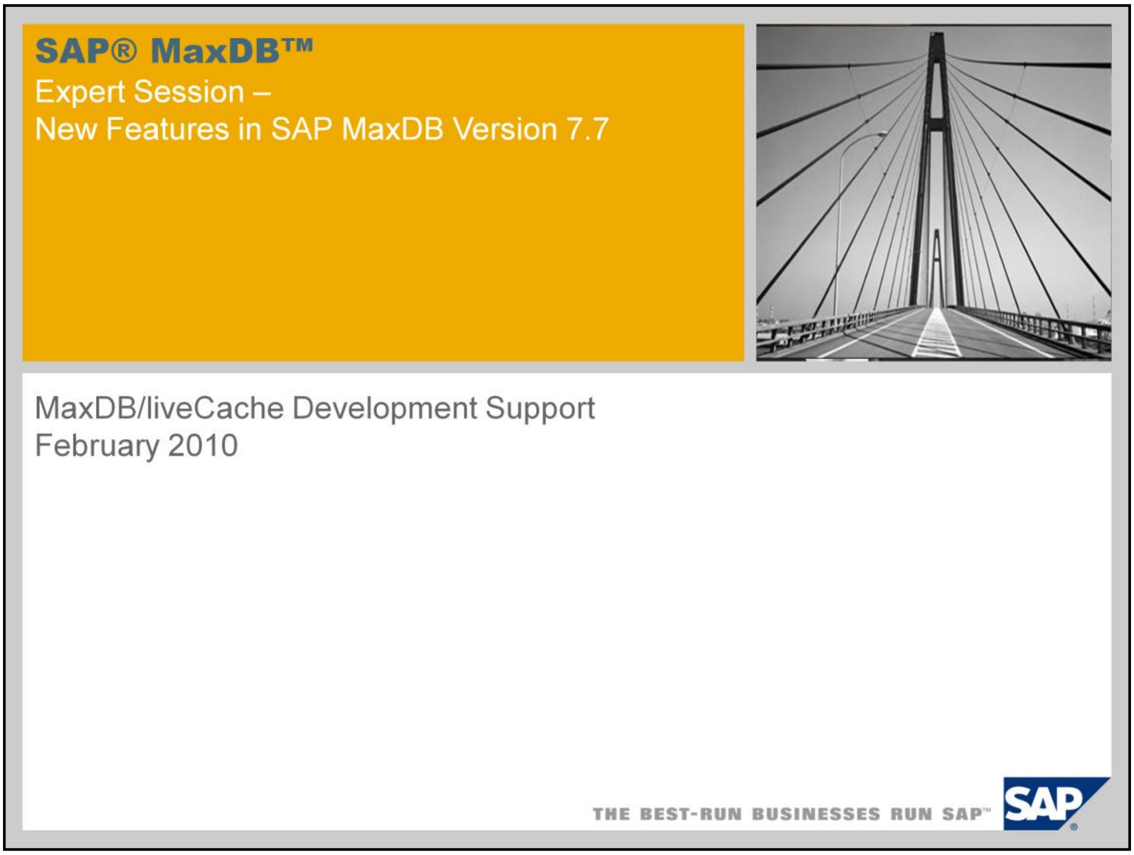
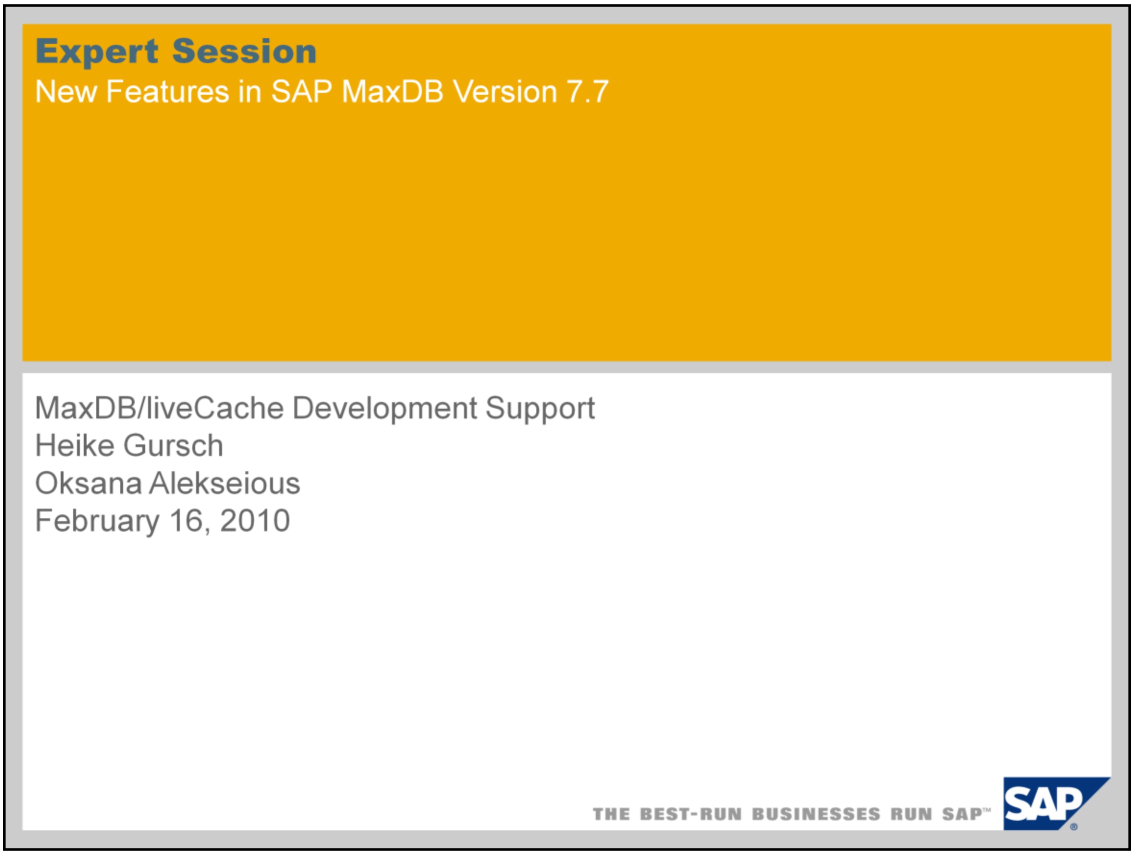


SAP® MaxDB™

Expert Session – New Features in SAP MaxDB Version 7.7

MaxDB/liveCache Development Support
February 2010



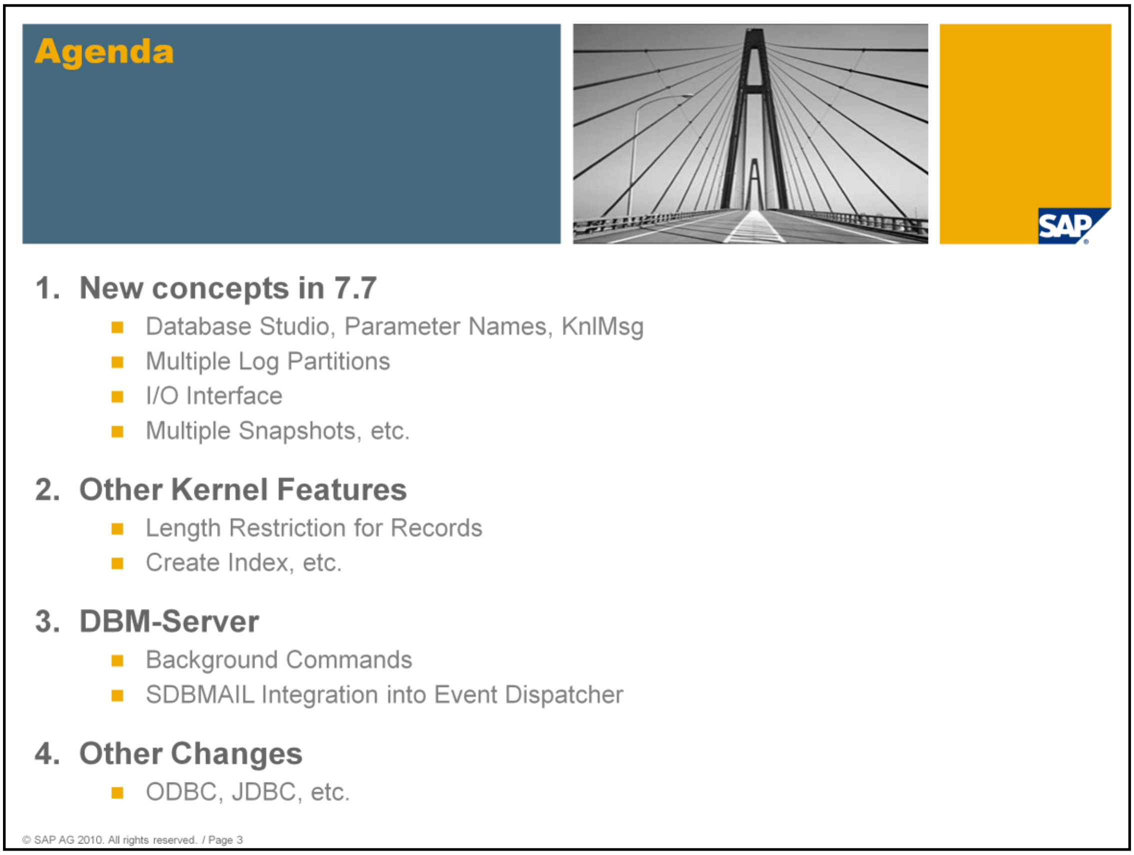
Expert Session

New Features in SAP MaxDB Version 7.7

MaxDB/liveCache Development Support
Heike Gursch
Oksana Alekseious

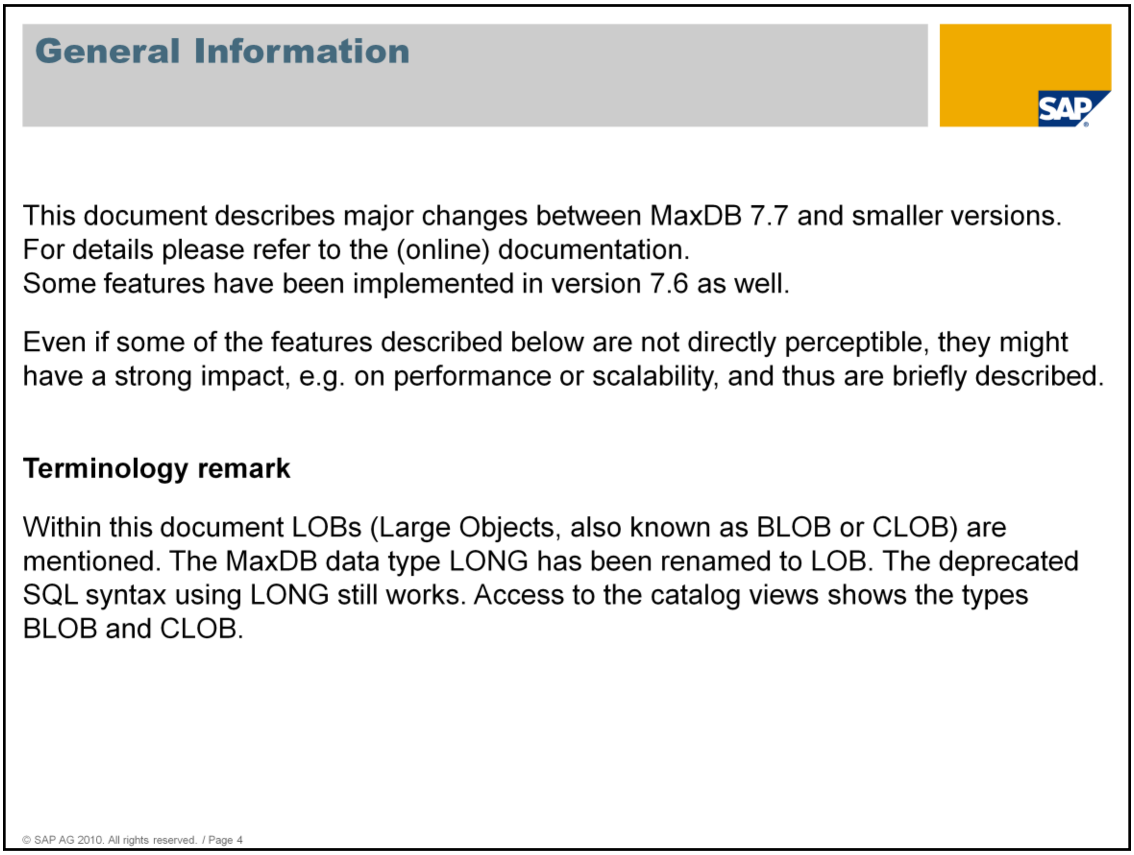
February 16, 2010

THE BEST-RUN BUSINESSES RUN SAP™



Agenda

1. **New concepts in 7.7**
   - Database Studio, Parameter Names, KnlMsg
   - Multiple Log Partitions
   - I/O Interface
   - Multiple Snapshots, etc.
2. **Other Kernel Features**
   - Length Restriction for Records
   - Create Index, etc.
3. **DBM-Server**
   - Background Commands
   - SDBMAIL Integration into Event Dispatcher
4. **Other Changes**
   - ODBC, JDBC, etc.



General Information

This document describes major changes between MaxDB 7.7 and smaller versions.
For details please refer to the (online) documentation.
Some features have been implemented in version 7.6 as well.

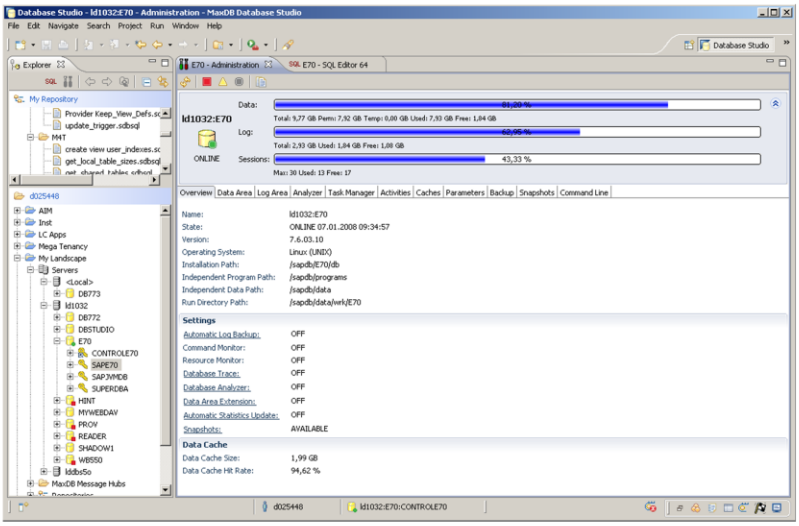
Even if some of the features described below are not directly perceptible, they might have a strong impact, e.g. on performance or scalability, and thus are briefly described.

Terminology remark

Within this document LOBs (Large Objects, also known as BLOB or CLOB) are mentioned. The MaxDB data type LONG has been renamed to LOB. The deprecated SQL syntax using LONG still works. Access to the catalog views shows the types BLOB and CLOB.

Database Studio

The Database Studio is an Eclipse based Java tool substituting the DBMGUI and SQLStudio. It further has GUI components like loader plug-ins and supports database servers as of version 7.5. The Database Studio can run on all supported platforms. For now it's released for Windows and Linux (both 32 and 64 bit).



Data: 81,20 %

Total: 9,77 GB Perm: 7,92 GB Temp: 0,00 GB Used: 7,93 GB Free: 1,84 GB

Log: 62,95 %

Total: 2,93 GB Used: 1,84 GB Free: 1,08 GB

Sessions: 43,33 %

Max: 30 Used: 13 Free: 17

Name:	ld1032:E70
State:	ONLINE 07.01.2008 09:34:57
Version:	7.6.03.10
Operating System:	Linux (UNIX)
Installation Path:	/sapdb/E70/db
Independent Program Path:	/sapdb/programs
Independent Data Path:	/sapdb/data
Run Directory Path:	/sapdb/data/wrk/E70

Settings

Automatic Log Backup:	OFF
Command Monitor:	OFF
Resource Monitor:	OFF
Database Trace:	OFF
Database Analyzer:	OFF
Data Area Extension:	OFF
Automatic Statistics Update:	OFF
Snapshots:	AVAILABLE

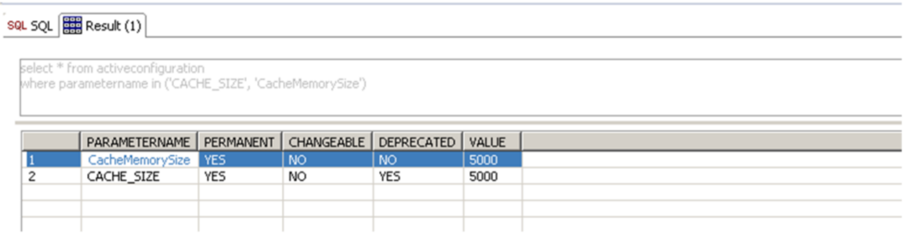
Data Cache

Data Cache Size:	1,99 GB
Data Cache Hit Rate:	94,62 %

New Parameter Names

Almost all database parameters have been renamed. Subtitles in parameter names are separated by uppercase letters.

