IBM®

IBM *@server* zSeries 890 — A multipurpose server for an on demand world

Overview

The IBM *@server* z890 represents the continuation of the new generation of scalable servers introduced with the IBM *@server* z990. Using z/Architecture™ and the latest zSeries® building blocks and virtualization technology, the z890 extends key zSeries platform characteristics of reliability, availability, scalability, clustering, and quality of service to respond to the ever-changing business climate. It offers a processor that delivers extensive growth options and excellent price/performance for those customers requiring a lower-capacity entry point than offered with the z990.

The IBM *@server* z890 is designed to help enable your businesses to be resilient in the unpredictable on demand world. With a single model and a wide range of capacity settings, the newest member of the zSeries family delivers significantly improved granularity and enriched functions over its predecessor, the z800 — it can provide up to almost twice the processing power, up to 123% greater total system capacity, and significantly increased I/O capacity. The z890 can support double the number of Logical Partitions (LPARs) and the Logical Channel SubSystem (LCSS) feature introduced on z990, which facilitates horizontal growth, and is introducing the new *@server* zSeries Application Assist Processor (zAAP), which provides an attractively priced Java™ execution environment.

To address the growing complexity of fiber optic connectivity in the Information Technology (IT) infrastructure, IBM Networking Services will continue to offer scalable fiber optic cabling services to help satisfy e-business infrastructure requirements at both the product level and the enterprise level.

Key prerequisites

- Refer to the **Software requirements** section of this announcement.

- Customers who are still using parallel-attached devices must obtain a parallel channel converter box such as:

  - The IBM 9034, which may be available through IBM Global Financing (IGF).

  - A third-party parallel channel converter box such as the Optica 34600 FXBT. For more information about Optica offerings, contact Optica at

    http://www.opticatech.com/

- A Systems Assurance Pre-Installation Review is required for all installations in a customer location. For details, refer to the *z890 Systems Assurance Product Review (SAPR) Guide* (SA04-002), available via Resource Link

    http://www.ibm.com/servers/ resourcelink

Planned availability dates

- New builds — May 28, 2004
- Upgrades from z800 to z890 — May 28, 2004
- zSeries Application Assist Processor (zAAP), feature number 6520 — June 30, 2004 (hardware only)
- Feature MES — July 30, 2004
- z890 to z890 Upgrades and Downgrades — July 30, 2004
- Upgrades from z890 to z990 — August 30, 2004
- OSA-Express GbE LX (#1364) for z800 — September 30, 2004
- OSA-Express GbE SX (#1365) for z800 — September 30, 2004

For ordering, contact:
Your IBM representative, an IBM Business Partner, or the Americas Call Centers at

| **800-IBM-CALL** | Reference: YE001

At a glance

Compared to the z800, the new z890 has the capability of providing the following when properly configured:

- Increased scalability — up to 123% more total capacity than the largest z800
- A lower-capacity entry point into the family with 32% less capacity than the smallest z800
- Twenty-eight levels of capacity, offering enhanced incremental growth options
- Double the supported CHPIDs
- Double the LPARs over z800 (except on the smallest sub-uniprocessor equipped capacity setting)
- Quadruple the number of HiperSockets (internal LANs) over z800
- Performance assists for Linux and z/VM®
- OSA-Express enhancements including the new Integrated Console Controller
- FICON™ Express, ICB, ISC-3, and OSA-Express spanned channels
- Increased channel maximums for ESCON®, FICON Express, ISC-3, and OSA-Express over z800 (except on the smallest sub-uniprocessor equipped capacity setting)
- On/Off Capacity on Demand
- Fiber optic cabling services from IBM Networking Services
- IBM zSeries world class SSL performance extended to 2900 SSL handshakes per second for z890
- The IBM *@server* zSeries Application Assist Processor
- Internal Battery Feature (IBF)
- GDPS™/PPRC Cross-Site® Parallel Sysplex® distance now up to 100 km
- Up to 48 ISC-3 links in peer mode, CFCC level 13, CFCC enhanced patch apply

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This announcement is provided for your information only. For additional information, contact your IBM representative, call 800-IBM-4YOU, or visit the IBM home page at: http://www.ibm.com.

Description
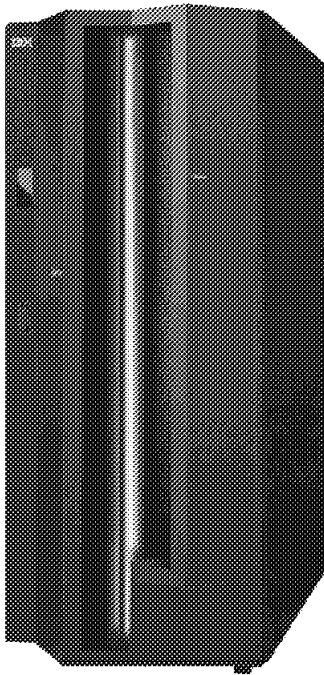
A z890 technology overview

z890 — the platform "right-sized" for server consolidation: The design of z890 represents the continuation of a major change for the latest zSeries technologies which were introduced with IBM @server zSeries 990. IBM @server zSeries 890, like zSeries 990, contains a new superscalar microprocessor architecture exploiting the CMOS9S-SOI technology and improving uniprocessor performance. z890 is an air-cooled, single-frame, single-book variant of the z990 platform. The capability for a significant capacity increase versus z800 has been achieved with the availability of the following on z890:

- Up to 32 gigabytes of memory — 8 GB, 16 GB, 24 GB, 32 GB.

- Up to 16 gigabytes of bandwidth for data communication between I/O and memory via up to eight Self-Timed Interconnect (STI) host buses.

- One I/O cage with 28 I/O slots (16 on the smallest sub-uniprocessor equipped capacity setting).

- A new Channel SubSystem (CSS). Two Logical Channel SubSystems (LCSSs) can exist for horizontal growth, supporting up to 256 CHPIDs per LCSS for a total of 512 CHPIDs per server.

- Double the number of Logical Partitions (LPARs) — now 30 LPARs (15 on the smallest sub-uniprocessor equipped capacity setting).

- Increased channel maximums for ESCON, FICON Express, ISC-3, and OSA-Express (except on the smallest sub-uniprocessor equipped capacity setting).

- Quadruple the number of HiperSockets — now 16 internal LANs.

- Three cryptographic options:

  - New CP Assist for Cryptographic Function (CPACF) on every CP.

  - New PCIX Cryptographic Coprocessor (PCIXCC) feature.

  - PCI Cryptographic Accelerator (PCICA) feature.

- Integrated Cluster Bus-4 (ICB-4), up to two times faster than an ICB-3.

- Coupling Facility Control Code (CFCC) Level 13, supporting:

  - CFCC Enhanced Patch Apply.
  - DB2® Performance for cast-out processing.

- Five Processor Units (PUs):

  - One model.

  - Twenty-eight unique capacity settings, offering increased granularity.

  - Up to four Central Processors (CPs). One mandatory System Assist Processor (SAP). Refer to the table following.

- IBM @server zSeries Application Assist Processor (zAAP).

- Internal Battery Feature (IBF).

A PU is the generic term for the z/Architecture processor on the MultiChip Module (MCM) that can be characterized as a:

- CP to be used by the operating system

- Internal Coupling Facility (ICF) to be used by the CFCC

- Integrated Facility for Linux (IFL)

- IBM @server zAAP

With z890 at least one CP, ICF, or IFL must be purchased and activated. For each zAAP engine installed there **must** be a corresponding CP engine permanently purchased and installed. PUs can be characterized in single-PU increments and are orderable by feature number.

Functions and features: The IBM eServer zSeries 890

- z890 consists of one Model (A04) and 28 capacity settings.

- All configurations of z890 contain the same number of physical Processor Units (five), however, the customer is only licensed to use the Licensed Internal Code (LIC) to support the amount of capacity actually purchased.

- Each configuration has **one mandatory SAP** and must contain at least one CP, IFL, or ICF engine. For each zAAP engine installed there **must** be a corresponding CP engine permanently purchased and installed.

- A z890 can be configured with all IFL or all ICF engines.

- Any remaining PUs (subject to configuration rules and execution of appropriate terms and conditions, as applicable) may be assigned to optional functions such as ICFs, IFLs, zAAPs, On/Off Capacity on Demand (On/Off CoD), or Capacity Backup Upgrade (CBU), or they may be assigned as spares.

- The total number of SAP, CP, ICF, IFL, zAAP, spare, On/Off CoD, or CBU engines cannot exceed five (the total number of PUs available).

- CBU applies to whole zSeries CP engine additions only and only to the largest capacity configuration (full engine).

- CBU does not apply to changes in capacity setting and does **not** apply to IFLs, ICFs, SAPs, zAAPs, or memory.

- CBU is always a temporary capacity upgrade.

- On/Off CoD is a LIC enabled temporary capacity upgrade with a prerequisite of enablement feature numbers 9898 and 9896. Downgrades from this temporary capacity are to the original capacity setting only.

- With On/Off CoD, while capacity upgrades to the processor itself are concurrent, some operating system software may not be able to take advantage of changes in capacity without performing an Initial Program Load (IPL).

- On/Off CoD activation is mutually exclusive with CBU activation. Both On/Off CoD and CBU can reside on the server, but only one can be activated at a time.

- On/Off CoD can be activated and the CBU feature is not removed.

The following table describes the content of the z890 Model A04, including the number of:

- Processor Units (PUs)
- System Assist Processors (SAPs)
- Central Processors (CPs)
- Optional Internal Coupling Facilities (ICFs)
- Optional Integrated Facility for Linux features (IFLs)
- Optional IBM @server zSeries Application Assist Processor features (zAAPs)
- Spare Processor Units (Spares)
- Available engines for On/Off Capacity on Demand (On/Off CoD)
- Available engines for Capacity Backup Upgrade (CBU)

Processor unit usage — Traditional engines

Feature number	PUs	SAPs	CPs max	ICFs max	IFLs max	zAAPs max	Spares max	On/Off CoD engines max	CBU engines max
6110	5	1	1	3	3	1	3	3	3
6120	5	1	1	3	3	1	3	3	3
6130	5	1	1	3	3	1	3	3	3
6140	5	1	1	3	3	1	3	3	3
6150	5	1	1	3	3	1	3	3	3
6160	5	1	1	3	3	1	3	3	3
6170	5	1	1	3	3	1	3	3	3
6210	5	1	2	2	2	2	2	2	2
6220	5	1	2	2	2	2	2	2	2
6230	5	1	2	2	2	2	2	2	2
6240	5	1	2	2	2	2	2	2	2
6250	5	1	2	2	2	2	2	2	2
6260	5	1	2	2	2	2	2	2	2
6270	5	1	2	2	2	2	2	2	2
6310	5	1	3	1	1	1	1	1	1
6320	5	1	3	1	1	1	1	1	1
6330	5	1	3	1	1	1	1	1	1
6340	5	1	3	1	1	1	1	1	1
6350	5	1	3	1	1	1	1	1	1
6360	5	1	3	1	1	1	1	1	1
6370	5	1	3	1	1	1	1	1	1
6410	5	1	4	0	0	0	0	0*	0
6420	5	1	4	0	0	0	0	0*	0
6430	5	1	4	0	0	0	0	0*	0
6440	5	1	4	0	0	0	0	0*	0
6450	5	1	4	0	0	0	0	0*	0
6460	5	1	4	0	0	0	0	0*	0
6470	5	1	4	0	0	0	0	0	0

* Additional engines **not** available, but capacity can be changed by changing capacity setting

Note: Some of these configuration options are mutually exclusive.

Processor unit usage ─ Nontraditional engines

Feature number	PUs	SAPs	CPs min/max	ICFs min/max	IFLs min/max	zAAPs min/max	Spares min/max	On/Off CoD engines min/max	CBU engines min/max
6516	5	1	0/0	NA	1/4	NA	0/3	0/2	NA
6518	5	1	0/0	1/4	NA	NA	0/3	0/2	NA
6520	5	1	1/3*	NA	NA	1/2	0/2	0/2 **	NA

*	Requires a traditional engine feature number
**	CP and/or zAAP
NA	Not applicable

On/Off CoD zAAP offering

The maximum number of On/Off CoD zAAPs available for z890 cannot exceed the number of zAAPs, with the additional restriction that the sum of zAAPs and On/Off CoD zAAPs cannot exceed the number of CPs.

Base capacity setting	On/Off CoD capacity setting **	Base zAAPs	Maximum On/Off CoD zAAPs
1X0	No On/Off CoD Capacity Installed	0	0
1X0	No On/Off CoD Capacity Installed	1	0
1X0	2X0	0	0
1X0	2X0	1	1
2X0	No On/Off CoD Capacity Installed	0	0
2X0	No On/Off CoD Capacity Installed	1	1
2X0	No On/Off CoD Capacity Installed	2	0
2X0	3X0	0	0
2X0	3X0	1	No PUs Available
2X0	4X0	0	No PUs Available
3X0	No On/Off CoD Capacity Installed	0	0
3X0	No On/Off CoD Capacity Installed	1	No PUs Available
3X0	4X0	0	No PUs Available

**	On/Off CoD Capacity Setting is restricted to once again the base capacity. For example, capacity setting 110 is eligible for On/Off CoD upgrades to only capacity settings 120 and 210. All other target capacity settings would result in more than two times the base capacity.

z890 Central Processor (CP) feature numbers

	1-way		2-way		3-way		4-way
CP F/C	On/Off CoD F/C	CP F/C	On/Off CoD F/C	CP F/C	On/Off CoD F/C	CP F/C	On/Off CoD F/C
6110	NA	6210	6211	6310	6311	6410	6411
6120	6121	6220	6221	6320	6321	6420	6421
6130	6131	6230	6231	6330	6331	6430	6431
6140	6141	6240	6241	6340	6341	6440	6441
6150	6151	6250	6251	6350	6351	6450	6451
6160	6161	6260	6261	6360	6361	6460	6461
6170	6171	6270	6271	6370	6371	6470	6471

Feature number definitions

- Position one = Fixed value of 6
- Position two = Number of CPs (1 ─ 4)
- Position three = Capacity Setting (1 ─ 7)
- Position four = Engine identifier:
  - 0 = CP
  - 1 = On/Off CoD Use Day

Upgrades

- There will be no upgrades from machine types 9672, 2003, and 7060.

- z800 to z890 upgrades: From z800 Models 002 and 004 only.

- z890 to z890 upgrades: Any to any.

- z890 to z990 upgrades: There will be limited upgrade paths from z890 Model A04 to z990 Model A08 only. For details contact your IBM representative or an IBM Business Partner.

Refer to the **Customer Initiated Upgrade Capacity** section of this announcement for information on permanent and temporary capacity.

Server consolidation facilitated

With the expanded capacity of z890 over z800, and its new Channel SubSystem, there is a significant increase in server scalability, facilitating consolidation of multiple servers into one z890.

With z/OS® V1.4 z990 Exploitation Support feature, you will be able to install more operating system images and up to a total of 512 CHPIDs (up to 256 CHPIDs maximum per operating system), allowing each z890 except the smallest sub-uniprocessor equipped capacity setting to

access more channels, Coupling Links, and LANs — ESCON (up to 420 channels), FICON Express (up to 40 channels), ISC-3 (up to 48 links), and OSA-Express (up to 40 ports).

The performance advantage

Performance estimates with z/OS V1.4: IBM's Large Systems Performance Reference method provides comprehensive z/Architecture processor capacity data for different configurations of Central Processor Units across a wide variety of system control program and workload environments.

Compared to some of the 2066 z800 servers, the z890 server is expected to offer the following performance advantage:

2086-110	0.61 — 0.76	times 2066-0E1
2086-210	1.22 — 1.43	times 2066-0E1
2086-310	1.82 — 2.12	times 2066-0E1
2086-410	2.40 — 2.81	times 2066-0E1
2086-120	1.15 — 1.32	times 2066-0E1
2086-220	2.26 — 2.48	times 2066-0E1
2086-320	3.34 — 3.62	times 2066-0E1
2086-420	4.34 — 4.76	times 2066-0E1
2086-130	2.25 — 2.48	times 2066-0E1
2086-230	4.33 — 4.65	times 2066-0E1
2086-330	6.30 — 6.86	times 2066-0E1
2086-430	8.18 — 9.09	times 2066-0E1
2086-140	2.81 — 3.09	times 2066-0E1
2086-240	5.43 — 5.80	times 2066-0E1
2086-340	7.87 — 8.60	times 2066-0E1
2086-440	10.22 — 11.40	times 2066-0E1
2086-150	4.41 — 4.81	times 2066-0E1
2086-250	8.52 — 9.03	times 2066-0E1
2086-350	12.36 — 13.41	times 2066-0E1
2086-450	16.04 — 17.76	times 2066-0E1
2086-160	5.40 — 5.86	times 2066-0E1
2086-260	10.42 — 11.01	times 2066-0E1
2086-360	15.12 — 16.34	times 2066-0E1
2086-460	19.63 — 21.64	times 2066-0E1
2086-170	1.98 — 2.09	times 2066-001
2086-270	1.94 — 2.02	times 2066-002
2086-370	1.99 — 2.11	times 2066-003
2086-470	2.04 — 2.21	times 2066-004

The above performance estimates are Internal Throughput Rate Ratios (ITRR) based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here. For more detailed performance information, consult the Large Systems Performance Reference (LSPR). Customers interested in LSPR should contact their IBM representative.

The proper IBM zSeries workload tuning and capacity sizing tools should be utilized if you need assistance from IBM to help determine the appropriate capacity to purchase.

Performance assists for Linux and z/VM

z890 adapter interruptions for Linux and z/VM

Reducing overhead for CHPID types FCP and OSD: The new z890, Linux on zSeries, and z/VM V4.4, and later, work together to help enable performance improvements by exploiting extensions to the Queued Direct Input/Output (QDIO) architecture when running Linux on zSeries under this configuration. **Adapter interruptions,** first added to z/Architecture with HiperSockets, is designed to help provide an efficient, high-performance technique for I/O interruptions to reduce path lengths and overhead in both the host operating system and the adapter — FICON Express when using the CHPID type FCP, and OSA-Express when using the CHPID type OSD.

In extending the use of adapter interruptions to FICON Express CHPID type FCP and OSA-Express CHPID type OSD, IBM has reduced the programming overhead to process a traditional I/O interruption. This can benefit OSA-Express TCP/IP support in both Linux on zSeries and z/VM, FCP support in Linux on zSeries, and Linux on VSE/ESA™ V2.7 (OSD CHPID Type only).

Support for adapter interruptions is designed to improve performance of VSE/ESA V2.7 guest operating systems using TCP/IP for VSE/ESA when VSE/ESA V2.7 is running as guest system under z/VM V4.4 (for OSA-Express CHPID type OSD only).

Adapter interruptions apply to all of the FICON Express features available on z890 when in FCP mode (CHPID type FCP). FCP supports attachment of SCSI disks via Directors in a Linux on zSeries environment. Adapter interruptions apply to all of the OSA-Express features available on z890 when in QDIO mode (CHPID type OSD). This support is exclusive on zSeries to z890 and z990.

Note: HiperSockets supported adapter interruptions at introduction.

Refer to the **Software requirements** section of this announcement for further information regarding z/VM and Linux on zSeries. This support may be exploited with z/VM V4.4 and z/VM V5.1, and later. Refer to Software Announcement 203-128, dated May 13, 2003, and Software Announcement 204-057, dated April 7, 2004.

Also, refer to the following Web site

   http://www.ibm.com/zseries/zvm/

The QDIO architecture is utilized by:

- FICON Express when configured to support SCSI disks using the Fibre Channel Protocol (CHPID type FCP) in a Linux on zSeries environment

- HiperSockets (CHPID type IQD) for IP communication between LPARs, between an LPAR and a VM guest, or between VM guests

- All of the OSA-Express features in QDIO mode (CHPID type OSD)

QDIO continues to be the preferred architecture on zSeries for high-speed communication, helping to reduce host interruptions and improve response time.

Performance assist for V=V guests in the z/VM environment

Passthrough of adapter interruptions for CHPID types FCP, IQD, and OSD: z890's support of virtual machine technology has been enhanced to include a new performance assist for virtualization of **adapter interruptions.** This performance assist is available to

V=V guests (pageable guests) that support QDIO with z/VM V4.4 (with PTFs), and later. The deployment of adapter interruptions is designed to help improve efficiency and performance by reducing overhead.

The **performance assist for V=V guests** is a passthrough architecture that reduces host programming overhead by avoiding the need to stop guest processing when adapter interruptions are presented. Without the assist, the z/VM control program must intercede to process and route the adapter interruptions.

The performance assist can help improve Linux on zSeries performance under z/VM by allowing guest I/O — FICON (CHPID type FCP), HiperSockets (CHPID type IQD), and OSA-Express (CHPID type OSD) — to be handled with minimal z/VM overhead through direct presentation of adapter interruptions by the server to a pageable guest, helping to boost I/O performance.

This support is available with z/VM V4.4, and later. z/VM V4.4 requires PTFs to support this assist. Refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket prior to installing a z890. Refer to Software Announcement 203-128, dated May 13, 2003, and Software Announcement 204-057, dated April 7, 2004.

Also, refer to the following Web site

http://www.ibm.com/zseries/zvm/

IBM eServer® zSeries Application Assist Processor

The new assist feature, IBM zSeries Application Assist Processor (zAAP) (#6520), will be available on z890 and z990. zAAP is an attractively priced specialized processor unit that provides an economical Java execution environment for customers who desire the traditional Qualities of Service and the integration advantages of the zSeries platform.

When configured with Central Processors (CPs) within Logical Partitions (LPARs) running z/OS or z/OS.e, zAAPs may help increase CP productivity and may contribute to lowering the overall cost of computing for z/OS and z/OS.e Java technology-based applications. zAAPs are designed to operate asynchronously with the CPs to execute Java programming under control of the IBM Java Virtual Machine (JVM). This can help reduce the demands and capacity requirements on CPs which may then be available for reallocation to other zSeries workloads.

The IBM JVM processing cycles can be executed on the configured zAAPs with no anticipated modifications to the Java applications. Execution of the JVM processing cycles on a zAAP is a function of the Software Developer's Kit (SDK) 1.4.1 for zSeries, z/OS and z/OS.e V1.6, and Processor Resource/Systems Manager™ (PR/SM™).

The amount of CP savings will vary based on the amount of Java application code executed by zAAPs. This is dependent upon the amount of Java cycles used by the relevant applications and on the zAAP execution mode selected by the customer.

Execution of the Java applications on zAAPs (#6520), within the same z/OS or z/OS.e SMP LPAR as their associated database subsystems, can also help simplify the server infrastructures and improve operational efficiencies. For example, use of zAAPs could reduce the number of TCP/IP stacks, firewalls, and physical interconnections (and their associated processing latencies) that might otherwise be required when the application servers and their database servers are deployed on separate physical server platforms.

IBM does not impose software charges on zAAP capacity. Additional IBM software charges will apply when additional CP capacity is used.

Customers are encouraged to contact their specific Independent Software Vendors (ISVs) or Utilities Software Vendors (USVs) directly to determine if their charges will be affected.

Extended Translation Facility

The Extended Translation Facility adds 10 new instructions to the zSeries instruction set. These new instructions may enhance performance for data conversion operations done supporting data encoded in Unicode, improving the ability to efficiently support applications enabled for Unicode and/or Globalization. The instructions add hardware support for conversions to and from the various Universal Character Set (UCS) Transformation Formats (UTF) encodings used to support Unicode.

These formats for encoding data are used in a number of important technologies emerging in the Web Services, Grid, and on demand environments, such as XML and SOAP as well as being supported in DB2 for data storage. The initial programming support for the new instructions are intended to be provided in High Level Assembler.

Refer to the **Software requirements** section of this announcement for further information.

z/OS.e and zSeries 890 for new application workloads

z/OS.e is unique for z890 and z800 — a specially priced offering of z/OS, providing the z/OS qualities of service to help you deploy new applications. z/OS.e has the same migration, fallback, and coexistence as z/OS, allowing you to leverage existing skills and investments. z/OS.e must execute in z/Architecture (64-bit) mode.

Breaking the barrier — A new Channel SubSystem

Breaking the barrier of 256 CHPIDs: With the introduction of a new server structure and all of its scalability benefits, it is essential that the Channel SubSystem (CSS) also be scalable and permit "horizontal" growth. This is facilitated by allowing more than one Logical Channel SubSystem (LCSS) on a single z890. Consistent with this premise, IBM is introducing increased connectivity by offering the following channel/port maximums. For reference, the new maximums are contrasted with the z800 maximums.

Channel type	z890 maximum	z890 capacity setting 110 maximum	z800 maximum
ESCON	420 *	240	240
FICON Express	40 *	32	32
ISC-3 **	48	48	24
OSA-Express	40 *	24	24

*   Except on the smallest sub-uniprocessor equipped capacity setting

** A maximum of 32 ISC-3s can be defined in compatibility mode.

The new Channel SubSystem structure offers the following:

• Two LCSSs

– Each LCSS can have up to 256 CHPIDs defined.

– Each LCSS can be configured with one to 15 Logical Partitions (LPARs).

-- Cannot exceed 30 LPARs per server (15 LPARs on the smallest sub-uniprocessor equipped capacity setting)

z/OS V1.4 z990 Exploitation Support feature is required for z/OS to run in more than a single LCSS. Without z/OS V1.4 z990 Exploitation Support feature, z/OS may only execute in LCSS0. z/VM V3.1, V4.3, and later, may execute in LCSS0 and LCSS1. However, when using z/VM V3.1 and V4.3 compatibility support, dynamic I/O configuration is supported in LCSS0 only.

