White paper
Fujitsu BS2000/OSD-BC V9.0

Key points in Fujitsu BS2000/OSD V9.0 are the integration of Net-Storage, the support of ETERNUS DX clone and snap functions based on SHC-OSD and the support of the new device type LTO-5.
Further improvements of performance plus measures for simplification of system operation complete this new version of the operating system.
Furthermore BS2000/OSD V9.0 supplies the prerequisite for support of several functions of future SQ server generation.

Important functional extensions to BS2000/OSD-BC V9.0 concern:

New Hardware

- Support of new SQ server SQ210
- Peripheral support: LTO-5 MTC devices incl. LTO-5 drive encryption support
- Peripheral support: Archive system Scalar i6000 in connection with ROBAR V6.5

Scalability/Performance

- High-performance support of the SQ servers with higher Multi Processor level
- Formal support of the SQ servers up to MP level 32
- Extended PAV, PAV for paging

Improved storage integration

- BS2000/OSD integration for Net-Storage (on the basis of the NAS/NFS file server)
- BS2000/OSD integration for ETERNUS DX replication functions Clone (EC and REC) and Snap in connection with SHC-OSD V9.0 and follow-up version V10.0

Manageability / Ease-of-use

- New PUBSET-SHOW commands, more EDIT commands
- COMPARE-DISK-FILES command for simpler comparison of files
- Clearer messages
- MAIL-File extensions for PDF and library elements

Automation / Dynamization

- Unconditional waiting for command WAIT-EVENT
- Online SNAP file configuration (+ extension of the dump)
- Online update of change dates

Openness and integration ability

- New version POSIX A43 with transparent access to BS2000 files from NFS (subsequent delivery in 12.2012)

General Release of BS2000/OSD-BC V9.0: June 2012

The release of new SW product versions will also be made within the time frame of BS2000/OSD-BC V9.0. The most important function extensions are also shown here for several selected products (e.g. DAB, HSMS, openNet Server, ROBAR and SHC-OSD).

The description of the functions and the statements to the dates correspond to the currently agreed planning status. We reserve the right to make changes up to the general release.

Content

Hardware support

Support of the BS2000/OSD business server of the S and the SQ series

BS2000/OSD-BC V9.0 supports all the released servers of the S and SQ series. The X2000-status V5.2A08 (B70 status for SQ200) is required for SQ servers.

The use of new functions with X2000 support for SQ servers (e.g. BS2000 files on Net-Storage) requires the use on these servers of the X2000 version 5.3, which was developed for the SQ210.

BS2000/OSD-BC V9.0 is released for the SQ server as part of a follow-up version of the OSD/XC package (OSD/XC V9.0). The OSD/XC package for BS2000/OSD-BC V9.0 is called OSD/XC V9.0 so as to make the affiliation to the OSD version immediately obvious.

Support of future SQ server generation

BS2000/OSD-BC V9.0 supports the new BS2000/OSD SQ210 Business Server (new HW basis). SQ210, which will be available in the second half-year 2012, is used to support defined scenarios for High Availability (homogeneous 1:1 configurations) and Live Migration, mainly through extensions in X2000 and the use of Xen functions.

SQ210 is foreseen as a multiprocessor system for up to 16 systems. The high-performance support of 16 CPUs is among other things achieved through measures in BS2000 memory management (x86-PageTable optimization, see the section "Scalability/Performance").

No support for SX servers

By the time B70 is reached for BS2000/OSD-BC V9.0 in 06.2012, almost all of the older SX servers with X2000 V3.0 will have already reached MEK90 (MEK90 of the SX150 is planned for 09.2012). Only the SX servers, SX100-D and SX160, will continue to be maintained for longer (MEK90 is planned for 12.2014). SX160 / SX100-D customers will migrate to SQ business servers during the next few years.

The following is available as a migration path:
1. change the SX server to SQ on the basis of OSD V8.0 and
2. perform an OSD version change from OSD V8.0 to OSD V9.0 on the SQ server.

Peripheral support: LTO-5 including LTO-5 Encryption

In addition to the previous LTO device types, the device type LTO-5 is also supported in BS2000/OSD-BC V9.0. LTO-5 devices are intended for operation in the current SQ and S servers on the FC channel in conjunction with a Quantum library system Scalar 10K, i6000 or i500. LTO-5 devices can also be operated on SQ servers on an MTC changer ETERNUS LT40 connected via FC.

LTO-5 devices have even higher data rates than LTO-4 devices. The maximum data rate is 160 MB/sec (uncompressed) compared with 120 MB/sec with LTO-4. However, the minimum data rate required for streaming the LTO-5 tapes at 30 MB/sec still remains identical to that of the LTO-4 (and LTO-3).

LTO-5 drives are equipped with the hardware feature 'Tape Encryption'. As was already the case with the LTO-4, support for tape encryption is provided in conjunction with MAREN V12.0. MAREN takes over both the function of key management as well as control of decryption and encryption. The encryption takes place according to the AES standard with a symmetric 128-bit key.

Only LTO-5 drives from IBM (not from HP) are supported in the directly connected Scalar libraries.

LTO-5 support is also released for BS2000/OSD-BC V8.0 using a Rep solution: for the S server in correction package 1/2011 in June 2011, the SQ200 requires the X2000-status V5.3 supplement, which is available in the middle of 2012.

Peripheral support: Scalar i6000 in connection with ROBAR V6.5

The Scalar i6000 replaces the Scalar i2000 in the Quantum Scalar product series for tape automation. The Scalar i6000 can currently be operated on the BS2000 with ROBAR V6.0C in Scalar i2000-compatible mode. The explicit BS2000 support for Scalar i6000 is performed with ROBAR V6.5: Detection and support of the library as Scalar i6000, if necessary with the support of the new library functions. ROBAR V6.5 is released with effect from OSD V7.0.

Scalability/Performance

High-performance support of the SQ servers with higher Multi Processor level

The aim of all performance measures to be released for BS2000/OSD-BC V9.0 for SQ servers is to achieve an equally good Multi-Processor factor for MP levels 8 to 16, as with the S servers.

x86-PageTable Optimizations

The main approach to increasing MP performance with the SQ is to perform x86-PageTable optimization.

Today, the BS2000 uses "/390 PageTables" and "storage KEYs" on SQ servers, which are emulated from the X2000(-μ kernel). For this purpose, the X2000 generates x86-PageTables in an "X2000-PageTable cache" for the last used virtual addresses.

x86 PageTable handling is optimized in OSD V9.0 using the following measures:

1. Invalidation of PT entries that are no longer used by the BS2000 using a new command on the X2000 interface (new PVA command 'Purge Virtual Addresses'). This new function reduces "cache contamination" through invalid PTs.
2. New segment-table entry format for sharing PTs in the X2000-PT cache between different users (including POSIX fork). Up to now, every sharer had a separate PT copy; as of OSD V9.0 an x86 PT can be used for all sharers - this leads to a notable reduction in the PTs in the X2000-PT cache.

