IBM zEnterprise EC12 (zEC12)

Highlights

- Centrally managed, integrated hybrid computing technology

- Keeping data secure, available and easy to manage

- Balanced design offering virtually limitless cloud expansion and elasticity

- Comprehensive security and resiliency built in for highest levels of trust and confidence

New technologies for cloud, big data, analytics, mobile devices and social media are redefining the way that businesses will be operating on and IT must be transformed to support these technologies. The shift can offer the opportunity to assess and improve the business model and interaction with the customers, partners and employees. To capitalize on this opportunity, organizations must be able to tap into their data and energize applications without going over budget and all the while keeping everything protected and secure.

The IBM® zEnterprise® System delivers unique value and industry leading capabilities allowing you to maximize the business value of your unique information. Make informed and optimized decisions, exploit cloud delivery models to improve operational efficiency, reduce costs and complexity with Infrastructure as a Service, and use the built in IBM z Systems™ security at every level to improve customer trust and confidence and know your IT infrastructure is secure. The IBM zEnterprise EC12 (zEC12) and the IBM z BladeCenter® Extension offer a proven hybrid computing design that supports mainframe and the distributed technologies of IBM POWER7® and IBM System x® blades. IBM z Unified Resource Manager (zManager) can manage and integrate workloads on the multiple architectures with the simplicity of a single system.

Unprecedented performance and scale

The IBM zEnterprise EC12 (zEC12) is the cornerstone of our latest zEnterprise System and flagship of the IBM z Systems portfolio. The superscalar design allows the zEC12 to deliver a record level of capacity
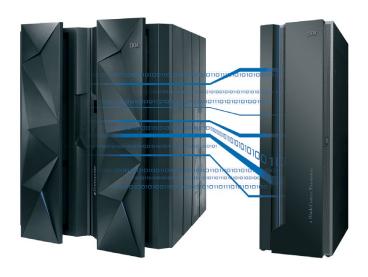
over the prior System z® servers. It is powered by 120 of the world's most powerful microprocessors running at 5.5 GHz and is capable of executing more than 78,000 millions of instructions per second (MIPS).[1] This extreme scale, up to 50 percent[1] more total capacity than its predecessor, the IBM zEnterprise 196 (z196), makes the zEC12 perfect to grow either horizontally or vertically within one server. The zEC12 is excellent for doing large scale consolidation, providing secure data serving and delivering mission critical transaction processing capabilities. Plus with over 100 configurable cores, finding the best mix of cores to fit your processing requirements is not a problem.

IBM continues to enhance z/Architecture® with memory hierarchy improvements enabled by System z chip designs, continued refinements in execution processing, and improved prefetch instructions. All of these can help you realize throughput for many workloads including those using Java™ and DB2® for z/OS®. Support in z/OS, combined with zEC12 hardware support for 2 GB pages, helps reduce system memory management overhead to help improve performance. This can benefit both exploiting memory-intensive workloads such as those using Java, with better overall JVM performance and improved Java garbage collection (memory reclamation).

Our zEC12 processor chip has been optimized for software performance. With a redesign of cache, there is almost 2X the amount of cache on the chip and 2X the amount in the processor book than on the z196. A bigger and faster cache helps to avoid untimely swaps. When you have multiple workloads running on a multi-core system, you want to avoid losing/reloading of cache in order to maximize the throughput of your concurrent workloads. The zEC12 microprocessor also includes multiple innovative architectures that will allow new software paradigms to be deployed in the platform. The zEC12 supports a general purpose hardware transactional memory architecture called Transactional Execution. It is baked into the firmware and initially the chief exploiter is Java7SR3. Transactional Execution allows for the elimination of tension between locks for workloads running in parallel. Other innovative instructions are included, such as software directives to affect

branch prediction effectiveness and to perform fine-grained cache management. A new set of instructions is incorporated to enable broader exploitation of Decimal Floating Point (DFP) arithmetic. We are seeing great results with the enhancements. We are seeing up to 45 percent improvement in Java workloads on the zEC12. Using Java7SR3 provides an additional 13 percent improvement when exploiting the -Xaggressive option and exploiting Flash Express 1M large pages. IMS™ can make use of the faster CPU and CP clock speed, and the larger cache with complete sharing of cache to improvement performance and throughput. Our internal measurements show a 30 percent improvement in IMS throughput.