Note: There is no change to the operating system maximums. One operating system image continues to support up to a maximum of 256 Channel Path Identifiers (CHPIDs).

The I/O SubSystem (IOSS) continues to be viewed as a single Input/Output Configuration Data Set (IOCDS) across the entire server with up to two LCSSs. Only one Hardware System Area (HSA) is used.

In the past, a two-digit identifier, a CHPID, was associated with a physical I/O connection. Now a three-digit Physical Channel Identifier (PCHID) is being introduced to accommodate the mapping of 512 CHPIDs to two LCSSs with up to 256 CHPIDs each. CHPIDs continue to exist and will be associated with PCHIDs.

As a result of the introduction of PCHIDs, a new CHPID Mapping Tool (CMT) is being introduced and the CHPID report from the IBM Configurator For e-business (eConfig) is replaced by a PCHID report. CMT is available from Resource Link™ as a standalone PC-based program.

http://www.ibm.com/servers/resourcelink

Refer to z890 documentation for additional information on the new mapping tool, CHPIDs, and PCHIDs.

Dynamic I/O configuration support: Allows channel paths, control units, and devices to be dynamically added, changed, and deleted in multiple LCSSs. Refer to the **Software requirements** section of this announcement for further information.

When z/VM is the controlling LPAR, z/VM's dynamic I/O support is designed to handle all of the new elements of the multiple Channel SubSystem facility for dynamic I/O configuration changes. To dynamically change the I/O configuration one of two techniques can be employed:

• z/VM Control Program (CP) suite of interactive dynamic I/O commands

• HCM/HCD ─ New configuration management tools

Spanned channel support

Transparent sharing of internal and external channels across LCSSs: When LCSSs were introduced on z990, transparent sharing of internal channels was introduced ─ sharing of HiperSockets and Internal Coupling Channels (ICs) between separate LCSSs. Support on zSeries 890 includes support for sharing of internal channels (HiperSockets and ICs), as well as sharing of external channels ─ FICON Express, ICB-3, ICB-4, ISC-3, and OSA-Express features; they can all now be configured as Multiple Image Facility (MIF) spanning channels, allowing sharing of channel resources across LPARs.

Spanned channels can be shared among LPARs across LCSSs. FICON Express, HiperSockets, ICs, ICB-3, ICB-4, ISC-3, and OSA-Express can be configured to multiple channel subsystems and be transparently shared by any or all of the configured LPARs without regard to the LCSS to which the LPAR is configured.

The following may be spanned:

Feature	CHPID type
Internal spanned channels	
HiperSockets	IQD
IC	ICP
External spanned channels	
FICON Express	FC, FCP
ICB-3	CBP, Peer
ICB-4	CBP, Peer
ISC-3	CFS, Coupling Sender, Compatibility mode
ISC-3	CFP, Peer
OSA-Express	OSC, OSD, OSE

Note: While the PCICA and PCIXCC features do not have CHPID types and are not identified as spanned channels, all LPARs in all LCSSs have access to the PCICA feature, up to 30 LPARs per feature. All LPARs in all LCSSs have access to the PCIXCC feature, up to 16 LPARs per feature.

For the minimum software requirements for all of the spanned channel types identified, refer to the **Software requirements** section of this announcement. Under certain circumstances earlier releases of the z/OS operating system are supported. Refer to the publication *z/OS Migration* (GA22-7499) for more details. An update to this publication, discussing the external spanned channel types, is planned to be available in the z/OS V1.6 timeframe.

The addition of FICON Express, ICBs, ISC-3, and OSA-Express to the line up of channel types that can be spanned satisfies the Statement of General Direction in Hardware Announcement 103-142, dated May 13, 2003.

Another breakthrough ─ More subchannels for increased connectivity: With two LCSSs come more subchannels. There has been a 63k subchannel limitation. Since there was one CSS, there was a maximum of 63k subchannels. With two LCSSs, each LCSS can have its own set of up to 63k subchannels.

With two LCSSs you can have:

• Up to a maximum of 63k devices/subchannels per LCSS

• Up to a maximum of 126k devices for two LCSSs

– Two LCSSs x 63k subchannels for each LCSS

Each LPAR can access the 63k devices in its assigned LCSS.

This capability helps to relieve the I/O device configuration constraints experienced by large server configurations.

A giant step ─ Support for 30 Logical Partitions

Doubling the number of LPARs supported: Processor Resource/Systems Manager (PR/SM™), introduced in February 1988, allowed IBM S/390® and now zSeries to be logically partitioned. Prior to that time, IBM mainframes could only be physically partitioned. When IBM introduced PR/SM and Logical Partitions (LPARs), initially **four LPARs** were supported, growing to **10 LPARs**

in June 1992, followed by **15 LPARs** in June 1997, and finally **30 LPARs** at introduction of zSeries 990. zSeries 890 supports 30 LPARs, 15 LPARs per LCSS, except on the smallest sub-uniprocessor equipped capacity setting which supports a total of 15 LPARs.

Refer to the **Software requirements** section of this announcement for further information.

Dynamic add/delete of a Logical Partition name: The ability to add meaningful LPAR names to the configuration without a Power-On Reset is being introduced. Prior to this support, extra LPARs were defined by adding reserved names in the Input/Output Configuration Data Set (IOCDS), but one may not have been able to predict what might be meaningful names in advance.

Dynamic add/delete of an LPAR name allows reserved LPAR "slots" to be created in an IOCDS in the form of extra LCSS, Multiple Image Facility (MIF) image ID pairs. These extra LCSS MIF image ID pairs (CSSID/MIFID) can be later assigned an LPAR name for use (or later removed) via dynamic I/O commands using the Hardware Configuration Definition (HCD). The IOCDS still must have the extra I/O slots defined in advance since many structures are built based upon these major I/O control blocks in the Hardware System Area (HSA). This support on zSeries is exclusive to the z890 and z990 and z/OS and z/OS.e V1.6 (planned to be available September 2004).

Customer Initiated Upgrade Capacity — Technology on demand

Customer Initiated Upgrade enhancement: When your business needs additional capacity quickly, Customer Initiated Upgrade (CIU) with the Express option is here to deliver it.

CIU is designed to allow you to respond to sudden increased capacity requirements by downloading and applying an IBM @server zSeries Processor Unit (PU) and/or memory upgrade via the Web, using IBM Resource Link and the Remote Support Facility. IBM now has a faster process for upgrading your server. With the Express option on CIU, an upgrade may be installed as fast as within a few hours after order submission.

Permanent upgrades: Orders (MESs) of PUs and memory for IBM @server zSeries servers that can be delivered by Licensed Internal Code, Control Code (LIC CC) are eligible for CIU delivery. This includes the upgrade of PUs for z800, z900, z890, and z990 as well as memory for z900 and z990, and limited memory upgrades for z890 (24 GB to 32 GB) and z990 servers up to the maximum available on the installed server.

While capacity upgrades to the processor itself are concurrent, your software may not be able to take advantage of the increased capacity without performing an Initial Program Load (IPL).

Temporary capacity

IBM eServer On/Off Capacity on Demand: When your business needs short-term additional capacity, On/Off Capacity on Demand (On/Off CoD) is designed to deliver it. On/Off CoD is designed to temporarily turn on uncharacterized PUs available within the current machine as CPs, Internal Coupling Facilities (ICFs), IFLs, and zSeries Application Assist Processors (zAAPs).

Activation of this capability is mutually exclusive with CBU activation. Both On/Off CoD and CBU can reside on the server, but only one can be activated at a time.

On/Off CoD is delivered through the function of CIU. To participate in this offering, you must have installed CIU Enablement (#9898) and On/Off CoD Enablement (#9896). Subsequently, you may concurrently install temporary capacity by ordering On/Off CoD Use Days (one of #6121 through #6471), On/Off CoD Active IFLs (#9888), On/Off Active ICFs (#9889), or On/Off CoD Active zAAP (#9893) up to the current capacity setting or the number of IFLs, ICFs, and zAAPs, respectively, and use the additional capacity for an indeterminate time. You will be billed for each On/Off CoD Active engine turned on in any given 24-hour period continuing until such On/Off CoD Active engine is turned off. Each month your bill will be calculated for the sum of all orders installed within the prior month. Monitoring will occur through the server call home facility and a bill will be generated if the capacity has been enabled for any portion of a calendar month. You will continue to be billed for use of temporary capacity until you return the server to the original state. After concurrently returning to the original state, you may choose to activate a new On/Off CoD upgrade which can be different from the previous upgrade. When you dispose of the server, or decide that you want to disable future temporary upgrades, you are required to remove the enablement feature, On/Off CoD Enablement (#9896).

IBM eServer On/Off Capacity on Demand from IBM Global Financing: Let IBM Global Financing, a leading provider of IT financing, assist in your acquisition of IBM leading-edge technology.

Through Total Solution Financing we provide a single source that allows you to consolidate your solution, including hardware, software, and services. You have an innovative and tailored solution that helps make acquiring your IBM @server fast, easy, and affordable.

Through our Total Solution Financing offerings we can provide financing for your on demand needs. Match your investment to your usage with competitive financing for your fixed and variable costs for On/Off CoD.

Connectivity abounds

What's new with HiperSockets?

HiperSockets, first introduced in October 2001, employs the Queued Direct Input/Output (QDIO) architecture for very high speed internal TCP/IP communication (network within the box — an independent internal LAN) between programs running on z/OS, z/OS.e, z/VM, or Linux on zSeries, or as guests under z/VM, whether in the same or in different LPARs on the same server. A synchronous data mover function transfers data at memory access speed with very low latency.

HiperSockets now supported by VSE/ESA: In VSE/ESA V2.7, IBM extended the support for HiperSockets to include the VSE/ESA environment. TCP/IP for VSE/ESA V1.5 (a new release) provides support for HiperSockets. Refer to Software Announcement 203-043, dated February 18, 2003.

HiperSockets VLAN support in a Linux environment: Virtual Local Area Networks (VLANs), IEEE standard 802.1q, are now being offered for HiperSockets in a Linux on zSeries environment. VLANs can reduce overhead by allowing networks to be organized for more optimal traffic flow; the network is organized by traffic patterns rather than physical location. This enhancement permits traffic to flow on a VLAN connection both over HiperSockets and between HiperSockets and an OSA-Express GbE, 1000BASE-T Ethernet, or Fast Ethernet feature.

Refer to the **Software requirements** section of this announcement for further information.

HiperSockets ─ *Up to 16 internal LANs:* When HiperSockets was introduced, up to **four internal** Local Area Networks (LANs) could be configured. That number is now being increased to up to **16 internal LANs.** A HiperSockets channel must be spanned in order to communicate between LPARs in different LCSSs.

This support is exclusive on zSeries on z890 and z990. There are no prerequisite software requirements.

HiperSockets broadcast support for IPv4 packets ─ *Linux, z/OS, z/VM:* Internet Protocol Version 4 (IPv4) broadcast packets are now supported over HiperSockets internal LANs. TCP/IP applications that support IPv4 broadcast, such as OMPROUTE when running Routing Information Protocol Version 1 (RIPv1), can send and receive broadcast packets over HiperSockets interfaces.

This support is exclusive on zSeries on z890 and z990. Broadcast for IPv4 packets is supported by z/OS V1.5 and later, z/VM V4.4 and later, as well as Linux on zSeries. Refer to Software Announcement 203-131, dated May 13, 2003, and Software Announcement 203-128, dated May 13, 2003. Also, refer to the **Software requirements** section of this announcement.

TCP/IP broadcast support for the OSA-Express features was announced in April 2002, and was made available in the following environments: z/VM V4.3 (May 2002), z/OS V1.4 (September 2002), and Linux on zSeries.

Refer to the **Software requirements** section of this announcement.

HiperSockets spanned channels: As previously mentioned, HiperSockets (CHPID type IQD) can be configured to multiple Channel SubSystems and transparently shared by any or all configured LPARs without regard to the LCSS to which the LPAR is configured. Refer to the **Software requirements** section of this announcement.

HiperSockets Network Concentrator simplifying network addressing: HiperSockets Network Concentrator simplifies network addressing between HiperSockets and OSA-Express, allowing seamless integration of HiperSockets-connected operating systems into external networks, without requiring intervening network routing overhead, thus helping to increase performance and simplify configuration.

HiperSockets Network Concentrator is implemented between HiperSockets, OSA-Express, and Linux on zSeries. HiperSockets Network Concentrator provides support for unicast, broadcast, and multicast. There is no z/VM guest LAN support planned for HiperSockets Network Concentrator.

HiperSockets Network Concentrator was previously referred to as HiperSockets Linux Layer 2 Switch support when it was announced on z990 in May 2003. HiperSockets Network Concentrator is exclusive on zSeries on z890 and z990. Refer to the **Software requirements** section of this announcement for further information.

A 75% increase in ESCON connectivity: With the introduction of two Logical Channel SubSystems (LCSSs), it is now possible to define up to a maximum of **420 ESCON channels** on your z890 (240 on the smallest sub-uniprocessor equipped capacity setting), up to a maximum of 28 features. This can facilitate server consolidation. The maximum number of configurable CHPIDs is 256 per LCSS and per operating system image.

The high-density, 16-port Enterprise Systems CONnection (ESCON) feature can have 15 active channels. One is always reserved as a spare in the event of a failure of one of the other channels. When four channels are ordered, two 16-port ESCON features are installed and two channels are activated on each feature. After the first pair, ESCON features are installed in increments of one. ESCON channels continue to be ordered in increments of four.

ESCON supports five operating system environments: Enterprise Systems Connection (ESCON) is supported by OS/390® , z/OS, and z/OS.e as well as z/VM, VSE/ESA, TPF, and Linux on zSeries. Refer to the **Software requirements** section of this announcement for further information.

Fiber Quick Connect, an integrated "quick" connect for ESCON channels: Fiber Quick Connect (FQC), coupled with the IBM Fiber Transport System (FTS) from IBM Network Integration and Deployment Services for enterprise fiber cabling, delivers a solution designed to help reduce the amount of time required for on-site installation and setup of cabling, to help minimize disruptions, and to isolate the activity away from the active server as much as possible. FQC facilitates adds, moves, and changes of ESCON multimode fiber optic cables in the data center.

The Fiber Quick Connect feature, for factory installation of IBM FTS direct-attach fiber harnesses, may be the right answer for your installation, to help minimize the number of jumper cables exiting the server and residing under the floor. FQC supports all installed ESCON features in all installed I/O cages.

Cabling is a customer responsibility. Refer to the IBM Networking Services section of this announcement for information on fiber optic cabling available from IBM Global Services. Refer to the *Sales Manual* for additional information on Fiber Quick Connect.

Parallel channels no longer supported: Parallel channels features are not supported on z890, just as they are not supported on z800 or z990. This is consistent with the Statement of General Direction in Hardware Announcement 100-323, dated October 3, 2000.

Customers who are still using parallel-attached devices can obtain a parallel channel converter product:

- The IBM ESCON Converter Model 1, 9034-001, which may be available through IBM Global Financing (IGF).

- A third-party parallel channel converter product such as the Optica 34600 FXBT.

For more information about Optica offerings, contact Optica directly at

http://www.opticatech.com/

FICON Express update

A 25% increase in the number of FICON Express channels: z890 supports up to a maximum of 20 FICON Express features, a total of **40 FICON channels** (32 on the smallest sub-uniprocesor equipped capacity setting). This is a 25% growth over what was available on z800. Fibre Connection (FICON) Express continues to be a high-performance I/O channel optimized for efficient, high-speed communication. The FICON Express SX and LX features are capable of supporting an average of 3600 start I/Os per second on a channel that is 50% utilized.

The FICON Express features (CHPID types FC and FCP) can be defined as a spanned channel and can be shared among LPARs within and across LCSSs.

The FICON Express features offer multiple I/O connectivity options:

Function	CHPID type	Connectivity
FICON Bridge	FCV	ESCON devices
FICON Native	FC	FICON devices
FICON CTC	FC	Server-to-Server or LPAR-to-LPAR
Fibre Channel Protocol	FCP	SCSI disks/Linux

The FICON Express features support a 1 Gigabit per second (Gbps) or 2 Gbps link data rate, auto-negotiating the speed, point-to-point, without application or end-user intervention. Two features continue to be available — FICON Express LX (long wavelength) for use with 9 micron single mode fiber optic cabling, and FICON Express SX (short wavelength) for use with 50 or 62.5 micron multimode fiber optic cabling. Refer to the *Sales Manual* for a more complete description of these features.

The most common use of these features continues to be FICON Native with large infrastructures often feeding terabytes of storage.

FICON natively supports five operating system environments: FICON (CHPID type FC) is supported natively by OS/390, z/OS, and z/OS.e as well as z/VM, VSE/ESA, TPF, and Linux on zSeries. Refer to the **Software requirements** section of this announcement for further information.

Fiber optic cabling is a customer responsibility.

Refer to the **Fiber optic cabling services from IBM Networking Services** section of this announcement for information on fiber optic cabling services.

Cascaded Director support: On January 31, 2003, IBM made generally available the FICON Cascaded Director function. FICON Cascading enables two FICON Directors to be interconnected, or cascaded. FICON Cascading, used for cross-site connectivity, can help minimize the number of channels and cross-site connections helping to reduce implementation costs for disaster recovery applications such as Geographically Dispersed Parallel Sysplex™ (GDPS) and Remote Copy. This support is applicable to z800, z900, z890, and z990. Support is offered in z/OS V1.3 with PTFs or later releases. Support is also available with z/VM V4.4, and later.

For more information on Cascaded Directors, consult the I/O Connectivity Web site at

> **http://www.ibm.com/servers/eserver/zseries/ connectivity/**

Maximum unrepeated distance between Cascaded Directors: For information regarding the maximum unrepeated distance supported between Cascaded Directors, refer to the following Web site and select the specific director product of interest

> **http://www.storage.ibm.com/product/index.html**

FCP for attachment to SCSI disks in Linux environments: The Fibre Channel Protocol (FCP) capability, supporting attachment to Small Computer Systems Interface (SCSI) disks in Linux on zSeries environments, was made available on z800 and z900 February 20, 2003. This support is also available on the z890. This support is

applicable to all of the FICON Express features supported on z890 when configured as CHPID type FCP.

Refer to the connectivity Web site listed at the end of this section for updated information on supported devices.

For Linux on zSeries using FCP-attached SCSI disks and operating as a guest under z/VM, z/VM V4.3, and later, is required.

z/VM V5.1 plans to provide the capability to install z/VM from a DVD to an Enterprise Storage Server™ (ESS) SCSI disk emulated as a Fixed-Block Architecture (FBA) disk as well as from a DVD to a 3390 disk. Thus, Linux guests may be started and run completely from FCP disks on your hardware configuration. Refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket for any service required for z/VM support for SCSI IPL.

z/VM V5.1 supports SCSI-attached disks to be used for installation, IPL, and operation such as storing guest dumps, and other functions, while continuing to provide support for ESCON- or FICON-attached disk or tape.

z/VM SCSI support can allow a Linux server farm to be deployed on z/VM in a configuration that includes only SCSI disks.

Refer to Software Announcement 203-128, dated May 13, 2003, for additional information on z/VM V4.4 and to Software Announcement 204-057, dated April 7, 2004, for additional information on z/VM V5.1.

For Linux on zSeries support, refer to the Web site listed at the end of this **FICON Express update** section.

FICON/FCP intermix: On March 31, 2003, zSeries announced support for intermixing Fibre Connection (FICON) and the Fibre Channel Protocol (FCP) within the same physical FICON Director. FICON/FCP intermix is supported on the McDATA Intrepid 6000 Series Directors and CNT FC/9000 Directors. Now a single director may be shared, on a port-by-port basis, between FICON-capable servers/devices and FCP-capable servers/devices.

FICON/FCP Intermix facilitates asset utilization. If you have chosen to implement small director footprints which can scale up over time, this may be of assistance as you pursue that strategy.

The Control Unit Port (CUP) continues to be used to communicate with operating systems, including Linux.

For additional details, refer to FICON/FCP White Papers which are available at the following Web sites

> **http://www.cnt.com/literature/documents/ PL673.pdf**

> **http://www.mcdata.com/downloads/mkt/wpaper/ ficon_intermix.pdf**

For Linux on zSeries support of FCP, refer to the following Web site for further information

> **http://www10.software.ibm.com/developerworks/ opensource/linux390**

For more information, consult IBM's I/O Connectivity Web site

> **http://www.ibm.com/servers/eserver/zseries/ connectivity/#fcp**

FCP SAN management support: The zSeries 890 FICON Express features, when configured as FCP CHPID type, support the industry-standard interface for Storage Area Network (SAN) management tools. The FICON Express

features may be used with industry-standard SAN management tools which leverage the Common Host Bus Adapter (HBA) Applications Programming Interface (API). The HBA API is used by management application programs to request SAN management services, enabling the management of Fibre Channel Host Bus Adapters (FC HBAs) and the discovery of SAN resources.

SAN management software tool support for exploiting the z890 function of FCP SAN Management is to be delivered by software vendors. Software vendors are now welcome to include the Linux on zSeries FICON Express features as an additional platform for SAN management tool development and exploitation.

Refer to the **Software requirements** section of this announcement.

Fibre Channel Protocol SCSI Initial Program Load: Small Computer System Interface (SCSI) Initial Program Load (IPL) allows the IPL of an operating system from a SCSI-type device attached via the zSeries FICON Express features when configured as a Fibre Channel Protocol channel (CHPID type FCP).

You may also IPL a standalone-dump program from a SCSI-type device attached via the zSeries FCP channel. The standalone dump program may also store the generated dump data on such a disk. Thus, the Linux-based LPARs may be started and operated completely from their FCP-attached disks in your hardware configuration. To use this function, a no-charge orderable platform feature (#9904) is required.

Delivery of SCSI IPL satisfies the Statement of General Direction ("IPL from FCP-attached disks") in Hardware Announcement 103-142, dated May 13, 2003.

z/VM V4.4, and later, support of SCSI IPL allows Linux and other guest operating systems that support SCSI IPL to be IPLed from FCP-attached SCSI disks when z/VM is running on a z800, z900, z890, z990, or equivalent server equipped with the SCSI IPL function. Thus, Linux guests may be started and run completely from FCP disks on your hardware configuration. z/VM V5.1 plans to provide support that can allow z/VM to be IPLed from SCSI-attached FCP disks. Refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket for any service required for z/VM support for SCSI IPL. Refer to Software Announcement 203-128, dated May 13, 2003, for additional information on z/VM V4.4 and to Software Announcement 204-057, dated April 7, 2004, for additional information on z/VM V5.1.

Refer to the **Software requirements** section of this announcement for information on z/VM and Linux on zSeries requirements.

FICON Express performance improvement: Relative to the FICON Express performance documented in the whitepaper *FICON and FICON Express Channel Performance Version 2.0,* dated November 2003, a customer may see an increase of up to 15% in the maximum of 4K I/O operations per second. This improvement is based on laboratory measurements. The actual I/O rate a customer may see will vary with factors such as the I/O configuration used and the level of the channel LIC installed. This performance improvement was achieved with the FICON Express LX feature (#2319) and the FICON Express SX feature (#2320) on z890 using the May 2004 level of LIC with measurements averaged over four channels.

FCP availability enhancement ─ FCP concurrent patch: FICON, when configured as CHPID type FCP, supports concurrent patch allowing application of new Licensed

Internal Code without requiring a configuration on/off. This is an exclusive FCP availability feature on zSeries offered on the z890 and z990 FICON Express features (#2319, 2320) when configured as CHPID type FCP. This concurrent patch capability requires the zSeries 890 May 2004 level of Licensed Internal Code.

Adding to the family of Directors supported by FICON: The FICON Express features now support attachment to the IBM M12 Director (2109-M12). This support became available October 14, 2003. A no-charge upgrade, Enterprise Operating System 4.1.2, is required for the IBM M12 Director.

The IBM M12 Director supports attachment of FICON Express channels on z890 via native FICON (CHPID type FC) and Fibre Channel Protocol (CHPID type FCP) supporting attachment to SCSI disks in Linux environments.

The FICON Express channels on the z890 continue to support attachment to McDATA Intrepid 6000 Series Directors and the CNT FC/9000 Directors.

For more information, refer to the IBM I/O Connectivity Web site

> **http://www-1.ibm.com/servers/eserver/zseries/ connectivity/**

The OSA-Express family of LAN adapters

Now 40 connections to your network ─ a 67% increase over z800: With the introduction of z890, its increased processing capacity, and the availability of two Logical Channel Subsystems, the Open Systems Adapter family of Local Area Network (LAN) adapters is also expanding by offering up to a maximum of 40 ports of LAN connectivity per z890 (24 ports on the smallest sub-uniprocessor equipped capacity setting). You can choose any combination of OSA-Express features: the new OSA-Express Gigabit Ethernet LX (#1364), the new OSA-Express Gigabit Ethernet SX (#1365), the new OSA-Express 1000BASE-T Ethernet (#1366), and the current OSA-Express Token Ring (#2367). You can also carry forward on an upgrade from z800, OSA-Express Gigabit Ethernet LX (#2364), OSA-Express Gigabit Ethernet SX (#2365), OSA-Express Fast Ethernet (#2366), and OSA-Express Token Ring (#2367). There are no unique software requirements to support 40 connections.

New OSA-Express Gigabit Ethernet features on z890: A new generation of Open Systems Adapter-Express (OSA-Express) Gigabit Ethernet (GbE) features first offered on zSeries with z990 is now also available on z890. New feature numbers have also been introduced. These new features are offered on new builds and replace the current OSA-Express GbE features (#2364, 2365) which can also be brought forward to z890 on an upgrade from z800. OSA-Express Gigabit Ethernet (CHPID type OSD) can be defined as a spanned channel and can be shared among LPARs within and across LCSSs.

