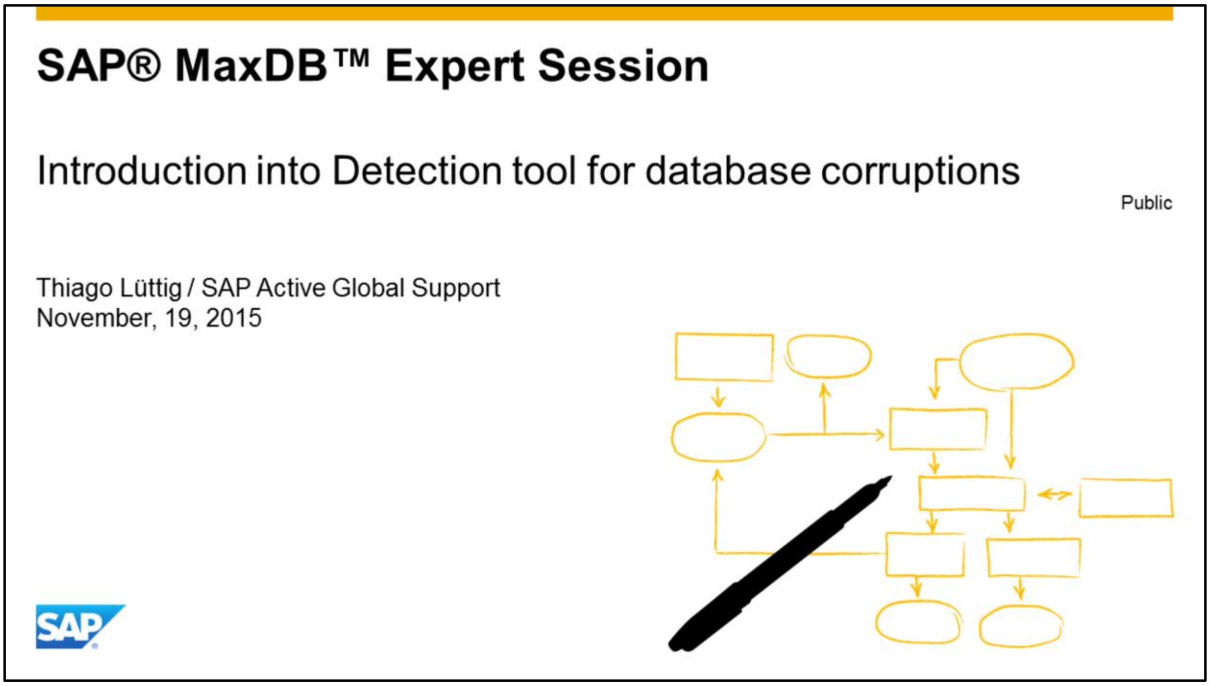
SAP® MaxDB™ Expert Session

SAP® MaxDB™: Detection tool for database corruptions
Thiago Lüttig Nov. 19, 2015

Public

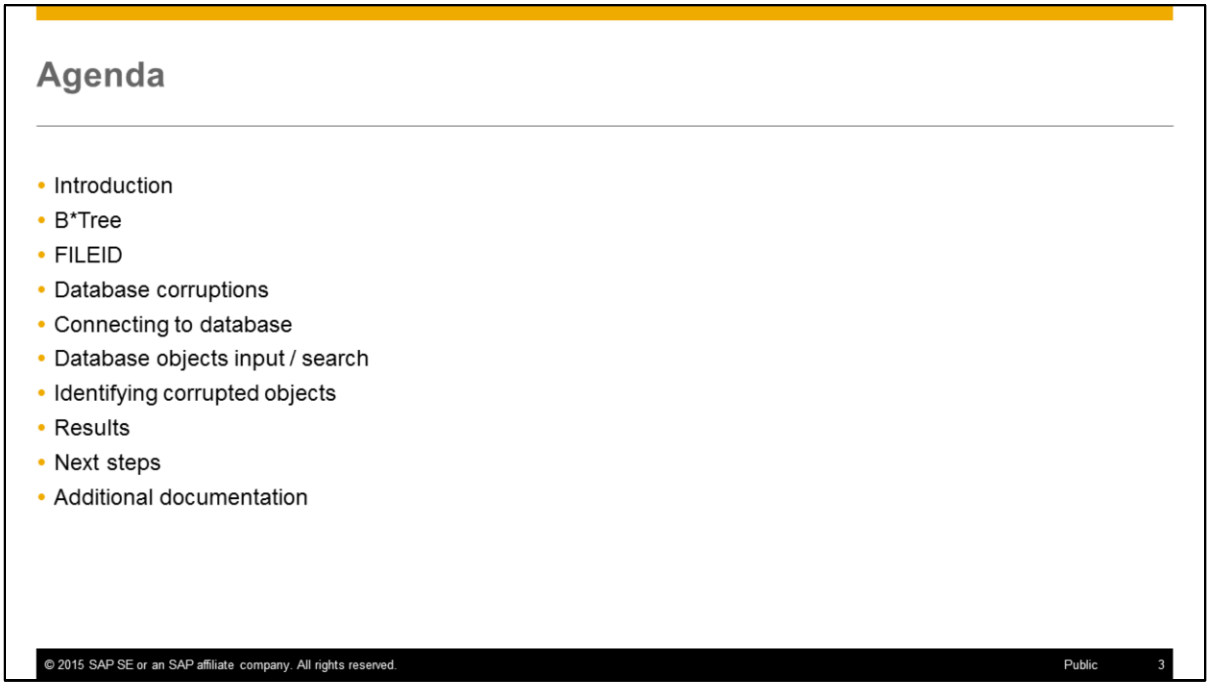


SAP® MaxDB™ Expert Session

Introduction into Detection tool for database corruptions

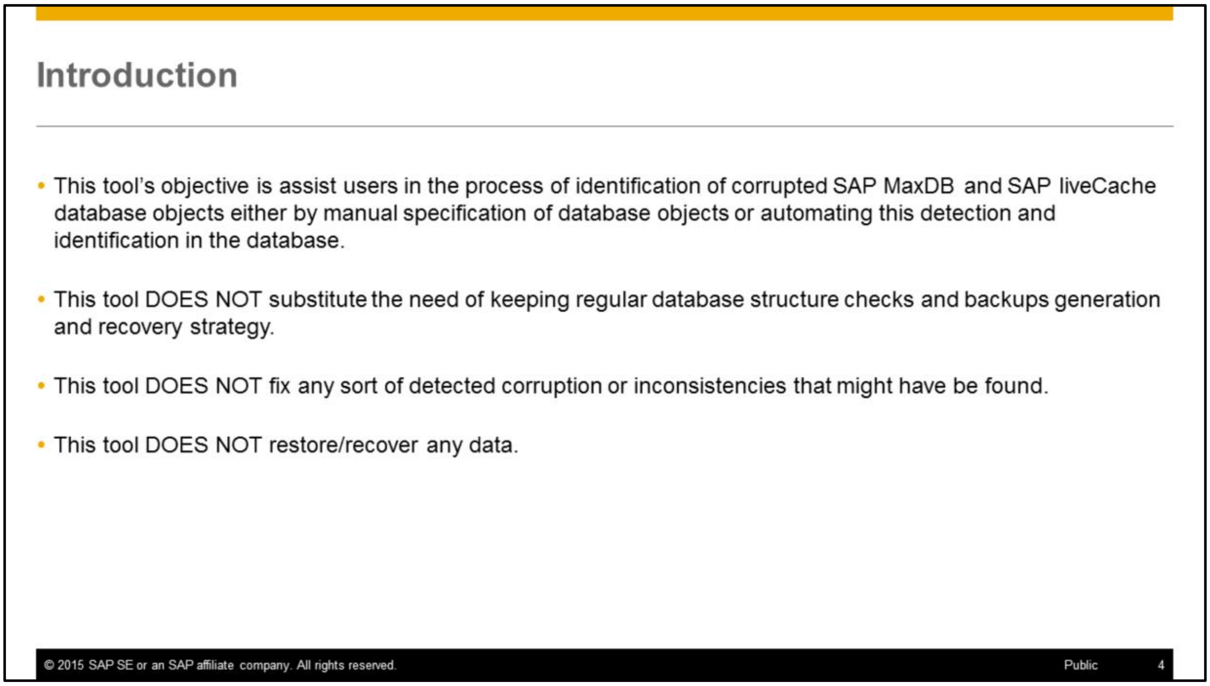
Public

Thiago Lüttig / SAP Active Global Support
November, 19, 2015



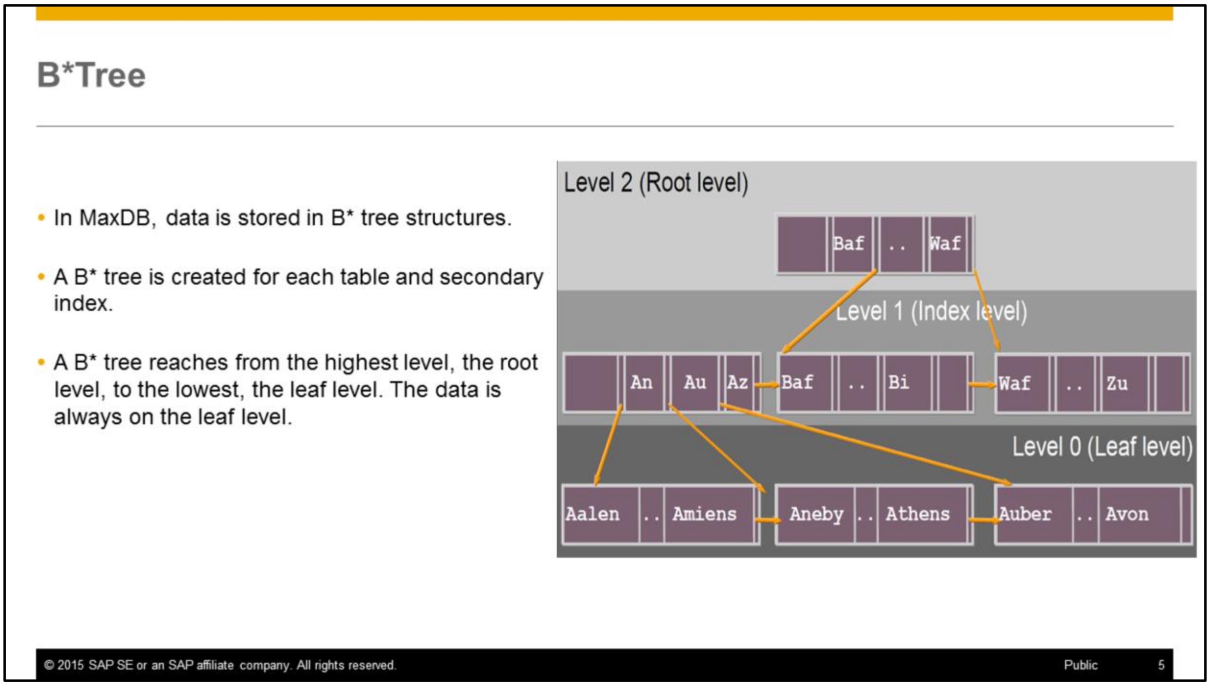
Agenda

- Introduction
- B*Tree
- FILEID
- Database corruptions
- Connecting to database
- Database objects input / search
- Identifying corrupted objects
- Results
- Next steps
- Additional documentation



Introduction

- This tool's objective is assist users in the process of identification of corrupted SAP MaxDB and SAP liveCache database objects either by manual specification of database objects or automating this detection and identification in the database.
- This tool DOES NOT substitute the need of keeping regular database structure checks and backups generation and recovery strategy.
- This tool DOES NOT fix any sort of detected corruption or inconsistencies that might have be found.
- This tool DOES NOT restore/recover any data.



B*Tree

- In MaxDB, data is stored in B* tree structures.
- A B* tree is created for each table and secondary index.
