

SESAM™/SQL-Server V5.0 (BS2000/OSD)

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Introduction

SESAM™/SQL-Server is a state-of-the-art SQL server for the BS2000/OSD environment, combining the advantages of a relational database system with all the features that users expect from a production system designed to handle heavy workloads. SESAM™/SQL-Server is the perfect choice for an industrial-strength, high-performance database system for business-critical e-business solutions and midrange to high-end online transaction processing applications.

Today, there are numerous SESAM™ installations in which many thousands of users concurrently access shared data resources, performing many hundreds of transactions per second and accessing databases that are terabytes in size. The number of users and the size of the database are virtually unlimited.

This gives users the assurance that the system will go on providing high performance in spite of rapid rises in both data capacities and numbers of users.

SESAM™/SQL-Server runs on BS2000/OSD systems, on the SX line based on SPARC architecture as well as on the S line based on /390 architecture, and can be accessed as a data server from arbitrary platforms.

Functional Description

SQL2003 standard

SESAM/SQL-Server uses SQL as a standard language and uniform concept system for defining, building and maintaining a relational database and for creating application programs. SESAM/SQL-Server is based closely on the current standard ISO/IEC 9075:2003. In addition to the basic SQL operations of standard SQL, SESAM/SQL-Server contains important extensions to Core SQL as defined by the SQL standard, such as multiple columns and operations to store and retrieve large objects of up to 2 GByte (BLOBs) in SQL tables. The standard also includes functions for maintaining data consistency (such as referential integrity and check clauses). As a result, SESAM/SQL-Server offers greater security in architectures in which a large number of PCs access production databases.

For data manipulation there is also a "native call" interface (SESAM-CALL-DML) for the COBOL, Assembler, FORTRAN, PL/1, PASCAL and RPG programming languages. Applications created with earlier versions of SESAM on the basis of this interface will run unchanged with SESAM/SQL-Server. SESAM-CALL-DML and SQL statements can be used together in one application program. SQL statements may even be used within CALL-DML transactions.

High performance

■ 64Bit Main Storage Database

The 64bit main storage database can keep large amounts of data resident in memory. This is useful in any case where the phys. I/O is forming a bottleneck, especially in web applications, OLAP, data mining and OLTP applications with strong response time requirements. The 64bit main storage database facilitates a significant reduction of the „elapsed time“ by saving phys. I/O.

The technical implementation of the 64bit main storage database is made by the use of 64bit addressable data-spaces, for systems based on /390 as well as on SPARC architecture. SESAM/SQL-Server V4.0 or higher implements the 64bit addressing for the secondary data buffer. Thus the secondary data buffer can be extended up to 48 GB, leaving more space for the primary data and cursor buffer within the program space.

■ Multithreading

Advanced parallel processing techniques ensure that OLTP operation and any additional OLAP analyses that may be running (OLAP = Online Analytical Processing) do not impede one another. This is an important requirement for eBusiness applications, where the data server often has to manage highly variable workloads.

The multithreading architecture allows the SESAM database handler (DBH) to process requests in parallel and so make use of the time in which requests are waiting for input/output operations to be completed (e.g. read and write access to hard disks). Thus, another executable request can be activated for processing while the I/O operation processing is continuing. This greatly increases throughput. Long-running and complex database queries (OLAP) can also be processed partition by partition without affecting OLTP operation.

■ Multitasking

SESAM/SQL-Server is available in a Standard Edition offering single-task processing or in an Enterprise Edition which supports multitasking. The multitasking architecture enables the DBH to be loaded with up to 16 tasks for high performance requirements. In multiprocessor systems, the DBH workload can thus be distributed across multiple processors. Load balancing is handled independently by SESAM/SQL-Server, which flexibly adapts to the load situation at a given time.

■ Parallel processing of administration tasks

Administration utilities and sort operations are also exported to special system tasks. They run in parallel with DBH operation and do not degrade the performance of the DBH.

■ **Cost-based optimizer**

When a SQL statement is issued by an application, an access schedule is produced. This defines the type and sequence of the individual evaluation steps of the SQL statement. The cost-based optimizer ensures that a particularly efficient access schedule is produced to minimize the use of system resources (CPU time, I/O access operations, etc.).

■ **Shared SQL**

The optimized access schedule for static and dynamic SQL statements is stored in main memory and can be used by more than one user (shared SQL). This can increase performance significantly, particularly with OLTP applications in which certain processing steps are often repeated.