The new OSA-Express Gigabit Ethernet SX (short wavelength) and OSA-Express Gigabit Ethernet LX (long wavelength) features support **Checksum Offload,** and have a new connector type, LC Duplex, replacing the current SC Duplex connector. This conforms to the fiber optic connectors currently in use for ISC-3 and the FICON Express features which began shipping October 31, 2001.

The new OSA-Express GbE features continue to be dual-port features occupying a single I/O slot, and utilize one CHPID per port, two CHPIDs per feature. The OSA-Express GbE features continue to support Queued

Direct Input/Output (QDIO) mode only, full-duplex operation, and jumbo frames.

The current OSA-Express GbE features are supported on z890 on an upgrade from z800, OSA-Express Gigabit Ethernet LX (#2364) and OSA-Express Gigabit Ethernet SX (#2365). The connector remains the same, SC Duplex.

These new features on zSeries are exclusive to z890 and z990. There are no unique software dependencies for the new OSA-Express Gigabit Ethernet features, with the exception of the Checksum Offload support. Refer to the Checksum Offload text in this announcement for more details. Refer to the **Software requirements** section of this announcement for further information.

Refer to the Standards section of this announcement for conformance information as well as additional information on the features.

1000BASE-T Ethernet — A new copper Ethernet: A new copper Ethernet feature is being introduced on z890. This new feature is offered on new builds and replaces the current OSA-Express Fast Ethernet (#2366) which can also be brought forward to z890 on an upgrade from z800. OSA-Express 1000BASE-T Ethernet (CHPID types OSC, OSD, OSE) can be defined as a spanned channel and can be shared among LPARs within and across LCSSs.

This new feature, 1000BASE-T Ethernet, is capable of operating at 10, 100, or 1000 Mbps (1 Gbps) using the same Category 5 Unshielded Twisted Pair (UTP) cabling infrastructure that is utilized for Fast Ethernet. The new Gigabit over copper adapter allows a migration to gigabit speeds wherever there is a copper cabling infrastructure instead of a fiber optic cabling infrastructure.

The new 1000BASE-T Ethernet feature supports:

- Auto-negotiation (the target device must also be set to auto-negotiate)

- A QDIO and a non-QDIO environment allowing you to make the most of your TCP/IP and SNA/APPN® /HPR environments at up to gigabit speeds

- Checksum Offload when in QDIO mode

When configured at 1 Gbps (1000 Mbps), the 1000BASE-T Ethernet feature has the following attributes:

- Operates in QDIO mode or non-QDIO mode

- Carries SNA (non-QDIO mode) and TCP/IP packets (QDIO or non-QDIO mode)

- Operates in full-duplex mode only

- Supports jumbo frames in QDIO mode

There are no unique software dependencies for the new 1000BASE-T Ethernet feature, with the exception of the Checksum Offload support. Refer to the **Software requirements** section of this announcement for further information.

Refer to the Standards section of this announcement for conformance information as well as additional information on the feature.

OSA-Express Integrated Console Controller: Today, IBM is introducing a new function for the Open Systems Adapter-Express 1000BASE-T Ethernet feature and a new Channel Path Identifier (CHPID) type, OSC. The new Open Systems Adapter-Express Integrated Console Controller (OSA-ICC) function supports TN3270E (RFC 2355) and non-SNA DFT 3270 emulation. Now, 3270 emulation for console session connections is integrated in the zSeries 890 via a port on the OSA-Express 1000BASE-T Ethernet feature. This can eliminate the requirement for external console controllers (2074, 3174), helping to reduce cost and complexity. Each port can support up to 120 console session connections.

OSA-ICC support on zSeries is exclusive to z890 and z990 and is available via the OSA-Express 1000BASE-T Ethernet feature, only. OSA-ICC can be configured on a port-by-port basis; a port on the 1000BASE-T Ethernet feature can be configured as CHPID type OSC, OSD, or OSE.

Refer to *IBM @server zSeries 990 and 890 Open Systems Adapter-Express Integrated Console Controller User's Guide* (SA22-7990) for installation and setup assistance. Refer to the **Software requirements** section of this announcement for further information.

Checksum Offload for IPv4 packets when in QDIO mode — z/OS and Linux: A new function, **Checksum Offload,** offered for the new OSA-Express GbE and 1000BASE-T Ethernet features, is being introduced for the Linux on zSeries and z/OS environments. Checksum Offload provides the capability of calculating the Transmission Control Protocol (TCP), User Datagram Protocol (UDP), and Internet Protocol (IP) header checksums. Checksum verifies the correctness of files. Because the checksum calculations are moved to a Gigabit or 1000BASE-T Ethernet feature, host CPU cycles are reduced and performance is improved.

When checksum is offloaded, the OSA-Express feature performs the checksum calculations for Internet Protocol Version 4 (IPv4) packets. This function applies to packets which actually go onto the Local Area Network (LAN) or come in from the LAN. When multiple IP stacks share an OSA-Express, and an IP stack sends a packet to a next hop address owned by another IP stack sharing the OSA-Express, OSA-Express sends the IP packet directly to the other IP stack without placing it out on the LAN. Checksum Offload does not apply to such IP packets. This function does not apply to IPv6 packets. TCP/IP will continue to perform all checksum processing for IPv6 packets. This function also does not apply to ICMP checksum processing. TCP/IP will continue to perform processing for ICMP checksum.

Checksum Offload is supported by the new OSA-Express GbE features (#1364, 1365) and the new 1000BASE-T Ethernet feature (#1366) when operating at 1000 Mbps (1 Gbps). This is applicable to the QDIO mode only.

Checksum offload support is available with z/OS V1.5. Refer to Software Announcement 203-131, dated May 13, 2003.

Refer to the **Software requirements** section of this announcement for z/OS and Linux on zSeries support.

Full VLAN support for z/OS to increase traffic flow when in QDIO mode: z/OS Communications Server (CS) now supports Virtual Local Area Network Identifications (VLAN IDs). Support is offered for one global VLAN (ID) per IP version per TCP/IP stack:

- One global VLAN (ID) for IPv4
- One global VLAN (ID) for IPv6

Previously CS supported VLAN priority tagging. CS will support both priority tagging and VLAN IDs.

VLAN support conforms to the IEEE 802.1q standard which defines a VLAN as a subset of the active topology of the LAN. VLANs ease the administration of logical groups of users so that they can communicate as if they were on the same LAN. VLANs can increase traffic flow and reduce

overhead by allowing the organization of networks by traffic patterns rather than by physical location.

Full VLAN support is offered in z/OS V1.5 Communications Server. Full VLAN support is available on the following OSA-Express features: 1000BASE-T Ethernet (#1366), Fast Ethernet (#2366), and Gigabit Ethernet (#2364, 2365, 1364, 1365) when in QDIO mode. This support is applicable to z800, z900, z890, and z990. Refer to Software Announcement 203-131, dated May 13, 2003.

Virtual Local Area Network (VLAN) support for z/VM: z/VM V4.4, and later, exploits the VLAN technology and implements the IEEE 802.1q standard. TCP/IP for z/VM supports Virtual Local Area Network Identifications (VLAN IDs). In z/VM V4.4, support is offered for one global VLAN ID for IPv4. In z/VM V5.1, support is offered for one global VLAN ID for IPv6. The z/VM TCP/IP stack supports one VLAN ID per OSA-Express port. Each port can be configured with a different VLAN ID.

Support is offered for the following OSA-Express features: 1000BASE-T Ethernet (#1366), Fast Ethernet (#2366), and Gigabit Ethernet (#2364, 2365, 1364, 1365) when in QDIO mode. This support is applicable to z800, z900, z890, and z990.

Refer to Software Announcement 203-128, dated May 13, 2003, and to Software Announcement 204-057, dated April 7, 2004.

VLAN support for Linux on zSeries: VLAN (IEEE 802.1q) support in a Linux on zSeries environment is supported for the OSA-Express Gigabit Ethernet, 1000BASE-T Ethernet, and Fast Ethernet features when in QDIO mode. Refer to the **Software requirements** section of this announcement.

Intrusion Detection Services (IDS) enhancements: In z/OS V1.5 Communications Server, interface flood detection (Denial of Service ─ DoS) was added to the current IDS support. In the case where the interface flood is occurring on an OSA-Express QDIO interface, the source MAC address of packets can be identified. IDS can help detect attacks on the TCP/IP stack that would potentially harm its ability to function normally and cause a misuse of server resources.

The source MAC identification feature on zSeries is exclusive to z890 and z990 and supported by all of the OSA-Express features on z890 when in QDIO mode (CHPID type OSD). Refer to Software Announcement 203-131, dated May 13, 2003.

Now 160 TCP/IP stacks per OSA-Express port when in QDIO mode: TCP/IP connectivity is now increased with the capability to allow up to a maximum of 160 IP stacks per OSA-Express port and 480 devices. There is up to a maximum of 84 IP stacks and 254 devices per LPAR. There continue to be four QDIO priorities. Previously, the OSA-Express features, when configured for QDIO, had been capable of supporting up to 80 IP stacks and 240 devices.

This support is applicable to all of the OSA-Express features available on z890, either as a new build z890 or on an upgrade from z800 when using QDIO mode (CHPID type OSD). This support is offered in the z890 Licensed Internal Code (LIC). There are no prerequisite software requirements.

OSA/SF Java GUI for client operating system independence: A new version of the Open Systems Adapter/Support Facility (OSA/SF) is available and includes a Java language-based Graphical User Interface (GUI) in support of the client application. The Java GUI is independent of any operating system/server (transparent to operating system), and is expected to operate wherever the Java 1.4 runtimes are available. Interoperability testing has been performed for Windows™ 2000, Windows XP, and Linux on zSeries. In the past, workstation support was downloaded to a client supporting Windows NT™, Windows 95, or OS/2®. Use of the GUI is optional; a REXX command interface is also included with OSA/SF. OSA/SF is not required to set up the OSA-Express features in QDIO mode (CHPID type OSD).

OSA/SF has been, and continues to be, integrated in z/OS, z/OS.e, OS/390, z/VM, and VSE/ESA and runs as a host application. For OSA/SF, Java GUI communication is supported via TCP/IP only. In the past, communication was supported via EHLLAPI (3270), APPC, and TCP/IP.

This new integrated version of OSA/SF is a complete replacement for the currently integrated versions in z/OS, z/OS.e, OS/390, and VSE/ESA. This new version of OSA/SF is not being offered as a separately orderable program product.

The OSA/SF is used primarily to:

- Manage all OSA ports
- Configure all OSA non-QDIO ports
- Configure ATM LANE ports on G3 ─ G6 Servers, z800, and z900
- Configure local MAC

This deliverable is a complete replacement for OSA/SF V2.1 (5655-B57). A separately orderable program product is no longer available. This new integrated version is applicable to all in service releases of z/OS, z/OS.e, OS/390, z/VM, and VSE/ESA.

In the z/OS and z/OS.e environments, delivery will be via the z/OS V1.4 z990 Exploitation Support feature and the z/OS.e V1.4 z990 Coexistence Update feature and z990 Compatibility for Selected Releases Web deliverable (for releases OS/390 V2.10, z/OS V1.2, z/OS V1.3, and z/OS.e V1.3).

The new version of OSA/SF is integrated in z/VM V4.4, and later, and replaces OSA/SF V2.1. In currently supported versions/releases of z/VM and VSE/ESA, the new version will be delivered as a PTF and will overlay OSA/SF V2.1.

This support is applicable to all OSA-Express and OSA-2 features on all supported servers.

Note: The OSA-2 features are not available on z890 nor z990.

Refer to Software Announcement 203-131, dated May 13, 2003.

Refer to Software Announcement 203-128, dated May 13, 2003.

OSA-Express SNMP update: The Simple Network Management Protocol (SNMP) allows network managers to monitor network devices and their functions, and identify problems in a TCP/IP environment. A separate standard, Management Information Base (MIB), defines the set of variables that SNMP servers maintain. The OSA-Express features support SNMP.

The OSA-Express Direct SNMP subagent and the OSA-Express Direct SNMP subagent MIB were first introduced in April 2002, for the QDIO mode only (CHPID type OSD). Prior to the introduction of the OSA-Express Direct SNMP subagent, OSA-Express management data

was only available with the z/OS Communications Server TCP/IP subagent which required the OSA/SF to obtain the data.

With the release of the OSA-Express Direct SNMP subagent, OSA/SF was no longer required to manage SNMP data for the OSA-Express features when configured in QDIO mode. With the introduction of Direct SNMP subagent support for LCS (see below), Direct SNMP subagent supported has been expanded to include TCP/IP when configuring a LAN Channel Station (LCS) connection when in non-QDIO mode (CHPID type OSE).

Traps and Set now supported: IBM is introducing, today, enhanced support for the OSA-Express Direct SNMP subagent to include **Traps** and **Set,** in addition to the previously released **Get** and **GetNext** support. Support for Traps and Set helps network managers to seamlessly integrate the zSeries OSA-Express features with the overall SNMP management strategy.

Trap support allows the SNMP manager to asynchronously receive an alert when one or more conditions are met, thus enabling a central source access to all information relating to the network connections. Direct SNMP users may configure the manager to send a Trap notification when the status of an OSA-Express port has changed.

Set support allows an SNMP manager to change a value identified by an Object Identifier (OID) in the OSA-Express Management Information Base (MIB). The initial object made settable in this implementation is the ability to set Traps on/off. Setting Traps "off" can be helpful if excessive Traps are being reported at the SNMP console.

Trap and Set support applies to all of the OSA-Express features supported on z890 and z990 when configured in QDIO mode (CHPID type OSD). Refer to the **Software requirements** section of this announcement for further information.

OSA-Express Direct SNMP subagent support for LCS: IBM is introducing, today, expanded support for Direct Simple Network Management Protocol (SNMP) to now include TCP/IP when configuring a LAN Channel Station (LCS) connection. This applies to the non-QDIO mode (CHPID type OSE) when carrying TCP/IP traffic.

This support applies to all of the OSA-Express features supported on z890 and z990, and at availability will be exclusive in z/OS to z/OS V1.6. Direct SNMP for LCS when configured in non-QDIO mode supports the same SNMP requests and alerts offered in QDIO mode ─Get, GetNext, Trap, Set.

In the past, Direct SNMP subagent support was exclusive to the QDIO mode (CHPID type OSD). Refer to the **Software requirements** section of this announcement for further information.

Performance data reflecting OSA-Express utilization: In May 2003, IBM announced a usability enhancement via the Direct SNMP subagent to return performance data, in individual objects, for each image reflecting OSA-Express utilization without the need to "decode" a larger object that previously contained all of the information. The information returned includes the percentage of time the microprocessor was utilized to transfer data, as well as the number of inbound and outbound packets.

This support applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD). Refer to the **Software requirements** section of this announcement for further information.

Summarizing the OSA-Express Direct SNMP subagent support offered via the OSA-Express features that is available via zSeries 890 Licensed Internal Code (LIC):

- **Get** and **GetNext** requests.

  This support was introduced in April 2002.

  - Applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

- **dot3StatsTable.**

  Ethernet data for dot3StatsTable was first introduced in May 2003, and applies to the SNMP EtherLike MIB module in RFC 2665 which provides statistics for Ethernet interfaces. These statistics can assist in the analysis of network traffic congestion.

  - Applies to all of the Ethernet features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

- **Performance data** reflecting OSA-Express utilization was first introduced in May 2003.

  - Applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

- **Traps** and **Set** is introduced in this announcement.

  - Applies to all of the OSA-Express features supported on z890 and z990 when configured in QDIO mode (CHPID type OSD).

- **Direct SNMP support for LCS**, introduced in this announcement.

  - Applies to all of the OSA-Express features supported on z890 and z990 when configured in non-QDIO mode (CHPID type OSE) supporting TCP/IP applications only and the same SNMP requests and alerts offered in QDIO mode ─ Get, GetNext, Trap, Set.

  - Applies in z/OS exclusively to the z/OS V1.6 environment.

For more information on SNMP support as well as the applicable features and modes of operation, refer to the *Open Systems Adapter-Express Customer's Guide and Reference* (SA22-7935). Refer also to the **Software requirements** section of this announcement.

The zSeries 890 May 2004 LIC includes support for the following:

- Get and GetNext

- dot3StatsTable

- New Gigabit Ethernet features

- New 1000BASE-T Ethernet feature

- Logical Channel SubSystems (LCSSs)

- Updated performance table with more detailed information

- Traps and Set

- Direct SNMP for LCS when configured in non-QDIO mode

Note: Direct SNMP for LCS when configured in non-QDIO mode is planned to be available in the z/OS V1.6 timeframe.

The OSA-Express Direct SNMP subagent MIB information can be found on Resource Link.

If you subscribe to the document *OSA-Express Direct SNMP subagent MIB module*, you will receive e-mail notification of document changes.

OSA-Express usability enhancement ─ Port name relief: When configuring an OSA-Express feature in QDIO mode (CHPID type OSD), specification of a PORTNAME is no longer required as part of the operating system configuration and can be omitted if not needed by the operating system. For compatibility purposes, OSA-Express will now permit activation with or without a PORTNAME.

Prior to this change, operating system administrators that wished to share an OSA-Express were required to coordinate the configuration of the PORTNAME (configure matching names). If a mismatch occurred, activation would fail. To avoid the coordination effort when multiple operating systems share an OSA-Express, this usability enhancement has been introduced.

Operating Systems notes:

1. z/OS

   z/OS Communications Server (z/OS CS) still requires the use of the OSA-Express PORTNAME. The PORTNAME must be the same among all z/OS systems (or any operating system that still uses PORTNAME) sharing the OSA-Express CHPID.

2. z/VM

   In a z/VM environment when using a guest LAN with a simulated OSA-Express QDIO feature, the PORTNAME may now be omitted when configuring the device. For example, in z/VM TCPIP the PORTNAME is specified on the OSD DEVICE statement and now may be omitted. Linux on zSeries guests may now omit the PORTNAME in the add_parms command of the qeth interface parameters.

   For z/VM V4.3 corequisites refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket. This function is integrated in z/VM V4.4.

3. Linux on zSeries images may now omit the PORTNAME in the add_parms command of the qeth interface parameters. Refer to the **Software requirements** section of this announcement.

This usability enhancement is supported on all of the OSA-Express features offered on z800, z900, z890, and z990. This support is applicable to all of the OSA-Express features in QDIO mode (CHPID type OSD).

Introducing new OSA-Express GbE features on z800: New OSA-Express Gigabit Ethernet (GbE) features are being introduced on z800, to replace the currently available OSA-Express GbE features. OSA-Express GbE LX feature number 1364 replaces feature number 2364. OSA-Express GbE SX feature number 1365 replaces feature number 2365. The functions of these new OSA-Express GbE features are equal to the functions currently available on z800. There are no changes. Refer to the z800 *Sales Manual* for details on these features. There are no unique software requirements.

These new GbE features have a new connector type, LC Duplex, replacing the current SC Duplex connector. This conforms to the fiber optic connectors currently in use for the ISC-3 and FICON Express features on z800.

When feature numbers 1364 and 1365 are made available third quarter, 2004, feature numbers 2364 and 2365 will no longer be orderable. There are no unique software dependencies for the new OSA-Express GbE features on z800.

OSA-Express Token Ring outlook: The demand for Token Ring in mainframe environments continues to decline. IBM zSeries is seeing an increasing shortage of Token Ring components as suppliers discontinue the manufacture of Token Ring.

A migration from a Token Ring to an Ethernet environment should be a part of all long-term LAN planning.

OSA-Express ATM no longer supported: The OSA-Express Asynchronous Transfer Mode (ATM) features are not supported on z890. ATM is not offered as a new build option on z890 and ATM is not offered on an upgrade from z800. This is consistent with the Statement of General Direction in Hardware Announcement 102-123, dated April 30, 2002.

If ATM connectivity is still desired, a multiprotocol switch or router with the appropriate network interface (for example, 1000BASE-T Ethernet, Gigabit Ethernet) can be used to provide connectivity between the z890 and an ATM network.

Further integration of cryptographic support with z890

New cryptographic function on every Central Processor (CP): To achieve the required throughput and implement new functions while maintaining balanced usage of server resources, integrated hardware is key. zSeries introduces the Message Security Assist Architecture along with the new CP Assist for Cryptographic Function (CPACF) delivering cryptographic support on every CP ─ data encryption and decryption with support of Data Encryption Standard (DES), Triple Data Encryption Standard (TDES), and Secure Hash Algorithm-1 (SHA-1). This offers balanced use of server resources and is designed to provide unprecedented scalability ─ a z890 can have from one to four CPs, depending upon capacity setting, and data rates at up to 1.8X or more faster than the CMOS Cryptographic Coprocessor Facility (CCF). Since these cryptographic functions are implemented in each and every CP, the association of cryptographic functions to specific CPs, as was done with previous generations of zSeries, is eliminated.

The DES and TDES functions use clear key values. The SHA-1 function is shipped enabled. However, DES and TDES functions require enablement of the CPACF function (#3863) for export control.

For IBM and customer-written programs, the CPACF for DES, TDES, and SHA-1 functions can be invoked by five new problem state instructions as defined by an extension to the zSeries architecture.

Refer to the **Software requirements** section of this announcement for further information.

PCIXCC for more secure encrypted transactions with higher performance: The PCIX Cryptographic Coprocessor (PCIXCC) (#0868) is a replacement for the PCI Cryptographic Coprocessor (PCICC) (#0861) and the CMOS Cryptographic Coprocessor Facility that were offered on z800. All of the equivalent PCICC functions that are implemented are designed to offer higher performance. In addition, the functions on the CMOS Cryptographic Coprocessor Facility used by known applications have also been implemented in the PCIXCC feature. All LPARs in all LCSSs have access to the

PCIXCC, up to 16 LPARs per feature. While a PCIXCC feature occupies an I/O slot it does not use CHPIDs.

The PCIXCC feature supports:

- Cryptographic functions
- Use of encrypted key values
- User-Defined Extensions

The CPACF feature (#3863) must be enabled to use the PCIXCC feature. Refer to the **Software requirements** section of this announcement for further information.

z/VM V5.1 provides dedicated-queue support for secure key and clear key cryptographic functions for z/OS guests and shared-queue and dedicated-queue support for clear key cryptographic functions for Linux guests, with up to 256 dedicated queues, using the PCIXCC feature. z/VM guest support for the PCIXCC feature satisfies the Statement of General Direction in Software Announcement 203-128, dated May 13, 2003, and Hardware Announcement 103-142, dated May 13, 2003.

Linux on zSeries support for the PCIXCC feature was delivered as an Open Source contribution in January 2004, via

> **http://www10.software.ibm.com/developerworks/ opensource/linux390**

Linux on zSeries support for the PCIXCC feature satisfies the Statement of General Direction in Hardware Announcement 103-142, dated May 13, 2003.

Refer also to the **Software requirements** section, **Supplemental** section, and **Limitations** section of this announcement for further information. Refer to the *Sales Manual* for a complete description of the PCIXCC feature.

PCIXCC User-Defined Extensions to support unique requirements: User-Defined Extensions to the Common Cryptographic Architecture (CCA) support program that executes within the PCIX Cryptographic Coprocessor are expected to be supported via an IBM Service Offering. For unique customer applications, the PCIX Cryptographic Coprocessor will support the loading of customized cryptographic functions on z890. Support is available via ICSF and the z990 and z890 Enhancements to Cryptographic Support Web deliverable.

Under a special contract with IBM, PCIX Cryptographic Coprocessor customers will gain the flexibility to define and load custom cryptographic functions themselves. This service offering can be requested via the IBM "Cryptocards" Web site by selecting the "Custom Programming" option.

> **http://www.ibm.com/security/cryptocards/**

The Web site will direct your request to an IBM Global Services (IGS) location appropriate for your geographic location. A special contract will be negotiated between you and IGS, covering development of the UDX by IGS per your specifications as well as an agreed-upon level of the UDX. The contract may also include e-mail, telephone, or on-site support if negotiated (IGS may subcontract any piece of this work to a third-party vendor).

The CP Assist for Cryptographic function (#3863) is a prerequisite when ordering the PCICA and PCIXCC features and utilizing any of the functions/enhancements identified in this announcement.

PCIXCC support for double length DUKPT: Derived Unique Key Per Transaction (DUKPT) is a key management method that allows you to write applications that implement the DUKPT algorithm as defined by the ANSI X9.24 standard, providing added security for point of sale transactions. At introduction, IBM supported single length DUKPT on zSeries 990. Now, IBM is introducing support for double length DUKPT on the z890 and z990 for the PCIXCC feature. This support on OS/390 and z/OS is exclusive to the OS/390 V2.10, z/OS, and z/OS.e environments and is part of the ICSF Web deliverable z990 and z890 Enhancements to Cryptographic Support. Refer to the **Software requirements** section of this announcement for further information.

PCIXCC support for EMV 2000 Standard: Europay Mastercard and Visa (EMV) support allows you to write applications that comply with the EMV 2000 standard, which is used for financial transactions among heterogeneous hardware and software. Support for the EMV 2000 standard applies only to the PCIXCC feature and to z890 and z990. This support on OS/390 and z/OS is exclusive to the OS/390 V2.10, z/OS, and z/OS.e environments and is part of the ICSF Web deliverable z990 and z890 Enhancements to Cryptographic Support. Refer to the **Software requirements** section of this announcement for further information.