- A B* tree reaches from the highest level, the root level, to the lowest, the leaf level. The data is always on the leaf level.

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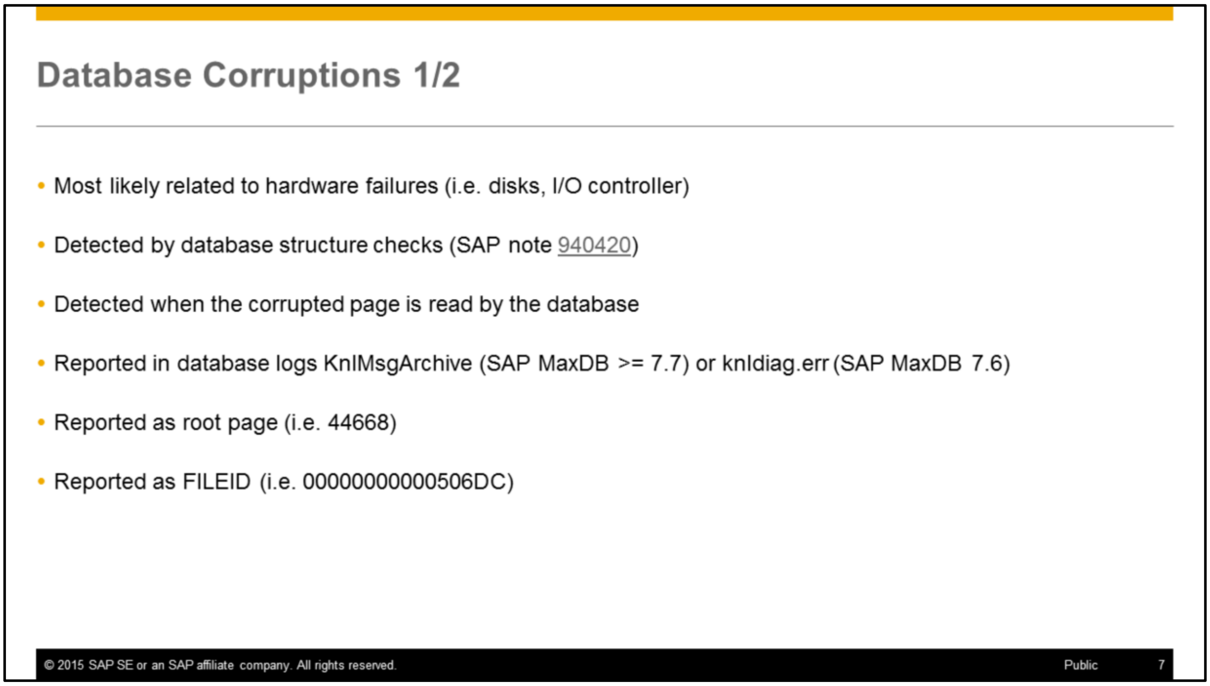
In MaxDB, data is stored in B* tree structures.
The smallest storage unit is the page. In MaxDB, the size of a page is 8 KB.
A B* tree is created for each table and secondary index.
A B* tree reaches from the highest level, the root level, to the lowest, the leaf level. The data is always on the leaf level.
The primary index of the tables serves as a sorting criterion for the setup of the tree structure.
It can be demonstrated that a B* tree procedure generally requires fewer accesses to find single records than other access methods.

FILEID

- A table, which is known to the user by a name, is internally administered with a ‘tableid’. The correlation between the names and **tableid**s is registered in the database system dictionary (catalog).

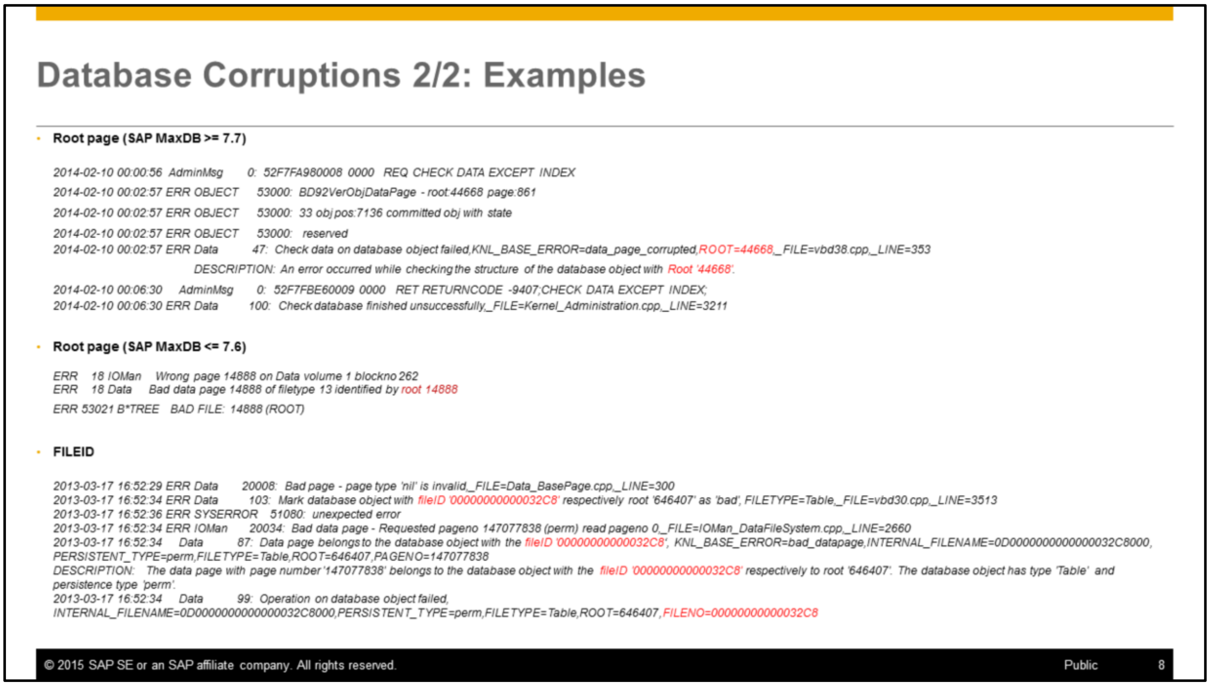
- There is also the database **file directory**, which contains the assignments of the root nodes of the B* trees to the tableids of the database objects. The tableids are stored in the file directory along with a type flag which indicates what contents the underlying B* tree has.

