IBM Servers

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G326-3070-08

S/390® Parallel Enterprise Server™ and OS/390® Reference Guide

February 1999

e-business

Contents

This pocket guide provides a comprehensive overview of the features and functions of the Generation 5 S/390 Parallel Enterprise Server models and OS/390® operating system for both Parallel Sysplex® and stand-alone environments. This guide also focuses on the latest Parallel Sysplex system hardware and software enhancements and includes details on the S/390® Coupling Facility, Parallel Sysplex cluster connectivity options, and the latest version of OS/390.

The basic building block for all the S/390 Parallel Servers and the S/390 Coupling Facility is IBM's CMOS (Complementary Metal Oxide Semiconductor) microprocessor technology. CMOS designs are now providing a broad range of performance and can provide significant savings in energy, facilities and maintenance costs.

S/390 Parallel Enterprise Server

The S/390 Parallel Enterprise Servers provide a wide range of computing capacity for enabling S/390, client/server and open applications. These systems provide S/390 architecture and function with outstanding availability and environmental characteristics. The systems are general-purpose servers for OS/390, MVS/ESA™, VM/ESA®, VSE/ESA™, and TPF/ESA environments. They fully participate in Parallel Sysplex environments and have the integrated gateway Open Systems Adapter (OSA) for connecting networks directly to the system. These servers provide price/performance leadership in a strategy directed at lowering the total cost of computing while maintaining the traditional strengths of high-end computing.

S/390 Coupling Facility

The S/390 Coupling Facility 9674 and 9672 R06 deliver scalability and availability through parallel processing for critical business applications. The latest S/390 Parallel Enterprise Servers – Generation 5 ("S/390 G5 servers") extend the performance range of the Coupling Facilities and provide more flexibility in meeting application requirements.

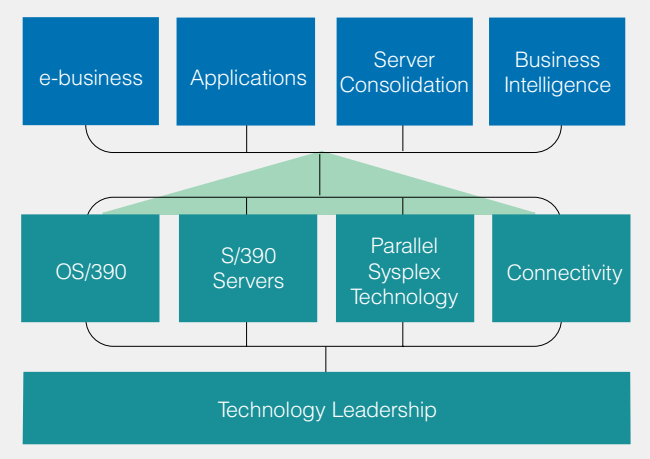
S/390 Parallel Sysplex cluster technology

S/390 Parallel Sysplex cluster technology represents a pioneering breakthrough in large-scale enterprise-wide computing. This parallel processing architecture with data sharing and workload management across multiple S/390 systems makes it an industry leader. The systems in a Parallel Sysplex configuration have all the capabilities of the standard S/390 system and run the same applications. The IBM S/390 Parallel Sysplex technology allows users to harness the power of multiple S/390 systems as if they were a single logical computing system. The Parallel Sysplex system encompasses the concept of Parallel Sysplex capable processors, the S/390 Coupling Facility, high-speed Coupling Links or connections, the Sysplex Timer®, shared DASD, and software, both system and subsystem, designed for parallel processing.

The architecture is centered around the implementation of an S/390 Coupling Facility running the Coupling Facility Control Code (CFCC) and high-speed coupling connections for intersystem communications. The Coupling Facility is responsible for providing high-speed data sharing with data integrity across multiple S/390 systems.

A Parallel Sysplex cluster offers many benefits to the processing environment, including the ability to configure for continuous application availability. This can greatly enhance the flexibility of your information technology organization to respond to changing business requirements.

S/390 Technology Leadership



S/390's enhanced technology integrates software and hardware functions to offer comprehensive end to-end enterprise solutions, a requirement in today's volatile and competitive business environments.

Enterprise servers must have the capacity and the scalability to support new applications, handle the explosive growth in the number of Internet and intranet users, and support the integration of multiple alternate platform UNIX server application workloads. They must deliver mission-critical information when and where it is needed while providing superior network and system-wide security and throughput. And, they must offer very high availability for a continuous computing environment, at a low total cost of computing. S/390 Parallel Enterprise Servers, Parallel Sysplex cluster technology, Open Network Connectivity and OS/390 work as a team to help meet these demands.

This solid base enables IBM's four business initiatives:

e-business:
OS/390 V2 gives customers high security for conducting e-business over the Web. The integrated WebSphere™ Application Server for OS/390 includes an auditing mechanism and authentication (Secure Sockers Layer V3) for access control. WebSphere Application Server for OS/390 also can dynamically determine if hardware encryption is available and together with the Integrated Cryptographic Service Facility (ICSF), will automatically use hardware encryption to help improve overall performance and throughput. For those servers that don't yet have hardware encryption, software encryption is provided and utilized. Firewall technology is integrated in eNetwork™ Communications Server and Security Server.

A rich set of CICS®, IMS™ and DB2® Internet Gateway coded examples can be easily modified and used by customers. An enhanced eNetwork Communications Server delivers improved performance for all TCP/IP applications. Network Station™ support is integrated also into eNetwork Communications Server.

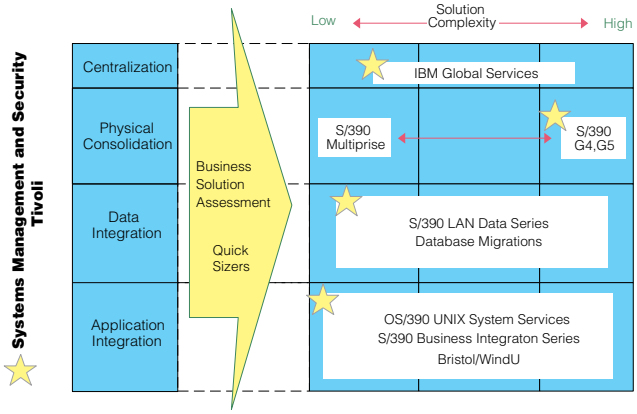
Applications:
OS/390 is a flexible, open, and scalable environment that leverages S/390 strengths for execution and development of a wide range of applications. The following software technologies and functions are supported:

- UNIX95 branding
- Simplified configuration and customization via OS/390 Application Enabling Technology
- Component Broker — a business object technology
- Graphical User Interface (GUI) offered via VisualLift® and ISPF
- Java™ for OS/390
- Lotus® Domino™
- C and C++ languages for UNIX® applications
- Distributed Computing Environment (DCE AS) Application Support
- ENCINA® Toolkit Executive
- WLM JES2 Batch Management

Application support from leading Independent Software Vendors (ISVs), such as SAP AG, BAAN, Oracle, PeopleSoft and Walker Interactive, can help protect customers' investment in business applications and industry solutions for the OS/390 environment.

Server Consolidation:
Rising systems and operations management costs of alternate platform servers in many enterprises are becoming prohibitive and of serious concern to many business unit and IT executives. Consolidation of these multiple, mixed servers can help obtain and preserve competitive business advantage.

OS/390 is unique among commercial operating systems in the variety and amount of work it can handle and delivers the technology, function and performance required for consolidation of multiple LAN servers, UNIX servers, print servers and multimedia servers. As a result of server consolidation, fewer systems management resources can be needed, and it can help to lower the total cost of computing. The robustness of OS/390 gives organizations fast, direct access to enterprise-wide data. In addition, OS/390 provides enhancements such as dynamic, goal-oriented management of batch scheduling and Parallel Sysplex system performance monitoring and reporting capabilities for analyzing Parallel Sysplex system workload activity in Goal mode, Coupling Facility activity and shared DASD device activity in Goal mode, Coupling Facility activity and shared DASD device activity. Parallel Sysplex cluster technology brings a new dimension of scalability and availability to this merged environment, adding even more value to server consolidation.



S/390 Server Consolidation Segments

Business Intelligence:
S/390 provides new ways to help achieve competitive advantages through the exploration of existing corporate data to find hidden answers to real-world business questions. Key enablers of business intelligence are OS/390, which supports Intelligent Miner™ and provides an integrated text search engine called NetQuestion, along with DB2, which delivers parallel query capability. Organizations can obtain a single view of their data, providing the ideal underlying technology to help exploit data warehouse, data mining and decision support disciplines.

Business Intelligence Touch Points

S/390 Parallel Enterprise Servers – Generation 5

IBM announced its new S/390 G5 models in May 1998. Today, IBM offers a total of 26 S/390 G5 server models and the R06 Coupling facility, all exploiting the latest IBM Complementary Metal Oxide Semiconductor (CMOS) technology yielding up to 2.4 times the performance of the corresponding S/390 G4 models, and of the corresponding ES/9000®-9021 711-based models.The high-end "turbo" models, the Y16 through YX6, exploit IBM's advanced Modular Cooling Unit (MCU), with 2.0 ns cycle time providing the fastest single engine and largest single system image. Capacity Backup Upgrades provide a means of reserving capacity that can quickly be activated in case of an emergency. Many flexible upgrade paths are provided from previous generations of IBM CMOS systems to the S/390 G5 models and full upgradability is provided within the S/390 G5 line. With Capacity Upgrade on Demand, announced in January 1999, many upgrades within the S/390 G5 line can be accomplished non-disruptively.

All S/390 G5 servers offer significant new function and feature options such as IEEE Binary Floating Point, FIbre CONnection channels (FICON™), dual Cryptographic Coprocessors and Open System Adapter-Express Gigabit Ethernet connections. S/390 server's design excellence balances processors, memory and I/O connectivity optimizing them for enterprise computing. Memory and I/O bandwidth has increased over 100% from previous CMOS servers.

The 9672-R06 (the G5 Coupling Facility model), the new Internal Cluster Bus (ICB) and Internal Coupling (IC) channel extend the balanced design concept to the Parallel Sysplex cluster. Many other new clustering capabilities such as shared ICF support provide our customers with more flexible and cost effective options to configure Parallel Sysplex clusters.

The S/390 G5 server models provide the Parallel Sysplex customer more Single Systems Image (SSI) capacity, continuous availability, scalability and performance. S/390 G5 models also provide the single system customer with the upgradability, performance and functionality to increase existing workload capability, and provide increased capacity for the new workloads every enterprise has witnessed.

The S/390 G5 server has significant improvements for decimal instructions compared to the S/390 G4 server models. The S/390 G5 models also provide increased performance and throughput for customers who have substantial binary floating point arithmetic calculations and other types of numerically intensive workloads. Furthermore, the S/390 G5 server models also offer new instructions to further enable C/C++ and Java. The S/390 G5 server models can enable a cost effective replacement of older servers, efficient workload consolida-tion, new applications and UNIX workload enablement. In addition, the models can provide for smooth transitions from bipolar to CMOS possible in both stand-alone and Parallel Sysplex enabled data sharing environments.

Non-disruptive growth with the S/390 G5 servers

Most companies can not fully predict the impacts on IT associated with the challenges and complexities that lie ahead. Technologies such as e-business have placed very stringent requirements on IT. As the value of IT to businesses and their customers increases, the qualities of service such as response time, availability, and security demanded from the IT environment have also increased. This has led to a requirement for advanced non-disruptive growth strategies. IBM is responding to this requirement with the ability to grow non-disruptively with the S/390 G5 servers beginning 3Q 1999.

Plan-Ahead

Responding to accelerated or unexpected growth does requires sound planning and a flexible IT infrastructure that can respond quickly to change. Some of the factors that should be considered as part of a capacity planning process include:

- Known growth of existing applications
- Replacement of existing applications
- New applications
- New business ventures, mergers/acquisitions
- Testing for Year 2000 and EURO support
- Buffer to cover unanticipated growth

IBM has long been committed to working with customers to assess and determine their capacity needs. Through an enhanced Plan-Ahead process, and new functions and features of the S/390 G5 server, IBM can assist customers in determining future capacity needs. Plan-Ahead supports non-disruptive I/O and capacity growth for S/390 G5 servers, enabling customers to accommodate growth at low risk to their business.

Plan-Ahead requires the use of a new Capacity Upgrade on Demand function and the Concurrent Conditioning feature with planning assistance available from IBM. Planning-Ahead can reduce or eliminate outages associated with increasing capacity.

Capacity Upgrade on Demand

Capacity Upgrade on Demand allows for the non-disruptive addition of one or more Central Processors (CPs) and/or Internal Coupling Facilities (ICFs). Capacity Upgrade on Demand can add processors up to the maximum number of engines available by the S/390 G5 server's technology building block, its MCM. This provides value to customers wanting or needing to upgrade without disruption to their ongoing IT business as well as for customers with capacity backup requirements to enable capacity as efficiently and non-disruptively as possible.

Concurrent Conditioning

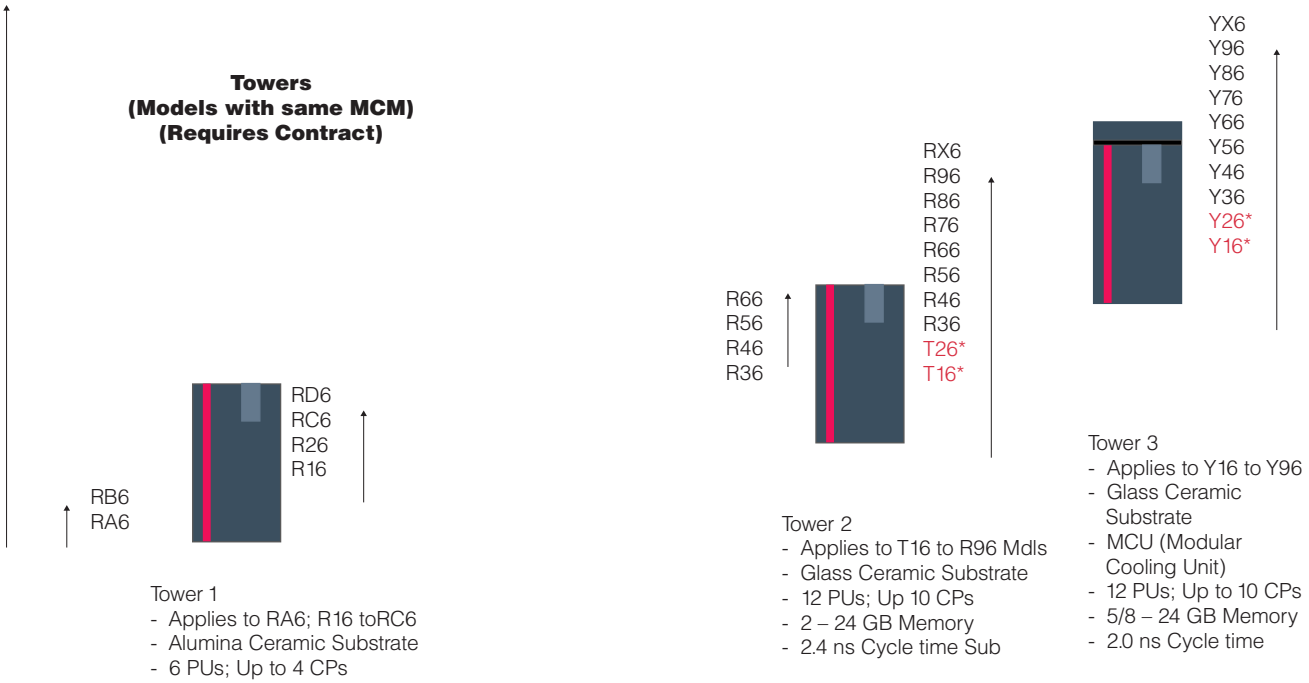
Concurrent Conditioning configures a system for hot plugging of I/O based on a future specified target configuration. Concurrent Conditioning uses the S/390 server configurator to assist customers in Planning-Ahead for their future system. Use of the Concurrent Conditioning feature will install the necessary hardware in a S/390 G5 system that will enable non-disruptive addition of I/O components (ESCON®, Parallel, FICON, OSA-2, OSA-Express, ICB and HiPerLinks) that would otherwise have required a system outage.

At the completion of the Plan-Ahead process, IBM will have assisted in identifying the "G5 capacity tower" that is best suited to the customer's future business requirements. The result is a flexible IT infrastructure that can accommodate anticipated and unanticipated growth in a low risk non-disruptive way. Depending on the required Concurrent Conditioning, there is at most minimal cost associated with dormant G5 capacity. This creates an attractive new option for businesses considering piloting or extending new applications without the inconvenience, cost and complexity of bringing additional servers into their IT environment before they are actually required.

Contact your IBM Account Team for more information and to start Planning-Ahead.

G5 Server Towers of Vertical Growth

Growth Range



Tower 1
- Applies to RA6; R16 toRC6
- Alumina Ceramic Substrate
- 6 PUs; Up to 4 CPs
- 1 – 12 GB Memory
- 2.6 ns Cycle time

Tower 2
- Applies to T16 to R96 Mdls
- Glass Ceramic Substrate
- 12 PUs; Up 10 CPs
- 2 – 24 GB Memory
- 2.4 ns Cycle time Sub

Tower 3
- Applies to Y16 to Y96
- Glass Ceramic Substrate
- MCU (Modular Cooling Unit)
- 12 PUs; Up to 10 CPs
- 5/8 – 24 GB Memory
- 2.0 ns Cycle time

* T16, T26, Y16 to Y46, Y26 Models available only with CBU Feature (FC 7995, 7994) and Capacity Backup contract.

System must be configured with processor storage and I/O to accommodate CBU target machine.

S/390 G5 Server Capacity Backup Upgrade (CBU)

Special Capacity Backup Upgrade (CBU or EBU) models and features are offered with the S/390 G5 servers providing reserved emergency backup CPU capacity for situations where customers have lost capacity in another part of their establishment and want to recover the processing capability by adding reserved capacity on a designated CBU system in an expeditious manner.

A CBU system normally operates with a "base" CPU configuration and with a preconfigured number of additional Processor Units (PUs) reserved for activation in case of an emergency. Because CBU capacity is equivalent to or less than the customers original capacity, no additional software charges are incurred for the temporary use of the reserved capacity.

The S/390 G5 technology is ideally suited for providing Capacity Backup. Since the reserved CBU Processor Units (PUs) are on the same technology building block, the MCM, as the regular CPs, the S/390 G5 server can easily support two diverse configurations with the same MCM. The S/390 G5 server can scale from a 1-way up to a 10-way.

The "base" CBU configuration must have sufficient memory and channels to accomodate the potential needs of the larger CBU target machine. When capacity is needed in an emergency, the primary operation performed is activating the emergency CBU configuration with the reserved PUs added as CPs.

Models at the top of the pathways or Towers of Vertical Growth (the RD6, RX6 and YX6), can not be base CBU models as they have no spare engines. These models, however, can be the "emergency" target of the CBU configuration. The T16, T26, Y16 and Y26 models are only available with the CBU feature.

Until the availability of Capacity Upgrade on Demand, the capability to concurrently add CPs, activation of the "emergency" CBU configuration is disruptive. After the "emergency" is over, the S/390 G5 is returned to its original configuration with a planned Initial Program Load (IPL).

Starting 2Q 1999, an additional option to electronically activate a CBU emergency configuration will be available. Upon request from the customer, IBM can remotely activate the emergency configuration. This is a fast electronic activation that eliminates time associated with waiting for an IBM CE to arrive onsite to perform the activation.

Starting 3Q 1999, Capacity Upgrade on Demand will enable non-disruptive activation of "emergency" CBU configurations.

To facilitate testing of the customer's emergency recovery procedures, a provision allows for a three day yearly test with the "emergency" CBU configuration. Activation of the emergency configuration for testing can be planned or unplanned.

IBM S/390 servers offer a number of S/390 Open System Adapter features to match customer requirements and to provide seamless, scalable connectivity to Local Area Networks (LANs). One OSA feature is standard. The feature choices are dependent upon the model. Up to 12 OSA-2 features can be installed on G3,G4 and G5 servers. Additionally, on S/390 G5 servers, up to 12 OSA-Express features can be installed providing support for up to 24 Open System Adapter features.

S/390 Open System Adapter-Express (OSA-Express) Gigabit Ethernet (GbE)

IBM is introducing Gigabit Ethernet (GbE) on the S/390 G5 servers in support of TCP/IP environments. The new S/390 Open Systems Adapter-Express (OSA-Express) Gigabit Ethernet (GbE) features attach directly to the S/390 G5 server's Self-Timed Interconnect (STI) bus allowing data to be moved to and from the system in a very fast and efficient manner.

The new OSA-Express GbE features and eNetwork Communications Server for OS/390 V2 R7 (CS OS/390), together, deliver a balanced solution to help maximize throughput and minimize I/O subsystem resources by avoiding host interrupts. GbE can ensure that the increasing high volumes of data traversing the Local Area Network (LAN) do not encounter a bandwidth bottleneck, whether the data is exchanged via intranet Web Servers, centralized file servers, the Internet, or extranets.

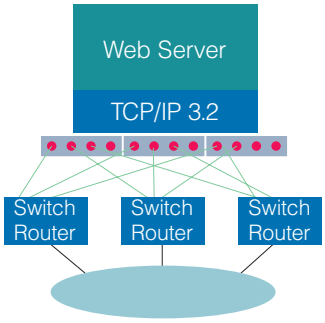
OSA-Express GbE provides interoperability with Ethernet and Fast Ethernet LANs, and delivers benefits similar to those of Fast Ethernet: integration with installed Ethernet LANs, higher performance, and a familiar management environment.

The OSA-Express GbE features, along with CS OS/390, have implemented a new, highly efficient design called Queued Direct Input/Output (QDIO), as well as a new design called IP Assist (IPA) which moves compute-intensive functions such as Medium Access Control (MAC) handling and packet filtering, from the S/390 server to the OSA-Express GbE feature, reducing the S/390 cycles required for these networking functions.