PCICA and PCIXCC support for PKD service enhancement: The Public Key Decrypt (PKD) service has been upgraded to support a Zero-Pad option for clear RSA private keys. With this support, PKD can be used as an accelerator for raw RSA private operations, including the use of CRT format keys. This enhancement applies to z890 and z990, to the OS/390 V2.10, z/OS, and z/OS.e environments, and is part of the ICSF Web deliverable z990 and z890 Enhancements to Cryptographic Support. Refer to the **Software requirements** section of this announcement for further information.

PCICA and PCIXCC support for PKE service enhancement: The Public Key Encrypt (PKE) service has been enhanced to support the Mod_Raised_to Power (MRP) function. The MRP function can be used to offload the compute-intensive portion of the Diffie-Hellman protocol for both the PCICA and PCIXCC features for improved performance and more efficient use of CP resources. This enhancement on OS/390 and z/OS, applies to z890 and z990, and is exclusive to the OS/390 V2.10, z/OS, and z/OS.e environments, and is part of the ICSF Web deliverable z990 and z890 Enhancements to Cryptographic Support. Refer to the **Software requirements** section of this announcement for further information.

PCICA — Continued cryptographic support for e-business environments: The PCI Cryptographic Accelerator (PCICA) feature, supported on z800, is available on z890 and may be carried forward on upgrades from z800 to z890. This hardware-based cryptographic solution continues to address the Secure Sockets Layer (SSL) performance needs of on demand businesses. The SSL and Transport Layer Security (TLS) protocols are essential and widely used protocols to help support secure e-business applications. Compute-intensive public key cryptographic processes as used by SSL/TLS can be offloaded from the host to the PCICA feature to help reduce CP usage and to increase system throughput. All LPARs in all LCSSs have access to the PCICA, up to 30 LPARs per feature. While a PCICA feature occupies an I/O slot it does not use CHPIDs.

The new z890 server is designed to provide increased secure Web transaction performance by supporting up to 2,900 SSL handshakes per second when running on a properly configured system. The SSL rate was achieved with a z890 with four processors and four PCICA cards (two features), May 2004 licensed internal code, z/OS

V1R5 with z890 support, ICSF FMID HCR 770A, and SSL R14 driver. These measurements are examples of the maximum transactions per second achieved in a lab environment with no other processing occurring and do not represent actual field measurements. Details are available upon request. To enable the use of the PCICA feature, the CPACF feature (#3863) must be installed.

Beginning with z/VM V4.2, z/VM support of PCICA provides clear key RSA support for a considerably large number of Linux guests enabling hardware SSL acceleration. z/VM V5.1 will provide dedicated-queue support for clear key cryptographic functions for z/OS guests and shared-queue support for clear key cryptographic functions for Linux guests.

With VSE/ESA V2.7 and IBM TCP/IP for VSE/ESA V1.5, support is offered for the PCICA feature.

Refer to the **Supplemental** section, **Limitations** section, and **Software requirements** section of this announcement for further information on the PCICA feature. Refer to the *Sales Manual* for a complete description of the PCICA feature.

Trusted Key Entry (TKE) 4.1 code level workstation: The TKE 4.1 code level workstation is an optionally priced feature that provides a basic key management system. The key management system allows an authorized person a method for key identification, exchange, separation, update, backup, and management. The TKE workstation is a tool for security administrators to use in setting up and establishing the security policy and placing it into production. The TKE feature is a combination of workstation hardware and software networked-connected to z890. The TKE workstation and 4.1 code level are designed to provide a security-rich, flexible method of providing master key entry (and now operational key entry), and to locally and remotely manage Cryptographic Coprocessor features.

TKE 4.1 code level for secure operational key entry: The TKE 4.1 code now provides a security-rich local and remote method of providing operational key entry, along with the master key entry that was previously announced. This support applies to the Cryptographic Coprocessor features and is exclusive to z890 and z990.

Operational key entry via the TKE workstation satisfies the Statement of General Direction in Hardware Announcement 103-142, dated May 13, 2003. Customers with TKE 3.X installed workstations may carry them forward to control legacy systems only. An update from TKE 3.0 or TKE 3.1 code levels to TKE 4.1 code level is required to control the z890. To use the TKE function, the PCIX Cryptographic Coprocessor (PCIXCC) feature, the TKE 4.1 code level, and the CP Assist for Cryptographic Function (CPACF) must be installed.

z890 cryptographic migration: The IBM PCI Cryptographic Accelerator (#0862) is supported on z890, and can be carried forward on an upgrade from z800.

Refer to the **Software requirements** section of this announcement for Web deliverables to support PCICA and TKE and exploit PCIXCC.

Fiber optic cabling services from IBM Networking Services

Fiber optic cabling complexity continues to be a reality of the Information Technology (IT) infrastructure as diverse protocols (ESCON, FICON, FCP, Gigabit Ethernet) and industry-standard small form factor (SFF) connectors continue to proliferate in the enterprise. If your enterprise has multiple generations of products, the problem can be exacerbated. Even more critical is the availability of skills and dedicated personnel tasked to support the short-term as well as the long-term requirements of the IT infrastructure in addition to supporting the open systems e-business environment.

To satisfy the cabling requirements of z800, z900, z890, and z990, **IBM Networking Services** has fiber optic cabling services. **IBM Network Integration and Deployment Services for zSeries fiber cabling** provides planning and installation services for individual fiber optic connections. **IBM Network Integration and Deployment Services for enterprise fiber cabling** provides planning for IBM Fiber Transport System trunking components and installation services for small, medium, and large enterprises.

Refer to Services Announcement 603-012, dated May 13, 2003.

IBM Networking Services is continually working to help ensure IBM has a comprehensive set of services geared for today and tomorrow. These services take into consideration the requirements for all of the protocols and media types supported on zSeries (for example, ESCON, FICON, Coupling Links, OSA), whether the focus is the data center, the Storage Area Network (SAN), the Local Area Network (LAN), or the end-to-end enterprise.

Fiber optic cabling services from **IBM Networking Services** make the most of your cabling investments. IBM has the skills to facilitate the design and installation of your cabling with the consulting services so critical when the clock matters. Knowing that new installations, upgrades, and relocations require intelligent execution, IBM offers comprehensive solutions to help reduce the complexity and simplify the process. The **zSeries fiber cabling services** and **enterprise fiber cabling services** have been designed to solve the IT infrastructure dilemmas at the product level and the enterprise level.

These services can meet the needs of your server configurations be they small, medium, or large. IBM connectivity experts will help you select the option that is best suited to achieve your business goals, and to simplify the zSeries deployment with effective on-site fiber optic cable planning and installation support.

Fiber optic cables, cable planning, labeling, and installation are all customer responsibilities for new z890 installations and upgrades. Fiber optic conversion kits and Mode Conditioning Patch (MCP) cables are not orderable as features on z890. Installation Planning Representatives (IPRs) and System Service Representatives (SSRs) will not perform the fiber optic cabling tasks without a services contract.

Under the **zSeries fiber cabling services** umbrella there are **three** options to provide individual fiber optic cables (jumper cables, conversion kits, MCP cables) for connecting to z800, z900, z990, or z890.

- Option 1 — Fiber optic jumper cabling package. IBM does the detailed planning. This option includes planning, new cables, installation, and documentation. An analysis of the zSeries channel configuration, I/O devices, and any existing fiber optic cabling is required to determine the appropriate fiber optic cables.

- Option 2 — Fiber optic jumper cable migration and reuse for a zSeries upgrade. This option includes planning, reuse of existing cables, and documentation. IBM organizes the existing fiber optic cables based upon the new z890 connection details. Relabeling, rerouting, and reconnection to the appropriate z890 channels are performed. New cables are not offered as a part of this option.

- Option 3 — Fiber optic jumper cables and installation. You tell us what you need. You do the detailed planning. The service includes new cables, installation, and documentation. Planning and providing the list of required cables are customer responsibilities.

Options 1 and 2 can be combined within one statement of work to provide comprehensive upgrade coverage.

Under the **enterprise fiber cabling services** umbrella there are **two** options to provide fiber optic trunk cables (fiber optic trunk cables, fiber harnesses, panel-mount boxes) for connecting to the z800, z900, z890, and z990.

- Option 1 — zSeries fiber optic trunk cabling package. IBM can reduce the cable clutter under the floor. An analysis of the zSeries (z800, z900, z890, and z990) channel configuration and any existing fiber optic cabling is performed to determine the required FTS fiber optic trunking commodities (trunk cables, harnesses, panel-mount boxes). This option includes zSeries planning, FTS fiber optic trunking commodities, installation, and documentation. This option does not include enterprise-level planning.

- Option 2 — Enterprise fiber cabling services. IBM organizes the entire enterprise zSeries cabling. This option includes enterprise planning, new cables, fiber optic trunking commodities, installation, and documentation. This is the most comprehensive set of services of the two options.

A comprehensive evaluation of the enterprise helps to ensure your long-term planning goals can be achieved.

Enterprise fiber cabling services employ the use of a proven modular cabling system, the Fiber Transport System (FTS), which includes trunk cables, zone cabinets, and panels for your servers, directors, and storage devices.

FTS supports Fiber Quick Connect (FQC), a fiber harness integrated in the zSeries frame for "quick" connect, which is offered as a feature on zSeries for connection to ESCON channels.

Whether you choose a packaged service or a custom service, high-quality components are used to facilitate moves, adds, and changes in the enterprise to help prevent extending your maintenance "window."

Refer to the Planning information, **Cabling responsibilities** section of this announcement for more information or contact IBM Global Services for details.

Parallel Sysplex marches on

Enhancing the scalability of Parallel Sysplex

Coupling Facility Control Code (CFCC) level 13: A new CFCC level available for the z890, CFCC level 13 provides Parallel Sysplex availability and performance enhancements.

CFCC enhanced patch apply: The CFCC patch apply process has been enhanced to eliminate the need for a power on reset (POR) of the z890 to apply a "disruptive" CFCC patch. This enhancement provides you the ability to:

- Selectively apply the new patch to one of possibly several CFs running on a z890. For example, if you have a CF that supports a test Parallel Sysplex and a CF that supports a production Parallel Sysplex on the same z890, you now have the ability to apply a "disruptive" patch to only the test CF without affecting the production CF. After you have completed testing of the patch, it can be applied to the production CF as identified in the example.

- Allows all other LPARs on the z990 where a "disruptive" CFCC patch will be applied to continue to run without being impacted by the application of the "disruptive" CFCC patch.

This enhancement does not change the characteristics of a "concurrent" CFCC patch, but does significantly enhance the availability characteristics of a "disruptive" CFCC patch by making it much less disruptive.

Previously, small enhancements or "fixes" to the CFCC were usually distributed as a "concurrent" patch that could be applied while the CF was running. Occasionally, a CFCC patch was "disruptive." When such a "disruptive" change needed to be applied to a CF, it required a POR of the server where the CF was running. This was especially disruptive for those enterprises that had chosen to use internal CFs, because a POR of the server affects the CF where the change was to be applied and all other LPARs running on the same server. Further, if an enterprise was using multiple internal CFs on the same server (to support both a test and production configurations, for example), there was no way to selectively apply the "disruptive" patch to just one of the CFs — once applied, all the CFs on the server had the change. Consequently, the application of the "disruptive" CFCC patch was very disruptive from an operations and availability perspective.

Additional CFCC enhancements: CFCC level 13 also provides changes that will affect different software environments that run within a Parallel Sysplex. For example, DB2 data sharing is expected to see a performance improvement, especially for cast-out processing against very large DB2 group buffer pool structures.

Enhancing the availability of Parallel Sysplex: z890 fully supports System-Managed CF Structure Duplexing. This is a set of architectural extensions to Parallel Sysplex in support of duplexing of Coupling Facility structures for high availability. All three structure types — cache structures, list structures, and locking structures — can be duplexed using this architecture.

The IBM technical paper *System Managed CF Structure Duplexing* (GM13-0103) includes information about:

- The cost/benefit trade-offs in duplexing

- Determining which structures should be duplexed in a specific Parallel Sysplex

This paper is available at

http://www.ibm.com/server/eserver/zseries/pso

z890 Coupling Link options for Parallel Sysplex

ICs, ICBs, and ISC-3 on z890: Like its predecessor, z890 supports Internal Coupling Channels (ICs), Integrated Cluster Bus (ICB), and InterSystem Channel-3 (ISC-3) for passing information back and forth in a Parallel Sysplex environment. These technologies are all members of the family of Coupling connectivity options available on z890.

Internal Coupling Channels (ICs) are for internal communication between Coupling Facilities and to other CFs or to z/OS images on the same server. ICs (CHPID type ICP) can be defined as spanned channels and can be shared among LPARs within and across LCSSs.

Integrated Cluster Buses (ICBs) are used for server-to-server communication over short distances.

The newest ICB member, ICB-4, supports a link data rate of 2 gigabytes per second (GBps), compared to ICB-3, which supports a link data rate of 1 GBps. ICBs carry traffic over 10 meter (33 feet) copper cables, of which 3 meters is reserved for intra-server connection. ICB-3s and ICB-4s (CHPID type CBP) can be defined as spanned channels and can be shared among LPARs within and across LCSSs. z890 supports ICB-3 and ICB-4. z890 does not support ICB-2.

InterSystem Channel-3s (ISC-3s) are used for server-to-server communication over long distances ─up to an unrepeated distance of 20 kilometers. ISC-3 supports a link data rate of 2 gigabits per second (Gbps) and carries traffic over 9 micron single mode fiber optic cabling. If the ISC-3 link is connected to another zSeries server and defined as a peer (CFP) mode channel, the link operates in peer mode, and the link is capable of 2 Gbps. The peer mode is used between zSeries servers only. If the link is connected to a coupling-capable server (G5/G6) which is not a zSeries and is defined as a sender/receiver (CHPID types CFS/CFR) channel, the link operates in compatibility mode, and the link is capable of 1 Gbps. The compatibility mode is used between a zSeries server and 9672 coupling-capable servers. ISC-3s (CHPID type CFS ─ Coupling Sender, compatibility mode, or CHPID type CFP ─ peer) can be defined as spanned channels and can be shared among LPARs within and across LCSSs.

Up to a 100% increase in ISC-3 physical connectivity versus z800: To continue to provide "horizontal" growth opportunities for Parallel Sysplex solutions, zSeries 890 is doubling the number of InterSystem Channel-3 (ISC-3) links, now supporting 48 ISC-3 link in peer mode ─ 12 features (four links per feature) versus the 24 ISC-3 links in peer mode offered on z800.

The family of Coupling Link options available on z890 is as follows:

Coupling Link options summary

Link type	Name	Communication use	Maximum links
IC	Internal Coupling channel	Internal between CFs and z/OS LPARs	32
ICB-3	Integrated Cluster Bus-3	Server-to-server z890 to z800, z900	16
ICB-4	Integrated Cluster Bus-4	Server-to-server z890 to z890, z990	8
ISC-3	InterSystem Channel-3	Server-to-server	48

1. The maximum number of Coupling Links combined (ICs, ICB-3s, ICB-4s, and active ISC-3 links) cannot exceed 64 per server.

2. A maximum of 48 ISC-3s can be defined in peer mode (operating at a link data rate of 2 Gbps) and a maximum of 32 ISC-3s can be defined in compatibility mode (operating at 1 Gbps, instead of 2 Gbps).

3. An ISC-3 feature on a z890 can be connected to another zSeries server in peer mode (CHPID type CFP) operating at 2 Gbps or to a HiPerLink (ISC-2) on a G5/G6 in compatibility mode (CHPID type CFS/CFR ─ sender/receiver) operating at 1 Gbps.

Refer to the *Sales Manual* for a complete description of all of the Coupling Link options. There are unique cables for ICB-3 and ICB-4. Refer to the *Sales Manual* for additional information on these cables.

Geographically Dispersed Parallel Sysplex (GDPS) enhancements

GDPS, an industry-leading e-business continuity solution, is a multisite solution that is designed to provide the capability to manage the remote copy configuration and storage subsystems, automate Parallel Sysplex operational tasks, and perform failure recovery from a single point of control, thereby helping to improve application availability. GDPS supports both the synchronous Peer-to-Peer Remote Copy (PPRC), as well as the asynchronous Extended Remote Copy (XRC) forms of remote copy. Depending on the form of remote copy, the solution is referred to as GDPS/PPRC or GDPS/XRC.

GDPS/PPRC and GDPS/XRC have been enhanced to include new functions.

GDPS/PPRC HyperSwap*™ *function: The GDPS/PPRC HyperSwap function is designed to broaden the availability attributes of GDPS/PPRC by extending the Parallel Sysplex redundancy to disk subsystems.

The **Planned HyperSwap** function provides the ability to:

- Transparently switch all primary PPRC disk subsystems with the secondary PPRC disk subsystems for a planned reconfiguration

- Perform disk configuration maintenance and planned site maintenance without requiring any applications to be quiesced

The Planned HyperSwap function became generally available December 2002.

The **Unplanned HyperSwap** function contains additional function to transparently switch to use secondary PPRC disk subsystems in the event of unplanned outages of the primary PPRC disk subsystems or a failure of the site containing the primary PPRC disk subsystems.

The Unplanned HyperSwap function allows:

- Production systems to remain active during a disk subsystem failure. Disk subsystem failures will no longer constitute a single point of failure for an entire Parallel Sysplex.

- Production servers to remain active during a failure of the site containing the primary PPRC disk subsystems if applications are cloned and exploiting data sharing across the two sites. Even though the workload in the second site will need to be restarted, an improvement in the Recovery Time Objective (RTO) can be accomplished.

The Unplanned HyperSwap function became generally available February 2004.

GDPS/PPRC management for open systems Logical Unit Numbers (LUNs): GDPS/PPRC technology has been extended to manage a heterogeneous environment of z/OS and open systems data. If installations share their disk subsystems between the z/OS and open systems platforms, GDPS/PPRC, running in a z/OS system, can manage the PPRC status of devices that belong to the other platforms and are not even defined to the z/OS platform. GDPS/PPRC will also provide data consistency across both z/OS and open systems data.

GDPS/PPRC management of open systems LUNs became generally available February 2004.

GDPS supports PPRC over Fibre Channel links: In 2003, IBM TotalStorage® Enterprise Storage Server (ESS) announced support of PPRC over Fibre Channel for the ESS Model 800. Refer to Hardware Announcement 103-298, dated October 14, 2003.

This support is designed to provide improved throughput (compared to ESCON), and a reduction in cross-site connectivity (two PPRC Fibre Channel links per ESS are considered sufficient for most customer workloads).

One of the potential benefits of this support is the ability for customers to increase the distance between sites while maintaining acceptable performance. GDPS/PPRC support for PPRC over Fibre Channel became generally available February 2004.

GDPS supports FlashCopy® v2 elimination of the LSS constraint: In 2003, IBM TotalStorage Enterprise Storage Server (ESS) announced support of FlashCopy v2. Refer to Hardware Announcement 103-141, dated May 13, 2003. Prior to this announcement, both source and target volumes had to reside on the same logical subsystem (LSS) within the disk subsystem. Since this constraint has been removed with FlashCopy v2, GDPS will now allow a FlashCopy from a source in one LSS to a target in a different LSS within the same disk subsystem. This new flexibility can help simplify administration and capacity planning for FlashCopy.

GDPS/PPRC support for FlashCopy v2 became generally available February 2004.

GDPS/PPRC and Cross-site Parallel Sysplex distance extended to 100 km: On October 31, 2003, IBM delivered, via a Request for Price Quote (RPQ), the capability to configure GDPS/PPRC or a multi-site Parallel Sysplex up to a distance of 100 kilometers (62 miles) between two sites. This extended distance can potentially decrease the risk that the same disaster will affect both sites, thus permitting enterprises to recover production applications at another site.

Support has been extended up to a distance of 100 km from the current capability of 50 km (31 miles) for:

- External Time Reference (ETR) links

  - An ETR link on a zSeries or S/390 server provides attachment to the Sysplex Timer®.

- InterSystem Channel-3 (ISC-3) links operating in peer mode

  - ISC-3 links, supported on all zSeries servers, connect z/OS and OS/390 systems to Coupling Facilities in a Parallel Sysplex environment.

The extended distance support for ETR and ISC-3 links is now consistent with other cross-site link technologies that currently support 100 km between two sites (such as FICON, Peer-to-Peer Remote Copy [PPRC], Peer-to-Peer Virtual Tape Server [PtP VTS]).

It should be noted that the maximum fiber optic cable distance between a pair of Sysplex Timers in an Expanded Availability configuration remains at 40 km (25 miles). Therefore, to achieve the extended distance of 100 km between sites, one of the options to be considered is locating one of the Sysplex Timers in an intermediary site that is less than 40 km from one of the two sites. Other potential options can be evaluated when the RPQ request is submitted to IBM for review.

Coordinated near continuous availability and disaster recovery for Linux guests: GDPS plans to exploit the new z/VM HyperSwap function to provide a coordinated near continuous availability and disaster recovery solution for z/OS and Linux guests running under z/VM. z/VM 5.1 provides a new HyperSwap function, so that the virtual device associated with one real disk can be swapped transparently to another. HyperSwap can be used to switch to secondary disk storage subsystems mirrored by PPRC. This solution is especially valuable for customers who share data and storage subsystems between z/OS and Linux on zSeries — for example, a SAP application server running on Linux on zSeries and a SAP DB server running on z/OS. HyperSwap can also be helpful in data migration scenarios to allow applications to migrate to new disk volumes without requiring them to be quiesced.

GDPS/PPRC will provide the reconfiguration capabilities for the Linux on zSeries systems and data in the same manner it does for z/OS systems and data. To support planned and unplanned outages, GDPS provides the following recovery actions:

- In-place re-IPL of failing operating system images

- Site takeover/failover of a complete production site

- Coordinated planned and unplanned HyperSwap of disk subsystems, transparent to the operating system images and applications using the disks

This innovative continuous availability and disaster recovery solution requires IBM Tivoli® System Automation for Linux, and z/VM V5.1 in addition to the other GDPS/PPRC prerequisites.

Performance enhancements for GDPS/PPRC and GDPS/XRC configurations: Concurrent activation of Capacity Backup Upgrade (CBU) can now be performed in parallel across multiple servers, which results in an improved RTO. This improvement applies to both the GDPS/PPRC and GDPS/XRC configurations.

In a GDPS/XRC configuration, it is often necessary to have multiple System Data Movers (SDMs). The number of SDMs is based on many factors, such as the number of volumes being copied and the I/O rate. Functions are now capable of being executed in parallel across multiple SDMs, thus providing improved scalability for a coupled SDM configuration.

Analysis has shown that PPRC commands issued by GDPS will generate a large number of Write to Operator messages (WTOs) that may cause WTO buffer shortages and temporarily adversely impact system performance. The Message Flooding Automation function will substantially reduce the WTO message traffic and improve system performance by suppressing redundant WTOs.

The CBU and SDM Performance enhancements for GDPS/PPRC and GDPS/XRC became generally available March 24, 2003. The Message Flooding Automation function became generally available February 2004.

These GDPS enhancements are applicable to z800, z900, z890, and z990.

For a complete list of other supported hardware platforms and software prerequisites, refer to the GDPS executive summary white paper, available at

http://www.ibm.com/server/eserver/zseries/pso

SNA Operations Management

With the industry move to TCP/IP networks, Systems Network Architecture (SNA) Operations Management commands will no longer be supported on z890 servers. These commands were previously used by the System Automation for OS/390 product as well as NetView®. It

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is recommended that you now use the Simple Network Management Protocol (SNMP) Application Programming Interfaces (APIs) for your automation needs.

- If you previously used the System Automation for OS/390 product, you must now use Version 2.2 or later. This will allow you to define an automation policy for SNMP APIs rather than a policy for SNA Operations Management commands.

- If you directly used the SNA Operations Management commands on NetView, you must now use an SNMP agent and the SNMP APIs for systems automation management.

For detailed information on the SNMP APIs commands and environment requirements, refer to *zSeries Application Programming Interfaces* (SB10-7030). For more information on the SNA Operations Management command support that is not offered on z890, refer to *Managing Your Processors* (GC38-0452). Both publications are available via IBM Resource Link.

Reliability, availability, and serviceability

Continuing to provide high availability and reliable operation, z890 delivers features for Reliability, Availability, and Serviceability (RAS).

Processor Unit Sparing: Processor Units (PUs) not purchased by or reserved for a client will be available for transparent sparing and no repair action will be initiated as a result. Reserved, but currently unused PUs may be used for sparing but will generate a repair action. Where there are no available PUs, a failure will cause the client to run degraded by one processor until a repair action can be completed.

Coupling Facility Control Code enhanced patch apply: The Coupling Facility Control Code (CFCC) patch apply process has been enhanced to eliminate the need for a power on reset (POR) of the z890 to apply a "disruptive" CFCC patch. A detailed description can be found in the **Parallel Sysplex marches on** section of this announcement.

Concurrent capacity upgrade: At planned availability, a z890 can leverage the inherent zSeries Capacity Upgrade on Demand (CUoD) capability to be upgraded via the concurrent addition of additional PUs and I/O and limited memory upgrades (24 GB to 32 GB increment) with no disruption to current operations. However, while capacity upgrades to the processor itself are concurrent, your software may not be able to take advantage of the increased capacity without performing an Initial Program Load (IPL).

Sparing for Storage Protect Keys: The robust configuration of the Storage Protect Keys has been enhanced with chip sparing. Already a triple-array with parity protection and voting, the Key structure for z890 has added sparing, similar to Main Memory chip sparing, to further enhance the availability of this critical function.