File-Directory				File-Directory		
TABLEID	OWNER	TABLENAME	INDEX NAME	TYPE	ROOT	FILE_ID
0000000000000CE1	SAPS13	CUEX	CUEX~1	NAMED INDEX	119047	C2EB5DA3FFFFFFFF7FFFFFFF0000FFFF07D101000100000A0701000000000000000CE1000000000000
0000000000000CE1	SAPS13	CUEX	?	TABLE	119036	39EA5DA3FFFFFFFF7FFFFFFF0000FFFFFCD001000100000A0D000000000000000CE1000000000000
0000000000000CE1	SAPS13	CUEX	?	SHORT STRING FILE	119030	33EA5DA3FFFFFFFF7FFFFFFF0000FFFFF6D001000100000A12000000000000000CE1000000000000
0000000000000290	?	?	?	LONG COLUMN	4311	122A5CA3FFFFFFFF7FFFFFFF0000FFFFD71000000100000C010000000000000002900000000000000
00000000000004BD	?	?	?	LONG COLUMN	4398	EB2B5CA3FFFFFFFF7FFFFFFF0000FFFF2E1100000100000C01000000000000000004BD000000000000
Datenbank-Katalog						Datenbank-Katalog



Database Corruptions 1/2

- Most likely related to hardware failures (i.e. disks, I/O controller)
- Detected by database structure checks (SAP note 940420)
- Detected when the corrupted page is read by the database
- Reported in database logs KnlMsgArchive (SAP MaxDB >= 7.7) or knldiag.err (SAP MaxDB 7.6)
- Reported as root page (i.e. 44668)
- Reported as FILEID (i.e. 00000000000506DC)



Database Corruptions 2/2: Examples

- **Root page (SAP MaxDB >= 7.7)**

```
2014-02-10 00:00:56  AdminMsg       0:  52F7FA980008  0000   REQ  CHECK DATA EXCEPT  INDEX
2014-02-10 00:02:57 ERR OBJECT     53000:  BD92VerObjDataPage - root:44668 page:861
2014-02-10 00:02:57 ERR OBJECT     53000:  33 obj pos:7136 committed obj with  state
2014-02-10 00:02:57 ERR OBJECT     53000:   reserved
2014-02-10 00:02:57 ERR Data        47:  Check data on database object failed,KNL_BASE_ERROR=data_page_corrupted,ROOT=44668,_FILE=vbd38.cpp,_LINE=353
                         DESCRIPTION:  An error occurred while checking the structure  of the database object with  Root '44668'.
2014-02-10 00:06:30     AdminMsg       0:  52F7FBE60009  0000   RET RETURNCODE  -9407;CHECK  DATA EXCEPT  INDEX;
2014-02-10 00:06:30 ERR Data        100:  Check database finished unsuccessfully,_FILE=Kernel_Administration.cpp,_LINE=3211
```

- **Root page (SAP MaxDB <= 7.6)**

```
ERR    18 IOMan    Wrong page 14888 on Data volume 1 blockno 262
ERR    18 Data     Bad data page 14888 of filetype 13 identified by root 14888
ERR 53021 B*TREE   BAD FILE:  14888 (ROOT)
```

- **FILEID**

```
2013-03-17 16:52:29 ERR Data       20008:  Bad page - page type 'nil' is invalid,_FILE=Data_BasePage.cpp,_LINE=300
2013-03-17 16:52:34 ERR Data        103:  Mark database object with fileID '00000000000032C8' respectively  root '646407' as 'bad', FILETYPE=Table,_FILE=vbd30.cpp,_LINE=3513
2013-03-17 16:52:36 ERR SYSERROR   51080:  unexpected error
2013-03-17 16:52:34 ERR IOMan      20034:  Bad data page - Requested pageno 147077838 (perm) read pageno 0,_FILE=IOMan_DataFileSystem.cpp,_LINE=2660
2013-03-17 16:52:34     Data        87:  Data page belongs to the database object with  the fileID '00000000000032C8', KNL_BASE_ERROR=bad_datapage,INTERNAL_FILENAME=0D000000000000032C8000,
PERSISTENT_TYPE=perm,FILETYPE=Table,ROOT=646407,PAGENO=147077838
DESCRIPTION:   The data page with  page number '147077838' belongs to the database object with  the  fileID '00000000000032C8' respectively to root '646407'.  The database object has type 'Table'  and
persistence type  'perm'.
2013-03-17 16:52:34     Data        99:  Operation  on database object failed,
INTERNAL_FILENAME=0D000000000000032C8000,PERSISTENT_TYPE=perm,FILETYPE=Table,ROOT=646407,FILENO=00000000000032C8
```

- In above examples, the part of interest for this detection is the root page of the object. This is the first data page of the object's B*tree and it is the single entry point of the B*tree.
In the examples, we can see that it is reported in the following lines respectively:

*An error occurred while checking the structure of the database object with **Root '44668'**.*

and

*The data page with page number '147077838' belongs to the database object with the fileID '00000000000032C8' respectively to **root '646407'***

and

*ERR 18 Data Bad data page 14888 of filetype 13 identified by **root 14888***

- Also, there are some cases where the **fileID (or FILENO)** field is the relevant one for the search of the corrupted objects (versions >= 7.6).
Whenever you see it being reported like:

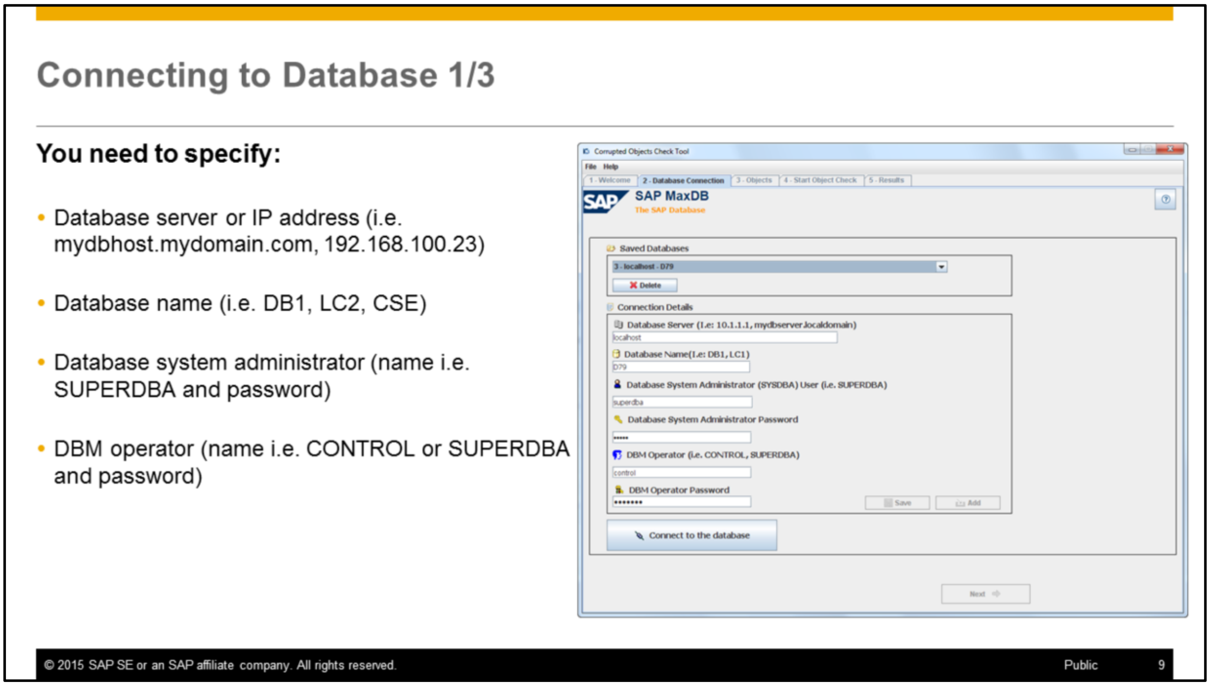
*The data page with page number '147077838' belongs to the database object with the **fileID '00000000000032C8'** respectively to root '646407'*

or

*Mark index as not accessible,REASON=no redo of index creation,ROOT=2147483647,**FILENO=00000000000506DC**'*

or

Check data on database object failed,KNL_BASE_ERROR=index_not_accessible,ROOT=NIL,**FILENO=00000000000506DC**,_FILE=vbd38.cpp,_LINE=674



Connecting to Database 1/3

You need to specify:

- Database server or IP address (i.e. mydbhost.mydomain.com, 192.168.100.23)
- Database name (i.e. DB1, LC2, CSE)
- Database system administrator (name i.e. SUPERDBA and password)
- DBM operator (name i.e. CONTROL or SUPERDBA and password)

Saved Databases: 3 - localhost - D79

Connection Details

Database Server (I.e: 10.1.1.1, mydbserver.localdomain): localhost

Database Name(I.e: DB1, LC1): D79

Database System Administrator (SYSDBA) User (i.e. SUPERDBA): superdba

Database System Administrator Password: •••••

DBM Operator (i.e. CONTROL, SUPERDBA): control

DBM Operator Password: •••••••

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In this screen, you need to fill all the connection details for the database that will be verified. You need to specify:

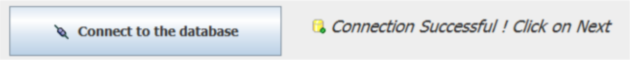
- Database server name or IP address
- Database name
- Database system administrator (name i.e. SUPERDBA and password)
- DBM operator (name i.e. CONTROL, SUPERDBA and password)

You can also select a previously saved connection from the dropdown list

Connecting to Database 2/3

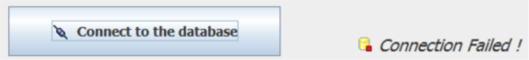
- Once the details are entered of the existent connection is selected, user can establish the database connection by clicking on the *Connect to the database* button save the existent connection.

