

## IBM @server® zSeries 990



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### Highlights

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- **Optimized to help meet the requirements of today's on demand solutions**
- **Innovative design can scale up to three times the capacity of the IBM @server® zSeries® 900 Model 216**
- **zSeries Application Assist Processor provides a specialized and highly integrated z/OS® Java™ execution environment**
- **On/Off Capacity on Demand is designed to provide greater flexibility in managing constantly changing workload demands**
- **Ability to scale up physically and scale out virtually helps you simplify your infrastructure and integrate multiple workloads**
- **Partition security leadership with Common Criteria Evaluation Assurance Level 5 (EAL5) certification**

### IBM's server for the on demand world

Customers of every size, and across every industry, are looking for ways to make their businesses more productive and more resilient in the face of change and uncertainty. They need the ability to react to rapidly changing market conditions, manage risk, outpace their competitors with new capabilities and deliver clear returns on investments.

Welcome to the on demand era—the next phase of e-business. To meet the challenges of constant change, companies must go beyond simply integrating business processes. They must have the flexibility to provide products and services to customers on demand. But success in this environment takes a new approach to business—and a new kind of IT infrastructure to support it.

The IBM @server zSeries 990 (z990) delivers enriched functions for the on demand operating environment. zSeries is the enterprise-class e-business server optimized for mixed workload integration, high transaction processing and data serving for the

on demand world. In implementing the z/Architecture™ with new technology solutions, zSeries is designed to facilitate IT and business transformation and reduce the stress of growing business-to-business, business-to-customer and business-to-employee computing requirements. The zSeries represents an advanced generation of servers that feature enhanced performance, support for zSeries Parallel Sysplex® clustering, improved hardware management controls, open and industry standard technologies such as Linux® and Java, and innovative functions to address infrastructure simplification and on demand business operations.

The z990 is designed to provide a balanced system and improved price/performance. From processor storage to the system's I/O and network channels, end-to-end bandwidth is designed to deliver data where and when it is needed. With a choice of four models, the largest z990 can be configured with up to three times the processing power, four times the memory, four times the

HiperSockets™, up to four times the number of ESCON® channels, up to two and one half times more FICON® and up to twice the number external coupling links of an IBM @server zSeries 900 (z900) model 216 server. Each model adds to the system's total resources—so you can have the ability to scale up with z/OS and reliably handle your most critical business transactions.

#### **Powerful**

zSeries is based on the 64-bit z/Architecture, which is designed to reduce memory and storage bottlenecks and can automatically direct resources to priority workloads through Intelligent Resource Director (IRD).

With the superscalar microprocessor and the CMOS 9S-SOI technology, the z990 is designed to further extend and integrate key platform strengths such as dynamic flexible partitioning and resource management for mixed and unpredictable workloads. zSeries provides scalability, high availability and Quality of Service.

The z990 provides a significant increase in system scalability and opportunity for server consolidation by providing a multi-book system structure that supports the configuration of one to four books.

Each book is comprised of a MultiChip Module (MCM), memory cards—that can support up to 64GB of memory per book—and high performance Self-Timed Interconnects.

To support the highly scalable multi-book system design, the Channel SubSystem (CSS) has been enhanced with Logical Channel SubSystems (LCSSs) which provide the capability to install up to 1024 ESCON channels across three I/O cages. With Spanned Channel support, HiperSockets, ICB, ISC-3, OSA-Express, OSA-Express2, FICON Express and FICON Express2 can be shared across LCSS for additional flexibility. High-speed interconnects for TCP/IP communication, known as HiperSockets, let TCP/IP traffic travel among partitions and virtual servers at memory speed, rather than network speed.

Continuing enhancements to the Open Systems Adapters provide improved throughput, enhanced virtualization with up to 4 times the supported TCP/IP connections, Large Send TCP Segmentation offload, concurrent LIC updates, a 10 Gigabit Ethernet feature and the capability to perform like a Layer 2-type device providing the capability of being protocol or Layer 3 independent.

