

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server



## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

**Session 8923**





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### Agenda

- IBM zEnterprise 196 Overview
- z196 Support by z/OS Releases
- Migration Considerations
  - General
  - Migration Considerations for Selected Functions
  - Multisystem/Sysplex Considerations
  - Exploitation Considerations for Selected Functions
- Migration Paths
  - General Recommendations and Considerations
  - Recommended Paths for Supported z/OS Releases
- Summary
- Backup
  - Cryptographic Support

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## **z/OS Software Positioning for the IBM zEnterprise System**

The IBM zEnterprise System is comprised of the IBM zEnterprise 196, the IBM zEnterprise Unified Resource Manager, built-in support for the IBM zEnterprise BladeCenter Extension (zBX), and optimizers or IBM blades.

Preparing z/OS systems to support the new IBM zEnterprise System is easy. All supported releases can run on the new server; and enhancements in SMP/E V3.5 integrate the identification, verification, acquisition, and installation of required PTFs into standard SMP/E processing.

In this session, the speaker will cover z/OS software and configuration changes required to support the latest IBM zEnterprise System, the IBM zEnterprise 196 central processor complex (CPC), the IBM zEnterprise Unified Resource Manager, and the IBM zEnterprise BladeCenter Extension (zBX). He will describe the different functionality supported on each z/OS release, as well as any migration or exploitation actions required to use new functions on the IBM zEnterprise System. Systems programmers and their managers who will upgrade to the latest server will find lots of useful information in this session.


# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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## Scope

- **The IBM zEnterprise System is comprised of:**
  - the IBM zEnterprise 196 (z196),
  - the IBM zEnterprise Unified Resource Manager,
  - the IBM zEnterprise BladeCenter Extension (zBX) with
    - Optimizers or IBM blades.
- **z/OS platform software requirements for:**
  - Hardware upgrade to z196
    - With or without zBX
  - Install a new z196 server
    - With or without zBX
- **Outside scope**
  - z/VM (native), zLinux, and zTPF considerations
  - Non-z/OS software required for zBX solutions

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## IBM zEnterprise System Functions and Features (GA)

|   |  |  |
|---|--|--|
| Five hardware models  |  <p style="text-align: center;">z196 <span style="margin-left: 100px;">zBX</span></p> <p style="text-align: center;">(z/OS Support in blue)</p> | OSA-Express3 Inbound Workload Queuing (IWQ)  |
| Quad-core 5.2 GHz processor chips   |  | Capacity Provisioning enhanced               |
| Up to 80 processors configurable as CPs, zAAPs, zLIPs, IFLs, ICFs, or optional SAPs (up to 32-way on R7, 64-way on R9, 80-way on R11) |  | 6.0 GB/sec InfiniBand I/O interrupt          |
| Out of order instruction execution  |  | Three subchannel sets per LCSS               |
| Improved processor cache design   |  | FICON Discovery and AutoConfiguration (zDAC) |
| Up to 15 subcapacity CPs at capacity settings 4, 5, or 6  |  | Concurrent I/O drawer add, remove, replace   |
| Up to 3TB real memory (1TB per LPAR)  |  | Doubled number of HiperSockets to 32         |
| Improved availability with Redundant Array of Independent Memory (RAIM)   |  | CFCC Level 17 enhancements                   |
| Power save functions  |  | Up to 80 External Coupling Link Ports        |
| 8 slot, 2 domain I/O drawer   |  | Up to 128 Coupling Link CHPIDs Defined       |
| On Demand enhancements  |  | Optional water cooling                       |
| Crypto Express3 enhancements  |  | Optional High Voltage DC power               |
| Secure key HMAC Support   |  | Optional overhead I/O cable exit             |
| Elliptic Curve Cryptography (ECC) Digital   |  | Support for OSX and OSM CHPIDs               |
| IBM zEnterprise Unified Resource Manager (from HMC)   |  | zBX-002 Smart Analytics Optimizer            |
| New and enhanced instructions   |  | zBX-002 IBM Blades                           |

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## IBM zEnterprise System Overview

**IBM zEnterprise System** is a first-of-a-kind workload-optimized multiplatform technology offering. The system consists of the IBM zEnterprise 196 (z196) central processor complex (CPC), the IBM zEnterprise Unified Resource Manager, and built-in support for the IBM zEnterprise BladeCenter Extension (zBX) Model 002. The IBM zEnterprise 196 is designed with improved scalability, performance, security, resiliency, availability, and virtualization. The z196 Model M80 provides up to 1.6 times the total system capacity of the z10 EC Model E64, and all z196 models provide up to twice the available memory of the z10 EC. The zBX

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Infrastructure works with the IBM zEnterprise 196 to enhance System z virtualization and management to deliver an integrated hardware platform that spans System z mainframe and POWER7 technologies. The IBM zEnterprise Unified Resource Manager, delivered with the z196, is designed to deliver end-to-end virtualization and management along with the ability to optimize technology deployment according to individual workload requirements.