There are two OSA-Express GbE features:

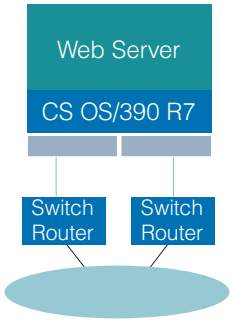
- The OSA-Express GbE Short Wavelength (SX) feature has one physical port supporting attachment to a one gigabit per second (Gbps) Ethernet LAN using a short wavelength optical transceiver for multimode fiber. This is beneficial for those customers who currently have a multimode fiber infrastructure, and do not require distances greater than 550 meters (1,804 feet), the maximum distance supported using multimode, 50 micron fiber.
- The OSA-Express GbE Long Wavelength (LX) feature has one physical port supporting attachment to a one Gbps Ethernet LAN using a long wavelength optical transceiver for multimode fiber or single mode fiber. This accommodates environments with multimode or single mode fiber, with the added advantage of extending the unrepeated

With ESCON



- √ Approximately 100 MB/sec
- √ 9 12 MB/sec paths
- √ 9 CHPIDs
- √ 9 Switch ports
- √ One TCP/IP stack per CP
- √ 9 IP addresses

With Gigabit Ethernet (GbE)



- √ Approximately 100 MB/sec
- √ 2 GbE links
- √ 2 CHPIDs
- √ 2 Switch ports
- √ One TCP/IP stack
- √ 2 IP addresses

distance of a LAN segment to five kilometers (3.1 miles), when using single mode, nine micron fiber. If multimode fiber is used with the Long Wavelength transceiver, a pair of mode conditioning patch (MCP) cables are required.

Support for Jumbo Frames

The OSA-Express GbE features can be configured to use a maximum jumbo frame size of up to 9,000 bytes. Support for jumbo frames means more efficiency for data-intensive applications, reducing packet processing overhead. Jumbo frame support reduces bottlenecks when operating at gigabit speeds.

Queued Direct Input/Output (QDIO)

Queued Direct Input/Output (QDIO) is a new design implemented and supported by CS OS/390 and the OSA-Express GbE features that dramatically improves throughput. QDIO allows the microprocessor on the OSA-Express GbE feature to communicate directly with the S/390 server's communications program through the use of data queues in S/390 memory and a new S/390 instruction..

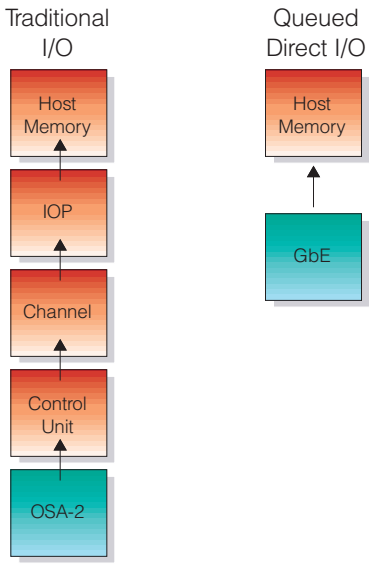
Ease of Use Features

With the S/390 Open Systems Adapter 2 (OSA-2) features, I/O subsystem and TCP/IP profile information must be defined in the OSA Address Table (OAT). For the OSA-Express GbE features, the network connections that are defined in CS OS/390 will be passed to the corresponding OSA-Express GbE feature during initialization, and the OAT is built dynamically. Profile information does not have to be defined using OSA/SF for OS/390 V2R7 when configuring an OSA-Express GbE feature. This reduces configuration and setup time, helps eliminate duplicate data entry, and reduces the chance of data entry errors and incompatible definitions.

Resource Measurement Facility (RMF™) reporting is being enhanced for OSA-Express GbE. This will allow the support staff to better understand what is occurring within an OSA-Express GbE feature.

OS/390 Version 2.7, CS OS/390 Version 2.7 and associated PTFs are required for OSA-Express GbE and associated RMF support.

Detailed information can be found in SA22-7403, *OSA-Express Customer's Guide and Reference*.



S/390 Open Systems Adapter 2 (OSA-2)

One S/390 Open Systems Adapter 2 is shipped with each S/390 G4 and S/390 G5 server providing seamless, scalable connectivity to Local Area Networks (LANs). The S/390 Open Systems Adapter 2 feature plugs into an I/O slot and has the same reliability and availability characteristics as an S/390 channel. Any of the media types can be selected up to a maximum of 12 features for each S/390 G5 server. The selectable features are as follows:

- The Ethernet/Token-Ring (ENTR) feature has two independent ports which can be configured as either Ethernet or Token-Ring. The ENTR feature supports full duplex/switched environments permitting a simultaneous transmit and receive for an effective throughput of up to 20 Mbps (Ethernet) and 32 Mbps (Token-Ring). Implementing a switched infrastructure can help solve network capacity problems with minimal disruption to the infrastructure, reducing changes to the wiring closets, building cabling and software.
- The Fast Ethernet feature has a single port that automatically adjusts to 10 or 100 Mbps, auto-sensing/auto-negotiation. This feature supports shared or switched, half or full duplex environments. SNA/APPN®, TCP/IP, or HPDT MPC (used by HPDT for UDP or High speed Access Services) are supported concurrently. Fast Ethernet offers familiarity, and coexistence with 10 Mbps Ethernet LANs, while delivering greater bandwidth to the network.
- The FDDI feature has a single port that supports dual-ring or single-ring attachment as well as attachment to an optical bypass switch. FDDI can be used as a network backbone to connect routers, bridges and servers. It delivers greater bandwidth than Ethernet or Token-Ring LANs.
- There are two ATM features supporting attachment to an ATM network; one supporting connectivity to multimode fiber optic cables, and one supporting connectivity to single mode fiber optic cables. The ATM feature can be configured in three "modes":

  – ATM Forum-compliant LAN Emulation (ATM LANE) emulating either an Ethernet or a Token-Ring LAN. This allows integration of ATM-based networks with little change while benefiting from the characteristics of ATM technology — scalability, a consistent protocol across the LAN and WAN, and integration of data, video and voice traffic.

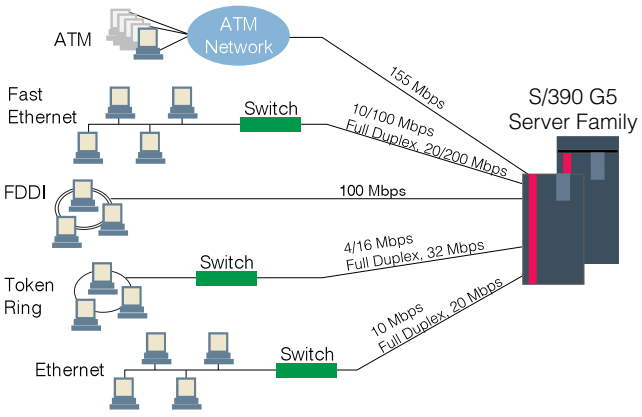
  – ATM IP Forwarding for OS/390 and MVS/ESA TCP/IP environments, supporting direct connectivity to the Wide Area Network (WAN), allowing consolidation of WAN data traffic and carrying it on a single LAN backbone. This offers more seamless connectivity between the S/390 server and intranets and the Internet, and can result in faster, less expensive network access to S/390 data and applications.

  – Native ATM:
  For OS/390 High Performance Data Transfer (HPDT) and High Performance Routing (HPR) environments supporting high bandwidth virtual circuits over APPN networks; little or no changes to applications, and can provide reduced management costs, reduced overhead, and the flexibility to negotiate availability, segregate traffic, and provision bandwidth.

  Native ATM:
  For Communications Server OS/390 Version 2 Release 5 environments (classical IP, RFC 1577); IP traffic can be transmitted over ATM networks. Overhead can be reduced and administration can be less complex compared to running ATM Forum-compliant LAN emulation.

Windows Support

With the introduction of S/390 Open Systems Adapter Support Facility for OS/390 Version 2 Release 1, (OSA/SF for OS/390 V2R1), a Graphical User Interface (GUI) supporting Microsoft® Windows 95® and Windows NT® is now available, as well as the current OS/2® GUI, making it easier to identify a non-dedicated workstation to run the client application.



S/390 FIbre (Channel) CONnection (FICON)

A new, high bandwidth channel, FICON, is being introduced on the S/390 G5 server models as the result of the requirement for higher bandwidth and increased connectivity. This new FICON channel matches customer data storage/access requirements and the latest technology in servers, control units, and storage devices. FICON channels allow a more efficient and faster data transfer while, at the same time, allowing customers to use their currently installed single mode and multimode fiber optic cables.

The S/390 G5 server supports a maximum of 24 FICON channels. A single FICON channel is capable of supporting over 4,000 I/O operations per second, delivering the same capacity as eight ESCON channels; this eight to one ratio now allows customers the option of channel consolidation. An S/390 G5 server configured with 24 FICON channels would provide a total system I/O equivalence of up to 360 channels without the need for more than 256 channel addresses. FICON helps reduce configuration complexity, infrastructure costs and the number of channels that must be managed.

The FICON channel can coexist with current channels in any model S/390 G5 server or follow-on and is supported by ESCON Multiple-Image Facility (EMIF).

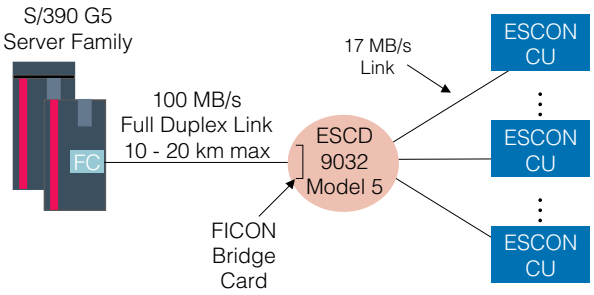
FICON is compatible with the Fibre Channel Physical and Signaling Standard (FC-PH). This is consistent with the S/390 direction of providing an “OPEN” platform for connectivity. The FICON channel can coexist with parallel and ESCON channels, the S/390 Open Systems Adapter 2 (OSA-2), OSA-Express and HiPerLinks, plugging into a standard
I/O slot.

FICON supports a maximum unrepeated distance of up to 10 km (20 km via RPQ, up to 100km with repeaters) for nine micron single mode fiber and up to 550 meters for 50 or 62.5 micron multimode fiber. FICON reduces the data droop that made similar distances not viable for ESCON. FICON’s distance capability is becoming increasingly important as customers are moving towards remote I/O, vaulting for disaster recovery and Geographically Dispersed Parallel Sysplexes for availability.

The 9032 Model 005 ESCON Director* will be the first device to support FICON through the use of a bridge card and is intended to help provide investment protection for customers’ currently installed ESCON control units. Up to 16 bridge cards are supportable on a single 9032 Model 005 with each card capable of sustaining up to eight concurrent ESCON control unit transfers. Direct connect FICON control units and a FICON switch will be available in the future. Current 9032 Model 005 ESCON Directors can be field upgradable to support the new FICON bridge cards, and both bridge cards and ESCON cards can coexist in the same box.

Resource Measurement Facility (RMF) is being enhanced for FICON and will report on the Peripheral Component Interconnect (PCI) bus utilization, as well as port bandwidth for performance management and capacity planning. OS/390 R3 or higher with PTFs is required for FICON and associated RMF support.

The new FICON channels will help reduce bandwidth constraints and channel contention to enable easier Server Consolidation, New Application Growth, large Business Intellegence queries, and exploitation of Network Computing.



* More information can be found in the *ESCON Reference Guide*, form number G326-0005.

S/390 Cryptographic Coprocessor

IBM leads the industry by offering the first CMOS Cryptographic Coprocessor as a standard feature on the S/390 G4 and G5 servers and as a priced feature on the G3 server models to meet the increasing needs for data security and integrity. The Cryptographic Coprocessor hardware, which is a member of the SecureWay family of products, is implemented in CMOS technology on a single chip, providing more capability than any previous cryptographic offering. Included in the design is battery backed non-volatile memory storage, laser delete chip personalization, integrated tamper detection and response, and high speed DES, Triple DES, RSA, Pseudo Random Number Generation and hashing algorithms.

On January 18, 1999 IBM announced that the IBM CMOS Cryptographic Coprocessor chip has earned the highest certification for commercial security ever awarded by the U.S. government known as the Federal Information Processing Standard (FIPS) 140-1 Level 4. It covers all Cryptographic Coprocessors that have shipped since June 1997, including, the G3, G4, G5, Multiprise™ 2000, and the Application StarterPac Servers. IBM S/390 is a leader in enterprise security from both functional and throughput perspectives.

Following along with IBM's commitment to our Network Computing Framework (NCF), including our Net.commerce initiatives, S/390 has enhanced our number of exploiters of S/390 hardware encryption. They include:

- CommercePOINT™
- WebSphere Application Server for OS/390
- OS/390 Firewall
- DCE Security Server
- VTAM® Session Level Encryption
- OS/390 LDAP

This hardware will run all current Integrated Cryptographic Feature (ICRF) functions previously offered on ES/9000® 9021 processors, and now includes Public Key Algorithms (RSA) with digital signature generation and verification.

The software that enables this solution and provides the Application Programming Interface (API) is a follow-on release of the ICSF/MVS product. This release is integrated into the base of OS/390 Version 2 Release 5. This enhanced software release supports new functions built into the chip, as well as continues to support all previous ICSF/MVS functions found on prior 9021 machines. The software supports all the current standards and requirements as did the previous versions. New applications developed by and available from non-IBM developers can allow customers to exploit many more opportunities worldwide in the increasingly important area of Digital Signatures. This currently includes SDM and CONNEX products, as well as BSAFE, an RSA Inc. product used by over 14 million customers. With these additional companies incorporating our Cryptographic Coprocessor functions into their products, the information explosion we see today can expand with a much higher level of privacy and integrity.

The TKE Workstation is an optionally priced feature. This workstation provides a secure, remote and flexible method to provide Master Key Part Entry. The algorithm utilizes Digital Signature, Diffie-Hellman and DES functions to provide a highly secure, auditable and remote method of key entry and can be used by those customers requiring very high security for key entry. An optional SmartCard Reader can also be attached permitting secure storage, convenient transport and rapid re-entry of key parts.

The S/390 CMOS Cryptographic Coprocessor enhancements help to provide secure, integrated, flexible, business-essential solutions. These enhancements are available on the S/390 G4 and G5 servers. The significant new components are:

- Dual Cryptographic Coprocessor on two-way models and above. On S/390 G5 servers, the Coprocessor(s) are now packaged within the S/390 G5 MultiChip Module (MCM). On dual-cluster G5 models (R36-Rx6 and Y46-YX6) each Coprocessor attaches to two Central Processors maximizing availability in case of a CP failure.
- Secure Electronic Transaction (SET[1])support for helping to safeguard payment card purchases made over open networks.
- Support for CVV and CVC: VISA and MasterCard specifications for encrypting information on a payment card such as the personal account number (PAN), the card expiration date and the service code.
- Public Key Algorithm(PKA) Cryptographic Key Data Set
- Zero Pad for DES Key Exchange with RSA when using the Symmetric Key Generate, Symmetric Key Import and Symmetric Key Export functions.
- Double-Key MAC Support
- Triple DES (TDES): DES encryption for ICSF has been enhanced to now include TDES (168 bits) encryption.

1 Please not that this product is based on the SET protocol and enrolled in the SET compliance testing process, but as of the date this material was prepared, has not been designated compliant with the SET Secure Electronic Transaction LLC.

S/390 Parallel Sysplex clustering was designed to bring the power of parallel processing to business-critical S/390 applications. A Parallel Sysplex cluster consists of up to 32 OS/390 images coupled to one or more Coupling Facilities (CFs) using high speed specialized links. The Coupling Facilities, at the heart of the Parallel Sysplex cluster, enable high-speed, record-level datasharing among the OS/390 images in a cluster.

The OS/390 Workload Manager can dynamically route incoming work to the OS/390 image best capable of handling the work enabling dynamic workload balancing among the images and providing application end-users with a single system image. The Parallel Sysplex cluster is managed as a "single operational image", removing the complexities associated with managing individual images separately.

The IBM 9037 Sysplex Timer, provides a common time reference to all OS/390 images which enables the managment of the cluster as a single operational image. The common time source also enables proper sequencing and time stamping of updates to shared databases, a feature critical to recoverability of the shared data.

When configured properly, a Parallel Sysplex cluster has no single point of failure and can povides customers with continuous application availability over planned and unplanned system outages, nearly unlimited capacity to accommodate application growth and low incremental cost when adding capacity. For detailed information on IBM's S/390 Parallel Sysplex technology visit our Parallel Sysplex Home Page at http://www9.s390.ibm.com/products/pso/.

As high-end processors have evolved, IBM has paid particular attention to balancing I/O and memory with processor performance to help ensure that no component becomes a bottleneck. The IBM S/390 G5 family offers the R06 Coupling Facility, the new Internal Cluster Bus (ICB) links and the new Internal Coupling (IC) channel. With these new components, coupling performance is balanced with the performance of OS/390 images running on G5 servers in a Parallel Sysplex cluster.

Coupling Facility Configuration Alternatives

The S/390 Coupling Facility (CF), the key component of the Parallel Sysplex cluster, enables multisystem coordination and datasharing among OS/390 images in the cluster. IBM CFs run Coupling Facility Control Code (CFCC), a special purpose Licensed Internal Code (LIC), to perform coupling operations. CFCC, the "operating system" for the CFs is continuously enhanced to improve performance, support new hardware, enable new functions and new application exploitation of the Parallel Sysplex environment. Through the evolution of CFCC, all major IBM databases (DB2, IMS, VSAM) and transaction managers (CICS, IMS) now benefit from datasharing and parallel processing. A table is provided on page 52 summarizing the major functionality added in each CF Level. Parallel Sysplex clusters should be configured with redundant CFs to help ensure that a CF failure does not become a single point of failure.

IBM offers different options for creating a functioning Coupling Facility:

- Stand-alone Coupling Facility: 9674 or 9672-R06 models provide a physically isolated, totally independent CF environment with facilities dedicated to coupling function. There are no software charges associated with stand-alone CF models. For datasharing environments it is recommended that Parallel Sysplex clusters are configured with at least one stand-alone CF for availability reasons. The R06, built on S/390 G5 technology is the most powerful stand-alone CF available. Flexible upgrade paths to the R06 from older 9674 CFs are provided. The R06 can be upgraded to grow from a 1 to a 10-way. The R06 can also be upgraded to S/390 G5 server models.
- Internal Coupling Facility (ICF): Customers considering clustering technology can now get started with S/390 Parallel Sysplex technology at a lower cost. An ICF feature is a spare processor unit (PU) which can only run Parallel Sysplex coupling code (CFCC or ICMF) in a Processor Resource/Systems Manager™ (PR/SM™) CF partition. Since CF LPARs on ICFs are restricted to running only Parallel Sysplex coupling code, there are no software charges associated with ICF capacity configured on an S/390 server. ICF partitions are appropriate for test as well as most production environments. All S/390 G5 models except 10-ways (RX6 and YX6) are capable of having at least 1 ICF.

- Coupling Facility partition on a 9672 Server using application CPs as CF processors: A CF can be configured to run in either a dedicated or shared PR/SM logical partition on application CPs. Application CPs, unlike ICFs, can run S/390 applications and are therefore subject to software charges even when they are used to run coupling code. This may be a good alternative for test configurations that require very little CF processing resource or for providing hot-standby CF backup using the Dynamic Coupling Facility Dispatching function.
- Integrated Coupling Migration Facility (ICMF): This facility was designed to provide a single-system Parallel Sysplex test/migration environment. CF LPARs running ICMF coupling code and the OS/390 images that connect to these CF LPARs must all be housed on the same S/390 server. Links to connect the OS/390 images to the ICMF LPARs are emulated by PR/SM, eliminating the requirement and cost of external links. ICMF is not suited for environments with high performance and availability requirements. On S/390 G5 servers, the availability of the Internal Coupling (IC) channel can replace PR/SM emulated links and the requirement to run ICMF.

  A CF partition running on S/390 server or S/390 Coupling Facility models can be configured to take advantage of a combination of different Parallel Sysplex capabilities.
- *Dedicated ICFs / CPs.* Dedicating ICFs or CPs to a CF partition is just like dedicating CPs to OS/390 partitions. For performance reasons, it is recommended that datasharing production environments run with dedicated CF partitions.
- *Shared ICFs / CPs*. Sharing of application or CPs or stand-alone CF processors among CF partitions has always been a supported capability. The capability to share ICFs among CF partitions on S/390 G5 server models will be available 3/99. This new support will provide those coupling workloads that did not warrant the full capacity of the S/390 G5 ICF, the ability to share ICFs. In conjunction with the S/390 G5 Internal Coupling (IC) channel support, the capability to share ICFs will enable customers to leverage S/390 G5 coupling technology at a very low cost. The S/390 G5 Capacity Upgrade on Demand capability is supported for shared ICFs. One or more ICFs (except on R06) can be added to the pool of shared ICFs non-disruptively providing increased coupling capacity for the CF partitions sharing this pool of ICFs.

- *Dynamic CF Dispatch*. Prior to the availability of the Dynamic CF Dispatch algorithm, shared CF partitions could only use the "active wait" algorithm. With active wait, a CF partition, once dispatched, uses all of it's allotted timeslice, whether it has any requests to service or not. The optional Dynamic CF Dispatch algorithm puts a CF partition to "sleep" when it there are no requests to service and the longer there are no requests, the longer the partition sleeps. Although less responsive than the active wait algorithm, Dynamic CF Dispatch will conserve CP or ICF resources when a CF partition has no work to process and will make the resources available to other partitions sharing the resource. Dynamic CF Dispatch can be used for test CFs and also for creating a hot-standby partition to backup an active CF.
- *Dynamic ICF Expansion*. This is a significant function that provides greater flexibility in configuring a Parallel Sysplex cluster and extends the life of key computing assets. Dynamic ICF expansion provides value by providing extra CF capacity when there are unexpected peak workloads or in case of loss of CF capacity in the cluster.
  - ICF Expansion into shared CPs (G3/G4/G5). A CF partition running on an S/390 server with dedicated ICFs needing CF processing capacity beyond what is available with the dedicated ICFs, can "grow" into the shared pool of application CPs being used to execute S/390 applications on the same server.
  - ICF Expansion into shared ICFs. This new S/390 G5 unique function that will be availabe 6/99 allows a CF partition running with dedicated ICFs to "grow" into the shared pool of ICFs in case the dedicated ICF capacity is not sufficient. The resulting partition, and "L-shaped" LPAR, will be composed of both shared ICF and dedicated ICF processors, enabling more efficient utilization of ICF resources across the various CF LPARs.

To understand which of the options and capabilities discussed above are suitable for your environment please review GF22-5042, *"Coupling Facility Configuration Options: A Positioning Paper"* at http://www.s390.ibm.com/marketing/gf225042.html.

