MaxDB – The Professional(’s) Database

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Germany

MySQL Users Conference, 2005
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Agenda

DBMS Today
MaxDB’s Roots
MaxDB & MySQL
MaxDB @ Work
MaxDB TCO
Inside MaxDB
MaxDB 7.7
Summary
Additional Session

MaxDB – That's Cool! Learn why

Cool Features Session
Wednesday 2:20 p.m.
(No Reorg, Backup Concept, Synchronization Mgr)
DBMS TODAY ...
Does IT Matter?

OS are necessary but boring (except for OS experts)
  Linux vs. Windows is important for Microsoft but not for CIO's

DBMS are necessary but boring (except for DBMS experts)
  MaxDB vs. another DBMS is no longer a strategic CIO decision

Important questions for CIO's are:
  Do we run the right applications?
  Can they be customized?
  Does everything fit into our budget?
  Can our IT staff handle the systems?
  Who will provide service and support?
  How long will our supplier be around?
The enterprise DBMS market is dominated by three players:

Oracle
IBM
Microsoft

DBMS technology has reached saturation level.
MaxDB’s Roots …
MaxDB History

1977 - 1997
Started as a research project at the Technical University of Berlin. Subsequently owned by: Nixdorf, Siemens, Software AG, SAP AG (1997- today)

1993
Support of SAP R/3

2000
Open source under GPL/LGPL license (www.sapdb.org)
Commercial license from SAP

2003
Cooperation with MySQL AB
Re-branding to MaxDB
Open source under GPL license (www.mysql.com)
Commercial license from SAP
Commercial license from MySQL

Various Product Names
Reflex, Supra 2, DDB/4, Entire SQL-DB, Adabas D, SAP DB, MaxDB
MaxDB & MySQL
Motivation to Open Source MaxDB

Energize competition in the DBMS market:
   Establish MaxDB in the DBMS market
   Provide a distribution channel to non-SAP customers
   End the over-priced phase of the DBMS market

Create a community of MaxDB users beyond SAP customers

Use the Open Source community to get feedback
Teaming Up With MySQL

Cooperation agreement with MySQL AB in 2003

MySQL is the most popular Open Source DBMS

Combining the enterprise-class MaxDB technology with the community and ecosystem of MySQL

SAP DB has been renamed to MaxDB

MySQL AB has become an SAP Global Technology Partner
SAP’s Commitment to MaxDB

MaxDB is SAP’s strategic DBMS offering:
   - Part of SAP’s technology stack
   - Runs all important SAP applications
   - Bundled with SAP NetWeaver
   - Means one-stop shopping for SAP customers

Competitive feature set and performance level
Easy administration and minimal cost of ownership
Ongoing SAP investment into the development of MaxDB
SAP needs a low-cost alternative to other DBMS offerings
Facts around the cooperation

SAP continues to own MaxDB
SAP continues to develop MaxDB
SAP continues to support MaxDB
SAP continues to offer MaxDB
  Database of choice for SAP solutions
  ”Batteries included” component of some of the SAP products

MySQL has commercial rights to resell MaxDB
MySQL’s dual licensing business model is applied to MaxDB
  GPL version for Open Source projects, development, trial, demo
  Commercial license and support by MySQL
  Commercial license and support by SAP
What Does This Mean for SAP Customers?

- Re-branding will not affect existing SAP DB customers
- MaxDB 7.5 has been released backward down to R/3 3.1I (Ext. kernel)
- MaxDB is a continuation of the SAP DB code line, i.e. identical behavior and performance
- Replacing the Open Source versions of SAP DB 7.3 and 7.4 by MaxDB 7.5 has no impact on their SAP maintenance schedule
- Pricing for new MaxDB customers in 2004: License is 3% of SAV
- No change for SAP DB users upgrading to MaxDB
- No impact for mySAP SCM and liveCache customers
SAP liveCache – highly integrated

SAP Applications

mySAP SCM, ...

