FUJITSU

DATA SHEET

BS2000/OSD-BC
Version 8.0
Operating System BS2000/OSD Basic Configuration

Issue November 2009

Pages 6

BS2000/OSD-BC is the operating system for the BS2000/OSD business servers.

BS2000/OSD-BC is unrivaled in providing an available, scalable, high-performance platform for business-critical applications that is totally compatible across numerous versions. At the same time, with its open interfaces BS2000/OSD-BC offers future-proof integration into modern application architectures. The server scalability from 12 RPF to 5.000 RPF enables tailor-made configurations with high growth potential.

For SQ servers, the x86 architecture ported BS2000/OSD-BC V8.0 variant, and for SX servers, the SPARC64 architecture ported BS2000/OSD-BC V8.0 variant is available as a part of the OSD Extended Configuration Package OSD/XC V4.0.

Efficiency, Innovation, Openness and Continuity are the main BS2000/OSD development goals.
In BS2000/OSD-BC V8.0 emphasis is placed on the following aspects:

- **New business servers S175 and S210 for top performance requirements**
- **New business server line of the SQ series based on Intel standard processors**
- **Performance measures to optimize data backup to fast tape devices (LTO)**
- **Functions for simpler and more effective BS2000 operation.**
- **Enhanced openness and integration ability**

Main features	Benefits
Business Servers and Peripherals - Innovations ■ Business Server S175 and S210 – the high-end series for the data center ■ Business Server SQ100 of the SQ series – the powerful mainframe for the entry- and medium-sized performance range ■ LTO-4 Ultrium drive, LTO-4 Ultrium drive encryption support in connection with MAREN V12.0	■ Allows enterprise-wide consolidation and fits for steadily increasing demand for computing power ■ BS2000 applications run as object-compatible code on high-end Intel x86 servers, the most widespread server platform ■ Most recent tape technology is available with BS2000/OSD.
Scalability / Performance ■ Disk I/O tuning by optimum transfer lengths ■ Enhanced support for the EMC^2 Symmetrix TimeFinder Snap function	■ Optimized data backup to fast tape devices ■ Greater flexibility by more snapset backups
Manageability / Ease of Use ■ Mail interface in BS2000/OSD ■ Broad filter possibilities for console messages ■ BS2000 ZIP enhancements: Crypto password to protect the files within the ZIP container	■ Emails from within system processes instead of print output ■ Flood of console messages can be limited easier ■ Data exchange of encrypted ZIP files with Windows systems
Openness and Integration New POSIX version providing transparent access to BS2000 files ■ New version Apache: Porting of Apache V2.2.8 with integrated SSL support	■ The extensive facilities of the POSIX tool environment can be used for processing BS2000 files ■ Secure transfer of documents and data over the internet

Product Characteristics

BS2000/OSD-BC is a multiprocessor operating system for servers based on /390 or SPARC64 or Intel x86 architecture. Characterized by a virtual storage concept, it runs on both monoprocessor and (max.15-way) multiprocessor systems. It also has the capability to activate spare and extra CPUs during online operation. In multiprogramming mode, up to 4096 tasks (including system tasks) can be administered concurrently. The address spaces allocated to individual users are protected against unauthorized access by other users. Exceptional user friendliness is achieved through automatic resource and data management. Transaction processing is optimized with the aid of efficient, high-performance, fault-tolerant storage systems including global storage (GS).
BS2000/OSD-BC includes a suite of utility routines to support recurrent routine activities. The products TIAM and openNet Server are required in addition for interactive (dialog) or remote operation of BS2000/OSD. EDT is another required product for BS2000/OSD operation.
BS2000/OSD-BC provides the security functions required as a basis for secure handling of e-business applications. Together with the SECOS product as of V5.2, BS2000/OSD-BC V8.0 conforms to the F2/Q3 certification level of the security criteria catalog published by the German Federal Office for Security in Information Processing (BSI).

Functional Description

Basic System

The basic system provides all other functional units of BS2000/OSD-BC with resources that are independent of the hardware architecture. For this purpose, the control and management functions and some operating functions for hardware resources such as central processor, main memory, global storage, I/O processor, including channels and peripherals, are activated via software functions.

Task management
Task management ensures that the operating system handles task processing requirements in the most efficient way possible. This includes ensuring optimum utilization of server and peripherals as well as delivering high program throughput. Task management can also involve giving precedence to individual tasks in order to fulfill specific requirements. The sequence in which tasks are processed is controlled by means of priorities, as well as by assigning separately managed categories. A system of "service slots" ensures that no task can make excessive use of the processor(s) without explicit permission. An aging mechanism makes sure that lower-priority tasks are also processed.