Parallel Sysplex Coupling Connectivity

The Coupling Facilities and OS/390 images in the Parallel Sysplex communicate over specialized, high-speed connections (links). For availability purposes, it is recommended that there be at least two links connecting each OS/390 image to each CF in a Parallel Sysplex cluster. As processor performance increases, it is important to also use faster links so that link performance does not become a bottleneck. The performance, availability and distance requirements of a Parallel Sysplex environment are the key factors that will identify the appropriate connectivity option for a given configuration. The IBM S/390 coupling connectivity options are:

- The Internal Coupling (IC) Channel is a S/390 G5 server unique coupling connectivity option that enables high-speed, efficient communication between a Coupling Facility PR/SM partition and one or more OS/390 logical partitions running on the same S/390 G5 server. The IC channel is a linkless connection (implemented in Licensed Internal Code) and thus does not require any hardware or cables. The IC channel provides the fastest Parallel Sysplex connectivity, significantly faster than any external link alternatives and the emulated ICMF connections. The IC channel performance will result in better coupling efficiency than with external links, effectively reducing the CPU cost associated with Parallel Sysplex technology. ICMF partitions with emulated links only allow connecting to OS/390 partitions on the same server whereas Coupling Facility partitions with IC channels can connect to other S/390 servers using external links. With IC channels there is no need for ICMF. IC channels can be used in test or production configurations and reduce the cost of moving into Parallel Sysplex technology while enhancing performance and reliability. IC channels will be available 3/99 and are free of charge. Employing ICFs with IC channels will result in considerable cost savings when configuring a Parallel Sysplex cluster.
- The Integrated Cluster Bus (ICB), also S/390 G5 server unique, like the linkless IC channel, has better performance and reliability characteristics than the traditional coupling links and HiPerLinks. The ICB uses the S/390 G5 server's 333 Mb/sec Self Timed Interconnect (STI) bus to perform S/390 coupling communication between S/390 G5 servers and or the R06. Highly integrated, with very few parts, ICBs are extremely reliable. ICBs may provide better coupling efficiency (less CPU overhead associated with coupling systems) when compared to HiPerLinks. The ICB connection is made via a 10 meter cable. Therefore, the distance between the S/390 servers being connected is restricted to 7 meters. The ICB is very fast and cost effective and should be the coupling connectivity of choice when connecting S/390 G5 Coupling Facilities and S/390 G5 servers over short distances.
- HiPerLinks, available on S/390 G3, G4 and G5 servers and the corresponding C04, C05 and R06 Coupling Facilities are fiber-optic links offering transfer speeds of up to 100MB/sec over distances up to 40 kilometers (10 kilometers standard, 20 with RPQ and 40 in a Geographically Dispersed Parallel Sysplex configuration using the IBM 9729 wave division multiplexors). HiPerLinks can significantly improve coupling efficiency over the first generation ISC coupling links for asynchronous service requests that transfer large amounts of data.

S/390 Parallel Sysplex Professional Services

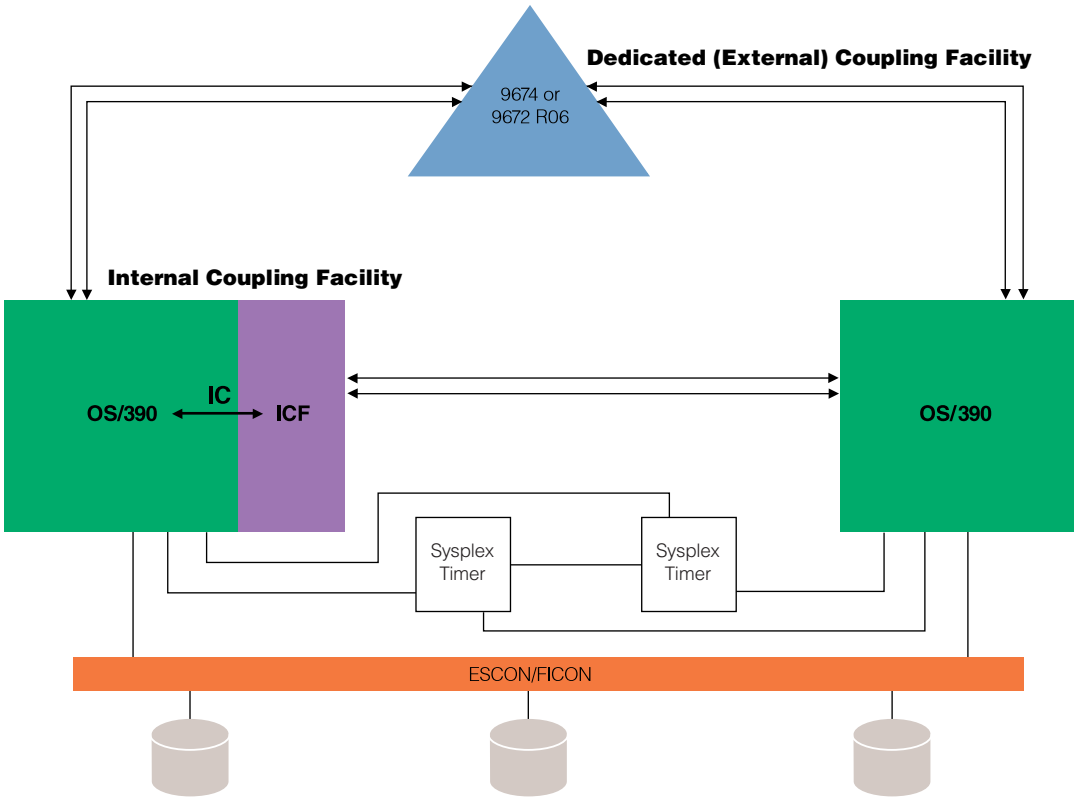
IBM provides extensive services to assist customers with migrating their environments and applications to benefit from Parallel Sysplex clustering. A basic set of IBM services is designed to help address planning and early implementation requirements. These services can reduce the time and costs of planning a Parallel Sysplex environment and moving it into production. An advanced optional package of services is also available and includes datasharing application enablement, project management and business consultation through advanced capacity planning and application stress testing.

Geographically Dispersed Parallel Sysplex

The Geographically Dispersed Parallel Sysplex (GDPS) is a multi-site high availability solution offering that can provide automated, fast business recovery/continuity with no data loss across planned/unplanned, system, DASD or site outages. A Geographically Dispersed Parallel Sysplex consists of a Base or Parallel Sysplex cluster spread across two sites separated by up to 40 kilometers (RPQ or 9729 WDM required based on distance) with all critical data mirrored between the sites. GDPS uses System Automation for OS/390 (SAOS/390) and builds on Parallel Sysplex and Peer-to-Peer Remote Copy (PPRC) technology. GDPS provides the capability to manage the remote copy and Parallel Sysplex configuration, automates planned and unplanned reconfigurations and provides the fastest failure recovery available in the industry, using a single, automated point of control.

GDPS is discussed in detail in the *"Geographically Dispersed Parallel Sysplex: the S/390 Multi-site Application Availability Solution"* whitepaper, GF22-5063, available at http://www.s390.ibm.com/marketing/gf225063.html.

Continuous Availability
Recommended Configuration



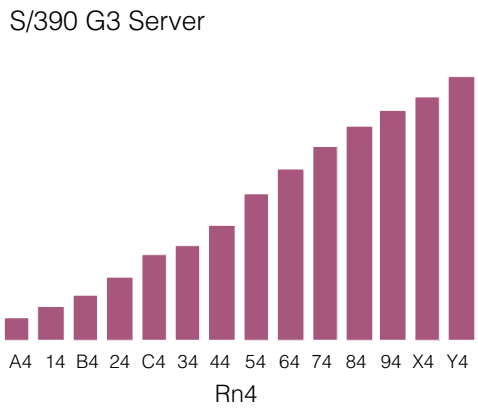
Components and assumptions

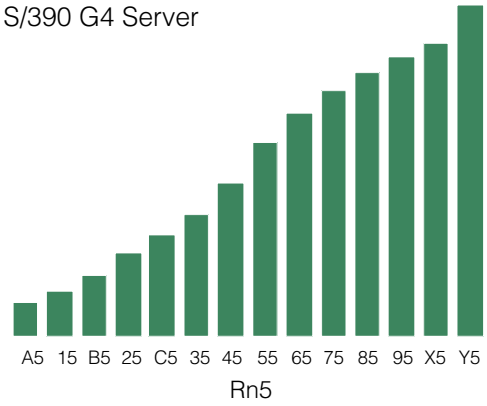
- Two Coupling Facilities, at least one external
- Two Sysplex Timers
- Two OS/390 servers, redundant backup capacity
- Two Links from each CF to each OS/390 image
- Two hardware management consoles
- Two ESCON Directors with cross-connected DASD
- Dual electrical power grids
- Cloned OS/390 images, latest available software levels
- Automation capabilities for recovery/restart
- Critical Data on RAID and/or mirrored DASD

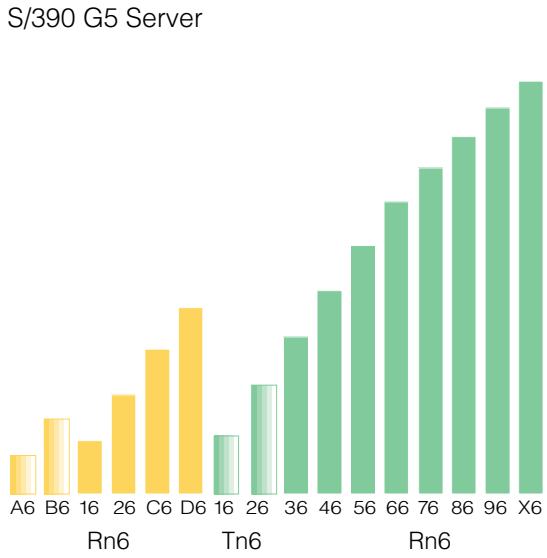
Key attributes

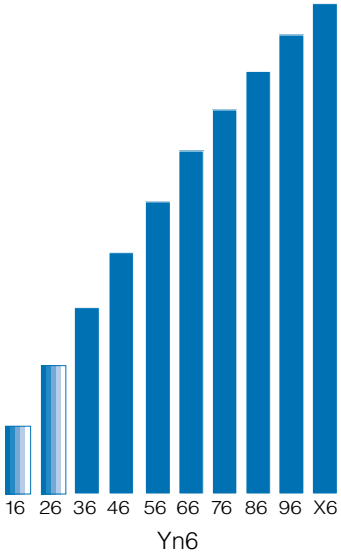
- No single points of failure
- Fast, automatic recovery:
  - CF: rebuild in surviving CF
  - CEC/OS390: restart subsystems on surviving image
  - TM/DBMS: restart in place
- Surviving components absorb new work
- No service loss for planned or unplanned outages
- Near unlimited, plug and play, growth capacity

Performance comparison





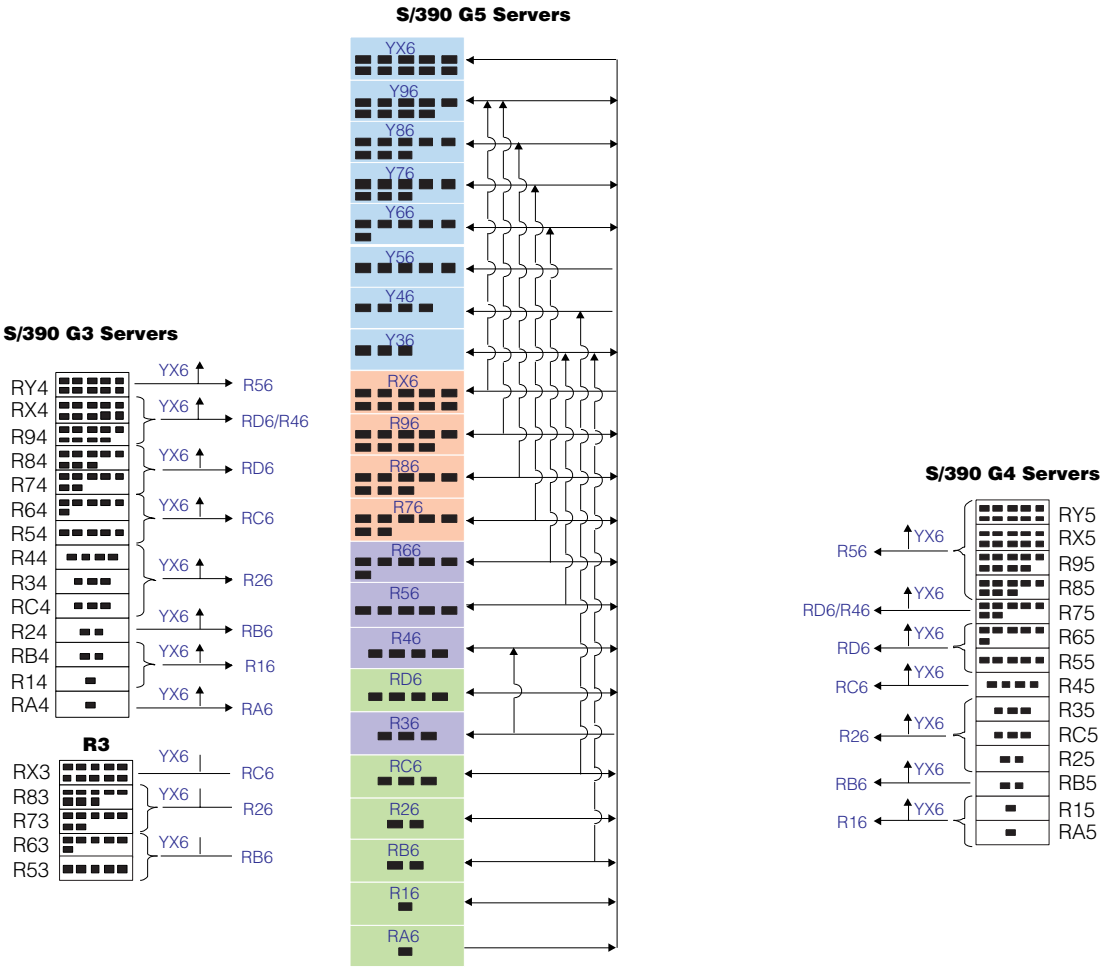




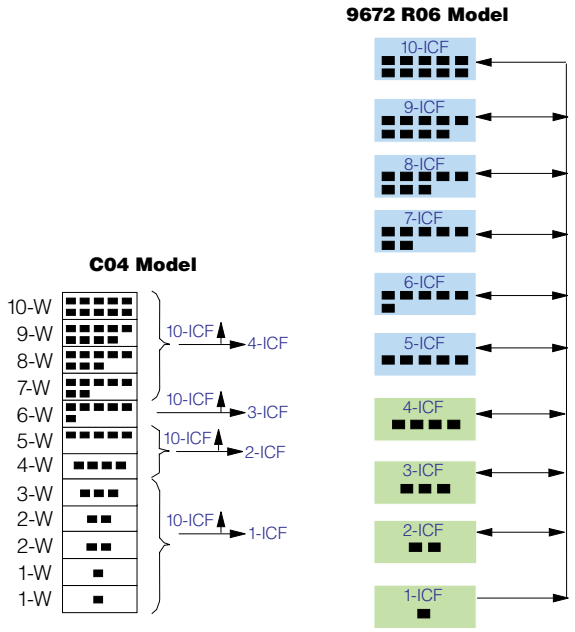
Note: The figures on these pages are to be used to depict the relationship of different models of the S/390 Parallel Enterprise Servers in terms of increasing capacity within each family.

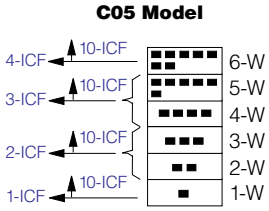
Comparing relative performance of one model with other models should be done using LSPR data and the specific workloads to be processed.

Parallel Enterprise Server
R3, G3, G4 to S/390 G5 server upgradability

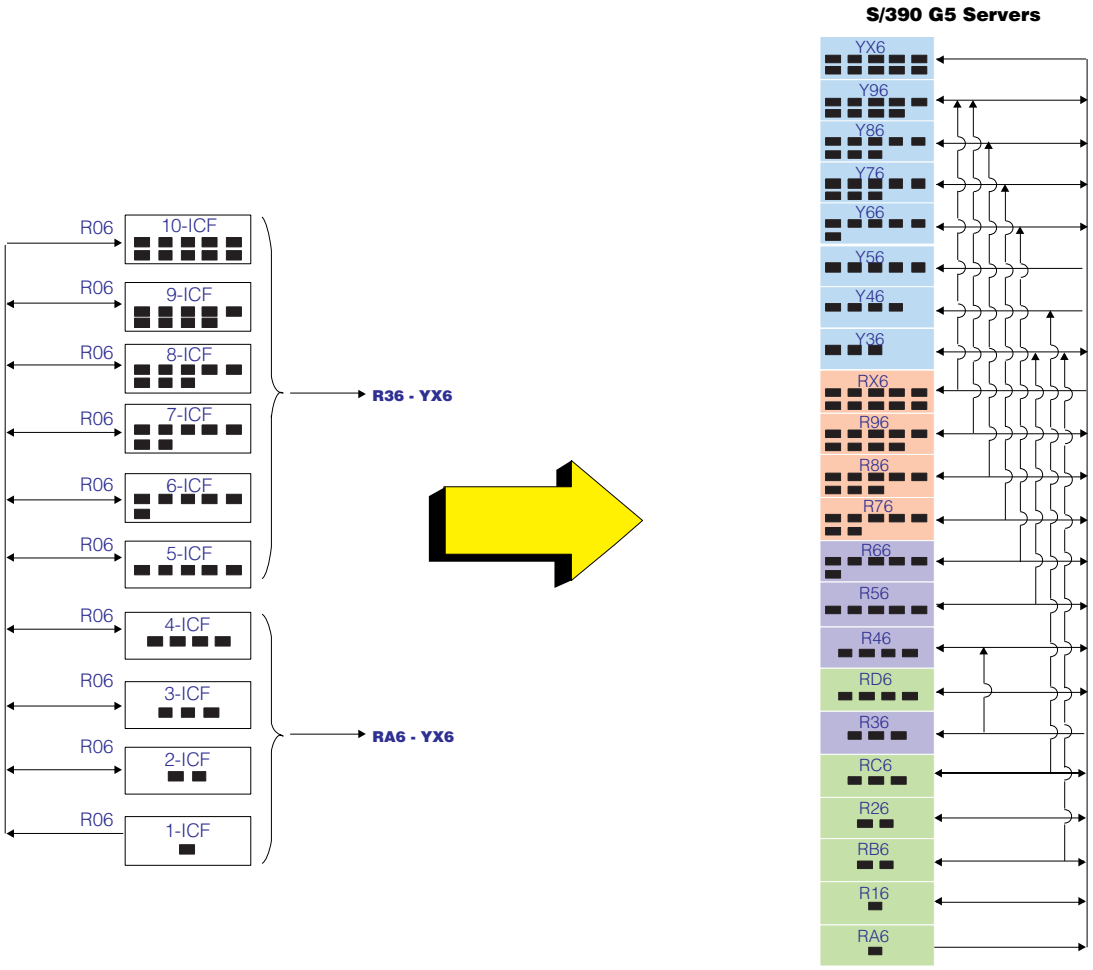


9674 Models C04, C05 to 9672 Model R06 upgradability



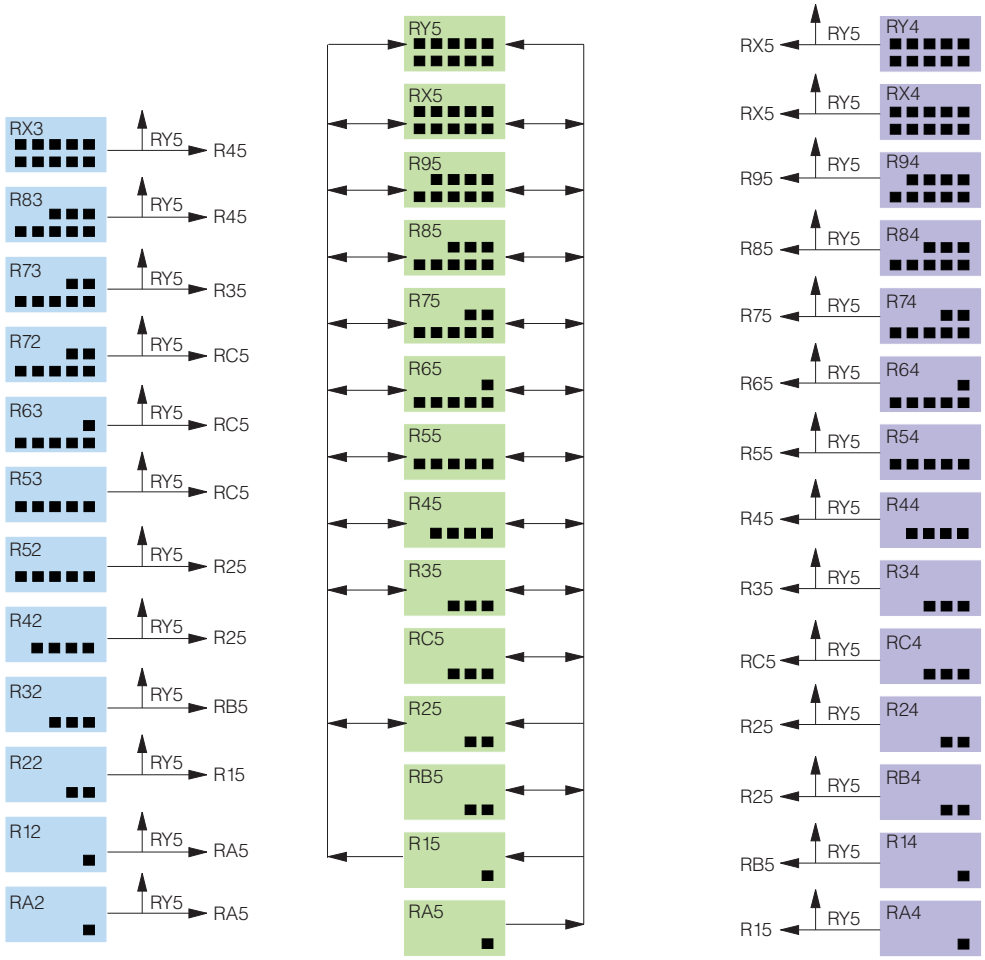


9672 Model R06 to S/390 G5 server upgradability

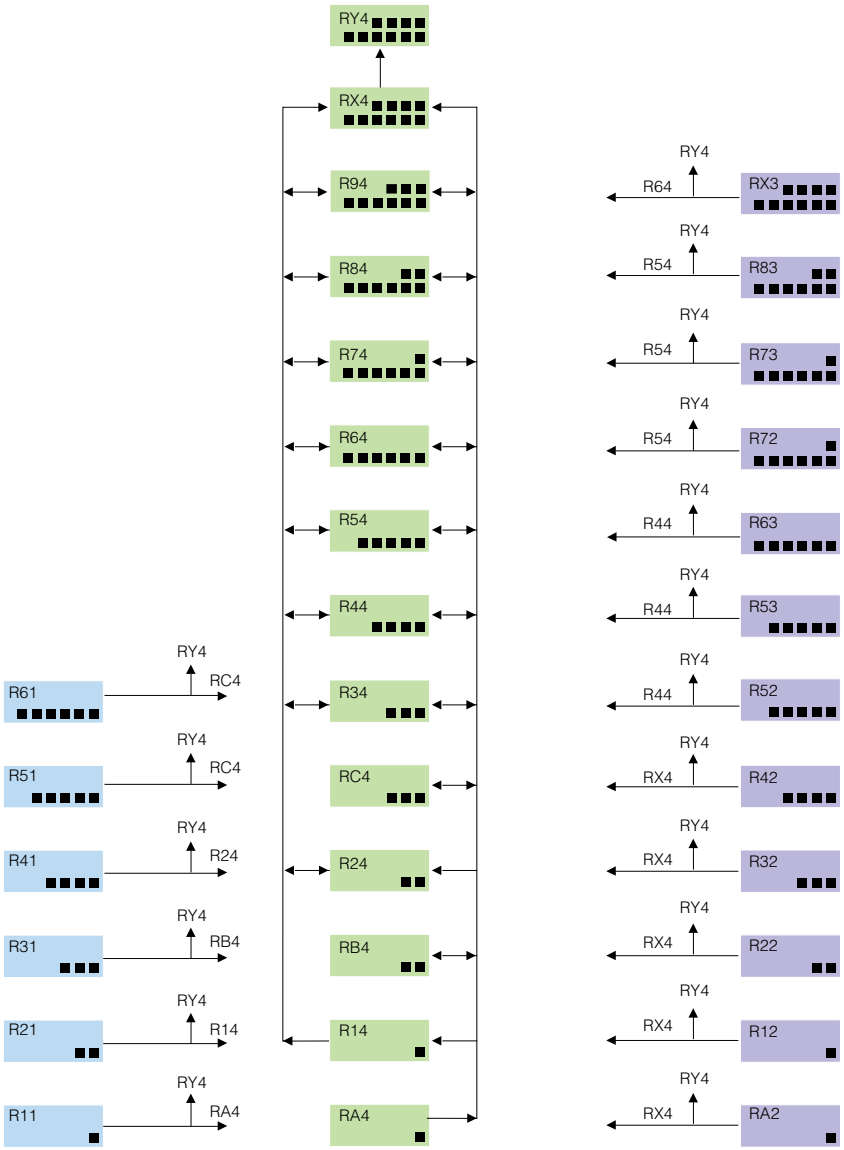


Note: R06 5-10 way does not upgrade to RA6-RD6.