MaxDB

C++ Objects

... more DB

SAP liveCache = MaxDB + more

SQL
MaxDB @Work
SAP Database Objects and Figures

Database figures for SAP R/3 Enterprise 4.7:
- 40,000 tables
- 6,200 indexes
- 5,500 views
- 16 GB initial database size

If we assume there are 30,000 SAP customers worldwide with an average of only 250 GB of SAP data, we have 7,500,000 GB which is 7.5 Petabyte of SAP data worldwide.
Installation Statistics

6,000+ MaxDB installations worldwide:

MaxDB as SAP DBMS runs in about 3,000 customer installations

MaxDB as liveCache for mySAP SCM has about 2,900 installations

MaxDB as Content Server for SAP KM has up to 2,000 installations

... plus those uncounted based on downloaded free versions.
SAP Customers Using MaxDB//liveCache Technology
MaxDB Platforms

IBM AIX: PowerPC
HP-UX: PA-Risc, IA64
Sun Solaris: Sparc, X86/64
Linux: X86-32, IA64,
       AMD Opteron/X86-64,
       Intel Nocona/X86-64,
       PowerPC (PLinux)
Windows: 2000,
          XP,
          2003,
          2003/IA64,
          2003/X86-64

It’s your choice!
# DBMS Requirements & MaxDB Rationale

<table>
<thead>
<tr>
<th>Your requirements:</th>
<th>Availability, performance, adaptiveness, ease of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our vision:</td>
<td>Self managing DBMS Make IT invisible</td>
</tr>
<tr>
<td>Our rationale:</td>
<td>Do things right – Simply elegant</td>
</tr>
<tr>
<td></td>
<td>No nonsense – Less is more</td>
</tr>
<tr>
<td></td>
<td>Fight complexity – Elegant simplicity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Your benefits:</th>
<th>Lowest cost of ownership Convenience Simplicity</th>
</tr>
</thead>
</table>

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Anatomy of a MaxDB Instance

MaxDB Instance

MaxDB Kernel

Application

One Pool of DB Objects

Log Volume

Data Volume

Pool of DB Objects

Joerg Hoffmeister

MaxDB – The Professional(‘s) Database
MaxDB TCO
What Is Minimal Cost of Ownership?

- DBMS license costs: Low impact
- DBMS maintenance costs: Low impact
- Hardware resources: Medium impact
- DBA resources: High impact

TCO means people!
### DBA Resources as Planned by SAP Hosting

<table>
<thead>
<tr>
<th>DB Size / Instance</th>
<th>MaxDB</th>
<th>System B</th>
<th>System A</th>
<th>System C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30 GB</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>30 - 100 GB</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>100 - 500 GB</td>
<td>0.2</td>
<td>0.4</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>500 GB - 1 TB</td>
<td>0.2</td>
<td>0.5</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>&gt; 1 TB</td>
<td>0.3</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Incoming Messages per Installation (Databases)

SAP 2004: DB Platforms/Messages

Average: 21.1
Average: 6.0

MaxDB
MaxDB‘s Ease of Use & Availability

Low cost of ownership
  Few configuration parameters
  No size estimates for individual database objects
  Automatic space management
  Automatic balancing of disk I/O
  No permanent attention required
  Unattended desktop/laptop installation and operation

No planned shutdowns, continuous operation
  No reorganization
  Online backup of database and log
  Online extension of database and log
  Online change of configuration parameters
  Parallel backup and restore
  Support of cluster and hot standby configurations (failover)
MaxDB Performance

Multi-process / Multi-threaded server
SMP scalability
Minimal I/O's
CREATE INDEX by parallel threads
Tuned for SAP applications

Competitive performance level:

Visit [www.sap.com/benchmark](http://www.sap.com/benchmark) and take a look at the SD 2-tier and SD 3-tier sections. On a comparable hardware (!) there is no significant difference between DBMS's from different vendors.
Customer Statement of Thyssen-Krupp Hosting

Quotes from Hans Reiffer, Head of Triaton Hosting Center:

As an SAP partner for Hosted Solution, Triaton has been using SAP DB as a database for Hosting customers for many years. Of now more than 600 systems in Triaton's computer centers, 90 systems work with an SAP DB database.

The biggest system with a size of about 2 TB was recently put into productive operation.

For administering the SAP DB databases of these 90 systems, only 2 FTE are required, as the database system has stood out for years through its easy operation, robustness and performance.
Customer Statement of TDS

Quotes from Klaus Zimmermann, SAP Administrator:

*TDS Informationstechnologie AG has been employing SAP DB successfully in Application Hosting since 1992. At present, we run approximately 90 SAP DB installations in 7x24 operation for various mySAP solutions. Thanks to the convenient maintenance and operating characteristics of SAP DB, the administration effort is distinctly lower than with other databases. The storage management concept saves memory space and costs of reorganization.*

*SAP DB is completely integrated into our backup and monitoring concept and thus runs efficiently, with high performance, and “silently” - all that to the benefit of our satisfied customers.*
Customer Statement of Translogic Corporation

Quotes from Charlie Brann, SAP Administrator:

During these last seven years, we have found this database product to be very stable and highly reliable. We have a relatively small IT staff with only one SAP Technical Resource person: me. I serve as ABAP programmer, Security administrator, Basis administrator, and DBA. I've worked with System A and System B in the past, but I find SAP DB to be easier to administer, more stable, and it requires a great deal less of my time.

