MVS/ESA Benefits Reference Guide

The base for growth into the '90s

IBM
**Enterprise Systems...comprehensive large systems support**

Enterprise Systems Architecture/370™ (ESA/370™) is a vehicle for processing increasing amounts of data and enabling further growth.

An evolutionary step beyond 370-XA, ESA/370 is the large systems architectural base into the '90s. It is unique to IBM ES/3090™ and ES/4381™ Model Group 90E, 91E, and 92E processors.

- Supported by new and enhanced versions of software for:
  - System control
  - Data management
  - System security
  - Storage subsystems
  - DB/DC
  - Systems management
  - Sorting
- Uses enriched ESA/370 instruction set.
- Facilitates data in memory:
  - Provides reduced I/O through use of expanded storage.
  - Permits higher levels of CPU utilization.
  - Allows more effective use of total system resource.

---

<table>
<thead>
<tr>
<th>IMS</th>
<th>CICS</th>
<th>DB2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMF</td>
<td>TSO/E</td>
<td></td>
</tr>
<tr>
<td>JES2/JES3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- RACF
- DFSORT
- DFHSM
- DFDSS
- MVS/DFP™ V3
- MVS/SP™ V3
- MVS ESA™
- DFSMS™

- ESA/370
- ES/3090
- ES/4381
System control

MVS/ESA
MVS/ESA consists of MVS/SP Version 3 and MVS/DFP Version 3 with the storage management subsystem.

MVS/SP Version 3
- Runs on ES/3090 and ES/4381 Model Group 90E, 91E, and 92E processors, and uses the enriched ESA/370 instruction set.
- Offers powerful addressing capability through creation of multiple data spaces (data-only spaces) up to two gigabytes (GB) in size, which can be private or shared.
- Additional exploitation of expanded storage through hiper VSAM™ (high-performance space) for reduced I/O.
- Contains data windowing services that provide up to a 16 terabyte seamless view of data via calls from COBOL, PL/I, FORTRAN, Pascal, C/370, and Assembler for simplified application development.
- Includes virtual lookaside facility (VLF) that uses data spaces for program libraries, TSO/E, CLISTS, REXX execs, and catalog entries.

Benefits
- Improves performance through I/O avoidance, which provides improved response time, reduced I/O tuning effort, and reduced central processor cycles; maximum benefit derived through use of expanded storage.
- Provides up to one megabyte VSCR with VSAM control blocks above 16MB virtual.
- Improves I/S professional productivity.
- Improves data integrity by allowing separation of programs and data.
- Enables application growth through improved data handling capabilities.
- Provides platform for data in memory.
- Easy to install and use—similar to a release-to-release migration.
- Over 75 user group requirements satisfied.

Data management

Data Facility Storage Management Subsystem (DFSMS)
DFSMS is a collection of products which, along with practices and procedures, automates the operation of the storage subsystem. DFSMS provides separation of logical views of data and physical device characteristics through the implementation of data classes, storage classes, management classes, and storage groups at the data set level.

Benefits
- Enables system managed storage.
- Improves system programmer productivity up to 20%.
- Improves application programmer productivity up to 7%.
- Reduces window time for new DASD migration up to 50%.
- Allows for increased DASD space utilization up to 20%.
- Permits up to 60% fewer tape mounts.
- Enables addition/deletion of hardware without disruption.
- Offers data set level caching.
- Provides an automatic way to achieve new storage system technology benefits.
- Satisfies more than 70 user group requirements.
MVS/Data Facility Product (MVS/DFP) Version 3
MVS/DFP introduces the new storage management component.
Enhancements under the ESA/370 architecture include:
- Integrated catalog facility use of data spaces, which reduces catalog I/O by up to 23% in shared environments.
- VSAM buffers in hiperspace improve performance and provide virtual storage constraint relief.
- Automatic IBM 3990 Model 3 storage control unit exploitation, including dual copy, DASD fast write, and data set level caching.

Data Facility Sort (DFSORT) Release 11
- Improved Performance:
  - Fixed length records with MVS/ESA compared to R10 with MVS/XA:
    25% elapsed time reduction.
    46% channel busy time reduction.
    17% CPU time reduction.
    85% EXCP count reduction.
- Hipersorting **:
  - Uses hiperspace for sort work space.
  - Exploits expanded storage.
  - Improves performance.
  - Reduces DASD space requirements.
- Maximizes benefits of IBM hardware through utilization of:
  - Expanded storage.
  - Read Track command—3990 storage control and 3380-CJ2.
  - Cache Fast Write of the 3990-3.*
  - Sorting instructions.
  - High-speed buffer.
  - Physical geometry on the 3380.
- DFSMS function:
  - Improved programmer productivity.
  - Interactive ISMF/ISPF panels.