- If the connection is successful user can advance to the next screen.

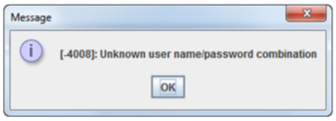


Connection Successful ! Click on Next

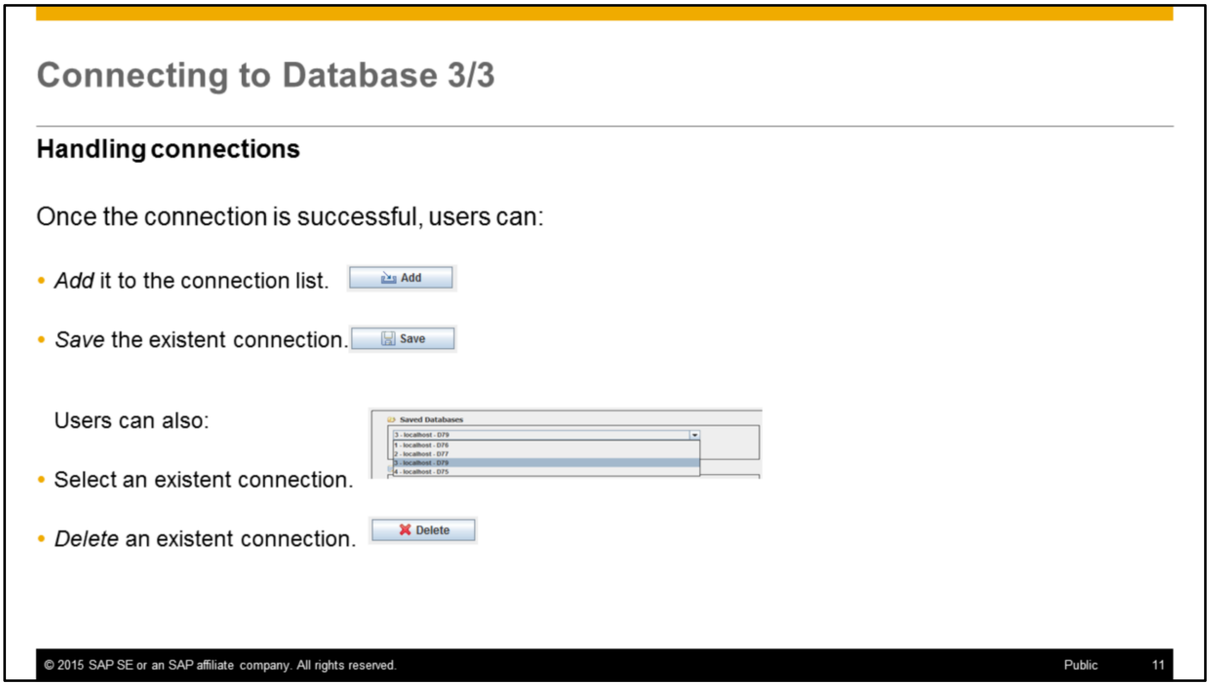
- If the connection fails, a connection failed message will be displayed alongside the relevant error (i.e. invalid host, user or password is invalid).



Connection Failed !



[-4008]: Unknown user name/password combination



Connecting to Database 3/3

Handling connections

Once the connection is successful, users can:

- *Add* it to the connection list.
- *Save* the existent connection.

Users can also:

- Select an existent connection.
- *Delete* an existent connection.

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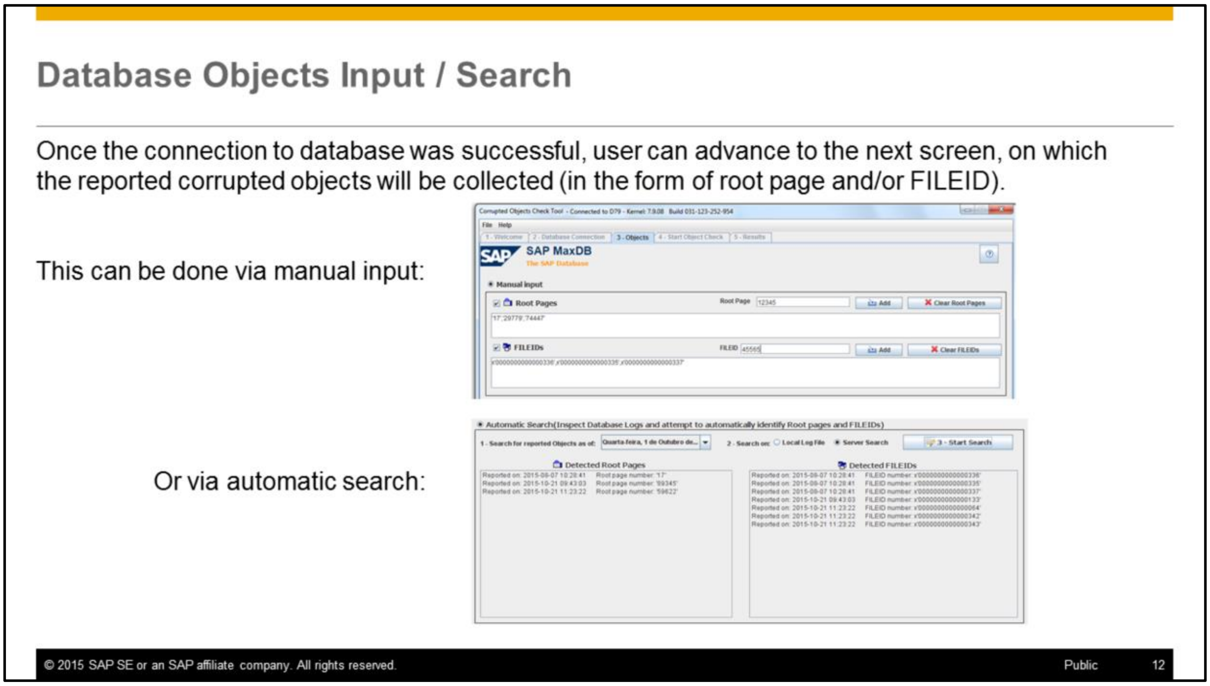
- Once user has established a successful connection, its details (server, database name, users) can be saved for later usage by clicking on *Add* button.
- User can remove previously saved connection by selecting the desired connection from the list, and clicking on *Delete* button.
- User can also save an existent connection if any details have been changed (i.e. user has changed the database system administrator password in the database).

It can be done by clicking on *Save* button once the connection is successful.



Database Objects Input / Search

Once the connection to database was successful, user can advance to the next screen, on which the reported corrupted objects will be collected (in the form of root page and/or FILEID).

This can be done via manual input:

● Manual input

☑ Root Pages — Root Page: 12345

'17';'29779';'74447'

☑ FILEIDs — FILEID: 45565

x'000000000000336',x'000000000000335',x'000000000000337'

Or via automatic search:

● Automatic Search(Inspect Database Logs and attempt to automatically identify Root pages and FILEIDs)

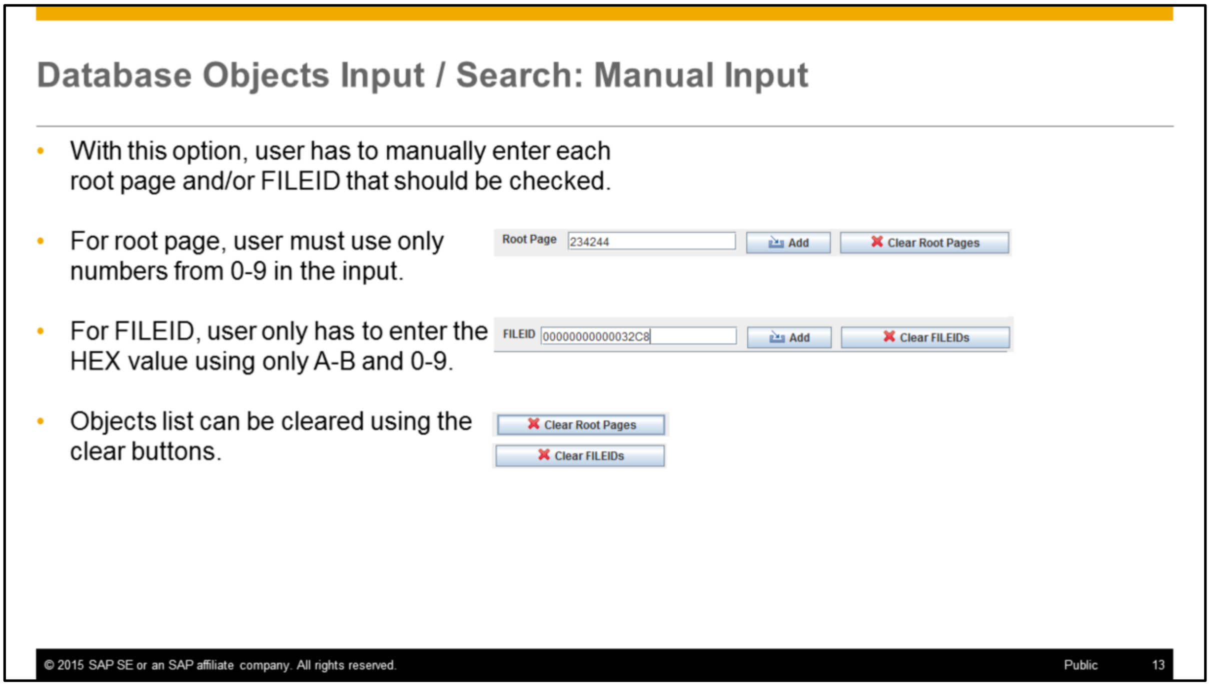
1 - Search for reported Objects as of: Quarta-feira, 1 de Outubro de...