Parallel Enterprise Server
R2, R3, G3 to S/390 G4 server upgradability



Parallel Enterprise Server
R1, R2, R3 to S/390 G3 server upgradability



S/390 Parallel Enterprise Server Features and Functions

	G3	G4	G5
Availability:			
Spare Memory Chips	Y	Y	Y
Dynamic Memory Sparing	Y	Y	Y
Partial Memory Restart	Y	Y	Y
Internal Battery Feature (IBF)	Y	Y	Y
Dual Utility Power Feeds	Y	Y	Y
N+1 power supply and cooling technology	Y	Y	Y
Concurrent Maintenance: Parallel/ESCON Channels, OSA-2, Coupling Links, Powers Supplies, AC Power cables, IBF, AMDs, SE, HMC	Y	Y	Y
Concurrent Maintenance of Licensed Internal Code (LIC): CP/PU, LPAR, SAP, Channels, OSA-2, CFCC, Coupling Links, Power/Thermal, SE, HMC	Y	Y	Y
Dynamic I/O Reconfiguration Management	Y	Y	Y
CICS Subsystem Storage Protection (SSSP)	Y	Y	Y
CICS Subspace Group Facility	Y	Y	Y
Suppression on protection	Y	Y	Y
Cancel I/O Request Facility	Y	Y	Y
Console Integration	Y	Y	Y
Enhanced Processor Design – Dual Instruction/Execution Units	– –	Y Y	Y Y
Application Preservation	–	Y	Y
Enhanced Application Preservation	–	–	Y
Dual Cryptographic Coprocessors	Y	Y	Y
Enhanced Storage Recovery	–	–	Y
Enhanced Memory Granularity	–	–	Y
External Time Reference (ETR)	Y	Y	Y
Spare Processor Unit (PU) – Dynamic SAP Sparing/Reassignment – Dynamic CP (Shared LPAR) – Concurrent CP Sparing – Transparent CP/ICF Sparing	 Y – Y –	 Y Y Y –	 Y Y Y Y
Business Continuance function – Partial memory – Partial I/O – Half of a PU cluster	 Y – –	 Y – –	 Y Y Y
Capacity Upgrade on Demand (except R06)	–	–	Y
Concurrent Conditioning	–	–	Y
Dual System Element	–	–	Y
Non-disruptive I/O removal/replacement	–	–	Y
CBU Fast Activation	–	–	Y

	G3	G4	G5
Processor Resource/Systems Manager™ (PR/SM):			
Up to 15 LPARs	Y	Y	Y
2 GB/LPAR	Y	Y	Y
Dynamic Storage Reconfiguration (DSR)	Y	Y	Y
ESCON Multiple Image Facility (EMIF)*	Y	Y	Y
Automatic Reconfiguration Facility (ARF)	Y	Y	Y
Dynamic Reconfiguration Management	Y	Y	Y
Resource Capping	Y	Y	Y
LPAR Definitions Retained	Y	Y	Y
LPAR Time Management Reporting	Y	Y	Y
LPAR Preferred Path	Y	Y	Y
Logical CP Vary On/OF	Y	Y	Y
Enhanced DSR	Y	Y	Y
Coupled Systems:			
Parallel Sysplex	Y	Y	Y
Sysplex Timer (ETR)	Y	Y	Y
Integrated Coupling Migration Facility (ICMF)	Y	Y	Y
Coupling Facility Control Code	Y	Y	Y
Coupling Links	Y	Y	Y
HiPerLinks	Y	Y	Y
Coupling Facility (CF)	Y	Y	Y
Internal Coupling Facility (ICF) – Dedicated ICF Partitions – Shared ICF Partitions	 Y –	 Y –	 Y Y
Dynamic CF Dispatching	Y	Y	Y
Dynamic ICF Expansion – Expansion into Shared CP Pool – Expansion into Shared ICF Pool	 Y –	 Y –	 Y Y
Integrated Cluster Bus (ICB)	–	–	Y
Internal Coupling Channel	–	–	Y
Enhanced Clock Function	–	–	Y
Year 2000 Sysplex Test Datesource	Y	Y	Y
Parallel Sysplex Connectivity:			
255 Connectors per cache structure	Y	Y	Y
32 Connectors per list/lock structure	Y	Y	Y
1-32 OS/390 image(s)	Y	Y	Y

Notes: See page 52, CF Level Support, for required level to enable Parallel Sysplex function and features.

*EMIF is supported for ESCON, FICON, OSA-2, OSA-Express, ISC Senders and ICB Senders.

	G3	G4	G5
I/O Connectivity:			
ESCON 17 MB/sec Channel	Y	Y	Y
ESCON CTC Extended and Basic Mode	Y	Y	Y
FICON 100 MB/sec Channel	–	–	Y
S/390 Open Systems Adapters			
– OSA-Express GbE	–	–	Y
– OSA-2	Y	Y	Y
Check Sum Facility	Y	Y	Y
Asynchronous Data Mover Facility (ADMF)	Y	Y	Y
Hardware Assisted Data Compression	Y	Y	Y
DB2 Sort Assist	Y	Y	Y
SIE Assist	Y	Y	Y
Move Page	Y	Y	Y
Enhanced Move Page	Y	Y	Y
Hiperbatch™	Y	Y	Y
Data Spaces	Y	Y	Y
Hipersorting®	Y	Y	Y
Asynchronous Pageout Facility	Y	Y	Y
Logical String Assist	Y	Y	Y
Scalar Square Root Instructions	Y	Y	Y
Immediate-and-Relative Instruction	Y	Y	Y
Compare-and-Move Extended	Y	Y	Y
Called Space Identification	Y	Y	Y
PLO	Y	Y	Y
IEEE-FP (Floating Point)	–	–	Y

Note: Several new G5 features and functions can only be enabled with the more current releases of OS/390. Integrated Clustering Bus (ICB), Internal Coupling Channel (IC) and FICON channels all require a minimum of OS/390 V1 R3 to be enabled. IEEE Floating Point is enabled with OS/390 V2 R6 and has not been rolled back to previous releases. ICs and FICON channels will be available March 1999. OSA-Express GbE features will be available in June 1999 and require OS/390 V2 R7.

New S/390 Architecture Instructions

S/390 G5 server architecture has many new hardware instructions. Major categories of instructions include:

- S/390 The Configuration Reporting Architecture, the enabler for Capacity Upgrade on Demand, provides system level information such as the system serial number and the number of configured CPs, as well as information on a single CPU. A new instruction, Store System Information, is introduced to allow streamlined reporting of information critical to effective system management of changes in system capacity. It will also serve as a single point of focus for reporting static, unchanged configuration data.
- Architecture for Extended Translation. The Unicode character encoding standard is an international character code for information processing that includes all the major scripts of the world. Unicode transformation formats allow a certain number of ASCII values to be transmitted as-is. Unicode is enhanced with with the Extended Translation Architecture improving performance of translations between Unicode and UTF-8, a commonly used transformation format.
- Hardware implementation of IEEE Floating Point Arithmetic: This enhancement supports the ANSI IEEE standard for Binary Floating Point Arithmetic with 16 floating point registers (generations prior to S/390 G5 support four registers). In conjunction with OS/390 V2.6 this new support improves performance for certain Java and C/C++ applications as well as simplifying porting of C/C++ applications from other platforms.
- Year 2000 Support: Instructions have been added to accelerate execution of Runtime Analyzer for MVS™ and OS/390 and Millennium Runtime Windowing Tool. These applications remediation tools can help find and fix Year 2000 date exposures in: Batch, Started Tasks (STCs), CICS and IMS application code. For additional information consult “Year 2000” on IBM’s Web site: *http://www.ibm.com/year2000* home page.

S/390 Parallel Enterprise Server Configuration Detail

Model	*No.of Proc.*	*ICF*	*Proc. Storage*	*Total Chnls*	*Parallel Chnls*[13]	*ESCON Chnls*	*FICON Chnls*	*HiPer-Links*	*IC*	*ICB*	*OSA-2*[10]	*OSA-Express*
RA4-R24												
Minimum	1	0	512 MB	3	0	0	–	0	–	–	1	–
Maximum	2	4	8 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	Note 1	–	3	4	–	1	–	–	1	–
RC4-R54												
Minimum	3	0	1 GB	3	0	0	–	0	–	–	1	–
Maximum	5	4	8 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	Note 2	–	3	4	–	1	–	–	1	–
R64-RY4												
Minimum	6	0	2 GB	3	0	0	–	0	–	–	1	–
Maximum	10	4	8 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	2 GB	–	3	4	–	1	–	–	1	–
RA5-R25												
Minimum	1	0	512 MB	3	0	0	–	0	–	–	1	–
Maximum	2	4	16 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	Note 3	–	3	4	–	1	–	–	1	–
RC5-R55												
Minimum	3	0	1 GB	3	0	0	–	0	–	–	1	–
Maximum	5	4	16 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	Note 4	–	3	4	–	1	–	–	1	–
R65-RY5												
Minimum	6	0	2/4 GB	3	0	0	–	0	–	–	1	–
Maximum	10	4	16 GB	256[9]	96	256[9]	–	32	–	–	12	–
Increments	–	1	Note 5	–	3	4	–	1	–	–	1	–
RA6-RD6*												
Minimum	1	0	1GB	3	0	0	0	0	0	0	1	0
Maximum	4	3	12GB	256[9]	96	256[9]	24[12]	32	32[11]	6	12	12[12]
Increment	–	1	Note 6	–	3/4	4	1	1	1	1	1	1
R36-RX6**												
Minimum	3	0	2GB	3	0	0	0	0	0	0	1	0
Maximum	10	7	24GB	256[9]	96	256[9]	24[12]	32	32[11]	18	12	12[12]
Increment	–	1	Note 7	–	3/4	4	1	1	1	1	1	1
Y36-YX6***												
Minimum	5	0	5/8GB	3	0	0	0	0	0	0	1	0
Maximum	10	4	24GB	256[9]	96	256[9]	24[12]	32	32[11]	18	12	12[12]
Increment	–	1	Note 8	–	3/4	4	1	1	1	1	1	1

Notes:

1. 512MB to 1GB; 1GB to 2GB; 2GB to 4GB, 6GB, 8GB
2. 1GB to 2GB; 2GB to 4GB, 6GB, 8GB
3. 512MB to 1GB, 1.5GB, 2GB; 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB/16GB
4. 512MB to 1.5GB, 2GB; 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB, 16GB
5. 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB, 16GB
6. Memory sizes are 1GB, 1.5GB, 2GB, 2.5GB, 3GB, 3.5GB, 4GB, 5GB, 6GB, 7GB, 8GB, 10GB, 12GB
7. Memory sizes are 2GB, 2.5GB, 3GB, 3.5GB, 4GB, 5GB, 6GB, 7GB, 8GB, 10GB, 12GB, 16GB, 20GB, 24GB
8. Only Y36 – Y66 have 5GB minimum. Y76-YX6 have 8GB minimum. Memory sizes are 5GB, 6GB, 7GB, 8GB, 10GB, 12GB, 16GB, 20GB, 24GB
9. The standard OSA-2 card takes 1 I/O slot, hence reducing the total number of channels to 252. A maximum of 256 ESCON channels is only possible if the first OSA-2 is removed.
10. Up to 12 ATM ports, up to 12 FDDI LAN ports, up to 24 Ethernet LAN ports or up to 24 Token-Ring LAN ports or combinations. Each FDDI feature has one port, each Ethernet/Token-Ring feature has two ports which can be configured as two Ethernet ports or two Token-Ring ports or one port of each. Two ATM features (multimode & single mode types having one port each).
11. Although S/390 G5 servers RA6-RD6 can connect up to 6 ICBs, R36-YX6 can connect up to 18 ICBs and the R06 can connect up to 24 ICBs, this number may change based on the combination of ICBs and HiPerLinks installed. Here are some rules:
    - The total number of external links (i.e., ICB + HiPerLink) cannot exceed 32
    - The total number of senders cannot exceed 32
    - The total number of Coupling CHPIDS (ICB + HiPerLink + IC sender + IC receiver) cannot exceed 64
    - When HiPerLinks are configured the maximum allowed ICBs is as follows: 6 for RA6 - RD6; 18 for R36 - YX6; 6 for 1-4 way R06; 18 for 5-10 way R06.
12. Total number of FICON plus OSA-Express can not exceed 24. The total number of OSA-2 and OSA-Express cannot exceed 12.
13. On a new S/390 G5 server, every parallel card will have four channels. S/390 G3 and G4 servers, when upgraded to a S/390 G5 server, will retain the installed parallel cards which have only three channels.

* RA6, R16, RB6, R26, RC6, RD6 4 part parallel card available 2Q 1999.
** T16 and T26, special capacity backup models, have minimums and maximums the same as R36.
*** Y16 and Y26, special capacity backup models, have minimums and maxmums the same as Y36.

S/390 Coupling Facility 9674 Model C04, C05 and 9672 Model R06 Configuration Detail

Model	Proc.	ICF	Proc. Storage	HiPer-Links	ICB
C04 1-Way					
Min	1	–	256MB	2	–
Max	1	–	4GB	32	–
Increment	–	–	Note 1	1	–
C04 2- to 5-Way					
Min	2	–	512MB	2	–
Max	5	–	4GB	32	–
Increment	1	–	Note 2	1	–
C04 6- to 10-Way					
Min	6	–	2GB	2	–
Max	10	–	8GB	32	–
Increment	1	–	2GB	1	–
C05 1- to 2-Way					
Min	1	–	512MB	2	–
Max	2	–	16GB	32	–
Increment	1	–	Note 3	1	–
C05 3- to 5-Way					
Min	3	–	1GB	2	–
Max	5	–	16GB	32	–
Increment	1	–	Note 4	1	–
C05 6-Way					
Min	6	–	2GB	2	–
Max	6	–	16GB	32	–
Increment	–		Note 5	1	–
R06 1- to 4-Way					
Min	–	1	1GB	0	0
Max	–	4	12GB	32	12
Increment	–	1	Note 6	1	1
R06 5- to 10-Way					
Min	–	5	2GB	0	0
Max	–	10	24GB	32	24
Increment	–	1	Note 7	1	1

Notes:

1. 256MB to 512MB; 512MB to 1GB; 1GB to 2GB; 2GB to 4GB
2. 512MB to 1GB; 1GB to 2GB; 2GB to 4GB
3. 512MB to 1GB, 1.5GB, 2GB; 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB, 16GB
4. 512MB to 1.5GB, 2GB; 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB, 16GB
5. 1GB to 3GB, 4GB; 2GB to 6GB, 8GB; 4GB to 12GB, 16GB
6. 1GB to 1.5GB,2GB,2.5GB,3GB,3.5GB,4GB; 1GB to 5GB,6GB,7GB,8GB; 2GB to 10GB,12GB
7. 2GB to 2.5GB,3GB,3.5GB,4GB; 1GB to 5GB,6GB,7GB,8GB; 2GB to 10GB,12GB; 4GB to 16GB, 20GB, 24GB

Coupling Facility — CF Level of support

CF Level	Function	G3	G4	G5
8	Dynamic ICF expansion into shared ICF pool			•
7	Shared ICF partitions on server models			•
	DB2 Delete Name optimization	•	•	•
6	ICB & IC			•
	TPF support	•	•	•
5	DB2 cache structure duplexing	•	•	•
	DB2 castout performance improvement	•	•	•
	Dynamic ICF expansion into shared CP pool*	•	•	•
4	Performance optimization for IMS & VSAM RLS	•	•	•
	Dynamic CF Dispatching	•	•	•
	Internal Coupling Facility*	•	•	•
	IMS shared message queue extensions	•	•	•
3	IMS shared message queue base	•	•	•
2	DB2 performance	•	•	•
	VSAM RLS	•	•	•
	255 Connectors/1023 structures for IMS Batch DL1 (non-BMP)	•	•	•
1	Dynamic Alter support	•	•	•
	CICS temporary storage queues	•	•	•
	System logger	•	•	•

Notes:

– G1 base CF Level code is 0 and can be upgraded to CFLevel 4.
– G2 base CF Level code is 1 and can be upgraded to CF Level 5.
– G3 and G4 can be upgraded to CF Level 7.
– G5 base CF level code is CF Level 6.
– Detailed information regarding CF Levels can be found in *"Coupling Facility Level (CFLEVEL) Considerations"* at url *http://www.s390.ibm.com/products/pso/cftable.html*

* G3, G4 and G5 only

S/390 Parallel Enterprise Server
Physical Characteristics - G3, G4, G5 Server

	RA4-RY4		RA5-RY5		RA6-YX6	
	Minimum 1 Frame System	Maximum 2 Frame System	Minimum 1 Frame System	Maximum 2 Frame System	Minimum 1 Frame System	Maximum 2 Frame System
Power Requirement						
50/60 Hz, KVA	0.6	5.0	0.6	6.4	0.6	5.5
Heat Output						
KBTU/hr	2.0	17.1	2.0	21.6	2.0	18.8
Airflow, CFM	300	1050	290	1400	290	1400
Airflow m*3/min	8.5	29.8	8.2	38.6	8.2	38.6
Floor Space						
sq ft	10.4	19.7	10.4	19.7	10.4	19.7
sq meters	1.0	1.8	1.0	1.8	1.0	1.8
Including Service Clearance						
sq ft	27.4	51.9	27.4	51.9	27.4	51.9
sq meters	2.5	4.8	2.5	4.8	2.5	4.8
Approximate Weight						
Lbs	1346	2057	1346	2107	1346	2057
Kg	612	938	612	958	612	938

Coupling Facility
9674 Model C04, C05 and
9672 Model R06

	C04		C05		R06	
	Min	Max	Min	Max	Min	Max
Power Requirement						
50/60 Hz, KVA	0.6	2.6	0.6	2.6	0.6	2.6
Heat Output						
KBTU/hr	2.0	8.9	2.1	8.9	2.1	8.9
Airflow, CFM	300	550	290		290	
Airflow m*3/min	8.5	15.6	8.2		8.1	
Floor Space						
sq ft	10.4		10.4		10.4	
sq meters	1.0		1.0		1.0	
Including Service Clearance						
sq ft	27.4		27.4		27.4	
sq meters	2.5		2.5		2.5	
Approximate Weight						
Lbs	1215	1364	1346	1364	1346	1364
Kg	551	620	612	620	612	620

S/390 Parallel Enterprise Server Software Groups and Software Support

S/390 Parallel Enterprise Server Software Pricing

Model	Processor Software Group	Processor MSUs
RA4	38	6
R14	38	8
RB4	40	11
R24	40	15
RC4	50	20
R34	60	22
R44	60	28
R54	70	35
R64	80	41
R74	80	46
R84	80	51
R94	80	55
RX4	80	59
RY4	80	64
RA5	38	8
R15	40	11
RB5	40	15
R25	50	20
RC5	60	24
R35	60	28
R45	70	35
R55	80	45
R65	80	51
R75	80	57
R85	80	61
R95	80	65
RX5	80	69
RY5	80	78
RA6	40	15
R16	50	20
RB6	60	28
R26	70	37
RC6	80	55
RD6	80	71
T16	60	22
T26	80	41
R36	80	59
R46	80	76
R56	IMLC	93
R66	IMLC	109
R76	IMLC	124
R86	IMLC	136
R96	IMLC	146
RX6	IMLC	156

S/390 Parallel Enterprise Server Software Pricing

Model	Processor Software Group	Processor MSUs
Y16	60	26
Y26	80	48
Y36	80	70
Y46	IMLC	90
Y56	IMLC	109
Y66	IMLC	128
Y76	IMLC	146
Y86	IMLC	161
Y96	IMLC	174
YX6	IMLC	186

Software support	G3	G4	G5
OS/390			
Version 2			
Releases 7, 6, 5 and 4	•	•	•
Version 1			
Releases 3, 2 and 1	•	•	•
MVS Basic and LPAR Mode			
MVS/ESA V5R2 and subsequent releases	•	•	•
MVS/ESA V5R1	•	•	•
MVS/ESA V4R3	•	•	•
ICF/MVS 2.1	•	•	•
VM/ESA Basic and LPAR Mode			
VM/ESA V2, Releases 3, 2 and 1	•	•	•
VM/ESA V1R2.2	•	•	•
VM LPAR Mode			
VM/ESA V1R1.5 (370 feature)	•		
VSE/ESA Basic and LPAR Mode			
VSE/ESA V2, Releases 3, 2 and 1	•	•	•
VSE/ESA V1R4 (ESA mode only)	•	•	•
TPF/ESA			
TPF V4R1	•	•	•

Note: 370 mode not supported on S/390 G4/G5 servers.