Data Facility Hierarchical Storage Manager (DFHSM) Version 2.4
- Automatic space management reduces the effective cost of storage.
- Automation of manual tasks.
- People involvement for monitoring and exception handling only.
- Data set level control versus volume level control.
- Automatic migration of low-activity data.

Data Facility Data Set Services (DFDSS) Version 2.4
- High-performance data mover support for DFSMS.
- Interactive panel interface for storage administrator through Interactive Storage Management Facility (ISMF).
- Enhanced copy and dump/restore for VSAM data sets.
- Conversion to system managed data sets with or without data movement.

*DFSORT will use Cache Fast Write when the Cache Fast Write feature is available.
**Job Entry Subsystems (JES)**

**JES2 Version 3.1.1**
- Growth, performance, productivity, ease of use.
- Up to 32K jobs supported.
- VSCR:
  - Up to 480K common area (TSO).
  - Up to 112K private area (batch).
- Improved restart time—reduced up to 90%.
- Continuous operations:
  - Trace improvements: fewer restarts.
  - Directly loaded JES2 modules: fewer IPLs.
  - Dynamic addition/change of workstations and nodes.
  - TSO/E SUBMIT command improvements.
- DFSMS support.
- NJE/RJE limits increased to 9,999.

**JES3 Version 3.1.1**
- Growth, performance, productivity, ease of use.
- Up to 32K jobs supported.
- Global processor utilization reduced by up to 47%.
- Improved restart/DSI—elapsed time reduced up to 76%.
- I/O reduction—job control table placed in its own data space.
- Supports multiple printers per address space.
- Dynamic NJE node addition and deletion.
- Spool maintenance replaced by enhanced commands.
- DFSMS support (JES3 V3.1.2).

**Time Sharing Option/Extended (TSO/E)**

- Supports the requirements of:
  - System programmers in maintaining and tuning the system.
  - Application programmers in developing and maintaining code.
  - Programming librarians in controlling development and production libraries.
  - End users, problem solvers, information center staff.

**Benefits**
- REXX:
  - Increased usability and productivity
  - Systems Application Architecture™ (SAA) procedural language.
- Central storage constraint relief below 16MB.
- CLIST/REXX use of data spaces:
  - Response time improvements through I/O reduction.
  - Up to 33% more transactions with MVS/ESA and ES/3090 Model 600S.
**Data Base/Data Communications (DB/DC)**

**DB2 Version 2**
- Full-function relational data base management system.
- Designed to effectively utilize MVS capabilities.
- Provides direct access to enterprise data resources for a growing population of data processing users.
- Base for SAA distributed data.

**Benefits compared to DB2 Version 1**
- Up to five times faster for complex queries with sort.
- Up to 438 trans./sec. for high-volume transactions.
- Up to 270 trans./sec. for full-function transactions.
- Up to 32% reduction in CPU utilization for data base load.
- Up to 10X faster index creation.
- Up to 53% reduction in CPU utilization for batch reporting.
- Significant new function:
  - Referential integrity.
  - Resource consumption limiter.
  - Selective auditing.

**IMS/VS Version 2.2**
A full-function transaction management system for hierarchical data base management providing high-performance and availability characteristics and high-transaction throughput.

**Benefits**
- Virtual storage constraint relief in control region.
- Improved system availability:
  - XRF.
  - Offline dump.
- DL/I VSAM buffers in hiperspace:
  - Up to 50% reduction in I/O.
  - No application changes.
- Program libraries in data spaces:
  - Program load I/O reduced up to 98%, compared with traditional program fetch.
- Up to 56% more transactions with MVS/ESA and ES/3090 Model 600S.

**IMS/ESA™ Version 3**
- DL/I VSCR—VSAM and OSAM above 16MB virtual.
- Fastpath high-speed sequential processing.
- Log compression.
- Log reduction.
- Improved VSAM buffers in hiperspace:
  - Multiple buffer pools allowed for similar CI sizes.
  - Different hiperspace sizes supported for each buffer pool.
CICS/MVS™ Version 2
A data communications management system that greatly reduces the effort needed to implement terminal-oriented transaction processing systems. It interfaces between user-written application programs, TP access methods, and database managers.

Benefits
• DL/I VSAM buffers in highspan:
  - Up to 50% reduction in I/O.
  - No application changes.
• VSAM buffers in highspan:
  - Potential for I/O reduction.
• VSAM-related control blocks above 16MB virtual.
• Provides data set level support for 3990 extended function:
  - Performance improved using DASD fast write for log.
• Up to 52% more transactions with MVS/ESA and ES/3090 Model 600S.

Data Tables feature:
Data Tables offer the ability to store application data in processor storage to provide substantially improved performance by significantly reducing pathlength and physical I/O activity for full key direct access data.