FICON Express2™ features can provide improved throughput, support for up to four FICON channels, support for up to 2 Gigabit per second high speed attachment of traditional disk and tape storage, connectivity to SCSI-based open storage via Linux on zSeries and availability enhancements with Purge Path Extended. Additionally, with FICON Express and FICON Express2, FCP LUN Access Control is previewed and is designed to enhance security and resource sharing on SCSI storage controllers and devices.

OSA-Express Integrated Console Controller (OSA-ICC) support can be enabled using a port on the 1000BASE-T Ethernet feature. Each

OSA-ICC port is designed to support up to 120 console session connections for z990 Initial Program Load and z/OS, z/VM®, VSE/ESA™ and TPF operational consoles. OSA-ICC also supports spanned channels.

The zSeries Application Assist Processor (zAAP) is an attractively priced, specialized processing unit that provides a strategic z/OS Java execution environment for customers who desire the powerful integration advantages and traditional qualities of service of the zSeries platform.

zAAPs enable you to effectively integrate and run e-business Java workloads on the same server as your database, helping to simplify and reduce the infrastructure required for Web applications while helping to lower your overall total cost of ownership.

zAAPs are designed to operate asynchronously with the general purpose Central Processors (CPs) to execute Java programming under control of the IBM Java Virtual Machine (JVM). This

can help reduce the demands and capacity requirements on general purpose CPs which may then be available for reallocation to other zSeries workloads. The amount of general purpose CP savings may vary based on the amount of Java application code executed by zAAP(s). And best of all, IBM JVM processing cycles can be executed on the configured zAAPs with no anticipated modifications to the Java application(s). Execution of the JVM processing cycles on a zAAP is a function of the IBM Software Developer's Kit (SDK) for z/OS Java 2 Technology Edition, z/OS 1.6 (or z/OS.e 1.6) and the innovative Processor Resource/Systems Manager™ (PR/SM).

Essentially, zAAPs allow customers to purchase additional processing power exclusively for z/OS Java application execution without affecting the total MSU rating or machine model designation. Conceptually, zAAPs are very similar to a System Assist Processor (SAP); they cannot execute an Initial Program Load and only assist the general purpose CPs for the execution of Java

programming. Moreover, IBM does not impose software charges on zAAP capacity. Additional IBM software charges apply only when additional general purpose CP capacity is used.

### **Intelligent**

Improving capacity, bandwidth and performance is good, but managing these resources to help meet your business goals is even better. The z990 can help you save time and money with its self-optimizing and autonomic capabilities.

Intelligent Resource Director (IRD) is a key feature of the z/Architecture. Together, Parallel Sysplex® technology and IRD are designed to provide the flexibility and responsiveness required by on demand business workloads. These capabilities can significantly help minimize the complexities inherent in broadly distributed IT infrastructures and can help lower your total cost of ownership.

The z990 extends the power and versatility of z/OS's innovative Workload Manager from the edge of a network to the heart of the data. Business priorities

are used for real time prioritization of network and I/O requests when combined with Cisco technology and through the IBM TotalStorage® Enterprise Storage Server®. The Sysplex Distributor function of z/OS provides intelligent load balancing of TCP/IP traffic across a Parallel Sysplex cluster. Dynamic Virtual Internet Protocol Addressing (VIPA) support extends the workload distribution and availability features of Parallel Sysplex technology to the TCP/IP network.

### **Autonomic**

The zSeries is designed to deliver the highest level of application availability required in today's on demand environment. It offers extremely high reliability and is endowed with self-healing and self-managing features so your system can constantly fine-tune itself to help provide the level of performance required for on demand business operations. Fault avoidance and tolerance design features can help minimize business disruptions, as well as permit concurrent maintenance and repairs.

The IBM @server Capacity Upgrade on Demand capability allows for the nondisruptive addition of one or more Central Processors (CPs), Internal Coupling Facilities (ICFs), IBM @server zSeries Application Assist Processor (zAAP), and/or Integrated Facility for Linux (IFLs) to increase your server resources when you need them without incurring downtime.