**zEnterprise System** is designed to deliver:

- **Improved total system capacity** in a 96-way core design.
  - Improved performance of all workloads
  - Massive scalability for secure data serving and transaction processing and large-scale consolidation
  - Up to 80 cores that are customer-configurable
- **Quad-core 5.2 GHz processor chips** with 100+ new instructions that enable improved code efficiency, and are designed to help improve the execution of CPU-intensive workloads.
- **Up to 3 terabytes (TB) of available real memory per server** for growing application needs (with up to 1 TB real memory per LPAR).
- Improved availability in the memory subsystem with **redundant array of independent memory (RAIM)**.
- Availability improvement - **concurrent add/delete of I/O drawer**.
- **Increased scalability** with 45 available subcapacity settings.
- **Crypto Express3 cryptographic enhancements**.
- **Auto-renewal of On/Off Capacity on Demand records** which is designed to eliminate the need to manually replenish your On/Off CoD records.
- **Purchase of unassigned CP or IFL capacity** via Customer Initiated Upgrade.
- **Up to 128 coupling CHPIDs** (double that of z10) and up to 80 physical external coupling links (12x InfiniBand, 1x InfiniBand, ISC-3), a 25% increase compared to z10.
- Up to 72 I/O, networking, and crypto features.
- Up to 240 ESCON channels.
- **Up to 32 HiperSockets** (double the number available on z10 EC).
- **Energy efficiencies** - more performance to help you run more efficiently in the same footprint.
  - Energy monitoring capability and power save option for the processor, which is designed to provide a 25 - 30% reduction in power consumption depending on the system configuration
  - Optional water cooling, providing the ability to cool systems with user-chilled water
  - Optional high-voltage DC power, which can save System z customers 1-3%, on average, on their power bills
- **Top exit I/O cabling**, which is designed to provide increased flexibility and increase air flow in raised-floor environments.
- **Unified Resource Manager**, enabling management and virtualization of heterogeneous workloads. Unified Resource Manager manages the deployment of heterogeneous hardware resources based on individual workload requirements by providing:
  - Performance management
  - Integrated private data network
  - Virtual server lifecycle management
  - Hypervisor management
  - Integrated operational controls
  - Management as system z firmware

## Planned availability dates

September 10, 2010

- Features and functions for the z196
- z196 Models M15, M32, M49, M66, and M80
- Water Cooling (#0159) for z196
- Manage suite (#0019) for z196
- z9 EC upgrades to air-cooled z196
- z9 EC upgrades to water-cooled z196

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- z10 EC upgrades to air-cooled z196
- z10 EC upgrades to water-cooled z196
- 3-in-1 Bolt Down Kit (#8008 or #8009) for new build z196

November 9, 2010

- HMC with Dual Ethernet (#0091) on z10 EC and z10 BC
- TKE workstation (#0841) on z10 EC and z10 BC
- TKE 7.0 LIC (#0860) on z10 EC and z10 BC

November 19, 2010

- Manage suite enhancement (#0019) functions for z196
- Automate suite (#0020) for z196
- IBM Smart Analytics Optimizer for DB2 for z/OS for z196 in blade quantities of 7, 14, or 28 (#0019 or #0020)
- POWER7 blade for z196 in a zBX (#0019 or #0020)

3Q2010

- Inbound workload queuing (IWQ) for OSA-Express3 on z10

December 17, 2010


- IBM Smart Analytics Optimizer for DB2 for z/OS for z196 in blade quantities of 42 or 56 (#0019 or #0020)

December 31, 2010

- 3-in-1 Bolt Down Kit (#8008 or #8009) MES z196
- MES features for Models M15, M32, M49, M66, and M80
- Model conversions for z196



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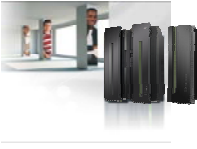
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## Software Line Items – Quality Of Service View

**Scalability**  
Greater than 64 CPs on the server (up to 80); Greater than 64 CPs on the LPAR (up to 80); Greater than 1023 CF Structures; Greater than 64 Coupling Link CHPIDs; Power Save Mode support; Three subchannel sets; Removal of the 64k byte data transfer limit for zHPF multitrack operations ...