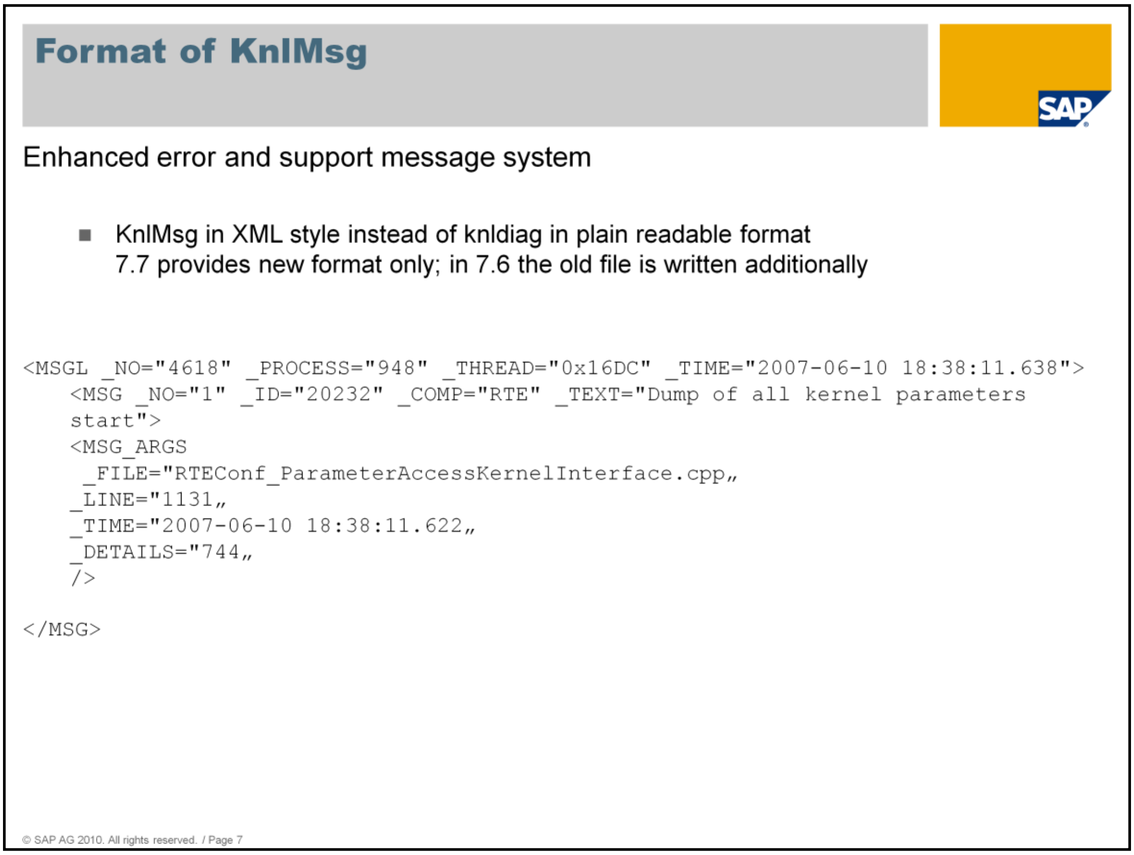
The dbmcli commands still accept the outdated names. The system views show both names.



```
select * from activeconfiguration
where parametername in ('CACHE_SIZE', 'CacheMemorySize')
```

	PARAMETERNAME	PERMANENT	CHANGEABLE	DEPRECATED	VALUE
1	CacheMemorySize	YES	NO	NO	5000
2	CACHE_SIZE	YES	NO	YES	5000

As of version 7.7.03 the parameter names were consolidated. Therewith most parameters got a new name without containing underlines. The legibility of parameter names is improved by the use of upper and lower case characters. You can read and set the parameters by using the old names. The command param_directgetall only shows the new parameter names. The view ACTIVECONFIGURATION shows old and new parameter names.



Format of KnlMsg

Enhanced error and support message system

- KnlMsg in XML style instead of knldiag in plain readable format
  7.7 provides new format only; in 7.6 the old file is written additionally

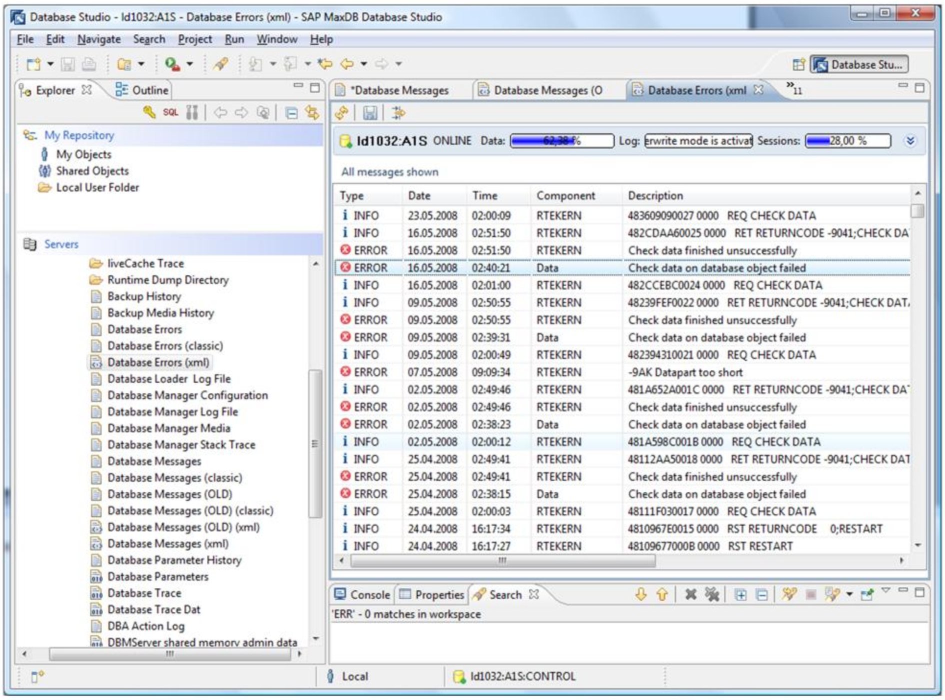
```
<MSGL _NO="4618" _PROCESS="948" _THREAD="0x16DC" _TIME="2007-06-10 18:38:11.638">
   <MSG _NO="1" _ID="20232" _COMP="RTE" _TEXT="Dump of all kernel parameters
   start">
   <MSG_ARGS
    _FILE="RTEConf_ParameterAccessKernelInterface.cpp„
   _LINE="1131„
   _TIME="2007-06-10 18:38:11.622„
   _DETAILS="744„
   />

</MSG>
```

The file ***KnlMsg*** contains messages of the database kernel.It is recreated each time the database instance is started. The previous file is renamed to ***KnlMsg.old***. The messages - apart from the header (start messages) - are overwritten cyclically.

Error messages are recorded in ***KnlMsg*** but also - due to the risk that they will be overwritten there - in the file ***KnlMsgArchive*** (***knldiag.err)***. This file is written continuously.

As of version 7.7 ***KnlMsg*** files replace the files ***knldiag*.*** A specialty of the new files is that they are stored in an XML-like representation to make it possible in further states of expansion that together with the error messages directly instructions are delivered. This implies that the files – if you look at them on operating system level – have to be prepared before they can be displayed properly (***protconv***). If you choose Database Studio, DBMGUI or transaction DB50 to display the ***KnlMsg*** the conversion to a readable format is done automatically.

KnlMsg 2



Id1032:A1S ONLINE Data: 62,38 % Log: erwrite mode is activat Sessions: 28,00 %

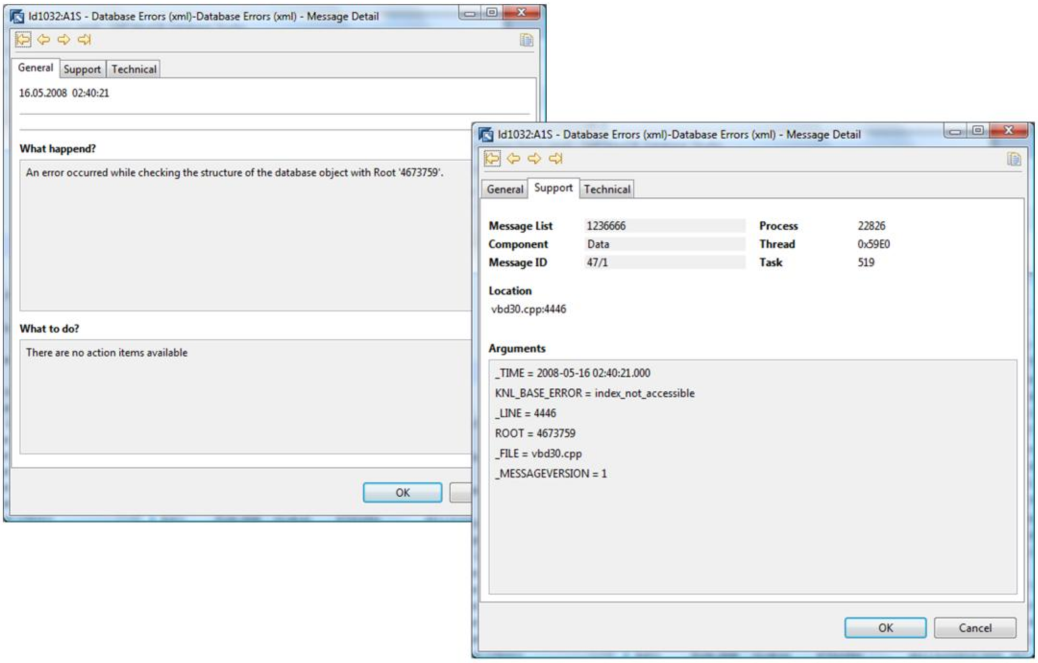
All messages shown

Type	Date	Time	Component	Description
INFO	23.05.2008	02:00:09	RTEKERN	483609090027 0000 REQ CHECK DATA
INFO	16.05.2008	02:51:50	RTEKERN	482CDAA60025 0000 RET RETURNCODE -9041;CHECK DA
ERROR	16.05.2008	02:51:50	RTEKERN	Check data finished unsuccessfully
ERROR	16.05.2008	02:40:21	Data	Check data on database object failed
INFO	16.05.2008	02:01:00	RTEKERN	482CCEBC0024 0000 REQ CHECK DATA
INFO	09.05.2008	02:50:55	RTEKERN	48239FEF0022 0000 RET RETURNCODE -9041;CHECK DAT.
ERROR	09.05.2008	02:50:55	RTEKERN	Check data finished unsuccessfully
ERROR	09.05.2008	02:39:31	Data	Check data on database object failed
INFO	09.05.2008	02:00:49	RTEKERN	482394310021 0000 REQ CHECK DATA
ERROR	07.05.2008	09:09:34	RTEKERN	-9AK Datapart too short
INFO	02.05.2008	02:49:46	RTEKERN	481A652A001C 0000 RET RETURNCODE -9041;CHECK DA
ERROR	02.05.2008	02:49:46	RTEKERN	Check data finished unsuccessfully
ERROR	02.05.2008	02:38:23	Data	Check data on database object failed
INFO	02.05.2008	02:00:12	RTEKERN	481A598C001B 0000 REQ CHECK DATA
INFO	25.04.2008	02:49:41	RTEKERN	48112AA50018 0000 RET RETURNCODE -9041;CHECK DAT
ERROR	25.04.2008	02:49:41	RTEKERN	Check data finished unsuccessfully
ERROR	25.04.2008	02:38:15	Data	Check data on database object failed
INFO	25.04.2008	02:00:03	RTEKERN	48111F030017 0000 REQ CHECK DATA
INFO	24.04.2008	16:17:34	RTEKERN	4810967E0015 0000 RST RETURNCODE 0;RESTART
INFO	24.04.2008	16:17:27	RTEKERN	48109677000B 0000 RST RESTART

'ERR' - 0 matches in workspace

Database Studio offers to the user to either display the file ***KnlMsg*** in the familiar classical way or in the XML representation (see above). By double-clicking a line in the XML representation you can get more information about the error (see next slide).

KnlMsg 3


Id1032:A1S - Database Errors (xml)-Database Errors (xml) - Message Detail
General
Support
Technical
OK

16.05.2008 02:40:21

What happend?

An error occurred while checking the structure of the database object with Root '4673759'.

What to do?

There are no action items available

Id1032:A1S - Database Errors (xml)-Database Errors (xml) - Message Detail
General
Support
Technical
OK
Cancel

Message List	1236666	**Process**	22826
Component	Data	**Thread**	0x59E0
Message ID	47/1	**Task**	519

Location

vbd30.cpp:4446

Arguments

```
_TIME = 2008-05-16 02:40:21.000
KNL_BASE_ERROR = index_not_accessible
_LINE = 4446
ROOT = 4673759
_FILE = vbd30.cpp
_MESSAGEVERSION = 1
```

The following windows are displayed delivering more information about the error and proposing possibilities to correct the error. As mentioned above the windows are still partially empty and some more content is required.

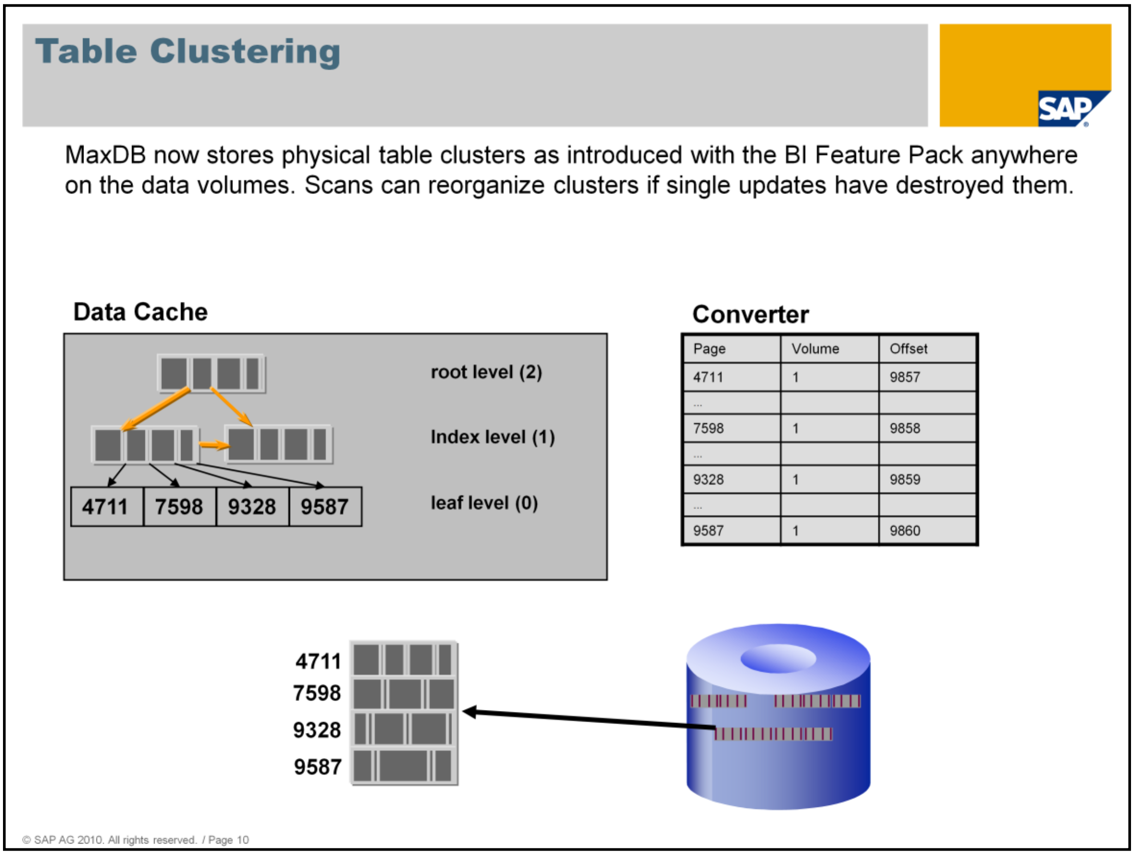


Table Clustering

MaxDB now stores physical table clusters as introduced with the BI Feature Pack anywhere on the data volumes. Scans can reorganize clusters if single updates have destroyed them.

Data Cache

Converter

Page	Volume	Offset
4711	1	9857
...		
7598	1	9858
...		
9328	1	9859
...		
9587	1	9860

MaxDB builds clusters for tables with the cluster flag to improve read performance for scans.