2 - Search on: ○ Local Log File ● Server Search

```
Reported on: 2015-08-07 10:28:41    Root page number: '17'
Reported on: 2015-10-21 09:43:03    Root page number: '89345'
Reported on: 2015-10-21 11:23:22    Root page number: '59622'
```

```
Reported on: 2015-08-07 10:28:41    FILEID number: x'000000000000336'
Reported on: 2015-08-07 10:28:41    FILEID number: x'000000000000335'
Reported on: 2015-08-07 10:28:41    FILEID number: x'000000000000337'
Reported on: 2015-10-21 09:43:03    FILEID number: x'000000000000133'
Reported on: 2015-10-21 11:23:22    FILEID number: x'000000000000064'
Reported on: 2015-10-21 11:23:22    FILEID number: x'000000000000342'
Reported on: 2015-10-21 11:23:22    FILEID number: x'000000000000343'
```

- To use the manual input mode, user has to know which are the root pages or FILEIDs beforehand.
- Automatic search directly scans database logs (either via *diagpkg.tgz* diagnostics package or directly in the server) and identifies the reported root pages and FILEIDS as of the specified search date.



Database Objects Input / Search: Manual Input

- With this option, user has to manually enter each root page and/or FILEID that should be checked.
- For root page, user must use only numbers from 0-9 in the input.
- For FILEID, user only has to enter the HEX value using only A-B and 0-9.
- Objects list can be cleared using the clear buttons.

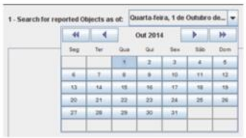
Root Page 234244

FILEID 00000000000032C8

- The root page is identified by a numeric value.
- FILEID is identified by a HEX value.

Database Objects Input / Search: Automatic Search 1/3

- With this option, user can trigger a search in the database logs as of a given selected date and the automatic detection of reported corrupted objects
- The search period can be defined by the date selector.

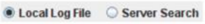


1 - Search for reported Objects as of: Quarta-feira, 1 de Outubro de...

Out 2014

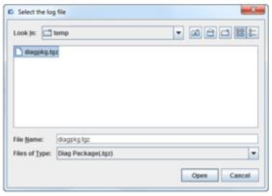
Seg	Ter	Qua	Qui	Sex	Sáb	Dom
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

- Logs can be searched using a generated diagnostics package (*diag_pack*).



● Local Log File ○ Server Search

- If user wants to use the *diag_pack*, a selection window will be displayed



Select the log file

Look In: temp

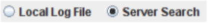
diagpkg.tgz

File Name: diagpkg.tgz

Files of Type: Diag Package(.tgz)

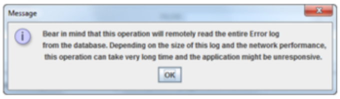
Database Objects Input / Search: Automatic Search 2/3

- User can also search the logs directly in the database server.



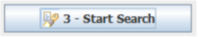
○ Local Log File ● Server Search

- The search runtime can depend on network’s performance and the database logs size.



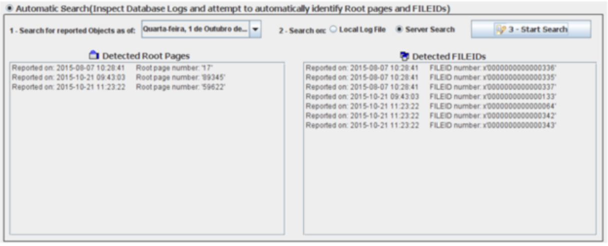
Bear in mind that this operation will remotely read the entire Error log
from the database. Depending on the size of this log and the network performance,
this operation can take very long time and the application might be unresponsive.

- Once the search start date and location is specified user can start the search by clicking on *Start Search* button.



Database Objects Input / Search: Automatic Search 3/3

- All detected objects will be added to the list.



● Automatic Search(Inspect Database Logs and attempt to automatically identify Root pages and FILEIDs)

1 - Search for reported Objects as of: Quarta-feira, 1 de Outubro de...

2 - Search on: ○ Local Log File ● Server Search

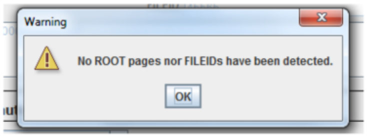
Detected Root Pages

```
Reported on: 2015-08-07 10:28:41    Root page number: '17'
Reported on: 2015-10-21 09:43:03    Root page number: '89345'
Reported on: 2015-10-21 11:23:22    Root page number: '59622'
```

Detected FILEIDs

```
Reported on: 2015-08-07 10:28:41    FILEID number: x'0000000000000336'
Reported on: 2015-08-07 10:28:41    FILEID number: x'0000000000000335'
Reported on: 2015-08-07 10:28:41    FILEID number: x'0000000000000337'
Reported on: 2015-10-21 09:43:03    FILEID number: x'0000000000000133'
Reported on: 2015-10-21 11:23:22    FILEID number: x'0000000000000064'
Reported on: 2015-10-21 11:23:22    FILEID number: x'0000000000000342'
Reported on: 2015-10-21 11:23:22    FILEID number: x'0000000000000343'
```

- If no reported objects were identified as of the specified search date, an information message will be displayed.

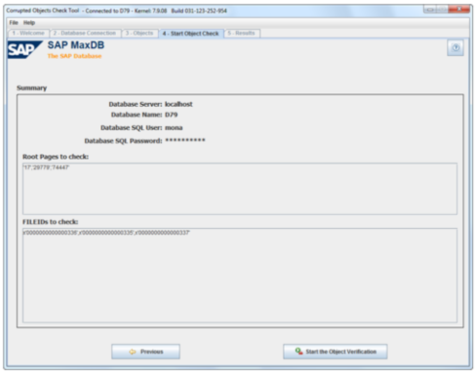


Warning

No ROOT pages nor FILEIDs have been detected.

Identifying Corrupted Objects

- Once all objects were entered or detected, the summary screen will be shown with the database details and objects that will be identified.



Summary

Database Server: localhost
Database Name: D79
Database SQL User: mona
Database SQL Password: **********

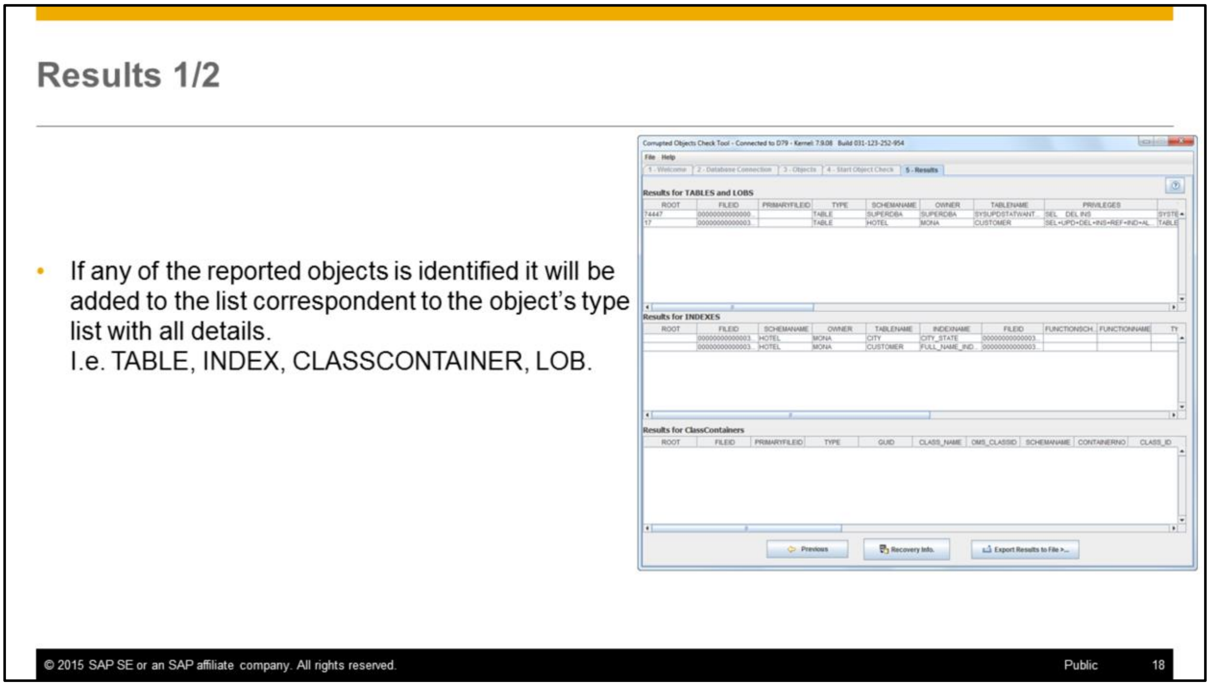
Root Pages to check:

'17','29779','74447'

FILEIDs to check:

x'0000000000000336',x'0000000000000335',x'0000000000000337'

- The identification process is started once user click on the *Start the Object Verification* button.