■ **Shared record lock**

Transaction performance is also enhanced by an extended lock concept. When a record is read, it is normally locked to prevent access by other transactions. With a "shared record lock" it is now possible for other transactions to read this record. This reduces the number of blocks and enables more transactions to be executed in parallel. It also means that long-running and complex queries can be started without degrading OLTP operation. Full transaction security is guaranteed.

■ **Selectable consistency level**

In addition to this general locking technique, the programmer can select a consistency level for each transaction; this level can in turn be modified for the individual statement.

■ **Block mode**

Records may be fetched and inserted in "batches". With a typical SQL statement of medium complexity, for example, fetching in batches of 15 records, each containing 10 values plus indicator bytes, saves up to 50% of the instructions. With simple statements the improvement is even greater.

■ **Data compression**

Data is automatically compressed when it is stored. Compressing the data to significant attribute values enables the database to be configured for maximum requirements. There is no storage overhead in defining attributes for which there are as yet no contents in the database. Attributes for which there are values in only a few records can therefore also be easily defined.

■ **Global storage and input/output optimization**

SESAM/SQL-Server can use BS2000/OSD global storage as a data cache, thereby dramatically reducing the number of read and write operations. Overall performance can be increased significantly as a result. A number of other techniques, including database cache, buffering, asynchronous I/O, and group commit, can be used to minimize read and write operations to the relatively slow mass storage media.

■ **Comprehensive transactional security**

SESAM/SQL-Server and the universal transaction monitor openUTM (BS2000/OSD) together form a powerful, fully integrated DB/DC system for restartable online transaction processing (OLTP) applications. SESAM/SQL-Server allows OLTP operation to begin even before the restart process is completed and enables you to control the restart time.

Availability and fault tolerance

■ **Tuning of DBH parameters during the ongoing session**
Virtually all DBH parameters can be changed online. Thus the system can be optimized without interruption.

■ **Automatic extension of database boundaries**

If the predefined physical boundaries of the database prove to be too restrictive during a session as a result of intensive insertion or update activities, they are automatically extended during online operation. Since this procedure is automatic, availability is enhanced considerably.

■ **Online data definition and utilities**

With SESAM/SQL-Server, database administration can be performed online. The administrator does not have to shut down the database to perform tasks such as database loading, backup, recovery (commitment of changes) and reorganization of databases. New databases can also be created online and existing database schemas can be changed.

■ **Space concept**

With the Storage Structure Language (SSL), users can optimize the way in which storage is organized to suit their particular application and so speed up data access or control how storage resources are used.

These optimizations and the reconstruction of defective databases do not affect the entire database, but only smaller physical units (spaces). A SESAM/SQL-Server database can consist of up to 400 spaces.

■ **Partitioned Tables**

Large database tables can be partitioned into a number of spaces. The splitting may be performed by way of primary key values or by a hashing algorithm (BLOB tables). The splitting is transparent to the applications. The partitioning of a large table into a number of smaller units reduces the necessary backup and recovery times. If a partition fails, the remaining partitions are available furthermore.

■ **Comprehensive security with TimeFinder**

With the support of EMC's Time Finder functionality, you can repair a database using EMC mirror disks (Business Continuance Volumes, or BCVs). This eliminates the need for a backup run and users can be absolutely certain that the backup copy will be available when they need it.

■ **Replicates**

Replicate databases can be used for retrieval applications. A replicate can also be used in shadow database operation for swift repair of a crashed original database.

Security

SESAM/SQL-Server offers protection against unauthorized access with access protection down to field level. Access authorizations can be granted so that users can only access the data they require to perform their tasks. SQL access protection enables differentiation of access rights according to users and user groups. In combination with the openUTM transaction monitor, passwords can be assigned to give access not only to data but also to applications and procedures. If SECOS is used, the DBH supplies the Security Audit Trail (SAT) of SECOS with data from events where security is concerned.

Easy administration

■ **Utility monitor**

A utility monitor makes it easier to perform database administration tasks. This means DDL and utility functions can be activated not only via ESQL programs but also online via screen masks. The actions can be logged in a file which can then be used in batch mode for performing recurrent administration tasks.

■ **Session administration**

The SESADM program is used for administration of the DBH and the SESAM network. SESADM provides an easy-to-use SDF interface, enabling administration tasks in a distributed environment to be performed from a single central point.

■ **SESMON performance monitor**

SESAM/SQL-Server includes a performance monitor which operates without imposing a load on the DBH task. Its output data can be presented graphically and can be sent to a SNMP agent as well. This allows online evaluation and supervision of the database operation within a SNMP configuration, whereas management platforms of arbitrary manufacturers may be used. The performance monitor provides the administrator with information on resource utilization (e.g. buffers, disk accesses, etc.). Based on this information, the database

system can be optimally tuned to the particular application scenario.