Benefits
• Rapid access to data in memory.
• Command level API.
• Data Tables maintained by CICS or user.
• Up to 95% improvement in transaction rates for an application exclusively using Data Tables.

CICS statement of direction
• New code base - MVS/ESA.
• Increased 31-bit implementation.
• Command level only.

MVS system control program support

<table>
<thead>
<tr>
<th>MVS function</th>
<th>MVS/XA</th>
<th>MVS/ESA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for ESA/370</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data spaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSO/E REXX &amp; CLISTs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catalog entries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtual lookaside facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expanded storage*</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>VIO expanded storage support*</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Hiperspace*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSAM buffers in hiperspace*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hipersorting*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data in Virtual</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Data Windowing Services*</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Central storage utilization</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Constraint relief below 16MB*</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CICS data tables</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Support for 512MB</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Multi-address space access</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Global resource serialization</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Up to six-way single image support</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>3990-3 extended function</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>32K job limit (JES2/JES3)</td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>

* Benefits from expanded storage
  ● Function supported
  ○ Function enhanced
Data in memory example

The effects on response times
Take a sample transaction on an ES/3090-180E with 27 I/Os to DASD. Assume online CPU utilization is 70%, and the response time is one second:

<table>
<thead>
<tr>
<th>CPU time</th>
<th>CPU queuing time</th>
<th>I/O times</th>
</tr>
</thead>
<tbody>
<tr>
<td>97ms</td>
<td>226ms</td>
<td>675ms</td>
</tr>
<tr>
<td>Response time = 1.00 secs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using data in memory techniques, the number of I/Os reduce by 50%, and the number of CPU cycles reduce by 10%, resulting in a CPU utilization of 63% (the CPU queuing time is calculated by using the formula \( u/(1-u) \) where \( u \) is the utilization).

<table>
<thead>
<tr>
<th>CPU time</th>
<th>CPU queuing time</th>
<th>I/O times</th>
</tr>
</thead>
<tbody>
<tr>
<td>87ms</td>
<td>148ms</td>
<td>338ms</td>
</tr>
<tr>
<td>Response time = 0.57 secs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now the CPU can be driven harder, for example, to 80% CPU utilization. This increases the CPU queuing time, yet still achieves a response time improvement over the original 1.00 sec. response time:

<table>
<thead>
<tr>
<th>CPU time</th>
<th>CPU queuing time</th>
<th>I/O times</th>
</tr>
</thead>
<tbody>
<tr>
<td>87ms</td>
<td>348ms</td>
<td>338ms</td>
</tr>
<tr>
<td>Response time = 0.77 secs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Benefits
- Increased system capacity.
- Reduced DASD I/O load.
- Improved elapsed run times.

*Benefits may vary depending on your environment. For an estimate of the benefits in your installation, contact your IBM representative.*
The effects on capacity
Data in memory can save I/O and the associated CPU cycles. More effective use can be made of the CPU and throughput increased.

- In the example on the previous page, a processor handling 7.22 transactions per second with a 10% savings in CPU cycles per transaction could result in 8.02 transactions per second at the same CPU utilization:
  - 11% more transactions due to CPU savings.
- Increasing CPU utilization from 70% to 80% means 9.17 transactions per second:
  - 14% more transactions due to higher CPU utilization.
- Combined effect of reducing CPU cycles per transaction and driving CPU harder means increasing the effective capacity of the CPU with improved response time:
  - 27% more capacity for online transactions.
  - 23% reduction in response time.

Data in memory candidates

Possible candidates
System code
Application code
Program libraries
Directories
Catalogs
CLISTS
REXX execs
SORTWORK areas
User tables
Data sets
Data base buffers
etc.

Benefits of data in memory

Example 1—DFSORT R11 Hipersorting
DFSORT R11 under MVS/ESA with intermediate work files in hiperspace compared with DFSORT R11 under MVS/XA, ES/3090-300E, 128MB central storage, 256MB Expanded Storage (using 3MB-150MB files, fixed length records):
- Elapsed run time reduced 21%.
- EXCPs reduced by 75%.
- Channel busy time reduced 46%.

Example 2—IMS/DL/I—VSAM buffers in hiperspace
Transaction rate held constant.
ES/3090-200S, 128MB central storage, 256MB expanded storage:
- VSAM I/Os reduced 40%.
- CPU time per transaction reduced 7%.
- MPR transit time reduced 32%.

Example 3—CICS/MVS—large VSAM buffer pools in an address space
CPU driven harder, response time maintained.
ES/3090-600E, 512MB central storage:
- Transaction rate increased 40%.
- DASD I/Os reduced 28%.
- CPU time per transaction reduced 8%.

Example 4—CICS/MVS—large DB2 buffer pools in an address space
CPU driven harder, response time maintained.
ES/3090-400E, 128MB central storage:
256MB expanded storage:
- Transaction rate increased 60%.
- DASD I/Os reduced 40%.
- CPU time per transaction reduced 17%.

