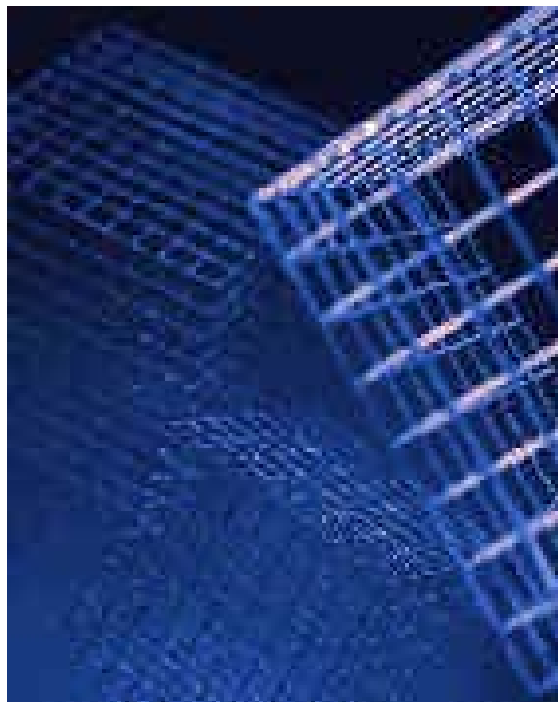# Backup and Restore Interface for SAP DB Systems
(Backint for SAP DB)

Version 7.x

Copyright

Icons

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Backup and Restore Interface for SAP DB Systems of Version 7.x

The implementation of a Backint for SAP DB interface allows the backup and recovery of SAP DB database systems by means of external backup tools enabling the communication between SAP DB tools and external backup tools via an open interface. For that purpose, it allows to initiate a data transfer for backup and recovery actions with files and/or pipes to/from the external backup tool, and to query available backups.

This document describes which properties any implemention of Backint for SAP DB should have.

As SAP has already created the open interface BACKINT for integrating common client/server backup programs in the ORACLE backup and restore program SAPDBA, the Backint for SAP DB interface Is defined analogously to BACKINT.

Backint for SAP DB is designed to be implementable together with BACKINT (for Oracle) in one single program.

> For general information on the SAP DB database system, see the documentation The SAP DB Database System on the SAP DB Web Site *http://www.sapdb.org* under *Documentation*.

Supported Platforms

The following platforms are supported:

HP-UX, IBM AIX, SNI Reliant, SUN Solaris, Compaq TRUE64Unix, Windows NT, Windows 2000, Windows XP, Linux (Intel)

Backup and Recovery Using SAP DB Programs

Backup and recovery of a SAP DB database system are performed with the help of SAP DB programs. This ensures an easy and complete backup, and smooth system operation. SAP DB programs allow complete and incremetal backups to tapes, files, named pipes and autoloader. Backups can be performed in online and offline operational state of the database system.

Backups and recoveries are controlled with the help of the administration tool Database Manager that is supplied with the SAP DB database software package. The Database Manager consists of a server part, called DBM Server program, and a client part.

The DBM Server creates the connection to the database instance and can access its environment using operating system resources.

There are three different clients available for the Database Manager: Database Manager GUI, Database Manager CLI and Web DBM. They create a connection to the DBM Server and exchange data with the DBM Server using a request-response mechanism.

Backup and Recovery Using External Backup Programs

The integration of external backup programs (common client/server backup programs) is based on the backup of SAP DB to named pipes, since this is an effective feature provided by SAP DB for transferring a complete database backup to another program.

There are two possibilities:

- The external backup tool is controlled by the SAP DB program DBM Server.

  In the case of a backup, the DBM Server initiates the data transfer from the database to one or more pipes, and it calls the external backup tool for backing up the data supplied in the pipes. If the SAP DB database system or the external backup tool cause an error, the DBM Server ends the data transfer and informs the counterpart of the data transfer.

  In the case of a recovery, the client queries the available backups via the DBM Server from the external backup tool. Then it displays the result of this query to the user, and initiates and controls that the desired backups are transferred with the help of one or more pipes from the external backup tool to the database.

  The latest version of the Database Manager supports the current and preceding versions of SAP DB.

- The external backup tool uses the SAP DB client application Database Manager CLI for controlling the database.