Memory management
Memory management in BS2000/OSD-BC is based on the virtual storage concept and supports 2 GB virtual address spaces (user and system). BS2000/OSD-BC maps the virtual address spaces onto the actually available real memory. Real main memory can be a multiple of 2 GB. The maximum size is determined by the main memory capacity of the BS2000/OSD business servers. The system is capable of addressing memory in the terabyte range. Real memory is automatically reorganized by the system. Only the program sections actually required at a given time for active tasks need to be resident in main memory. This function is handled by a paging mechanism, which makes the relevant program sections available to the tasks as necessary. The paging mechanism fetches the required pages from background storage into main memory and writes these pages back to background storage once they have been updated and released. The size of the supported paging area is max. 4 Terabyte.

Data spaces
As well as the 2 GB program address space, a program can make use of additional 2 GB data address spaces. These address spaces are partitioned like the program address space and may only contain data. The data can be accessed at byte level by access commands as applicable for the program address space.

Support for Global Storage (GS)
Global storage on BS2000/OSD S series business servers permits extremely fast, synchronous and fault-tolerant access to frequently needed disk-resident data. Functions supporting reconfiguration of a GS complex, consisting of two GS units operated in mirror mode and one to four GS servers, are available in BS2000/OSD-BC V8.0. Individual components can be detached from the GS complex and reattached subsequently.

Fibre Channel support
Fibre Channel is the standard for host-storage connections in the open systems world. With the Fibre Channel support in BS2000/OSD-BC V8.0, this connectivity standard is available for the entire range of the current BS2000/OSD business servers and peripheral devices. Key benefits of Fibre Channel connection technology are high transmission rates and extremely short response times. It enables the integration of the servers into an enterprise storage area network (SAN), thereby also allowing their integration into a storage consolidation scheme based on the most advanced connection standards. The SANCHECK utility supports the detection of generation errors and the location of error states in the SAN.

Parallel Access Volume (PAV)
Using the Parallel Access Volume (PAV) function, multiple I/O accesses to a logical volume can be performed concurrently. A PAV volume consists of a base device and up to 3 alias devices, which in case of connection via channel type S are set up in the Symmetrix controller and must be generated in the BS2000 system. In case of Fibre Channel connection, PAV needs no Symmetrix setup, the generation of alias devices in BS2000/OSD is sufficient. I/O queues building up in front of a logical volume can be avoided with PAV.

Disk I/O tuning by optimum transfer lengths
To further optimize sequential reading from disk and consequently data backup to high-speed tapes (LTO), the internal transfer length will be increased in BS2000/OSD-BC V8.0, e.g. from 80 to 240 Pam pages on NK2 disk with the strategic disk format D3435 on Symmetrix.
The bigger internal transfer length is used in the COPY-FILE command of BS2000/OSD-BC V8.0 and in HSMS/ARCHIVE V9.0.

Autonomous Dynamic I/O Resources Control (IORM)
The BS2000 IORM subsystem comprises the following functions to control I/O resources in an autonomous dynamic manner (devices, controllers, channels, paths):

- IOPT - I/O Priority Handling for Tasks
- DPAV - Dynamic Parallel Access Volume: allocates PAV alias devices dynamically
- DDAL - Dynamic Device Allocation: optimizes load balancing for CentricStor operation
- IOLVM - I/O Limit for Virtual Machines

IORM connects itself at the BS2000 I/O system at start up and collects I/O data about it. With these data, the I/O resource load can be determined. IORM checks periodically, if the I/O operation must be intervened.
The IORM functions IOPT, DPAV and IOLVM deal with disk devices, the DDAL function deals with tape devices.

Data management system

The data management system functions are subdivided into the following categories:
- file management,
- data management and
- device management.

File management
The BS2000/OSD operating system is file-oriented, i.e. all data such as I/O data, programs etc. are held in BS2000/OSD files. The files are accessed via system catalogs which are allocated to the pools of shared (public) data volumes. With its expanded catalog format “extra large”, BS2000/OSD-BC supports to create approx. 240.000-320.000 files.
BS2000/OSD supports files and volumes with capacities up to 4 Terabyte. By default, users can access only their own files. The owner of a file can also assign access rights to other users. As an added safeguard, other criteria such as passwords, read-only access, etc. can be set.

Data management
Access to the files is handled by the data management function. The user has a choice of access methods, the most important being sequential (SAM), indexed sequential (ISAM), user primary access method (UPAM), and Data in Virtual (DIV). DIV enables a user-oriented access method in memory. A feature of DIV is that it does not require data to be structured and the user does not have to invoke any explicit I/O operations.
Disks are always initialized in a standard basic format. Three different disk formats are available for data storage:
- 2K key-formatted disks
- 2K keyless disks
- 4K keyless disks.