Results 1/2

- If any of the reported objects is identified it will be added to the list correspondent to the object's type list with all details.
  I.e. TABLE, INDEX, CLASSCONTAINER, LOB.

Corrupted Objects Check Tool - Connected to D79 - Kernel: 7.9.08 Build 031-123-252-954
File
Help
1 - Welcome
2 - Database Connection
3 - Objects
4 - Start Object Check
5 - Results

Results for TABLES and LOBS

ROOT	FILEID	PRIMARYFILEID	TYPE	SCHEMANAME	OWNER	TABLENAME	PRIVILEGES	
74447	00000000000000...		TABLE	SUPERDBA	SUPERDBA	SYSUPDSTATWANT...	SEL DEL INS	SYSTE
17	0000000000003...		TABLE	HOTEL	MONA	CUSTOMER	SEL+UPD+DEL+INS+REF+IND+AL...	TABLE

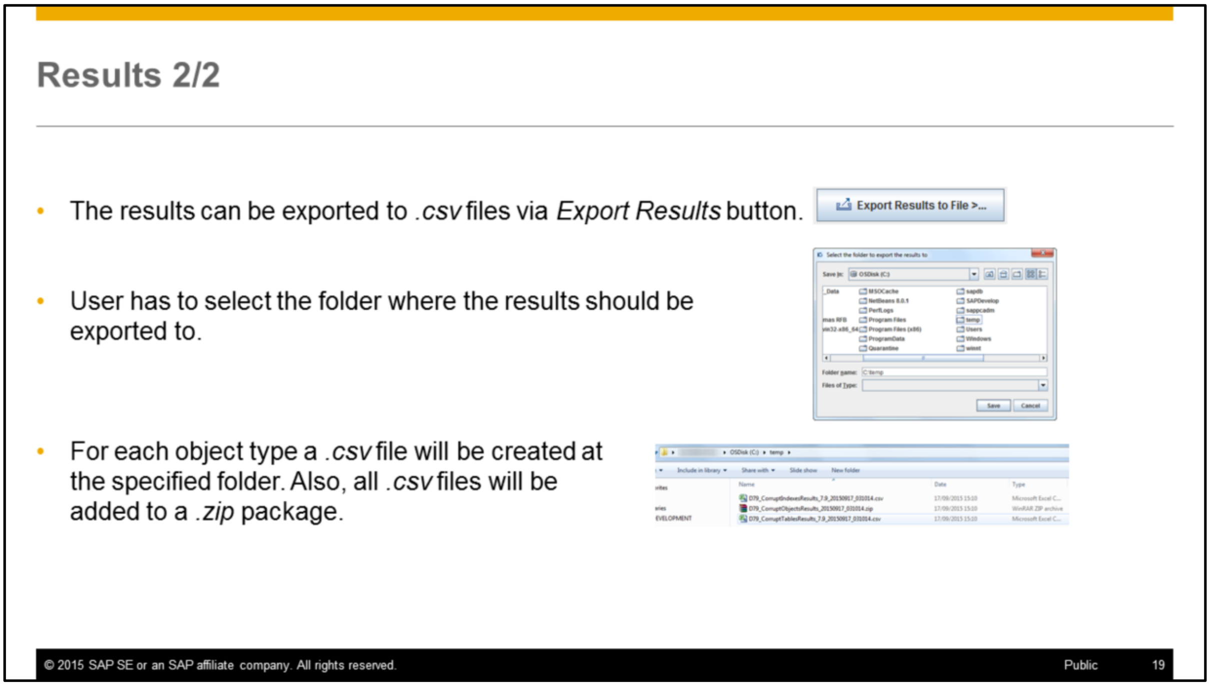
Results for INDEXES

ROOT	FILEID	SCHEMANAME	OWNER	TABLENAME	INDEXNAME	FILEID	FUNCTIONSCH...	FUNCTIONNAME	TY
	0000000000003...	HOTEL	MONA	CITY	CITY_STATE	0000000000003...			
	0000000000003...	HOTEL	MONA	CUSTOMER	FULL_NAME_IND...	0000000000003...			

Results for ClassContainers

ROOT	FILEID	PRIMARYFILEID	TYPE	GUID	CLASS_NAME	OMS_CLASSID	SCHEMANAME	CONTAINERNO	CLASS_ID

- CLASSCONTAINER is a data type relevant for SAP liveCache databases only.



Results 2/2

- The results can be exported to *.csv* files via *Export Results* button.
- User has to select the folder where the results should be exported to.
- For each object type a *.csv* file will be created at the specified folder. Also, all *.csv* files will be added to a *.zip* package.

Folder name: C:\temp

Name	Date	Type
D79_CorruptIndexesResults_7.9_20150917_031014.csv	17/09/2015 15:10	Microsoft Excel C...
D79_CorruptObjectsResults_20150917_031014.zip	17/09/2015 15:10	WinRAR ZIP archive
D79_CorruptTablesResults_7.9_20150917_031014.csv	17/09/2015 15:10	Microsoft Excel C...

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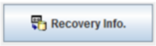
- The .zip package can be provided to SAP support if requested alongside any other database logs.

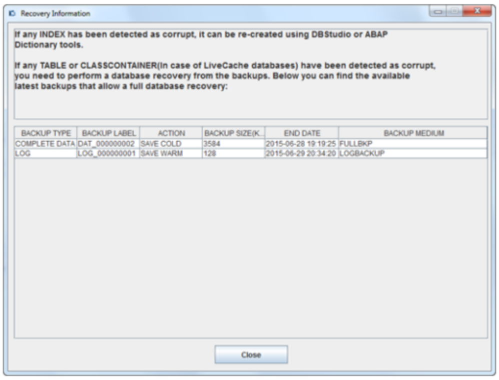
Next Steps

- If the corrupted object is a TABLE, LOB or CLASSCONTAINER most likely the database has to be recovered from backups. To check what are the most recent backups that would allow a complete database recovery, user can click on the *Recovery Info* button.

- If the corrupted object is an INDEX, it could be re-created using Database Studio or ABAP dictionary tools (like SE14).

- For more information about database recovery check SAP note 1377148

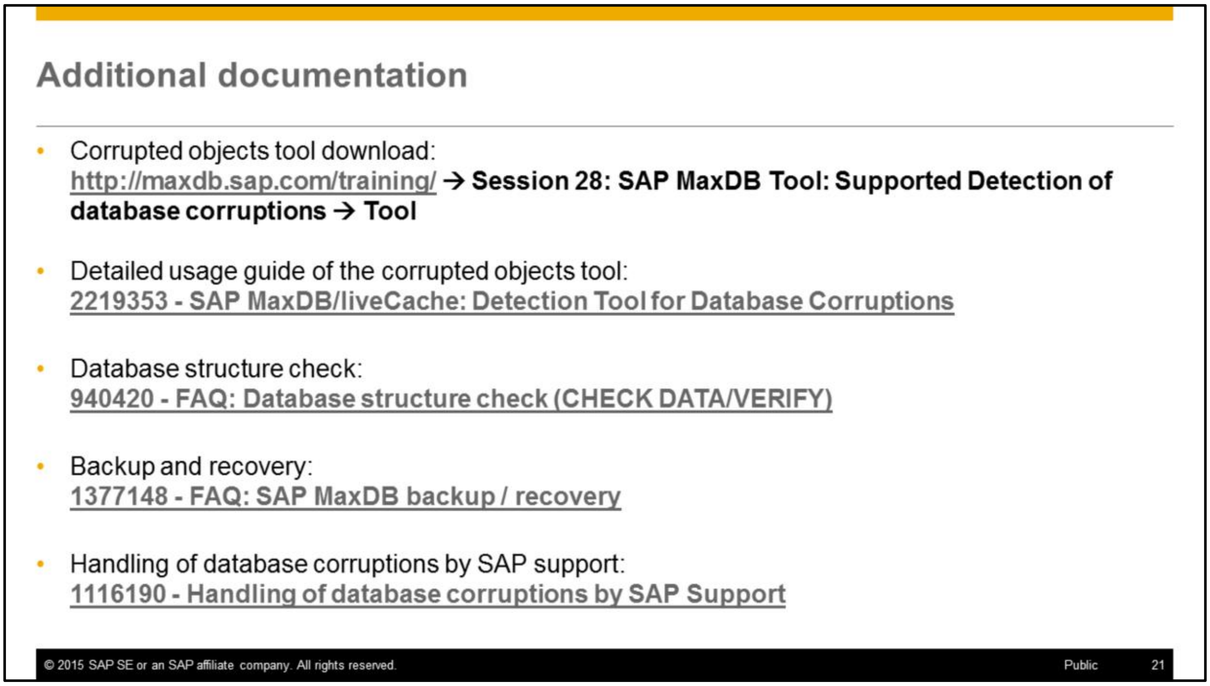




If any INDEX has been detected as corrupt, it can be re-created using DBStudio or ABAP Dictionary tools.