■ Administration by browser interface

The administration functions of the utility monitor, the performance monitor and session administration can also be controlled using a browser.

■ SESAM request logging

For test and diagnostic purposes, measurement data can be recorded on a request-related basis in the course of a session. The data can be analyzed in detail and according to various criteria using the SESCOSP utility.

■ Backup system

For tape backup, SESAM/SQL-Server uses the hierarchical storage management system HSMS (BS2000/OSD) and/or the high-performance backup system ARCHIVE (BS2000/OSD). This means that database backups can be integrated into the overall backup concept. HSMS and ARCHIVE can also work in combination with the archiving system MAREN (BS2000/OSD), a central administration system for all tapes in a computer center.

■ Importing and exporting tables

To transfer data as quickly as possible from one database to another, a table (e.g. from a backup copy) can be mounted into another catalog with the appropriate metadata changes. The catalog into which the table is to be mounted may be located on another DBH or even on another computer altogether.

Great flexibility

■ Multi-database operation

A DBH can process up to 254 databases in parallel. This means that each application program can access more than one database at the same time. Distribution of the data among various databases according to logical association increases availability and simplifies handling. Any number of tables can be created in each database, and any one table can contain more than 25,000 columns (attributes), which gives even more scope for data structuring (database and table level).

■ Distributed database system with SESAM/SQL-DCN

The add-on product SESAM/SQL-DCN (BS2000/OSD) provides the means for transparent and efficient processing of distributed databases in BS2000 computer networks. As a result, performance and availability requirements and organizational structures can be addressed with great flexibility. The application programs are not affected by this distribution.

■ Spanned records

With SESAM/SQL-Server, the length of the records to be stored is not limited by the size of a physical database block. A record can extend over several blocks ("spanned record").

■ Multiple columns

SESAM/SQL-Server allows the use of multiple columns. With a multiple column, up to 255 values can be stored in one record. It is therefore possible to minimize the number and complexity of tables (many columns) and save on time-consuming links.

■ Binary Large Objects (BLOBs)

Binary Large Objects (BLOBs) are required for storing multimedia data content such as text, graphics, images, audio and video. By storing, reading and modifying BLOBs in the database along with the general structural data of an IT process, the user is presented with a common interface for business and multimedia data. All this is provided with the transaction security and backup mechanisms of the database systems.

Data access options

■ ESQL

The embedded SQL product ESQL-COBOL (BS2000/OSD) SQL can be used to create SQL applications under COBOL.

■ DRIVE

DRIVE/WINDOWS is a fourth-generation programming language (4GL). It offers a host of convenience features and powerful tools for achieving huge productivity gains in the development process.

■ XML

XML is becoming increasingly important both for Web applications and also more generally as a format for exchanging documents between applications and databases. SESAM/SQL-Server supports the storage of XML documents in their entirety. SESAM/SQL-Server provides the appropriate function calls which make it possible to read and write XML documents. XML support is implemented in SESAM/SQL-Server on the basis of the new "BLOB" Functionality (Binary Large Object).

Generating XML documents from existing SQL tables and mapping XML documents to SQL tables requires a mapping logic which is best realized in pre-database components. To this purpose, openUTM offers an XML parser and a DOM interface. This has the added benefit that existing openUTM database applications can easily migrated to XML.

■ APACHE Webserver with SESAM connection

The APACHE Webserver (runnable on BS2000/OSD as well as on UNIX, Linux and Windows systems) has its own connection to SESAM/SQL-Server. The scripting language PHP (Hypertext Preprocessor) can be used to query and modify SESAM/SQL databases. The PHP code is executed exclusively on the server, with only HTML code being transferred to the client. This means that the application logic remains hidden from the Web user, which ensures that increased security demands can be met in full. APACHE also supports Java servlets, which access the SESAM/SQL databases via the JDBC interface.

■ ODBC interface

SESAM/SQL-Server supports the ODBC (Open Database Connectivity) interface defined by Microsoft to allow communication between Windows applications and database systems. The partner product ODBC-Rocket from gfs, Hamburg, is an ODBC driver for SESAM/SQL-Server. ODBC-Rocket also supports access to UDS/SQL, LEASY and ISAM.

■ Java

A JDBC driver is supplied at no extra cost on CD-ROM together with SESAM/SQL-Server. JDBC stands for Java Database Connectivity and is the standard call-level interface for accessing SQL databases in Java programs. It allows the programmer to write programs using a standardized DB interface and to create database-independent Java applications, Java servlets and Java applets. The JDBC driver is a type 4 driver, i.e. a "native-protocol fully Java technology-enabled driver", and is written in pure Java. The advantage of this is that no binary code at all needs to be installed on the client machine and the JDBC driver can therefore run on any Java-capable platform.