Pubsets always consist of a uniform disk type, i.e. either keyless or key-formatted volumes. The HOME pubset must always consist of key-formatted or keyless volumes in 2 K format.
Non-key (NK) access methods (NK-SAM, NK-ISAM, NK-UPAM) are also available to support disk operation in keyless mode. The NK access methods can be used on pubsets with PAM key as well as on keyless pubsets. NK-ISAM (NON-KEY-ISAM) also delivers a significant improvement over ISAM in terms of throughput and parallelization of data processing. The buffers (NK-ISAM pools) are always related to single files and are automatically generated by the system.

Device management
BS2000/OSD differentiates between shared public volumes (disk) and private volumes (magnetic tape or disk). A number of shared disks can be grouped together to form a pool, called a pubset. Several pubsets can be operated in parallel (Multiple Public Volume Sets, or MPVS). One pubset (HOME pubset) must be permanently available. Failing explicit specification otherwise, files are written to pubsets by default. Volumes are assigned automatically by the system. When retrieving data, users also have no need to be concerned with where the files are physically located. All the relevant information is held in the catalogs. The use of preformatted volumes gives the user programs a high level of hardware independence. It is possible to perform pubset-oriented reconfiguration by attaching and detaching (ATTACH / DETACH) disks also at the level of an entire pubset. This increases operating reliability and allows a higher degree of automation.

Online provisioning for pubsets
SPACEPRO (SPACE PROvisioning) is a PROP-XT application in BS2000/OSD-BC V8.0 which monitors pubsets for saturation and where necessary extends them in a controlled manner with volumes from a free pool.
With SPACEPRO, the number of disks in a BS2000 pubset can be adjusted automatically, potential operator errors can be avoided and (temporarily) unattended operation is supported.

Save/Restore to / from Snapsets
BS2000/OSD-BC V8.0 supports snapshot-oriented backup/restore scenarios in EMC^2 Symmetrix configurations as well as in FibreCAT CX configurations on SX and SQ servers. The pubset copy that can be used for restore consists of the simultaneously generated snap units for all volumes of the pubset and is called the „snapset“. Snapsets are created and deleted by the administrator; the administrator can restore an entire pubset from the last snapset. New DMS functions enable the end user to restore individual files and job variables from the available snapsets. The increased amount of snapsets in BS2000/OSD-BC V8.0 allows that backups on working days can cover more than one monthly period using only snapset backups.

System Managed Storage
System Managed Storage (SMS) denotes an extended concept for data management by the system. It is based on the principle of separate logical and physical views of the data. Multiple pubsets can be grouped together to form a system-managed pubset (SM pubset) in order to offer the user different types of services. The user formulates a logical description of the structural, availability and performance requirements of his file. The system then automatically finds the optimum storage location for the data within the system-managed pubset. System-managed pubsets are self-contained switchover units within the overall storage hierarchy. Using an SM pubset the storage administrator can define an hierarchical storage system consisting of the online processing level and the migration level (HSMS background level).
SMS supports operation of an Information Lifecycle Management (ILM) system aimed at providing the right information at the right time and at the right place at minimum cost.

Job management system

The job management system in BS2000/OSD includes the following functional groups:
- Local job management system,
- SPOOL system and
- Accounting.

Local job management
The local job management system controls and manages all pending jobs. Jobs can be submitted as interactive or batch jobs. Time settings can be specified for batch jobs (time or calendar jobs) so that they are repeated at regular intervals. Each job is assigned to a job class, which determines the service level and resource limitations. Job classes can in turn be combined into different job streams, with each job stream being able to control job starts according to a separate scheduling strategy.

SPOOL system
SPOOL is used to read in job descriptions (SPOOLIN) and to output the results (SPOOLOUT). For output, the temporal link between provision of the data and the actual output of the data to a device is broken. Spooled-in user jobs and output jobs in progress are saved beyond the end of a system run and can be processed in the next session. The configuration

of devices operated via SPOOL can be changed. The assignment of special usage modes (e.g. printers for special character sets or types of paper) can be changed dynamically and is taken into account when jobs are processed.

Accounting
The accounting system collects data on the overall system and on the individual programs/tasks (e.g. CPU time, input/output, allocated resources) and writes this data to the accounting file in the form of accounting records. This file can be analyzed using special accounting software tools, e.g. RAV.