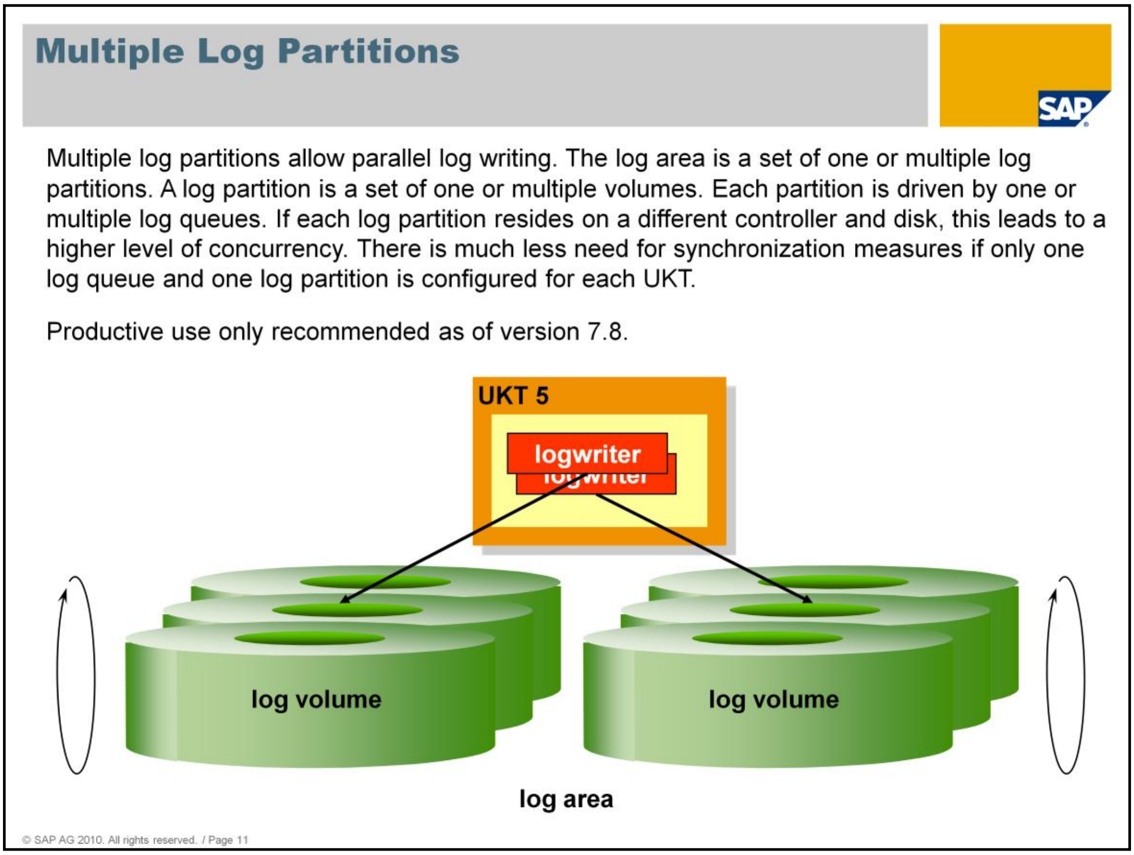
If blocks are written for cluster tables the pager tasks are looking for logically clustered blocks. Logically clustered blocks are those with successive cluster keys. The cluster key is defined by the primary key or another logical key which must not be unique on application side (f.e. time characteristic). Pager tasks write those blocks adhesively to the data area.

A cluster built by pager tasks is only written to a separate FBM (Free Block Manager) section if the number of blocks within the cluster is at least ClusterWriteThreshold % of DataIOClusterSize and a free section in the data volumes is available. During backup and restore the clustering is not lost. If the percentage falls below ClusterWriteThreshold and no more free section is available the cluster is splitted and written to different free blocks.

If the database is filled to a high amount there is increased risk of writing too small clusters because there are no more free FBM sections for bigger clusters. So the scan performance of the system will be restricted.

FBM sections are released if they are only filled with a few blocks and if the condition for parameter ClusterCompressionThreshold is fulfilled.

At the end of a savepoint it is checked by pager tasks if there are FBM sections with a low filling grade. Server tasks read the affected blocks to the data cache and mark it as modified. The blocks are written to other positions in the data area at the latest with the next savepoint. The FBM sections are now free for large table clusters.



Multiple Log Partitions

Multiple log partitions allow parallel log writing. The log area is a set of one or multiple log partitions. A log partition is a set of one or multiple volumes. Each partition is driven by one or multiple log queues. If each log partition resides on a different controller and disk, this leads to a higher level of concurrency. There is much less need for synchronization measures if only one log queue and one log partition is configured for each UKT.

Productive use only recommended as of version 7.8.

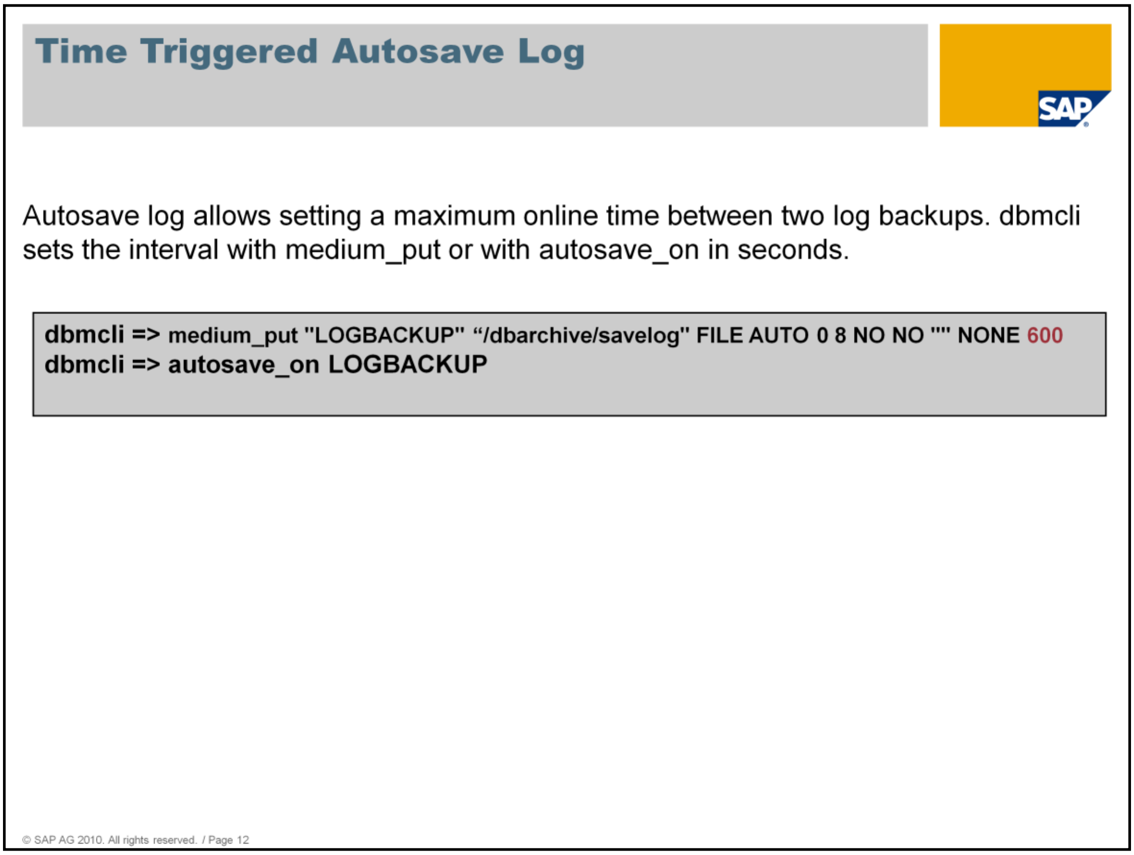
As of version 7.7 MaxDB allows the use of multiple log partitiions. With parallel writing to the log volumes the database prevents bottlenecks during the access to the log queue and additionally wait situations for writes into the log volumes.

Partitions and also volumes of the partitions may have different sizes.

Normally user tasks of a UKT are assigned to a special log writer and therewith to a partition. This implies that for some tasks the state „log full“ might occur even if there is still some free space for a user task of another UKT in the corresponding log partition. Perform a backup of the log area if the state „log full“ is shown.

With the use of the CLEAR LOG command the backup history is interrupted. Make sure that a complete data backup is performed. If desired the automatic log backup can be switched on again.

The concept has been implemented in version 7.7 but productive use is only recommended as of version 7.8.



Time Triggered Autosave Log

Autosave log allows setting a maximum online time between two log backups. dbmcli sets the interval with medium_put or with autosave_on in seconds.

```
dbmcli => medium_put "LOGBACKUP" “/dbarchive/savelog" FILE AUTO 0 8 NO NO "" NONE 600
dbmcli => autosave_on LOGBACKUP
```

Automatic log backup is not a new feature of 7.7.

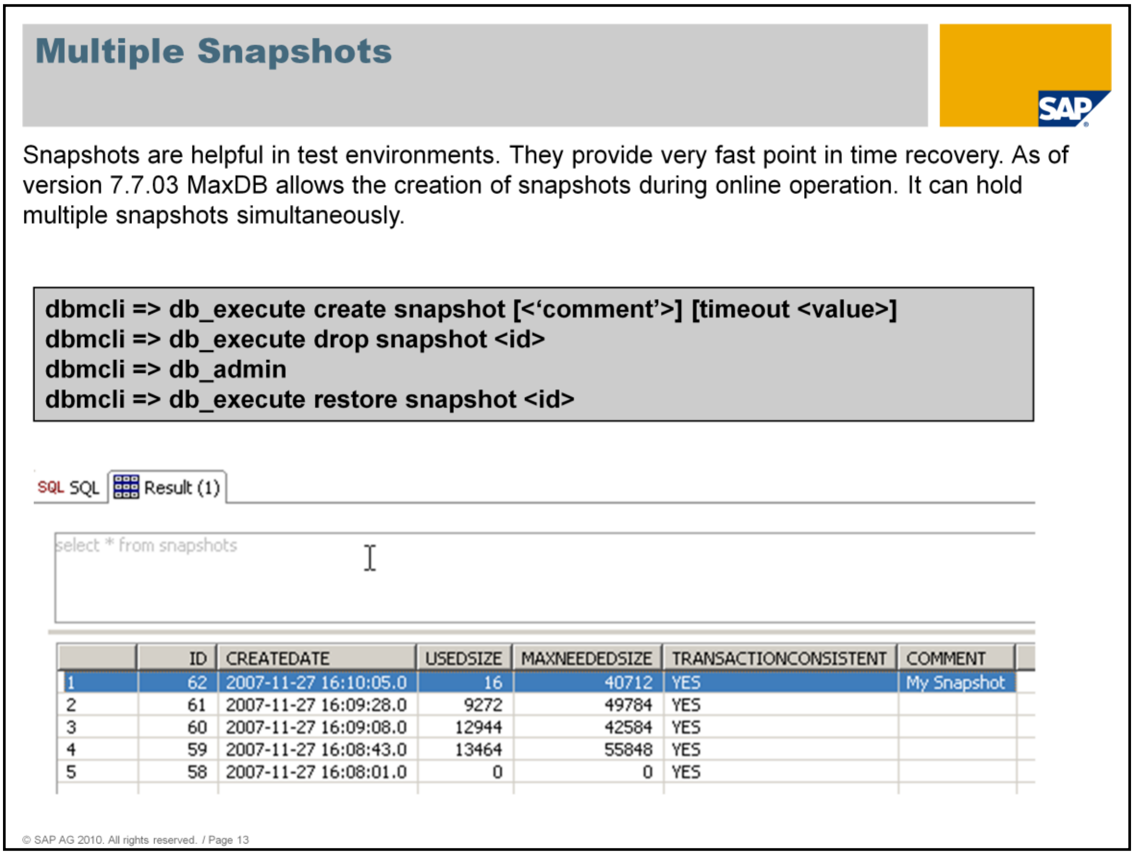
The database kernel can create the log backup automatically.

You activate automatic log backup with the dbmcli command autolog_on.

The log backup is automatically created asynchronously upon completion of a segment.

Newly implemented in 7.7 is the use of a time interval; there has also been a down port to 7.6.

As of MaxDB version 7.6.02 also a time interval may be set to launch the automatic log backup along this interval.



Multiple Snapshots

Snapshots are helpful in test environments. They provide very fast point in time recovery. As of version 7.7.03 MaxDB allows the creation of snapshots during online operation. It can hold multiple snapshots simultaneously.

```
dbmcli => db_execute create snapshot [<‘comment’>] [timeout <value>]
dbmcli => db_execute drop snapshot <id>
dbmcli => db_admin
dbmcli => db_execute restore snapshot <id>
```

```
select * from snapshots
```

	ID	CREATEDATE	USEDSIZE	MAXNEEDEDSIZE	TRANSACTIONCONSISTENT	COMMENT
1	62	2007-11-27 16:10:05.0	16	40712	YES	My Snapshot
2	61	2007-11-27 16:09:28.0	9272	49784	YES	
3	60	2007-11-27 16:09:08.0	12944	42584	YES	
4	59	2007-11-27 16:08:43.0	13464	55848	YES	
5	58	2007-11-27 16:08:01.0	0	0	YES	

From version 7.5, you can freeze the data area of a database instance using a snapshot.

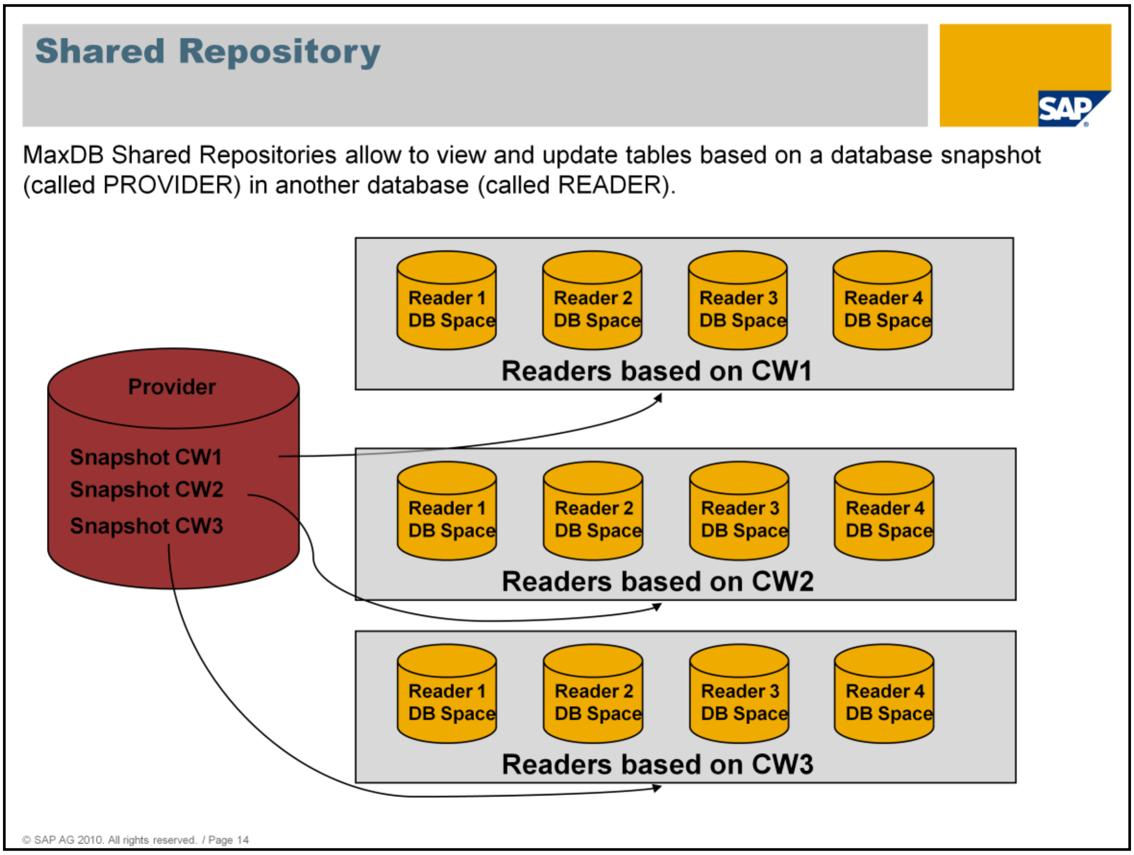
In versions 7.5 and 7.6 a snapshot is generated in the ADMIN state. As of 7.7 it is also possible to create it in ONLINE mode. Later you can reset the data to its state at the time of the snapshot and/or delete the snapshot.

With the CREATE_SNAPSHOT command, the database kernel copies the restart page from the second block of the first data volume to another position. The complete converter is also copied. The original restart record contains a reference to the restart record that corresponds to the snapshot.

With the command RESTORE_SNAPSHOT, the current converter is deleted. All blocks that are no longer needed are marked as free in the FBM (Free Block Manager). The log is formatted such that the state HISTLOST occurs. At the next restart, the instance works with the data as they were at the time of the CREATE_SNAPSHOT.

The statement DROP_SNAPSHOT deletes the restart record and the corresponding converter that is relevant for the snapshot. The FBM marks all blocks that are no longer needed as free.

Up to 7.6 MaxDB supports only a single snapshot, as of 7.7 several snapshots can be generated. Operating the instance with one or several snapshot(s) uses more of the capacity of the data area.



Shared Repository

MaxDB Shared Repositories allow to view and update tables based on a database snapshot (called PROVIDER) in another database (called READER).

MaxDB version 7.7 is able to administer several snapshots at the same time.You can create and drop snapshots in online mode.