There is no recurring daily, weekly, or monthly process that must be accomplished to keep the DB humming. I spend only an hour or so a week on the DB directly, just checking and verifying – just in case...
Disclaimer

This presentation reflects either current planning or current status. Contents may be changed without prior notice, and are in no way binding upon SAP AG or MySQL AB.
# MaxDB Component Portfolio

<table>
<thead>
<tr>
<th>Operations</th>
<th>Tools</th>
<th>Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Manager</td>
<td>SQL Studio <em>(Windows)</em></td>
<td>SQLDBC</td>
</tr>
<tr>
<td>Database Manager</td>
<td>Web SQL</td>
<td>ODBC 3.5</td>
</tr>
<tr>
<td>DBMGUI <em>(Windows)</em></td>
<td>Loader</td>
<td>JDBC 3.0</td>
</tr>
<tr>
<td>Web DBM</td>
<td>Sync Manager</td>
<td>Perl</td>
</tr>
<tr>
<td>DBMCLI</td>
<td>WebDAV</td>
<td>Python</td>
</tr>
<tr>
<td>DBAnalyzer</td>
<td></td>
<td>PHP</td>
</tr>
</tbody>
</table>

MaxDB Kernel
Standby Database (Log Shipping)

Master

Log

Data

Log Backup

Staging Directory

Log

Backup

Log Restore

Standby

Data

Initial Data Backup

Initial Data Backup
Hot Standby Configuration

Master

Standby

Application

RECONNECT

IP SWITCH

Clustering

After Images

Data

continous

RESTART

Data

Archive Log

Data

Storage System
User-Defined Functions

Extend the built-in SQL functions of MaxDB
- Standard data types (except LOB's) as a function result
- Functional indexes

create table person (id int key, name char (20))

insert person values (1, 'Miller')
insert person values (2, 'miller')

create function uppercase (name varchar) returns varchar
AS return upper(name)

create index myup on person (uppercase(name))

Select * from person
where uppercase (name) = 'MILLER'

<table>
<thead>
<tr>
<th></th>
<th>Miller</th>
<th>miller</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Database Manager

Administration of multiple database instances
Backup Wizard
Recovery Wizard
Backup History
  Access to backup history
  Context-specific visual guidance during the recovery process (Backup/recovery, complete/incremental/log backup)
Integrated documentation as Windows Help
Support of hot standby configurations
Database Manager (1)
Database Manager (2)

Select Items for Recovery
Select items to specify the use of incremental backups.

Select the incremental backup items you want to use for recovery. The use of incremental backups is much faster than the recovery of logs. We recommend that you use the specified incremental backups.

Start Recovery
Check your selection and start the recovery.

You have completed the steps required to perform a recovery. Your recovery is defined below:

Make the specified medium available for recovery. Choose 'Start' to begin the recovery. If you want to restore the database until a particular point in time, specify the date and time.
Web DBM

![Web DBM - Microsoft Internet Explorer provided by SAP IT]

Address: http://p59951:9999/webdbm/005000000000

Log Off

Information
- Backup History
- Caches
- Data Area
- IO
- Log Area
- Locks
- Sessions
- Versions
- Backup
  - Complete Data
  - Incremental Data
  - Log
  - Auto Log on/off
  - Recovery
- Database
- Indexes
- Volumes
  - Tuning
  - Optimizer Statistics
  - Index Use
  - Check
- Database Structure
- Backup
- Database Options

State

- Data: 50%
- Log: 17%
- Sessions: 20%
- Data Cache Hit Rate: 100%
- Auto Log: ON
- Database Full: NO
- Bad Indexes: NO
- Kernel Trace: OFF