**Performance**  
RSM exploitation of new OPCODEs; HiperDispatch cache and affinity node changes; C/C++ exploitation of new OPCODEs; OSA-Express3 Inbound Workload Queuing (IWQ); ...

**Improving Reliability, Availability, and Serviceability (RAS)**  
HiperDispatch performance and serviceability enhancements; CFCC Diagnostics; CPU Measurement Facility (Hardware Instrumentation Services); Language Environment High Register Resolution ...



**Self Managing Capabilities**  
z/OS FICON Discovery and AutoConfiguration (zDAC); IBM zEnterprise Unified Resource Manager; new Guest Platform Management Provider (GPMP) agent; Capacity Provisioning enhancements; New OSA Command – Display OSAINFO; Simplified key management with Trusted Key Entry Workstation (TKE 7.0 LIC); ...

**Supporting New Applications and New Workloads**  
Use of new optimizers for computing intensive workloads, and IBM Blades for multi-tiered applications, ...

**Extending the Network**  
Intranode Management Network (INMN) – OSM CHPID's, Intraensemble Data Networks (IEDN) – OSX CHPID's

**Improving Usability and Skills**  
Simplified usability with Crypto Express3 migration wizard, ...

**Enhancing Security**  
Crypto Express3 enhancements: ANSI TR-31 key Block for DES and Triple-DES key exchange; ANSI X9.8 PIN security; Enhance CCA keys wrapping to comply with ANSI X9.24-1 key bundling requirements; Secure key HMAC (Keyed-Hash Message Authentication Code); Elliptical Curve Cryptography (ECC) Digital Signatures; CP Assist for Cryptographic Function (CPACF) enhancements; 64 Bit; CKDS Constraint Relief; PCI Audit; CBC Key Wrap; and RMF Postprocessor Crypto Activity report support for 4096-bit; ...

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## z/OS Software Positioning for the IBM zEnterprise System

### Scalability and Performance Enhancements

The IBM zEnterprise 196 server adds additional scalability and performance capabilities for your z/OS environment.

- The new 96-way core design (with 80 cores that are customer configurable) delivers massive scalability for secure data serving and transaction processing for large-scale businesses. The performance of a z196 (2817) processor is expected to be 1.3 to 1.5 times the performance of a z10 EC (2097) based on workload and model. The largest z196 (z196 Model M80) is expected to exceed 1.6 times the capacity of the largest z10 (2097-764). It has up to twice the available real memory, 3 terabytes (TB) per server (with up to 1 TB real memory per LPAR) compared to the z10 EC Model E64. New quad-core 5.2 GHz processor chips, with more than 100 new instructions to enable improved code efficiency, are also designed to help improve the execution of Java and CPU-intensive workloads. For example, it is anticipated that z/OS and zEnterprise 196 servers can provide a significant performance improvement for Java workloads.
- In addition, you now have the ability to extend the amount of addressable storage capacity to help facilitate storage growth with the introduction of a third subchannel set - an additional 64K subchannels - to help complement other functions such as "large" or extended address volumes (EAV) and HyperPAV. This may also help facilitate consistent device address definitions, simplifying addressing schemes for congruous devices. The first subchannel set (SS0) allows definitions of any type of device (such as bases, aliases, secondaries, and devices that do not implement the concept of associated aliases or secondaries). The second and third subchannel sets (SS1 and SS2) can now both be used for disk alias devices (both primary and secondary devices) and/or Metro Mirror secondary devices only. The third subchannel set supports ESCON, FICON, and zHPF protocols.
- The zEnterprise 196 provides many enhancements to a z/OS Parallel Sysplex environment:
  - Connectivity improvements with up to 80 coupling links: The IBM zEnterprise 196 increases the number of external coupling links allowed from 64 to 80. This allows the full configuration of 32 PSIFB links and 48 ISC-3 links to be used. In addition, you can also configure up to 32 (internal) IC links for coupling between images defined on the same server. Having more coupling links is important to provide sufficient coupling connectivity for larger single Parallel Sysplexes, as well as for configurations where the same server hosts multiple Parallel Sysplexes and Coupling Facility images.
  - Connectivity improvements with 128 coupling CHPIDs per server: To support larger Parallel Sysplexes with ever-increasing amounts of data sharing traffic to the Coupling Facility, the