Programming system

The BS2000/OSD programming system includes a set of functions for BS2000/OSD users wanting to write their own programs. The programming system consists of the following functional units:

- Editor
- Compiler
- Binder Loader System
- Debugging aid and program library system.

Of these the Binder Loader System and the library access method are already included in BS2000/OSD-BC.
The Binder Loader System (BLS) in BS2000/OSD supports static and dynamic mounting, loading and starting of user programs. This functionality is provided by the following functional units of the Binder Loader System:

- Binder (static),
- Loader (static) and
- Binder-loader (dynamic).

The binder mounts user programs compiled by the compiler (object modules) or link/load modules to create a (link) load module, which can then be loaded by the loader and executed or else processed further by the binder. The binder-loader mounts the link/load modules, loads and starts them immediately. The binder-loader also provides functions for dynamically mounting a program online. The binder is a BS2000/OSD utility routine, while the loader and binder-loader are integrated in the system.

POSIX in BS2000/OSD

BS2000/OSD-BC features standardized interfaces conforming to POSIX / XPG4.2. The POSIX-BC function complex of BS2000/OSD-BC includes the POSIX programming and application interfaces as library functions for the C programming language, the POSIX subsystem, i.e. the runtime environment for the POSIX system calls, as well as the entire POSIX shell. Metadata journaling enables fast restart of the POSIX file system. The BS2000 file system bs2fs allows to access BS2000 files transparently from POSIX.

Java

With the Java "write once, run everywhere" concept, it is possible to run applications across networks of heterogeneous computer systems – across the most disparate platforms and operating system boundaries.
With the BS2000/OSD Environment for Java (JENV), all Java programs, regardless of the platforms on which they were written, can be run on BS2000/OSD systems. Similarly, Java applications developed for BS2000/OSD can also run on other platforms.

Apache, WebTransactions

BS2000/OSD-BC V8.0 includes the Apache web server V2.2 with integrated SSL support. Another component provided as part of the BS2000/OSD-BC V8.0 operating system basic configuration is the openSEAS component WebTransactions for OSD, enabling web integration of BS2000/OSD applications, executable on BS2000/OSD under POSIX, with unlimited user licenses.

Unicode in BS2000/OSD

With Unicode support in BS2000/OSD, the EBCDIC character sets available in BS2000/OSD systems are being extended by additional characters that will be required in the European language area in the future. Users are provided with the programming and runtime environment that they need in order to extend their existing applications with Unicode data fields. A suitable software configuration is being provided under BS2000/OSD-BC V8.0.

System administration

BS2000/OSD system administration includes:

- Functions for setting up and installing an executable software configuration that provides the user with the required operating functions and resources and is parameterized to ensure that existing performance and reliability requirements are met.
- Operation monitoring functions, for recording and evaluating qualitative performance (fault diagnosis).
- Support functions that respond to hardware failures or system software problems either by initiating hardware or software reconfiguration measures to permit operation to continue, or by ensuring an orderly shutdown.
- Some system administration functions are also implemented via utility routines.

Operator interface system

The BS2000/OSD operator interface system includes all functions to support operation of the system by the user, system administrator or operator. The main function of the system administrator is to manage system access authorizations for timesharing mode. Users are also granted detailed privileges for system use by means of a system user ID. The operator is responsible for starting up the system, controlling and monitoring its operation and providing any manual support needed, e.g. by operating peripheral devices. For specific installations, some of the system administrator's tasks can be handled by the operator.
BS2000/OSD-BC V8.0 provides broad filter possibilities for console messages, in order to easier limit the flood of console messages.
Support for the operator is provided by the teleservice and by an option enabling operator functions to be delegated to the automatic operator, authorized applications and other servers. This enables systems to be operated without a human operator needing to be in attendance on-site.
The operator interface system includes the functional units SDF/CMD (with SYSFILE), MIP, JOIN, Operating and NDM. SDF/CMD implements the command interface for the user and the system administrator. It is controlled by the command and statement specifications contained in the activated syntax files. The SYSFILE functional unit provides the basic function for running nested command procedures and manages the allocation of system files to user files. The MIP functional unit implements functions for editing and output of system messages. NDM (Nucleus Device Management) is responsible for managing the peripheral device configuration and the mounted volumes. NDM provides optimal monitoring / reservation and utilization of available resources.
BS2000/OSD-BC V8.0 provides mail functions which permit system components and user programs to generate emails easily from within system processes. An email address can be assigned to every user; it is stored in the user entry of the BS2000 user ID. A MAIL-FILE command and macro interface is provided. The actual sending of emails from within BS2000 is performed using the Mail-Sender of the Internet Services product. So the print output of system processes can be completely replaced by mail.

