Datasheet
FUJITSU Software BS2000/OSD-BC V9.0 Operating System

Operating System BS2000 Basic Configuration

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

Efficiency, Innovation, Openness and Continuity are the main BS2000/OSD development goals. In BS2000/OSD-BC V9.0 emphasis is placed on the following aspects:
- Extended storage integration
- Performance enhancement by optimizing data backup to fast tape devices (LTO)
- Functions for simpler and more effective BS2000 operation
- Extensions for enhanced openness and integration ability
- Functional enhancements as preparation for future SQ server generations

For SQ servers BS2000/OSD-BC V9.0 is available as a part of the package OSD/XC V9.0 and for Server Units /390 and x86 of SE Infrastructure as part of OSD/XC V9.5.

Features and benefits

Main features	Benefits
Extended storage integration ■ BS2000 files on NAS storage ■ Integration of Fujitsu ETERNUS DX clone and snap functions based on SHC-OSD	■ Additional storage for performance-uncritical data and access to common used data at the original by inhomogeneous applications ■ Further storage system Fujitsu ETERNUS DX including replication function available from BS2000
Scalability / Performance ■ High-performance support of the SQ servers with higher Multi Processor level ■ Extension and simplification of PAV functionality	■ Optimized performance on SQ servers ■ Greater flexibility and optimization of disk I/O
Manageability / Ease of Use ■ Adaptation of the SHOW and MODIFY commands and new EDIT commands ■ Extended mail interface in BS2000/OSD	■ Simplified finding of appropriate commands; Pre-allocation of operand values relieves the input of commands ■ Emails from within system processes also for library elements and PDF files
Automation / Dynamization ■ Online SNAP file configuration ■ Online update of the change dates for summer and winter time	■ Activation/deactivation of snapshot process in the ongoing session ■ Modification of change dates without interrupt operations
Openness and Integration ■ New POSIX version including NFS connection of the BS2000 file system	■ Simplified access to BS2000 file from open systems
Business Servers and Peripherals - Innovations ■ Support of new SQ server SQ210 ■ LTO-5 magnetic tape devices and LTO-5 drive encryption (in connection with MAREN V12.0) for S and SQ servers	■ Support of defined scenarios for High Availability and Live Migration ■ Most recent tape technology is available with BS2000/OSD.

Topics

Product Characteristics

BS2000/OSD-BC is a multiprocessor operating system for servers based on /390 or Intel x86 architecture. Characterized by a virtual storage concept, it runs on both mono-processor and (max.15-way) multiprocessor systems. As of BS2000/OSD V9.0 the formal support of up to 32 processors is possible on SQ servers – a preparatory action for later high-performance SQ servers.BS2000/OSD-BC 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. The product EDT (editor) 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.

Given their security functions (in particular SECOS), BS2000/OSD business servers can be successfully included in security audits and with it contribute to certification of the security management of a company.

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 server 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. 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. 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.

Support of new device type LTO-5

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 current S and SQ servers on the FC channel in conjunction with a Quantum library system Scalar 10K, i6000 or i500. Support for LTO-5 tape encryption is provided in conjunction with MAREN V12.0.

Parallel Access Volume (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.

The use of the extended PAV functionality for devices on the FC channel as of BS2000/OSD V9.0 lifts the previous restriction that an alias device has to be in the same logical control as the basic device. 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.

Furthermore as of BS2000/OSD V9.0 PAV can be used for parallelization of paging I/Os on S servers. It is possible to perform up to 4 I/Os per device in parallel with the new implementation.

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.

Save/Restore to / from Snapsets

BS2000/OSD-BC supports snapshot-oriented backup/restore scenarios in EMC^2 Symmetrix configurations as well as in CLARiiON CX configurations on SQ servers. For Fujitsu ETERNUS DX configurations this scenarios are available as of BS2000/OSD V9.0 by successor version of SHC-OSD. 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 huge amount of snapsets 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 a 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.

Net-Storage integration
Different storage media - various types of disks and tapes - have been used in the BS2000. In BS2000/OSD V9.0 storage media that offer their services via Internet Standard NFS can also be used by the BS2000. This functionality is fully compatible to directly connected disk systems for the applications and gives following new possibilities:

- Archiving of performance-uncritical BS2000 files on favorably priced NAS storage systems with somewhat less performance than on the SAN disks.
- Direct access to common used data at the original by co-operating inhomogeneous applications.