Information - Caches

<table>
<thead>
<tr>
<th>Type</th>
<th>Accesses</th>
<th>Successful</th>
<th>Unsuccessful</th>
<th>Hit Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA</td>
<td>189166</td>
<td>188963</td>
<td>203</td>
<td>100</td>
</tr>
<tr>
<td>CATALOG</td>
<td>60730</td>
<td>36594</td>
<td>24136</td>
<td>60</td>
</tr>
<tr>
<td>SEQUENCE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>COMMANDPREPARE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>COMMANDEXECUTE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CATALOG</td>
<td>68</td>
<td>68</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>CATALOG</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
DBAnalyzer

Rule-based expert system to watch MaxDB instances
Collects statistical and monitoring data
Collects system messages
Supports remote access
Fully integrated into CCMS (LC10, DB50)
Detects and reports:
  - Low cache hit rates
  - High I/O load
  - Low hit rates of DML commands (Select, Update, Delete)
  - Log queue overflows
  - User lock collisions
  - Command timings
  - Timings and frequencies of system locks
SQL Studio

```
select * from bkpf
```
Web SQL

Path of Stored Statement:

```
select * from bkpf
```

```
<table>
<thead>
<tr>
<th>MANTR</th>
<th>BUKRS</th>
<th>BELNR</th>
<th>GJAHR</th>
<th>BLART</th>
<th>BLDAT</th>
<th>BUDAT</th>
<th>MONAT</th>
<th>CPUKD</th>
<th>CPUKM</th>
<th>AEDAT</th>
<th>UPDDT</th>
<th>VVWRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>0001</td>
<td>0100000000</td>
<td>1995</td>
<td>SA</td>
<td>19950606</td>
<td>19950606</td>
<td>06</td>
<td>19950606</td>
<td>142800</td>
<td>00000000</td>
<td>00000000</td>
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<tr>
<td>800</td>
<td>1000</td>
<td>0100000000</td>
<td>1994</td>
<td>AA</td>
<td>19941109</td>
<td>19941109</td>
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<td>113525</td>
<td>19941110</td>
<td>00000000</td>
<td>19941109</td>
</tr>
<tr>
<td>800</td>
<td>1000</td>
<td>0100000001</td>
<td>1994</td>
<td>AA</td>
<td>19941109</td>
<td>19941109</td>
<td>11</td>
<td>19941109</td>
<td>132022</td>
<td>19941110</td>
<td>00000000</td>
<td>19941109</td>
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<td>800</td>
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<td>AA</td>
<td>19940602</td>
<td>19940603</td>
<td>05</td>
<td>19941109</td>
<td>133013</td>
<td>19941110</td>
<td>00000000</td>
<td>19940603</td>
</tr>
</tbody>
</table>
```
Document Repository and XML Indexing

WebDAV server
- Document repository with files and folders
- Accessible via HTTP (web folders)
- Checkout / checkin support
- The Internet file system
- Fits to future SAP Archiving

Indexing of XML data
- XML data is stored as LOB
- XML indexes are defined by XPath expressions
- Synchronous or asynchronous index maintenance
- XML indexes are implemented by SQL tables
- Retrieval support for pre-defined XML indexes

Internet connectivity to (XML) documents
WebDAV GUI & Explorer View
Snapshots

Instant Backup
  Instantaneous (delta-)backup of the complete database
  Freeze current database state
  All subsequent changes are written to new pages

Instant Recovery
  Restore frozen state
  Restart

Usage scenarios
  Restore of demo or training systems to a previous state
  Restore of incremental backups from master possible
  Very fast point-in-time recovery (e.g. during SAP solution upgrades)
MaxDB Installation Manager

Goal: Invisible DBMS
- Mobile clients / Laptop
- Workstations / PC
- Embedded DBMS

Installation and configuration without user interaction
- Silent mode
- Optional template selection
- Optional demo database

Automatic operations
- Restart, shutdown
- Backup, recovery
- Database extension

GUI
- Based on wxWidgets
MaxDB Installation Manager

Install MaxDB software and optionally create or upgrade a database instance

- Start installation/upgrade
- Show MaxDB components
- Remove MaxDB components
- Visit MaxDB website

Exit
MaxDB Installation Manager
MaxDB 7.6

Further TCO reduction with respect to supportability
  XML-based protocol files
  Hints and advices
  Improved monitoring

Further TCO reduction with respect to configuration changes
  Allow downsizing of a database instance
  Drop volume
MaxDB 7.6