BS2ZIP is the WinZip-compliant compression tool of BS2000/OSD. In BS2000/OSD-BC V8.0 the files within the ZIP container can be protected by a container-associated crypto password. This enables data exchange of encrypted ZIP files with Windows systems.

High availability

The high availability of the BS2000/OSD hardware and software is well-known. Thanks to the advanced CMOS technology used, single servers of the S model series often operate for years without hardware failure. BS2000/OSD is a world-beater in terms of stability and minimal need for scheduled downtimes (high parallelization level). BS2000/OSD achieves this high quality through systematic application of the following techniques:

- high component reliability, resulting in high MTBF values for the hardware,
- avoidance of single points of failure through use of redundant hardware components,
- avoidance of operator errors, and interrupt-free operation through wide-ranging automation of system management,
- dynamic attachment and detachment of hardware and software components,
- version coexistence and quality management.

Utility routines

The following utility routines (selection) are included as part of the BS2000/OSD-BC V8.0 software product:

Diagnostics
SLED
Self-loading emergency dump routine
DAMP
Tool for analyzing area, user, system, SLED and SNAP dumps

System generation
SIR
System installation and restore
IOGEN
Hardware generation utility

Binder
BINDER
Static binder

Utilities
BS2ZIP
WinZip-compatible compression tool
DPAGE
Outputting and modifying disk files
INIT
Initialization of magnetic tapes
IORM
Dynamic control of I/O resources
JMU
Processing of job classes and scheduling algorithms
MSGMAKER
Message file management and editing routine
PASSWORD
Password encryption
PRM
Print(er) resources management routine
PVSREN
Pubset renaming routine
SANCHECK
Checking the SAN configuration
SDFCONV
Conversion tool for converting ISP command procedures into SDF format
SMPGEN
System-managed pubset generation routine
SPCCNTRL
Disk space allocation monitoring routine
SPSERVE
SPOOL parameter management routine
TPCOMP2
Tape compare routine
VOLIN
Disk volume initialization routine

System Exits

Customers can selectively modify system behavior by adding their own custom routines, called exit routines. This is achieved by inserting customer instructions that cause system modules to call exit routines at specific points. Parameters and input data are then passed to the exit routine. The input data can be partially modified or supplemented for specific exits. On a similar exit-specific basis, the exit routine can generally determine on its return whether the system function is to be executed or rejected.

Conditions for the use of System Exits

The customer is liable for any industrial property right infringements resulting from extending BS2000/OSD with custom-built exit routines. Where customers add their own exit routines to BS2000/OSD, Fujitsu Technology Solutions is under no obligation to take this into account when making changes to its products. If the support and maintenance overhead for the supplied hardware and software products increases as a result of customers extending BS2000/OSD with their own exit routines, customers may be invoiced separately for the extra costs involved.

TECHNICAL DETAILS

BS2000/OSD-BC V8.0

Technical Requirements Hardware	BS2000/OSD Business Server
Technical Requirements Software	openNet Server V3.3, TIAM V13.2, EDT V17.0
Operating mode	Interactive (dialog), transaction and batch mode
Implementation language	Assembler, SPL, C++
User interface	Commands in English, message texts in German/English
Installation	By the customer according to the release notice
Documentation	■ ADAM ■ Binder-Loader-Starter ■ BINDER ■ BS2ZIP Zip Archiving in BS2000/OSD ■ CALENDAR ■ Commands manuals (Vols. 1-6) ■ Diagnostics Handbook ■ DMS Introduction ■ DMS Macros ■ Executive Macros ■ Files and Volumes Larger than 32 GB ■ IMON Installation Monitor ■ Migration Guide ■ MSGMAKER ■ Performance Handbook ■ POSIX manuals ■ System Managed Storage ■ Subsystem Management ■ SDF manuals ■ SPOOL manuals ■ Systems Support ■ System Installation ■ System Exits ■ System Messages ■ Utility Routines ■ Unicode in BS2000/OSD
Training	See course offer at: http://ts.fujitsu.com/training
Demands on the user	Knowledge of BS2000/OSD
Conditions	This software product is supplied to the customer subject to the relevant conditions against a single payment or installments.
Ordering and delivery	This software product may be obtained from your local Fujitsu Technology Solutions GmbH regional office.

Information about environmental care, policies, programs and our Environmental Guideline FSC03230:
ts.fujitsu.com/aboutus
Take back and Recycling information: ts.fujitsu.com/recycling

Published by:
Fujitsu Technology Solutions GmbH
ts.fujitsu.com