With the JDBC driver, SESAM/SQL-Server also supports applications developed on the basis of the Enterprise JavaBeans (EJB) component architecture.

More Web tools

■ WebTransactions

WebTransactions (BS2000/OSD) is a software product which can be used to Web-enable existing openUTM and SESAM/SQL-Server applications.

■ ODBC-Rocket

The partner product ODBC-Rocket from gfs, Hamburg, allows Web access via the ODBC interface. The ODBC interface can be addressed in Microsoft Active Server Pages or in a scripting language of the APACHE Webserver.

Business intelligence

■ Report writer

The ADILOS (BS2000/OSD) report generator provides SESAM/SQL-Server users with a powerful reporting system. ADILOS is a tool capable of editing vast amounts of data. The layout of the reports can be tailored to meet specific requirements.

■ **OLAP (Online Analytical Processing) with INFPLAN**
INFPLAN (BS2000/OSD) can be used for professional analysis of SESAM data as well as data from other sources for business processes.

Enhancements of SESAM/SQL-Server V5.0 compared to V4.0:

Unicode Support

The introduction of the new NCHAR and NVARCHAR data types enables Unicode characters to be stored in SQL tables and to be processed using SQL tools. As well as support for the new data types by the SQL data manipulation language, their use in the different service functions (e.g. LOAD, UNLOAD, IMPORT, EXPORT) is also allowed. To convert from e.g. CHAR to NCHAR and vice versus, SESAM/SQL makes use of the call functions provided by XHCS. The SESAM-internal data comparison is always performed in binary form for national data as well.

Technical Data	
Technical Requirements Hardware	<p>BS2000/OSD server</p> <p>The use of 64bit addressable space is not supported for some systems of the S model series, which do not support the necessary instruction set enhancement: S110, S115, S130, S135, S150, S160.</p> <p>Memory requirements: For detailed information, see the Release Notice</p>
Technical Requirements Software	<p>BS2000/OSD-BC or higher V6.0B OSD/XC or higher V2.0 CRTE or higher V2.6 LMS or higher V3.3 SORT or higher V7.8B SORT or higher V7.9 (*2) TIAM or higher V13.1</p> <p>Optional: ADILOS or higher V6.4C ARCHIVE or higher V7.0B COBOL85 or higher V2.3 COBOL2000 or higher V1.2 (*1) COBOL2000 or higher V1.4 (*1) (*2) DRIVE or higher V3.1A10 EDT or higher V16.6B05 EDT or higher V17.0 (*2) ESQL-COBOL or higher V2.0C ESQL-COBOL or higher V3.0 (*2) HSMS or higher V7.0 (for tape backup only) INFPLAN or higher V5.3B JV or higher V14.0B openNet Server or higher V3.0 openUTM or higher V5.2 SDF-P or higher V2.3(*3) SECOS or higher V5.0 SESAM-KLDS or higher V3.1D SSC-BS2 or higher V6.0 (for SNMP-Management using RDBMS-MIB only) TOM-REF or higher V3.0B XHCS or higher V2.0 (*2)</p> <p>(*1) For limitations on functions beyond the range of COBOL85 see the COBOL2000 release note. (*2) The product is necessary only if the UNICODE functions are used. (*3) The product is necessary only if tool procedures included with SESAM/SQL-Server are used.</p>
User Interface	German/English; can also be adapted to other languages.
Installation	By the user according to the Release Notice
Documentation	<p>The documentation is available online, see http://manuals.fujitsu-siemens.com, or in printed form which must be paid and ordered separately at http://fsc-manualshop.com/.</p> <ul style="list-style-type: none"> ■ SESAM/SQL-Server Core Manual ■ SESAM/SQL-Server Database Operation ■ SESAM/SQL-Server SQL Language Reference Manual Part 1 SQL Statements ■ SESAM/SQL-Server SQL Language Reference Manual Part 2 Utilities ■ SESAM/SQL-Server Utility Monitor ■ SESAM/SQL-Server Messages ■ SESAM/SQL-Server CALL-DML Applications ■ SESAM/SQL-Server Glossary and Master Index ■ SESAM/SQL-Server Performance Manual ■ ESQL-COBOL for SESAM/SQL-Server
User Requirements	Basic knowledge of BS2000/OSD
Training	See course offer at: http://www.fujitsu-siemens.com/training
Conditions	This software product is supplied to the customer against payment by installments subject to our conditions for the use of software products.
Warranty	Class: A; Delivery format: Machine language