Backint for SAP DB Interface Description

Backint for SAP DB is the connecting link between the DBM Server and the external backup tool. Backint for SAP DB inquires about former backups, and carries out backups and restores using the corresponding backup tool. If the external backup tool is a client/server program, Backint for SAP DB communicates with the client or implements the client running on the database server. Thus, SAP DB's administration tool is able to make standardized use of different external backup tools.

Overview of the programs involved in the backup with an external backup tool
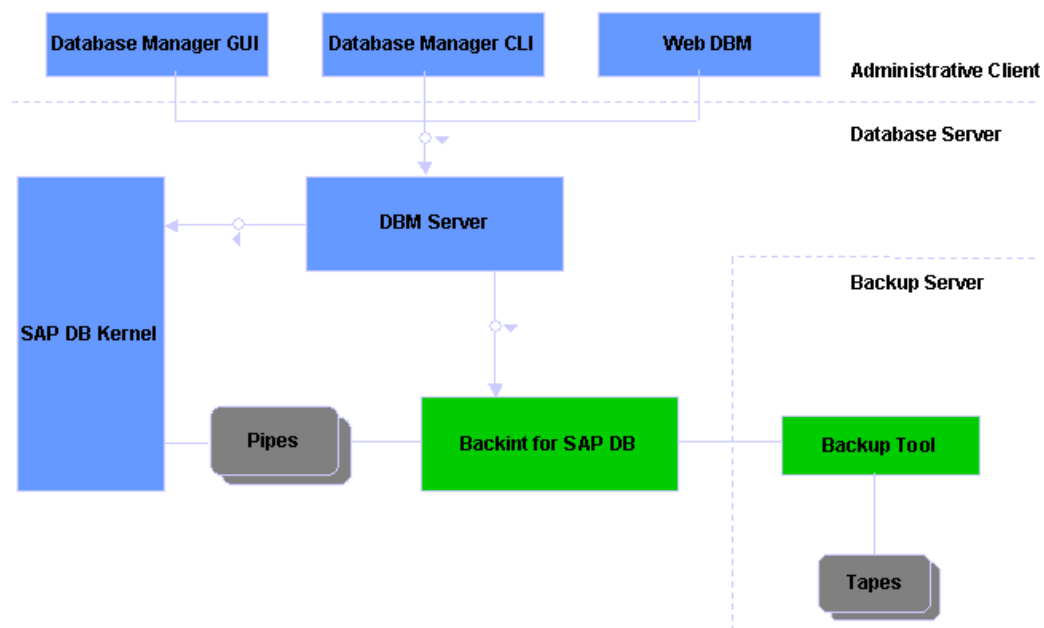
General Description of Interface Functions

Backint for SAP DB supports the following functions:

- backup function

- restore function

- inquiry function

- deletion function

In all cases, the mandatory user ID (UID) parameter will be used as an identifier for the SAP DB database. After a function has been executed, the interface program returns an integer value, which indicates whether or not the call was successfully.

Backup Function

The backup function defines a backup request for the files or pipes specified in a list. On return, the backup tool generates a backup ID (BID) for the saved files or pipes that clearly identifies the backup. The interface program informs the user which files or pipes have been backed up successfully and which have not, which BID was assigned to each file and to each pipe, and how many bytes were saved for each pipe.

The sequence in which the files in the list are backed up can be freely determined by the external backup tool.

If more than one pipe is specified in the list, the pipes have to be backed up in parallel. The special requirements for parallel pipe backups are described in the section *Formal Definition of the Interface Program for the Backup Utility*. Parallel backups are an optional feature of Backint for SAP DB.

Restore Function

The restore function is used to pass on a restore request to the external backup tool. This request consists of the UID and a list of files and pipes to be restored. Files are specified by their BID, their name, and a directory where the file is to be created. Pipes are specified by their BID, their name, and the name of the current pipe where the content of the saved pipe should be restored to. The name of the directory the file is to be created in and the name of the current pipe are optional. If the BID is not set, the last backup of the related file or pipe is used. The return information indicates which files or pipes have been restored successfully and which BIDs have been used.

The sequence in which the files in the list are restored can be freely determined by the external backup tool.

If more than one pipe is specified in the list, they have to be restored in parallel. The special requirements for parallel pipe restores are described in the section *Formal Definition of the Interface Program for the Backup Utility*. Parallel backups and parallel restores are an optional feature of Backint for SAP DB.