VSE/ESA

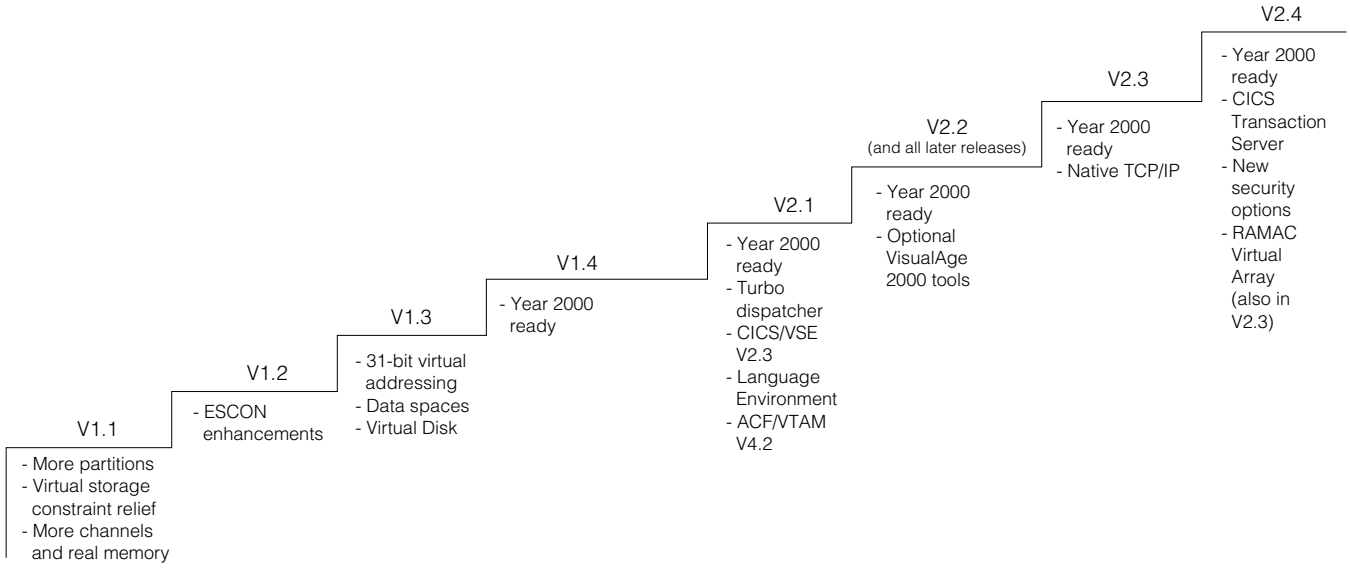
VSE/ESA is IBM's strategic Year 2000 ready entry operating environment for cost effective transaction and batch processing, as well as client/server computing.

The latest releases of VSE/ESA V2 continue to enhance VSE in the areas of network computing, client/server, Turbo dispatcher, increased capacity, and application development. VSE/ESA V2 is Year 2000 ready and, with associated Year 2000 ready IBM and non-IBM products, forms the basis for the application changes each customer must put in place to address their own Year 2000 challenge. The newest release of VSE/ESA V2 R3 satisfies a number of key customer requirements for VSE, including providing a native TCP/IP implementation. This TCP/IP for VSE/ESA allows VSE to participate in a multivendor, open networking environment using the TCP/IP protocol suite for communications and interoperability. TCP/IP for VSE/ESA also provides a native Web server capability that allows VSE customers to easily implement intranet/Internet applications using VSE/ESA and S/390.

These enhancements to VSE/ESA, combined with your existing VSE or VM/VSE applications will assist enablement of workload growth for years to come, while helping to provide protection of your current investment.

Benefits

- Year 2000 ready
- Increased throughput and capacity
- Native TCP/IP implementation for VSE/ESA
- Improved performance and increased data transfer rates
- Investment protection
- OS/390 affinity
- Can be used alone or with VM/ESA
- Streamlined product content
- Improved cost of computing
- Ease-of-use



VM/ESA Version 2 solidifies VM's position as an Enterprise Server. Beginning with Release 2, VM/ESA V2 is Year 2000 ready and provides the critical support for the Year 2000 required by customers to help ensure that their VM systems will function correctly through the change of century.

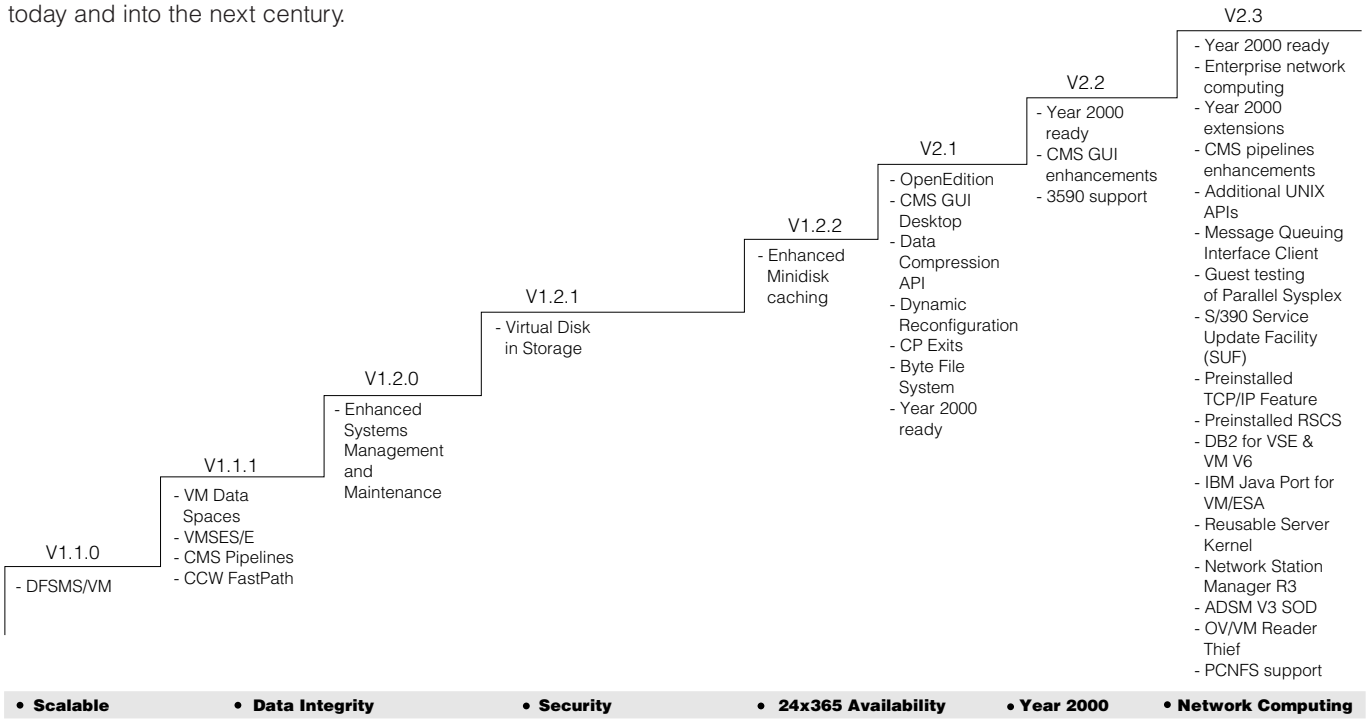
Network computing can help leverage your systems and skills to enhance your business success. Your VM system has consistently delivered the benefits of robust, centralized computing to your organization. Now this flexible, high-performance server platform is being enhanced to enable more network-based computing solutions with VM/ESA Version 2 Release 3.0.

An integrated TCP/IP suite, Network File System (NFS) access to VM files, Java and NetRexx™ for more rapid development of Internet applications, and Message Queueing Interface (MQI) support further strengthen VM's role as a platform for business solution deployment in networked environments. Because VM/ESA Version 2 Release 3.0 is a Year 2000 ready base for your existing applications, it is the right platform for your business today and into the next century.

In addition to expanded network computing support, VM/ESA Version 2 Release 3.0 will provide:

- OS/390 Parallel Sysplex Testing support, enabling customers to test entire OS/390 Sysplex clusters as a set of guest virtual machines on selected processors
- Integrated IBM Language Environment® (LE), at no additional charge, and additional UNIX interfaces to simplify application enablement and porting
- The RSCS product, preinstalled in the VM/ESA base DDR as a priced program
- support for IBM's newest S/390 Server hardware
- Extensions to the Year 2000 support delivered in VM/ESA Version 2 Release 2

Solution providers other than IBM are also delivering new VM-based facilities, including data management solutions and high capacity World Wide Web servers. Combining these new capabilities with your existing VM applications will help enable you to leverage your VM investments for years to come.



OS/390 Version 2

UNIX-branded and Year 2000 ready, OS/390 is the platform of choice for helping to protect user investments in existing applications and for deploying new applications. The time is right and the necessary function is available for customers to move aggressively to future computing environments, while maintaining stability and cost effectiveness in their current business processes.

OS/390 has reduced complexity and improved installability through the integration and testing of over 70 elements and optional features available in a single offering. Customer productivity is enhanced and installation time reduced through ServerPac installation and subsystem and system integration testing.

Significant improvements in OS/390 ServerPac production efficiency can mean faster delivery of customer orders and shorter transition time to production status.

The OS/390 software provides very high levels of availability for mission-critical workloads through IBM's Parallel Sysplex clustering technology. Dynamic workload balancing and transparent and granular application scalability support true enterprise-wide network computing and the global demands of e-business. Additionally, OS/390 provides comprehensive, integrated systems management and security so that e-business transactions can occur in a highly-protected manner.

Rapid migration to new technologies and business initiatives is possible through support of critical base components for server consolidation, network computing, enterprise applications and business intelligence. The S/390 Partners in Development program currently has over 1400 Independent Software Vendors (ISVs). Hot industry applications, such as Lotus Domino, SAP R/3, PeopleSoft and many more are delivering and exploiting OS/390 technology.

OS/390's Version 2 family of releases inherits all the value that Version 1 offered and builds on that value to respond to the industry trends of server consolidation, e-business, application enablement, and business intelligence with continued technology leadership. OS/390 Version 2 is a comprehensive network application server operating system for the entire range of S/390 customers.

Here is how OS/390 Version 2 enables end-to-end enterprise solutions:

- OS/390 V2 is a consummate network application server. OS/390 takes the ability to access and surf networks, provided in earlier releases to a level of transacting highly secure e-business via new SET† protocol and CVV/CVC codes support.
- For Systems Management, the future integration of Tivoli's Management Framework for OS/390 will enable systems management applications to provide end-to-end management from OS/390.
- A new paradigm for application development:
  - Component Broker for OS/390 delivers a new business object oriented programming model.
  - Java for OS/390 provides an Application Development Kit and a single new language that can be used to build both Internet and general business applications.
- Enablement of the hottest Enterprise Resource Planning and Business Management System (ERP/BMS) Enterprise-wide applications, such as Oracle Applications, PeopleSoft, SAP R/3, BAAN and Lotus Domino.
- For Distributing Computing, the addition of the ENCINA Toolkit Executive, DCE Application Support and enhancements to DCE Base Services will further extend OS/390 distributed computing.
- Technology that enables the easy integration and consolidation of alternate platform UNIX servers at a low total cost of computing.
- A robust platform for Business Intelligence that supports Data Mining, Data Warehousing and Decision Support.
- Year 2000 ready server operating system that is applicable to customers with less complex computing needs as well as those with the largest demands.
- Provide the foundation and technology leadership for entry into additional environments.
- Extend OS/390 platform strengths with continued enhancements.
- Provides faster and easier exploitation of the industry's newest software technologies.

† Please note that this product is based on the SET protocol and enrolled in the SET compliance testing process, but as of the date this material was prepared, has not been designated compliant with the SET specification by SET Secure Electronic Transaction LLC.

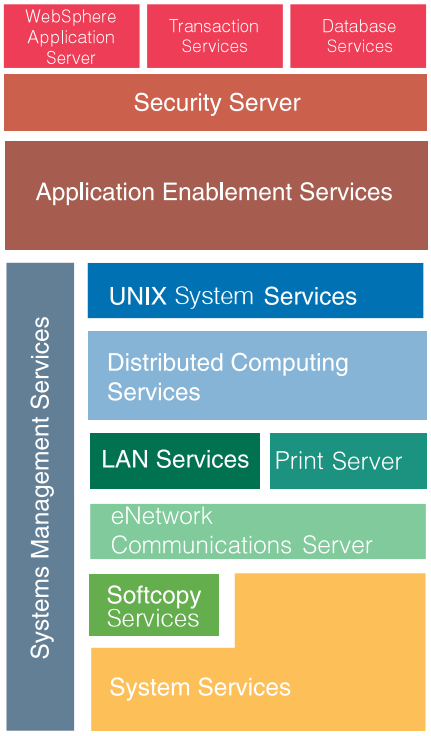
- WebSphere Application Server for OS/390, along with key e-business Enterprise Connectors, such as Net.Data® for OS/390, provide Web access to traditional DB2, IMS and CICS data.
- As a Communications Server, the latest new TCP/IP protocol stack provides improved performance for all application environments.
- OS/390 Version 2 can also offer outstanding value for customers who need the advantages of a robust server operating system while requiring a smaller computing investment.

Benefits

- Year 2000 ready
- Business responsiveness
  - The base for many packaged applications
  - Fast and easy to implement and maintain
- Applications growth
  - Uses new technologies to enable applications based on X/Open's UNIX95 interfaces, client/server, object-oriented, multimedia, and the Internet
  - Continues support for traditional applications
  - Choice of network that is independent of application
  - Enhanced capabilities for data access and management across platforms in a heterogeneous environment
- Integration
  - Version 1 combined functions of more than 50 existing products and features. Version 2 combines functions of more than 70 products, features and unique OS/390 functional enhancements.
  - Interoperability between RACF®, DCE and Kerberos V5
  - Inclusion of IBM's world-class set of WAN and LAN networking services
  - Extensive Print Server functionality
  - Systems Management enabling functions
- Reduced cost-of-computing and improved productivity
  - Reduces effort and time to plan, install, test and maintain OS/390
  - Pre-delivery systems integration testing can significantly reduce customer testing
  - On-line and integrated softcopy information improves productivity
  - Enhanced service deliverable with recommended service upgrade (RSU) support
  - WLM JES Batch Management
- High availability, recovery and usability
  - Global Resource Serialization “star” topology
  - Coupling Facility policy enhancements
  - More usable RMF® Coupling Facility Activity Report
  - JES3 enhancements
  - Single Node Persistent Sessions and Multi-Node Persistent Sessions
- Network Computing
  - WebSphere Application Server for OS/390:
    - NetQuestion textual search functionality
    - HTTP Server for OS/390
  - Integrated Firewall Technologies
  - High bandwidth ATM connectivity
  - GDDM® support for GIF files
  - SET† protocol and CVV/CVC, card-verification codes support

† Please note that this product is based on the SET protocol and enrolled in the SET compliance testing process, but as of the date this material was prepared, has not been designated compliant with the SET specification by SET Secure Electronic Transaction LLC.

OS/390 Functional Group Summary



- System Services — provide the classic strengths of OS/390: reliability, availability and security
- Systems Management Services — the window to enterprise-wide systems management
- Security Server — provides security services for host and distributed environments
- Application Enablement Services — for rapid development and deployment
- eNetwork™ Communications Server — opens OS/390 for network computing applications
- Transaction Services — high capacity and availability for mission critical applications
- Database Services — Access to large amounts of interactive data
- UNIX Services — give UNIX applications S/390 classic strength
- LAN Services — exploitation of S/390 as a LAN application and data server
- Distributed Computing Services — application interoperability and client/server processing
- Network Computing Services — WebSphere Application Server for OS/390 enables OS/390 as an Internet/intranet Server
- Print Server — provides enterprise print services for host and LAN Printing
- Softcopy Services — improve productivity in systems information installation and management

OS/390 is the foundation for new S/390 software servers and services, which are collections of functionally related elements and features that support a specific workload environment. These servers and services share common objectives with OS/390:

- Integrated function and features support application enablement
- Reduced total cost of computing
- Reduced installation and test time
- Functional consistency and interoperability across software servers on other platforms (OS/2 WARP, OS/400®, AIX® and other UNIX systems)

System Services

System Services — the classic strengths of OS/390: reliability, availability, serviceability and scalability.

The MVS operating system provides a robust base platform for all the functions that comprise OS/390. The backbone of the OS/390 system is the Basic Control Program (BCP) with JES2 or JES3. These provide the essential services that make OS/390 the system of choice when workloads must be processed reliably, securely, with complete data integrity and without interruption.

Highlights

- Work is submitted to the BCP through JES2 which interprets the Job Control Language (JCL) and manages disposition and the file and printer output. JES2 provides a single system image and basic workload management for a Parallel Sysplex environment. The installation can optionally elect JES3, which exercises centralized control in a multiprocessor environment and performs pre-execution of job setup.
- DFSMSdfp™ provides a comprehensive set of functions to manage storage resources on the system. Data management functions support storage and retrieval of data on DASD, optical and tape devices. Program Management functions allow creation and retrieval of executable pro-

gram libraries. Device management functions provide the means to define and control the operation of input and output storage devices. Distributed File Manager (DFM) supports access to remote data and storage resources.

- Time Sharing Option/Extensions (TSO/E) is a base interactive interface that provides non-DP professionals, end users, system and application programmers, and administrators with an extensive set of commands, services, facilities and programming languages to do productive work on OS/390.
- Integrated Systems Productivity Facility (ISPF) provides a host of services for the end-users and application developers to develop and manage dialogs, definitions and libraries.
- Many other services are integral to these base operating systems. They support transfers of bulk data between systems, file data between host and workstations, and communication with terminal hardware. Complete facilities are provided for recovery and reporting of device errors. Software failure data and dumps are captured along with other relevant information.

Benefits

The existence of a completely integrated set of system services assures that a customer can focus on extracting the maximum business value from the OS/390 installation. The system manages the workload, program libraries and I/O devices. Complexities are minimized and problem determination is facilitated with recovery and reporting facilities.

Systems Management Services

OS/390 provides systems management functions and features to manage not only S/390 resources, but also distributed systems resources. These capabilities have a long, successful history of usage by S/390 customers. OS/390 has enhanced many of these systems management functions and features to provide more robust control and automation of the basic processes of OS/390.

Highlights

- Hardware Configuration Definition (HCD) defines the operating system configuration and the processor hardware configuration. Hardware Configuration Manager (HCM) provides a graphical user interface to HCD to support the management of the system configuration.
- System Display and Search Facility (SDSF) provides an easy and efficient way to monitor and control job initiation, processing and output.
- SMP/E is a tool which provides a consistent and reliable method for installing, maintaining and upgrading the software in an OS/390 system.
- Resource Measurement Facility (RMF) is the window on OS/390 resource usage. Information is gathered at the Parallel Sysplex environment, single-system or address-space level and reports are available at any system in a Parallel Sysplex environment. Real time performance monitoring is handled by Performance Monitor (PM).
- Optional DFSMS™ Features (DFSMSdss™, DFSMShsm™, DFSMSrmm™) provide additional data and space management. DFSMSdss provides DASD data and space management. DFSMShsm manages space and data availability in a storage hierarchy for low-activity and inactive data. DFSMSrmm manages the installation's tape volumes and the data sets on the volumes.

Benefits

- Comprehensive systems management solutions
- Single point of control for enterprise systems management
- Modular, scalable functions
- Easy to install, customize and use
- Built on trusted S/390 strengths

Also featured as part of Systems Management is the Integrated Cryptographic Service Facility, which provides cryptographic functions for data security, data integrity, personal identification, digital signatures, and the management of cryptographic keys. These functions are provided through the combination of secure cryptographic hardware, the ICSF cryptographic API, and the ICSF administration interface. The cryptographic services support a wide variety of applications with high performance, security and availability. ICSF supports the Common Cryptographic Architecture (CCA), as well as the Data Encryption Standard (DES) algorithms, RSA public key cryptography, the Digital Signature Standard, and the Public Key Cryptographic Standard.

Highlights

- Trusted Key Entry (TKE) Workstation for highly secure entry of master keys
- Optional levels of security to help meet worldwide requirements-CDMF, RSA, SET
- Exploitation of hardware cryptographic processors
- Compatible with all traditional (DES) applications
- Open Standards allow new users — e.g., SSL session establishment

Benefits

- Integrated functions provide tailored levels of security
- High performance for increasing exploitation of cryptography with e-business, for traditional and emerging transaction security
- Easy and secure administration, including automatic key generation for high-volume business
- Easily extended as new standards emerge and are widely adopted

Security Server

The optional OS/390 Security Server combines the traditional benefits of RACF with the Open Software Foundation DCE level 1.2. It forms the basis for all security services from traditional applications, UNIX applications, and distributed systems. Access to resources can be selectively controlled, audited, and managed with appropriate centralized or decentralized control as required by each installation.

Highlights

- Interoperation of OSF DCE and RACF enables DCE application servers to share strong access control and auditing mechanisms provided by RACF.
- Reduced administration effort
- RACF remote sharing and password synchronization
- LDAP V3 Server support
- Firewall Technologies
- Tivoli® administration interface

Benefits

- Extensive security controls over emerging e-business opportunities
- Flexible control of access to protected resources, including installation-defined items
- Choice of centralized or decentralized control of security profiles
- Transparency to end users
- Choice of platform for DCE security server, with RACF for access control, and remote administration

Application Enablement Services

OS/390 provides a rich and comprehensive set of functions to create and enhance existing applications using the latest technologies, such as CORBA 2.0 distributed objects, open and distributed computing, and Networking Computing (intranet and Internet) applications. It also retains the traditional strengths which have made S/390 so attractive for large scale, high performance, OLTP, database and batch work.

Today's applications require much more than a set of traditional development tools. To provide true business value they must also:

- Enable rapid application development to deliver timely business function
- Be portable and interoperable
- Enable function to be delivered with performance across the network
- Allow access to data in a heterogeneous environment
- Be manageable and highly secure

Highlights

- DCE Application Services provides distributed application enabling to the OS/390 system, including support for developing and running DCE-based distributed transaction processing applications, which include CICS and IMS.
- ENCINA Toolkit Executive provides a set of tools for developing client components of distributed transactional applications.
- GDDM provides presentation services and device-driving capability.