All five models of the zEC12 are machine type 2827. The server supports up to a total of 3 terabytes (TB) of real memory. Beyond the customer-purchased memory, the zEC12 has doubled the amount of memory—32 gigabytes (GB) for the Hardware System Area (HSA) which holds the I/O configuration data for the server.

High-speed connectivity out to the data and the network are critical in achieving sufficient levels of transaction throughput and enabling resources inside and outside the server to maximize application performance. The host bus interface of the zEC12 is designed to help satisfy storage class memory, clustering, security, SAN and LAN requirements. The industry standard Peripheral Component Interconnect Express Generation 2 (PCIe Gen2) I/O drawer not only provides improved performance and granularity support for FICON Express 8S, OSA-Express, including the new OSA-Express5S, Crypto Express4S, and Flash Express, an internal solid state disk. The zEC12 continues to offer High Performance FICON for System z (zHPF) for OLTP workload performance optimization. Plus zHPF can now convert 100 percent of DB2 I/O's for improved bandwidth and response time.

A high speed networking link is available that can be used to optimize z/OS V2.1 server-to-server communications, with reduced latency and with lower CPU overhead than traditional TCP/IP communications. The capability, called Shared Memory Communications - Remote Direct Memory Access (SMC-R), offers great time to value because any TCP sockets based application can seamlessly use this capability without requiring any application changes. The feature of the PCIe I/O drawer to support SMC-R is the 10GbE RoCE Express.

A z/OS V2.1 capability, IBM zEnterprise Data Compression (zEDC), is designed to support a new data compression function for low-latency compression. zEDC uses a new feature of the zEC12 PCIe drawer called zEDCExpress. Applications that today are using the industry standard zlib compression for large files may find compression with zEDC to be more efficient and help improve wall clock time. With compression of large files, zEDC may be helpful for large cross platform file transfers. BSAM/QSAM extended format data, can realize benefits from zEDC to help reduce disk space and improve effective bandwidth without significant CPU overhead.

The zEC12 offers solutions that can help reduce wattage and power usage across an entire data center. There is an option for high-voltage DC, which can eliminate the need for a Universal Power Supply (UPS) inverter and Power Distribution Unit (PDU). Top exit I/O cabling and power cabling, can improve flexibility in the data center by helping to increase air flow in a raised-floor environment. The zEC12 offers a water cooling option that does not increase the system footprint and offers energy savings without compromising performance. The zBX has an optional rear door heat exchanger to help reduce energy consumption. And something new, the zEC12 server can install and run on a non-raised floor, a new option for data center designs, particularly for disaster recovery solutions.

Embracing and managing all system resources

The z BladeCenter Extension (zBX) continues to support workload optimization and integration for z Systems. It optionally can attach to the zEC12 via a secure high-performance private network, and houses the IBM WebSphere® DataPower® Integration Appliance XI50 for zEnterprise (DataPower XI50z), and select IBM BladeCenter PS701 Express blades or IBM BladeCenter HX5 (7873) blades for increased flexibility in "fit for purpose" application deployment.

The zBX is tested and packaged together at the IBM manufacturing site and shipped as one unit—relieving complex configuration and set up requirements. With a focus on availability, the zBX has hardware redundancy built in at various levels—the power infrastructure, rack-mounted network switches, power and switch units in the BladeCenter chasses and redundant cabling for support and data connections. Best of all, support for the zBX is with System z hardware maintenance services (24×7 with System z Support Specialist Representative) and the System z maintenance strategy is extended to DataPower XI50z and any installed blades.

The innovative zUnified Resource Manager handles the job of managing system resources across the entire environment. It can help achieve throughput goals by providing hardware and platform management for the system as a whole. Presenting resources simply as a single virtualized heterogeneous system; Unified Resource Manager provides "workload context" that can be used to identify and optimize the physical and virtual system resources that support an application. This allows Unified Resource Manager to have workload awareness—the ability to inspect, report, and manage all connected resources (no matter which platform or operating environment) used in the service of the defined workload.