Inquire Function

The inquire function provides information about the backups managed by the external backup tool. This function is called using UID, BID and the file or pipe name (the last two parameters are optional). If the BID is not set, a list of available backups (BIDs) is provided, which includes the specified file or pipe. If a file or pipe name is not specified, a list of files or pipes belonging to a specific BID is generated.

If none of the two parameters is set, a list of available backups (BIDs) is generated. If both parameters are specified, the system checks whether this file or pipe was saved with a specific BID.

Delete Function

The delete function is used to inform Backint for SAP DB about previously saved files or pipes, which are not needed any longer, e.g. if a backup was only partially successful Backint for SAP DB is informed about that through the delete function. The files or pipes which are not needed any longer are specified by their UID, BID, and name. Backint for SAP DB is allowed to ignore a delete request.

Formal Definition of the Interface Program for the Backup Tool

Variables

In the subsequent sections of this document, all variables are used as per the following meanings and definitions:

Variable	Description	Type (max. Length)
`<backup_id>`	Backup ID (BID) See also section Backup ID	CHAR(16)
`<backup_vol>`	Backup volume (e.g. tape label)	CHAR(10)
`<dest_dir>`	File directory	CHAR(255)
`<dest_name>`	Pipe name	CHAR(255)
`<file>`	File	CHAR(255)
`<in_file>`	Input file name	CHAR(255)
`<out_file>`	Output file name	CHAR(255)
`<par_file>`	Parameter file name	CHAR(255)
`<pipe>`	Pipe	CHAR(255)
`<size>`	File or pipe size	CHAR(16)
`<user_id>`	User ID (UID)	CHAR(16)

Syntax of the Backint for SAP DB Call Interface

Backint for SAP DB has a call interface at command line level using the following syntax:

```
backint -u <user_id> [-f <function>] [-t <type>]
[-p <par_file>] [-i <in_file>] [-o <out_file>] [-c]
```

For the description of `-u <user_id>`, `-f <function>`, `-t <type>` and `-c` see the section Basic Options.

For the description of `-p <par_file>`, `-i <in_file>` and `-o <out_file>` see the section Control Options.

In addition to the command line options, the interface also supports some environment variables set by the DBM Server before Backint for SAP DB is called:

Environment Variable	Value	Description
BI_CALLER	**DBMSRV**	Backint for SAP DB called by the DBM Server
BI_BACKUP	**FULL | PARTIAL | ARCHIVE**	complete data backup or incremental data backup or log backup
BI_REQUEST	**NEW | OLD**	first or subsequent call of Backint for SAP DB within a running backup

As the DBM Server sets the environment dynamically (`putenv`), Backint for SAP DB as the child process can inherit these variables (`getenv`), and use their values to control further processing.

Basic Options

The following basic options can be set for Backint for SAP DB:

Command Line Option	Description	Default
`-u <user_id>`	`<user_id>` (UID) Backup tool user, normally database instance name (e.g. SAPDB_SID)	None
`-f <function>`	`<function>: backup|restore|inquire|delete` Type of operation	`backup`
`-t <type>`	`<type>: file` Backup type: backup of individual files or pipes See section Command Line Option –t file	`file`
`-c`	Unattended mode (no action by operator possible)	attended mode

See also the section Variables.

Command Line Option -t file

For the backup, restore, inquire, and delete functions, the backup type `file` is the only type possible for handling files or pipes. The backup type `file` is equivalent to the type of the same name defined by BACKINT (for Oracle). They differ in the permissible backup objects.

BACKINT (for Oracle) allows files, directories and raw devices.

Backint for SAP DB allows only files and pipes.

For the `backup` function, Backint for SAP DB must identify whether the backup object is a file or pipe. For the `restore`, `inquire` and `deletete` functions, Backint for SAP DB must remember whether the backup object is a file or pipe.

In the list specified in the input file they can be mixed.

Control Options

The following control options can be set for Backint for SAP DB.

Command Line Option	Description	Default
`-p <par_file>`	Parameter file name Text file for the backup tool containing parameters which determine the backup procedure It is specific to the backup tool. File name type is CHAR, max. length is 255 The SAP tools specify the location of this file in their own parameter file but do not evaluate its content.	None
`-i <in_file>`	Input file name Text file containing the object of the function (`backup`, `restore`, `inquire` or `delete`). File name type is CHAR, max. length is 255. See section <u>Content of the Input File</u>	If this option is not set, the data is read from the standard input (`STDIN`).
`-o <out_file>`	Output file name Text file serving as a pool for messages about the processing and results of the executed function. File name type is CHAR, max. length is 255. See section <u>Content of the Output File</u>	If this option is not set, the messages are written to the standard output (`STDOUT`) .

