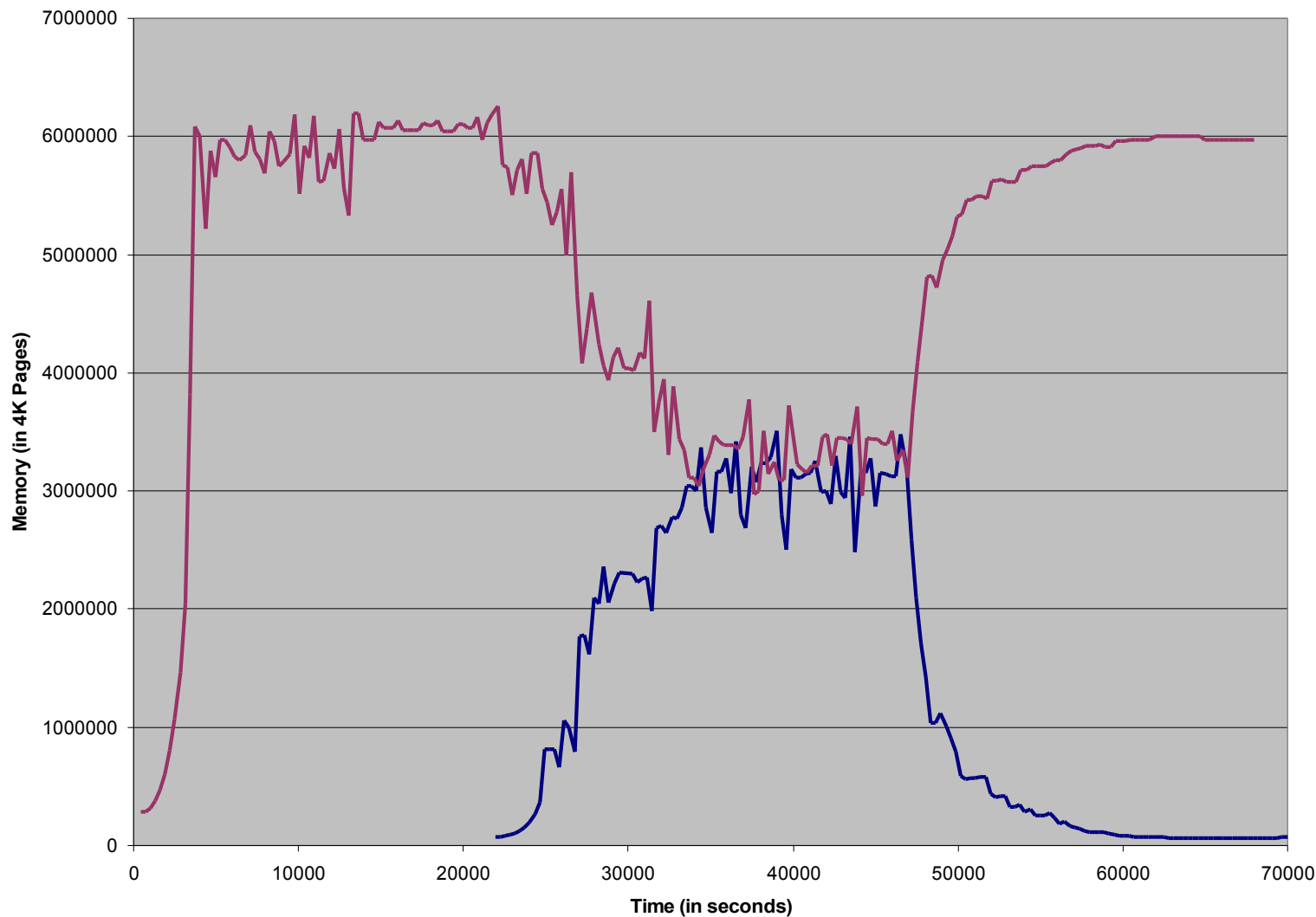
STMM In Action



STMM In Action

Two Databases On The Same Box

Unique to DB2



IBM Power - Staffing

Staff Discipline	DB2	Oracle
Account management	0.1	0.1
Application management	0.9	1.4
Backup and archiving	0.1	0.7
Business recovery services	0.2	0.3
Database management and administration	1.5	4.3
Disk and file management	0.9	1.2
HW and network configuration / re-configuration	0.3	0.3
ITW deployment	0.3	0.3
Operations	4.7	7.2
OS support	0.3	0.3
Planning and process management	0.7	1.0
Performance tuning	0.7	2.1
Repository management	0.2	0.2
Security and virus protection	0.1	0.1
Service desk	3.2	5.7
Software deployment	0.3	0.5
Storage capacity planning	0.3	0.7
Systems research, planning and product management	0.1	0.1
Traffic management & planning	0.9	0.9
User administration	0.2	0.5
Total staffing level	16.0	27.9

What Customers are Saying About DB2



*"IBM DB2 provides **excellent reliability, security and scalability**, and ensures that Britannia is fully able to increase its business operations at low total costs of operation."*
- T S Purushothaman, corporate head of IT systems for Britannia.

*Britannia expects a **30% decrease in database administration costs***



*"We use DB2 as the database of choice for our SAP NetWeaver BI solution because it offers **simple administration and lower licensing costs**. System performance in parallel mode has increased, and **the fully integrated database cockpit helps to reduce operator workload.**"*
- Matthias Assmann, Head of Management Information



*"IBM and SAP have formed a close alliance and IBM DB2 has transformed into becoming a leading database platform for SAP applications, **with high functionality, easy management and low operational costs**. We soon began to see the advantages of migrating to the IBM platform."*
- Ozcan Soke, IT Manager

Summary

- **DB2 Performance on IBM Power**
 - Higher Performance = Lower Costs
- **DB2 High Availability with IBM Power**
 - More Reliable
- **DB2 and IBM Power Lowers Total Cost of Ownership**
- **Deep Technology Innovation Delivers More Value**
- **DB2 on POWER7 delivers even more integration and more value to customers**