The new NAS connection of ETERNUS CS High End V5 is the first supported NET server hardware. A special release for a NAS system of NetApp is possible.

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.

System handling
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.

Support for the operator is provided by the tele-service 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.

EDIT commands, for which the current operand values are defined in advance, are offered in BS2000/OSD V9.0 for a range of frequently used MODIFY commands. This allows the operand value to be shown and changed in a single work step. Furthermore additional SHOW commands are offered for pubset administration in such a way that the corresponding MODIFY commando can also be found for a SHOW command by means of the function prefix alone, and vice versa.

In BS2000/OSD V9.0 the MAIL function of BS2000, which allows sending of e-mails from system processes, was extended. Library elements and PDF files can be sent as e-mail attachment file.

As of BS2000/OSD V9.0 the new function "Compare two disk files" is offered both as a command interface COMPARE-DISK-FILES and as a program interface. COMPARE-DISK-FILES compares two disk files of an identical file structure (SAM, ISAM, UPAM) on a byte-by-byte basis.

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.

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.

Interoperability

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. In POSIX A43, available in an additional supply to BS2000/OSD V9.0, further innovations are provided; amongst others BS2000-files can be accessed then via NFS.

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 includes the Apache web server V2.2 with integrated SSL (Secure Socket Layer) support. Another component provided as part of the BS2000/OSD-BC 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. In POSIX shells the entire functional range of EDT in Unicode mode is available.

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 V9.0 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

Technical details	
Technical Requirements Hardware	BS2000 Business Server
Technical Requirements Software	openNet Server V3.5
	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	Following manuals are available to BS2000/OSD V9.0
	ADAM
	BINDER
	BS2ZIP Zip Archiving in BS2000/OSD
	CALENDAR
	Commands manuals (Vols. 1-7)
	Diagnostics Handbook
	DMS Introduction
	DMS Macros
	DSSM/SSCM
	Dynamic Binder-Loader-Starter
	Executive Macros
	Files and Volumes Larger than 32 GB
	IMON
	Introductory Guide to Systems Support
	Migration Guide
	MSGMAKER
	Performance Handbook
	POSIX manuals
	System Managed Storage
	SDF manuals
	SPOOL manuals
	System Installation
	System Exits
	Utility Routines
	Unicode in BS2000/OSD
Training	See course offer at:
	https://training.ts.fujitsu.com/de/bs2000-osd.html (German)
Demands on the user	Knowledge of BS2000/OSD
Conditions	This software product is supplied to the customer subject to the relevant conditions against installments.
Ordering and delivery	This software product may be obtained from your local Fujitsu Technology Solutions GmbH regional office.

More information

Fujitsu platform solutions

In addition to Fujitsu BS2000, Fujitsu provides a range of platform solutions. They combine reliable Fujitsu products with the best in services, know-how and worldwide partnerships.

Dynamic Infrastructures

With the Fujitsu Dynamic Infrastructures approach, Fujitsu offers a full portfolio of IT products, solutions and services, ranging from clients to datacenter solutions, Managed Infrastructure and Infrastructure as a Service. How much you benefit from Fujitsu technologies and services depends on the level of cooperation you choose. This takes IT flexibility and efficiency to the next level.

Computing products

www.fujitsu.com/global/services/computing/
- PRIMERGY: Industrial standard server
- SPARC Enterprise: UNIX server
- PRIMEQUEST: Mission-critical IA server
- ETERNUS: Storage system
- BS2000/OSD mainframes

Software

www.fujitsu.com/software/
- Interstage: Application infrastructure software
- Systemwalker: System management software

More information

Learn more about Fujitsu BS2000/OSD-BC V9.0, please contact your Fujitsu sales representative, or visit our website. http://ts.fujitsu.com/products/bs2000/software/os/bs2000osd/index.html

Fujitsu green policy innovation

Fujitsu Green Policy Innovation is our worldwide project for reducing burdens on the environment. Using our global know-how, we aim to resolve issues of environmental energy efficiency through IT. Please find further information at: http://www.fujitsu.com/global/about/environment/

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