Reference Recording on Demand
"Reference Recording" is a /390 HW feature for paging support: An R-bit (reference bit) is available for each main memory page, which is set by the HW during each access to the page ("Reference Recording"). This is scanned periodically in SIH using an RRBE command and reset in order to determine recent accesses (=> "LRU-Page-Detection").
"Reference Recording" is emulated by the HAL on x86 architecture.
As of OSD V9.0 reference recording on SQ servers only takes place "on demand": HAL emulation is only activated when the main memory is "well filled" (i.e. only when required). The constant primary load for LRU page detection is thus no longer required.

Due to these measures a performance improvement of 5 - 10% is expected with mono-processors and 10 - 20% with multi-processors.

Increase in the number of parallel RSC I/Os per device from 4 to 6
The RSC (Remote System Call) interface between BS2000 and X2000 is used for disk I/Os on SQ servers. As standard 4 I/Os are simultaneously output on one device so far. This value is increased to 6 in OSD V9.0 in order to increase I/O parallelization.

Formal support of up to 32 processors (as a preparatory action for later high-performance SQ servers)
Up to OSD V8.0 the BS2000 could support a maximum of 16 CPUs. As of OSD V9.0 the formal support of up to 32 processors is possible on SQ machines.
No specific SQ model is planned with >16 CPUs with OSD V9; the extension is intended as a preparatory action for later high-performance SQ servers.

Extended PAV
PAV (Parallel Access Volume) can be used for several I/Os to take place simultaneously on one logical volume. PAV can be used to reduce the response times for disks with great loads and to increase the maximum I/O rates to one volume. A PAV volume on the FC channel consists of a basic device and up to 3 alias devices, which must be generated in BS2000/OSD.
Alias devices must be generated as separate devices, they must be in the same logical control as the basic device and with the same LUN, but they must have a different unit address. As a maximum of 256 unit addresses are possible for each logical controller, only (256-n) alias devices are possible for "n" generated volumes.
If you use Extended PAV for devices on the FC channel, the previous restriction that an alias device has to be in the same logical control as the basic device is lifted. A further logical control (even several if required) with 256 alias devices can be configured to an existing logical control.
Extended PAV creates higher flexibility in case of (unforeseen) bottlenecks and is particularly suited for configurations, in which PAV was not planned from the outset, in which no or only a few free addresses for alias devices are available.

Parallelization of the paging I/Os with PAV
When high data quantities are created in the main memory over a short period of time, the paging mechanism must displace the contents of the main memory at the same speed or an even higher speed as the new data is being created.
To also ensure this with constantly increasing server performance, parallelization of paging I/Os is effected in BS2000/OSD-BC V9.0 (can be used via PAV on S servers and as standard via the RSC mechanism on SQ servers).
It is possible to perform up to 4 I/Os per device in parallel with the new implementation.

Improved PTHREADS performance
Up to now, if a new application instance was generated from a pthread (POSIX-Threads) environment by means of a "fork", as a precautionary measure the existing Cl6 Memory Pool (MP) was passed on to the new application, whereby the entire contents of this MP in TU was copied to a new MP. This means that multiple large memory areas were held in the main memory and possibly damage the working set of other applications and thus implicitly performance.
The copying of the entire MP is replaced by "copy-on-write semantics" for the CL6 memory pool of the PTHREADS. This enables the relevant data only to be copied from the existing CL6 memory pool to the new CL6-MP during write access. Data that is not changed is therefore not transferred.
Customers with SHC-OSD configurations, ORACLE EMAGENT and SM2 users benefit from the improvements.

Asstranized subsystem GET-TIMX

So far, the subsystem GET-TIME is operated as an emulation on SQ servers, which is also the case with asstranized products like SESAM. Frequent changing from an asstranized to an emulated procedure is time consuming. This is why (due to a requirement from SESAM) an additional subsystem called GET-TIMX is also offered (for SQ servers) **parallel** to the currently emulated operating subsystem GET-TIME as of OSD V9.0. Users are SESAM V7.0 and CRTE V2.9.

Extended storage integration

BS2000/OSD integration for Net-Storage

Different storage media - various versions of disks and tapes - have been used in the BS2000. In BS2000/OSD V9.0 storage media that offer their services via NFS can also be used by the BS2000.

The new functionality gives following new possibilities:
- Archiving of performance-uncritical BS2000 files on NAS storage systems (e.g. for backup and filing of logging-files and test data).
- Direct access to common used data at the original by co-operating inhomogeneous applications (imaginable: applications deposit status information in files; further processing of PDF- and HTML-files, which were stored on Net-Storage by BS2000).

The applications, which use the files on this type of storage media (generally referred to as Net-Storage), process them just as well as on a classic local pubset. The new functionality is widely transparent to directly connected disk systems for the applications.

Architecture

A separate Linux system acts as a gateway for the Net-Client (gateway between BS2000 and NFS storage).
HNC (HNC IV and HNC V) is used as the gateway platform for S servers and X2000 is used directly for SQ servers (the X2000 version 5.3 developed for SQ210).
Like every BS2000 file, a file on a Net-Storage has a catalog entry on a pubset. The information to the file system is stored in this catalog entry.