Affordable technology for workload optimization

Specialty engines continue to help deliver greater efficiencies and help optimize the capabilities of the platform to support a broad set of applications and workloads, while helping to dramatically improve mainframe economics. The zEC12 continues to offer these integrated and aggressively priced technology offerings providing cost-effective, specialized application execution environments. Processor cores can be characterized as System z Integrated Information Processors (zIIPs), System z Application Assist Processors (zAAPs), Integrated Facility for Linux (IFLs) or Internal Coupling Facilities (ICFs).

The specialty engines can be used independently or can complement each other to optimize workload execution and lower costs by enabling you to purchase additional processing capacity without affecting IBM software pricing and the MSU rating of the IBM zEnterprise model designation. This means that adding a specialty engine will not cause increased charges for IBM System z platform software running on general purpose processors and may even help reduce the utilization and demands on general purpose processors possibly lowering your overall MSU requirements and associated IBM software costs.

The IBM z Integrated Information Processor (zIIP) is designed to help free up general computing capacity and lower overall total cost of computing for select data and transaction processing workloads for a wide and varied group of eligible workloads including business intelligence (BI), ERP and CRM, and select network encryption workloads on the mainframe. OMEGAMON® V5.1 may offload up to 73 percent of CICS® Server Level Agreement (SLA) report builder processing on to a zIIP. Investment of the zIIP can be optimized by enabling zAAP-eligible workloads to run on the zIIP when there is no installed zAAP—allowing the zIIP to support Java and XML-based data services.

The System z Application Assist Processor (zAAP) is designed to support the strategic integration of application technologies such as Java, technology-based web applications, and XML-based data interchange services with core business database environments. It helps make running these new application technologies on z/OS much more cost effective. Workloads eligible for the zAAP include all Java processed with the IBM Solution Developers Kit (SDK), and XML processed locally via z/OS XML System Services.

An Integrated Facility for Linux (IFL) supports Linux and open standards, which creates a great opportunity for consolidation and infrastructure simplification. Linux on System z brings a wealth of available applications that can be run in a real or virtual environment within System z. If you need a stand-alone Linux environment, the zEC12 can be configured as a Linux-only server.

The Internal Coupling Facility (ICF) helps cut the cost of coupling facility functions by reducing the need for an external coupling facility. IBM Parallel Sysplex® technology allows for greater scalability and availability by coupling mainframes together. Using Parallel Sysplex clustering, System z server groups are designed for up to 99.999 percent availability.

Clients are able to reduce labor, energy, and development costs when consolidating database workloads to Linux on System z rather than on Intel servers.

Integrated and optimized workloads on z Systems

Applications in your enterprise grow exponentially, and the resulting proliferation of servers across your business has driven hidden costs and growing complexity. Leveraging your existing investments, and the IBM zEnterprise System, is a great way to help address these challenges.

The zEC12 can help to reduce costs by delivering superior resource sharing and virtualization efficiency, improve service through system management capabilities that help users satisfy business demands with incredible speed and agility, manage risk through unrivaled system availability and flexible business continuance, as well as disaster recovery options to help you protect your business. The unmatched scalability of the zEC12 allows for growth and expansion without changing the IT footprint, and with the zBX it provides the ideal platform and infrastructure required for our customers' increasingly complex workloads.

Applications running in two or three-tier environments, with data maintained by z Systems, may be excellent candidates for migration to zEC12 and the zBX. The PS701 BladeCenter Express and the BladeCenter HX5 blades represent the most flexible and cost-efficient blade solutions available in the market, and they support AIX® on Power Systems™, Linux on System x, and Microsoft Windows applications. Workloads across all industries can exploit the capabilities provided by the z Systems hybrid computing architecture model. For example, in banking there are components across retail and wholesale banking that rely on several architectures to execute, but the core of most banking applications relies on z Systems and z/OS. The insurance industry typically maintains claims processing on z Systems but reaches out to the internet for interaction with consumers, utilizing UNIX and Intel®.

The IBM WebSphere DataPower Integrated Appliance XI50 for zEnterprise (DataPower XI50z) is a multifunctional appliance that can be implemented to provide XML and non-XML message hardware acceleration, to streamline and secure valuable service-oriented architecture (SOA) applications, or to provide drop-in integration for heterogeneous environments by enabling core Enterprise Service Bus (ESB) functionality including routing, bridging, transformation and event handling. Installed in the zBX, the DataPower XI50z benefits from having Unified Resource Manager do the management and having the IBM Systems Support Representative (zSSR) maintain and support the blades.