* Benefits may vary depending on your environment. For an estimate of the benefits in your installation, contact your IBM representative.
System security

Resource Access Control Facility (RACF) is IBM's system security product for MVS and VM. In addition to providing access control for data, transactions or terminals, RACF works with MVS/DFP to enhance administrative options associated with system-managed storage.

U.S. Department of Defense security ratings
- MVS/XA RACF is currently rated C2.
- Statement of direction:
  - C2 VM/SP HPO and VM/XA™ SP with RACF.
  - Multi-level security (B1).
  - MVS/ESA with RACF.
  - VM/SP HPO with RACF.
  - VM/XA SP with RACF.

RACF Version 1.8.1 enhancements
- DFSMS defaults in RACF user and group profiles.
- RACF administrative control.
- Resource owner in data set profile.
- Execute control for programs.
- Dump control.

MVS/ESA RACF benefits
- Flexible DFSMS control.
- Commitment for multi-level security.

Systems management

Systems management products are a set of IBM software tools specifically designed to help manage an I/S installation. IBM's Resource Management Facility (RMF), Information/Family, Operations Planning and Control/Advanced (OPC/A), Service Level Reporter (SLR), and NetView™ are key components for improved systems management.

RMF
RMF collects and reports on specific aspects of system performance, providing data as input for performance measurement and capacity planning.

RMF Version 4
- MVS/SP V3 and MVS/DFP V3 support.
- DFSMS support.
- Large processor constraint relief.
- Processor Resource/Systems Manager™ (PR/SM™) support.
- Monitor III operations support:
  - Color alert for critical threshold information.
  - Enhanced data analysis.
- New Monitor III storage reports and SMF record.
- Hiperspace support.

The Information/Family
IBM's Information/Family provides a set of integrated applications and data bases, as well as a management framework for better management and control of problems, changes, configurations, and inventory.

Benefits
- Quicker problem resolution.
- Increased operator productivity.
- Improved quality of service to end users.
- Higher levels of system availability.
**OPC/A**
OPC/A provides comprehensive solutions for efficient batch workload scheduling. OPC/A assists in planning, controlling, and automating both long- and short-term batch production on local or remote processors.

**Benefits**
- Batch workload control is an important step toward automatic, unattended operations.
- Automatic job recovery improves operator productivity.
- Predefined error recovery reduces likelihood of operator error.
- Extensive security controls available via RACF.

**SLR**
SLR provides summary management information from the large amounts of data generated in system and subsystem logs.

**Benefits**
- Identification and prevention of potential performance problems.
- Extensive color graphics support.
- Historical data for forecasting capacity requirements.

**NetView**
NetView provides a comprehensive set of network management functions in a single product. NetView is IBM's strategic offering for automated console operations across MVS, VM, and VSE operating systems and subsystems. NetView's common automated operations support is for both systems and networks.

**Benefits**
- Improved operator productivity.
- Reduced operational complexity.
- Increased system availability.
- Improved management control.

---

**Systems Application Architecture (SAA)**

SAA enables application portability and cross-system consistency across major IBM computing environments—MVS/ESA, VM/XA SP, OS/400,™ and OS/2™. Extended Edition.

![Systems Application Architecture Diagram]

**Benefits**
- Helps protect software investment across environments.
- Increases programmer and end-user productivity.
- Improves communications usability.
What customer environments benefit from MVS/ESA, DFSMS, and the ES/3090 S models?

Customers may receive benefits up to:

More transactions

- IMS  56%
- CICS  52%

DASD utilization

- DFSMS  20% better

Restart time

- JES2  90% reduction
- JES3  76% reduction

Tape mounts

- DFSMS  60% less

System programmer productivity

- DFSMS  20% improvement

Global CPU utilization

- JES3  47% reduction

MVS availability

- 75 improvements

More transactions

- TSO/E  33%
- Vector ITRR  1.4 x faster

More transactions

- CICS Data Tables 95%

Number of I/Os

- CICS/IMS 10-50% less
- DFSORT 85% less

Channel busy

- DFSORT 46% less

Transaction rate

- DB2 270/sec. 120% more

Data base index create

- DB2 10 x faster

Application programmer productivity

- DFSMS 7% improvement

Data base load time

- DB2 32% less

Complex data base queries

- DB2 5 x faster

Elapsed time

- DFSORT 25% reduction

Shared catalog I/O

- DFP 23% less

Based on laboratory measurements in comparison to MVS/XA and prior releases/versions of DFSORT, DB2, JES2 and JES3 on ES/3090 E processors without system-managed storage. MVS/ESA CICS/MVS Data Tables results are compared to MVS/ESA CICS/MVS measurements without Data Tables. These results may not be additive and actual customer results may vary.