Client/server communication

Security enhancements
  SSL
  Challenge/response authentication

IPv6 enabling

Improved join performance

Parallelization

Avoid materialization of interim results

Join optimization based on improved table statistics
MaxDB 7.6

Logging of DBM Server protocol (DBMCLI calls)
Switched on by protocol option

PHP
Support for MySQL PHP via MySQL proxy
Native support via SQLDBC

Schema support (next slide)
CREATE/DROP
GRANT
MaxDB 7.6 - Schema Support

Grant Access to Schema '4You' to Bob and Carl

USER Bob
- Bob’s Table T1
  - Bob’s Default Schema 'Bob'

USER Mona
- Mona’s Default Schema 'Mona'
  - Mona’s Table T1
  - Mona’s Table 4You.T1
    - Mona’s Additional Schema '4You'
  - Bob’s Table 4You.T2

USER Carl
- Carl’s Default Schema 'Carl'
  - Carl’s Table T1
  - Carl’s Table 4You.T3
  - Mona’s Additional Schema '4You'
MaxDB 7.6 - Synchronization Manager

- Synchronization Mgr GUI
- Master DB
- Synchronization Service
- Message Server
- Message DB
- Synchronization Service
- Synchronization Service
- Client1 DB
- Client2 DB
MaxDB 7.6 - Sync Manager Features

- Replication of tables from a master database to client databases
- Synchronization Manager decouples master and client DBMS's
- Initial replication of the complete DBMS state
- Delta replication of transactions
- Point-to-point replications (queues)
- Broadcast replications (publish/subscribe)
- Support for bi-directional replications with conflict resolution
- Admin tool to define replication scenarios
- Supports MaxDB and MinDB
MaxDB 7.6 - MinDB

Minimal footprint pure Java DBMS in main memory
Targets mobile clients (PDA) and desktops
JDBC-compliant
SQL subset of MaxDB
Supported SQL functionality:
  - Create/Delete Table, Create/Delete Index
  - Simple Select, Insert, Update, Delete, Commit/Rollback
Multi-session support
Backup and restore of the main memory database
Schema support to distinguish between read and read/write data
MaxDB 7.7
MaxDB 7.7 - Focus

Supportability: SIMPLE
Self-Tuning: ROBUST
Adaptiveness: FLEXIBLE
MaxDB 7.7 – A first collection

User-Defined Extension (UDE) based on Java
    Java-based user-defined extensions (SP, trigger, UDF)
    Delivery of phase 1

Developer Studio for UDE's
    C++
    Java (Eclipse)
    UDE debugger

Before Statement Trigger
**liveCache Architecture**

Application server

ABAP Application

Database Interface

Application

- SQL methods
- Stored procedures (C++)

OMS

- OMS methods

SQL basis

OMS basis

DBMS basis

liveCache

- Application code is executed inside the DBMS address space

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UDE Server / Architecture

Client1 -> Session1
Client2 -> Session2

MaxDB Address Space

Session1
- Std MaxDB Conn to JDBC A
- Start new session

Session2
- Std MaxDB Conn to JDBC B

Java UDE
- Std MaxDB Conn

Python UDE
- Same proceeding is valid for Python etc.

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UDE Server

Client initiates 'CREATE PROCEDURE' on DB

Procedure code (e.g. JAR-File) could be kept either on DB (BLOB) or on UDE Server, call attributes define how UDE has to locate code

1 to 1 connection of database session to UDE session

CALL PROCEDURE launches execution

First call of procedure establishes database connection between UDE and DB

Not only Java but also others like Python, C++ can be thought of in the future
MaxDB 7.7 – A first collection

Error logging and protocol files based on XML message lists
Central user management
Multi-instance support
Adaptive memory management
Adaptive task management
Multi version read (Consistent Read)
Index wizard
MaxDB 7.7 – A first collection

BW support
  Partitions
  Clustered IO
  Enhanced prefetching

Platform independent Eclipse plugins for DBM GUI and SQL Studio

... and much more
Finally ...
Summary

Selecting a DBMS is no longer a strategic but a tactical decision

Today MaxDB is your choice if you are looking for enterprise class database technology from MySQL AB:

- MaxDB is an enterprise-class low-cost DBMS
- MaxDB automates most DBA activities which means minimal TCO
- MaxDB is licensed and supported by SAP
- MaxDB is licensed and supported by MySQL AB
- MaxDB is fit for the job and tuned for SAP applications
Further Information

MaxDB on the Web
www.mysql.com/maxdb
www.sdn.sap.com

Consulting Contacts
MySQL AB: Patrik Backman, Hana Hütter, Kaj Arnö
SAP AG: Reinhold Schamberger, Jörg Hoffmeister