Next generation availability

The z Systems, along with z/OS and its middleware stack, have earned a well-deserved reputation for industry-leading reliability and high availability (HA), and the zEC12 is no exception. Many types of planned outages, such as planned maintenance, upgrades or configuration changes are avoided through support for non-disruptive configuration changes and dynamic replacement capabilities. Unplanned outages are mostly avoided or their effects mitigated through robust support for recovery after a failure. This support can help limit the scope of an outage's impact, mask the effects completely or dynamically restart a failed element after an unrecoverable error. The zEC12 continues to offer fault tolerant memory through Redundant Array of Independent Memory (RAIM) to support memory availability.

Flash Express is designed to help improve availability and performance when running z/OS V1.13 (with additional function) and later. Using Flash Express can bolster availability by eliminating paging related delays during workload transitions such as the start of day processing in trading environments, using it for 1 MB pageable large pages can improvement performance for Java, or during diagnostic collection. Flash Express can help organizations meet their most aggressive service level agreements enabling them to compete more effectively where time is at a premium. Flash Express is easy to configure and operates transparently, providing rapid time to value.

IBM zAware is designed to offer near real time diagnostics to help you identify potential problems in your z Systems environment. It is an analytics solution executed in firmware, which intelligently examines OPERLOG message logs for potential deviations, inconsistencies, or anomalies. For many z/OS operating system environments, based on system size, the number of applications and the amount of users, the amount of daily messages generated can be as many as 25 million messages. This high volume makes it too difficult for operations personnel to consume and analyze easily. IBM zAware automatically processes the large log data to help pinpoint unusual behavior quickly, providing a simple graphical user interface (GUI) for easy drill-down. IBM zAware is particularly helpful for isolating anomalies in IT systems which experience problems that are complex, rare and/or involve multiple systems. Any message with a well-formed message ID will be analyzed. With rapid identification of message anomalies, organizations can accelerate the time to resolve problems, focus their efforts more precisely, address IT problems quickly, minimize availability lapses and intervene with problem resolution before they become more severe.

Availability requirements also mean that IT departments must be agile so they can respond rapidly to change. It may be necessary to coordinate changes in people, processes and technology. The zEC12 continues to build on the z Systems capacity on-demand offerings that simplify modifications. Permanent and temporary capacity is available to help satisfy capacity requests that are long-term or short-term (such as capacity spikes or for testing new applications). Defining processor cores as Capacity Back-up (CBU) can help provide reserved emergency capacity for multiple processor configurations. And Capacity for Planned Events (CPE), a variation on CBU, is available when there is unallocated capacity available in a server.

Data Ready

Business analytics are more critical than ever before. Having the right insight allows individuals, no matter which industry they are in, to make smarter, faster decisions and drive better business outcomes. The z Systems plays a critical role in business analytics because z Systems is the right place to store your data—it's secure, available and easy to manage. And with z Systems you get the scale and performance you need along with Unified Resource Manager to configure, monitor and govern workloads that are deployed across z Systems assets.

DB2 for z/OS is engineered for the z Systems platform and takes full advantage of the hardware components such as the zIIP, integrated hardware compression, and Licensed Internal code to maximize the performance of analytical workloads. The use of 1 MB large pages improves DB2 performance on all servers. The zEC12, with additional function available on z/OS V1.13, is able to support 1 MB pageable large pages with Flash Express.

Data analytics solutions on the zEC12 include the IBM Smart Analytics System 9710 and the IBM DB2 Analytics Accelerator for z/OS V3, which are designed to enable you to efficiently store, manage, retrieve, and analyze vast amounts of data for business insight, without creating unnecessary cost or complexity.

Cloud Ready

From consumers to IT professionals, the buzz word in all aspects of life today is 'cloud'. For businesses, Cloud computing promises greater business agility and performance at a lower cost than today's IT infrastructures. Further cost savings, flexibility and performance benefits can result from architecting the IT infrastructure with purpose-built components that help eliminate the traditional fixed-hardware boundaries of CPU, memory, network and storage.