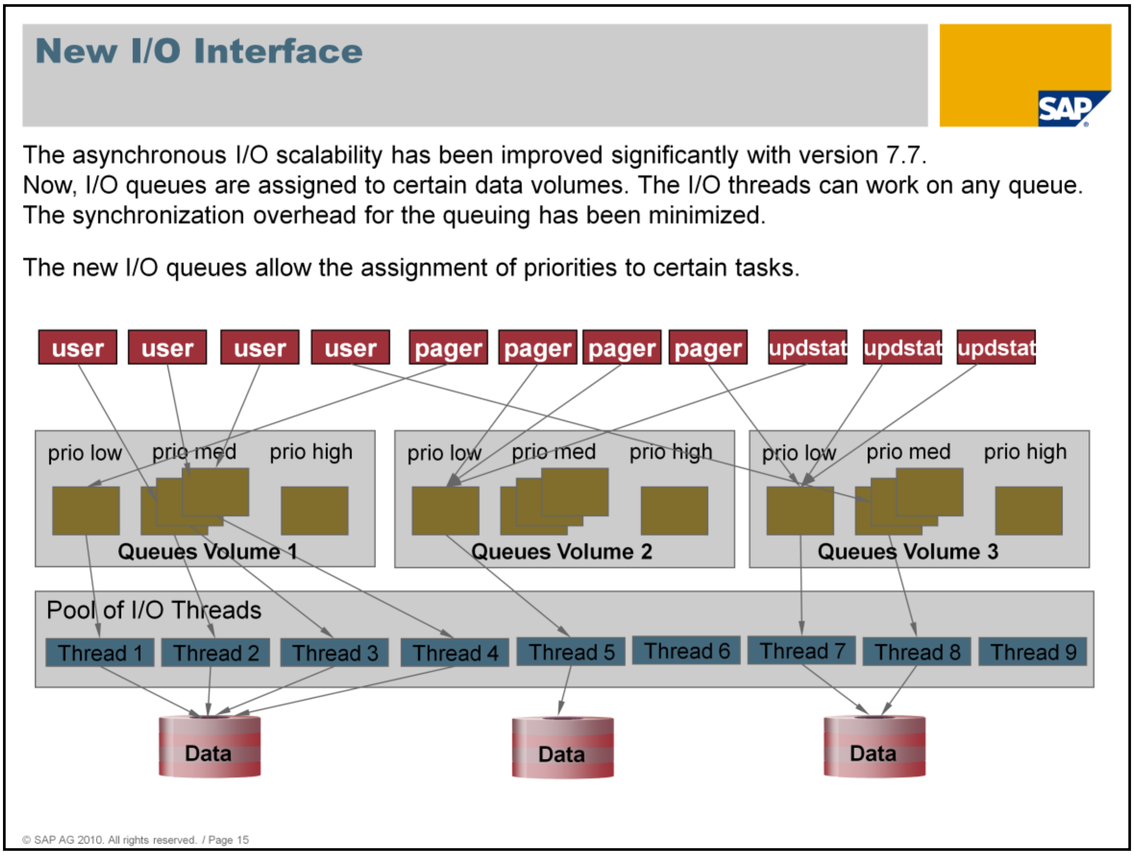
An instance (reader) can access to the snapshot of another instance (provider) via the I/O interface and import tables logically.

Access to the snapshot is done in read-only mode. Changed blocks of the imported tables are stored physically in the data volumes of the reader.

In that way using a master system a lot of system copies on the level of tables or schemas, respectively, can be created. The required space of the reader is basically determined by the changed blocks.

The readers subject to the usual concept for MaxDB backups whereas only those blocks are saved that are stored in the reader. For a restore the snapshot of the accordant provider must be accessible.

The import of a snapshot and the related tables also works within the same instance if a second schema is used.



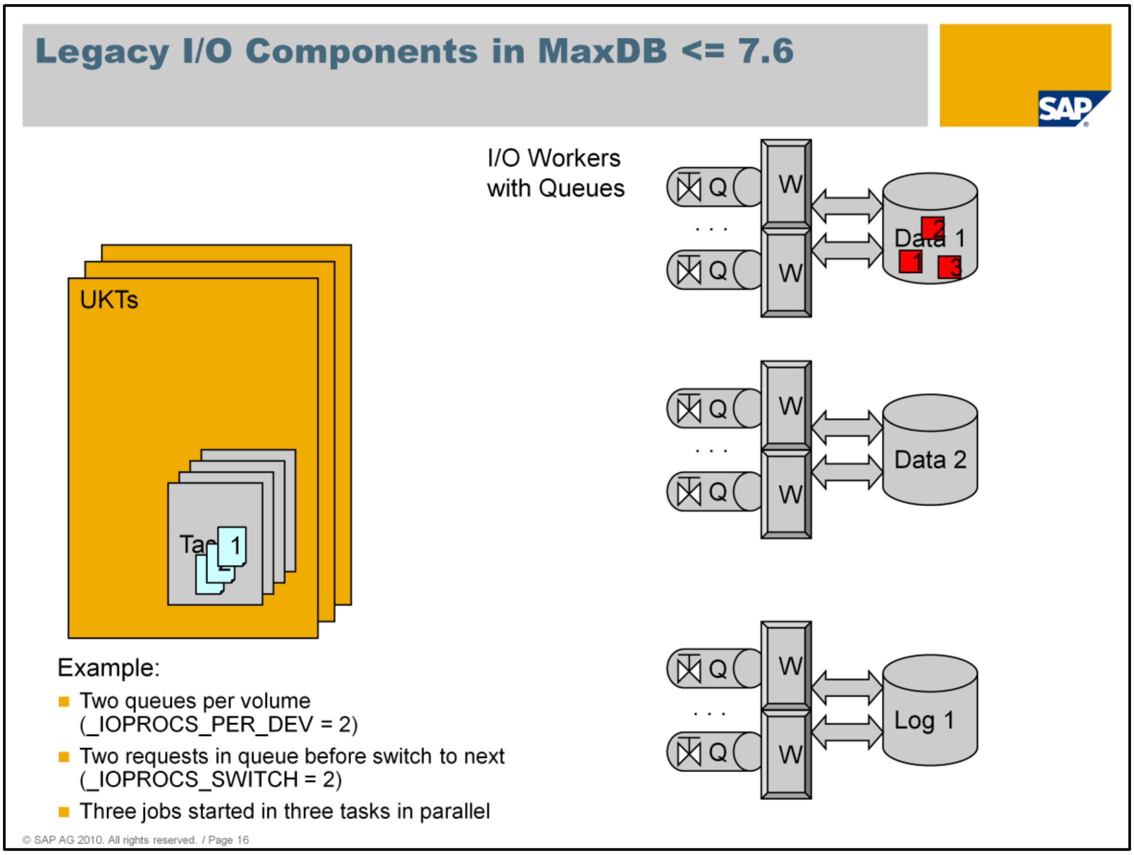
New I/O Interface

The asynchronous I/O scalability has been improved significantly with version 7.7.
Now, I/O queues are assigned to certain data volumes. The I/O threads can work on any queue.
The synchronization overhead for the queuing has been minimized.

The new I/O queues allow the assignment of priorities to certain tasks.

With version 7.7 the I/O interface to the operating system has been reimplemented. Version 7.7 uses different parameters than version 7.6. The new I/O system in version 7.7 has the following essential advantages:

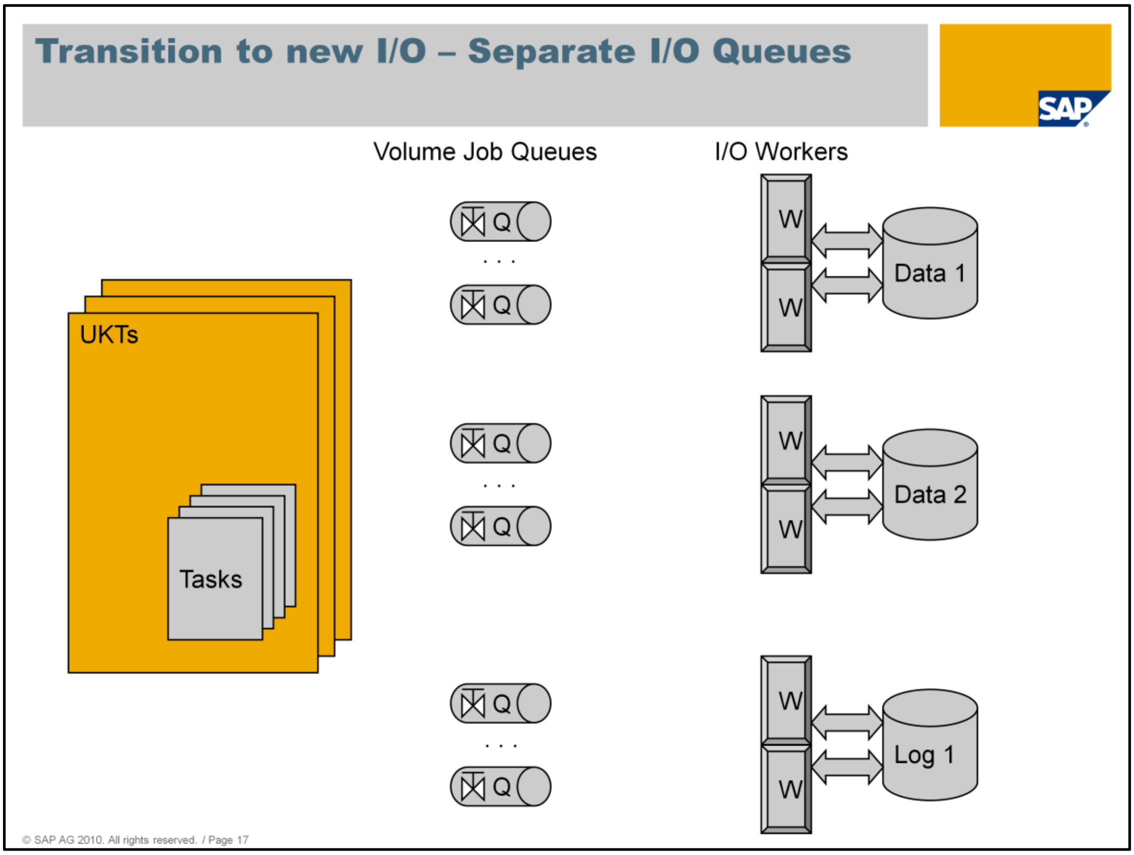
- No direct assignment of a I/O worker thread to a volume. This implies a better scalability of I/O.
- I/O worker threads can be started on request. This prevents the use of unnecessary resources.
- The synchronization of accesses to the I/O queues has been changed. The access is done collision free. This additionally improves the scalability of I/O.
- Prioritization of special I/O requests. Dedicated jobs within the database (f.e. CHECK DATA) can run with lower priority. Online operation is stressed less.
- Tasks can send I/O requests asynchroneously to the I/O system. They don‘t have to wait until the I/O request has been fulfilled but can continue their work.
- Support of multiple database instances.



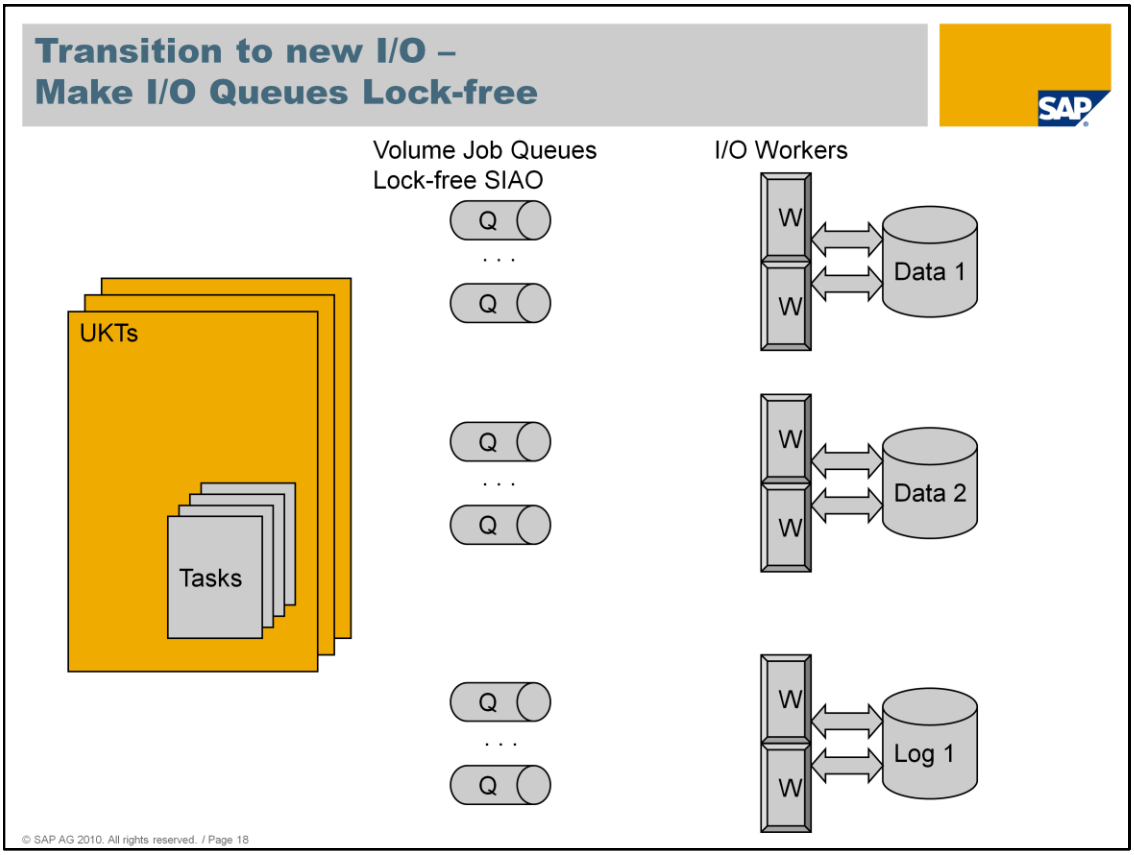
Legacy I/O Components in MaxDB <= 7.6

Example:

- Two queues per volume (_IOPROCS_PER_DEV = 2)
- Two requests in queue before switch to next (_IOPROCS_SWITCH = 2)
- Three jobs started in three tasks in parallel



Transition to new I/O – Separate I/O Queues

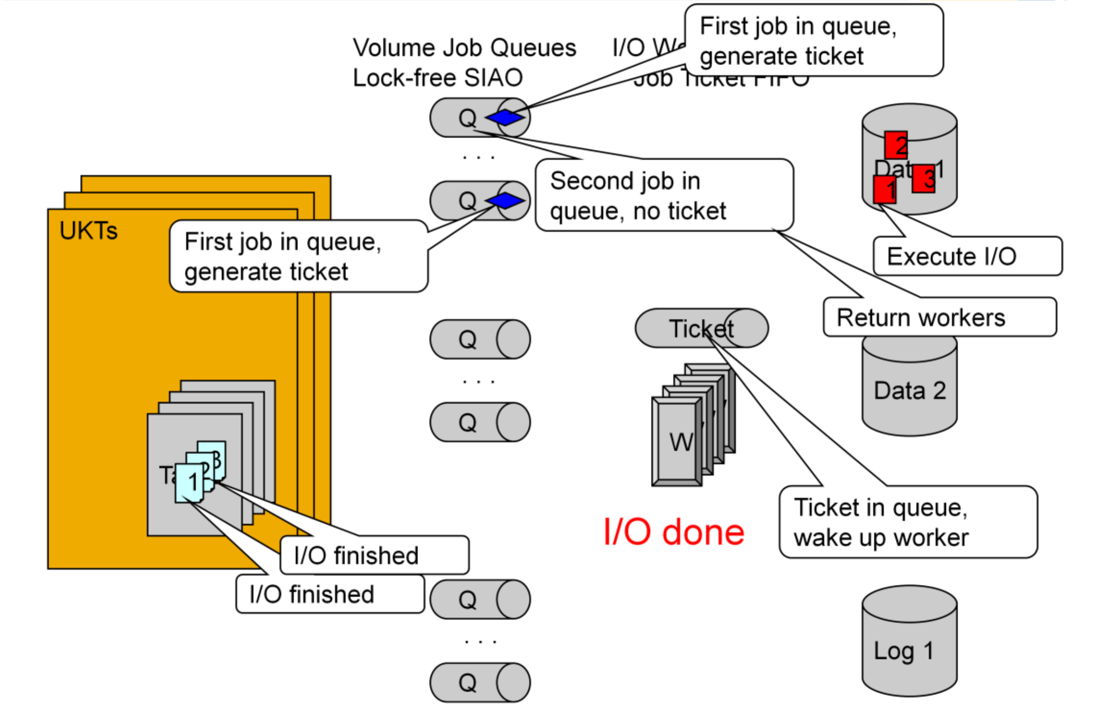


Transition to new I/O – Make I/O Queues Lock-free

Volume Job Queues
Lock-free SIAO

I/O Workers

New I/O Components in MaxDB >= 7.7



Volume Job Queues
Lock-free SIAO

I/O W
Job Ticket FIFO

First job in queue, generate ticket

Second job in queue, no ticket

First job in queue, generate ticket

Execute I/O

Return workers

Ticket in queue, wake up worker

I/O done

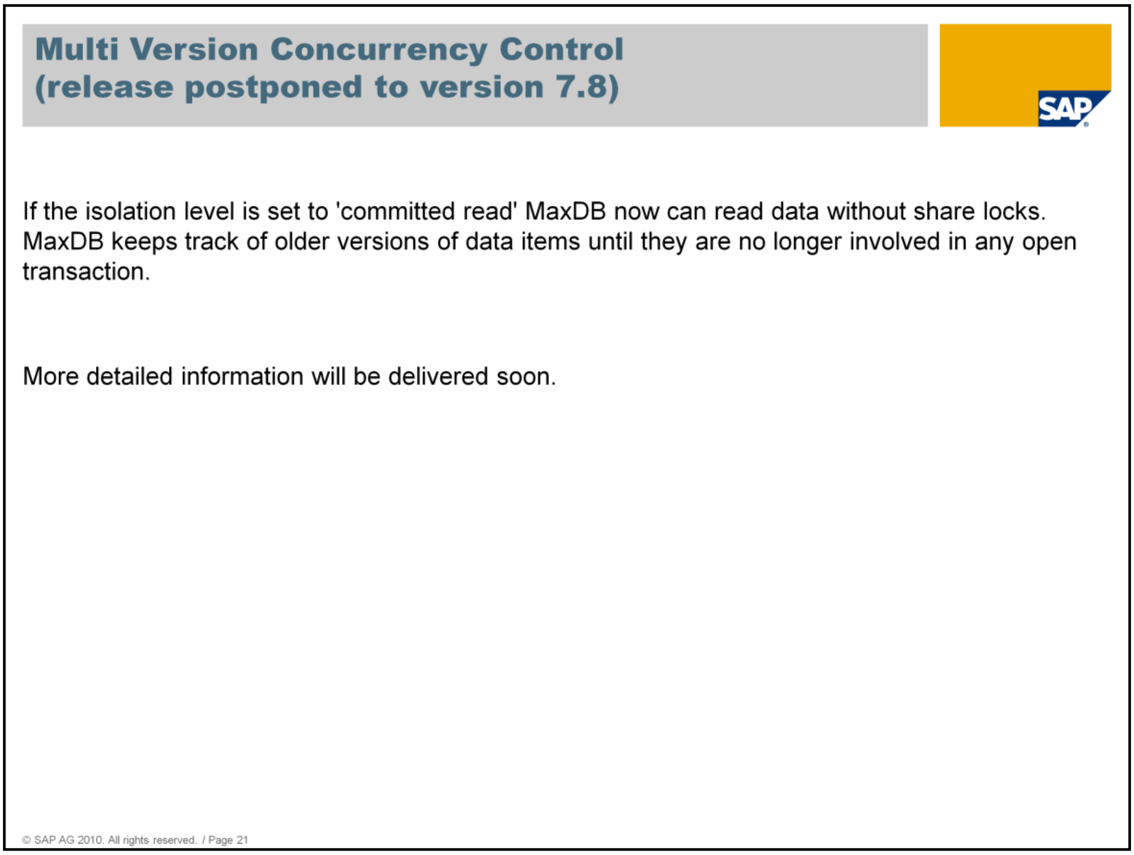
I/O finished

I/O finished

Post Mortem Console

The shared memory of the runtime still exists after emergency shutdowns. The MaxDB console can start a database kernel which is able to read all information from the shared memory although the productive database is not available anymore. This improves the analysis of database aborts.