Failure containment for the Memory Bus Adapter (MBA): MBAs are designed to provide the critical link between the z890 PUs and the I/O subsystem. The Model A04 has two MBAs. In the unlikely event of a catastrophic failure of an MBA chip, the z890 is designed to isolate the failure of that chip such that the remaining MBA chip continues to operate. This helps minimize the impact of a failure and allows for scheduling maintenance. These features give the z890 a very impressive RAS structure.

Software pricing

For updated software pricing, refer to Software Announcement 204-056, dated April 7, 2004, EWLC Tiered Price Structure for IBM @server zSeries and zELC for z890 Capacity Setting 110. In addition, software pricing MSUs for the z890 can be located at the following Web site

http://www-1.ibm.com/servers/eserver/zseries/ library/swpriceinfo/

Resource Link

Resource Link is a customized Web-based solution, helping to provide customers everything needed to plan for, install, and maintain the zSeries 890 and associated software. Simply register for a no-charge Resource Link user ID and password to access product Planning, Education, and Library services.

- Subscribe to Resource Link content for e-mail notification any time content changes.

- Create Personal Folders to organize site information according to your personal interests.

The Resource Link Web address is

http://www.ibm.com/servers/resourcelink

Other Resource Link functions include the use of Forums to collaborate with fellow product owners, links to hardware and software Fixes, hardware and software Problem solving databases, Services for servers, software and solutions, and Tools designed for specific server and software planning, installation, and configuration. Resource Link content includes:

- Customized Planning Aids — Allow for the planning, arrival, and installation of @server hardware on order. All that is needed is an order number and the Configuration Control Number (CCN) to access the planning aids that were customized for a specific order. Included in these planning aids are the feature codes that affect the weight, height, power requirements, cooling, and cables necessary for system installation. The aids also provide customized system information for processor codes and descriptions, system power information, frame requirements, cooling requirements, and hardware management console and support element information.

- Customer Initiated Upgrade (CIU) and On/Off Capacity on Demand (On/Off CoD) — CIU is an IBM Resource Link Web-based solution that enables customers to set up, order, and download microcode for vertical upgrade of processor and/or memory. CIU simplifies planning and installation because no IBM service visit is required to perform the upgrade. With the enhancement of On/Off CoD, customers can add or remove temporary computing capacity as needed, to support fluctuating business cycles, matching computing cost with capacity utilization.

- CHPID Mapping Tool — Downloadable from Resource Link, this tool allows you to map hardware I/O ports on order to your IOCP CHPID definitions. An availability option automatically maps hardware I/O ports to CHPIDs, minimizing single points of failure. Use of this tool is not mandatory, but recommended for all new z890 hardware builds or for upgrades from a z800 to a z890, as well as for making changes to an already installed machine after hardware upgrades that change or increase the number of channels.

- Fiber Cabling Service ─ Provides the cabling connectivity necessary for installing your new z890 server. Because IBM offers a wide range of cables and cabling solutions to meet customer requirements for connecting I/O and networks, this cabling service is available through your IBM service representative from Resource Link.

- Education ─ Use this no-charge, online education to train and refresh skills at the convenience of your enterprise. Product education includes planning, introduction, getting started, and "how to" courses. Learn how to use your IBM server products before your server arrives.

- Library ─ View, print, or download documents on IBM hardware and software products. These documents include product overviews, user's guides, planning information, parts catalogs, and safety documentation. Also available are product and description documents, which contain high-level descriptions of specific microcode driver and version levels for each machine family, including EC changes for the associated Hardware Management Console and Support Element.

- Machine Information ─ View or search for machine information from reports for machines with IBM maintenance agreements. Simply register for machine information on Resource Link and receive authorization to view reports based on machine serial number as well as links to MES content information. The report data is collected from IBM servers on a weekly basis using the Call Home feature, which transmits critical machine data and also detects failures or pending failures.

Additional information

All offers are subject to availability. IBM reserves the right to alter product offerings and specifications at any time without notice. IBM is not responsible for photographic or typographic errors.

IBM makes no representation or warranty regarding third-party products or services.

z890 connectivity summary

There are 28 I/O slots in one I/O cage. Two Logical Channel SubSystems (LCSSs) are supported with a maximum of 256 Channel Path IDentifiers (CHPIDs) per LCSS and per operating system image, and a total of 512 CHPIDs per system.

Per server

Feature name	Minimum features	Maximum I/O slots used by features	Maximum connections	Ports/ channels/ increments per feature	Purchase increments
16-port ESCON	0[1]	28	420 channels *	16[2] channels	4[3] channels
FICON Express	0[1]	20[4]	40 channels *	2 channels	1 feature
STI-3[5]	0	8	NA	2 outputs	NA
ICB-3 link	0[1]	NA	16 links[6]	NA	1 link
ICB-4 link	0[1]	NA[7]	8 links[6]	NA	1 link
ISC-3[8]	0[1]	12	48 links[6]	4 links	1 link[9]
OSA-Express	0	20[4]	40 ports *	2 ports	1 feature
PCICA	0	2[4]	4 accelerator cards	2 accelerator cards	1 feature
PCIXCC	0[10]	4[4]	4 coprocessors	1 coprocessor	1[10] feature

* Except on the smallest sub-uniprocessor equipped capacity setting where less I/O capability is available

1. A minimum of one I/O feature (ESCON, FICON Express) or one Coupling Link (ICB, ISC-3) is required.

2. Each ESCON feature has 16 channels of which 15 channels may be activated. One channel is always reserved as a spare.

3. ESCON channels are purchased in increments of four and are activated via Licensed Internal Code, Configuration Control (LIC CC). Channels are activated equally across all installed 16-port ESCON features for high availability.

4. The maximum quantity of FICON Express, OSA-Express, PCICA, and PCIXCC in combination cannot exceed 20 features per server.

5. The STI-3 distribution card which supports the ICB-3s resides in the I/O cage, occupying one I/O slot. Thus it is listed on this summary chart.

6. The maximum number of Coupling Links combined (ICs, ICB-3s, ICB-4s, and active ISC-3 links) cannot exceed 64 per server.

7. ICB-4s do not require connectivity to a card in the I/O cage. ICB-4s are not included in the maximum feature count for I/O slots.

8. A maximum of 48 ISC-3s can be defined in peer mode (operating at a link data rate of 2 Gbps) and a maximum of 32 ISC-3s can be defined in compatibility mode (operating at 1 Gbps, instead of 2 Gbps).

9. It is recommended that an initial order for ISC-3 include two links. ISC-3 is offered in one link increments. When two links are purchased, two ISC-3 features are shipped and activated links are balanced across ISC-3 features for high availability.

10. PCIXCC feature increments are 0, 2, 3, or 4.

Section 508 of the U.S. Rehabilitation Act

IBM @server z890 is capable on delivery, when used in accordance with IBM's associated documentation, of satisfying the applicable requirements of Section 508 of the Rehabilitation Act of 1973, 29 U.S.C. Section 794d, as implemented by 36 C.F.R. Part 1194, provided that any Assistive Technology used with the Product properly interoperates with it.

Product positioning

The IBM z890 is the latest member of the zSeries family. The z890 servers are intended to provide customers with the power and functionality of the latest zSeries product line, with improved granularity in capacity levels that fit their business. The range of the z890 will be positioned to extend up to 2.2 times higher than our z800 server as well as introducing a lower-capacity entry point than the smallest z800. The z890 is intended to support mission critical enterprise server requirements for e-business transaction processing and data management with the flexibility to respond to changing business demands by allowing it to grow in small or large increments — with your business, run multiple applications — with multiple operating systems if needed, and provide all current zSeries functionality, all on a single server. It is a lower entry price platform for customers who want z/Architecture benefits when running new workloads with Linux or z/OS.e, it is ideal for VSE/ESA customers who have growing traditional workloads along with growing Linux e-business applications, it is ideal for Linux and z/VM customers consolidating workloads onto a single zSeries server. In addition, the z890 offers an excellent application development platform for larger customers or Independent Software Vendors (ISVs) requiring 64-bit z/Architecture and advanced functions like a large number of CHPIDs, LPARs, HiperSockets, or FICON channels.

The z890 will provide a cost-effective and flexible server with the ability to help improve application performance, increase the number of users supported, support more transactions, increase scalability, and consolidate workloads beyond what is available on a z800, in a capacity your business requires.

Statement of general direction

Token Ring on Hardware Management Console, SE, TKE workstation, IBM 2074: The z890 and z990 will be the last zSeries servers to offer Token Ring adapter features on the Hardware Management Consoles, Support Elements (SEs), and Trusted Key Entry (TKE) workstations. The IBM 2074 Model 3 Console Support Controller will be the last controller to offer Token Ring adapter features.

IBM zSeries is making these statements to allow enterprises sufficient opportunity to prepare for a migration to an Ethernet environment.

Hardware Management Consoles: Beginning with the next zSeries server after the IBM @server zSeries z890 and z990, all new Hardware Management Consoles on all currently marketed zSeries servers are intended to become closed platforms. They will only support the Hardware Management Console application and not the installation of other applications such as the IBM ESCON Director and the IBM Sysplex Timer console applications.

When available, the next-generation Hardware Management Console is expected to communicate only with G5 servers and above (Multiprise® 3000, G5/G6, z800, z900, z890, z990).

TCP/IP is intended to be the only communications protocol supported.

OSA-Express Layer 2 support: IBM intends to extend its network virtualization capabilities with updates to OSA-Express, Virtual Switch, and guest LANs. When updated, these facilities will be designed to operate in Layer 2 mode (referring to Layer 2 of the Open Systems Interface [OSI] reference model). This is planned to allow destination and target nodes to be referenced by their Media Access Control (MAC) addresses instead of by Internet Protocol (IP) addresses, which is intended to enable protocol-independent network connectivity. Layer 2 support applies to an OSA-Express feature when configured in QDIO mode (CHPID type OSD). Layer 2 support is expected to be applicable, initially, to the z/VM and Linux on zSeries environments.

ISC-3s in compatibility mode: IBM intends z890 and z990 to be the last family of zSeries servers to support:

- Attachment of ISC-3 links to HiPerLinks (ISC-2) on G5/G6 servers

- Compatibility mode definitions for ISC-3 links (CHPID types CFS and CFR)

All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

Reference information

- Hardware Announcement 102-052, dated February 19, 2002 (IBM @server zSeries 800 Full Family)

- Services Announcement 602-003, dated February 19, 2002 (zSeries Fiber Cabling Service)

- Hardware Announcement 102-123, dated April 30, 2002 (New Models of IBM @server zSeries z900 and New Functions for z800 and z900)

- Hardware Announcement 102-271, dated October 22, 2002 (IBM @server zSeries New Model 0E1 and Non-Raised Floor Support)

- Hardware Announcement 102-323, dated December 3, 2003 (IBM @server zSeries 800 Sub Dyadic Model 0X2)

- Hardware Announcement 103-142, dated May 13, 2003 (IBM @server zSeries z990 a Multipurpose Server for an On Demand World)

- Hardware Announcement 103-280, dated October 7, 2003 (IBM @server zSeries z990 Enhancements: Integral to the On Demand Infrastructure)

- Hardware Announcement 104-118, dated April 7, 2004 (IBM @server zSeries z990 A Multipurpose Server for the On Demand Enterprise)

- Hardware Announcement 104-115, dated April 7, 2004 (Replacement for the Hardware Management Console and Trusted Key Entry Console)

- Software Announcement 204-056, dated April 7, 2004 (EWLC Tiered Price Structure for IBM @server zSeries and zELC for z890 Capacity Setting 110)

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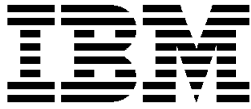
Education support

Your primary source for education on the zSeries® 890 should be the courses provided in the Education section on the Resource Link™ Web site. You may also call IBM Education and Training at 800-IBM-TEACH (426-8322) for other catalogs, schedules, and enrollments.

Publications

The following publications are shipped with the announced product:

Installation Manual	GC28-6826
Service Guide	GC28-6827
Safety Notices	G229-9054
Safety Inspection	GC28-6833

Publications for zSeries 890

Publications for the zSeries 890 can be obtained via Resource Link by accessing

http://www.ibm.com/servers/resourcelink

Using the instructions on the Resource Link panels, obtain a user ID and password. Resource Link has been designed for easy access and navigation.

z890 publication available April 7, 2004, in the Library section of Resource Link:

System Overview: SA22-6832

z890 publications available at general availability in the Library section of Resource Link:

Agreement for Licensed Internal Code	SC28-6822
Application Programming Interfaces	SB10-7030
Capacity Backup User's Guide	SC28-6823
CHPID Mapping Tool User's Guide	GC28-6825
Coupling Facility Channel I/O Interface Physical Layer	SA23-0395
ESCON® and FICON™ Channel-to-Channel Reference	SB10-7034
ESCON Physical Layer	SA23-0394
FICON I/O Interface Physical Layer	SA24-7172
Hardware Management Console Operations Guide (V1.8.2)	SC28-6830
Installation Manual for Physical Planning	GC28-6828
Installation Manual	GC28-6826
IOCP User's Guide	SB10-7037
Maintenance Information for Desktop Consoles	GC38-3115
Maintenance Information for Fiber Optic Links	SY27-2597
Maintenance Information for ThinkPad® Consoles	GC38-3117
Parts Catalog	GC28-6829
Planning for Fiber Optic Links	GA23-0367
PR/SM™ Planning Guide	SB10-7036

Safety Notices	G229-9054
Safety Inspection	GC28-6833
Service Guide	GC28-6827
Standalone IOCP User's Guide	SB10-7040
SCSI IPL ─ Machine Loader Messages	SC28-6839
Support Element Operations Guide (Version 1.8.2)	SC28-6831

The following publication is currently available. To order, contact your IBM representative.

IBM Lotus® Domino™ 6.5 for Linux on zSeries Implementation

Revised: February 23, 2004   ISBN: 0738499471

Explore the book online at

> **http://www.redbooks.ibm.com/abstracts/
> sg247021.html**

The following publication will be available at General Availability on May 28, 2004.

To order, contact your IBM representative.

Title	Order number	Web address
z890 Technical Introduction	SG24-6310	www.redbooks.ibm.com

The Publication Notification System (PNS) is available by order number or product number. Customers currently subscribing to PNS will automatically receive notifications by e-mail. Customers who wish to subscribe can visit the PNS Web site location at

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The IBM Publications Center Portal

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The Publications Center is a WW central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided, as well as payment options via credit card. Furthermore, a large number of publications are available online in various file formats, which can currently be downloaded free of charge.

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Services

Integrated Technology Services (IBM Global Services)

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

IBM Technology Services help you learn about, plan, install, manage, or optimize your IT infrastructure for e-business. We can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

Visit the appropriate link below for details on services available dependent on the brand the product belongs to.

- zSeries

  http://www.ibm.com/services/its/us/mainframe.html

For details on education offerings related to the products listed, visit

  http://www.ibm.com/services/learning/index.html

Select your country, and then select the product as the category.

For more details on IBM Global Services capabilities, contact your IBM representative, or visit

  http://www.ibm.com/services/

Your IBM representative can help you determine availability of standard and customized services.

Technical information

Specified operating environment

Physical specifications

- Width: 785 mm
- Depth: 1577 mm
- Height: 1941 mm
- Weight: 1542 kg (without IBF)
- Weight: 1730 kg (with IBF)
- Machine area: 1.24 meters squared
- Service clearance: 3.03 meters squared

To assure installability and serviceability in non-IBM industry-standard racks, review the installation planning information for any product-specific installation requirements.

Standards: PCIXCC feature designed for FIPS 140-2 Level 4 Certification — October 2003. (**Note:** FIPS 140-2 Level 4 Certification has not yet been achieved.)

The OSA-Express family of LAN adapters conforms to the following standards.

- Ethernet (10BASE-T)
  - IEEE 802.2 Logical Link Control Protocol
  - IEEE 802.3 CSMA/CD Protocol
  - ISO/IEC 8802-3
  - DIX Version 2
- Ethernet (100BASE-TX)
  - IEEE 802.3u CSMA/CD Protocol
- Ethernet (1000BASE-T)
  - IEEE 802.1p
  - IEEE 802.1q
  - IEEE 802.3ab
  - IEEE 802.3ac
  - IEEE 802.3ad
  - IEEE 802.3u
  - IEEE 802.3x
  - PCI v2.2
- Ethernet (1000BASE-SX, 1000BASE-LX)
  - DIX Version 2
  - IEEE 802.1p
  - IEEE 802.1q
  - IEEE 802.3ac
  - IEEE 802.3ad
  - IEEE 802.3x
  - IEEE 802.3z
  - PCI v2.2
- Token Ring
  - IEEE 802.2 Logical Link Control Protocol
  - IEEE 802.5 MAC Protocol
  - ISO/IEC 8802-5

The OSA-Express family of LAN adapters has the following characteristics:

OSA-Express Gigabit Ethernet SX (#1365)

- Data rate: 1000 Mbps (1 Gbps)
- Operating mode: Full duplex
- Channel type: OSD (QDIO)
- Traffic type: TCP/IP only
- Frame size: IEEE 802.3: 1492 bytes
- Frame size: DIX V2: 1500 bytes; for jumbo frame 8992 bytes
- Connector type: LC Duplex
- Port count: Two
- Cable types: Multimode fiber (50 or 62.5 micron)

OSA-Express Gigabit Ethernet LX (#1364)

- Data rate: 1000 Mbps (1 Gbps)
- Operating mode: Full duplex
- Channel type: OSD (QDIO)
- Traffic type: TCP/IP only
- Frame size: IEEE 802.3: 1492 bytes
- Frame size: DIX V2: 1500 bytes; for jumbo frame 8992 bytes
- Connector type: LC Duplex
- Port count: Two
- Cable types: Single mode fiber (9 micron); accommodates reuse of existing multimode fiber (50 or 62.5 micron) when used with a pair of mode conditioning patch (MCP) cables

OSA-Express 1000BASE-T Ethernet (#1366)

- Data rate: 10 Mbps, 100 Mbps, or 1000 Mbps
- Operating modes: Auto-negotiate, half duplex, full duplex
- Channel types: OSD (QDIO) or OSE (non-QDIO) or OSC (OSA-ICC)
- Traffic types: TCP/IP and/or SNA/APPN® /HPR
- Frame size: IEEE 802.3: 1492 bytes

- Frame size: DIX V2: 1500 bytes; for jumbo frame 8992 bytes (when operating at 1 Gbps)

- Connector type: RJ-45

- Port count: Two

- Cable type: EIA™/TIA Category 5 Unshielded Twisted Pair (UTP) cable with a maximum length of 100 meters (328 feet)

OSA-Express Token Ring (#2367)

- Data rate: 4 Mbps, 16 Mbps, or 100 Mbps

- Operating modes: Autosense, 4 Mbps half or full duplex, 16 Mbps half or full duplex, 100 Mbps full duplex

- Channel types: OSD (QDIO) or OSE (non-QDIO)

- Traffic types: TCP/IP and/or SNA/APPN/HPR

- Frame size: 4 Mbps, up to 4550 bytes; 16/100 Mbps, up to 18200 bytes

- Connector types: RJ-45 or DB-9 D shell

- Port count: Two

- Cable types: EIA/TIA Category 5 Unshielded Twisted Pair (UTP) cable with a maximum length of 100 meters (328 feet) and an RJ-45 connector or a Shielded Twisted Pair (STP) cable with a DB-9 D Shell connector

Hardware requirements: For the appropriate peripheral hardware and device attachments, contact your IBM representative.

IBM devices previously attached to IBM S/370™ or S/390® systems are supported for attachment to z890 server channels, unless noted. The subject I/O devices must meet ESCON or FICON architecture requirements to be supported. I/O devices that meet OEMI architecture requirements are supported only via an external converter. Prerequisite Engineering Change Levels may be required. For further details, contact IBM service personnel. While this product supports devices as described above, IBM does not commit to provide support or service for an IBM device that has reached its End of Service effective date as announced by IBM.

Refer to the **Key prerequisites** section of this announcement for additional information regarding how to obtain external converters.

Note: IBM cannot confirm the accuracy of performance, compatibility, or any other claims related to non-IBM products. Questions regarding the capabilities of non-IBM products should be addressed to the suppliers of those products.

New hardware functions and capabilities with the IBM eServer® z890: In addition to the traditional functions of S/390 servers, the z890 when properly configured can provide:

- Up to 32 gigabytes of memory ─ 8 GB, 16 GB, 24 GB, 32 GB.

- Up to 16 gigabytes of bandwidth for data communication between I/O and memory via up to eight Self-Timed Interconnect (STI) host buses.

- One I/O cage with 28 I/O slots (16 on the smallest sub-uniprocessor equipped capacity setting).

- A new Channel SubSystem (CSS). Two Logical Channel SubSystems (LCSSs) can exist for horizontal growth, supporting up to 256 CHPIDs per LCSS for a total of 512 CHPIDs per server.

- Double the number of Logical Partitions (LPARs) ─ now 30 LPARs (15 on the smallest sub-uniprocessor equipped capacity setting).

- Increased channel maximums for ESCON, FICON Express, ISC-3, and OSA-Express (except on the smallest sub-uniprocessor equipped capacity setting).

- Quadruple the number of HiperSockets ─ now 16 internal LANs.

- Three cryptographic options:

  - New CP Assist for Cryptographic Function (CPACF) on every CP.

  - New PCIX Cryptographic Coprocessor (PCIXCC) feature.

  - PCI Cryptographic Accelerator (PCICA) feature.

- Integrated Cluster Bus-4 (ICB-4), up to two times faster than an ICB-3.

- Coupling Facility Control Code (CFCC) Level 13, supporting:

  - CFCC Enhanced Patch Apply.
  - DB2® Performance for cast-out processing.

- Five Processor Units (PUs):

  - One model.

  - Twenty-eight unique capacity settings, offering increased granularity.

  - Up to four Central Processors (CPs). One mandatory System Assist Processor (SAP).

- IBM @server zSeries Application Assist Processor (zAAP).

- Internal Battery Feature (IBF).

Software requirements

Software requirements for zSeries 890

Note: zSeries 890 supports LPAR mode only.

zSeries 890 in the z/OS® and OS/390® environment is supported by the following:

- z/OS and z/OS.e V1.5, and later

- z/OS V1.4 with z/OS V1.4 z990 Exploitation Support feature

- z/OS V1.4 with z/OS V1.4 z990 Compatibility Support feature (no longer orderable)

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence Update feature

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence feature (no longer orderable)

- OS/390 V2.10, z/OS V1.2, z/OS V1.3, and z/OS.e V1.3 with z990 Compatibility for Selected Releases ─ a Web deliverable

  Note: Refer to the z/OS subset of the 2086DEVICE Preventive Service Planning (PSP) bucket prior to installing a z890 server.

- z800, z900, G5/G6, and Multiprise® 3000 servers in a Parallel Sysplex® with a z890 or z990 require the following support when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or a z990

and the LPAR ID of the operating system or CF image is greater than 15 (x"F"):

- z/OS and z/OS.e V1.5, and later

- z/OS V1.4 with z/OS V1.4 z990 Exploitation Support feature

- z/OS V1.4 with z/OS V1.4 z990 Compatibility Support feature (no longer orderable)

- OS/390 V2.10, z/OS V1.2, z/OS V1.3, and z/OS.e V1.3 with z990 Compatibility for Selected Releases — a Web deliverable

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence Update feature

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence feature (no longer orderable)

    Note: z/OS.e cannot run on a z990

    Note: Refer to the z/OS subset of the 2086DEVICE PSP bucket prior to installing a z890 server.

Listed below are the descriptions of the features and Web deliverables indicated above:

- z/OS V1.4 z990 Compatibility Support feature: This unpriced and optional feature is required to allow z/OS V1.4 to run on a z890 or z990 server. It is also required on all systems in a Parallel Sysplex when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or z990 and the LPAR ID of the operating system or CF image is greater than 15 (x"F"). With regards to cryptography, it provides support for the PCICA feature and the CP Assist for Cryptographic Function for z/OS V1.4. This feature is no longer orderable. It was replaced by **z/OS V1.4 z990 Exploitation Support feature.**

- z/OS V1.4 z990 Exploitation Support feature: This orderable, unpriced, and optional feature provides exploitation support for two Logical Channel SubSystems and 30 LPARs on z890. It is required on all z/OS V1.4 servers in a Parallel Sysplex when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or z990 and the LPAR ID of the operating system or CF image is greater than 15 (x"F"). This feature is **mandatory** when ordering z/OS V1.4 as of February 24, 2004.

- z990 Compatibility for Selected Releases: This Web deliverable provides support to allow OS/390 V2.10, z/OS V1.2, and z/OS V1.3 to run on a z890 or z990 and to allow z/OS.e V1.3 to run on a z890. It is required on all OS/390 V2.10, z/OS V1.2, z/OS V1.3, and z/OS.e V1.3 servers in a Parallel Sysplex when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or z990 and the LPAR ID of the operating system or CF is greater than 15 (x"F"). z/OS.e cannot run on a z990.

- z/OS.e V1.4 z990 Coexistence feature: This feature provides support to allow a z800 and z890 running z/OS.e V1.4 to coexist in a Parallel Sysplex with a z890 or z990 when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or z990 and the LPAR ID of the operating system or CF is greater than 15 (x"F"). z/OS.e cannot run on a z990. This feature is no longer orderable. It was replaced by **z/OS.e V1.4 z990 Coexistence Update feature.**

- z/OS.e V1.4 z990 Coexistence Update feature: This feature allows customers to maintain a consistent code base for z/OS and z/OS.e, and allows z/OS.e V1.4 to support two Logical Channel SubSystems and 30 LPARs for z/OS.e V1.4 on a z890. It is required on all

z/OS.e V1.4 servers in a Parallel Sysplex when a z/OS or CF image in that same Parallel Sysplex is running on a z890 or z990 and the LPAR ID of the operating system or CF is greater than 15 (x"F"). It replaces the z/OS.e V1.4 z990 Coexistence feature. This feature is **mandatory** when ordering z/OS.e V1.4 as of February 24, 2004.