Net-Storage solution architecture (new functions red)
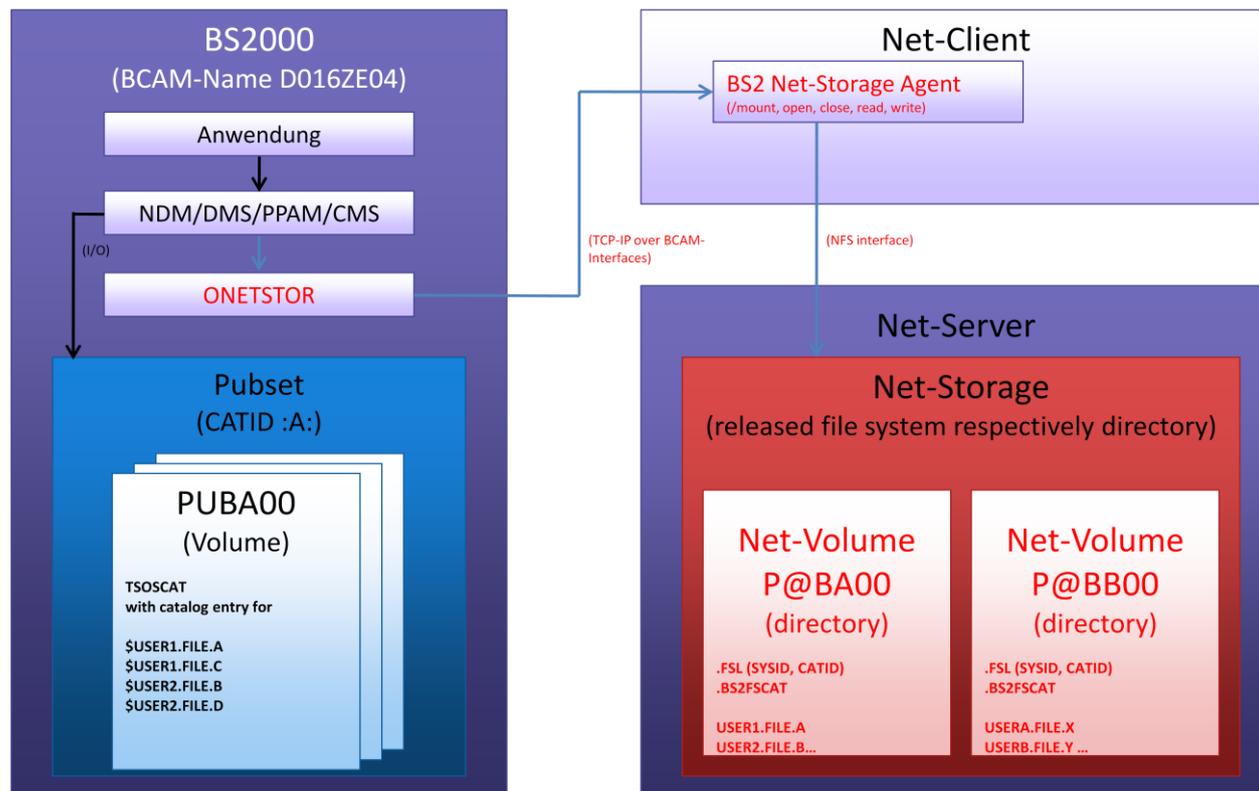
For realization of communication between DMS and Net-Storage two interface components were developed:
- a bs2-component (ONETSTOR), which accepts DMS jobs (open/close/read/write) on the BS2000 side and then forwards them in communication jobs to BCAM and,
- a linux-component (bs2net-agent), which unpacks the jobs again in the Net-Client and converts them to accesses to the remote file system (/mount, open, close, read, write etc. including the implementation of block <-> byte stream).

Functionality from a user point of view

■ Configuration and administration
Access from the BS2000 system to the Net-Storage must be permitted by means of an appropriate configuration.
The BS2000 system administrator receives new commands for administration of the Net-Storage, which is used by the BS2000 as BS2000 storage:
MOUNT-NET-STORAGE/UMOUNT-NET-STORAGE is used to establish the connection to a Net-Storage and make a directory that has been released on a remote storage system accessible in the BS2000, or end the connection to a Net-Storage again.
ADD-NET-STORAGE-VOLUME is used to set up a storage area on remote network storage and assign it to a local pubset. A directory is set up on the Net-Storage. From a BS2000 point of view this directory implements a volume (in the BS2000 the receptacles of files are generally volumes), which is allocated to a pubset. The customer doesn't need a own data media management.
REMOVE-NET-STORAGE-VOLUME is used to delete a directory (the respective volume in the BS2000) in a remote Net-Storage. The directory (volume) must have been emptied beforehand, i.e. it must not contain any of the cataloged files on the allocated pubset.
For recovery the allocation of BS2000 files on the Net-Storage can be changed to a pubset through the export/import functions.
SHOW-NET-STORAGE is used to get information about Net-Storage volumes, which are available in BS2000 system. Furthermore, existing display functions are extended.

■ End user interfaces
BS2000 files can be created directly on Net-Storage in BS2000/OSD V9.0. Existing BS2000 files can be copied to NAS storage systems. The affected commands are extended accordingly. File processing is done via the normal pubset / DMS user interfaces on the Net-Storage system directly.

■ OSD V9.0 Net-Storage Support in HSMS/ARCHIVE V9.0B
Data on Net-Storage also belongs to the backup scope of a pubset in OSD V9.0.
Thus, in backups with the previous standard settings in HSMS and ARCHIVE the data is always also backed up on the Net-Storage. The ARCHIVE user interface is not extended.
With regard to files on local pubsets and files on remote Net-Storage the backup amount can be selected directly via extended HSMS interfaces. In restore the selection of Net-Storage files is allowed, and Net-Storage is also provided as a target for the restore.

Hints for installation of Net-Storage are described in [Description Paper: Net-Storage Installation Guide](#).

Supported Net-Servers
The new NAS connection of ETERNUS CS High End V5 is the first supported Net-Server hardware.
A special release is available for NAS systems of NetApp.

General conditions and restrictions
The Net-Storage functionality is not offered for SQ100 servers
All file formats are supported except for Blk-Ctrl= PAM key.
FGGs (File Generation Groups) are not supported.

BS2000/OSD integration for the ETERNUS DX clone and snap functions based on SHC-OSD

The storage systems Fujitsu ETERNUS DX410/DX440, DX410 S2/DX440 S2 and DX8400/DX8700 are released for operation with Fujitsu BS2000/OSD business servers of the S and the SQ series with BS2000/OSD V7.0 and V8.0.
The release of the models ETERNUS DX 8000 S2 is planned in a supplement to SHC-OSD V9.0 for the 1st half-year of 2012.
The storage host component SHC-OSD and products/components based on it have until now offered a powerful and comprehensive functionality for controlling the replication functions of the EMC Storage systems Symmetrix and CLARiiON CX from the BS2000/OSD.
With the release of Fujitsu BS2000/OSD SHC-OSD V9.0 in mid-September 2011 information functions and event monitoring were also offered for ETERNUS DX and the ETERNUS DX replication functions Equivalent Copy and Remote Equivalent Copy were supported on BS2000 servers. EC is the local mirroring at volume level comparable to TimeFinder/Clone with Symmetrix. REC is the remote mirroring comparable to SRDF/S with Symmetrix.
The support of local mirroring with snaps and virtual provisioning for ETERNUS DX systems is planned for the follow-up version of SHC-OSD (V10.0), to be released probably in the 2nd half-year of 2012. The support of asynchronous remote mirroring is planned for a further follow-up version.
The clone and snap function of ETERNUS DX differs in some points from the clone/snap implementation of the EMC-Storage systems so that SHC-OSD cannot offer the underlying components snapsets, CCOPY and PVSREN any compatible interfaces. These components were adapted accordingly in the OSD versions concerned, thus offering the BS2000 customer an comparable alternative to the EMC Symmetrix systems.