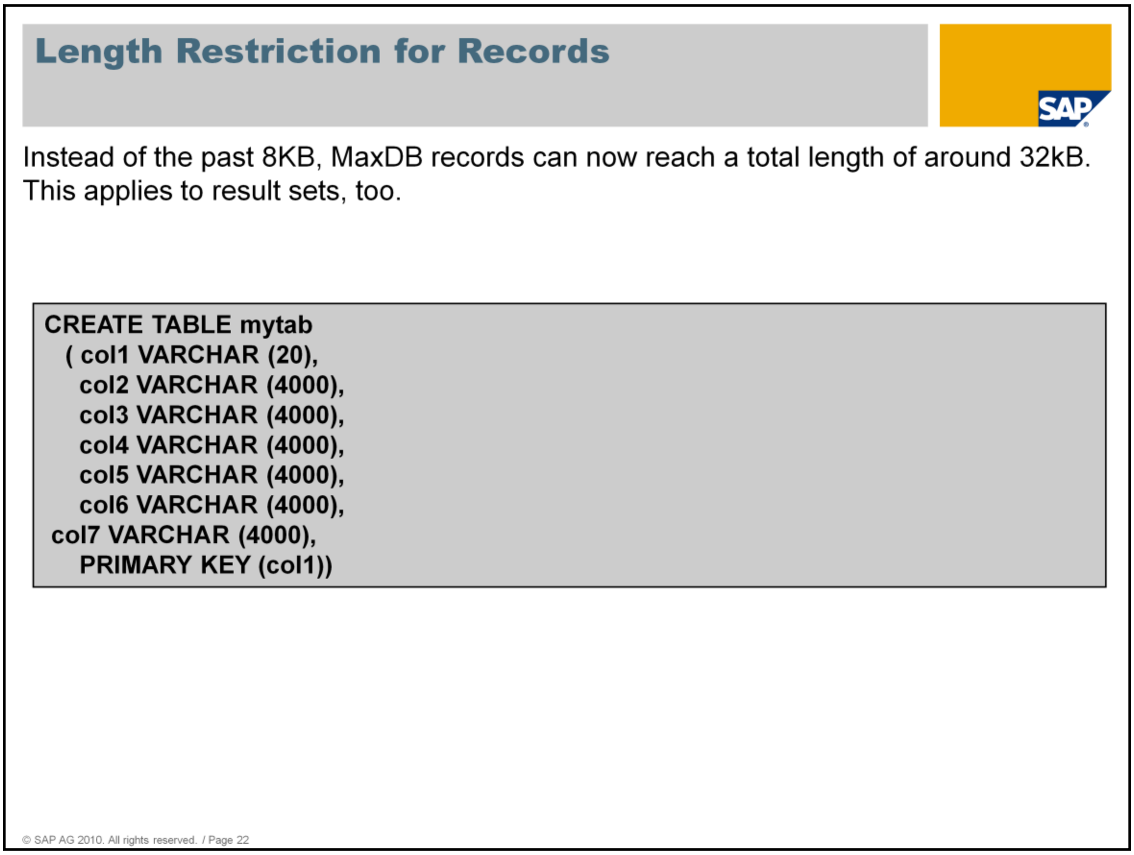
```
myserver:e70adm> x_cons E70 sh act

SERVERDB: E70

ID    UKT UNIX   TASK        APPL Current         Timeout Region     Wait
            tid  type         pid state          priority cnt try    item
T215    7  21117 User          0* Running               0 1446   10   18(r)


 *** Post Mortem Analysis for ServerDB E70 using kernel ***


Console command finished (2007-11-26 18:12:52).
```



Multi Version Concurrency Control (release postponed to version 7.8)

If the isolation level is set to 'committed read' MaxDB now can read data without share locks. MaxDB keeps track of older versions of data items until they are no longer involved in any open transaction.

More detailed information will be delivered soon.



Length Restriction for Records

Instead of the past 8KB, MaxDB records can now reach a total length of around 32kB. This applies to result sets, too.

```
CREATE TABLE mytab
   ( col1 VARCHAR (20),
     col2 VARCHAR (4000),
     col3 VARCHAR (4000),
     col4 VARCHAR (4000),
     col5 VARCHAR (4000),
     col6 VARCHAR (4000),
 col7 VARCHAR (4000),
     PRIMARY KEY (col1))
```

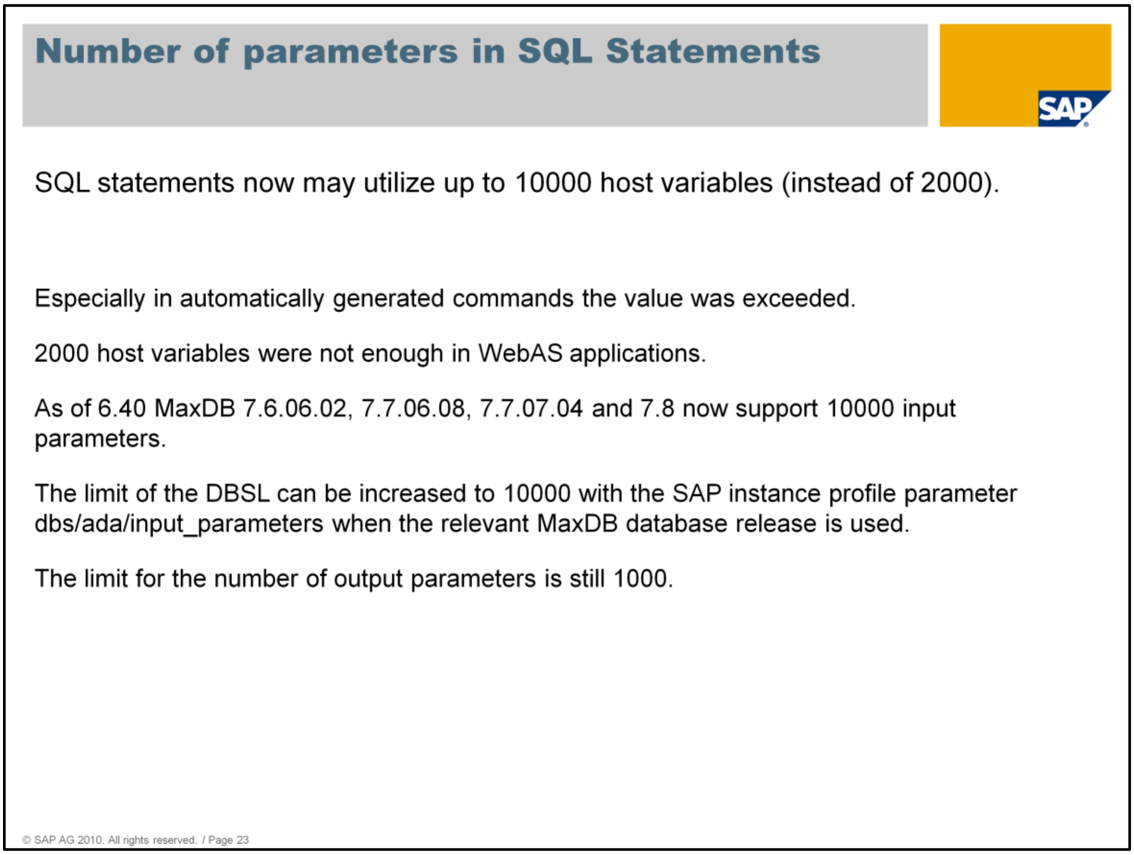
MaxDB now supports records with a length of up to 32767 bytes.

The maximum length for a single column still is 8100 bytes.

If a record‘s size exceeds 8100 bytes, a part of it is stored in a chain of 8KB pages. The record itself contains the start page number of that page chain.

→ redirection implies performance impact for usage of large records

→ in system view FILES, record extension pages will be shown as part of TREELEAVESSIZE



Number of parameters in SQL Statements

SQL statements now may utilize up to 10000 host variables (instead of 2000).

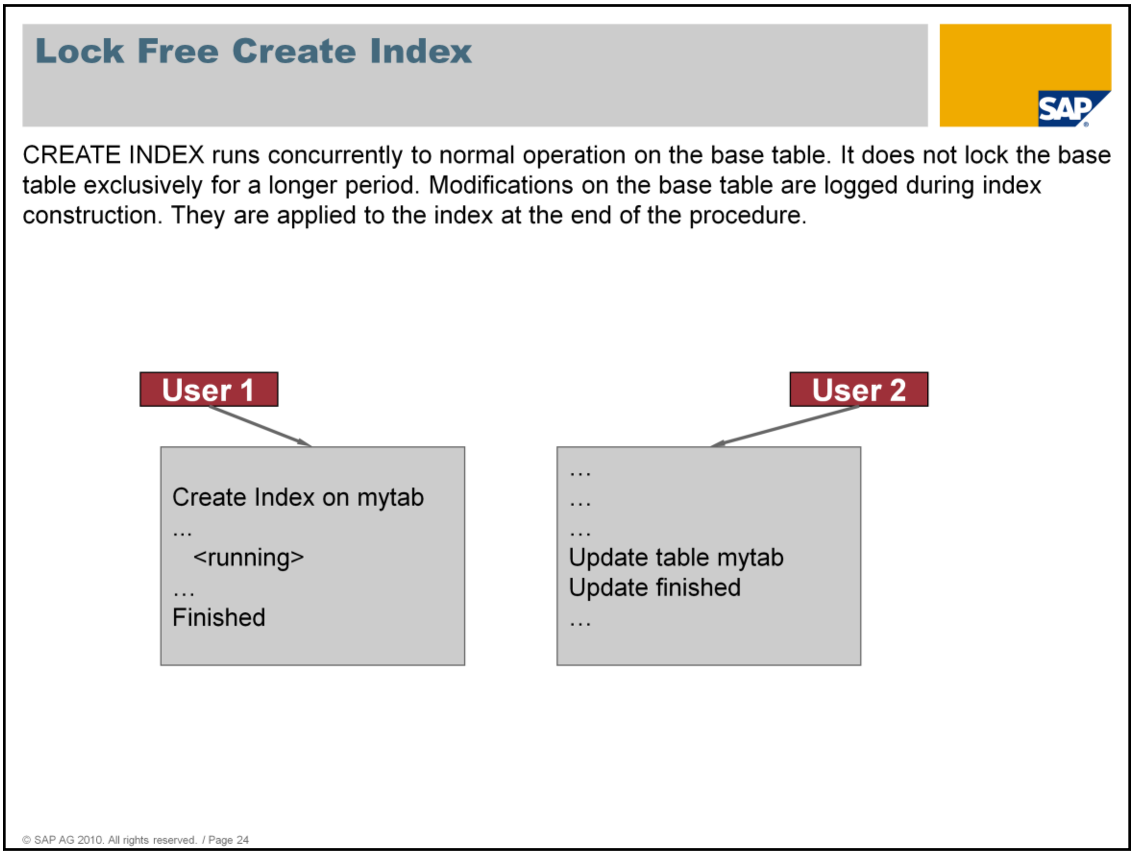
Especially in automatically generated commands the value was exceeded.

2000 host variables were not enough in WebAS applications.

As of 6.40 MaxDB 7.6.06.02, 7.7.06.08, 7.7.07.04 and 7.8 now support 10000 input parameters.

The limit of the DBSL can be increased to 10000 with the SAP instance profile parameter dbs/ada/input_parameters when the relevant MaxDB database release is used.

The limit for the number of output parameters is still 1000.



Lock Free Create Index

CREATE INDEX runs concurrently to normal operation on the base table. It does not lock the base table exclusively for a longer period. Modifications on the base table are logged during index construction. They are applied to the index at the end of the procedure.

User 1

```
Create Index on mytab
...
  <running>
…
Finished
```

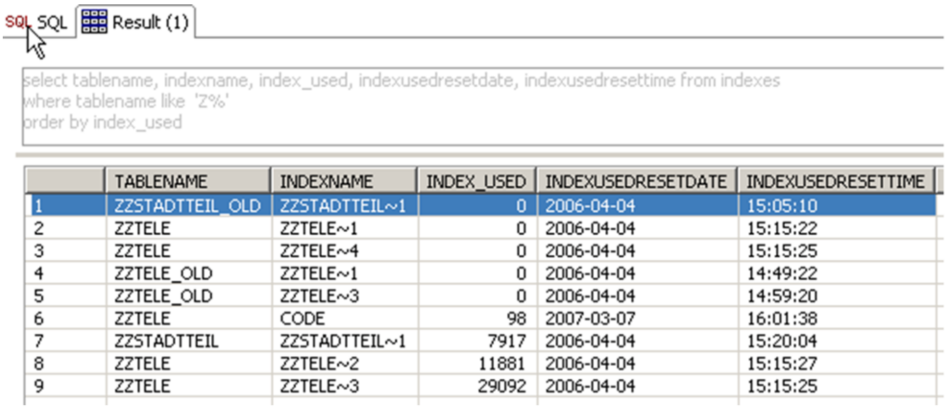
User 2

```
…
…
…
Update table mytab
Update finished
…
```

3

Index Usage Counter

MaxDB counts each usage of a secondary key index.
The database can reset the index usage counter.



```
select tablename, indexname, index_used, indexusedresetdate, indexusedresettime from indexes
where tablename like 'Z%'
order by index_used
```

	TABLENAME	INDEXNAME	INDEX_USED	INDEXUSEDRESETDATE	INDEXUSEDRESETTIME
1	ZZSTADTTEIL_OLD	ZZSTADTTEIL~1	0	2006-04-04	15:05:10
2	ZZTELE	ZZTELE~1	0	2006-04-04	15:15:22
3	ZZTELE	ZZTELE~4	0	2006-04-04	15:15:25
4	ZZTELE_OLD	ZZTELE~1	0	2006-04-04	14:49:22
5	ZZTELE_OLD	ZZTELE~3	0	2006-04-04	14:59:20
6	ZZTELE	CODE	98	2007-03-07	16:01:38
7	ZZSTADTTEIL	ZZSTADTTEIL~1	7917	2006-04-04	15:20:04
8	ZZTELE	ZZTELE~2	11881	2006-04-04	15:15:27
9	ZZTELE	ZZTELE~3	29092	2006-04-04	15:15:25

SQL: ALTER INDEX <indexname> on <schemaname>.<tablename> INIT USAGE

Index maintenance is space and time consuming. It does not make sense to define too much indexes that are not really used by the optimizer. To check whether and how often an index was used you can select in DOMAIN.INDEXES (column INDEX_USED).

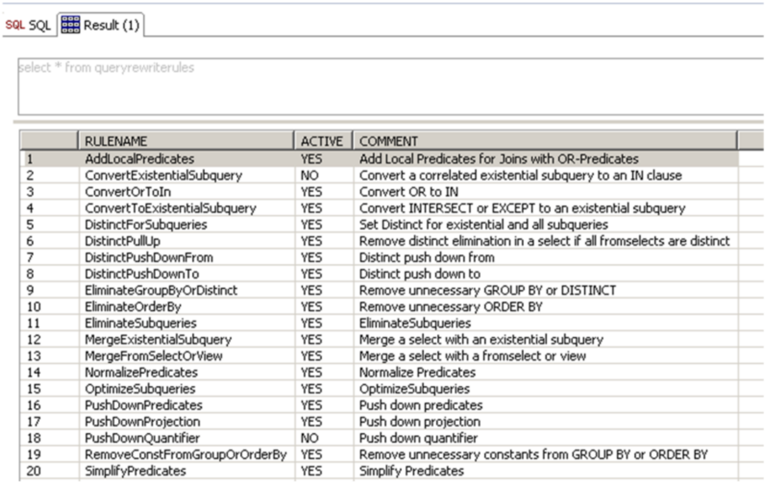
MaxDB counts each usage of a secondary key index.
The database can reset the index usage counter with the following command:

ALTER INDEX <indexname> on <schemaname>.<tablename> INIT USAGE

The INDEX_USED column in the system table DOMAIN.INDEXES is initialized with 0 then. This means that the mechanism that counts how frequently an index is used is restarted.