The IBM @server On/Off Capacity on Demand capability of the z990 is designed to provide even greater flexibility by allowing you to turn on additional, temporary system resources at busy times of the year and then turn them back off when they're no longer needed. This can give you exceptional control over costs while you meet your dynamic capacity needs.

The z990 can provide reserved emergency backup CPU capacity through its Capacity Backup Upgrade feature. This feature gives extra capacity to your operation in emergency situations where you have lost capacity in another part of your establishment and need to recover capacity on a designated z990 system.

### **Highly safe and secure**

In the on demand era, security is more critical than ever. An IT infrastructure can now be a tangible manifestation of a brand image. It is the way a company can help maintain the privacy of confidential information and the security of the system itself. The Crypto Express2 feature combines the functions of PCICA and PCIXCC in a single feature with two coprocessors. This is designed to provide an equivalent level of SSL acceleration and may provide improved secure-key and system throughput on the z990 system.

The Crypto Express2 feature, designed for FIPS 140-2 Level 4, supports highly secure applications requiring hardware acceleration for SSL and TLS protocol transactions, as well as the security functions—PKE, PKD, TDES, DUKPT and EMV2000—which were announced in April, 2004.

The zSeries cryptography is further advanced with the Cryptographic Assist Architecture implemented on z990 general purpose processors (CPs) and competitively priced Integrated Facility

for Linux (IFL) Processors. With unprecedented scalability and data rates the z990 processor provides a set of symmetric cryptographic functions, synchronously executed, which can enhance the performance of the en/decrypt function of SSL, VPN (Virtual Private Network) and data storing applications which do not require FIPS 140-2 Level 4 security.

### **An open, flexible server**

The z990 offers the flexibility to manage numerous operating systems on a single server, including z/OS, z/VM, VSE/ESA, TPF and Linux on zSeries and Linux on S/390®. The z990 supports both ESA/390 and z/Architecture modes. Since both of these architectures are supersets of previous architectures, they are designed to provide seamless support for previous architectures dating back to the S/360™. As such, they are designed to support existing application investments without change to realize the benefits of new

technologies with the z990. z/OS and the z990 are designed to automatically adapt to support the relevant 24-bit, 31-bit and 64-bit addressing schemes.

While zSeries servers support a number of different operating systems, their most advanced features are optimized for z/OS.

z/OS is the foundation for the future of zSeries, an integral part of the z/Architecture designed and developed to quickly respond to the demanding quality of service requirements for the on demand era. z/OS—coupled with the multi-book design of the z990—easily allows you to physically scale up to the amount of server capacity you need. It is designed to deliver the highest qualities of service for enterprise transactions and data, and extends these qualities to new applications using the latest software technologies. It provides a highly secure, scalable, high-performance base on which to deploy Internet and Java technology enabled applications, providing a comprehensive and diverse application execution environment.

## Powerful integration

With zAAPs, customers can extend the value of existing zSeries investments by strategically integrating new Java technology-based workloads alongside core-business applications and data on the mainframe at an extremely cost effective price point.

Attractively priced, zAAPs can allow your enterprise to further leverage the flexibility of the J2EE open programming model, along with zSeries virtualization technologies to help simplify and integrate the IT infrastructure, increase overall system productivity, and lower the overall costs of computing for running Java technology-based applications on the platform.

Integration of the Java applications executing on zAAPs, within the same z/OS LPAR as their associated database subsystems, can help simplify the server infrastructures and improve operational efficiencies. For example, use of zAAPs could reduce the number of TCP/IP programming 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.

z/VM, strategic to Linux and new workloads on zSeries, uses virtualization technology as a foundation to offer Virtual Machine (VM) capabilities on a mainframe. It allows you to virtualize processor, communications, storage, I/O and networking resources to help minimize the planning, purchasing and installing of dedicated hardware to support additional workloads. An ideal platform for consolidating servers and simplifying the infrastructure, z/VM enables you to run hundreds of Linux images simultaneously on a single system—helping to reduce both cost and complexity—while benefiting from the reliability and availability of the z990.