- Language Environment provides common services and language-specific routines in a single run-time environment. It provides consistent and predictable results for your language applications, independent of the language they are written in, including C/C++, COBOL, PL/I, Fortran.
- SOMobjects™ runtime library is a set of functions for creating objects and invoking methods on them.
- VisualLift (Runtime Environment and Application Development Environment) is a tool to modernize the interface of existing host applications. The new user interface is located on the workstation while the host application remains untouched.
- C/C++ IBM Open Class Library is a comprehensive set of C/C++ class libraries that is used to develop applications.
- High Level Assembler

Options

Additional functions for Application Enabling Services include:

- DFSORT™, IBM's world class sorting product which provides the ability to do faster and easier sorting, merging, copying, reporting and analysis of business information, as well as versatile data handling at the record, field and bit level. DFSORT R13 exploits both hardware functions and software features to optimize overall performance.
- GDDM-PGF (Presentation Graphics Facility) is a set of programs for creating presentation material in a variety of styles. It provides the Interactive Chart Utility (ICU), an easy-to-use end-user program for creating business charts and application programming interfaces that enables programs to call either the ICU or a set of presentation-graphics routines.
- C/C++ Compiler includes a C compiler, a C++ compiler, class libraries, and C/C++ application development utilities.
- IBM High Level Assembler Toolkit provides a powerful set of capabilities to improve application development, debugging and recovery.
- Language Environment Data Decryption provides decryption of data using the DES algorithm for use with certain C functions.

- SOMobjects Application Development Environment (ADE) allows applications written in different programming languages to use the same object-oriented class libraries. The ADE provides a SOM® compiler and source code for the SOM kernel (root) classes, Interface Repository Framework, and Emitter Framework. Distributed SOMobjects provides the ability to distribute objects and object processing.

Benefits

- Improved development productivity, cycle time and quality
- CORBA 2.0 compliance for objects
- Reuse of existing code as objects through "wrappering"
- Support for multiple language environments
- Improved end-user productivity through provision of GUIs for existing applications
- Choice of many high level languages enables use of existing skills
- Improved interoperation and portability of code and objects between heterogeneous platforms
- Distributed applications development

eNetwork Communications Server

eNetwork Communications Server combines SNA/APPN Services (includes VTAM), TCP/IP Services (includes TCP/IP for MVS) and multiprotocol/HPS Services (includes AnyNet®), allowing one communication server to serve all applications and communications protocols. TCP/IP is a set of industry standard protocols and applications that allow you to perform tasks, share data and communicate easily with a variety of other systems and workstations. This element also utilizes TCP/IP CICS Sockets, TCP/IP IMS Sockets and TCP/IP Host on Demand. VTAM is a network communication access method that implements Systems Network Architecture (SNA) and Advanced Peer-to-Peer Networking® (APPN). It provides the interface between application programs in a host processor and other resources in an SNA network, and links peer users of the network. AnyNet implements the multiprotocol transport networking (MPTN) architecture. AnyNet enables application program types to communicate without change over different transport networks and across interconnected networks. Some OS/390 Optional Features included are: TCP/IP Kerberos (DES and non-DES) and TCP/IP Network

Print Facility (NPF). eNetwork Communications Server provides the networking foundation for S/390 e-business. Users can access S/390 application and data over SNA, TCP/IP or mixed networks, WANs and LANs, and a wide variety of connection types such as frame relay and ATM, to connect to their employees, suppliers, customers or business partners worldwide. It provides end-to-end universal connectivity.

Highlights:

- Integration of SNA/APPN, TCP/IP and AnyNet
- New high performance TCP/IP stack for all applications
- High Performance Native Sockets (HPNS) for TCP/IP applications
- High Performance Data Transfer for SNA applications
- Multinode Persistent Sessions for SNA applications running in a Parallel Sysplex environment
- SNA 3270, Sockets, and APPC application support
- High Performance Routing enhanced to additional S/390 network configurations
- Native ATM support for high speed networking
- Easy access to host applications from Java-enabled Web browser
- Greater performance and mobility for CICS Sockets
- Enabled for IBM Network Station

Benefits:

- Simplified deployment of client/server applications
- Function for new Network Computing Internet and intranet applications
- Multivendor, multiplatform connectivity
- High performance, high availability, network choice
- SNA class of service over IP networks
- World class TCP/IP services

Transaction Services

OS/390 supports two transaction servers which are separately orderable, but have been integration-tested to work successfully with OS/390.

- CICS Transaction Server for OS/390
- IMS Transaction Server

These are the basis for very high transaction rates for critical applications — both traditional, and Web-based.

Highlights

- Parallel Sysplex exploitation
- CICS VSAM RLS
- Can provide support for thousands of transactions per second
- Can provide support for tens of thousands of users
- Improved systems management
- Interoperability

Benefits

- High availability for mission critical applications
- Highly scalable OLTP systems
- Can help provide investment protection for existing applications
- Integration with new applications

Database Services

OS/390 supports two optional database servers, and one integrated with the DFSMS VSAM component. These have all been integration-tested to work successfully with OS/390.

- VSAM Database Services (part of DFSMS base)
- IMS Database Services (for IMS or CICS transaction servers)
- DB2 Database Services

They provide flat file, hierarchical, and relational database capabilities. Any, or all can be selected.

Highlights

- Data sharing in Parallel Sysplex environment
- Support for very large databases
- Support for high I/O rates
- Client/Server interoperability
- Simplified installation

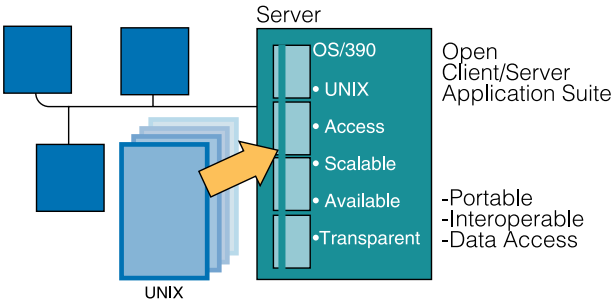
Benefits

- High performance for OLTP systems
- Excellent scalability
- Improved user productivity
- Reliable and available

UNIX System Services

The OS/390 UNIX is made up of the UNIX Application Services (shell, utilities and debugger) and the UNIX System Services (kernel and runtime environment). The Application Services Shell and Utilities provides the standard command interface familiar to interactive UNIX users. OS/390 includes all of the commands and utilities specified in the X/Open Company's Single UNIX Specification, also known as UNIX 95 or XPG4.2. This feature will allow UNIX programmers and other users to interact with OS/390 as a UNIX system without necessarily having to

Example – Porting UNIX to OS/390



learn the OS/390 command language or other interactive interfaces. The OS/390 UNIX Services Debugger provides a set of commands that allow a C language program to be debugged interactively. The command set is familiar to many UNIX users. UNIX System Services add the world of open UNIX-based computing to the OS/390 operating system. With Language Environment, they support industry standards for C programming, shell and utilities, client/server applications, and the majority of the standards for thread management and the X/Open Single UNIX Specification. Application developers and interactive users using these interfaces can exploit the capabilities of OS/390 without having to understand OS/390 itself. The combination of open computing and OS/390 allows the transparent exchange of data, easy portability of applications, cross-network management of data and applications, and the exploitation of traditional MVS system strengths in an open environment.

OS/390 has already begun to deliver certain key functions meeting immediate customer needs that are associated with UNIX 98 branding. Additional functions needed for UNIX 98 certification and their associated customer benefits are currently under assessment for future OS/390 releases. Additional UNIX 98 functions which deliver customer and application vendor value are planned for rollout over multiple future OS/390 releases.

Highlights:

- X/Open UNIX 95 Branded
- Permanent OS/390 UNIX Kernel
- Integrated/converged OS/390 UNIX Sockets
- Web application and UNIX C program performance improvements
- Improved OS/390 UNIX setup
- Web treading improvements
- Flexibility improvements — HFS files can be program controlled or APF authorized
- Addition of new UNIX commands
- Multiproc/MultiUser Kernel Support
- Significant performance enhancements in Version 2

Benefits:

- Development and execution of UNIX applications on OS/390 — OS/390 **is** a UNIX Platform
- Portability of applications to and from OS/390
- Use of UNIX development skills in an S/390 environment
- Consolidate multiple UNIX systems
- S/390 scalability for high growth UNIX applications
- Provide high availability
- Reduce systems management costs
- Application Enabling Technology
  - OS/390 provides systems management structures and automation policies, which, when enabled, allow the user to run on an OS/390 server without the need for MVS or OS/390 system programmer or operator skills. OS/390 uses OS/390 UNIX Services to provide an open UNIX interface to the end user. OS/390 Application Enabling Technology can also be used as a model for skilled OS/390 system programmers to use as a base for customizing solutions within their own center, or for deployment as a distributed or departmental server.

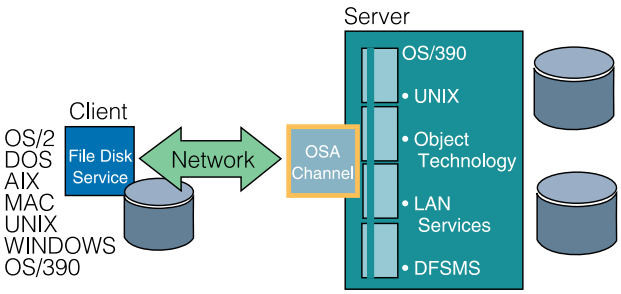
LAN Services

LAN services are functions of OS/390 which are designed to allow consolidation of various types of distributed functions to the host processor. This may improve management, performance, security, allow easier data and print sharing and distribution. Many popular types of LANs are supported, as well as most communications protocols. The Open Systems Adapter Support Facility (OSA/SF) software provides configuration services to allow attachment of LANs directly to the host processor using the IBM OSA hardware.

Highlights

- LANRES integrates NetWare LANs and S/390 environments. This includes administration, host-to-LAN and LAN-to-host printing, and file sharing
- NetWare workstation users store data on host DASD for performance and data sharing
- LAN Server provides file sharing services for OS/2 LAN Server or for TCP/IP environments which use Network File System
- Host backup processes (DFSMSdss, and ADSTAR® Distributed Storage Manager) can automatically manage backup and disaster recovery for all LAN files

Example – LAN Data Serving



- Open Systems Adapter Support Facility supports OSA-2 hardware feature which allows direct attachment of FDDI, Ethernet, Token Ring LAN, or ATM networks, using SNA, TCP/IP, or IPX as the protocol

Benefits

- Fewer servers to manage
- Higher availability and scalability
- Lower administrative costs
- Automatic data backup
- S/390 security, and data management for LAN applications
- S/390 disk capacity for LAN applications
- Quality-of-Service delivery for multimedia applications
- Shared access to large repositories of data
- High performance, high bandwidth access to data
- Support for heterogeneous clients

Distributed Computing Services

DCE Services provide the strengths of a distributed computing environment. All components supported are based on the Open Software Foundation (OSF) DCE level 1.2.1. The services consist of DCE Base Services, DCE DFS, NFS, and optionally DCE user-data privacy.

- The DCE Base Services support clients and servers that run on TCP/IP and SNA networks. Distributed Computing Environment (DCE) Distributed File Service (DFS) makes it easy for users to access and share data in a distributed environment across a wide range of platforms — both IBM and non-IBM
- NFS for OS/390 acts as a file server to workstations, personal computers, or other authorized systems in a TCP/IP network. It also provides an MVS client. It enables client users to remotely access MVS data sets or OS/390 UNIX Services files from any system on a TCP/IP network. The remote data sets or files are mounted from the mainframe to appear as local directories and files on the client system. NFS for OS/390 also provides access to the Hierarchical File System (HFS)
- DCE user-data privacy features enable data encryption using the data encryption standard (DES) algorithm and the commercial data masking facility (CDMF)

Highlights

- Remote Procedure Call (RPC) lets calls between programs running on different platforms appear as local procedure calls
- Directory Services allows resources to be found anywhere in an enterprise without the need to know local names

- Security Services helps solve security problems common in a distributed environment by handling identification and certification of users, clients, servers, and systems
- Distributed Time Services synchronizes clocks running on different nodes
- DFS allows access to both OS/390 UNIX Services Hierarchical File System and the OSF's DCE Local File System
- DCE DFS brings the strengths of S/390 systems management software and high-speed unique file naming across enterprises
- Client support for record-level access to PS, PDS, PDS/E, and VSAM data sets
- Security based on Kerberos authentication with access to RACF data as well
- NFS for OS/390 is a file server for remote data

Benefits

- Transparency of data and logic
- Distributed, consistent directory service
- Security for both clients and servers, including encryption if required
- Scalability of distributed applications
- Interoperability and portability

Network Computing Services

Businesses increasingly wish to use the Internet to market products and conduct business with suppliers and customers. WebSphere Application Server for OS/390 (formerly Domino Go Webserver) enables the use of S/390 as a Web server with the benefits of S/390 security, the utilization of large storage capacity on S/390, centralized skills, a single point of entry and control, consolidation of multiple Web sites, and secure Internet transactions.

NetQuestion is a powerful, full-text indexing and search server. It supports high-speed searching of OS/390 Web sites, as well as other documents stored on the OS/390 server. Free text searching is supported, as well as Boolean logic. NetQuestion returns a ranked list of hits. A full API set is provided so that NetQuestion functions can be used in other programs and products. It can also be used for Web-usage mining.

Highlights

- Repository for home pages
- Serves requests from Web browsers
- Stores text created with HTML
- Stores images, sound and video clips
- Authenticates digital certificates and uses the OS/390 Security Server for robust security
- Acts as a proxy server
- Provides interfaces to other OS/390 applications
- Can run in a Parallel Sysplex environment together with WLM, which provides multisystem workload balancing
- Common Gateway Interface (CGI) provides access to IMS, DB2, CICS, MQSeries® transactions and data
- Security enhancement including Access Control List, SSL V3 and exploitation of the hardware cryptography

WebSphere Application Server offers a host of further enhancements, such as HTTP 1.1 compliance, support for Java, data set support, and the ability to manage Internet processing through the Workload Manager (WLM). In addition, it provides:

- Automatic browser detection allows the server to respond to requests with the version of a Web page or document appropriate for that browser.
- Page counter and date/time information can be displayed on a page as graphical images.
- Enhanced logging and reporting.
- Dramatic improvements in single and multiple processor environments coupled with significant CPU requirement reductions provide higher throughput and shorter response time.
- Platform for Internet Content Selection (PICS) provides a way for users to filter material they encounter on the Internet and accept or reject the material based on its rating.
- Client Authentication provides server capability to determine, with a high degree of confidence, that the client is who it says it is.
- Web usage statistics

Benefits can include:

- e-business with security
- Utilization of large storage capacity on S/390
- Use of centralized skills
- Single point of entry and control
- Consolidation of multiple Web sites
- Secure Internet transactions
- Exploitation of OS/390 WLM

Print Server

Print Server is an automated facility used to transmit output data sets from the job entry subsystem (JES) to printers in a TCP/IP network. It can also be used to reroute VTAM application output (such as that produced by CICS and IMS) to JES for printing, without modifying VTAM applications. VTAM application output can be distributed to printers in a TCP/IP network.

Highlights

- IP PrintWay™/NetSpool™ — Included in the OS/390 Print Server is an automated facility to transmit output data sets from the job entry subsystem (JES) to printers in a TCP/IP network.
- IP PrintWay, acting as a line printer client (LPR), converts output data sets from EBCDIC to ASCII, if requested, and transmits the data set to any Line Print Daemon (LPD) in a TCP/IP network.
- NetSpool can be used with PrintWay to distribute VTAM application output (such as CICS and IMS) to a TCP/IP network, without modification of your applications.
- OS/390 Print Interface
- Workstation Client Support

Benefits

OS/390 Print Server provides an option to extend the print capabilities of the host to additional printers within an open network. In combination with the LAN services for LAN-to-Host printing, and the traditional JES and VTAM SNA print capabilities it allows complete control of the management and printing of output anywhere in the enterprise.

Softcopy Services

For retrievability and usability of information, and the costs and time associated with the storage of hardcopy, softcopy has been made the "entitled" medium of information delivery. Softcopy is automatically shipped on CD-ROM with the product. Softcopy is printable if you prefer using hardcopy. OS/390 Softcopy Print support, a base element in OS/390, enables you to print hardcopies of any book that can be viewed with BookManager® READ. PDF files are also available for printing OS/390 documentation.

Highlights

- OS/390 provides quality softcopy print support in the base product: an integrated subset of Print Services Facility (PSF) V2R2, Document Composition Control Facility (DCF) V1R4, BookMaster® V1R4 functions, and some fonts in the APF Font Collection V1R1, enables you to print input files generated by the BookManager PRINT or COPY functions.
- Users can search and view latest versions of any manual using BookManager READ/MVS, or any workstation with an appropriate BookManager Read program.
- Users can copy all or selected topics of a book and then submit a TSO/E batch job to format and print the book.
- BookManager BUILD/MVS (an optional product) lets you create your own on-line books from files marked up with GML (Generalized Markup Language) Starter Set or IBM Publishing Systems BookMaster.
- Files in BookMaster on-line format can be automatically translated to http format for Web Serving using BookServer (a base element), making IBM manuals available on a company Intranet.
- PDF files are also available in Release 6. The hardcopy books, printed from PDF files, look exactly the same as if they were ordered directly from IBM.

Benefits

- Consistent access to all of the latest documentation including diagrams
- Ease of searching and printing only relevant sections of documentation
- Simpler administration and installation of softcopy documentation rather then management and updating a physical library

IBM has identified four key business initiatives which customers can implement on S/390.

e-business
The e-business Initiative focus is to continue the rapid evolution of S/390 as the platform of choice for highly available, scalable and secure e-business. S/390 is a key player in the Internet/intranet opportunity and will remain so as new leading-edge capabilities are added to OS/390. IBM will continue to ship functional extensions to the Java Development Kit (JDK), enhancements to the eNetwork Communications Server and Security Server to further support Firewall Technologies, deliver Domino ancillary products on S/390, and a host of other network computing deliverables.

Applications
The goal of the Applications Initiative is to deliver new applications, new infrastructure in support of programming environments, and new support for application growth through tools for S/390 and OS/390. The Applications Initiative's customer-driven focus is based on object-oriented Component Broker technology, OS/390 UNIX technology, and technologies that optimize application development, porting and execution while delivering a low-cost hardware and software platform solution.

Component Broker for OS/390 will provide an environment for the hosting of new business applications on S/390 that, using a new programming model, will enable customers to rapidly design and develop their applications.

Business Intelligence
The goal of the Business Intelligence Initiative is to continue to evolve S/390 Parallel Sysplex capable hardware and OS/390 to meet the needs of increasingly diverse BI applications running on the S/390 platform. Key components which support BI include DB2 and data mining technologies, S/390 Parallel Sysplex technology, and Workload Manager to support large parallel queries and mixed query workloads in a data sharing environment.

Existing OLTP and query applications, and ported applications from UNIX and NT environments will run on a cost-effective, secure, robust, large-scale S/390 with OS/390 systems management. A key strength of OS/390 is the ability to manage variable BI workloads while maintaining current business-critical on-line and batch applications.

Server Consolidation
The S/390 Server Consolidation Initiative's goal is to continue to drive the consolidation of workloads to S/390, achieve customer-required cost reductions, and exploit new technologies and functions that enhance enterprise management, security, and application integration. In this way, customers have the ability and flexibility to compete in their market and grow their business.

S/390 delivers the ability customers require to "re-host" their workload to S/390; a strong, traditional application environment enhanced with support for UNIX and Windows NT applications — applications that require the robust support OS/390 provides. This initiative will help ensure that S/390 and OS/390 continually provide the latest enterprise system management, system software and hardware security protection, and reliable and complete transaction processing and business process automation — traditional applications blended with Web-related solutions.

The S/390 view of "Server Consolidation…and beyond," encompasses not only the consolidation of workloads to achieve cost reductions, but also the need for enterprise management to address the manageability and cost issues. In addition, secure applications/data, systems integrity, and control of resource access address security issues. And regardless of how an enterprise consolidates workloads, there will always be business processes that span heterogeneous platforms. Therefore, robust enterprise application integration solutions that combine message brokering with work flow technologies are integral to provide customers with the ability and flexibility to compete in their market and grow their business with minimal re-engineering.

Technology Leadership

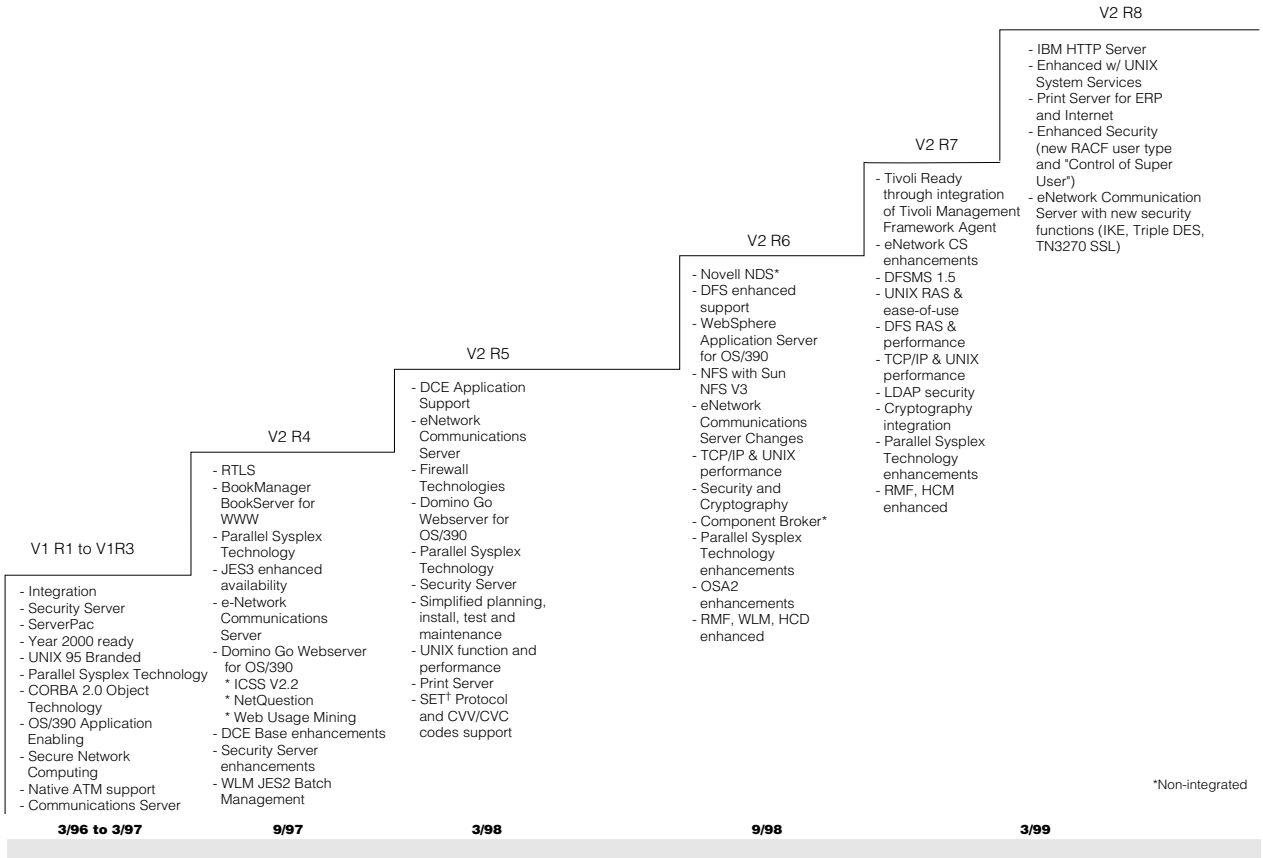
The four initiatives rely on the existing strengths of IBM's S/390 technology — which continues to be enhanced to provide Technology Leadership.