Query Rewrite

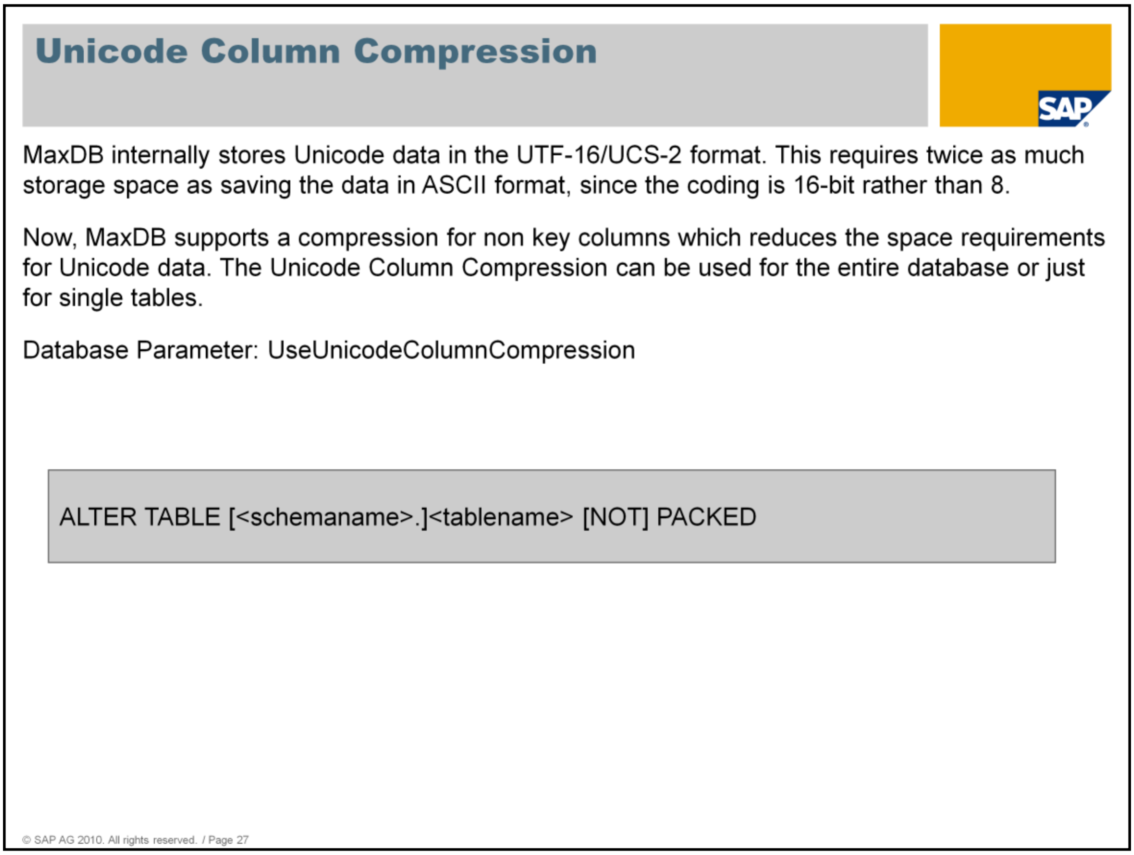
Complex statements will be rewritten to achieve a better and more efficient optimization and execution. Heuristic rules are applied, qualifications should be applied to the base table directly, even if placed somewhere else in the original statement.



```
select * from queryrewriterules
```

	RULENAME	ACTIVE	COMMENT
1	AddLocalPredicates	YES	Add Local Predicates for Joins with OR-Predicates
2	ConvertExistentialSubquery	NO	Convert a correlated existential subquery to an IN clause
3	ConvertOrToIn	YES	Convert OR to IN
4	ConvertToExistentialSubquery	YES	Convert INTERSECT or EXCEPT to an existential subquery
5	DistinctForSubqueries	YES	Set Distinct for existential and all subqueries
6	DistinctPullUp	YES	Remove distinct elimination in a select if all fromselects are distinct
7	DistinctPushDownFrom	YES	Distinct push down from
8	DistinctPushDownTo	YES	Distinct push down to
9	EliminateGroupByOrDistinct	YES	Remove unnecessary GROUP BY or DISTINCT
10	EliminateOrderBy	YES	Remove unnecessary ORDER BY
11	EliminateSubqueries	YES	EliminateSubqueries
12	MergeExistentialSubquery	YES	Merge a select with an existential subquery
13	MergeFromSelectOrView	YES	Merge a select with a fromselect or view
14	NormalizePredicates	YES	Normalize Predicates
15	OptimizeSubqueries	YES	OptimizeSubqueries
16	PushDownPredicates	YES	Push down predicates
17	PushDownProjection	YES	Push down projection
18	PushDownQuantifier	NO	Push down quantifier
19	RemoveConstFromGroupOrOrderBy	YES	Remove unnecessary constants from GROUP BY or ORDER BY
20	SimplifyPredicates	YES	Simplify Predicates

Query Rewrite is not a new functionality of 7.7 but has been improved in comparison to 7.6.



Unicode Column Compression

MaxDB internally stores Unicode data in the UTF-16/UCS-2 format. This requires twice as much storage space as saving the data in ASCII format, since the coding is 16-bit rather than 8.

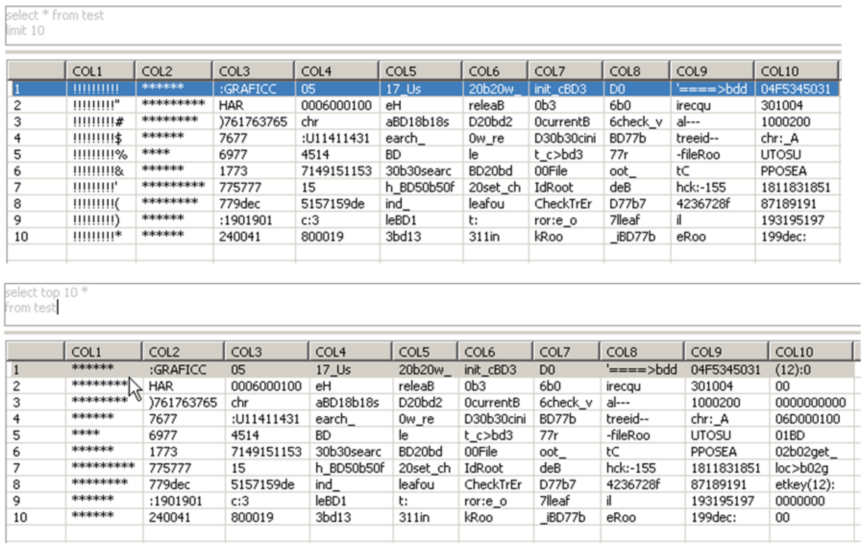
Now, MaxDB supports a compression for non key columns which reduces the space requirements for Unicode data. The Unicode Column Compression can be used for the entire database or just for single tables.

Database Parameter: UseUnicodeColumnCompression

```
ALTER TABLE [<schemaname>.]<tablename> [NOT] PACKED
```

LIMIT, TOP

MaxDB now supports the SQL syntax for LIMIT and TOP



```
select * from test
limit 10
```

	COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8	COL9	COL10
1	!!!!!!!!!!	******	:GRAFICC	05	17_Us	20b20w_	init_cBD3	D0	'====>bdd	04F5345031
2	!!!!!!!!!"	**********	HAR	0006000100	eH	releaB	0b3	6b0	irecqu	301004
3	!!!!!!!!!#	*********	)761763765	chr	aBD18b18s	D20bd2	0currentB	6check_v	al---	1000200
4	!!!!!!!!!$	******	7677	:U11411431	earch_	0w_re	D30b30cini	BD77b	treeid--	chr:_A
5	!!!!!!!!!%	****	6977	4514	BD	le	t_c>bd3	77r	-fileRoo	UTOSU
6	!!!!!!!!!&	******	1773	7149151153	30b30searc	BD20bd	00File	oot_	tC	PPOSEA
7	!!!!!!!!!'	**********	775777	15	h_BD50b50f	20set_ch	IdRoot	deB	hck:-155	1811831851
8	!!!!!!!!!(	*********	779dec	5157159de	ind_	leafou	CheckTrEr	D77b7	4236728f	87189191
9	!!!!!!!!!)	******	:1901901	c:3	leBD1	t:	ror:e_o	7lleaf	il	193195197
10	!!!!!!!!!*	******	240041	800019	3bd13	311in	kRoo	_iBD77b	eRoo	199dec:

```
select top 10 *
from test
```

	COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8	COL9	COL10
1	******	:GRAFICC	05	17_Us	20b20w_	init_cBD3	D0	'====>bdd	04F5345031	(12):0
2	*********	HAR	0006000100	eH	releaB	0b3	6b0	irecqu	301004	00
3	*********	)761763765	chr	aBD18b18s	D20bd2	0currentB	6check_v	al---	1000200	0000000000
4	******	7677	:U11411431	earch_	0w_re	D30b30cini	BD77b	treeid--	chr:_A	06D000100
5	****	6977	4514	BD	le	t_c>bd3	77r	-fileRoo	UTOSU	01BD
6	******	1773	7149151153	30b30searc	BD20bd	00File	oot_	tC	PPOSEA	02b02get_
7	**********	775777	15	h_BD50b50f	20set_ch	IdRoot	deB	hck:-155	1811831851	loc>b02g
8	*********	779dec	5157159de	ind_	leafou	CheckTrEr	D77b7	4236728f	87189191	etkey(12):
9	******	:1901901	c:3	leBD1	t:	ror:e_o	7lleaf	il	193195197	0000000
10	******	240041	800019	3bd13	311in	kRoo	_iBD77b	eRoo	199dec:	00

You can use the LIMIT clause (limit_clause) to limit the maximum number of rows in the result table. You either enter only the desired maximum number of rows or the additional information from which row the list should begin (offset value). The offset value of the initial row is 0. If no offset value is specified, the rows are listed from the beginning of the result table.

If both a LIMIT clause and an ORDER clause are entered, then all result rows are sorted and the relevant number of rows is displayed. Normally, the result differs from what you would receive if no ORDER clause was entered.

You can use the TOP syntax element to specify that only the first n lines of the result are to be generated. Whole numbers between 0 and 2147483647 are permitted.

If you use a TOP syntax element and an ORDER clause in a SELECT statement, the first n lines of all lines sorted by the ORDER clause are generated. If you do not use an ORDER clause in the SELECT statement, any n lines are generated.

If a QUERY expression (query_expression) consists of several QUERY specifications (query_spec), the TOP syntax element must only be contained in the first QUERY specification.

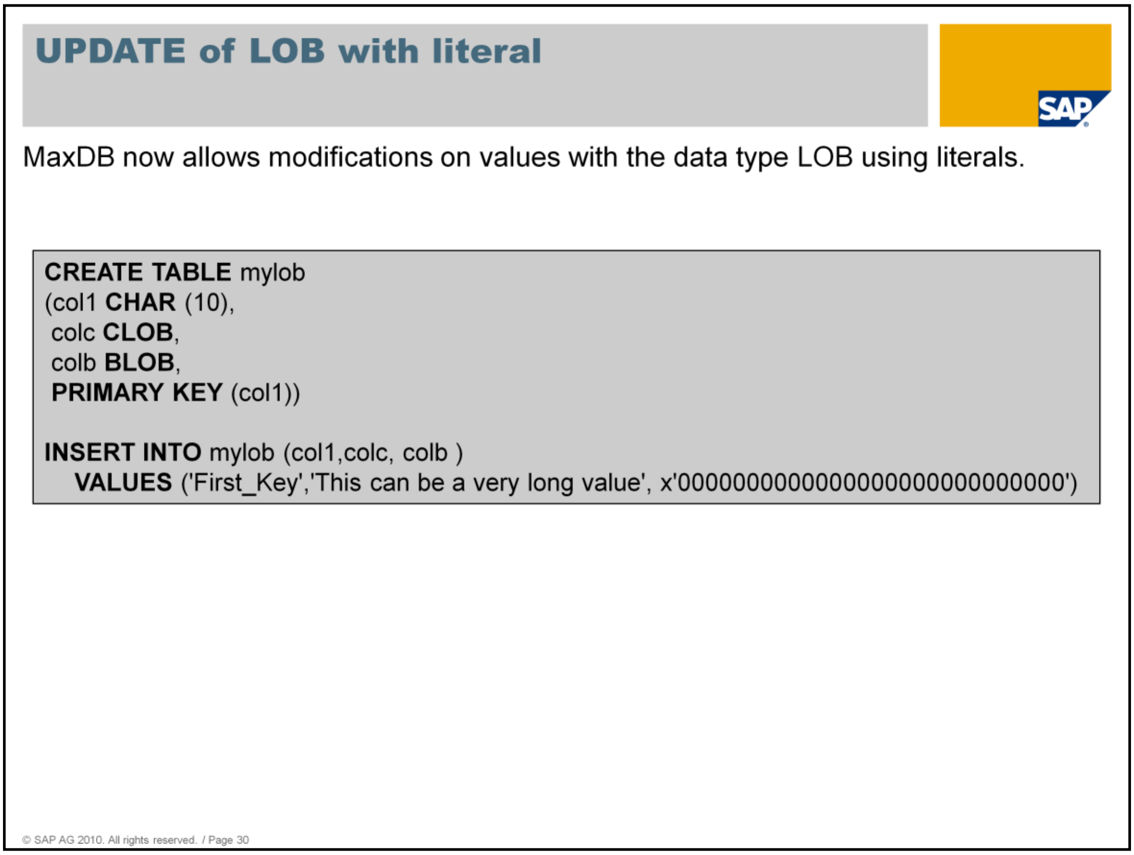
UPSERT

MaxDB now supports the combination of UPDATE and INSERT.

It’s an implementation of the following sequence

```
if record found
   then update record
else
   insert record
```

An application can avoid one communication step with the database when using UPSERT.



UPDATE of LOB with literal

MaxDB now allows modifications on values with the data type LOB using literals.

```
CREATE TABLE mylob
(col1 CHAR (10),
 colc CLOB,
 colb BLOB,
 PRIMARY KEY (col1))

INSERT INTO mylob (col1,colc, colb )
   VALUES ('First_Key','This can be a very long value', x'0000000000000000000000000000')
```

DELETE WITH COMMIT

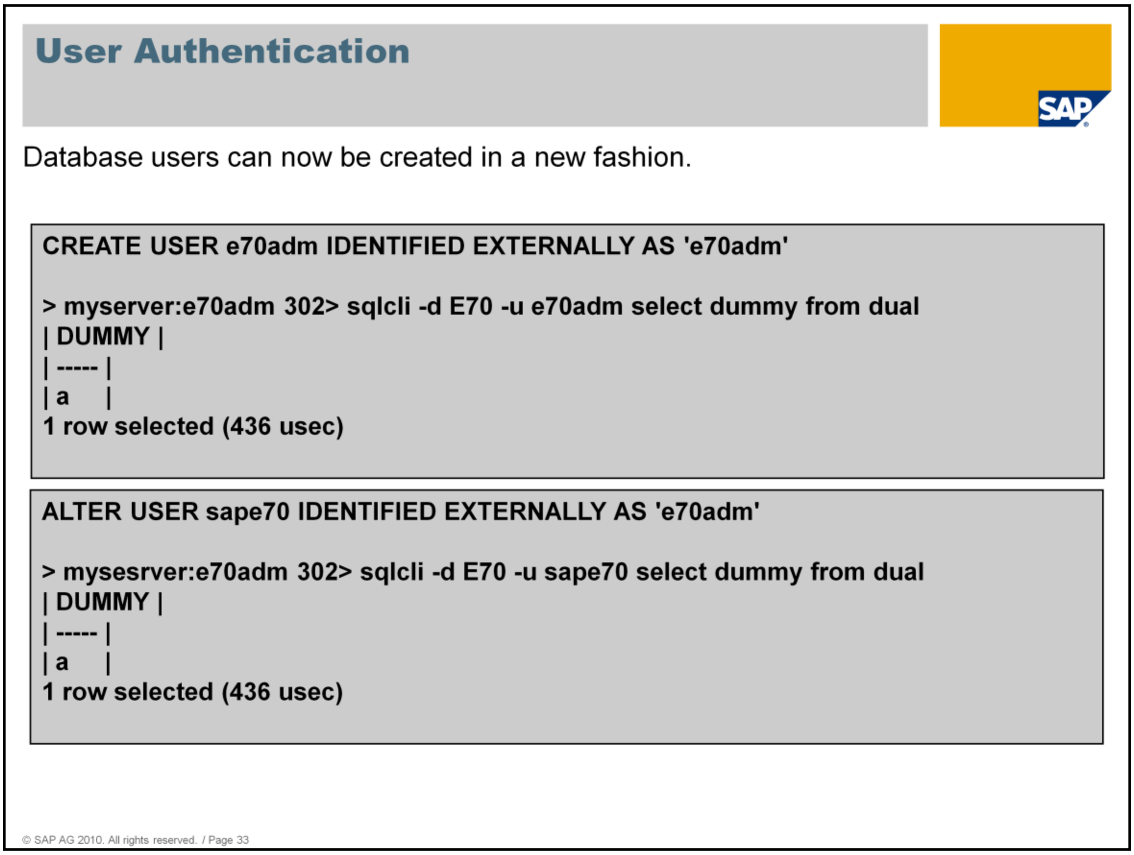
This command will execute the delete operation and subsequently commit it independent of the transaction it runs in. It only works for tables without referential integrity constraints and without trigger definitions. The insert will not be rolled back even if the contextual transaction will be. It might be useful e.g. for writing logs to keep track of your application and extends the INSERT WITH COMMIT introduced with version 7.6.

```
count = 0;
while (sqlcode != 0)
  {
  INSERT INTO tab (…) VALUES (…);
  count++;
  if (count mod 1000 == 0)
      DELETE FROM log_table WHERE key = ‘myentry’
               WITH COMMIT
   }
if (sqlcode != 0)
   COMMIT WORK
```