See also the section <u>Variables</u>.

Content of the Input File

The input file consists of a list of backup objects. The specifications to be made depend on the function defined through the Backint for SAP DB basic option `-f <function>`. They must comply with the syntax rules indicated below:

Function	Content of the Input File	Syntax
`backup`	Names of the files or pipes to be saved. Pipes need to be marked with the key word #PIPE. See section Command Line Option –f backup	`<file> | <pipe> #PIPE`

`restore`	Names of files or pipes to be restored and BIDs (see section Backup ID) of the backups or `#NULL <file>`;
	optional with changed target directories for files `<dest_dir>` and changed target names for pipes `<dest_name>`
	See section Command Line Option –f restore
		`<backup_id> <file> [<dest_dir>]`
		`| #NULL <file> [<dest_dir>]`
		`| <backup_id> <pipe> [<dest_name>]`
		`| #NULL <pipe> [<dest_name>]`

`inquire`	Names of files or pipes and/or BIDs about which information is requested, sorted by creation date (latest backup first)
	
	See section Input/Output File Correlation
		`#NULL`
		`| <backup_id>`
		`| #NULL <file>`
		`| #NULL <pipe>`
		`| <backup_id> <file>`
		`| <backup_id> <pipe>`

`delete`	BIDs and names of files or pipes that can be deleted.	`<backup_id> <file>` `| <backup_id> <pipe>`

See also the section Variables*.*

Backup ID (BID)

The Backint for SAP DB implementation generates a BID when saving a file or pipe, and writes it into the output file. It is then used with the restore, the inquire, and the delete function.

A BID is not necessarily unique since it can be assigned both to the backup of a single file or pipe and to the backups of several files and/or pipes. However, any backup of a file is identified by a unique combination of UID, BID and file or pipe name.

Command Line Option -f backup

If pipes listed in the input file do not exist, Backint for SAP DB either creates them or checks periodically their existence. The pipes are opened for reading only. The software (DBM server) or user that called Backint for SAP DB, ensures that every pipe in the list is opened and closed at least once. Backint for SAP DB returns an error for every pipe it has not opened.

For a data transfer, both sides of a pipe need to be opened successfully. The data transfer through a pipe ends when one side of the pipe is closed.

If a SAP DB version lower than 7.4.03 is used and more than one pipe is specified in the input file, they must all be processed in parallel and in a non blocking manner to avoid dead locks. In

other words, Backint for SAP DB must process all these pipes at the same time but independently of each other.

Therefore, an opening or reading operation on one pipe must not block the opening operations and the data transfers on the other pipes listed in the input file. For that purpose, Backint for SAP DB checks every pipe periodically to make sure that it can be opened or that data can be read from the pipe. This can be reached if one child process or thread is started for every single pipe and if any synchronisation between these processes and/or threads is avoided. Then, the processes or threads can open and read the pipes with normal blocking operations, since the operating system switches periodically to the processes or threads of the other pipes.

If SAP DB version 7.4.03 or higher is used, and more than one pipe is specified in the input file, Backint for SAP DB processes these pipes at least partially in parallel. Otherwise parallel backups do not offer any advantages. Interdependencies of the pipes or the processes/threads processing these pipes during the backup need not be avoided since the database itself processes the pipes independently of each other.

The support of parallel pipe backups and their suitability for SAP DB versions 7.4.03 and higher only, or for all SAP DB versions covered by this document, are optional for Backint for SAP DB.

Command Line Option -f restore

If pipes listed in the input file do not exist, Backint for SAP DB either creates them or checks periodically their existence. The pipes are opened for writing only. The software (DBM Server) or user that called Backint for SAP DB ensures that every pipe in the list is opened and closed at least once. Backint for SAP DB returns an error for every pipe it has not opened. Backint for SAP DB restores the data to a pipe in the sequence it was read in from the original, saved pipe.

For a data transfer, both sides of a pipe need to be opened successfully. The data transfer through a pipe ends when one side of the pipe is closed.

If a SAP DB version lower than 7.4.03 is used and more than one pipe is specified in the input file, Backint for SAP DB processes these pipes in a non blocking manner and in parallel to avoid dead locks. In other words, Backint for SAP DB processes all these pipes at the same time but independently of each other. This can be reached if an opening or writing operation in one pipe does not block the opening operations and data transfers in the other pipes listed in the input file.