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- throughput and capacity of more coupling CHPIDs is also required. With z196, the number of coupling CHPIDs per server has been increased from 64 to 128. Since IFB links allow for multiple (logical) CHPIDs over the same (physical) link, this can also allow for larger Parallel Sysplexes without requiring more coupling link hardware.
- Connectivity improvements with up to 2047 structures: CFCC Level 17 increases the number of structures that can be allocated in a CFCC image from 1023 to 2047. Allowing more CF structures to be defined and used in a sysplex permits more discrete data sharing groups to operate concurrently, and can help environments requiring many structures to be defined, such as to support SAP or service providers. z196 and CFCC level 17 also provide improved serviceability of Coupling Facilities with enhanced data collection and triggering of nondisruptive CF dumps.
  - z/OS on z196 servers with CFCC Level 17 also supports more connectors to list and lock structures. XES and CFCC already support 255 connectors to cache structures. With this new support XES also supports up to 247 connectors to a lock structure, 127 connectors to a serialized list structure, and 255 connectors to an unserialized list structure.
  - z/OS V1.12 on z196 servers is designed to provide improved networking performance with OSA-Express3 in QDIO mode with inbound workload queuing (IWQ). IWQ creates multiple input queues and allows OSA to differentiate workloads "off the wire" and then assign work to specific input queues to z/OS. With each input queue representing a unique type of workload, each having unique service and processing requirements, the IWQ function allows z/OS to use appropriate processing resources for each input queue. This approach allows multiple concurrent z/OS processing threads to process each unique input queue, avoiding traditional resource contention. In a heavily mixed workload environment, this "off the wire" network traffic separation provided by OSA-Express3 IWQ reduces the conventional z/OS processing required to identify and separate unique workloads, which is expected to result in improved overall system performance and scalability.
    - It is anticipated that networking performance for interactive workloads can be improved significantly, depending on amount of data being transferred, presence of bulk-data traffic in the mix, and whether communication is z/OS to z/OS, or z/OS to distributed system. For example, interactive networking response time improvements of 30-50% on a System z10 model 2097-E64 were recorded.
    - It is also anticipated that bulk-data (streaming) workloads can also benefit with OSA-Express3 IWQ and its ability to reduce the amount of costly network retransmissions (by reducing the incidence of out-of-order packets). A streamlined Communications Server execution path for Sysplex Distributor over IWQ is expected to improve performance for sysplex-distributed traffic as well.
    - When inbound workload queuing is enabled for a QDIO interface, inbound streaming bulk data is processed on an ancillary input queue (AIQ). This function is expected to improve throughput while reducing CPU consumption for inbound streaming bulk data.
    - When inbound workload queuing is enabled for a QDIO interface, inbound Sysplex Distributor traffic is processed on an AIQ. This function is expected to improve performance for inbound Sysplex Distributor traffic that is routed to a target stack.
  - z/OS V1.12 XL C/C++ also exploits new instructions in the IBM zEnterprise System 196 server. The z/OS V1.12 XL C/C++ compiler provides new ARCHITECTURE(9) and TUNE(9) options to help you exploit new instructions that are available on z196 servers. This is designed to provide better performing applications tuned for the new server. Additional optimization and tuning have been made to improve the floating-point performance. These changes can improve the performance of generated code without the need for changes to the source code. A performance improvement of over 11% was observed using code generated by the z/OS V1.12 XL C/C++ compiler with high optimization when compared to code generated using the z/OS V1.11 XL C/C++ compiler. Performance improvements are based on internal IBM lab measurements using the ILP32, XPLINK, ARCH(9), TUNE(9), HGPR, O3, HOT, and IPA(LEVEL(2)) with PDF compiler options. Performance results for specific applications will vary; some factors affecting performance are the source code and the compiler options specified.

### Expanding the Networking Capabilities

- The new zEnterprise System unifies the zEnterprise 196 server and the zEnterprise BladeCenter Extension, through the use of two new "internal" networks. Configured through OSA-Express3 adapters, the intranode management network (INMN) is used to provide system management functions and the intraensemble data network (IEDN) can be used to send data between the systems.