Manageability / Ease-of-use

Adaptation of the SHOW and MODIFY commands of the pubset administration

New (additional) SHOW commands are offered for pubset administration in such a way that a MODIFY commando can also be found for a SHOW command by means of the function prefix alone, and vice versa. This affects the following:

MODIFY-/SET-…command	New SHOW command	Previous SHOW command
MODIFY-PUBSET-CACHE-ATTRIBUTES	SHOW-PUBSET-CACHE-ATTRBUTES	SHOW-PUBSET-PARAMETERS
(no MODIFY available)	SHOW-PUBSET-OCCUPATION	SHOW-PUBSET-PARAMETERS
MODIFY-PUBSET-SPACE-DEFAULTS	SHOW-PUBSET-SPACE-DEFAULTS	SHOW-PUBSET-PARAMETERS
MODIFY-SPACE-SATURATION-LEVEL	SHOW-SPACE-SATURATION-LEVELS	SHOW-PUBSET-PARAMETERS
MODIFY-PUBSET-PROCESSING	SHOW-PUBSET-PROCESSING	SHOW-PUBSET-CONFIGURATION
MODIFY-PUBSET-DEFINITION-FILE	SHOW-PUBSET-DEFINITION-FILE	SHOW-PUBSET-CONFIGURATION
MODIFY-PUBSET-RESTRICTIONS	SHOW-PUBSET-RESTRICTIONS	SHOW-PUBSET-CONFIGURATION
SET-XCS-PUBSET	SHOW-XCS-PUBSET	SHOW-SHARED-PUBSET

New EDIT commands

EDIT commands, for which the current operand values are defined in advance, are offered for a range of frequently used MODIFY commands (analog to the already existing EDIT-FILE commands). This allows the operand value to be shown and changed in a single work step. The EDIT commands are implemented via SDF-P S-procedures and supplied as compiled
SDF-P S-procedures so that they cannot be modified by the customer.
Advantage: They do not require the chargeable product SDF-P for implementation with the customer.
In detail, EDIT commands are offered for the following MODIFY commands:

MODIFY command	New EDIT command
MODIFY-JOB	EDIT-JOB
MODIFY-JOB-OPTIONS	EDIT-JOB-OPTIONS
MODIFY-JV (release with JV V15.1)	EDIT-JV (release with JV V15.1)
MODIFY-JV-ATTRIBUTES (release with JV V15.1)	EDIT-JV-ATTRIBUTES (release with JV V15.1)
MODIFY-PUBSET-CACHE-ATTRIBUTES	EDIT-PUBSET-CACHE-ATTRIBUTES
MODIFY-PUBSET-DEFINITION-FILE	EDIT-PUBSET-DEFINITION-FILE
MODIFY-MASTER-CATALOG-ENTRY	EDIT-MASTER-CATALOG-ENTRY
MODIFY-USER-ATTRIBUTES	EDIT-USER-ATTRIBUTES
MODIFY-USER-PUBSET-ATTRIBUTES	EDIT-USER-PUBSET-ATTRIBUTES
MODIFY-POSIX-USER-ATTRIBUTES	EDIT-POSIX-USER-ATTRIBUTES
MODIFY-SPACE-SATURATION-LEVEL	EDIT-SPACE-SATURATION-LEVEL
MODIFY-PUBSET-SPACE-DEFAULTS	EDIT-PUBSET-SPACE-DEFAULTS
MODIFY-STORAGE-CLASS	EDIT-STORAGE-CLASS

New COMPARE-DISK-FILES command

The new function "Compare two disk files" is offered both as a command interface COMPARE-DISK-FILES and as a program interface COMPFIL.
COMPARE-DISK-FILES compares two disk files of an identical file structure (SAM, ISAM, UPAM) on a byte-by-byte basis. On detection of the first disparity execution is aborted and the file position of the disparity is output as a message.
To enable the comparison to be made, the two files must concur with regard to a series of file characteristics. This is checked before the actual file comparison.

More informative messages

In some commands additional information, such as the reference to the object (e.g. which file), is missing after a negative return code. Error diagnostics are as a result made more difficult for customers. Improvements have already been made for the command SHOW-FILE-ATTRIBUTES with BS2000/OSD V8.0.
In BS2000/OSD V9.0 appropriate measures are planned amongst others for the commands of pubset management.
Examples: Message DMS0807 as a supplement to DMS0533 (file not found) or DMS13FB to CMS0312 (MRSCAT not found).

Homogeneity test for pubset mirror as well as for clones

During pubset reconfiguration tests are currently performed in order to guarantee the pubset homogeneity for specific attributes. The tests currently performed for BCVs are also performed for clones as of OSD V9.0.

Selectable system reaction when CPU time limits are exceeded

Tasks and programs which exceed their predefined CPU time limit should be scheduled as close to the deadline as possible. When a CPU time limit is reached

- no time surcharges are granted,
- batch and dialog tasks are handled identically and
- no answerable console messages are output.

This behavior is also offered via the class-2 option DIATTL.

MAIL-FILE extensions

In BS2000/OSD V8.0 mail functions were implemented which enable system components and user programs to simply generate e-mails from system processes. Thus a text file can, as an alternative to the printout, be sent as an e-mail attachment file to the e-mail address of the user ID. The BS2000 file to be sent has until now had to be an SAM or ISAM file. In BS2000/OSD V9.0 library elements of print-editable element types (without the need for previous file extraction) and PDF files can also be sent (The command CONVERT-FILE-TO-PDF can be used to convert BS2000 text files (cataloged SAM or ISAM files) into "PDF files" (especially designated SAM-U files).

Function extensions for BS2000 commands

- The RUN command for the operator is extended by the option of starting RUN procedures from library elements.
- The new command SHOW-TEST-OPTIONS is used to display set and additional test options via the MODIFY-TEST-OPTIONS command.

JMS extensions for POSIX A43

In JMU and JMS new functions were implemented in order to define default job classes for POSIX subtasks: The following were realized:

- New JMU statement SET-POSIX- JOB-CLASS-DEFAULT
- Extension of the display in
    - JMU statement SHOW-JOB-CLASS
    - System command SHOW-JOB-CLASS

Automation / Dynamization

Online SNAP file configuration (+ extension of the dump)

To date the snapshot process could only be activated and deactivated during system startup via the parameter file. If an error occurs in the ongoing session, then the snapshot process was generally stopped. A restart was only possible with a complete system restart. It has until now not been possible to change the size of the $TSOS.SNAPFILE, either (data container for the snapshot process).

In BS2000/OSD-BC V9.0 the snapshot process can be stopped, restarted and re-initialized at will in the ongoing session. At the same time, changed general conditions also become effective, e.g. a change in size of the $TSOS.SNAPFILE.

New commands ACTIVATE-SNAPSHOT and DEACTIVATE-SNAPSHOT are provided for the purpose of switching on/off the SNAP dump function. The diagnostic support is improved by changing the memory dump:

- Suppressing the CL1 memory dump to provide as much as possible disk space for the dump of CL3/CL4 memory. The CL1 memory mainly contains modules, which are not of interest on a memory dump.
- Main memory dump also exceeding 2 GB.
    Today, the larger part of the CL4 memory is not backed up with a large main memory, because it exceeds 2 GB. As of OSD V9.0 the entire class-4 memory is safeguarded using SNAP.