The z990 provides important improvements to the QDIO architecture to help improve performance and minimize the overhead of running Linux and other virtual server guests running under z/VM V4 or V5.

Linux and zSeries make a great team. The Linux open standards-based platform supports rapid application portability which can be adapted to suit changing business needs. zSeries

enables massive scalability within a single server. Linux and z/VM take advantage of the zSeries capacity by allowing you to run hundreds of virtual blade servers simultaneously—so you can scale out virtually to leverage z990 high utilization and help lower the total cost of ownership. Vendor Grid computing products may be available which can help leverage Linux on zSeries and z/VM to provide Grid node capacity to help meet changing needs. Linux on zSeries supports the 64-bit architecture and can utilize the 16 HiperSockets available on the z990 for high-speed TCP/IP communication among partitions and virtual servers at memory speed.

z/VM V4.4 and later allows IPLing from Small Computer System Interface (SCSI) disks attached to FICON Express running FCP mode channels for Linux and other guest operating systems that contain the required support when z/VM is running on a z990, z890, z900, or z800 server equipped with the SCSI IPL feature enabler. z/VM V5 provides the ability to IPL the VM system directly from FCP-attached SCSI disks. With this support, you will be able to install, IPL, and run z/VM from SCSI disks.

Linux also benefits from the zSeries support of FICON Express and FICON Express2 FCP channels, switches and open storage FCP/SCSI devices with full fabric connectivity. With the z990, you can IPL operating systems that support SCSI-attached disk attached via the zSeries FCP channel. Additionally, zSeries FCP LUN Access Control, an exclusive on z990 and z890, is previewed and is designed to allow the host to control access to SCSI storage controllers and their devices in Linux and Linux hosted by z/VM environments, including Z/VM system owned SCSI disks. This expanded attachability means you have more choices for new storage solutions, may have the ability to partition existing SAN attached storage devices for improved consolidation to leverage your current investments and help lower the cost of ownership for your Linux implementation.

### **World-class servers**

The IBM @server brands—along with TotalStorage—are about uncompromising flexibility in selecting, building and deploying the applications your business needs. Toward that end, IBM offers one of the industry's broadest range of platforms and operating systems. IBM is committed to

industry-standard, cross-platform technologies—such as Java, XML, HTML, SOAP and UDDI—that are at the heart of a flexible on demand business infrastructure. Support for these standards in our key middleware—including DB2 Universal Database™, WebSphere Application Server and MQSeries®—means you won't be locked into a single platform as your business grows. As a result, you should always have the flexibility to deploy applications in a cost-effective way.

### **Paying for what you use**

The z990 and z/OS can be a powerful combination in helping to reduce computing costs by leveraging Workload License Charges (WLC). With WLC sub-capacity pricing, software charges are aligned with the utilization of an LPAR or LPARs where a software product executes. WLC also supports granular software growth and allows customers to manage their software costs, and it separates installed hardware capacity from software charges. Additionally, zAAPs, IFLs and ICFs do not change the software model number of the z990 server.

IBM Global Financing, a leading provider of IT financing services, offers solutions that can make acquiring your IBM @server zSeries 990 fast, easy and affordable. All your hardware, software and services can be included in a single monthly payment to help simplify your administration. By spreading your total cost of acquisition over the term of the financing, you turn large upfront expenses into regular monthly payments. This flexibility can allow you to overcome current budget restrictions, better manage your expenses, avoid technology obsolescence and eliminate hardware disposal issues.