Therefore, Backint for SAP DB checks every pipe periodically to make sure that it can be opened or that data can be written to the pipe. This can be reached if one child process or thread is started for each single pipe and if any synchronisation between these processes and/or threads, including synchronisations resulting from commonly used resources like tapes, is avoided. Then, the processes or threads can open and write to their pipes with normal blocking operations, since the operating system is periodically switching to the processes or threads of the other pipes.

If SAP DB version 7.4.03 or higher is used, and more than one pipe is specified in the input file, Backint for SAP DB processes a maximum of these pipes in parallel. Thus, minimum restore times are reached. Interdependencies of the pipes or the processes/threads processing these pipes during the backup need not be avoided since the database itself processes the pipes independently of each other.

The support of parallel pipe restores and their suitability for SAP DB 7.4.03 and higher only, or for all SAP DB versions covered by this document, are optional for Backint for SAP DB. However, the supported type of parallel restore must match the parallel backup type.

Content of the Output File

The output file contains the messages about the processing and the results of the executed function. Besides the messages with fixed format defined below, the file may contain other messages, which are simply passed on to the user.

If no output file is specified, the output is sent to the standard output (STDOUT).

The content of the output file depends on the function defined by the Backint for SAP DB basic option `-f <function>`.

Function	Success Message	Error Message

backup	`#SAVED <backup_id> <file>`
	`[<backup_vol>]`
	
	`| #SAVED <backup_id> <pipe>`
	`<size> [<backup_vol>]`
		`#ERROR <file>`
		`| #ERROR <pipe>`

restore	`#RESTORED <backup_id> <file>`
	`| #RESTORED <backup_id> <pipe>`
		`#NOTFOUND <file>`
		`| #NOTFOUND <pipe>`
		`| #ERROR <file>`
		`| #ERROR <pipe>`

inquire	`#BACKUP <backup_id>`
	`| #BACKUP <backup_id> <file>`
	`| #BACKUP <backup_id> <pipe>`
	
	see section Input/Output File Correlation
		`#NOTFOUND <file>`
		`| #NOTFOUND <pipe>`
		`| #ERROR <file>`
		`| #ERROR <pipe>`

delete	`#DELETED <backup_id> <file>`
	`| #DELETED <backup_id> <pipe>`
		`#NOTFOUND <file>`
		`| #NOTFOUND <pipe>`
		`| #ERROR <file>`
		`| #ERROR <pipe>`
		`| #NOTDELETED <file>`
		`| #NOTDELETED <pipe>`

See also section Variables.

Input/Output File Correlation

Since the content of the output file for the inquire function mainly depends on the type of request, four different cases are distinguished.

Correlation of Input and Output Values for the inquire Function

Case	Entries in the Input File	Entries in the Output File
1	Neither BID nor file or pipe name specified (`#NULL`)	List of BIDs for UID sorted by creation date (latest backup first) One list entry consists of one BID. (`#BACKUP <backup_id>`)
2	BID specified, file or pipe name not specified (`<backup_id>`)	List of BIDs and related files or pipes in the specified backup Every list entry consists of the specified BID and

	(`<backup_id>`)	a file or pipe name. (`#BACKUP <backup_id> <file>` `|#BACKUP <backup_id> <pipe>`)
3	BID not specified, file or pipe name specified (`#NULL <file> |#NULL <pipe>`)	List of BIDs related to the specified file or pipe, sorted by creation date (latest backup first) Every list entry consists of a BID and the specified file or pipe name. (`#BACKUP <backup_id> <file>` `|#BACKUP <backup_id> <pipe>`)
4	BID and file or pipe name specified (`<backup_id> <file>` `|<backup_id> <pipe>`)	BID and file or pipe name, if available, in the specified backup Every list entry consists of a BID and a file or pipe name. (`#BACKUP <backup_id> <file>` `|#BACKUP <backup_id> <pipe>`)

See also Variables

Backint for SAP DB Return Codes

Backint for SAP DB is called by the software (DBM Server) or user. The software and the user expect Backint for SAP DB to return a code as per the following description.

Return Code	Description
0	OK – All files and pipes were successfully processed without warnings.
1	WARNING – All files and pipes were successfully processed.
2	ERROR – Some or all files or pipes were not successfully processed.