    Note: z/OS.e cannot run on a z990.

zSeries 890 in the z/VM®, VSE/ESA™, TPF, and Linux on zSeries environments is supported by the following:

- z/VM V4.4, and later

- z/VM V3.1 and V4.3 with compatibility support

    Dynamic I/O configuration is supported in LCSS0 only. Refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket prior to installing a z890 server.

- VSE/ESA V2.6, and later

    For the latest information on compatibility support requirements, refer to the VSE subset of the 2086DEVICE PSP bucket prior to installing a z890 server.

- TPF V4.1

- Linux on zSeries

    The currently available distributions of SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

    The latest support for zSeries functions was delivered as an Open Source Contribution in January 2004, via

        http://www10.software.ibm.com/developerworks/
        opensource/linux390

    IBM is working with select Linux distributors to help enable them to provide these functions in future distribution releases.

    Note: Conectiva CLEE is Conectiva Linux Enterprise Edition Powered by UnitedLinux for zSeries.

16 — 30 LPARs

- z/OS and z/OS.e V1.5, and later

- z/OS V1.4 with z/OS V1.4 z990 Exploitation Support feature

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence Update feature

- z/VM V4.4, and later

- VSE/ESA V2.6, and later

- TPF V4.1

- Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

In the z/OS environment, under certain circumstances, earlier releases of the operating systems are supported. Refer to the publication *z/OS Migration* (GA22-7499) for more details.

Greater than one Logical Channel SubSystem (LCSS) on zSeries 890

- z/OS and z/OS.e V1.5, and later

- z/OS V1.4 with z/OS V1.4 z990 Exploitation Support feature

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence Update feature

- z/VM V4.4, and later

- z/VM V3.1 and V4.3 compatibility support (dynamic I/O configuration is supported in LCSS0 only)

- VSE/ESA V2.6, and later

- Linux on zSeries

  The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

Dynamic I/O support on zSeries 890 allows channel paths, control units, and devices to be dynamically added, changed, and deleted in multiple LCSSs.

- z/OS and z/OS.e V1.5, and later

- z/OS V1.4 with z/OS V1.4 z990 Exploitation Support feature

- z/OS.e V1.4 with z/OS.e V1.4 z990 Coexistence Update feature

- z/VM V4.4, and later

- z/VM V3.1 and V4.3 compatibility support (dynamic I/O configuration is supported in LCSS0 only)

- Linux on zSeries

  The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

Dynamic Add/Delete of an LPAR name on zSeries 890

- z/OS and z/OS.e V1.6 (planned to be available September 2004)

- Linux on zSeries

  The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE tolerate this function.

Extended Translation Facility on zSeries 990

- z/OS 1.6 (planned to be available September 2004)

zSeries Application Assist Processor (zAAP) on z890

- z/OS and z/OS.e 1.6 (planned to be available September 2004)

- IBM SDK for z/OS, Java™ 2 Technology Edition, V1.4 (5655-I56) with PTF

Software requirements for spanned channels

- **Internal spanned channels** applies to ICs and HiperSockets on z890 and z990.

  - HiperSockets (CHPID type IQD)

    -- z/OS V1.2, z/OS V1.3, and z/OS V1.4 with PTFs, and later releases

    -- z/OS.e V1.3, with PTFs, and later releases

    -- z/VM V4.4, and later

    -- z/VM V3.1 and V4.3 with compatibility support

    -- VSE/ESA V2.7 (for HiperSockets CHPID type IQD only)

  -- Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

  - Internal Coupling channels (ICs) (CHPID type ICP) have no prerequisite software requirement on z890 and z990.

- **External spanned channels** applies to FICON Express (CHPID types FC, FCP), ICB-3 and ICB-4 (CHPID type CBP), ISC-3 (CHPID types CFS, CFP), and OSA-Express (CHPID types OSC, OSD, OSE) on z890 and z990.

  - z/OS and z/OS.e V1.4, and later
  - z/VM V4.4, and later
  - z/VM V3.1 and V4.3 with compatibility support
  - Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE support CHPID types FC, FCP, OSD, and OSE only.

Under certain circumstances earlier releases of the z/OS operating system are supported. Refer to the publication *z/OS Migration* (GA22-7499) for more details. An update to this publication, discussing the external spanned channel types, is planned to be available in the z/OS V1.6 timeframe.

Software requirements for Performance Assists

- **Adapter Interruptions** applies to all of the FICON Express features (CHPID type FCP) and OSA-Express features (CHPID type OSD) on z890 and z990.

  - z/VM V4.4, and later

  - VSE/ESA V2.7 (for OSA-Express CHPID type OSD only)

  - Linux on zSeries

    The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **V = V Guests support** applies to all of the FICON Express features (CHPID type FCP) and OSA-Express features (CHPID type OSD) on z890 and z990 as well as HiperSockets (CHPID type IQD) on z890 and z990.

  - z/VM V4.4 with PTFs, and later

Software requirements for HiperSockets

- **HiperSockets** support applies to CHPID type IQD on z890 and z990.

  - z/OS V1.2, and later
  - z/OS.e V1.3, and later
  - z/VM V4.3, and later
  - VSE/ESA V2.7
  - Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

  Note: HiperSockets support for **16 internal LANs and 4096 TCP/IP stacks** is transparent to the operating systems.

- **VLAN (IEEE 802.1q)** applies to HiperSockets on z890 and z990.

  - Linux on zSeries

The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **Broadcast for IPv4 packets** applies to HiperSockets on z890 and z990.

  − z/OS and z/OS.e V1.5, and later
  − z/VM V4.4, and later
  − Linux on zSeries

  The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **HiperSockets Network Concentrator** applies to HiperSockets on z890 and z990. This was previously referred to as HiperSockets Linux Layer 2 Switch support.

  − z/VM V4.4, and later (for Linux guests)
  − z/VM V4.3 with PTF for APAR VM63397
  − Linux on zSeries

  The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE provide support for this function.

  IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

  For Linux on zSeries, refer to the instructions accompanying the October 31, 2003, updates on developerWorks™ for how to activate HiperSockets Network Concentrator unicast, broadcast, and multicast support.

Software requirements for the 16-port ESCON feature: The minimum software requirements apply to CHPID types CBY, CVC, CNC, and CTC except where indicated.

- z/OS V1.2, and later
- z/OS.e V1.3, and later
- OS/390 V2.10
- z/VM V3.1 and z/VM V4.3, and later
- VSE/ESA V2.6, and later
- TPF V4.1
- Linux on zSeries

  The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE support CHPID types CNC and CTC.

Software requirements for the FICON Express features

- **FICON Express (CHPID type FCV)** attachment to the ESCON Director Model 5 FICON Bridge feature requires at a minimum:

  − z/OS V1.2, and later
  − z/OS.e V1.3, and later
  − OS/390 V2.10
  − z/VM V3.1 and V4.3, and later
  − VSE/ESA V2.6, and later
  − TPF V4.1 at PUT 16

- **FICON Express (CHPID type FC)**, including Channel-To-Channel (CTC), requires at a minimum:

  − z/OS V1.2, and later
  − z/OS.e V1.3, and later
  − OS/390 V2.10
  − z/VM V3.1 and V4.3, and later
  − VSE/ESA V2.6, and later
  − TPF V4.1 at PUT 16
  − Linux on zSeries

The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **FICON Express (CHPID type FCP)** for support of SCSI disks requires at a minimum:

  − z/VM V5.1 (for z/VM install, IPL, and operation from SCSI disks)

  − z/VM V4.4, and later for

    -- Performance Assist for Adapter Interruptions (refer to 2086 PSP bucket)

    -- Performance Assist for V=V Guests

  − z/VM V4.3, and later (for Linux as a guest under z/VM)

  − Linux on zSeries

  The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **FCP SAN management**

  − Linux on zSeries

  Support was delivered in January 2004, as an Open Source contribution via

    http://www10.software.ibm.com/ developerworks/opensource/linux390

  IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

- **SCSI IPL for FCP**

  − z/VM V5.1 (planned to enable z/VM IPL from SCSI disks)

  − z/VM V4.4, and later (for Linux as a guest under z/VM)

  − Linux on Series

  The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE contain the tools to support IPL from SCSI disks.

  IBM is working with select Linux distributors to help enable them to provide installation support for SCSI IPL in future distribution releases.

- **Cascaded FICON Directors (CHPID types FC and FCP)**, including CTC with cascading, require at a minimum:

  − z/OS and z/OS.e V1.3 and V1.4 with PTFs, and later releases

  − OS/390 V2.10

    -- OS/390 V2.10 can support a cascaded configuration. z/OS V1.3 is required in an LPAR to dynamically define a Cascaded Director, for dynamic I/O changes, and to use the enhanced display functions. Refer to the 9032/9042 PSP buckets.

  − z/VM V4.4, and later

  − VSE/ESA V2.6, and later

  − TPF V4.1 at PUT 16

  − Linux on zSeries

The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

Software requirements for the OSA-Express features

- **OSA-Express Gigabit Ethernet (GbE)** (CHPID type OSD) supporting TCP/IP only

  - z/OS V1.2, and later
  - z/OS.e V1.3, and later
  - OS/390 V2.10
  - z/VM V3.1 and V4.3, and later
  - VSE/ESA V2.6, and later
  - TPF V4.1 at PUT 13 with PTF for APAR PJ2733

    Includes Virtual Internet Protocol Address (VIPA) support, which allows TCP/IP connections to be balanced in a loosely coupled environment

  - Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **OSA-Express 1000BASE-T Ethernet**

  QDIO mode (CHPID type OSD) supporting TCP/IP only and non-QDIO mode (CHPID type OSE) supporting TCP/IP and SNA

  - z/OS V1.2, and later
  - z/OS.e V1.3, and later
  - OS/390 V2.10
  - z/VM V3.1 and V4.3, and later
  - VSE/ESA V2.6, and later
  - Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **OSA-Express Integrated Console Controller (OSA-ICC)** support via the OSA-Express 1000BASE-T Ethernet (CHPID type OSC) is exclusive to z890 and z990 and requires at a minimum:

  - z/OS and z/OS.e V1.3, and later, with PTF for APAR OA05738

    -- HCD with PTF for APAR OA03689

  - z/VM V5.1

  - z/VM V4.4 with PTF for APAR VM63405

  - VSE/ESA V2.6, and later

  - TPF V4.1

- **OSA-Express Token Ring**

  QDIO mode (CHPID type OSD) supporting TCP/IP only and non-QDIO mode (CHPID type OSE) supporting TCP/IP and SNA

  - z/OS V1.2, and later
  - z/OS.e V1.3, and later
  - OS/390 V2.10
  - z/VM V3.1 and V4.3, and later
  - VSE/ESA V2.6, and later
  - Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **Checksum offload for IPv4 Packets** applies to OSA-Express Gigabit Ethernet features (#1364, 1365) and 1000BASE-T Ethernet (#1366) on z890 and z990 when in QDIO mode (CHPID type OSD).

  - z/OS and z/OS.e V1.5, and later
  - Linux on zSeries

    The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE provide support for this function.

    IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

- **z/OS Full VLAN (IEEE 802.1q) support** applies to OSA-Express 1000BASE-T Ethernet (#1366), Fast Ethernet (#2366), and Gigabit Ethernet (#2364, 2365, 1364, 1365) on z800, z900, z890, and z990 when in QDIO mode (CHPID type OSD).

  - z/OS and z/OS.e V1.5, and later

    One global VLAN (ID) for IPv4 per TCP/IP stack and one global VLAN (ID) for IPv6 per TCP/IP stack

- **z/VM VLAN (IEEE 802.1q) support** applies to OSA-Express 1000BASE-T Ethernet (#1366), Fast Ethernet (#2366), and Gigabit Ethernet (#2364, 2365, 1364, 1365) on z890 and z990 when in QDIO mode (CHPID type OSD).

  - z/VM V5.1 for one global VLAN ID for IPv6 per TCP/IP stack

  - z/VM V4.4, and later, for one global VLAN ID for IPv4 per TCP/IP stack

- **Linux on zSeries VLAN (IEEE 802.1q) support** applies to OSA-Express 1000BASE-T Ethernet (#1366), Fast Ethernet (#2366), and Gigabit Ethernet (#2364, 2365, 1364, 1365) when in QDIO mode (CHPID type OSD).

  - Linux on zSeries

    The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **Intrusion Detection Services** Source MAC identification applies to all of the OSA-Express features supported on z890 and z990 when in QDIO mode (CHPID type OSD).

  - z/OS and z/OS.e V1.5, and later

- **160 TCP/IP stacks per OSA-Express port** applies to all of the OSA-Express features supported on z890 when in QDIO mode (CHPID type OSD).

  This support is transparent to the operating systems.

- **Open Systems Adapter/Support Facility (OSA/SF) Java GUI** is a complete replacement of OSA/SF Version 2 Release 1 (5655-B57), is integrated in the operating systems, and is shipped as a PTF, where applicable. Refer to the appropriate PSP bucket. This support applies to all of the OSA-Express and OSA-2 features and to all servers that support them.

  The new version of OSA/SF with the Java GUI is supported by the following operating systems.

  - z/OS and z/OS.e ─ all in service releases

  - OS/390 V2.10 with z990 Compatibility for Selected Releases ─ a Web deliverable

  - z/VM V4.4, and later

  - z/VM V3.1 and V4.3

  - VSE/ESA V2.6, and later

- **OSA port name relief** applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when in QDIO mode (CHPID type OSD).

  - z/VM V4.4, and later.

  - z/VM V4.3 with corequisites. Refer to the z/VM subset of the 2086DEVICE Preventive Service Planning (PSP) bucket.

  - Linux on zSeries.

  The currently available distributions, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE.

- **OSA-Express Direct SNMP subagent support**

  - **Traps and Set** applies to all of the OSA-Express features supported on z890 and z990 when configured in QDIO mode (CHPID type OSD).

    -- z/OS and z/OS.e V1.5, and later

    Refer to z/OS Communications Server publications for more information.

  - **Direct SNMP for LCS** applies to all of the OSA-Express features supported on z890 and z990 when configured in non-QDIO (CHPID type OSE) using TCP/IP passthru and LAN Channel Station (LCS). When delivered, Direct SNMP for LCS will support the same SNMP commands and alerts currently offered in QDIO mode ─ Get, GetNext, Trap, Set.

    -- z/OS and z/OS.e V1.6 (planned to be available September 2004)

  - **Performance data** applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

    -- z/OS and z/OS.e V1.4, and later
    -- Linux on zSeries

    The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE provide support for this function.

    IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

  - **Get and GetNext** applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

    -- z/OS and z/OS.e V1.4, and later
    -- Linux on zSeries

    The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE provide support for this function.

    IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

  - **Ethernet data for dot3StatsTable** applies to all of the OSA-Express features supported on z800, z900, z890, and z990 when configured in QDIO mode (CHPID type OSD).

    -- z/OS and z/OS.e V1.4 with PTF for APAR PQ73478, and later

    -- Linux on zSeries

The currently available distributions SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE provide support for this function.

IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

Software requirements for cryptographic functions: Cryptographic support for z890 and z990 for OS/390 V2.10, z/OS V1.2 and later releases, and z890 for z/OS.e V1.3 and later releases is provided by the Web deliverables described below:

- **z990 Cryptographic Support** (planned to be available through May 27, 2004): This Web deliverable provides exploitation support for the CP Assist for Cryptographic Function (#3863), PCICA (#0862), and PCIXCC (#0868) features to OS/390 V2.10, z/OS V1.2 and later releases, and z/OS.e V1.3, and later releases. This will be replaced on May 28, 2004, by **z990 and z890 Enhancements to Cryptographic Support.**

- **z990 and z890 Enhancements to Cryptographic Support** (planned to be available on May 28, 2004): This Web deliverable includes support for OS/390 V2.10, z/OS V1.2, z/OS V1.3, z/OS V1.4, and z/OS V1.5, as well as support for z/OS.e V1.3, z/OS.e V1.4, and z/OS.e V1.5. In addition to exploitation support for the CP Assist for Cryptographic Function (#3863), and the PCICA (#0862) and PCIXCC (#0868) features, this deliverable provides support for the following functions:

  - Double length Derived Unique Key Per Transaction (DUKPT) (PCIXCC only)

  - EMV 2000 Standard (PCIXCC only)

  - Public Key Decrypt (PKD) Service enhancement (PCICA and PCIXCC)

  - Public Key Encrypt (PKE) Service enhancement (PCICA and PCIXCC)

- The recommended Web deliverable is **z990 and z890 Enhancements to Cryptographic Support**.

These Web deliverables are unpriced and can be downloaded at:

http://www.ibm.com/eserver/zseries/zos/downloads

Note: The end of service for a Web deliverable occurs at the end of service for the release on which it runs.

Listed below are the **minimum cryptographic software requirements** for z890:

- **CP Assist for Cryptographic Function (CPACF) (#3863)**

  Note: The SHA-1 function is shipped enabled. However, DES and TDES functions require enablement of the CPACF function (#3863) for export control.

  - z/OS V1.2, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  - z/OS.e V1.3, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  - OS/390 V2.10 with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  - z/VM V3.1 and V4.3, and later

  - Linux on zSeries

The currently available distributions, SUSE SLES 8, Turbolinux TLES 8, and Conectiva CLEE support this feature as well as other Linux distributions picking up the right combination of newest crypto libraries at

> **http://www-124.ibm.com/developerworks/ projects/libica**

and

> **http://www-124.ibm.com/developerworks/ projects/openCryptoki**

- **PCI Cryptographic Accelerator (PCICA) (#0862)**

  – z/OS V1.2, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – z/OS.e V1.3, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – OS/390 V2.10 with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – z/VM V5.1 (for z/OS and Linux guests)

  – z/VM V4.3, and later (for Linux guests)

  – VSE/ESA V2.7 and IBM TCP/IP for VSE/ESA V1.5

  – Linux on zSeries

    The currently available distributions, SUSE SLES 7, SUSE SLES 8, Red Hat RHEL 3.0, Turbolinux TLES 8, and Conectiva CLEE

- **PCI X Cryptographic Coprocessor (PCIXCC) (#0868)**

  – z/OS V1.2, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – z/OS.e V1.3, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – OS/390 V2.10 with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – z/VM V5.1 (for z/OS and Linux guests)

  – Linux on zSeries

    Support was delivered in January 2004, as an Open Source contribution via

> **http://www10.software.ibm.com/ developerworks/opensource/linux390**

  IBM is working with select Linux distributors to help enable them to provide this function in future distribution releases.

  PCIXCC User-Defined Extensions (UDX)

  – z/OS V1.2, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – z/OS.e V1.3, and later, with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

  – OS/390 V2.10 with z990 Cryptographic Support, or z990 and z890 Enhancements to Cryptographic Support

Limitations

OS/390 V2.10 and z/OS limited to LCSS0: OS/390 V2.10, z/OS V1.2, z/OS and z/OS.e V1.3, and z/OS and z/OS.e V1.4, with z990 and z890 compatibility support (z990 Compatibility for Selected Releases Web deliverable or z/OS V1.4 z990 Compatibility Support feature, or z/OS.e V1.4 z990 Coexistence feature) installed, can only be IPLed using LCSS0 when running in LPAR mode. However, these releases may run as a guest under z/VM 4.4, where z/VM 4.4 is using any channel subsystem. Therefore, you may run z/OS and z/OS.e (or OS/390 V2.10) in LCSS0, and z/VM in LCSS1 where one or more z/OS images are running as guests.

Note: With z/OS and z/OS.e V1.5, and later, z/OS V1.4 with the z/OS V1.4 z990 Exploitation Support feature installed, or z/OS.e V1.4 with the z/OS.e V1.4 z990 Coexistence Update feature installed, z/OS or z/OS.e can be IPLed on a z890 using any LCSS.

Planning information

Customer responsibilities

Customer responsibilities for site preparation: Information on customer responsibilities for site preparation can be found in the following publications which are available in the Library section of Resource Link at

> **http://www.ibm.com/servers/resourcelink**

- System Overview (SA22-6832).

- Systems Assurance Product Review (SAPR) Guide (SA04-002).

- Planning for Fiber Optic Links (GA23-0367).

- Installation Manual — Physical Planning (GC28-6828). This document contains information necessary for planning the physical installation of a zSeries system. It includes physical specifications, power and cooling data, cabling, and additional details required for physical installation planning. The intended audience for this document includes all customer personnel who are responsible for providing the necessary and appropriate environment for the successful installation and operation of a zSeries system.

Cable orders

Fiber optic cable orders: Fiber optic cables for z890 are available via IBM Networking Services.

IBM Networking Services has a comprehensive set of scalable solutions to address all cabling requirements, from product level to enterprise level. **IBM Network Integration and Deployment Services for zSeries fiber cabling** provides planning and installation services for individual fiber optic connections. **IBM Network Integration and Deployment Services for enterprise fiber cabling** provides planning, IBM Fiber Transport System trunking components, and installation services for small, medium, and large enterprises.

IBM Global Services (IGS) has the expertise and personnel available to effectively plan and deploy the appropriate cabling with the future in mind. These services may include planning, consultation, cable selection, installation, and documentation, depending upon the services selected.

These services are designed to be right-sized for your products or the end-to-end enterprise, and to take into consideration the requirements for all of the protocols and

media types supported on zSeries (for example, ESCON, FICON, Coupling Links, OSA) whether the focus is the data center, the Storage Area Network (SAN), the Local Area Network (LAN), or the end-to-end enterprise.

IBM Networking Services are designed to deliver convenient, packaged services to help reduce the complexity of planning, ordering, and installing fiber optic cables. The appropriate fiber cabling is selected based upon the product requirements and the installed fiber plant.

The services are packaged as follows:

Under the **zSeries fiber cabling services** umbrella there are **three** options to provide individual fiber optic cables (jumper cables, conversion kits, MCP cables) for connecting to z800, z900, z890, or z990, each option incorporating a specific set of services.

- Option 1 — Fiber optic jumper cabling package. IBM does the detailed planning. This option includes planning, new cables, installation, and documentation. An analysis of the zSeries channel configuration, I/O devices, and any existing fiber optic cabling is required to determine the appropriate fiber optic cables.

- Option 2 — Fiber optic jumper cable migration and reuse for a zSeries upgrade. IBM organizes the existing fiber optic cables based upon the new z890 connection details. Relabeling, rerouting, and reconnection to the appropriate z890 channels are performed. New cables are not offered as a part of this option.

- Option 3 — Fiber optic jumper cables and installation. You tell us what you need. You do the detailed planning. The service includes new cables, installation, and documentation. Planning and providing the list of required cables are customer responsibilities.

Options 1 and 2 can be combined within one statement of work to provide comprehensive upgrade coverage.

Under the **enterprise fiber cabling services** umbrella there are **two** options to provide IBM Fiber Transport System (FTS) trunking commodities (fiber optic trunk cables, fiber harnesses, panel-mount boxes) for connecting to the z800, z900, z890, and z990.

- Option 1 — zSeries fiber optic trunk cabling package. IBM can reduce the cable clutter under the floor. An analysis of the zSeries (z800, z900, z890, z990) channel configuration and any existing fiber optic cabling is performed to determine the required FTS fiber optic trunking commodities (trunk cables, harnesses, panel-mount boxes). This option includes zSeries planning, FTS fiber optic trunking commodities, installation, and documentation. This option does not include enterprise-level planning.

- Option 2 — Enterprise fiber cabling services. IBM organizes the entire enterprise zSeries cabling. This option includes enterprise planning, new cables, fiber optic trunking commodities, installation, and documentation. This is the most comprehensive set of services.

Refer to the services section of Resource Link for further details. Access Resource Link at

http://www.ibm.com/servers/resourcelink

Cabling responsibilities: Fiber optic cables, cable planning, labeling, and placement are all customer responsibilities for new installations and upgrades. Fiber optic conversion kits and Mode Conditioning Patch (MCP) cables are not orderable as features on z890. Installation Planning Representatives (IPRs) and System Service Representatives (SSRs) will not perform the fiber optic cabling tasks without a services contract.

The following tasks are required to be performed by the customer prior to machine installation.

- All fiber optic cable planning.

- All purchasing of correct fiber optic cables.

- All installation of any required MCP cables.

- All installation of any required Conversion Kits.

- All routing of fiber optic cables to correct floor cutouts for proper installation to server.

  - Use the Physical CHannel IDentifier (PCHID) report or the report from the CHannel Path IDentifier (CHPID) Mapping Tool to accurately route all cables.

- All labeling of fiber optic cables with PCHID numbers for proper installation to server.

  - Use the PCHID report or the report from the CHPID Mapping Tool to accurately label all cables.

Additional service charges may be incurred during the server installation if the above cabling tasks are not accomplished as required.

The table lists the connectors and cabling supported for each of the features available for ordering on the z890. For convenience, those features brought forward on an upgrade from z800 are also listed.