### **Smoothing the path**

The systems management functions and features of the z990 provide incredibly robust control and automation as well as exceptional serviceability and availability. For example, IRD extends the classic strengths of I/O priority queuing by prioritizing requests across the channels of the z990 to move to the workloads which require additional connectivity via Dynamic Channel Path Management. It can dynamically balance CPU resources across LPARs according to business goals.

z/OS can act as a server gateway in Tivoli® enterprise-based management of the whole IT environment. IBM Tivoli Business Systems Manager for z/OS and its applications can be ordered as part of the z/OS ServerPac.

z/OS installation is designed to be simpler, faster and less demanding on system programming skills and times. The ServerPac for z/OS offers the option of full system replacement and upgrading software in the same package. Other customized offerings (i.e. SystemPac®) assist in further reducing the workload associated with installing z/OS, CICS®, IMS™ and DB2®.

In addition, z/OS provides an entirely new approach for installing and configuring products: a managed system infrastructure. This approach goes a step beyond Web-based wizards by furnishing a step-by-step installation guide and automated system updates. For example, Managed Systems

Infrastructure for Setup can establish a Parallel Sysplex cluster quickly and easily by transparently creating the policies, parmlib specifications and initialization parameters necessary to configure a basic Parallel Sysplex environment.

#### **“The new frontier”**

What does the on demand era mean for your business? It means becoming more productive and being able to sense and respond to change on the fly and with flexibility. It means managing risk while lowering costs. It means greater control and transparency with less complicated management. It means robust participation with virtualization and provisioning for Infrastructure Simplification benefits. Success in the on demand environment relies on flexibility and resiliency of an on demand operating environment that is properly aligned to support your core business strategy and processes.

So how do you get there? While the term “mainframe” conjures images of large multi-national corporations, the incredible scalability of the z990 can bring on demand benefits to companies both large and small. Its multi-book design can help you tailor the right sized system for needs and the On/Off Capacity on Demand feature can give you greater control of your IT costs.

IBM's z990 can help almost any size company in any industry become more responsive, variable, focused and resilient—the key components of an on demand business. With its balanced design that is designed to ensure high levels of utilization, its ability to automatically allocate resources where and when they're needed according to business priorities, its flexibility to adapt to change and, its incredible reliability, the z990 is the data center for the on demand business world.

## IBM @server zSeries 990 enterprise server at a glance

### Hardware models

General purpose/Coupling facility/Linux A08, B16, C24, D32

| Coupling links | ISC-3 | IC | ICB-2 | ICB-3 | ICB-4 | Max # Links     |
|----------------|-------|----|-------|-------|-------|-----------------|
|                | 48    | 32 | 8     | 16    | 16    | 64 <sup>1</sup> |

### Channels

|            |   |
|------------|---|
| Minimum    | 0/0/0/0 (ESCON/FICON Express/OSA-Express/HiperSockets)              |
| Minimum    | 0/0/0 (FICON Express2 / OSA-Express2 - GbE/OSA-Express2 - 10 GbE)   |
| Maximum    | 1024/120/48/16 (ESCON/FICON Express/OSA-Express/HiperSockets)       |
| Maximum    | 240/48/24 (FICON Express2/OSA-Express2 - GbE/OSA-Express2 - 10 GbE) |
| Increments | 4/2/2/1 (ESCON/FICON Express/OSA-Express/HiperSockets)              |
| Increments | 4/2/1 (FICON Express2 / OSA-Express2 - GbE/OSA-Express2 - 10 GbE)   |

**Cryptographic<sup>4</sup>**

PCI-X Crypto Coprocessor—optional up to 4 features (4 coprocessor)  
 PCI Crypto Accelerator—optional up to 6 features (12 accelerators)  
 Crypto Express2—optional up to 8 features (16 coprocessors)

| Processor memory | Model A08 | B16   | C24   | D32   |
|------------------|-----------|-------|-------|-------|
| Minimum          | 16GB      | 16GB  | 16GB  | 16GB  |
| Maximum          | 64GB      | 128GB | 192GB | 256GB |