Online update of the change dates for summer and winter time

So far the change dates between summer and winter times were defined for a maximum of three years in advance in the SYSPAR file that is only read and evaluated by the startup, because the responsible governmental authority also only defined the change dates for such a period of time in advance. In order to maintain/extend the change dates the file SYSPAR.BS2.<ver> for the area "GTIME" had to be edited (a classic system administrator task). To modify the change dates it was necessary to restart the system - and thus interrupt operations - after at most three years. With OSD V9.0 new/modified change dates can be made known to the operating system by command. It is no longer necessary to restart the system for this purpose. The function is provided as a new subsystem "CHDATES" with the commands ADD-, /MODIFY-, /REMOVE-, /SHOW-CHANGE-DATES,

thus making interruptions to operations / STARTUP no longer necessary (7 * 24-hr operation). In the event of any legislative changes regarding summer and winter time it is possible to react quickly.

Unconditional waiting for command WAIT-EVENT

The command WAIT-EVENT was extended to include
- unconditional waiting for a certain period
- unconditional waiting up to a specific time

without triggering spin off.

Openness and integration ability

The strategy of openness that has been practiced for many years with BS2000/OSD-BC V9.0 is now being consequently continued in order to make the use of BS2000 in the heterogeneous data center more efficient.

POSIX A43

As the technical basis of the BS2000/OSD opening strategy, POSIX is being further developed in accordance with user requirements. In connection with BS2000/OSD-BC V9.0 the release of the new version POSIX A43 is planned for subsequent delivery in 12.2012. Functional extensions are:

NFS connection of the bs2fs

The BS2000 file system bs2fs (available since POSIX A41) permits access to BS2000 files from POSIX and with existing POSIX interfaces (commands and program interfaces).

Today, access of open systems to BS2000 data requires an upstream download or downstream upload of the bs2fs file (e.g. via file transfer or ftp).

The following extensions are implemented in POSIX A43:
- NFS release of bs2fs file systems
  Access from any NFS clients to BS2000 files and PLAM library elements is made possible through bs2fs. As a result replica administration is no longer required, and improved name and location transparency is achieved.
- Guarantee of the BS2000 access protection (no NFS-usual implicit access rights, but only rights explicitly issued by the administrator)

They can be used where e.g. the cycle "*download from BS2000 – local modification – upload*" is currently necessary using file transfer. In addition to improved access times and relief for the network (the larger they are, the smaller the modification in comparison to the file size), administration of the ensuing replicas is also no longer required. In contrast to the existing function in the "openFT Explorer" (since openFT V10.0) for transparent access to BS2000 files with standard applications (editors, viewers, ...),   the BS2000 files can be processed in this case by any client applications.

The extensions required in the shell command "share" in NFS/BS2000 are released as a correction version for NFS V3.0.

Backup of bs2fs files after error during close()

The close() of bs2fs files can fail, because the save in the BS2000 fails (e.g. due to space problems).

In POSIX A43 a "bs2fs_lost+found" is implemented, in which files are stored after an error during close() and from which they can be transferred by the user to the BS2000 (possibly with tool support) – after elimination of the cause of the error in the BS2000 (e.g. space problem).

Own job classes for POSIX tasks

Special job classes for POSIX tasks are introduced, which are defined for DIALOG und BATCH according to the default job classes. The resources for "POSIX tasks" can then be controlled via special job classes.

For this purpose, new functions for the definition of default job classes for POSIX subtasks were implemented in JMU, JMS and SRPM: The following were implemented:
- New JMU statement SET-POSIX-JOB-CLASS-DEFAULT
- Extension of the display with
    - JMU statement SHOW-JOB-CLASS
    - System commands SHOW-JOB-CLASS and SHOW-USER-ATTRIBUTES.

Task creation through fork() assigns the POSIX default job class to the task to be created, providing this is defined for the ID or on a system-wide basis.

Unicode-EDT (command "edtu")

The currently available shell command "edt" uses the V16.6 function of the EDT subprogram. The V17 version of the EDT subprogram offers new features
- Unicode and ISO character sets, new output formats, more work files
- Very important in POSIX: long lines (32768 bytes)

A new command "edtu", which uses the V17 function of the EDT subprogram, is integrated in the shell with POSIX A43.
- Processing several POSIX files (up to 22)
- Processing command output (via pipes).

Accelerating a POSIX shutdown

A POSIX subsystem and init process wait in the subsystem termination to some extent longer than necessary for events to occur. The waiting points are localized and the waiting times optimized.
The benefit here is the acceleration of maintenance and test work that requires a POSIX restart.

Introduction of "logrotate" ("syslogd")

A rotation is implemented in ongoing operation for POSIX log files (comparable to the mechanism with CONSLOG). This prevents bottlenecks in the var file system, which currently requires a POSIX restart.
A syslog-daemon is implemented or ported for this purpose. Small deliveries for CRTE V2.8 (OSD V8) and CRTE V2.9 (OSD V9) have been agreed for the calling of the "syslogd".
A "logrotate" command is provided, with which the log files used by the syslog-daemon can be changed during ongoing operation.

Improvement of the online help ("man")

The meaning of the options and parameters is displayed in the online help. This information is currently only included in the manual. This is why txt files are created for man pages.

Support @@Z on the block terminal

Analog to Ctrl-Z on the character terminal, @@Z generates an SIGTSTP signal on the BS2000 terminal (stops the program and thus also its terminal output (comparable to "K2" in BS2000))

Introduction of an IPv6-compatible "ping"

openNet Server V3.4 supplies an IPv6-compatible "ping6". The POSIX command "ping", which is currently only mastered by IPv4, is made IPv6-compatible.

POSIX-compliant support of SIGXCPU

The CPU limit can be defined with setrlimt(). If the limit is exceeded, an SIGXCPU signal is output.
This development measure is used to close a gap in the implementation of the POSIX standard.

The topics Support @@Z on the block terminal and Unicode-EDT (command "edtu") are implemented preferentially in POSIX A41 and already supplied in advance with KP1/11 for BS2000/OSD-BC V7.0 and V8.0.
The new POSIX A43 version is planned for 12.2012 and will be released as of BS2000/OSD-BC V7.0.
However, the function "Own job classes for POSIX tasks" only exists under BS2000/OSD-BC V9.0, as it requires extensions in JMS, JMU and SRPM of OSD V9.0.

Extensions in SWK products

Extensions in HSMS/ ARCHIVE V9.0B

HSMS/ARCHIVE support of the OSD V9.0 Net-Storage support

The data on the Net-Storage also belongs to the backup scope of a pubset in OSD V9.0. HSMS/ARCHIVE is therefore being extended by functions for the backup/restore of files on Net-Storage.
Thus, in backups with the previous standard settings in HSMS andARCHIVE the data is always also backed up on the Net-Storage. However, the ARCHIVE user interface is not extended.
With regard to files on local pubsets and files on remote Net-Storage the backup amount can be selected directly via extended HSMS interfaces. In restore the selection of NAS storage files is allowed, and NAS storage is also provided as a target for the restore.
(Note: the term "backup" covers the functions backup, archiving, export files.)