Enhanced ORDER BY for UNION

MaxDB supports an ORDER BY clause for columns in the column list of the first select in a union query expression.

```
SELECT dummy FROM dual
UNION
SELECT 1 FROM dual
ORDER BY dummy
```



User Authentication

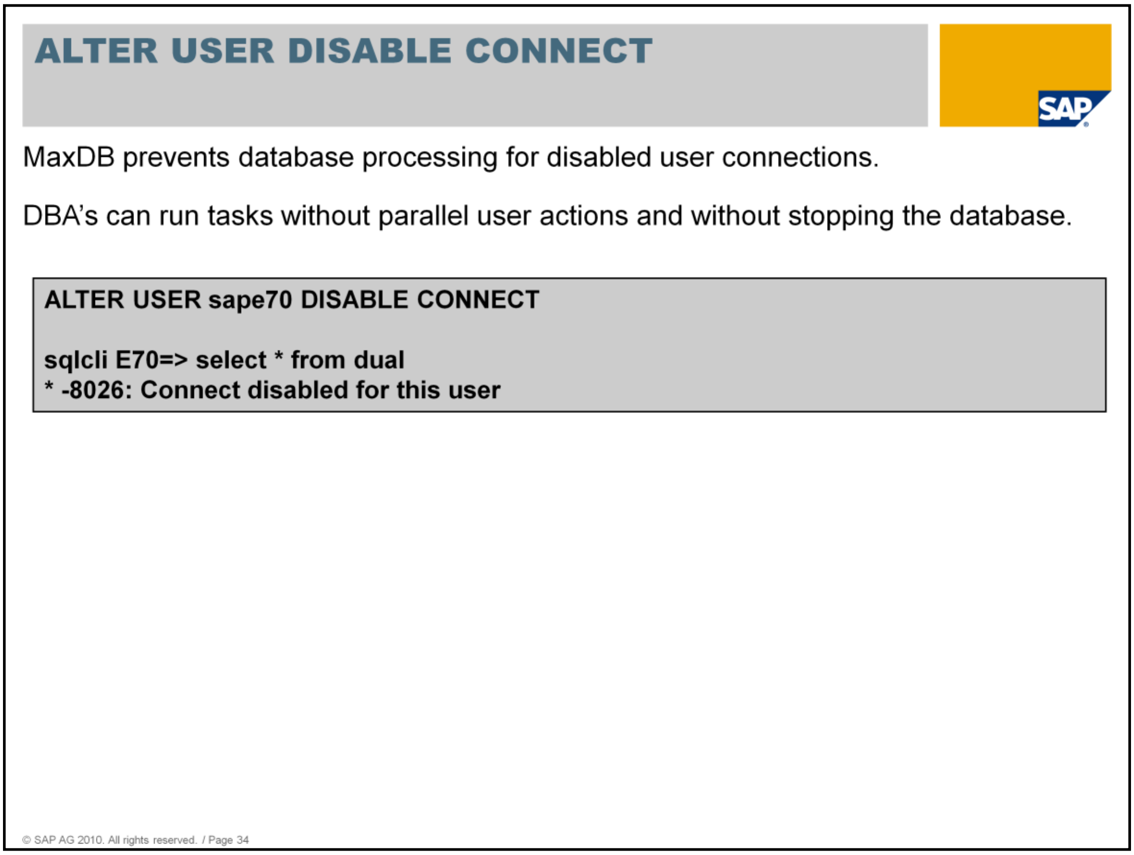
Database users can now be created in a new fashion.

```
CREATE USER e70adm IDENTIFIED EXTERNALLY AS 'e70adm'

> myserver:e70adm 302> sqlcli -d E70 -u e70adm select dummy from dual
| DUMMY |
| ----- |
| a     |
1 row selected (436 usec)
```

```
ALTER USER sape70 IDENTIFIED EXTERNALLY AS 'e70adm'

> mysesrver:e70adm 302> sqlcli -d E70 -u sape70 select dummy from dual
| DUMMY |
| ----- |
| a     |
1 row selected (436 usec)
```

As alternative to the traditional user authentication, database users can now be created in a new fashion.

With this method a user can connect to the database either through his operating system user or through one of the security protocols Kerberos or Secude.



ALTER USER DISABLE CONNECT

MaxDB prevents database processing for disabled user connections.

DBA’s can run tasks without parallel user actions and without stopping the database.

```
ALTER USER sape70 DISABLE CONNECT

sqlcli E70=> select * from dual
* -8026: Connect disabled for this user
```

You can define whether a database user can open database sessions.

If CONNECT mode is not specified, ENABLE CONNECT is implicitly assumed. ENABLE and DISABLE cannot both be specified at the same time.

ENABLE CONNECT: The database user (members of the database user group) can open database sessions.

DISABLE CONNECT: The database user (members of the database user group) cannot open database sessions. ALTER USER|USERGROUP statement: The database sessions of the specified database user (members of the specified database user group) are terminated. You can enable the individual members of a database user group to open database sessions again using the ALTER USER statement.

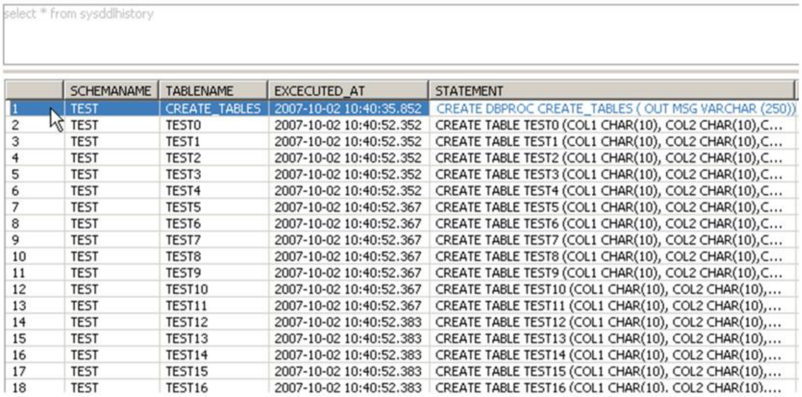
New Role DBA

All DBA users take over the privileges of the system role DBAROLE

```
sqlcli firstdba=> GRANT SELECT ON firstdba.zztele TO dbarole

sqlcli anotherdba=> SELECT * FROM firstdba.zztele
…
```

New View SYSDDLHISTORY

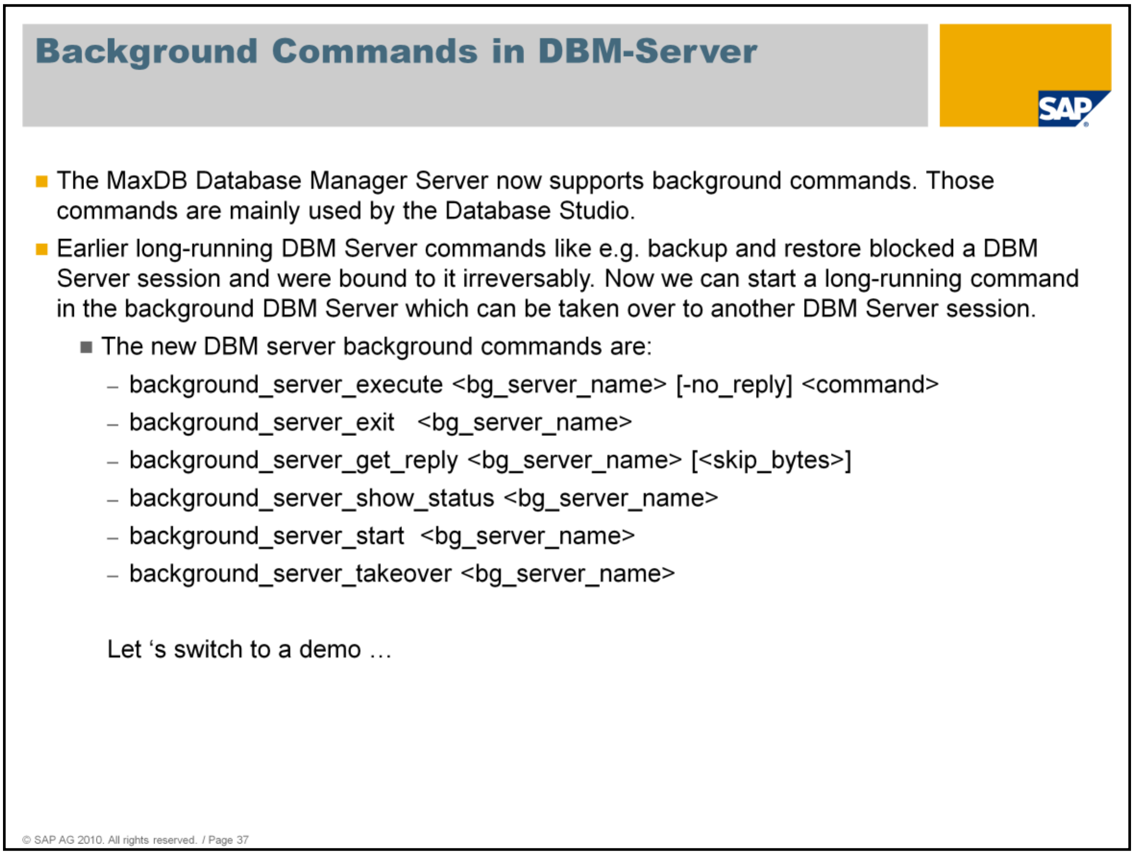
The system view SYSDDLHISTORY shows all DDL commands and the timestamps of the command executions.



```
select * from sysddlhistory
```

	SCHEMANAME	TABLENAME	EXCECUTED_AT	STATEMENT
1	TEST	CREATE_TABLES	2007-10-02 10:40:35.852	CREATE DBPROC CREATE_TABLES (OUT MSG VARCHAR (250))
2	TEST	TEST0	2007-10-02 10:40:52.352	CREATE TABLE TEST0 (COL1 CHAR(10), COL2 CHAR(10),C...
3	TEST	TEST1	2007-10-02 10:40:52.352	CREATE TABLE TEST1 (COL1 CHAR(10), COL2 CHAR(10),C...
4	TEST	TEST2	2007-10-02 10:40:52.352	CREATE TABLE TEST2 (COL1 CHAR(10), COL2 CHAR(10),C...
5	TEST	TEST3	2007-10-02 10:40:52.352	CREATE TABLE TEST3 (COL1 CHAR(10), COL2 CHAR(10),C...
6	TEST	TEST4	2007-10-02 10:40:52.352	CREATE TABLE TEST4 (COL1 CHAR(10), COL2 CHAR(10),C...
7	TEST	TEST5	2007-10-02 10:40:52.367	CREATE TABLE TEST5 (COL1 CHAR(10), COL2 CHAR(10),C...
8	TEST	TEST6	2007-10-02 10:40:52.367	CREATE TABLE TEST6 (COL1 CHAR(10), COL2 CHAR(10),C...
9	TEST	TEST7	2007-10-02 10:40:52.367	CREATE TABLE TEST7 (COL1 CHAR(10), COL2 CHAR(10),C...
10	TEST	TEST8	2007-10-02 10:40:52.367	CREATE TABLE TEST8 (COL1 CHAR(10), COL2 CHAR(10),C...
11	TEST	TEST9	2007-10-02 10:40:52.367	CREATE TABLE TEST9 (COL1 CHAR(10), COL2 CHAR(10),C...
12	TEST	TEST10	2007-10-02 10:40:52.367	CREATE TABLE TEST10 (COL1 CHAR(10), COL2 CHAR(10),...
13	TEST	TEST11	2007-10-02 10:40:52.367	CREATE TABLE TEST11 (COL1 CHAR(10), COL2 CHAR(10),...
14	TEST	TEST12	2007-10-02 10:40:52.383	CREATE TABLE TEST12 (COL1 CHAR(10), COL2 CHAR(10),...
15	TEST	TEST13	2007-10-02 10:40:52.383	CREATE TABLE TEST13 (COL1 CHAR(10), COL2 CHAR(10),...
16	TEST	TEST14	2007-10-02 10:40:52.383	CREATE TABLE TEST14 (COL1 CHAR(10), COL2 CHAR(10),...
17	TEST	TEST15	2007-10-02 10:40:52.383	CREATE TABLE TEST15 (COL1 CHAR(10), COL2 CHAR(10),...
18	TEST	TEST16	2007-10-02 10:40:52.383	CREATE TABLE TEST16 (COL1 CHAR(10), COL2 CHAR(10),...

Please note: SYSDDLHISTORY is a regular table and will grow over time and might take up a lot of space in the database.

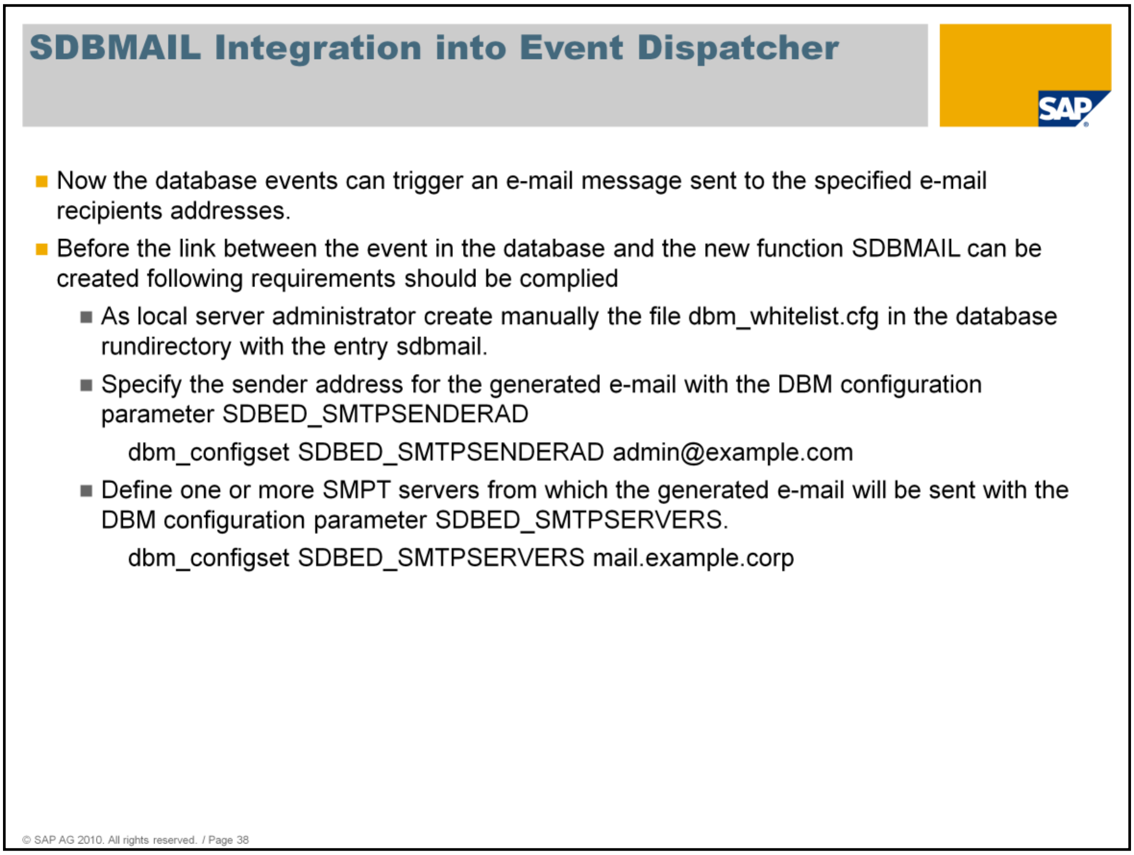


Background Commands in DBM-Server

- The MaxDB Database Manager Server now supports background commands. Those commands are mainly used by the Database Studio.
- Earlier long-running DBM Server commands like e.g. backup and restore blocked a DBM Server session and were bound to it irreversably. Now we can start a long-running command in the background DBM Server which can be taken over to another DBM Server session.
  - The new DBM server background commands are:
    - background_server_execute <bg_server_name> [-no_reply] <command>
    - background_server_exit <bg_server_name>
    - background_server_get_reply <bg_server_name> [<skip_bytes>]
    - background_server_show_status <bg_server_name>
    - background_server_start <bg_server_name>
    - background_server_takeover <bg_server_name>

Let ‘s switch to a demo …

Short description of the demo:
- first window: logon with dbmcli
- second window: logon with dbmcli
- second window: start background server BACKUP, util_connect (no_reply), start the data backup
- first window: dbm_shm_info, takeover of the background server, get reply, util_release (no_reply) and exit
- second window: show status of the background server, check with dbm_shm_info