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- The intranode management network (INMN) is a private and physically isolated OSA-Express3 1000BASE-T Ethernet internal management network operating at 1 Gbps, that connects all zEnterprise System resources (CPCs, Blade Centers, blades, top-of-rack switches, power distribution units, and hypervisors) for management purposes. This INMN is pre-wired, internally switched, configured, and managed with full redundancy for high availability. These characteristics of the INMN enable simplified and secure management with no effect on your application data traffic. The INMN is exclusive to zEnterprise System, and is configured with a CHPID type of OSM.
- Intraensemble data network (IEDN) is a private OSA-Express3 10 Gigabit Ethernet that connects all elements of a zEnterprise System ensemble. The IEDN is access-controlled using integrated virtual local area network (VLAN) provisioning. This requires no external customer-managed switches or routers, which helps to reduce the need for firewalls and encryption, and simplifies network configuration and management, while providing full redundancy for high availability. IEDN management provides enforcement of strict access control across heterogeneous environments, further augmenting security and simplicity. The intraensemble data network is exclusive to zEnterprise System, and is configured with a CHPID type of OSX.
- The z/OS Communications Server also eases the burden of configuration for these new OSA-Express3 CHPID types by dynamically finding and activating up to two OSA-Express3 adapters connected to the Intranode Management Network, and requiring minimal configuration for OSA-Express3 adapters connected to the Intraensemble Data Network.

### System Management Enhancements

- A new IBM System z Discovery and AutoConfiguration (zDAC) function, available with z/OS V1.12 on zEnterprise 196 servers, can help simplify the configuration of new and changed disk and tape I/O devices. zDAC can save time by discovering new and changed fabric-attached devices, and suggesting configurations aligned with best practices for availability and with the I/O policies that you set. For example, with zDAC, building an updated I/O configuration can take as little as a few minutes. zDAC is designed to perform discovery for a single system or for all the systems in a sysplex. These capabilities are integrated with HCD and z/OS Hardware Configuration Manager (HCM). When new controllers are added to an I/O configuration or changes are made to existing controllers, the system is designed to discover them, and propose configuration changes based on a policy you define in the Hardware Configuration Dialog (HCD). Your policy can include preferences for availability and bandwidth including parallel access volume (PAV), HyperPAV, DCM specifications, and preferred control unit and device number ranges.
- The new zEnterprise System also provides end-to-end workload monitoring and other systems management capabilities for System z ensembles, through the new IBM zEnterprise Unified Resource Manager. System z ensembles are collections of one or more zEnterprise System nodes in which each node comprises a z196 server and its optionally attached IBM zEnterprise BladeCenter Extension (zBX) model 002. An ensemble can consist of a single z196 server running z/OS images and z/VM hosting Linux for System z images but without a zBX attached, or it can consist of from 1 to 8 z196 servers, at least one of which has a zBX attached. The resources of a zEnterprise System ensemble are managed and virtualized as a single pool, integrating system and workload management across the multisystem, multitier, multiarchitecture environment. The zEnterprise Unified Resource Manager uses the intranode management network (INMN) for communication.
- z/OS integrates with this new management environment. A new agent, Guest Platform Management Provider (GPMP), communicates with z/OS WLM and provides basic data (such as system resource utilization, system delays, and paging delays) back to the zEnterprise Unified Resource Manager over the INMN network. The zEnterprise Unified Resource Manager can add additional workload relationships from the ensemble components to your z/OS workload; for example, linking a transaction that started on the zBX back to DB2 on z/OS data.
- In addition to IWQ, OSA-Express3 also introduces the capability for the operating system to directly query and display the current OSA configuration information (similar to OSA/SF). z/OS exploits this new OSA capability by introducing a new TCP/IP operator command called Display OSAINFO. Display OSAINFO allows the operator to monitor and verify the current OSA configuration, which can help you improve the overall management, serviceability, and usability of OSA-Express3. The display OSAINFO requires OSA-Express3 CHPID types OSD, OSM, and OSX, and z/OS V1.12.

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## Security Enhancements

- The z/OS security enhancements in support of the z196 server are provided in the Cryptographic Support for z/OS V1.10 through z/OS V1.12 Web deliverable which is planned to be made available September 10, 2010. To obtain this Web deliverable, when available, visit: <http://www.ibm.com/systems/z/os/zos/downloads/>. This Web deliverable is planned to support z/OS V1.10, z/OS V1.11, and z/OS V1.12. A number of ICSF enhancements are planned:
  - An improved symmetric key store (CKDS), to significantly increase the number of keys that can be stored in the CKDS and to reduce the overhead associated with updates to the CKDS. These improvements are intended to help position ICSF as the enterprise key store and reduce the batch update window for customers that add or rotate keys in the CKDS frequently.
  - 64-Bit enablement for the full set of ICSF callable services. This support is designed to reduce application overhead and simplify the use of ICSF callable services in 64-bit environments by eliminating the need to switch between 64-bit and 31-bit modes.
  - Additional content in audit records to include identity information intended to help you meet the requirements of specialized industry standards such as PCI DSS. New sections are planned to be added to SMF type 82 records to contain the identities of the ICSF server and cryptographic service caller. This enhancement is intended to help simplify compliance audits by minimizing the need to correlate ICSF audit records with other security audit records in order to obtain the identity information associated with the ICSF audit event.
  - API support for new symmetric encryption modes introduced in the IBM zEnterprise 196 (z196) server CP Assist for Cryptographic Functions (CPACF). The new encryption modes include CMAC, CCM, GCM, CFB, OFB, XTS and CBC-S. These new modes will be supported for both CPACF clear keys and CPACF protected keys. This new support is intended to help application programmers take advantage of these new encryption modes while using the familiar CCA callable services provided by z/OS ICSF.