If any TABLE or CLASSCONTAINER(In case of LiveCache databases) have been detected as corrupt, you need to perform a database recovery from the backups. Below you can find the available latest backups that allow a full database recovery:

BACKUP TYPE	BACKUP LABEL	ACTION	BACKUP SIZE(K...	END DATE	BACKUP MEDIUM
COMPLETE DATA	DAT_000000002	SAVE COLD	3584	2015-06-28 19:19:25	FULLBKP
LOG	LOG_000000001	SAVE WARM	128	2015-06-29 20:34:20	LOGBACKUP

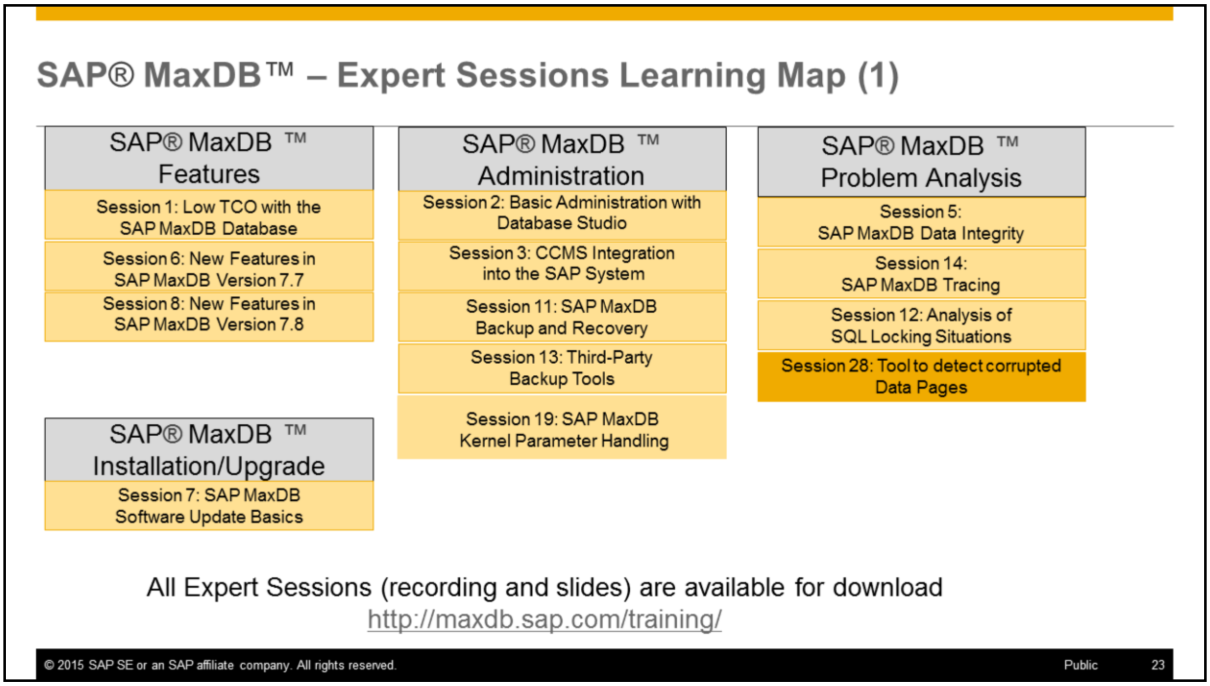


Additional documentation

- Corrupted objects tool download:
  http://maxdb.sap.com/training/ → **Session 28: SAP MaxDB Tool: Supported Detection of database corruptions → Tool**
- Detailed usage guide of the corrupted objects tool:
  2219353 - SAP MaxDB/liveCache: Detection Tool for Database Corruptions
- Database structure check:
  940420 - FAQ: Database structure check (CHECK DATA/VERIFY)
- Backup and recovery:
  1377148 - FAQ: SAP MaxDB backup / recovery
- Handling of database corruptions by SAP support:
  1116190 - Handling of database corruptions by SAP Support

Questions

SAP® MaxDB™ Detection tool for database corruptions



SAP® MaxDB™ – Expert Sessions Learning Map (1)

SAP® MaxDB ™ Features

- Session 1: Low TCO with the SAP MaxDB Database
- Session 6: New Features in SAP MaxDB Version 7.7
- Session 8: New Features in SAP MaxDB Version 7.8

SAP® MaxDB ™ Installation/Upgrade

- Session 7: SAP MaxDB Software Update Basics

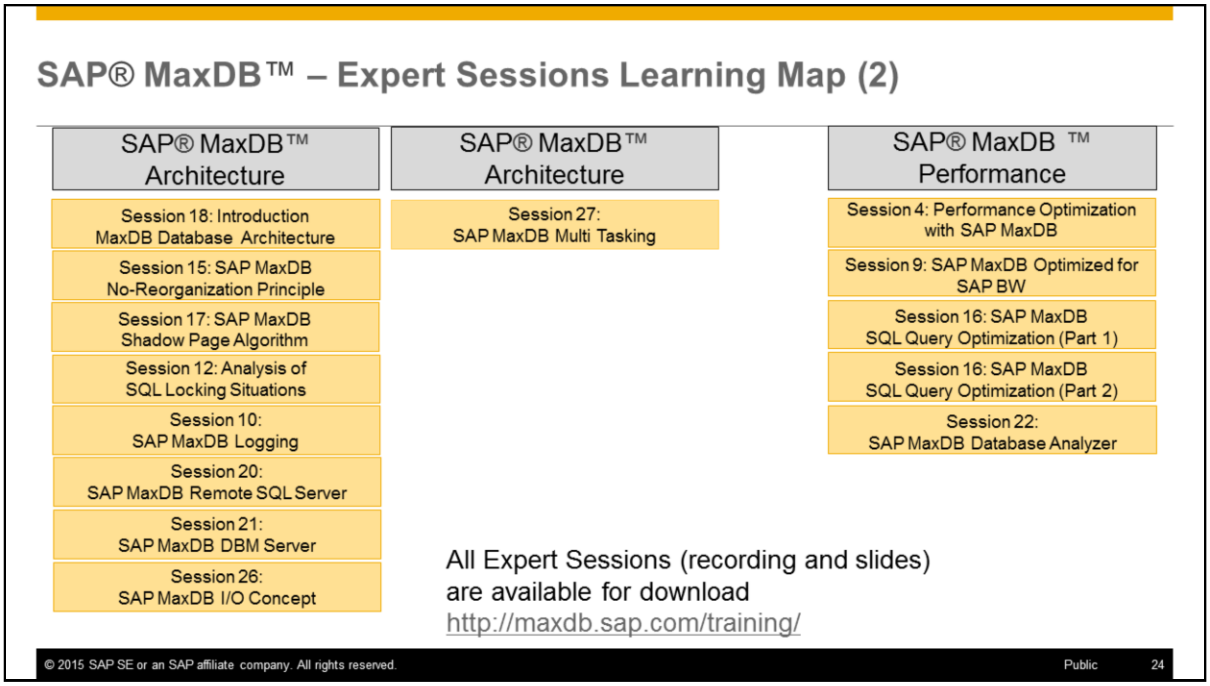
SAP® MaxDB ™ Administration

- Session 2: Basic Administration with Database Studio
- Session 3: CCMS Integration into the SAP System
- Session 11: SAP MaxDB Backup and Recovery
- Session 13: Third-Party Backup Tools
- Session 19: SAP MaxDB Kernel Parameter Handling

SAP® MaxDB ™ Problem Analysis

- Session 5: SAP MaxDB Data Integrity
- Session 14: SAP MaxDB Tracing
- Session 12: Analysis of SQL Locking Situations
- Session 28: Tool to detect corrupted Data Pages

All Expert Sessions (recording and slides) are available for download
http://maxdb.sap.com/training/



SAP® MaxDB™ – Expert Sessions Learning Map (2)

SAP® MaxDB™ Architecture

- Session 18: Introduction MaxDB Database Architecture
- Session 15: SAP MaxDB No-Reorganization Principle
- Session 17: SAP MaxDB Shadow Page Algorithm
- Session 12: Analysis of SQL Locking Situations
- Session 10: SAP MaxDB Logging
- Session 20: SAP MaxDB Remote SQL Server
- Session 21: SAP MaxDB DBM Server
- Session 26: SAP MaxDB I/O Concept