SDBMAIL Integration into Event Dispatcher

- Now the database events can trigger an e-mail message sent to the specified e-mail recipients addresses.
- Before the link between the event in the database and the new function SDBMAIL can be created following requirements should be complied
  - As local server administrator create manually the file dbm_whitelist.cfg in the database rundirectory with the entry sdbmail.
  - Specify the sender address for the generated e-mail with the DBM configuration parameter SDBED_SMTPSENDERAD

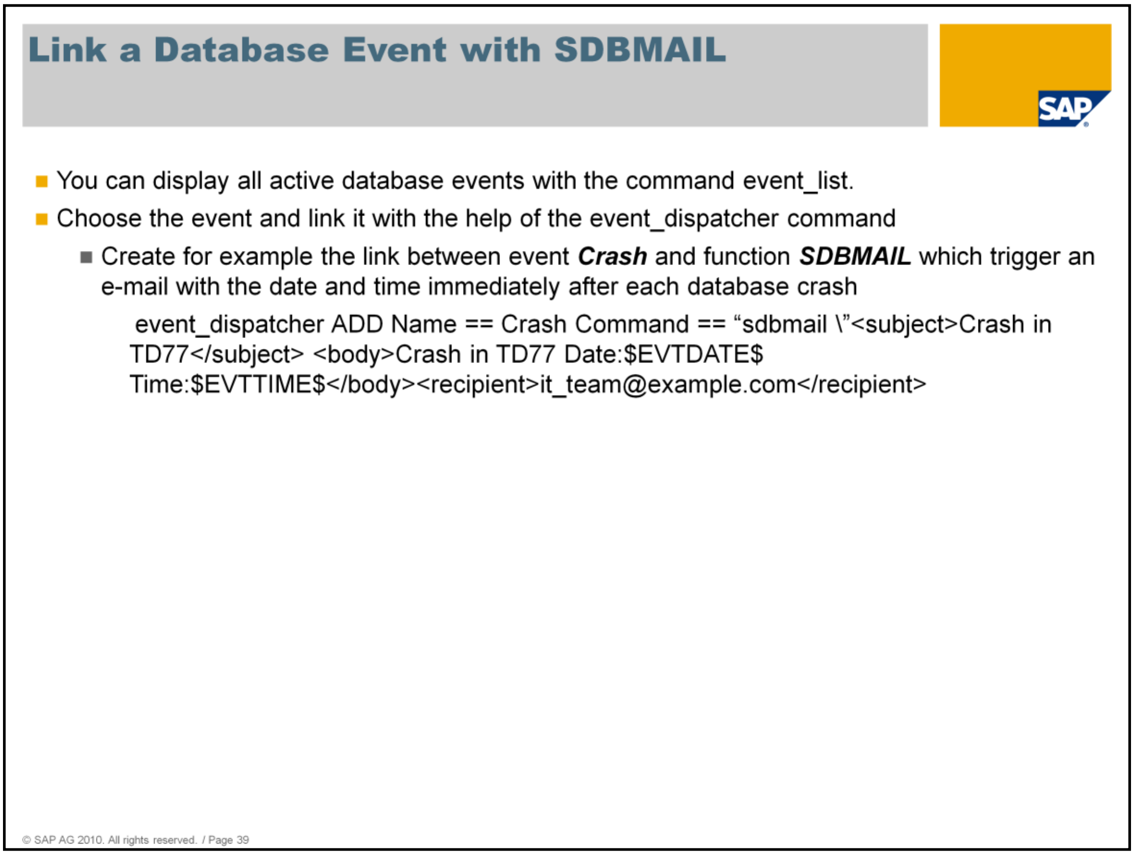
    dbm_configset SDBED_SMTPSENDERAD admin@example.com
  - Define one or more SMPT servers from which the generated e-mail will be sent with the DBM configuration parameter SDBED_SMTPSERVERS.

    dbm_configset SDBED_SMTPSERVERS mail.example.corp

Preparations done for the demo:
Create dbm_whitelist.cfg with entry sdbmail

```
dbm_configset SDBED_SMTPSENDERAD <email address of sender>
```

```
dbm_configset SDBED_SMTPSERVERS mail.sap.corp
```



Link a Database Event with SDBMAIL

- You can display all active database events with the command event_list.
- Choose the event and link it with the help of the event_dispatcher command
  - Create for example the link between event ***Crash*** and function ***SDBMAIL*** which trigger an e-mail with the date and time immediately after each database crash

    event_dispatcher ADD Name == Crash Command == “sdbmail \”<subject>Crash in TD77</subject> <body>Crash in TD77 Date:$EVTDATE$ Time:$EVTTIME$</body><recipient>it_team@example.com</recipient>

Preparations done for the demo:

event_dispatcher ADD Name == Offline Command == "sdbmail \"<subject>Database EXPERDB went into OFFLINE mode</subject> <body>Database EXPERDB went into OFFLINE mode Date:$EVTDATE$ Time:$EVTTIME$</body><recipient>name@sap.com</recipient>

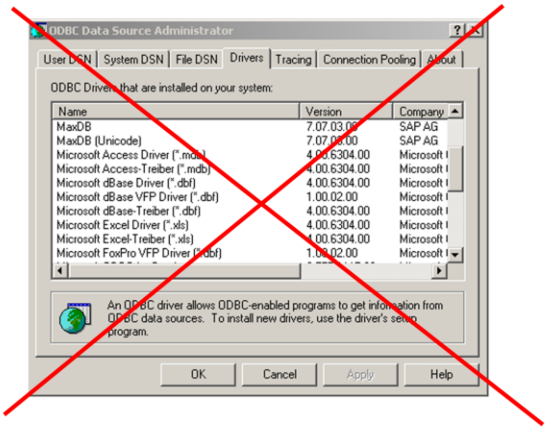
Short description of the demo:
event_list

Switch the database to OFFLINE mode.
➔ Automatic email is generated.

New ODBC Driver

The ODBC Driver has been re-implemented and uses SQLDBC.
The new driver runs with much better performance. Especially bulk operations have been accelerated significantly.

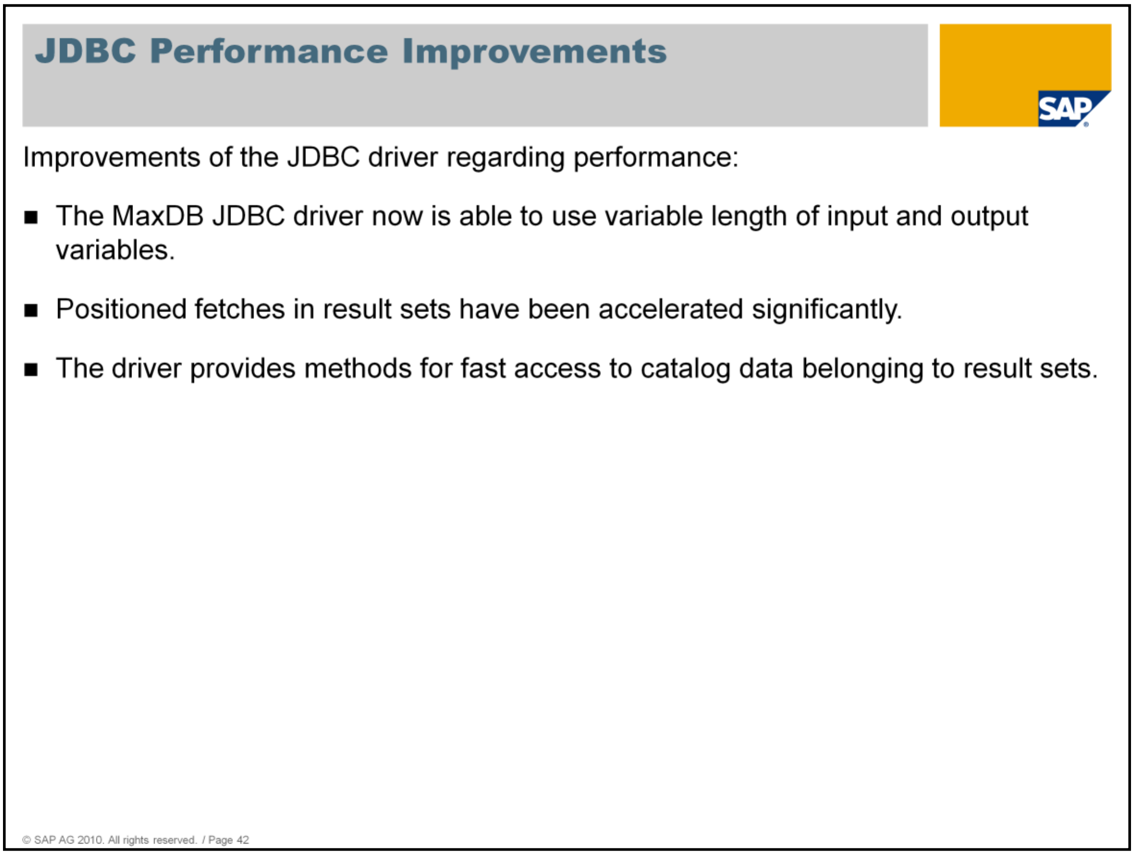
The new ODBC driver can work without the MS ODBC driver manager.



ODBC Drivers that are installed on your system:

Name	Version	Company
MaxDB	7.07.03.00	SAP AG
MaxDB (Unicode)	7.07.03.00	SAP AG
Microsoft Access Driver (*.mdb)	4.00.6304.00	Microsoft
Microsoft Access-Treiber (*.mdb)	4.00.6304.00	Microsoft
Microsoft dBase Driver (*.dbf)	4.00.6304.00	Microsoft
Microsoft dBase VFP Driver (*.dbf)	1.00.02.00	Microsoft
Microsoft dBase-Treiber (*.dbf)	4.00.6304.00	Microsoft
Microsoft Excel Driver (*.xls)	4.00.6304.00	Microsoft
Microsoft Excel-Treiber (*.xls)	4.00.6304.00	Microsoft
Microsoft FoxPro VFP Driver (*.dbf)	1.00.02.00	Microsoft

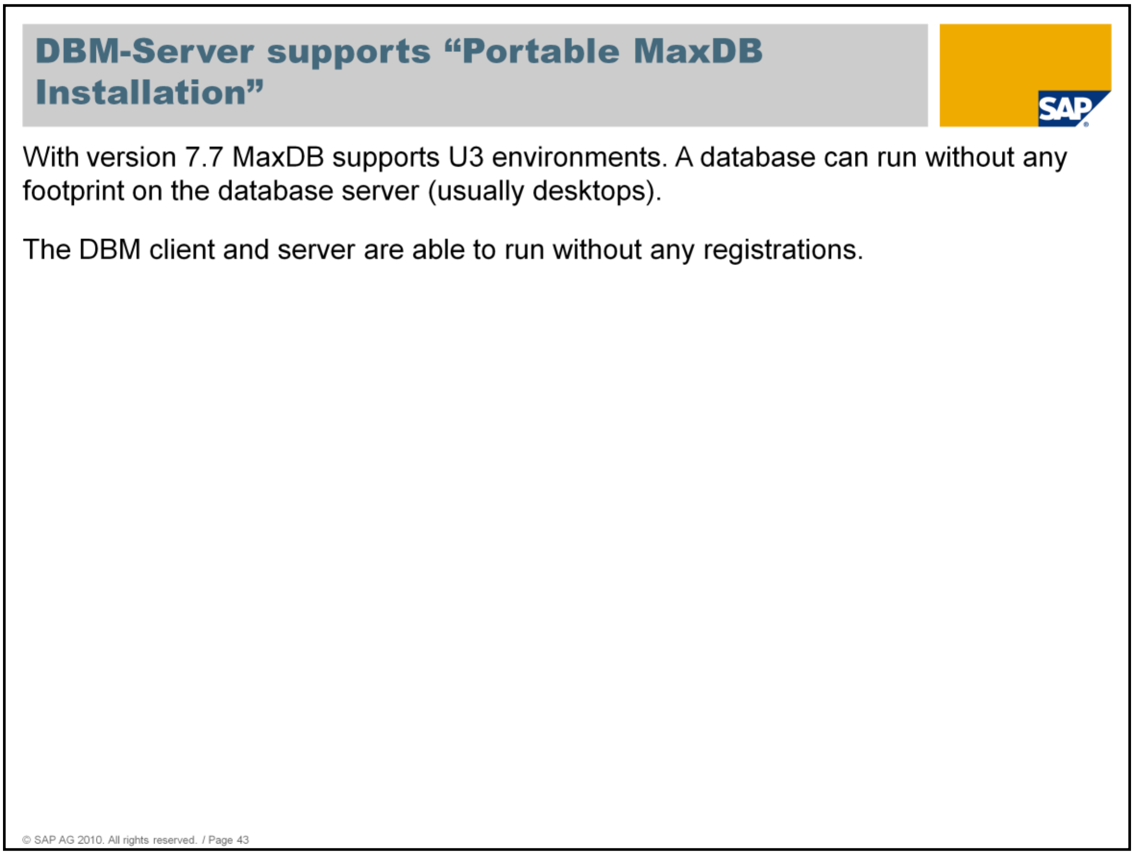
An ODBC driver allows ODBC-enabled programs to get information from ODBC data sources. To install new drivers, use the driver's setup program.



JDBC Performance Improvements

Improvements of the JDBC driver regarding performance:

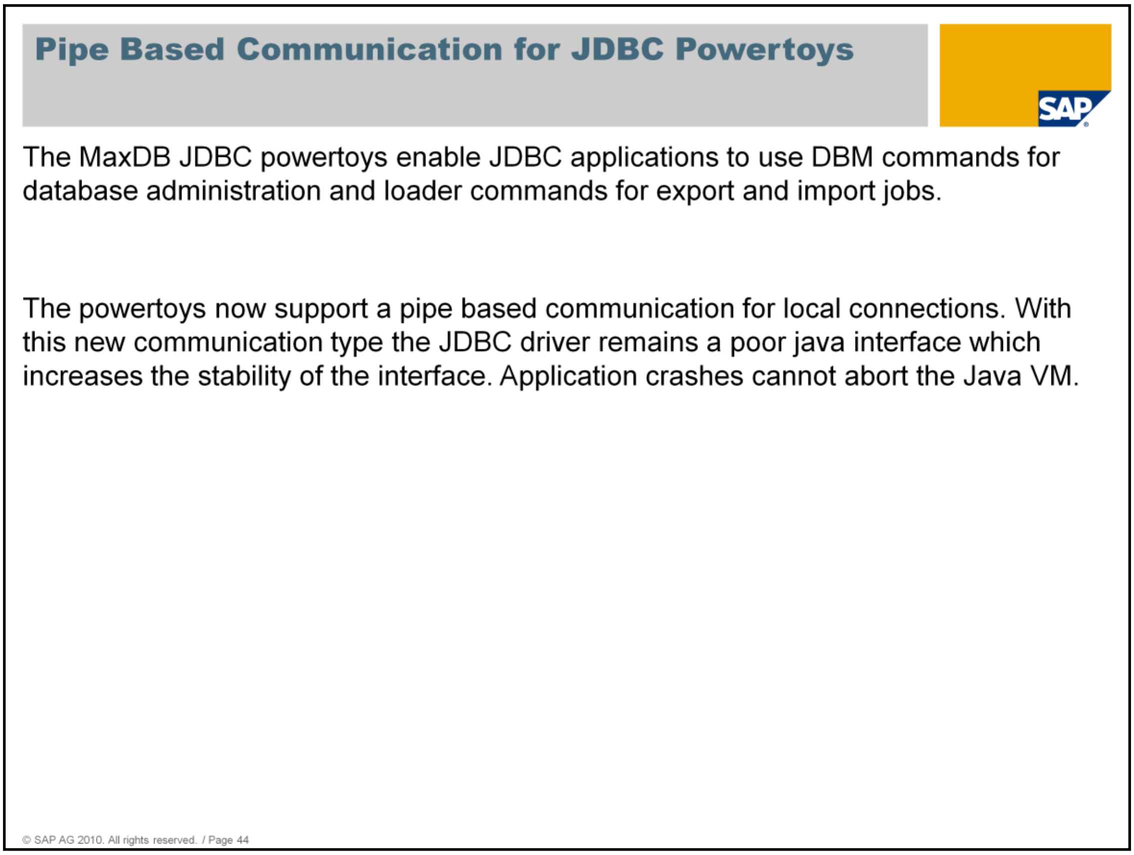
- The MaxDB JDBC driver now is able to use variable length of input and output variables.
- Positioned fetches in result sets have been accelerated significantly.
- The driver provides methods for fast access to catalog data belonging to result sets.



DBM-Server supports “Portable MaxDB Installation”

With version 7.7 MaxDB supports U3 environments. A database can run without any footprint on the database server (usually desktops).

The DBM client and server are able to run without any registrations.



Pipe Based Communication for JDBC Powertoys

The MaxDB JDBC powertoys enable JDBC applications to use DBM commands for database administration and loader commands for export and import jobs.

The powertoys now support a pipe based communication for local connections. With this new communication type the JDBC driver remains a poor java interface which increases the stability of the interface. Application crashes cannot abort the Java VM.

Summary

You have learned about the most important changes in version 7.7

- Some more or less formal changes have been done: new parameter names, new format of KnlMsg, switch to new administration tool Database Manager
- A new I/O concept has been introduced.
- Clustering of tables and indexes accelerates larger scan operations.
- Multiple log partitions are developed.
- Multiple snapshots are possible.
- Some other helpful kernel changes:
  - Lock free index generation
  - Unicode column restriction
  - Other user authentication possible
  - etc.

- New dbmserver functionality

- Some changes concerning ODBC and JDBC

Questions and Answers

Thank You!
Bye, Bye – And Remember Next Session

March 10, 2010	Session 7: SAP MaxDB Software Update Basics