Extended search function for archiving

After years of tape storage and the required reorganization and refresh cycles of tapes, the original assignment of archived data to the save version is now obsolete. In order to support the organization and reorganization of long-term archives a new search function is offered in SHOW-ARCHIVE which provides the following:
- Evaluation (pattern search) of the comment entered in the field "user information".
- Output of a list of all save version IDs and user information

BACKUP NODE FILE with improved path selection

The resolution of files / directories for backup node files with LIST-FILE and SELECTION-BOUNDARY was not standardized. The specification of a file list with   /, /var, /home and /var, /home brought about different results if e.g. a different file system was mounted under /var (locally or via nfs). Previously, files that were in another Posix container but were mounted locally were removed from the backup. The statement parameter SELECTION-BOUNDARY is extended in order to be able to back up everything that is available in the local BS2000 Posix (*ALL-LOCAL-FILE-SYSTEMS).

Restore of files without archive details

To give the user an opportunity to also restore files with original attributes without specifying the archive name the IMPORT-FILE command has been extended to include the operand DATE-AND-PROTECTION.

Support for the renaming of PVS

If PVSREN is used to rename a PVS, on which HSMS archives were set up with the appropriate archive directories ("directories"), the HSMS control file was then still given the file name of the archive directories with the original catalog ID.
A new operand in the command /MODIFY-ARCHIVE-ATTRIBUTES now supports the renaming of the PVS of the archive directory.

Extensions in DAB V9.3

Changes in the task structure and prevention of I/Os in the DBST task

The actions, which call the interfaces with potential long-lasting I/Os, are moved to a server task. This server task is monitored by the DBST task➔ Prevention of deadlock situations in case of HW failure.
I/Os, which had until now been initiated by the DBST task, for instance for catalog read operations or SVL accesses, are relocated to a new server task. This prevents the DBST task hanging because of HW problems and also due to its operations on files and pubsets, which are served from DAB caches.

Addition and removal of PUBSETs into/from a cache

If disk assignments with AUTODAB become more frequent during the course of time, the cache areas become larger. This increases the CPU requirement for caching (through longer-lasting scans via longer LRU and hash chains as well as more time used in intermediate backups).
The customer has the option of reacting dynamically to such situations (removal of PUBSETs from a cache) - without initially having to completely dissolve the existing DAB caches.
Pubsets can be added or removed for a cache area with automatic caching.   This enables dynamic redistribution of pubsets on AutoDAB caches. New operand values with the command MODIFY-DAB-CACHING (AREA = ADD-PUBSET or REMOVE-PUBSET) are introduced for this purpose.

Creation of cache and administration data above the memory minimum

In the event of a large cache requirement the minimum amount of memory today must be high.
A reboot has to be performed in order to reduce the memory minimum.
➔ The solution allows large caches above the memory minimum
➔ Customer benefits through flexibility when relocating a VM to standby VM with low memory (minimum) and renewed relocation to the original VM
When setting up DAB caches in the main memory, the option is provided of having the cache data created above the memory minimum instead of below the memory minimum as before. This creates the option of setting up DAB caches according to full memory size, for instance on a standby system, whose memory is extended when the production system fails to such an extent that it can be simply reduced later. In case of memory reduction the caches are then also made smaller. The preferred location of the cache data and the behavior during a storage reduction are controlled by means of a new sub-operand of the operand CACHE-MEDIUM = MAIN-MEMORY, with which four operand values are possible (*STD, *ANY, *BELOW-MIN-MEM-SIZE or *ABOVE-MIN-MEM-SIZE).

Extensions in FDDRL V18.0

Home pubset backup in ongoing operation

Compared with the logical backup with HSMS/ARCHIVE, the physical backup of home pubset with FDDRL has the advantage that the IPL capability, the pubset attributes, the entire software configuration and the user attributes are backed up and recovered during restore. A pubset restored with FDDRL can be put back into operation immediately. In contrast, a HOME pubset backed up with HSMS/ARCHIVE must first be set up again and configured.
As far as a fast and reliable restore of the home pubset is concerned, backup using FDDRL is essential and therefore strongly recommended. Since the software configuration is fairly consistent and is not changed every day, it is sufficient to perform an FDDRL backup at greater intervals, e.g. monthly. However, to backup the home pubset with FDDRL it has until now been necessary to end the system run. Then the home pubset can be backed up offline using another system.
The home pubset backup can take place in FDDRL V18.0 during ongoing operations.

New command SHOW-FDDRL-PARAMETERS

The //MODIFY-FDDRL-PARAMETERS statement can be used to be set up parameters for the FDDRL procedure. The current settings can be output using the new //SHOW-FDDRL-PARAMETERS statement.

FDDRL V18.0 is released for BS2000/OSD-BC as of V7.0; the new functionality "home pubset backup in ongoing operation" is available as of BS2000/OSD-BC V8.0.

Extensions in JV V15.1
- New EDIT commands for the commands MODIFY-JV and MODIFY-JV-ATTRIBUTES
- Adaptation of DELETE-JV to DELETE-FILE: with the DELETE-FILE command selection criteria can be specified for the files to be deleted using SELECT=*BY-ATTR. In JV V15.0B the command DELETE-JV is extended to such an extent that selection criteria for the JVs to be deleted can be specified accordingly using SELECT=*BY-ATTR.
- New meaningful messages on wrong input to commands /COPY-JV, /MODIFY-JV/SETJV, /MODIFY-JV-ATTRIBUTES/CATJV und /MODIFY-JV-CONDITIONALLY with output of concerned JV name.

JV V15.1 is released for BS2000/OSD-BC as of V7.0 and for OSD/XC as of V9.0.

Extensions in openNet Server V3.5
- Support of FQDN / Stage 2: FQDN support for configuration files (sysdat.bcam....) and also fixed assignment of the alias name (max. 8 bytes) to long DNS name and persistent storage
- Rebasing of LWRESD
- Introduction of an /etc/services file for implementing service names in port numbers and vice versa and thus storage of the assignment in an editable file instead of in configuration files.
- IPv4 Address Conflict Detection: Analog to IPv6 a check is made with own IP addresses to determine whether they are already being used by another processor. If they are, the address is set to invalid and is thus not used (a second time in the network).
- Adaptation of RFC5681 Congestion Control (replaces the previous RFC 2581)
- Support of RAW sockets and ICMP protocol (delivery for Oracle 11g)

openNet Server V3.5 is released for BS2000/OSD-BC as of V7.0 and for OSD/XC as of V9.0.