Feature number	Feature name	Connector type	Cable type
0219	ISC-3 link	LC Duplex	9 micron SM
6154	ETR	MTRJ	62.5 micron MM
2324	ESCON channel	MTRJ	62.5 micron MM[1]
2319	FICON Express LX	LC Duplex	9 micron SM[2]
2320	FICON Express SX	LC Duplex	50, 62.5 micron MM
1364	OSA-E GbE LX[3]	LC Duplex	9 micron SM
2364[4]	OSA-E GbE LX	SC Duplex[5]	9 micron SM
1365	OSA-E GbE SX	LC Duplex	50, 62.5 micron MM
2365[4]	OSA-E GbE SX	SC Duplex[5]	50, 62.5 micron MM
1366	OSA-E 1000BASE-T[6]	RJ-45	Category 5 UTP[7]
2366[4]	OSA-E Fast Ethernet[6]	RJ-45	Category 5 UTP
2367	OSA-E Token Ring	RJ-45	UTP or STP[8]

1. MM is multimode fiber.

2. SM is single mode fiber.

3. OSA-E refers to OSA-Express.

4. Brought forward to z890 on an upgrade from z800.

5. The OSA-Express GbE features brought forward from z800 have a different connector (SC Duplex) than the new OSA-E GbE features (LC Duplex).

6. 1000BASE-T is the new Ethernet feature.

7. UTP is Unshielded Twisted Pair.

8. STP is Shielded Twisted Pair.

Fiber Quick Connect (FQC), a fiber harness integrated in the zSeries frame for "quick" connect, is offered as a feature on zSeries for connection to ESCON channels.

Cables for Integrated Cluster Bus (ICB) links continue to be available as features. Refer to the *Sales Manual* for a list of these cables and their feature numbers.

For further details regarding the features, refer to the *Sales Manual*, the physical planning manual, or the General Information Manual (GIM) available on Resource Link.

Note: IBM Networking Services can satisfy your fiber optic as well as your copper cabling requirements.

Security, auditability, and control

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

IBM Electronic Services

IBM Global Services has transformed its delivery of hardware and software support services to put you on the road to higher systems availability. IBM Electronic Services is a Web-enabled solution that provides you with an exclusive, no-additional-charge enhancement to the service and support on the IBM @server. You can benefit from greater system availability due to faster problem resolution and pre-emptive monitoring. IBM Electronic Services is comprised of two separate but complementary elements: IBM Electronic Services news page and IBM Electronic Service Agent™.

IBM Electronic Services news page provides you with a single Internet entry point that replaces the multiple entry points traditionally used by customers to access IBM Internet services and support. The news page enables you to gain easier access to IBM resources for assistance in resolving technical problems.

The IBM Electronic Service Agent is no-additional-charge software that resides on your IBM @server system that is designed to proactively monitor events and transmit system inventory information to IBM on a periodic customer-defined timetable. The IBM Electronic Service Agent tracks system inventory, hardware error logs, and performance information. If the server is under a current IBM maintenance service agreement or within the IBM warranty period, the Service Agent automatically reports hardware problems to IBM. Early knowledge about potential problems enables IBM to provide proactive service that can help maintain higher system availability and performance. In addition, information collected through the Service Agent will be made available to IBM service support representatives when they are helping answer your questions or diagnosing problems.

To learn how IBM Electronic Services can work for you, visit

http://www.ibm.com/support/electronic

Terms and conditions

This product is available for purchase under the terms of the IBM Customer Agreement.

Each IBM machine is manufactured from parts that may be new or used. In some cases, a machine may not be new and may have been previously installed.

Regardless, IBM's appropriate warranty terms apply.

IBM Global Financing: Yes

Warranty period: One year

Warranty service: IBM On-Site Repair (IOR) 24 hours a day, 7 days a week, same-day response.

ServiceSuite™ and ServiceElect (formerly ESA) maintenance: IOR 24 hours a day, 7 days a week, same-day response.

Usage plan machine: No

IBM hourly service rate classification: Three

When a type of service involves the exchange of a machine part, the replacement may not be new, but will be in good working order.

Field-installable features: Yes

Model conversions: Yes

Machine installation: Installation is performed by IBM. IBM will install the machine in accordance with the IBM installation procedures for the machine. In the United States, contact IBM at 800-IBM-SERV (426-7378). In other countries contact the local IBM office.

Graduated charges: No

Licensed Internal Code (LIC): IBM LIC is licensed for use by a customer on a specific machine, designated by serial number, under the terms and conditions of the IBM Agreement for Licensed Internal Code, to enable a specific machine to function in accordance with its specifications, and only for the capacity authorized by IBM and for which the customer has paid.

Prices

Prices are available upon request.

Description	Machine type	Model	Feature number	Init/ MES
zSeries 890	2086			
		A04		
			1109	Both
Capacity Setting 110			6110	Both
Capacity Setting 120			6120	Both
Capacity Setting 130			6130	Both
Capacity Setting 140			6140	Both
Capacity Setting 150			6150	Both
Capacity Setting 160			6160	Both
Capacity Setting 170			6170	Both
Capacity Setting 210			6210	Both
Capacity Setting 220			6220	Both
Capacity Setting 230			6230	Both
Capacity Setting 240			6240	Both
Capacity Setting 250			6250	Both
Capacity Setting 260			6260	Both
Capacity Setting 270			6270	Both
Capacity Setting 310			6310	Both
Capacity Setting 320			6320	Both
Capacity Setting 330			6330	Both
Capacity Setting 340			6340	Both
Capacity Setting 350			6350	Both
Capacity Setting 360			6360	Both
Capacity Setting 370			6370	Both
Capacity Setting 410			6410	Both
Capacity Setting 420			6420	Both
Capacity Setting 430			6430	Both
Capacity Setting 440			6440	Both
Capacity Setting 450			6450	Both
Capacity Setting 460			6460	Both
Capacity Setting 470			6470	Both
Zero CP Engines			6070	Both
ETR 1 Port Card			6154	Both
CEC			0153	Both
Integrated Facility for Linux			6516	Both
Unassigned IFL			6517	Both
Internal Coupling Facility			6518	Both
Application Assist Processor			6520	Both
Capacity Backup CP			6800	Both

Description	Machine type	Model	Feature number	Init/ MES
Standard features (for all models):				
Memory:				
8GB LICCC Enablement Memory			3102	Both
16GB LICCC Enablement Memory			3104	Both
24GB LICCC Enablement Memory			3106	Both
32GB LICCC Enablement Memory			3108	Both
8GB Memory Card			2008	Both
16GB Memory Card			2016	Both
32GB Memory Card			2032	Both
IO:				
IO Cage Full Cardslot Airflow			0112	Both
IO Cage ISC-D Airflow			0113	Both
ISC-M			0217	Both
ISC-D (less than 10km)			0218	Both
ISC-3 Port on FC 0218			0219	Both
STI AFB-C 1/2 Airflow			0225	Both
eSTI-M card			0322	Both
STI-3 extender card			3993	Both
ICB Cable Connect ICB3 to z890			0227	Both
ICB Cable Connect ICB4 to z890			0228	Both
ICB-3 Function			0993	Both
ICB-4 Function			3393	Both
PCI Cryptographic Accelerator			0862	Both
PCI X Crypto Coprocessor			0868	Both
CPACF DES/TDES Enablement			3863	Both
OSA-Express GbE LX			1364	Both
OSA-Express GbE SX			1365	Both
OSA-Express 1000Base-T EN			1366	Both
OSA-Express High Speed TR			2367	Both
FICON Express LX Card			2319	Both
FICON Express SX Card			2320	Both
16-Port ESCON Card			2323	Both
ESCON Channel Ports			2324	Both
Power:				
Internal Battery Feature			3210	Both
Power Sequence Controller			6501	Both
6ft Chicago Only 250v 3 phase			8986	Both
14ft U.S./Can/Japan 250v 3 phase			8987	Both
14ft WT High and Low Volt 3 phase			8988	Both
6ft Chicago Only 480v 3 phase			8984	Both
14ft U.S. 480v 3 phase			8983	Both
6ft Chi Only 250v/Single phase			8989	Both
14ft U.S./Can/Japan 250v Single phase			8990	Both
14ft WT High and Low Volt Single phase			8991	Both
Fiber Quick Connect (FQC):				
FQC 1st + mount hdw			7945	Init
FQC Additional Brackets			7946	Init
ESCON MTRJ harness grp 5ft			7947	Init
ESCON MTRJ harness grp 6ft			7948	Init
eBoD:				
On/Off CoD Active IFLs			9888	MES
On/Off CoD Active ICFs			9889	MES
On/Off CoD Active zAAPs			9893	MES
On/Off CoD CP Enablement flag			9896	Both
CIU Enablement flag			9898	Both
CIU Activation flag			9899	MES

Description	Machine type	Model	Feature number	Init/ MES
120 On/Off CoD Use Day			6121	MES
130 On/Off CoD Use Day			6131	MES
140 On/Off CoD Use Day			6141	MES
150 On/Off CoD Use Day			6151	MES
160 On/Off CoD Use Day			6161	MES
170 On/Off CoD Use Day			6171	MES
210 On/Off CoD Use Day			6211	MES
220 On/Off CoD Use Day			6221	MES
230 On/Off CoD Use Day			6231	MES
240 On/Off CoD Use Day			6241	MES
250 On/Off CoD Use Day			6251	MES
260 On/Off CoD Use Day			6261	MES
270 On/Off CoD Use Day			6271	MES
310 On/Off CoD Use Day			6311	MES
320 On/Off CoD Use Day			6321	MES
330 On/Off CoD Use Day			6331	MES
340 On/Off CoD Use Day			6341	MES
350 On/Off CoD Use Day			6351	MES
360 On/Off CoD Use Day			6361	MES
370 On/Off CoD Use Day			6371	MES
410 On/Off CoD Use Day			6411	MES
420 On/Off CoD Use Day			6421	MES
430 On/Off CoD Use Day			6431	MES
440 On/Off CoD Use Day			6441	MES
450 On/Off CoD Use Day			6451	MES
460 On/Off CoD Use Day			6461	MES
470 On/Off CoD Use Day			6471	MES
070 Downgrade ─ Record Only			6072	MES
110 Downgrade ─ Record Only			6112	MES
120 Downgrade ─ Record Only			6122	MES
130 Downgrade ─ Record Only			6132	MES
140 Downgrade ─ Record Only			6142	MES
150 Downgrade ─ Record Only			6152	MES
160 Downgrade ─ Record Only			6162	MES
170 Downgrade ─ Record Only			6172	MES
210 Downgrade ─ Record Only			6212	MES
220 Downgrade ─ Record Only			6222	MES
230 Downgrade ─ Record Only			6232	MES
240 Downgrade ─ Record Only			6242	MES
250 Downgrade ─ Record Only			6252	MES
260 Downgrade ─ Record Only			6262	MES
270 Downgrade ─ Record Only			6272	MES
310 Downgrade ─ Record Only			6312	MES
320 Downgrade ─ Record Only			6322	MES
330 Downgrade ─ Record Only			6332	MES
340 Downgrade ─ Record Only			6342	MES
350 Downgrade ─ Record Only			6352	MES
360 Downgrade ─ Record Only			6362	MES
370 Downgrade ─ Record Only			6372	MES
410 Downgrade ─ Record Only			6412	MES
420 Downgrade ─ Record Only			6422	MES
430 Downgrade ─ Record Only			6432	MES
440 Downgrade ─ Record Only			6442	MES
450 Downgrade ─ Record Only			6452	MES
460 Downgrade ─ Record Only			6462	MES
470 Downgrade ─ Record Only			6472	MES

Support Element (SE):

Description	Machine type	Model	Feature number	Init/ MES
SE ─ Token Ring/Ethernet			0086	Both
SE ─ Dual Ethernet			0087	Both

Hardware Management Console:

Trusted Key Entry (TKE):

Description	Machine type	Model	Feature number	Init/ MES
TKE 4.1 Card Code			0852	Both

Console displays:

Description	Machine type	Model	Feature number	Init/ MES
17 in Black			6092	Both
21 in Black			6093	Both

Description	Machine type	Model	Feature number	Init/ MES
Hemisphere:				
Northern Hemisphere			9930	Init
Southern Hemisphere			9931	Init
Language:				
U.S. English			2924	Init
France			2928	Init
German			2929	Init
Spanish — Non Spain			2930	Init
Spain			2931	Init
Italian			2932	Init
Canadian/French			2935	Init
Portugal			2978	Init
Brazilian/Portuguese			2979	Init
U.K. English			2980	Init
Norwegian			2983	Init
Sweden/Finland			2987	Init
Netherlands			2988	Init
Belgian/French			2989	Init
Denmark			2993	Init
Swiss French, German			2997	Init
Luxembourg — Orders: Belgium			5560	Init
Iceland — Orders: Denmark			5561	Init
China — Orders: Hong Kong			5562	Init
Miscellaneous:				
Multi Order Ship Flag			9000	Both
Multi Order Rec Only NB Flag			9001	Both
Multi Order Rec Only MES Flag			9002	Both
RPO Action Flag			9003	Both
Capacity Downgrade per Req			9004	Both
EMEA Special Operations			1022	Both
WEB Only LIC (flag)			1750	MES
JCM Ops			2029	Both
SCSI-IPL			9904	Both
Height Reduction			9975	Both
Site Tool Kit			9965	Both
zSeries 800	2066			
		0E1		
		0A1		
		0B1		
		0C1		
		0X2		
		001		
		0A2		
		002		
		003		
		004		
TKE 4.1 Card Code			0852	Both
OSA-Express GbE LX			1364	Both
OSA-Express GbE SX			1365	Both

If installed at the time of an upgrade from z800 to z890, the features in the following table may be retained. Most are also orderable on a z890.

Description	Machine type	Model	Feature number	Init/ MES
Hardware Management Console			0073 *	MES
Hardware Management Console			0074 *	MES
Hardware Management Console			0075 *	MES
SE — Token Ring/Ethernet			0086	MES
SE — Dual Ethernet			0087	MES
Token Ring Adapter			0023 *	MES
Ethernet Adapter			0024 *	MES
3270 PCI Adapter			0036 *	MES
WAC Adapter			0038 *	MES
DVD Adapter			0047 *	MES
TKE 4.0 Card Code			0851 *	MES
TKE 4.1 Card Code			0852	MES
TKE Hardware (for Token Ring)			0866 *	MES

Description	Feature number	Init/ MES
TKE Hardware (for Ethernet)	0869 *	MES
TKE Hardware (for Token Ring)	0876 *	MES
TKE Hardware (for Ethernet)	0879 *	MES
ISC-M	0217	MES
ISC-D (less than 10km)	0218	MES
FICON Express LX Card	2319	MES
FICON Express SX Card	2320	MES
16-Port ESCON Card	2323	MES
ESCON Channel Ports	2324	MES
OSA-Express GbE LX	1364	MES
OSA-Express GbE SX	1365	MES
OSA-Express GbE LX	2364 *	MES
OSA-Express GbE SX	2365 *	MES
OSA-Express Fast Ethernet	2366 *	MES
OSA-Express High Speed Token Ring	2367	MES
17 in White Console Display	6090 *	MES
21 in White Console Display	6091 *	MES
17 in Black Console Display	6092	MES
21 in Black Console Display	6093	MES
PCI Cryptographic Accelerator PCICA	0862	MES
SCSI-IPL	9904	MES

* Not orderable on z890.

For ServiceElect (ESA) maintenance service charges, contact IBM Global Services at 888-IBM-4343 (426-4343).

Model conversions

From		To	
Type	Model	Type	Model
2066	002	2086	A04 *
2066	004	2086	A04 *
2086	A04	2084	A08 *

* Parts removed or replaced become the property of IBM and must be returned.

Feature conversions

Feature From	To	Returned parts		Continuous maintenance
6110	6070	Y	*	Y
6110	6120	Y	*	Y
6110	6130	Y	*	Y
6110	6140	Y	*	Y
6110	6150	Y	*	Y
6110	6160	Y	*	Y
6110	6170	Y	*	Y
6110	6210	Y	*	Y
6110	6220	Y	*	Y
6110	6230	Y	*	Y
6110	6240	Y	*	Y
6110	6250	Y	*	Y
6110	6260	Y	*	Y
6110	6270	Y	*	Y
6110	6310	Y	*	Y
6110	6320	Y	*	Y
6110	6330	Y	*	Y
6110	6340	Y	*	Y
6110	6350	Y	*	Y
6110	6360	Y	*	Y
6110	6370	Y	*	Y
6110	6410	Y	*	Y
6110	6420	Y	*	Y
6110	6430	Y	*	Y
6110	6440	Y	*	Y
6110	6450	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance
6110	6460	Y	*	Y
6110	6470	Y	*	Y
6120	6070	Y	*	Y
6120	6110	Y	*	Y
6120	6130	Y	*	Y
6120	6140	Y	*	Y
6120	6150	Y	*	Y
6120	6160	Y	*	Y
6120	6170	Y	*	Y
6120	6210	Y	*	Y
6120	6220	Y	*	Y
6120	6230	Y	*	Y
6120	6240	Y	*	Y
6120	6250	Y	*	Y
6120	6260	Y	*	Y
6120	6270	Y	*	Y
6120	6310	Y	*	Y
6120	6320	Y	*	Y
6120	6330	Y	*	Y
6120	6340	Y	*	Y
6120	6350	Y	*	Y
6120	6360	Y	*	Y
6120	6370	Y	*	Y
6120	6410	Y	*	Y
6120	6420	Y	*	Y
6120	6430	Y	*	Y
6120	6440	Y	*	Y
6120	6450	Y	*	Y
6120	6460	Y	*	Y
6120	6470	Y	*	Y
6130	6070	Y	*	Y
6130	6110	Y	*	Y
6130	6120	Y	*	Y
6130	6140	Y	*	Y
6130	6150	Y	*	Y
6130	6160	Y	*	Y
6130	6170	Y	*	Y
6130	6210	Y	*	Y
6130	6220	Y	*	Y
6130	6230	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance	Feature From	To	Returned parts		Continuous maintenance
6130	6240	Y	*	Y	6150	6440	Y	*	Y
6130	6250	Y	*	Y	6150	6450	Y	*	Y
6130	6260	Y	*	Y	6150	6460	Y	*	Y
6130	6270	Y	*	Y	6150	6470	Y	*	Y
6130	6310	Y	*	Y	6160	6070	Y	*	Y
6130	6320	Y	*	Y	6160	6110	Y	*	Y
6130	6330	Y	*	Y	6160	6120	Y	*	Y
6130	6340	Y	*	Y	6160	6130	Y	*	Y
6130	6350	Y	*	Y	6160	6140	Y	*	Y
6130	6360	Y	*	Y	6160	6150	Y	*	Y
6130	6370	Y	*	Y	6160	6170	Y	*	Y
6130	6410	Y	*	Y	6160	6210	Y	*	Y
6130	6420	Y	*	Y	6160	6220	Y	*	Y
6130	6430	Y	*	Y	6160	6230	Y	*	Y
6130	6440	Y	*	Y	6160	6240	Y	*	Y
6130	6450	Y	*	Y	6160	6250	Y	*	Y
6130	6460	Y	*	Y	6160	6260	Y	*	Y
6130	6470	Y	*	Y	6160	6270	Y	*	Y
6140	6070	Y	*	Y	6160	6310	Y	*	Y
6140	6110	Y	*	Y	6160	6320	Y	*	Y
6140	6120	Y	*	Y	6160	6330	Y	*	Y
6140	6130	Y	*	Y	6160	6340	Y	*	Y
6140	6150	Y	*	Y	6160	6350	Y	*	Y
6140	6160	Y	*	Y	6160	6360	Y	*	Y
6140	6170	Y	*	Y	6160	6370	Y	*	Y
6140	6210	Y	*	Y	6160	6410	Y	*	Y
6140	6220	Y	*	Y	6160	6420	Y	*	Y
6140	6230	Y	*	Y	6160	6430	Y	*	Y
6140	6240	Y	*	Y	6160	6440	Y	*	Y
6140	6250	Y	*	Y	6160	6450	Y	*	Y
6140	6260	Y	*	Y	6160	6460	Y	*	Y
6140	6270	Y	*	Y	6160	6470	Y	*	Y
6140	6310	Y	*	Y	6170	6070	Y	*	Y
6140	6320	Y	*	Y	6170	6110	Y	*	Y
6140	6330	Y	*	Y	6170	6120	Y	*	Y
6140	6340	Y	*	Y	6170	6130	Y	*	Y
6140	6350	Y	*	Y	6170	6140	Y	*	Y
6140	6360	Y	*	Y	6170	6150	Y	*	Y
6140	6370	Y	*	Y	6170	6160	Y	*	Y
6140	6410	Y	*	Y	6170	6210	Y	*	Y
6140	6420	Y	*	Y	6170	6220	Y	*	Y
6140	6430	Y	*	Y	6170	6230	Y	*	Y
6140	6440	Y	*	Y	6170	6240	Y	*	Y
6140	6450	Y	*	Y	6170	6250	Y	*	Y
6140	6460	Y	*	Y	6170	6260	Y	*	Y
6140	6470	Y	*	Y	6170	6270	Y	*	Y
6150	6070	Y	*	Y	6170	6310	Y	*	Y
6150	6110	Y	*	Y	6170	6320	Y	*	Y
6150	6120	Y	*	Y	6170	6330	Y	*	Y
6150	6130	Y	*	Y	6170	6340	Y	*	Y
6150	6140	Y	*	Y	6170	6350	Y	*	Y
6150	6160	Y	*	Y	6170	6360	Y	*	Y
6150	6170	Y	*	Y	6170	6370	Y	*	Y
6150	6210	Y	*	Y	6170	6410	Y	*	Y
6150	6220	Y	*	Y	6170	6420	Y	*	Y
6150	6230	Y	*	Y	6170	6430	Y	*	Y
6150	6240	Y	*	Y	6170	6440	Y	*	Y
6150	6250	Y	*	Y	6170	6450	Y	*	Y
6150	6260	Y	*	Y	6170	6460	Y	*	Y
6150	6270	Y	*	Y	6170	6470	Y	*	Y
6150	6310	Y	*	Y	6210	6070	Y	*	Y
6150	6320	Y	*	Y	6210	6110	Y	*	Y
6150	6330	Y	*	Y	6210	6120	Y	*	Y
6150	6340	Y	*	Y	6210	6130	Y	*	Y
6150	6350	Y	*	Y	6210	6140	Y	*	Y
6150	6360	Y	*	Y	6210	6150	Y	*	Y
6150	6370	Y	*	Y	6210	6160	Y	*	Y
6150	6410	Y	*	Y	6210	6170	Y	*	Y
6150	6420	Y	*	Y	6210	6220	Y	*	Y
6150	6430	Y	*	Y	6210	6230	Y	*	Y

Feature		Returned		Continuous	Feature		Returned		Continuous
From	To	parts		maintenance	From	To	parts		maintenance
6210	6240	Y	*	Y	6230	6430	Y	*	Y
6210	6250	Y	*	Y	6230	6440	Y	*	Y
6210	6260	Y	*	Y	6230	6450	Y	*	Y
6210	6270	Y	*	Y	6230	6460	Y	*	Y
6210	6310	Y	*	Y	6230	6470	Y	*	Y
6210	6320	Y	*	Y	6240	6070	Y	*	Y
6210	6330	Y	*	Y	6240	6110	Y	*	Y
6210	6340	Y	*	Y	6240	6120	Y	*	Y
6210	6350	Y	*	Y	6240	6130	Y	*	Y
6210	6360	Y	*	Y	6240	6140	Y	*	Y
6210	6370	Y	*	Y	6240	6150	Y	*	Y
6210	6410	Y	*	Y	6240	6160	Y	*	Y
6210	6420	Y	*	Y	6240	6170	Y	*	Y
6210	6430	Y	*	Y	6240	6210	Y	*	Y
6210	6440	Y	*	Y	6240	6220	Y	*	Y
6210	6450	Y	*	Y	6240	6230	Y	*	Y
6210	6460	Y	*	Y	6240	6250	Y	*	Y
6210	6470	Y	*	Y	6240	6260	Y	*	Y
6220	6070	Y	*	Y	6240	6270	Y	*	Y
6220	6110	Y	*	Y	6240	6310	Y	*	Y
6220	6120	Y	*	Y	6240	6320	Y	*	Y
6220	6130	Y	*	Y	6240	6330	Y	*	Y
6220	6140	Y	*	Y	6240	6340	Y	*	Y
6220	6150	Y	*	Y	6240	6350	Y	*	Y
6220	6160	Y	*	Y	6240	6360	Y	*	Y
6220	6170	Y	*	Y	6240	6370	Y	*	Y
6220	6210	Y	*	Y	6240	6410	Y	*	Y
6220	6230	Y	*	Y	6240	6420	Y	*	Y
6220	6240	Y	*	Y	6240	6430	Y	*	Y
6220	6250	Y	*	Y	6240	6440	Y	*	Y
6220	6260	Y	*	Y	6240	6450	Y	*	Y
6220	6270	Y	*	Y	6240	6460	Y	*	Y
6220	6310	Y	*	Y	6240	6470	Y	*	Y
6220	6320	Y	*	Y	6250	6070	Y	*	Y
6220	6330	Y	*	Y	6250	6110	Y	*	Y
6220	6340	Y	*	Y	6250	6120	Y	*	Y
6220	6350	Y	*	Y	6250	6130	Y	*	Y
6220	6360	Y	*	Y	6250	6140	Y	*	Y
6220	6370	Y	*	Y	6250	6150	Y	*	Y
6220	6410	Y	*	Y	6250	6160	Y	*	Y
6220	6420	Y	*	Y	6250	6170	Y	*	Y
6220	6430	Y	*	Y	6250	6210	Y	*	Y
6220	6440	Y	*	Y	6250	6220	Y	*	Y
6220	6450	Y	*	Y	6250	6230	Y	*	Y
6220	6460	Y	*	Y	6250	6240	Y	*	Y
6230	6070	Y	*	Y	6250	6260	Y	*	Y
6230	6210	Y	*	Y	6250	6270	Y	*	Y
6220	6470	Y	*	Y	6250	6310	Y	*	Y
6230	6110	Y	*	Y	6250	6320	Y	*	Y
6230	6120	Y	*	Y	6250	6330	Y	*	Y
6230	6130	Y	*	Y	6250	6340	Y	*	Y
6230	6140	Y	*	Y	6250	6350	Y	*	Y
6230	6150	Y	*	Y	6250	6360	Y	*	Y
6230	6160	Y	*	Y	6250	6370	Y	*	Y
6230	6170	Y	*	Y	6250	6410	Y	*	Y
6230	6210	Y	*	Y	6250	6420	Y	*	Y
6230	6220	Y	*	Y	6250	6430	Y	*	Y
6230	6240	Y	*	Y	6250	6440	Y	*	Y
6230	6250	Y	*	Y	6250	6450	Y	*	Y
6230	6260	Y	*	Y	6250	6460	Y	*	Y
6230	6270	Y	*	Y	6250	6470	Y	*	Y
6230	6310	Y	*	Y	6260	6070	Y	*	Y
6230	6320	Y	*	Y	6260	6110	Y	*	Y
6230	6330	Y	*	Y	6260	6120	Y	*	Y
6230	6340	Y	*	Y	6260	6130	Y	*	Y
6230	6350	Y	*	Y	6260	6140	Y	*	Y
6230	6360	Y	*	Y	6260	6150	Y	*	Y
6230	6370	Y	*	Y	6260	6160	Y	*	Y
6230	6410	Y	*	Y	6260	6170	Y	*	Y
6230	6420	Y	*	Y	6260	6210	Y	*	Y