**Upgradeability**

Upgradeable within zSeries 990  
 Upgrade from zSeries 900

| Physical configuration | Model A08, minimum <sup>2</sup> | Model D32, maximum <sup>3</sup> |
|------------------------|---------------------------------|---------------------------------|
| Weight (unpacked)      | 1174 kg (2582 lbs)              | 2007 kg (4415 lbs)              |
| Footprint              | 2.49 Sq meters (26.78 Sq. ft)   | 2.49 Sq. meters (26.78 Sq. ft)  |
| Service clearance      | 5.45 Sq meters (58.69 Sq. ft)   | 5.45 Sq. meters (58.69 Sq. ft)  |
| Input power            | 5.3 kW                          | 15.8 kW                         |
| Heat output            | 18.02 KWTU/hr                   | 53.73 KBTU/hr                   |
| Air flow               | CFM 500, m <sup>3</sup> /m      | CFM 1450, m <sup>3</sup> /m     |
| Height                 | 194.1 cm (76.4 inches)          | 194.1 cm (76.4 inches)          |

**General**

Conforms to EIA guidelines for frames

### Software

|                             |   |
|-----------------------------|---|
| z/OS LPAR mode:             | z/OS 1.2 <sup>5</sup> and subsequent releases           |
| z/VM@ LPAR mode:            | z/VM 3.1, z/VM 4.3 and subsequent releases, z/VM 5.1    |
| Linux on zSeries LPAR mode: | Red Hat, SUSE LINUX, Turbolinux, Linux as z/VM guest    |
| OS/390@ LPAR mode           | OS/390 2.10 <sup>5</sup>                                |
| VSE LPAR mode:              | VSE/ESA™ 2.5 <sup>5</sup> , 2.6 and subsequent releases |
| TPF LPAR mode:              | TPF 4.1 (ESA mode only)                                 |
| Linux on S/390@ LPAR mode:  | Red Hat, SUSE, Turbolinux                               |