Extensions in SM2-BS2 V9.0
New measuring program - OPENFT
As of openFT V11.0 openFT offers measurement values for each openFT instance via a new interface. The instances must be defined in openSM2 by the user (new SM2 statements: ADD/REMOVE-OPENFT-INSTANCE). Up to 16 instances can be specified
The data is output in a new OPENFT report in the TU section and on the C-interface SM2GDAT, and also written into the measurement value file. This also permits the data to be output by the inspector / analyzer.

Extended support of RSC-IOs
IOs for disks and tape devices are scheduled in parallel (RSC-IOs) on SQ servers. The average number of RSC-IOs is already entered beforehand by SM2.
RSC-IOs can also be used by paging in BS2000/OSD V9.0. If RSC-IOs exist, the utilization level of devices (busy) is calculated from the RSC-IOs and the maximum possible number of RSC-IOs: In BS2000/OSD V9.0 SM2 calculates the load from the RSC-IOs during paging.

Extensions in ROBAR V6.5
Support of Scalar i6000
The Scalar i6000 can currently be operated on the BS2000 with ROBAR V6.0C in Scalar i2000-compatible mode. The explicit BS2000 support for Scalar i6000 is performed with ROBAR V6.5: Detection and support of the library as Scalar i6000, if necessary with the support of the new library functions.
New i6000 functions (e.g. Media Data Integrity Analysis MeDIA) are also tested and, where necessary, supported.

Persistent LINUX device nodes for SCSI libraries
Today, ROBAR-SV uses non-persistent /dev/sg* device nodes. After each sever reboot, the device nodes can be changed (different name, different allocation) and the access rights are no longer correct.   -> Solution with persistent device nodes through udev rules and group assignment.

SLES11 Support for 64 Bit
Today, ROBAR-SV is a 32-bit application; the defined OS-Version is SLES10 SP4 x86.
SLES 11   64-bit are also supported with ROBAR-SV V6.5.

GUI in accordance with the FJ style guide
A redesign analog to that of the GUI redesign for the SQ200 is carried out for the ROBAR GUI, i.e. adaptation of the colors and controls to an FJ-compliant style guide (and no more "Siemens green" color).

Replacement of LoggingV3 with syslog-ng

ROBAR-SV (Linux) currently writes its error messages to Logging V3.
The logging on syslog-ng is changed in ROBAR-SV (Linux) V6.5, including own logging files with appropriate ROBAR group rights and a suitable log rotate.

User/role concept
The ROBAR instances are currently installed in "function IDs" - this is especially problematic with security-sensitive customers; a remedy is currently only possible with customer-specific project solutions.
A user/role concept is implemented in ROBAR-SV V6.5:
- Installation of the product in a central location (compliant with the Linux Filesystem Hierarchy Standard)
- IDs are configured for use within a group concept

The changes are not made in the actual product, but only during installation / basic configuration (separation code and configuration data).

The new version V6.5 is offered for ROBAR-SV and ROBAR-CL.
ROBAR V6.5 is released for BS2000/OSD-BC as of V7.0.

Extensions in SHC-OSD V9.0 and follow-up version
The storage systems Fujitsu ETERNUS DX410/DX440, DX410 S2/DX440 S2 and DX8400/DX8700 are released for operation with Fujitsu BS2000/OSD business servers of the S and the SQ series with BS2000/OSD V7.0 and V8.0.
The release of the models ETERNUS DX 8700 S2 is planned in a supplement to SHC-OSD V9.0 for the 1st half-year of 2012.
The storage host component SHC-OSD and products/components based on it have until now offered a powerful and comprehensive functionality for controlling the replication functions of the EMC Storage systems Symmetrix and CLARiiON CX from the BS2000/OSD.
With the release of Fujitsu BS2000/OSD SHC-OSD V9.0 in mid-September 2011 information functions and event monitoring were also offered for ETERNUS DX and the ETERNUS DX replication functions Equivalent Copy and Remote Equivalent Copy were supported on BS2000 servers.

New Functions in SHC-OSD V9.0 for ETERNUS DX storage systems
Information functions
The offered information functions for ETERNUS DX cover general information about the storage system and storage volume configuration (BS2000-specific details about MN, VSN, device type, as well as the appropriate storage-system-specific information, such as serial number, logical volume number, RAID level, status, configured capacity, etc.), and information about local mirroring with EC and remote mirroring with REC (details about MN, VSN, original and mirror disks, the logical volume numbers, type and serial number of the controllers, mirroring status, etc.). The information functions for ETERNUS DX storage arrays are mapped on existing interfaces.

Event Monitoring
SHC-OSD V9.0 also offers for ETERNUS DX systems the event monitoring that is offered for Symmetrix systems and CLARiiON CX in the form of BS2000 console output in the event of status changes for the storage subsystem and for individual volumes, also with regard to active data mirroring.

Local mirroring (clones) with Equivalent Copy (EC)
EquivalentCopy (EC) provides local, continuous mirroring on a volume basis with separable mirrors. A local mirror volume of identical size is allocated to an original volume and after initial synchronization is also carried as a mirror. A maximum of 16 EC mirrors are supported for one original by SHC-OSD. Multiple mirroring is supported for a maximum total of 32 mirror volumes.

Synchronous remote mirroring with Remote EquivalentCopy (REC)
It supports mirroring on a volume basis with separable mirrors between 2 or more ETERNUS DX systems. A mirror volume of identical size is allocated to a local original volume in the remote ETERNUS DX and after initial synchronization is also carried as a mirror. At present a maximum of 16 remote ETERNUS DX systems can be connected. Multiple mirroring is supported for a maximum total of 32 mirror volumes. A maximum of 4 simultaneous REC mirrors are supported by SHC-OSD for one original (concurrent remote copy).

New Symmetrix functions
Virtual Provisioning: Selection of logical volumes via pool names
To enable simple administration of virtual provisioning the selection of the logical volume numbers by (thin) pool names is provided for the commands /SHOW-SYMM-DEV-CONF and /SHOW-STOR-DEV-CONF .

Functions for the administration of the RA groups
The support introduced with SHC-OSD V8.0 of Dynamic SRDF (START-REMOTE-COPY and STOP-REMOTE-COPY) also requires for the option of dynamic SRDF functions for the administration of so-called RA groups, which define an SRDF connection between two volumes of two Symmetrix systems. For this purpose commands (ADD/MODIFY/REMOVE-SYMMETRIX-RA-GROUP) are provided for the administration of the RA groups and their allocation to local and remote directories.

The functionality is particularly important for the use of SRDF/A, because administration here does not take place at volume level, but via the RA groups.

DataMobility configurations on the basis of SRDF/AR
In addition to the already supported synchronous SRDF mode (SRDF/S), DataMobility configurations on the basis of SRDF mirroring in asynchronous "adaptive copy" mode are supported with the correction level for SHC-OSD V9.0, which is planned for Q2/2012.