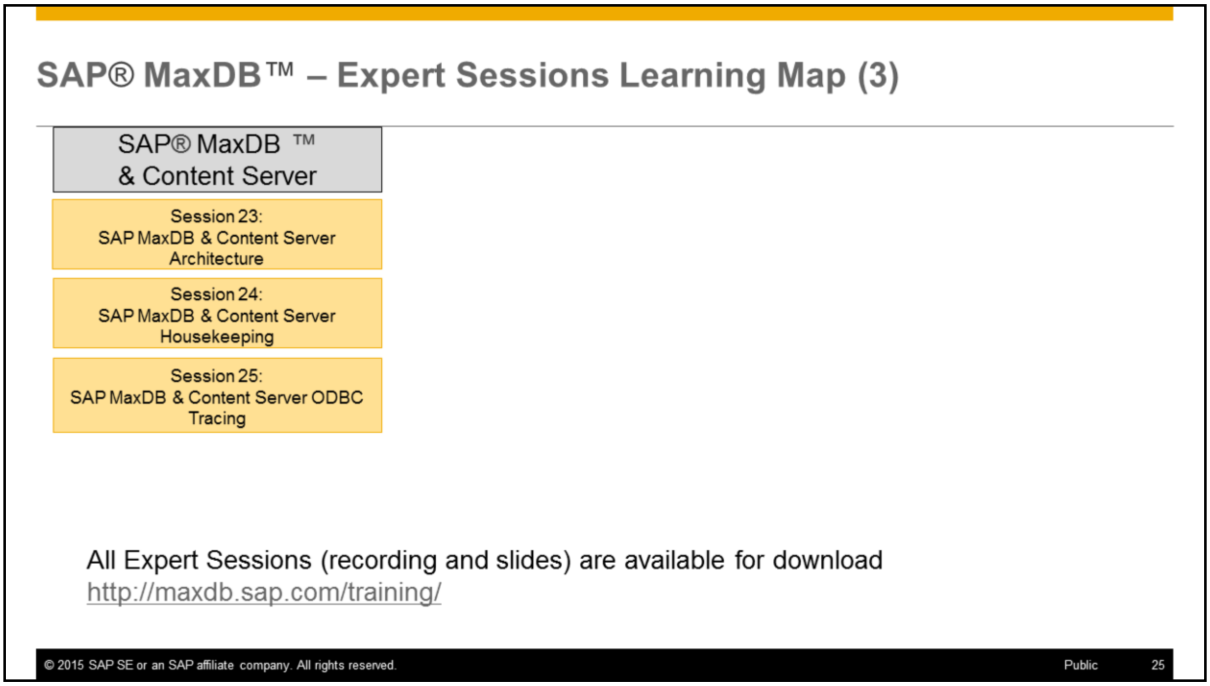
SAP® MaxDB™ Architecture

- Session 27: SAP MaxDB Multi Tasking

SAP® MaxDB ™ Performance

- Session 4: Performance Optimization with SAP MaxDB
- Session 9: SAP MaxDB Optimized for SAP BW
- Session 16: SAP MaxDB SQL Query Optimization (Part 1)
- Session 16: SAP MaxDB SQL Query Optimization (Part 2)
- Session 22: SAP MaxDB Database Analyzer

All Expert Sessions (recording and slides)
are available for download
http://maxdb.sap.com/training/



SAP® MaxDB™ – Expert Sessions Learning Map (3)

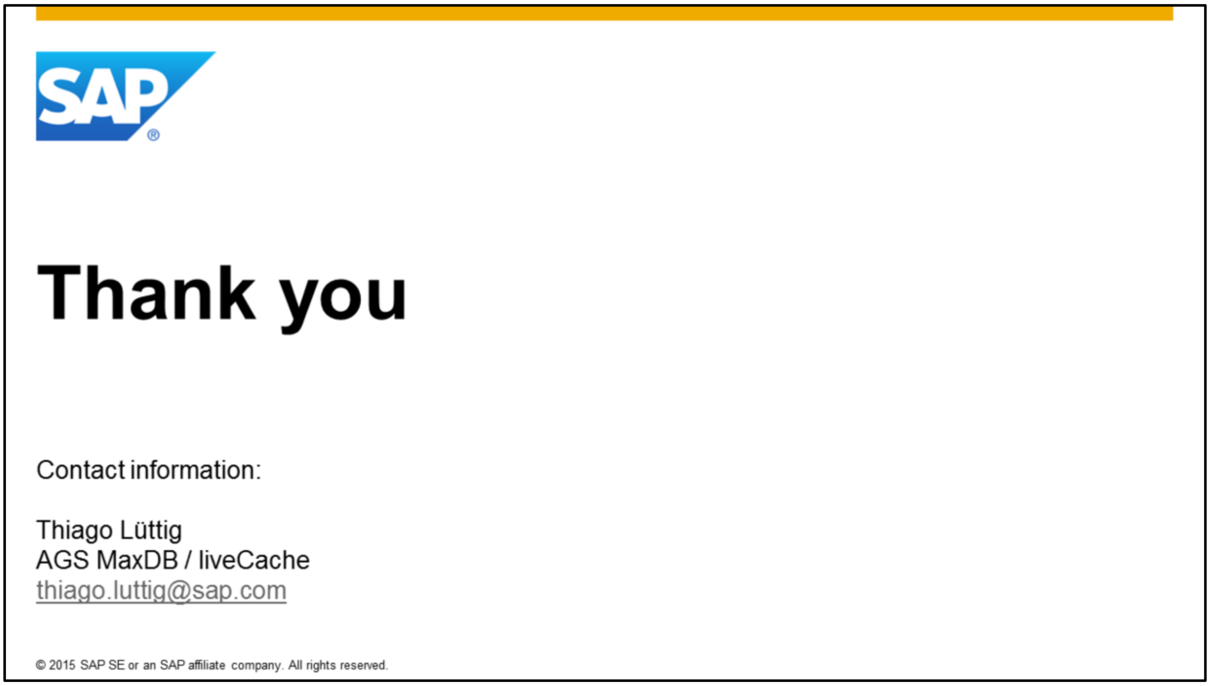
SAP® MaxDB ™
& Content Server

Session 23:
SAP MaxDB & Content Server Architecture

Session 24:
SAP MaxDB & Content Server Housekeeping

Session 25:
SAP MaxDB & Content Server ODBC Tracing

All Expert Sessions (recording and slides) are available for download
http://maxdb.sap.com/training/



Thank you

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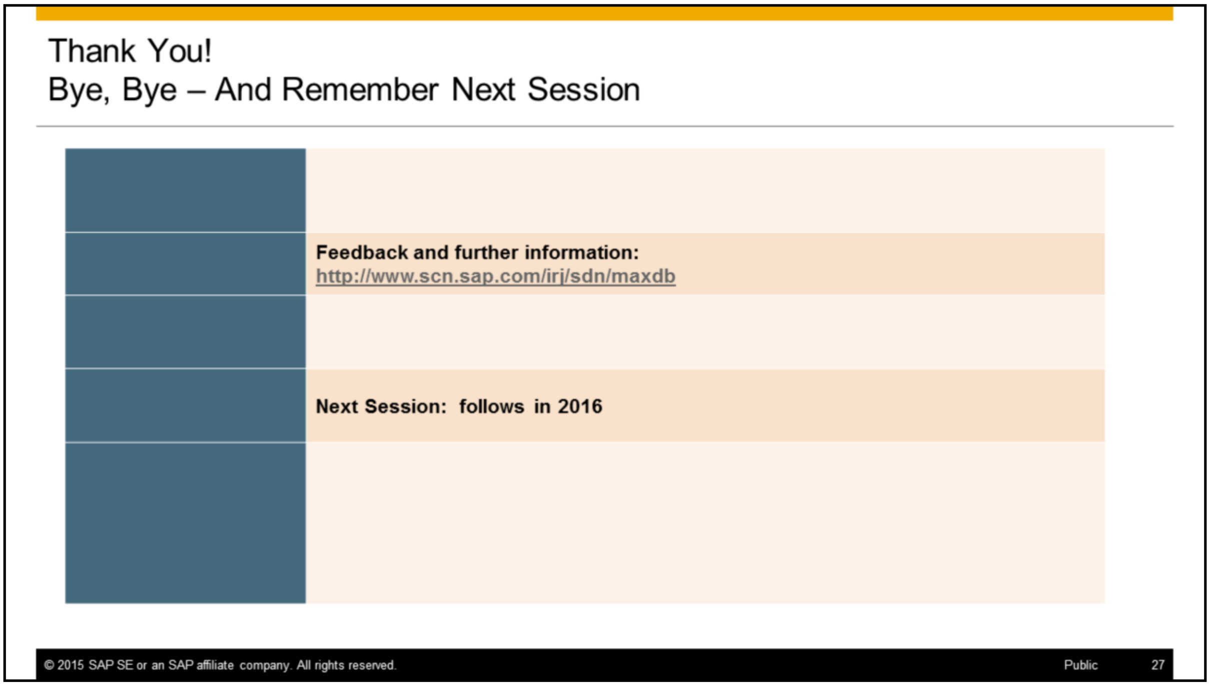
AGS MaxDB / liveCache
thiago.luttig@sap.com



Thank You!
Bye, Bye – And Remember Next Session

Feedback and further information:
http://www.scn.sap.com/irj/sdn/maxdb

Next Session: follows in 2016