<sup>1</sup> 64 External and 32 Internal

<sup>2</sup> Model A08 with one I/O Cage and no IBF

<sup>3</sup> Model D32 with three I/O Cages and IBF with a combined max. of 64

<sup>4</sup> Combined max. of 8 features

<sup>5</sup> Software release is End-of-Service

## IBM @server zSeries 990 enterprise server features and benefits

|                            |   |  |  |
|----------------------------|---|--|--|
| <b>z/Architecture</b>      | <ul style="list-style-type: none"> <li>Intelligent Resource Director</li> <li>Capacity Backup Upgrade</li> <li>Customer Initiated Upgrades</li> </ul>   | <ul style="list-style-type: none"> <li>Capacity Upgrade on Demand</li> <li>On/Off Capacity on Demand</li> <li>QDIO</li> </ul>  | <ul style="list-style-type: none"> <li>Integrated Facility for Linux</li> <li>HiperSockets</li> <li>zSeries Application Assist Processor</li> </ul>  |
| <b>Cluster systems</b>     | <ul style="list-style-type: none"> <li>Parallel Sysplex clustering technology</li> <li>Internal Coupling Facility (ICF)</li> <li>Internal Coupling Channel</li> <li>InterSystem Coupling-3 Links</li> <li>Integrated Cluster Bus</li> </ul>   | <ul style="list-style-type: none"> <li>Sysplex Distributor</li> <li>Geographically Dispersed Parallel Sysplex™</li> <li>Transparent ICF Sparing</li> <li>System-Managed CF Structure Duplexing</li> </ul>  | <ul style="list-style-type: none"> <li>Shared ICFs and CPs</li> <li>Dynamic CF Dispatching</li> <li>Dynamic ICF Expansion</li> <li>z/VM Virtual Parallel Sysplex</li> </ul>  |
| <b>Availability</b>        | <ul style="list-style-type: none"> <li>Transparent CP Sparing</li> <li>Failure Containment for MBA</li> <li>Dynamic memory sparing</li> <li>Partial memory restart</li> <li>Remote operations support</li> <li>N+1 power supply technology</li> <li>Concurrent channel, OSA-E and Coupling Link maintenance</li> <li>Dynamic I/O Reconfiguration</li> <li>Enhanced Firmware Simulation</li> <li>FICON Purged Path Extended</li> </ul> | <ul style="list-style-type: none"> <li>System Assist Processor (SAP)</li> <li>Fault Tolerant Interconnect Design</li> <li>Reassignment &amp; Sparing</li> <li>CICS® subsystem storage product</li> <li>Dual Support Elements</li> <li>Hybrid cooling</li> <li>Concurrent Hardware Management Console (HMC) and Support Element</li> <li>Concurrent Book Add</li> </ul> | <ul style="list-style-type: none"> <li>Enhanced Application</li> <li>Sparing for Storage Protect Preservation Keys</li> <li>CICS subspace group facility</li> <li>Dynamic Channel Path Management</li> <li>Concurrent power and thermal maintenance</li> <li>Concurrent Licensed Internal Code (LIC) maintenance for CP, SAP, SE, PR/SM™, LPAR, HMC, OSA-Express2</li> </ul> |
| <b>Management</b>          | <ul style="list-style-type: none"> <li>(SE) maintenance</li> <li>Internal Battery Feature</li> </ul>  | <ul style="list-style-type: none"> <li>Power/Thermal</li> <li>ESCON sparing</li> </ul>   | <ul style="list-style-type: none"> <li>Cancel I/O Requests</li> </ul>  |
| <b>PR/SM</b>               | <ul style="list-style-type: none"> <li>Up to 30 LPARs each with 64-bit central memory addressability</li> </ul>   | <ul style="list-style-type: none"> <li>Enhanced Dynamic Reconfiguration Management</li> </ul>  |  |
| <b>Performance</b>         | <ul style="list-style-type: none"> <li>IEEE binary floating point support for advanced Lotus® Domino™ and Java performance</li> <li>DB2® sort assist</li> </ul>   | <ul style="list-style-type: none"> <li>Up to 256 GB memory</li> <li>Hiperbatch™</li> <li>Hardware-assisted data compression</li> <li>Long Displacement Facility</li> </ul>   | <ul style="list-style-type: none"> <li>Hipersorting</li> <li>Compare-and-move extended</li> <li>Performed Locked Operations for enhanced IP performance</li> </ul>   |
| <b>I/O connectivity</b>    | <ul style="list-style-type: none"> <li>ESCON half duplex data transfer</li> <li>FICON full duplex data transfer</li> <li>Full fabric FCP support</li> <li>FCP LUN Access Control*</li> </ul>  | <ul style="list-style-type: none"> <li>Multiple Image Facility (MIF)</li> <li>FICON CTC</li> <li>FCP support for SCSI devices by Linux and z/VM</li> </ul>   | <ul style="list-style-type: none"> <li>ESCON CTC native and basic mode</li> <li>Logical Channel SubSystems</li> </ul>  |
| <b>Networking</b>          | <ul style="list-style-type: none"> <li>OSA-Express (1000BASE-T Ethernet, Token-Ring, Fast Ethernet)</li> <li>OSA-Express2 (Gigabit Ethernet, 10 Gigabit Ethernet)</li> <li>OSA-Express and OSA-Express2 Layer 2 support</li> <li>HiperSockets</li> </ul>  |  |  |
| <b>Console controller*</b> | OSA-Express Integrated Console Controller (1000BASE-T Ethernet)   |  |  |
| <b>Security</b>            | <ul style="list-style-type: none"> <li>Open Architecture Distributed Transaction Enablement</li> <li>AES Encryption support</li> <li>TKE Smart Card Reader support</li> <li>CP Assist for Cryptographic Functions</li> </ul>  | <ul style="list-style-type: none"> <li>SSL Acceleration for Linux and z/OS</li> <li>Certified for LPAR isolation - Common Criteria EAL5</li> </ul>   | <ul style="list-style-type: none"> <li>Tamper-proof Cryptographic Support</li> <li>Designed for FIPS 140-2 Level 4 certification</li> </ul>  |

\* Previewed



**For more information**

For more information about the IBM @server zSeries 990, contact your IBM marketing representative or IBM Business Partner or visit:

**ibm.com**/eserver/zseries



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