S/390 provides an infrastructure of hardware and software that responds quickly and easily to changing customer requirements and new opportunities. S/390's enhanced leading-edge technology integrates OS/390 software, and hardware functions to offer comprehensive end-to-end enterprise solutions required in today's extremely fast-paced and competitive business environments.

S/390 products are built on industry leading technologies. These state-of-the-art technologies are designed to exploit and expand the growth projected in both the traditional S/390 legacy and the new server environments. Key S/390 capabilities, such as Parallel Sysplex technology, OS/390 integrated packaging, connectivity, openness, and integrated bandwidth management, and S/390 CMOS provide the technology leadership to support customer business solutions critical areas such as server consolidation, security, e-business, application and development enablement, business intelligence, and general business at a low total cost of computing.

Technology Leadership is the essential platform for the success and growth of the S/390 environment.

OS/390 Evolution



† Please note that this product is based on the SET protocol and enrolled in the SET compliance testing process, but as of the date this material was prepared, has not been designated compliant with the SET specification by SET Secure Electronic Transaction LLC.

- Network Computing
  - Domino Go Webserver 4.6
  - eNetwork Communications Server
  - ICSF Cryptographic Solution

- Application Enablement
  - Year 2000 Ready
  - UNIX Services Enhancements
  - Run Time Library Services
  - C/C++ Enhancements
  - AET (Application Enabling Technology)

- Business Intelligence
  - Support for WLM
  - Parallel Data Management capabilities

- Server Consolidation
  - DCE enhancements
  - ENCINA Toolkit Executive
  - Security Server enhancements

- Technology Leadership
  - Dynamic LPA
  - Batch enhancements
  - WLM enhancements
  - DFSMS 1.4

System Services

WLM/JES2
In a JES2 system, WLM performs initiator batch management and resource affinity scheduling for system defined scheduling environments. New JES2 commands introduced and a migration aid to exploit WLM batch management. Additional WLM enhancements added for adaptive resource management, less disruptive policy activation and improved control of WLM provided system services.

DFSMS 1.4
Numerous availability, usability, performance and interoperability enhancements in DFSMS including space failure allocation reduction and VSAM, RMM and DSS enhancements.

Dynamic LPA
Allows refresh of modules in Link Pack Area (LPA) without requiring an IPL.

VSAM
VSAM RLS performance enhancements and extended addressability allowing manipulation of data sets larger than 4 GB in size.

JES3
Added 64K job number support. Also, availability improvements in a Parallel Sysplex environment through dynamic change support, faster restart and REFRESH with HOTSTART.

TSO/E
SEND, PARMLIB and CALL/TEST TSO commands are enhanced to be Parallel Sysplex capable.

Logger
System Logger enhanced to function in a single system environment.

StandAlone Dump
Usability and performance enhancements.

System Management Services

HCM
Integrated as an optional priced feature into OS/390 V2R4. Provides a GUI front end to HCD.

HCD
Added import/export facility in OS/390 V2R4. Allows sharing of configuration data between HCD and other applications.

RMF
Added new report support for WLM batch management, data set level reporting, cache reporting enhancements, spreadsheet reporter and performance monitoring of OS/390.

ICSF
New integration of ICSF provides software interface to Cryptographic Coprocessor and provides a high level of e-business security.

Security Server

RACF
Access control of DB2 objects directly from Security Server (RACF). RACF accepts authenticated Digital Certificates by Domino Go Webserver 4.6. Support is added for default OMVS segment and enhanced password history.

DCE
DCE Security Server registry on DB2.

Application Enablement Services

Run Time Library Services
RTLS allows application binding to various levels of LE run time libraries and eliminates the need to use STEPLIBs.

C/C++
Includes execution time performance improvements, new option to control conversion of string literals, support for Program Management Binder.

Application Enablement Technology
Introduced in V1R3, AET added NLS support.

eNetwork Communications Server

TCP/IP
New TCP/IP stack for UNIX System Services improves performance for UNIX TCP/IP applications. New Domain Name Server allows Parallel Sysplex TCP/IP users to exploit WLM. HPR benefits extended to additional devices. Added Network Station support.

UNIX System Services

OS/390 UNIX
Enhancements for performance and RAS include; file caching, WLM scheduling for Fork/Spawn, file system converged "C" sockets, tailored dump exploitation and extended locations for executable files.

UNIX Parallel Environment
Enables parallel data mining capabilities. Support for Workload Manager is added to leverage WLM management of data mining activities.

Distributed Computing Services

DCE
Added Cell Directory Server allows all DCE services to run on OS/390. Added NLS support, LDAP Client support and performance, availability and serviceability enhancements.

ENCINA Toolkit Executive
New in V2R4, works with DCE AS IMS to enable recoverable transaction capabilities. Tools and utilities provided to enable ENCINA clients to be Internet capable.

DCE AS
New in V2R4, DCE Application Support integrates IMS and CICS and its applications/transactions into an open environment.

Network Computing Services

Domino Go Webserver
Integrates Internet Connection Secure Server 2.2 (ICSS) into OS/390, enables secure e-business Webserving and exploitation of OS/390 strengths like WLM and DNS.

NetQuestion
Provides a powerful text search engine for Web site information retrieval.

BookServer
Allows Web user with any Web browser to access BookManager files. Provides GUI and navigational enhancements.

- Network Computing – Highlights
  - Domino Go Webserver 4.6.1
    - NetQuestion enhancements
  - e-Network Communication Server
  - Firewall Technology
  - ICSF enhancements

- Applications – Highlights
  - Component Broker (Beta)

- Server Consolidation – Highlights
  - DCE base enhancements
  - DFS enhancements
  - OS/390 Print Server
  - LDAP V2 Server
  - HCD/HCM configuration enhancements
  - OSA/SF usability and ATM support

- Technology Leadership
  - JES2 SDSF
    - OS/390 Print Server support
  - WLM enhancements
  - JES3 enhancements

System Services

JES2 and JES3

- JES2 and JES3 Provided Client Print Services
  JES provides client print services in a manner compatible with its standard operational characteristics.
- JES3 Support for IP PrintWay
  The JES3 component of OS/390 V2R5 supports Internet Protocol (IP) PrintWay addressing.

Base Control Program (BCP):
The BCP is enhanced to provide significantly improved lock performance and improves the performance of the multiprocessor serialization functions.

Workload Manager (WLM):
WLM is enhanced to provide the C language interfaces and kernel support to facilitate the use of WLM services by servers such as the Webserver, SAP R/3, and the Intelligent Miner.

DFSMS/MVS®
Two new XRC commands, XSET and XSUSPEND, allow modification of session characteristics and suspension of a session, respectively. Time control parameters are added to new and existing commands to allow control over the timing of delete, suspend and end functions.

Systems Management Services

HCD

- Verification of I/O Configuration
  This support provides the HCD dialog part of the verification of the physically attached I/O and adds prompting ability for priming data of the system.
- Address Large IODF Issues
  This support allows the distribution of single configurations of an IODF to a target system, and also to merge distributed IODFs back to a master IODF.

HCM

- HCM Windows 95 and Windows NT Client Support
- HCM Enhanced Filter Capabilities for HCM Diagrams

ICSF OS/390 V2R5 ICSF provides support for:

- Triple DES Encipherment
  Triple DES uses a triple-length data-encrypting key to encipher and decipher data.

- Secure Electronic Transaction (SET†) Protocol
  The SET protocol was developed jointly by Visa International and MasterCard for helping to safeguard bank card purchases made over open networks.
- Visa Card Verification Value (CVV) and MasterCard Verification Code (CVC)
  Verification codes are cryptographically generated values that can be used to detect forged credit cards.

SMP/E

Facilities are provided to simplify the installation of cooperative client/server products (such as OS/2). Information can be merged from one global zone into another global zone, allowing the reduction of the number of global zones to be managed. SMP/E will only build a load module if it can include all of its component modules, whether they were already installed or are being installed. SMP/E allows product packagers to provide information in the JCLIN to identify the highest return code allowable for each load module. SMP/E enhances the Exception SYSMOD Report to include new IBM OS/390 Enhanced HOLDDATA that is provided in ++HOLD statements. OS/390 R2V5 SMP/E provides performance improvements for SMP/E tasks, such as APPLY and ACCEPT. SMP/E now compresses the SYSMOD (PTF) data within the SMPPTS data set to reduce its size. SMP/E enables users to prevent the RECEIVE command from processing SYSMODs that are already applied or accepted. SMP/E has reduced the number and length of messages issued during APPLY, ACCEPT and RESTORE.

ISPF

The Move/Copy utility in the PDF component has been rewritten to be more efficient, faster, and provide enhanced reliability. The ISPF SCLM Component has improved performance, storage usage, and messages. An Automated Setup Utility is added along with sample projects which assist in the setup and customization of a new SCLM metavariable. The ISPF Client/Server component enhancements are:

- Improved performance
- Web access to ISPF applications provides the capability for an ISPF application to run on a network computer when referenced in an HTML Web page.
- Sun OS 2.5 support

† Please note that this product is based on the SET protocol and enrolled in the SET compliance testing process, but as of the date this material was prepared, has not been designated compliant with the SET specification by SET Secure Electronic Transaction LLC.

The VisualAge® for ISPF (VA for ISPF) is a component of ISPF that provides a customized VisualAge composition editor that contains ISPF parts for creating ISPF panels from a desktop workstation.

Security Server

Lightweight Directory Access Protocol (LDAP) Support

The LDAP Directory provides an easy way to maintain directory information in a central location for storage, update, retrieval and exchange.

Digital Certificate Support

A digital certificate or digital ID, issued by a certifying authority, contains information that uniquely identifies a client. The Domino Go Webserver (DGWS) authenticates a client using the client's certificate and the Secure Sockets Layer (SSL) protocol.

Kerberos Version 5 Support

Firewall Technologies

OS/390 V2R5 integrates Firewall technologies support into both the eNetwork Communications Server and the Security Server. OS/390 V2R5 enhancements include:

- FTP Proxy
- Socks Daemon
- Logging
- Configuration and Administration

Application Enablement Services

High Level Assembler (HLASM) Toolkit:

The HLASM Toolkit is enhanced to include flexible and powerful support for helping to migrate applications to support Year 2000 requirements.

DCE Application Support

- An administration Interface is added to allow the user to write client code to administer the Application Support server. Application Support is divided into three components to allow customization of the Application Support server.

Language Environment (LE)

- The HEAPPOOLS run-time option is added for OS/390 V2R5 LE to improve performance of C/C++ applications especially of heap storage requests in a multithreaded application.
- LE includes support for the GBK code page.

eNetwork Communications Server

TCP/IP

- New IP Communications Stack
  The IP communications stack benefits provided by OS/390 V2R4 will now be extended to all other popular TCP/IP Application Programming Interfaces (APIs) and applications in Release 5. Also, a common storage manager and shared device drivers will be employed for increased synergy and efficiency for OS/390's SNA and TCP/IP services.
- New Telnet Server Provides "TN3270E" with improved performance
- High Speed Web Access
  OS/390 V2R5 introduces a new service called High Speed Web Access. It provides superior performance for environments where there are large numbers of connections per second, and medium to large static pages mixed with dynamic pages.
- Domain Name Server Support Integration enables workload balancing
- AnyNet multiprotocol performance is improved
- Native ATM support is now available for TCP/IP users
- Additional enhancements are included for SNA/APPN and HPR users

VTAM

New enhancements include:

- Various MNPS enhancements including, MNPS Planned Takeover allows MNPS recovery to be performed in cases where no failures occur.
- Sockets Over SNA allows users to run sockets over SNA.
- SNA Using UNIX System Services support uses UNIX System Services instead of the IUCV interface for SNA/IP. This can significantly improve performance.

UNIX System Services

- MultiProc/MultiUser Kernel Support — supports multiple processes with multiple user identities in a single UNIX system services address space.
- Three New UNIX Commands — PASSWD, WALL and WHOAMI to improve UNIX System Services system management.

LAN Services

OSA Support Facility

The OS/390 V2 R5 enhancements to OSA/SF include:
The ability to customize an OSA-2 ATM feature using commands (no GUI), IP forwarding, which allows dissemination of information across a Wide Area Network (WAN), as well as support for RFC1483, 2047 physical units can now be defined to an ATM OSA-2 feature when configured to run ATM Forum-compliant LAN Emulation.

LANRES and LAN Server

LANRES now supports distribution commands, LAN to host print and host to LAN print in an NDS environment. The LANRES NetWare Server now supports a PCI ESCON channel connectivity option. It has also been improved with increased trace capabilities and trace panels. The OS/390 LAN Server has several RAS enhancements and has a new option, STATUS, on the Q FEP command.

Distributed Computing Services

DCE Base Services

Enhancements to the DCE Base Services include:

- Support for native Kerberos Version 5 applications on OS/390
- Support for DCE 1.2.1 and Kerberos Version 5 clients on workstations using the OS/390 Security Server
- GSS-API support for native Kerberos applications
- Kerberos administration support for non-DCE clients

DCE Distributed File Service (DFS)

- Enhancements include the implementation of OSF DCE 1.2.1 code function.
- Performance Enhancements
  – Directory in Memory Cache
  – Additional Adaptor Caching for HFS/RDS
- RAS/NLS Message Enhancements
- AIX Compatibility Enhancements
- RFS Enhancements
  Expands the DFS support for OS/390 record files (sequential, PDS, PDS/E, VSAM) and further enables non-S/390 system access to OS/390 record files.
- DFS Client Configuration Enhancements
- DFS API to Support ACL Data Read/Write — provides backup and restore support for OS/390 DFS ACL data.

Network Computing Services

Domino Go Webserver 4.6.1

- %%CERTIF%% Support
  %%CERTIF%% adds new access control for Domino Go Webserver, allowing an administrator to define an MVS userid and its associated access capabilities for a particular request. %%CERTIF%% allows a browser to present a certificate to the Domino Go Webserver, which is then used to establish the associated MVS userid to process the request.
- Java Servlet Support
  Java servlets (internal and external processes) are supported under OS/390 V2R5, based on the latest available JDK 1.1, enabling dynamic building of content and connecting to OS/390 data.
- NetQuestion Enhancements
  NetQuestion for OS/390 V2R5 provides National Language Support for HTML pages and all messages in nine languages and document indexing support languages.

Print Server

The OS/390 Print Server for V2R5 is a new feature (includes IP PrintWay/NetSpool) that allows users to print files on OS/390 printers from any workstation that has TCP/IP access. In addition to printing files, users can query the status of print requests and cancel print requests.

The OS/390 Print Server also provides enhanced UNIX printing commands, which allow applications running on OS/390 UNIX System Services to print, query and cancel files on OS/390 printers.

- IP Printway and Netspool have been integrated and enhanced.
- Multiple client environments (OS/2, Windows 95/NT, Sun, AIX…) can utilize any printer connected to the OS/390 Print Server
- Many printer types and popular industry standard print languages can be used

ServerPac

- ServerPac for OS/390 V2R5 now exploits the use of concatenated PARMLIB and PROCLIB to facilitate the separation of IBM-supplied data from customer data.
- ServerPac for OS/390 V2R5 adds an additional installation option that allows customers to use their existing operational data sets along with those supplied by ServerPac.

- Server Consolidation
  - Novell Network Services for OS/390
  - Security Server RACF Enhancements for Traditional and Open Systems, LDAP, Firewall
  - DFS and DCE performance improvements
  - RMF Reporting extended

- Network Computing
  - WebSphere Application Server for OS/390 (formerly Domino Go Webserver) performance, connectivity and functions
  - Many eNetwork Communications Server performance and security enhancements
  - ICSF and hardware cryptography additional support
  - Automated authentication of Digital Certificates to RACF
  - NFS integration, higher performance, new functions

- Applications
  - Additional ISV application support (e.g. Baan)
  - Many UNIX function and performance additions
  - Language enhancements (C/C++, HLASM)

- Technology Leadership
  - BCP additional hardware support for Fast Ethernet, RAS improvements, JES3 changes
  - Parallel Sysplex Coupling Facility management, WLM improvements and new exploitation by subsystems, Logger usability and RAS

- Delivery and Installation
  - Simplification and improvement of delivery and install options (ServerPac, SystemPac)
  - Exploitation of Internet for SUF, HOLDDATA, Documentation in PDF format

System Services

Coupling Facility

- Addition or restoration of a Coupling Facility is simplified by populating the added or restored CF from the set of allocated CF structures.
- Cache structure data can be duplexed in another CF to support fast "fail over" in the instance of CF failure or planned outage. DB2 will initially exploit this capability.
- Integrated Cluster Bus Link and Internal Coupling Channel Support for processors is added.

Base Control Program

- The BCP has added support for the new IEEE floating point hardware in the S/390 Generation 5 Server. Software simulation of the hardware facilities is provided for these processors where the hardware is not available.
- Allocation improvements allow DB2 to support customers with a requirement for more than 10,000 DB2 dynamically allocated table spaces.
- The S/390 Open Systems Adapter 2 (OSA-2) plugs directly into a standard I/O slot to provide Fast Ethernet LAN attachment.
- Dump command parameters can be supplied via a PARMLIB member. Parallel Sysplex problem determination is improved with convenient specification of multiaddress space and multisystem dumps.
- Display Logger command improves Parallel Sysplex-wide management of the MVS System Logger. Logger serviceability is improved with additional diagnostic and data capture capability. DASD Logger Offload processing is improved by operating asynchronously to overlap operations and more efficiently utilize the I/O subsystem.
- IOS Channel Path Availability is improved with asynchronous WTOR processing and enhanced recovery actions.
- Recoverable Resource Management Services (RRMS) is extended to recognize Resource Managers that manage work contexts as Work Managers. RRMS systems management is enhanced to support Work Manager names, wild card filtering, sorted displays, and exit duration reports with the result that it is easier to locate and manage RRMS coordinated transactions. Connections from any RRMS managed application-enabled environment to access IMS DB databases is supported by IMS Version 6 Open Database Access (ODBA) using the IMS Database Resource Adapter (DRA).

Workload Manager

- Management of discretionary work when it coexists with more important work is improved to give more resources to discretionary work as long as more important work goals are met.
- Administration improvements in WLM permit the customer to include additional descriptive commentary with the WLM definitions.

JES3

- JES3 DUMP JOB is enhanced to allow dynamic allocation of a tape not defined in the initialization stream.
- WLM batch management is now used by JES3 to support resource affinity scheduling batch work which has an affinity to a subset of systems in the Parallel Sysplex environment.
- JES3 LPA modules can be changed without IPL. The new module levels are activated when hot or local starts are performed.

Systems Management Services

RMF

- Coupling Facility support is improved with three new Monitor III reports providing overview data for Parallel Sysplex technology and single view to shared resources.
- A new Collector function is supported to start postprocessor jobs from the workstation without explicit host logon.
- The Postprocessor Cache Subsystem Activity report information is enhanced, and storage subsystems with more than 128 devices are supported.

HCM

- Communication between HCD and HCM is more flexible with TCP/IP being available as another communication protocol (in addition to APPC).

ICSF

- The ANSI x9.19 Optional Double-MAC procedure supports customer requirements for enhanced security for message authentication and the emerging European Visa International and MasterCard protocols.
- Secure RSA Key Generation for keys generated in TKE workstation and imported to the host.
- Secure Sockets Layer (SSL) Session initialization performance is improved with two new callable services which can be used for symmetric key management.

Security Server

RACF

- Digital Certificates can be automatically authenticated without administrator action.
- Administrative enhancements enable definition of profiles granting partial authority. Handling of new passwords and removal of class authority are simplified.
- Support is added to Component Broker for transporting Access Control Environmental Elements (ACEEs) across address spaces or systems.
- Network Qualified LU Names allow non-unique LU Names within interconnected networks.
- UNIX applications can be more readily ported to OS/390 by support for multiple process and users in a single address space.
- Identification and audit trail for a UNIX System user is added.
- Support is added for Tivoli management of all user segments
- R-admin callable services are updated to support products such as Tivoli.

Firewall

- Multithread support and other improvements are being added to improve performance.

LDAP

- Client access to information in multiple directories is supported with the LDAP protocol.

OS/390 Application Enablement Services

Component Broker

- Component Broker Beta code will be available in a beta program.

Language Environment (LE)

- Performance improved by HEAPPOOLS, message filtering, and pathlength reductions.
- Serviceability changes adding CEEDUMP, and IPCS support.

JAVA

- JAVA supports IEEE Floating Point.