The zEC12 is designed to create a centrally managed and controlled set of IT resources that provide an ideal private enterprise cloud for the rapid and flexible delivery of high value services. There are a portfolio of solutions that are designed to take your current virtualized environment from "cloud-ready," which is to say virtualization and simple deployment tooling, to "cloud-active" which can incorporate self-provisioning, monitoring and charge back models, all in a highly secure environment. A private cloud with the z/VM® 6.3 as virtualization foundation can provide improved economies of scale with support for 1 TB of real memory and improved price performance as a result of higher and more efficient utilization of processor hardware resources. Coupled with advanced virtualization features like multi-system virtualization and Live Guest Relocation, the zEC12 with z/VM and Linux provide a foundation for deploying private clouds for workloads that scale both horizontally and vertically at a low TCO with industry leading qualities of service. Clouds can also be deployed using IBM z/OS. On z/OS, you have the ability to run multiple dis-parate workloads with different service levels for those hosted workloads with isolation or multi-tenancy. Hence our approach for cloud on z/OS is focused on the ability to provision multiple workloads in a single z/OS instance. The IBM Tivoli® suite of service management products offers a robust set of cloud management capabilities allowing even greater control and automation of cloud resources. The value derived from a virtu-alized IT is that services can be identified through advanced accounting, enabling chargeback allocation of IT costs. These costs can be billed to the business processes they support.

The other critical component of cloud is security. The zEC12 delivers unmatched security for running multiple critical applications with the knowledge they won't step on each other. It provides a foundation for secure cloud for data, enabling improved service, and it delivers unmatched security and reliability to meet today's business demands.

Security Ready

Many experts believe that the best way to secure information is to encrypt it. Cryptography is in the 'DNA' of z Systems hardware and providing exceptional performance and function using Crypto Express4S cryptographic coprocessors and accelerators that are individually specialized to address various encryption needs.

To help secure sensitive data and business transactions, the zEC12 achieved Common Criteria Evaluation Assurance Level 5+ (EAL5+) certification for security of logical partitions. This means that the zEC12 is designed to prevent an application running on one operating system on one LPAR from accessing application data running on a different operating system image on another LPAR on the server.

On the processor core two kinds of protection are available. Bulk encryption is available with clear key support, and protected key support protects sensitive keys from inadvertent disclosure—the keys are not visible to the application or the operating system. Security for the internet with secure sockets layer (SSL) transactions and secure co-processing is delivered with Crypto Express4S— installed into the PCIe I/O drawer introduced previously on z Systems servers.

The zEC12 meets standards for digital signatures with support for PKCS #11—which will soon replace handwritten signatures in all industries. This capability will be important for smart cards or other mission-critical applications such as online banking. The zEC12 also supports Elliptic Curve Cryptography (ECC), a modern public-key algorithm that many experts believe provides the same or better security, with much shorter key lengths and less processing overhead, than RSA keys. This technology is appropriate in resource-constrained environments such as mobile phone and smart cards which may have limited space for saving of storage keys. Additional standards for the banking and finance industry, such as ANSI and ISO, are also supported by the zEC12.

z Systems is the mainframe for Smarter Computing

Smarter Computing is about deploying the right platform to solve the business challenge. The zEC12 and zBX can help. It allows you to grow your business by energizing, extending and transforming their applications and core business processes through integration, improved performance and new networking innovations that help you communicate within your shop and out to the network. It helps you address your budget by giving you extremely scalable options for consolidation, simplification and cloud options like Enterprise Linux Server. And best of call, z Systems lets you secure it all with confidence that allows you to protect your data and your brand reputation with the industries most trusted infrastructure.

Why IBM?

As you drive business innovation by examining your business processes, technology, products and services, IBM remains your trusted partner. You want smart, robust technology solutions without sending your budget out of control. We have the total expertise—in systems, software, delivery and financing—to help you refresh and optimize your IT for the constant flow of opportunities and challenges you face. Our experts can help you configure, design and implement a z Systems solution optimized for the needs of your business.

For more information

To learn more about the zEnterprise EC12, please contact your IBM representative or IBM Business Partner, or visit the following website: **ibm.com**/systems/zec12

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