New functions in SHC-OSD V10.0
The support of local mirroring with snaps and virtual provisioning for ETERNUS DX systems is planned for the follow-up version of SHC-OSD (V10.0), to be released probably in the 2nd half-year of 2012. The support of asynchronous remote mirroring is planned for a further follow-up version.

Extensions in VM2000 V10.0

VM2000 V10.0 provides a joint version serving business servers of both the S and the SQ series (SX servers become through VM2000 V10.0 no longer supports).
VM2000 V10.0 supports BS2000/OSD-BC V9.0 as monitor and as guest system.

New functions in VM2000 V10.0
Joint VM2000 version for S and SQ servers
After version V9.0 (S/SX) and V9.5 (SQ only) VM2000 V10.0 is a joint version, which again supports all the current HSI lines (S/SQ). SX servers are officially no longer supported.

Full support of ETERNUS disk systems
Eternus DX disk systems (DX400/8000) are supported to the same extent as EMC Symmetrix disk systems by VM2000 (PAV, Snap & Clones).

Backup of the VM2000 configuration and automatic recovery for server start (S and SQ servers)
The backup of an existing VM2000 configuration is intended to enable the VM2000 administrator to recover the VM2000 configuration after the restart of the overall VM2000 system, i.e. ending all guest systems and restarting the monitor system, without having to write a suitable procedure file with VM2000 commands or adapt an existing procedure file. It should also be possible to use the backup to recover the VM2000 configuration on a backup server, on which - apart from the monitor system - no further BS2000 guest systems run.
The VM2000 administrator can create a backup using the command SAVE-VM-CONFIGURATION. The VM2000 administrator can trigger the recovery of a VM2000 configuration through the installation of a backup with the command RESTORE-VM-CONFIGURATION.

CPU pools for BS2000-VMs also with the SQ server (incl. adaptation of the virtual multiprocessor capacity)
The restriction that in addition to the *static* CPU pools no further *dynamic* CPU pools can be configured on SQ servers is lifted. In order to administer the CPU pools the commands CREATE-, DELETE- and SHOW-VM-CPU-POOL as well as ASSIGN-VM-TO-CPU-POOL and SWITCH-VM-CPU are available to the VM2000 administrator. In the last two commands the current multiprocessor capacity of the affected VM(s) is - as on S servers - checked and automatically modified.

Support of 32 virtual CPUs per VM (SQ server)
The maximum multiprocessor capacity of a VM on an SQ server is increased from 16 to 32.

VM2000 support of high availability & LiveMigration configurations (SQ servers)
The high availability & LiveMigration functionality for SQ server units is mainly implemented through MARS, X2000 and HA-Addon software. Nevertheless, deliverables are also required in VM2000, which make it possible to use VM2000 in such a HA cluster (e.g. a global view of all VMs in a cluster due to the required global uniqueness of VM names and necessary VM2000-specific tests).

SWK product overview

The following overview includes all SWK products, for which a new or correction version is released to support BS2000/OSD V9.0, and includes a summary of the respective new functions.

Product	Version	New function with OSD V9.0
ARCHIVE	9.0B	Delivery for OSD V9.0 Net-Storage Support
COSMOS	18.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
CRTE	2.9	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
DAB	9.3	o Duplication of DBST task o Prevention of long-lasting I/Os in the DBST task o Addition and removal of PUBSETs into/from a cache o Saving the cache and administration data above the minimum memory
FDDRL	18.0	o Home pubset backup in ongoing operation o New command SHOW-FDDRL-PARAMETERS
HIPLEX-MSCF	7.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
HSMS	9.0B	o Delivery for OSD V9.0 Net-Storage Support o Extended search function for archiving (statement: Show-Archive) o Improvement of the path name resolution in backup node files with LIST-FILE and SELECTION-BOUNDARY o CRs
JV	15.1	o New EDIT commands (EDIT-JV, EDIT-JV-ATTRIBUTES) o Adapt DEL-JV to DEL-FILE with SELECT=*BY-ATTR o Specification of concerned JV name in error message
openNet Server	3.5	o Support of FQDN stage 2 o Rebasing of LWRESD o RFC5681 Congestion Control o Delivery for Oracle 11g (RAW sockets) o CRs (etc/services, IPv4 Conflict)
openSM2 (BS2000)	9.0	o Adaptation to BS2000/OSD-BC V9.0 (technically coupled product) o New measuring program - OPENFT o Extended support of RSC-IOs o Support of SQ business servers (VM2000 measuring value)
openUTM	6.1	**Extended openUTM-Cluster support:** o Continuation of a process on another node o Simple change from Stand-alone to Cluster
PCS	3.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
RFA	18.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
ROBAR	6.5	o Support of Scalar i6000: Detection and support of the library as Scalar i6000 o Persistent LINUX device nodes for SCSI libraries o ROBAR-SV GUI in accordance with the FJ style guide o Replacement of LoggingV3 with syslog-ng o User/role concept o Support of SLES11 64-bit
SCA	18.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
SCCA-BS2	2.2	Support of SYMAPI V7.3
SCCA-BS2	2.3	Support of new ECC software
SESAM/SQL	7.0	o Extension of SQL interface o Extension of JDBC functionality o Simple generation of test data by anonymization of productive data o Efficient support or a Foreign-Copy o Differentiated protocol of lock situations o Space files up to 4 TB o Use of Emails

Product	Version	New function with OSD V9.0
SHC-OSD	9.0	Functions for ETERNUS DX o Information function o Event Monitoring o Local mirroring (clones) with Equivalent Copy (EC) o Synchronous remote mirroring with Remote EquivalentCopy (REC) Functions for Symmetrix o Virtual Provisioning: Selection of logical volumes via pool names o Functions for the administration of the RA groups o Data Mobility configurations on the basis of SRDF/AR (amendment)
SHC-OSD	10.0	Functions for ETERNUS DX o REC extensions for DX4000 S2 o SnapOPC+ support o Data Mobility configurations o Thin Provisioning Functions for Symmetrix o Support of FAST/FAST VP configurations
SPACEOPT	6.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
TASKDATE	18.0	Adaptation to BS2000/OSD-BC V9.0 (technically coupled product)
VM2000	10.0	o Joint VM2000 version for S and SQ servers o Backup / restore of VM2000 configurations o SQ server: Live-Migration o SQ server: CPU pools for BS2000 VMs

OSD/XC package for OSD V9.0: OSD/XC V9.0

Function range	Product name	Version in OSD/XC V9.0
Operating system	BS2000/OSD-BC	V9.0
Open Networking	openNet Server	V3.5
	TIAM	V13.2
Data / Program Management	CRTE	V2.9
	EDT	V17.0
	LMS	V3.4
	PERCON	V2.9
	SCA	V18.0
	SORT	V7.9
Data backup	HSMS	V9.0B
	ARCHIVE	V9.0B
Printing / Batch job handling	JV	V15.1
	RSO	V3.6