C/C++

- The C/C++ Compiler has been extended to include support for IEEE Floating Point, and 64-bit long long integer format. Support is also added to the C/C++ Runtime Library.
- Performance and serviceability are improved, with a single optimization level, BCD format enhancements, and alloca() for stack storage
- Class library header in HFS

eNetwork Communications Server

- Dramatic improvements in TCP/IP performance, include optimization of the TCP/IP stack, and inclusion of a number of performance related capabilities such as:
  - FTP Long Fat Pipes using larger window size for higher throughput
  - High Performance Data Transfer (HPDT) for UNIX services, and FTP use of HPDT improves large data moves
  - IP Multicast support is more efficient when transmitting the same message to many users
  - Open Shortest Path First (OSPF) routing has lower overhead than Routing Information Protocol (RIP)
  - APPN Dynamic network node server switching selects the preferred server improving utilization
  - TCP/IP using XCF removes queuing to APPN
  - Client/Server Affinity improves reliability for socket servers implementing Synchpoint (multiphase commit)
- UNIX Sendmail is supported including the POP3 server
- TN3270 sessions are now able to use Secure Sockets Layer, with increased number of supported ports (255)
- Multi-Node Persistent Sessions (MNPS) includes recovery for Dependent LU Requester (DLUR)-owned LUs. This leads to full Parallel Sysplex exploitation with native IP networks, including nondisruptive session-switching
- Client/Server Affinity improvements to allow recovery over sync points in multiphase commit giving higher availability for these applications
- Simple Network Management Protocol (SNMP) Distributed Protocol Interface (DPI) instance level registration
- X-Motif uses Data Link Libraries (DLL) to reduce DASD space
- Virtual Private Network (VPN) easier to establish

OS/390 UNIX System Services

UNIX

- Performance Enhancements include recompiled and optimized functions within the kernel, and shell and utilities, addition of Socket Functions; use of Communication Storage Management buffer transfer instead of data movement; and optimized NFS Logical File System
- Multi-Process Multi-User allows faster process creation for customers and reduced storage usage for servers
- Semaphores without contention using the hardware Perform Locked Operation (PLO) instruction
- Shared memory (captured storage) reduces real storage when sharing large amounts of virtual storage
- UNIX System Services and UNIX debugger add support for IEEE-floating point

Application Enabling Technology (AET)

- Support added for DB2 for OS/390, Installation of DLL, and LDAP V2 and V3
- TCP/IP configuration GUI
- Automatic restart of AET
- Automated UNIX System option will be available as an additional OS/390 delivery option in Release 6

OS/390 LAN Services

- Network Directory Services (NDS) is provided as part of Novell Network Services for OS/390. This gives S/390 directory support so that it becomes a network server to which clients may log-in and administer their networks.

DCE — Distributed Computing Services

Distributed File Server (DFS)

- Supports 64-bit files on other servers and can export HFS files larger than 32 bits
- A separate address space for the DFSKERN kernel improves reliability allowing continuous tracing and improves restart capability
- Better performance using single tape for multiple files and virtual memory caching when exporting
- Translation of binary or text files based on filename extension

DCE

- Performance improvements by using Workload Manager to select the best host for DCE tasks
- Easier configuration by supporting both batch and UNIX tailoring

OS/390 Network File System (NFS) — formerly DFSMS/MVS® NFS

- Enhanced to support both SUN NFS Version 2 and Version 3.
  - NFS TCP transport added as alternative to the existing User Datagram Protocol (UDP)
  - Java can support WebNFS Protocol allowing filesharing
  - Performance improvements due to larger Transmission size
- Performance improvements to PORTMAP, Mount for public, Lookup, checkpoint for xmit, and other internal optimizations
- Support for Default filenames for PDS/PDSE
- Safe and Unsafe writes supported using Network Lock Manager and Network Status Monitor (giving CATIA support)

Network Computing Services

WebSphere Application Server for OS/390

- Security Enhancements include:
  - Public Key Infrastructure enablement
  - Crypto Keysize to specify security level
  - 128-bit encryption for export (for authorized institutions)
  - Key management function outside server
  - IP-specific certificates for SSL
  - LDAP support provides centralized access
- Performance Enhancements include:
  - Web Traffic Express (WTE) Integration: Web performance improved by proxy caching, auto-cache refresh, and cache override
  - WLM support of SSL requests
- New Functions and ease-of-use
  - Java Servlet internal process support
  - Frames-based user interface for Webserver
  - REXX GWAPI — user plugins written in REXX
  - User defined install path — coincident test and production systems.
  - HTTP 1.1 Compliance as far as defined

NetQuestion

- Improved usability, recovery and performance

Print Server

- Additional National Language support for Japanese and Spanish

OS/390 Softcopy services

- Softcopy Library Manager

- Server Consolidation
  - Enhanced Systems Management capabilities through integration of Tivoli Management Framework™ Agent

- e-business
  - Continued improvements in Webserving Performance and Function
    - eNetwork Communications Server
    - WebSphere Application Server for OS/390 new release
    - Advanced technology for SNA and TCP/IP integration (enterprise extendable)

- Applications
  - Language Environment performance, functions and RAS improved
  - Significant UNIX performance

- Business Intelligence
  - Parallel Environment for UNIX

- Technology Leadership
  - DFSMS R1.5 with many performance and functions enhanced (HFS, hsm, OAM, SMS)
  - BCP support for FICON channels

- Delivery and Installation
  - Reduced post-install work for UNIX
  - Planning and Migration Assistant

System Services

DFSMS 1.5

Parallel Sysplex enhancements including; multiple HSMplexes within a single GRSplex, shared catalogs, further OAM support, high availability with secondary host promotion for users of DFSMShsm. Enhanced HFS with improved performance, multivolume data-set support and preservation of mount integrity in a shared environment. Also added technology improvements, such as, extended format functions for VSAM ESDS, RRDS, VRRDS and LDS, limitation of 8,191 open datasets for IMS and CICS is lifted, enhancements for SMS storage management and DFSMSrmm tape management enhancements.

BCP

- SVC Dump exits for dump tailoring and Trace message delivery by message ID.
- S/390 Fiber Channel (FICON) support enables each channel to improve I/O rates and provide increased bandwidth. Software support is available via SPEs on OS/390 Version 1 Release 3 and Version 2 Releases 4 through 7. RMF, HCD and others also support FICON.

System Management Services

HCM

Will now run as a native Windows® 32-bit application on Windows NT/98/95 only. Added better visualization of ESCON Director configurations that will aid their aggregation to FICON.

RMF

Added support for UNIX System Services, with postprocessor and Monitor II reporting of HFS usage. Added extended enclave support, allowing reporting on enclave workloads with Monitor III.

SMP/E

The Planning and Migration Assistant for OS/390 has been integrated into OS/390 R7.

Security Server

RACF

%%CERTIF%% systems management interface added for automatic digital certificate management for large e-business operations.

LDAP

Added LDAP access to RACF data, LDAP Multi-Server Parallel Sysplex enhancement and LDAP Java support.

Application Enablement Services

LE

Region-wide run time options eliminate rework during migration and maintenance. RAS and performance enhancements.

HLASM

- High-Level Assembler supports IEEE Floating Point

eNetwork Communications Server

Further improvement to TCP/IP Sysplex support to increase usability, availability and performance. Sysplex Sockets, XCF Dynamics, and System Symbolics continue to improve performance, provide nondisruptive growth and reduce definition effort. Dynamic Fast Response Web caching within the TCP/IP service stack will provide up to two times improvement in performance. Service Policy Agent will offer Priority Networking for TCP/IP. Internet Security will be further improved with enhanced Firewall technologies and inclusion of the latest security standards such as IPSec and SNMPv3. Enhanced addressing for TN3270 Server will reduce consumption of resources and increase capacity.

UNIX System Services

OS/390 UNIX

Enhanced shells and utilities, automatic installation of SSL client certificates and RAS enhancements. The UNIX environment benefits from performance enhancements in TCP/IP, HFS and NFS. Improvements in HFS and utilities provide the ability to eliminate post install jobs.

UNIX Parallel Environment

- Enhanced to support MPI 1.2 specification for C/C++ applications.
- Support for Intelligent Miner data with the use of WLM facilities.

Distributed Computing Services

DCE

Elevated to DCE 1.2.1 interoperability between DCE applications on all platforms.

DFS

Implemented OSF 1.2.1 DCE DFS function. Added multi-home support to improve DFS server availability, ability to add range specification of DCE authentication levels for DFS client/server communication, support for workstation access to OS/390 file data and additional performance and RAS enhancements.

Network Computing Services

WebSphere Application Server

Lotus-Domino adapter allows Domino users to select the WebSphere Application Server as an alternative. Exploits new %%CERTIF%% Systems Management Security Server interface.

OS/390 Release 8 Preview

e-business

- IBM HTTP Server for OS/390
  - Easy problem determination and source identification

Applications

- Language Environment performance, functions and RAS improved
- UNIX System Services with better usability and capability

Server Consolidation

- Print Server enabled for ERP applications and Internet
- Distributed File Service with file/print services for Windows
- Enhanced security with new type of userid (in RACF)
- Service Level Agreements for network performance
- UNIX System Services with better control of “SuperUsers”

Technology Leadership

- Dynamically manage batch initiators in WLM and JES3

OS/390 Version 2 Release 7 – Base Elements

OS/390 provides the following base elements.

System services
- MVS/ESA SP *
  - Base Control Program (BCP) *
  - JES2 *
- ESCON Director Support *
- MICR/OCR Support *
- Bulk Data Transfer (BDT) base
- DFSMSdfp V1R5
- EREP/MVS V3R5
- High Level Assembler V1R3
- ICKDSF R16
- ISPF
- TSO/E *
- 3270 PC File Transfer Program V1.1.1
- FFST/ESA V1R2
- TIOC *

Systems Management and Security
- HCD *
- Cryptographic Services *
  - ICSF *
  - Open Cryptographic Services Facility *
  - System SSL *
- SMP/E *
- Tivoli Management Framework Agent

Application Enablement
- C/C++ IBM Open Class Library ‡
- Language Environment *
- SOMobjects MVS Runtime Library
- VisualLift RTE
- DCE AS *
- ENCINA Toolkit Executive *
- OS/390 Application Enabling Technology *

‡ Retroactive to OS/390 Version 1 Release 3, the C/C++ IBM Open Class Library component of the C/C++ Compiler feature is licensed with OS/390 base and can be used without enablement of the C/C++ optional features.

Distributed computing services
- NFS File System Feature *
- DCE Base Services at OSF DCE level 1.1 *
- DCE Distributed File Service (DFS) at OSF DCE level 1.2.2 *

Communications Server
- eNetwork Communications Server *
  - SNA/APPN Services (Includes VTAM) *
  - Multiprotocol/HPR Services (Includes Anynet) *
  - TCP/IP Services (Includes TCP/IP for MVS) *

e-business Services
- WebSphere Application Server for OS/390 *
  - IBM HTTP Server for OS/390 V5.1 *
- NetQuestion

LAN Services
- LANRes
- LAN Server
- OSA Support Facility Release 1.2

OS/390 UNIX System Services
- OS/390 UNIX System Services Application Services *
  - UNIX System Services Shell and Utilities *
  - UNIX System Services Debugger *

Softcopy Publications Support
- BookManager READ R3 *
- Softcopy Print *
- BookManager BookServer Version 2.1
- GDDM V3R2 (Including PCLK and OS/2 Link)

* OS/390 Version 2 Release 7 unique enhancements

OS/390 Version 2 Release 7– Integrated Optional Features

For those features that can be separately ordered, the version and release numbers are provided. Enhanced unique features are indicated as such.

System Services
- JES3 *
- Bulk Data Transfer (BDT) File-to-File
- Bulk Data Transfer (BDT) SNA NJE

Systems Management
- DFSMSdss V1R5
- DFSMShsm V1R5
- DFSMSrmm V1R5
- RMF *
- SDSF *
- HCM *

Cryptographic Services
- Open Cryptographic Services Facility France *#
- Open Cryptographic Services Facility Security Level 1 (RC2/RC4/RC5) *#
- Open Cryptographic Services Facility Security Level 2 (DES, RC2/RC4/RC5) *#
- Open Cryptographic Services Facility Security Level 3 (TDES, RC2/RC4/RC5) *#
- System SSL Crypto (TDES) *#

Security Server
- RACF *#
- Firewall Technologies *
- DCE Security Server at OSF DCE level 1.2.2 *
- LDAP Server - (RC2/RC4) with 40 bit crypto *#
- LDAP Server (includes DES/Triple DES crypto) *

Application Enablement Services
- C/C++ (with Debug Tool) * ‡
- C/C++ (without Debug Tool) *‡
- DFSORT R14
- GDDM-PGF V2R1.3
- GDDM REXX V3R2
- HLASM Toolkit V1R3 *
- Language Environment Data Decryption (DES) *
- SOMobjects for MVS Application Development Environment (ADE)
- VisualLift ADE Version 1.1.2
- OS/390 Print Server
  - IP PrintWay and NetSpool
  - OS/390 Print Interface *
- Distributed Computing Services
- DCE User Data Privacy DES/CDMF

Softcopy Services
- BookManager BUILD R3

Distributed Computing Services
- DCE User Data Privacy (DES/CDMF) *#

Communications Server
- eNetwork Communications Server Security Level 1 (RC2/RC4, CDMF) #
- eNetwork Communications Server Security Level 2 (DES, SnMPV3) #
- eNetwork Communications Server Security Level 3 (SnMPV3, TDES) #
- eNetwork Communications Server Print Facility *#
- IP Security - CDMF
- IP Security - DES
- IP Security - TDES

e-business
- IBM HTTP Server *
  - IBM HTTP Server N.A. Secure (TDES, RC2/RC4) #*
  - IBM HTTP Server Export Secure (DES, RC2/RC4) #*
  - IBM HTTP Server France Secure (RC2/RC4) #*
- Softcopy Duplicating Support
  - BookManager BUILD Release 3

In addition
- RS/6000 and PC Server with S/390 Server-on-Board Preconfigured System for OS/390 Version 2.6.0 CD

* OS/390 Version 2 Release 7 unique enhancements
\# Export controlled
‡ Retroactive to OS/390 Version 1 Release 3, the C/C++ IBM Open Class Library component of the C/C++ Compiler feature is licensed with OS/390 base and can be used without enablement of the C/C++ optional features.

Planning

- New releases of OS/390 are scheduled approximately every six months.
- Content of two releases is known in advance.
- Service upgrades are integrated into each new release.
- OS/390 Version 1 Release 1, 2 and 3, and Version 2 Release 4 will deviate from the OS/390 Service Policy (general availability date + three years). These OS/390 releases will be considered as current until at least January 31, 2001 with IBM providing maintenance during this period.
- Each new release of OS/390 Version 2 becomes the only orderable release.
- Releases can be skipped within sequence. Compatibility supports the coexistence of up to four consecutive releases (N-3) within a Parallel Sysplex environment.

Delivery and Installation

OS/390 can be ordered through two entitled delivery systems, ServerPac and CBPDO:

- ServerPac for OS/390 – a system replace vehicle, gives you:
  - A series of tapes, each in an IEBCOPY dump-by-dataset format (not a physical volume dump) of distribution libraries, target libraries, and SMP/E libraries already generated.
  - SMP/E installable workstation code, such as GDDM PCLK and OS2LINK delivered in the target and distribution libraries. You must however, download these functions from the host to the appropriate workstations.
  - Customized Offerings Driver System optionally orderable on 3380, 3390, 9345 and 4mm tape.
  - Non-SMP/E installable workstation code delivered on diskette (e.g., LANRES, LANServer, VisualLift ADE).
  - All products (and their service) that you selected from the ServerPac checklist, integrated into the same set of distribution, target, and SMP/E libraries. This includes:
    - All the OS/390 elements, all optional features that support dynamic enablement, and any other optional feature you selected.
    - Any other currently-marketed IBM products, with the MVS SREL, that are in the checklist.
    - Separate dialog install passes for the base and each sub-system (CICS, IMS, DB2 and NCP) using the same install dialogs.
    - A GLOBAL CSI, a target CSI for all target zones and a DLIB CSI for all distribution zones. Each target/DLIB zone is distributed with at least three zones.
      - OS/390 and any other products ordered that coexist in the same zone (Z038).
      - JES2 and SDSF
      - JES3
    - A set of dialogs that helps you install and tailor OS/390. These dialogs support all SMP/E installable host and workstation products.
    - Integrated service including all service through a designated PUTyymm level, all service that has been integration tested, and all HIPERS and PE fixing PTFs. Starting in October, 1998, IBM will upgrade the base service level for ServerPac to a designated system integration tested RSUyymm level on a monthly, rather than a quarterly, basis.
    - ServerPac for OS/390 V2R5 added an additional installation option that allows customers to use their existing operational data sets along with those supplied by ServerPac (product distribution and target libraries, SMP/E libraries, and CustomPac sample data sets). Using this option to save the existing JES Spool, Page Data Sets, Master Catalog, and other data sets can save significant effort and time during the installation process.
    - ServerPac for OS/390 V2R6 provides a new function, Data Set Merge, which enables the customer to merge similar data sets during a ServerPac installation. With the Data Set Merge function, the customer can now merge data sets that have matching attributes with a single data set. The merged data sets remain available for use in subsequent ServerPacs.
    - In OS/390 V2R6, ServerPac further streamlines installation by reducing the number of tasks needed to establish OS/390 UNIX System Services. Customers can use variables in installation dialog to tailor jobs that do allocates and restores of HFS file system and to update the BPX PRMxx member.

Service is provided through the implementation of a concept called Recommended Service Upgrade, or RSU. An RSU is a regular service upgrade that IBM recommends you apply. It will include PTFs that meet the following criteria:

- Severity 1 or 2
- HIPER
- PEFIX
- Security/integrity
- Special attention
  - Special attention means that IBM recommends this service because of new function, serviceability, installability or pervasiveness.

The intent of this new way of delivering service is to reduce the volume of PTFs customers need to apply for preventive maintenance. RSU will be delivered using the same processes that are used today, for example, Enhanced Service Offering, CBPDO, and CustomPacs. Corrective service will follow the traditional procedures.

- RSU means:
  - Integration tested quarterly
  - Reduced research time
  - Service currency and reduced defect rediscoveries

- CBPDO for OS/390 — a system upgrade vehicle which gives you an SMP/E stack of FMIDs in Relfile format with unintegrated service
  - Customized Offerings Driver System optionally orderable on 3380, 3390, 9345 and 4mm tape
  - Non-SMP/E installable workstation code delivered on diskette (e.g., LANRES, LANServer, VisualLift ADE)

All service in both ServerPac and CBPDO is current to within a week of order.

Test

To further reduce migration time, the OS/390 product is system integration tested using a production-like environment. This environment includes subsystems, such as CICS, IMS and DB2. This additional testing supplements existing functional tests, with a focus on tasks performed by customers in the production environment, thus helping establishments move more quickly to new function. System integration testing is provided for all OS/390 releases.

Service

All available non-PE service up through the OS/390 service integration cutoff date will be integrated and made available in ServerPac for OS/390 at general availability.

After GA, all RSU service will be system integration tested and integrated in a monthly ServerPac for OS/390 refresh.

Services

OS/390 can also be ordered through fee-based delivery vehicles, such as SoftwareXcel System Installation Express (SIE), and SystemPac®.

In addition, IBM has fee services such as SystemPac and other more customized offerings that can provide assistance to further reduce the workload associated with installing OS/390 and other program products such as CICS, IMS and DB2. These fee services can further reduce complexity and help you implement that new technology faster. When you need support, the S/390 Support Family of Services can help. These technical support services go beyond the scope of traditional hardware warranties, software entitlements, and maintenance agreements. The S/390 Support Family of Services can help enhance system availability and productivity by providing direct access to technical specialists.

A complete softcopy library is shipped on a platform-independent CD-ROM and tape.

- The softcopy collection called OS/390 Collection, SK2T-6700, contains the product libraries for:
  - OS/390 Server Operating System
  - Parallel Sysplex Programs
  - S/390 Application Programs that run on OS/390

Additional softcopy collections include:

- OS/390 Collection on tape
  - This collection contains the product libraries and licensed books for OS/390.
- OS/390 Licensed Product Library, LK2T-6702
  - This collection contains licensed books for the OS/390 Server Operating System.
- OS/390 PDF Library Collection, SK2T-6718
  - This new collection lets you print high-quality hardcopy books. It contains the books for OS/390 Version 2 Release 7 elements and features in Portable Document Format.

With your order of OS/390, you receive a complete set of softcopy books on CD and a small set of system–level hardcopy books.

- Welcome to OS/390, GK2T-7226
- OS/390 *An Introduction and Release Guide*, GC28-1725
- OS/390 *Planning for Installation*, GC28-1726
- OS/390 *Information Roadmap*, GC28-1727
- OS/390 *Printing Softcopy Books*, S544-5354

With your order you also receive hardcopy books of the key planning, installation, and migration books for the various elements of OS/390. It is highly recommended for new customers of OS/390. This set of books also includes the most commonly used system programming information, including initialization and Tuning guides and System Messages books.

You can obtain many other OS/390 hardcopy books for a fee by selecting additional feature codes when you order OS/390.

We are also continuously striving to improve World Wide Web access to OS/390 information. For instance, if you click on the “Library” bar from the OS/390 home page, http://www.s390.ibm.com/os390, you will be able to list, browse, and search all the OS/390 and related books in the OS/390 Collection CD-ROM kit, as well as the books in the S/390 “Rainbow Books” Collection CD-ROM kit. If a book in one of these collections has been updated since the last edition of the collection, click on “Latest books” to view it. By clicking on “Bookstore (IBM Direct),” you can order books.

The printable PDF files are also available on the OS/390 Internet Library. The Web Library also includes an OS/390 Task Atlas. The Task Atlas lets you link directly to pieces of information throughout the Library which you need for tasks such as installation and migration.

S/390 hardware publications

Order number	Title
GA22-7158	S/390 G5 — System Overview
GA22-7236	PR/SM Planning Guide
GC22-7106	Installation Manual — Physical Planning (G5 Models)
GC38-3120	Pre-Installation Configuration Workbook (G5 Models)
GC38-0401	IOCP User's Guide and ESCON CTC Reference
GC38-0452	Managing Your Processors
GC38-0458	Standalone IOCP User's Guide
GC38-0470	HMC Operations Guide
GC38-3119	Support Element Operations Guide
GC23-3870	OSA Planning
SC28-8143	HWMCA Programming Interfaces
SG24-2075	Parallel Sysplex Configuration: Overview
SG24-2076	Parallel Sysplex Configuration: Cookbook
SG24-2077	Parallel Sysplex Configuration: Connectivity
SG24-4770	OSA-2 Implementation Guide
SG24-5176	Introduction to IBM S/390 FICON
SG24-5169	IBM S/390 FICON Migration Guide
SK2T-2512	Learning to Use the S/390 CMOS Console
SY22-9876	Problem Analysis (PA) Guide
SC23-3978	TKE Workstation User's Guide
GC28-1860	Parallel Sysplex Overview
GC28-1861	Parallel Sysplex Systems Management
GC28-1862	Parallel Sysplex Hardware and Software Migration
GC28-1863	Parallel Sysplex Application Migration

Also visit *http://www.redbooks.ibm.com* for additional helpful S/390 books

To learn more

Visit the S/390 World Wide Web site at http://www.s390.ibm.com. or call IBM DIRECT at 1 800 IBM-CALL in the U.S. and Canada.

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Germany	1803-313233
Hong Kong	(20) 2825 6222
Hungary	165-4422
India	(80) 526 9050
Indonesia	(21) 252 1222
Ireland	1-850-205-205
Israel	03-6978111
Italy	167-017001
Japan	0120 300 426
Korea	(02) 781 7800
Malaysia	(03) 717 7890
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