Feature		Returned		Continuous	Feature		Returned		Continuous
From	To	parts		maintenance	From	To	parts		maintenance
6260	6220	Y	*	Y	6310	6430	Y	*	Y
6260	6230	Y	*	Y	6310	6440	Y	*	Y
6260	6240	Y	*	Y	6310	6450	Y	*	Y
6260	6250	Y	*	Y	6310	6460	Y	*	Y
6260	6270	Y	*	Y	6310	6470	Y	*	Y
6260	6310	Y	*	Y	6320	6070	Y	*	Y
6260	6320	Y	*	Y	6320	6110	Y	*	Y
6260	6330	Y	*	Y	6320	6120	Y	*	Y
6260	6340	Y	*	Y	6320	6130	Y	*	Y
6260	6350	Y	*	Y	6320	6140	Y	*	Y
6260	6360	Y	*	Y	6320	6150	Y	*	Y
6260	6370	Y	*	Y	6320	6160	Y	*	Y
6260	6410	Y	*	Y	6320	6170	Y	*	Y
6260	6420	Y	*	Y	6320	6210	Y	*	Y
6260	6430	Y	*	Y	6320	6220	Y	*	Y
6260	6440	Y	*	Y	6320	6230	Y	*	Y
6260	6450	Y	*	Y	6320	6240	Y	*	Y
6260	6460	Y	*	Y	6320	6250	Y	*	Y
6260	6470	Y	*	Y	6320	6260	Y	*	Y
6270	6070	Y	*	Y	6320	6270	Y	*	Y
6270	6110	Y	*	Y	6320	6310	Y	*	Y
6270	6120	Y	*	Y	6320	6330	Y	*	Y
6270	6130	Y	*	Y	6320	6340	Y	*	Y
6270	6140	Y	*	Y	6320	6350	Y	*	Y
6270	6150	Y	*	Y	6320	6360	Y	*	Y
6270	6160	Y	*	Y	6320	6370	Y	*	Y
6270	6170	Y	*	Y	6320	6410	Y	*	Y
6270	6210	Y	*	Y	6320	6420	Y	*	Y
6270	6220	Y	*	Y	6320	6430	Y	*	Y
6270	6230	Y	*	Y	6320	6440	Y	*	Y
6270	6240	Y	*	Y	6320	6450	Y	*	Y
6270	6250	Y	*	Y	6320	6460	Y	*	Y
6270	6260	Y	*	Y	6320	6470	Y	*	Y
6270	6310	Y	*	Y	6330	6070	Y	*	Y
6270	6320	Y	*	Y	6330	6110	Y	*	Y
6270	6330	Y	*	Y	6330	6120	Y	*	Y
6270	6340	Y	*	Y	6330	6130	Y	*	Y
6270	6350	Y	*	Y	6330	6140	Y	*	Y
6270	6360	Y	*	Y	6330	6150	Y	*	Y
6270	6370	Y	*	Y	6330	6160	Y	*	Y
6270	6410	Y	*	Y	6330	6170	Y	*	Y
6270	6420	Y	*	Y	6330	6210	Y	*	Y
6270	6430	Y	*	Y	6330	6220	Y	*	Y
6270	6440	Y	*	Y	6330	6230	Y	*	Y
6270	6450	Y	*	Y	6330	6240	Y	*	Y
6270	6460	Y	*	Y	6330	6250	Y	*	Y
6270	6470	Y	*	Y	6330	6260	Y	*	Y
6310	6070	Y	*	Y	6330	6270	Y	*	Y
6310	6110	Y	*	Y	6330	6310	Y	*	Y
6310	6120	Y	*	Y	6330	6320	Y	*	Y
6310	6130	Y	*	Y	6330	6340	Y	*	Y
6310	6140	Y	*	Y	6330	6350	Y	*	Y
6310	6150	Y	*	Y	6330	6360	Y	*	Y
6310	6160	Y	*	Y	6330	6370	Y	*	Y
6310	6170	Y	*	Y	6330	6410	Y	*	Y
6310	6210	Y	*	Y	6330	6420	Y	*	Y
6310	6220	Y	*	Y	6330	6430	Y	*	Y
6310	6230	Y	*	Y	6330	6440	Y	*	Y
6310	6240	Y	*	Y	6330	6450	Y	*	Y
6310	6250	Y	*	Y	6330	6460	Y	*	Y
6310	6260	Y	*	Y	6330	6470	Y	*	Y
6310	6270	Y	*	Y	6340	6070	Y	*	Y
6310	6320	Y	*	Y	6340	6110	Y	*	Y
6310	6330	Y	*	Y	6340	6120	Y	*	Y
6310	6340	Y	*	Y	6340	6130	Y	*	Y
6310	6350	Y	*	Y	6340	6140	Y	*	Y
6310	6360	Y	*	Y	6340	6150	Y	*	Y
6310	6370	Y	*	Y	6340	6160	Y	*	Y
6310	6410	Y	*	Y	6340	6170	Y	*	Y
6310	6420	Y	*	Y	6340	6210	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance	Feature From	To	Returned parts		Continuous maintenance
6340	6220	Y	*	Y	6360	6430	Y	*	Y
6340	6230	Y	*	Y	6360	6440	Y	*	Y
6340	6240	Y	*	Y	6360	6450	Y	*	Y
6340	6250	Y	*	Y	6360	6460	Y	*	Y
6340	6260	Y	*	Y	6360	6470	Y	*	Y
6340	6270	Y	*	Y	6370	6070	Y	*	Y
6340	6310	Y	*	Y	6370	6110	Y	*	Y
6340	6320	Y	*	Y	6370	6120	Y	*	Y
6340	6330	Y	*	Y	6370	6130	Y	*	Y
6340	6350	Y	*	Y	6370	6140	Y	*	Y
6340	6360	Y	*	Y	6370	6150	Y	*	Y
6340	6370	Y	*	Y	6370	6160	Y	*	Y
6340	6410	Y	*	Y	6370	6170	Y	*	Y
6340	6420	Y	*	Y	6370	6210	Y	*	Y
6340	6430	Y	*	Y	6370	6220	Y	*	Y
6340	6440	Y	*	Y	6370	6230	Y	*	Y
6340	6450	Y	*	Y	6370	6240	Y	*	Y
6340	6460	Y	*	Y	6370	6250	Y	*	Y
6340	6470	Y	*	Y	6370	6260	Y	*	Y
6350	6070	Y	*	Y	6370	6270	Y	*	Y
6350	6110	Y	*	Y	6370	6310	Y	*	Y
6350	6120	Y	*	Y	6370	6320	Y	*	Y
6350	6130	Y	*	Y	6370	6330	Y	*	Y
6350	6140	Y	*	Y	6370	6340	Y	*	Y
6350	6150	Y	*	Y	6370	6350	Y	*	Y
6350	6160	Y	*	Y	6370	6360	Y	*	Y
6350	6170	Y	*	Y	6370	6410	Y	*	Y
6350	6210	Y	*	Y	6370	6420	Y	*	Y
6350	6220	Y	*	Y	6370	6430	Y	*	Y
6350	6230	Y	*	Y	6370	6440	Y	*	Y
6350	6240	Y	*	Y	6370	6450	Y	*	Y
6350	6250	Y	*	Y	6370	6460	Y	*	Y
6350	6260	Y	*	Y	6370	6470	Y	*	Y
6350	6270	Y	*	Y	6410	6070	Y	*	Y
6350	6310	Y	*	Y	6410	6110	Y	*	Y
6350	6320	Y	*	Y	6410	6120	Y	*	Y
6350	6330	Y	*	Y	6410	6130	Y	*	Y
6350	6340	Y	*	Y	6410	6140	Y	*	Y
6350	6360	Y	*	Y	6410	6150	Y	*	Y
6350	6370	Y	*	Y	6410	6160	Y	*	Y
6350	6410	Y	*	Y	6410	6170	Y	*	Y
6350	6420	Y	*	Y	6410	6210	Y	*	Y
6350	6430	Y	*	Y	6410	6220	Y	*	Y
6350	6440	Y	*	Y	6410	6230	Y	*	Y
6350	6450	Y	*	Y	6410	6240	Y	*	Y
6350	6460	Y	*	Y	6410	6250	Y	*	Y
6350	6470	Y	*	Y	6410	6260	Y	*	Y
6360	6070	Y	*	Y	6410	6270	Y	*	Y
6360	6110	Y	*	Y	6410	6310	Y	*	Y
6360	6120	Y	*	Y	6410	6320	Y	*	Y
6360	6130	Y	*	Y	6410	6330	Y	*	Y
6360	6140	Y	*	Y	6410	6340	Y	*	Y
6360	6150	Y	*	Y	6410	6350	Y	*	Y
6360	6160	Y	*	Y	6410	6360	Y	*	Y
6360	6170	Y	*	Y	6410	6370	Y	*	Y
6360	6210	Y	*	Y	6410	6420	Y	*	Y
6360	6220	Y	*	Y	6410	6430	Y	*	Y
6360	6230	Y	*	Y	6410	6440	Y	*	Y
6360	6240	Y	*	Y	6410	6450	Y	*	Y
6360	6250	Y	*	Y	6410	6460	Y	*	Y
6360	6260	Y	*	Y	6410	6470	Y	*	Y
6360	6270	Y	*	Y	6420	6070	Y	*	Y
6360	6310	Y	*	Y	6420	6110	Y	*	Y
6360	6320	Y	*	Y	6420	6120	Y	*	Y
6360	6330	Y	*	Y	6420	6130	Y	*	Y
6360	6340	Y	*	Y	6420	6140	Y	*	Y
6360	6350	Y	*	Y	6420	6150	Y	*	Y
6360	6370	Y	*	Y	6420	6160	Y	*	Y
6360	6410	Y	*	Y	6420	6170	Y	*	Y
6360	6420	Y	*	Y	6420	6210	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance	Feature From	To	Returned parts		Continuous maintenance
6420	6220	Y	*	Y	6440	6420	Y	*	Y
6420	6230	Y	*	Y	6440	6430	Y	*	Y
6420	6240	Y	*	Y	6440	6450	Y	*	Y
6420	6250	Y	*	Y	6440	6460	Y	*	Y
6420	6260	Y	*	Y	6440	6470	Y	*	Y
6420	6270	Y	*	Y	6450	6070	Y	*	Y
6420	6310	Y	*	Y	6450	6110	Y	*	Y
6420	6320	Y	*	Y	6450	6120	Y	*	Y
6420	6330	Y	*	Y	6450	6130	Y	*	Y
6420	6340	Y	*	Y	6450	6140	Y	*	Y
6420	6350	Y	*	Y	6450	6150	Y	*	Y
6420	6360	Y	*	Y	6450	6160	Y	*	Y
6420	6370	Y	*	Y	6450	6170	Y	*	Y
6420	6410	Y	*	Y	6450	6210	Y	*	Y
6420	6430	Y	*	Y	6450	6220	Y	*	Y
6420	6440	Y	*	Y	6450	6230	Y	*	Y
6420	6450	Y	*	Y	6450	6240	Y	*	Y
6420	6460	Y	*	Y	6450	6250	Y	*	Y
6420	6470	Y	*	Y	6450	6260	Y	*	Y
6430	6070	Y	*	Y	6450	6270	Y	*	Y
6430	6110	Y	*	Y	6450	6310	Y	*	Y
6430	6120	Y	*	Y	6450	6320	Y	*	Y
6430	6130	Y	*	Y	6450	6330	Y	*	Y
6430	6140	Y	*	Y	6450	6340	Y	*	Y
6430	6150	Y	*	Y	6450	6350	Y	*	Y
6430	6160	Y	*	Y	6450	6360	Y	*	Y
6430	6170	Y	*	Y	6450	6370	Y	*	Y
6430	6210	Y	*	Y	6450	6410	Y	*	Y
6430	6220	Y	*	Y	6450	6420	Y	*	Y
6430	6230	Y	*	Y	6450	6430	Y	*	Y
6430	6240	Y	*	Y	6450	6440	Y	*	Y
6430	6250	Y	*	Y	6450	6460	Y	*	Y
6430	6260	Y	*	Y	6450	6460	Y	*	Y
6430	6270	Y	*	Y	6450	6470	Y	*	Y
6430	6310	Y	*	Y	6460	6070	Y	*	Y
6430	6320	Y	*	Y	6460	6110	Y	*	Y
6430	6330	Y	*	Y	6460	6120	Y	*	Y
6430	6340	Y	*	Y	6460	6130	Y	*	Y
6430	6350	Y	*	Y	6460	6140	Y	*	Y
6430	6360	Y	*	Y	6460	6150	Y	*	Y
6430	6370	Y	*	Y	6460	6160	Y	*	Y
6430	6410	Y	*	Y	6460	6170	Y	*	Y
6430	6420	Y	*	Y	6460	6210	Y	*	Y
6430	6440	Y	*	Y	6460	6220	Y	*	Y
6430	6450	Y	*	Y	6460	6230	Y	*	Y
6430	6460	Y	*	Y	6460	6240	Y	*	Y
6430	6470	Y	*	Y	6460	6250	Y	*	Y
6440	6070	Y	*	Y	6460	6260	Y	*	Y
6440	6110	Y	*	Y	6460	6270	Y	*	Y
6440	6120	Y	*	Y	6460	6310	Y	*	Y
6440	6130	Y	*	Y	6460	6320	Y	*	Y
6440	6140	Y	*	Y	6460	6330	Y	*	Y
6440	6150	Y	*	Y	6460	6340	Y	*	Y
6440	6160	Y	*	Y	6460	6350	Y	*	Y
6440	6170	Y	*	Y	6460	6360	Y	*	Y
6440	6210	Y	*	Y	6460	6370	Y	*	Y
6440	6220	Y	*	Y	6460	6410	Y	*	Y
6440	6230	Y	*	Y	6460	6420	Y	*	Y
6440	6240	Y	*	Y	6460	6430	Y	*	Y
6440	6250	Y	*	Y	6460	6440	Y	*	Y
6440	6260	Y	*	Y	6460	6450	Y	*	Y
6440	6270	Y	*	Y	6460	6470	Y	*	Y
6440	6310	Y	*	Y	6470	6070	Y	*	Y
6440	6320	Y	*	Y	6470	6110	Y	*	Y
6440	6330	Y	*	Y	6470	6120	Y	*	Y
6440	6340	Y	*	Y	6470	6130	Y	*	Y
6440	6350	Y	*	Y	6470	6140	Y	*	Y
6440	6360	Y	*	Y	6470	6150	Y	*	Y
6440	6370	Y	*	Y	6470	6160	Y	*	Y
6440	6410	Y	*	Y	6470	6170	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance	Feature From	To	Returned parts		Continuous maintenance
6470	6210	Y	*	Y	6360	4401	Y	*	Y
6470	6220	Y	*	Y	6370	4401	Y	*	Y
6470	6230	Y	*	Y	6430	4401	Y	*	Y
6470	6240	Y	*	Y	6440	4401	Y	*	Y
6470	6250	Y	*	Y	6450	4401	Y	*	Y
6470	6260	Y	*	Y	6460	4401	Y	*	Y
6470	6270	Y	*	Y	6470	4401	Y	*	Y
6470	6310	Y	*	Y	6170	4402	Y	*	Y
6470	6320	Y	*	Y	6250	4402	Y	*	Y
6470	6330	Y	*	Y	6260	4402	Y	*	Y
6470	6340	Y	*	Y	6270	4402	Y	*	Y
6470	6350	Y	*	Y	6330	4402	Y	*	Y
6470	6360	Y	*	Y	6340	4402	Y	*	Y
6470	6370	Y	*	Y	6350	4402	Y	*	Y
6470	6410	Y	*	Y	6360	4402	Y	*	Y
6470	6420	Y	*	Y	6370	4402	Y	*	Y
6470	6430	Y	*	Y	6430	4402	Y	*	Y
6470	6440	Y	*	Y	6440	4402	Y	*	Y
6470	6450	Y	*	Y	6450	4402	Y	*	Y
6470	6460	Y	*	Y	6460	4402	Y	*	Y
6070	6110	Y	*	Y	6470	4402	Y	*	Y
6070	6120	Y	*	Y	6170	4403	Y	*	Y
6070	6130	Y	*	Y	6250	4403	Y	*	Y
6070	6140	Y	*	Y	6260	4403	Y	*	Y
6070	6150	Y	*	Y	6270	4403	Y	*	Y
6070	6160	Y	*	Y	6330	4403	Y	*	Y
6070	6170	Y	*	Y	6340	4403	Y	*	Y
6070	6210	Y	*	Y	6350	4403	Y	*	Y
6070	6220	Y	*	Y	6360	4403	Y	*	Y
6070	6230	Y	*	Y	6370	4403	Y	*	Y
6070	6240	Y	*	Y	6430	4403	Y	*	Y
6070	6250	Y	*	Y	6440	4403	Y	*	Y
6070	6260	Y	*	Y	6450	4403	Y	*	Y
6070	6270	Y	*	Y	6460	4403	Y	*	Y
6070	6310	Y	*	Y	6470	4403	Y	*	Y
6070	6320	Y	*	Y	6170	4404	Y	*	Y
6070	6330	Y	*	Y	6250	4404	Y	*	Y
6070	6340	Y	*	Y	6260	4404	Y	*	Y
6070	6350	Y	*	Y	6270	4404	Y	*	Y
6070	6360	Y	*	Y	6330	4404	Y	*	Y
6070	6370	Y	*	Y	6340	4404	Y	*	Y
6070	6410	Y	*	Y	6350	4404	Y	*	Y
6070	6420	Y	*	Y	6360	4404	Y	*	Y
6070	6430	Y	*	Y	6370	4404	Y	*	Y
6070	6440	Y	*	Y	6430	4404	Y	*	Y
6070	6450	Y	*	Y	6440	4404	Y	*	Y
6070	6460	Y	*	Y	6450	4404	Y	*	Y
6070	6470	Y	*	Y	6460	4404	Y	*	Y
6070	4400	Y	*	Y	6470	4404	Y	*	Y
6170	4400	Y	*	Y	6170	4405	Y	*	Y
6250	4400	Y	*	Y	6250	4405	Y	*	Y
6260	4400	Y	*	Y	6260	4405	Y	*	Y
6270	4400	Y	*	Y	6270	4405	Y	*	Y
6330	4400	Y	*	Y	6330	4405	Y	*	Y
6340	4400	Y	*	Y	6340	4405	Y	*	Y
6350	4400	Y	*	Y	6350	4405	Y	*	Y
6360	4400	Y	*	Y	6360	4405	Y	*	Y
6370	4400	Y	*	Y	6370	4405	Y	*	Y
6430	4400	Y	*	Y	6430	4405	Y	*	Y
6440	4400	Y	*	Y	6440	4405	Y	*	Y
6450	4400	Y	*	Y	6450	4405	Y	*	Y
6460	4400	Y	*	Y	6460	4405	Y	*	Y
6470	4400	Y	*	Y	6470	4405	Y	*	Y
6170	4401	Y	*	Y	6170	4406	Y	*	Y
6250	4401	Y	*	Y	6250	4406	Y	*	Y
6260	4401	Y	*	Y	6260	4406	Y	*	Y
6270	4401	Y	*	Y	6270	4406	Y	*	Y
6330	4401	Y	*	Y	6330	4406	Y	*	Y
6340	4401	Y	*	Y	6340	4406	Y	*	Y
6350	4401	Y	*	Y	6350	4406	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance
6360	4406	Y	*	Y
6370	4406	Y	*	Y
6430	4406	Y	*	Y
6440	4406	Y	*	Y
6450	4406	Y	*	Y
6460	4406	Y	*	Y
6470	4406	Y	*	Y
6170	4407	Y	*	Y
6250	4407	Y	*	Y
6260	4407	Y	*	Y
6270	4407	Y	*	Y
6330	4407	Y	*	Y
6340	4407	Y	*	Y
6350	4407	Y	*	Y
6360	4407	Y	*	Y
6370	4407	Y	*	Y
6430	4407	Y	*	Y
6440	4407	Y	*	Y
6450	4407	Y	*	Y
6460	4407	Y	*	Y
6470	4407	Y	*	Y
6170	4408	Y	*	Y
6250	4408	Y	*	Y
6260	4408	Y	*	Y
6270	4408	Y	*	Y
6330	4408	Y	*	Y
6340	4408	Y	*	Y
6350	4408	Y	*	Y
6360	4408	Y	*	Y
6370	4408	Y	*	Y
6430	4408	Y	*	Y
6440	4408	Y	*	Y
6450	4408	Y	*	Y
6460	4408	Y	*	Y
6470	4408	Y	*	Y
4605	6110	Y	*	Y
4605	6120	Y	*	Y
4605	6130	Y	*	Y
4605	6140	Y	*	Y
4605	6150	Y	*	Y
4605	6160	Y	*	Y
4605	6170	Y	*	Y
4605	6210	Y	*	Y
4605	6220	Y	*	Y
4605	6230	Y	*	Y
4605	6240	Y	*	Y
4605	6250	Y	*	Y
4605	6260	Y	*	Y
4605	6270	Y	*	Y
4605	6310	Y	*	Y
4605	6320	Y	*	Y
4605	6330	Y	*	Y
4605	6340	Y	*	Y
4605	6350	Y	*	Y
4605	6360	Y	*	Y
4605	6370	Y	*	Y
4605	6410	Y	*	Y
4605	6420	Y	*	Y
4605	6430	Y	*	Y
4605	6440	Y	*	Y
4605	6450	Y	*	Y
4605	6460	Y	*	Y
4605	6470	Y	*	Y
4607	6110	Y	*	Y
4607	6120	Y	*	Y
4607	6130	Y	*	Y
4607	6140	Y	*	Y
4607	6150	Y	*	Y
4607	6160	Y	*	Y
4607	6170	Y	*	Y

Feature From	To	Returned parts		Continuous maintenance
4607	6210	Y	*	Y
4607	6220	Y	*	Y
4607	6230	Y	*	Y
4607	6240	Y	*	Y
4607	6250	Y	*	Y
4607	6260	Y	*	Y
4607	6270	Y	*	Y
4607	6310	Y	*	Y
4607	6320	Y	*	Y
4607	6330	Y	*	Y
4607	6340	Y	*	Y
4607	6350	Y	*	Y
4607	6360	Y	*	Y
4607	6370	Y	*	Y
4607	6410	Y	*	Y
4607	6420	Y	*	Y
4607	6430	Y	*	Y
4607	6440	Y	*	Y
4607	6450	Y	*	Y
4607	6460	Y	*	Y
4607	6470	Y	*	Y
1109	1108	Y	*	Y
6516	6517	N	*	Y
6517	6516	N	*	Y
3700	6516	Y	*	Y
3702	6518	Y	*	Y
6520	0520	Y	*	Y
6516	0516	Y	*	Y
6518	0518	Y	*	Y
1208	3102	Y	*	Y
1208	3104	Y	*	Y
1208	3106	Y	*	Y
1208	3108	Y	*	Y
3102	3104	Y	*	Y
3102	3106	Y	*	Y
3102	3108	Y	*	Y
3104	3106	Y	*	Y
3104	3108	Y	*	Y
3106	3108	Y	*	Y
3102	2601	Y	*	Y
3102	2602	Y	*	Y
3102	2603	Y	*	Y
3102	2604	Y	*	Y
3102	2605	Y	*	Y
3102	2606	Y	*	Y
3102	2607	Y	*	Y
3102	2608	Y	*	Y
3104	2602	Y	*	Y
3104	2603	Y	*	Y
3104	2604	Y	*	Y
3104	2605	Y	*	Y
3104	2606	Y	*	Y
3104	2607	Y	*	Y
3104	2608	Y	*	Y
3106	2603	Y	*	Y
3106	2604	Y	*	Y
3106	2605	Y	*	Y
3106	2606	Y	*	Y
3106	2607	Y	*	Y
3106	2608	Y	*	Y
3108	2604	Y	*	Y
3108	2605	Y	*	Y
3108	2606	Y	*	Y
3108	2607	Y	*	Y
3108	2608	Y	*	Y

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