ICSF is also planned to provide new support for new functions on zEnterprise 196 servers with the Crypto Express3 feature and minimum driver and microcode levels dated August 2010 or later:

- New CCA key token wrapping mechanisms designed to bring CCA key tokens into compliance with banking and finance industry standards that mandate key bundle compliance. This support is intended to enable ICSF to utilize key tokens that comply with ANSI x9.24-1 key management requirements for symmetric keys wrapped under either symmetric master keys or key-encrypting keys.
- Support for enhanced Personal Identification Number (PIN) protection techniques for online PIN verification via ATM and Point of Sale (POS) systems. The enhancements are intended to provide the functions defined as extensions to the ANSI x9.8 and ISO 9564-1 PIN Management and Security standards.
- New CCA functions implementing the Elliptic Curve Digital Signature Algorithm (ECDSA). These are intended to allow applications using ICSF to generate elliptic curve key pairs, store elliptic curve keys in the PKDS, and both generate and verify elliptic curve digital signatures. Support is planned for both NIST and Brainpool standard curves, and to support the Crypto Express3 Coprocessor card performing ECDSA within the bounds of the secure hardware.
- New CCA functions for Hashed Message Authentication Codes (HMAC) using the SHA-1 and SHA-2 families of hash functions. HMACs are widely used in internet and storage protocols and are used in specific geographies for the banking and finance industry. This support is designed to allow applications using ICSF to generate HMAC keys, store HMAC keys in the CKDS, and to generate and verify HMACs. This support was made available with the Cryptographic Support for z/OS V1.10 through z/OS V1.12 Web deliverable with the PTF for APAR OA33260 that closed in February 2011.

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## z196 Support by z/OS Release

- **z196 capabilities differ depending on z/OS release**
  - **Toleration support provided on z/OS 1.7, z/OS V1.8, and z/OS V1.9**
    - The IBM Lifecycle Extension for z/OS is required on z/OS V1.7 and z/OS V1.8
    - The IBM Lifecycle Extension for z/OS is now required on z/OS V1.9 (since 9/30/2010)
  - **Exploitation support on z/OS V1.10 and higher**
- **Software requirements differ depending on z/OS release and functions exploited**
  - **Support provided via a combination of web deliverables and PTFs**
  - **z196 Required PTFs**
    - **Documented in z196 PSP Bucket: Upgrade = 2817DEVICE, Subset = 2817/ZOS**
      - Broken out by z/OS release, identifying required and exploitation
    - **Can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY)**
      - Actual Fix Categories:
        - » **IBM.Device.Server.z196-2817**
        - » **IBM.Device.Server.z196-2817.ParallelSysplexInfiniBandCoupling**
        - » **IBM.Device.Server.z196-2817.ServerTimeProtocol**
        - » **IBM.Device.Server.z196-2817.zHighPerformanceFICON**
        - » **IBM.Device.Server.z196-2817.UnifiedResourceManager**
  - **zBX Required PTFs**
    - **Documented in z196 PSP Bucket: Upgrade = 2458DEVICE, Subset = 2458/ZOS**
      - Broken out by z/OS release, identifying required and exploitation
    - **Can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY)**
      - Actual Fix Categories:
        - » **IBM.Device.Server.zBX-2458**
        - » **IBM.Device.Server.zBX-2458.ISAOPT**

## z196 Support by z/OS Release

The software support for the z196 servers, similar to the IBM System z10 EC and z10 BC servers, differs by z/OS release level, and is provided by a combination of FMIDs and PTFs. The specific PTFs that need to be installed will depend on the z/OS release. In addition, exploitation of certain functions, specifically some cryptographic functions, requires the installation of an FMID. These FMIDs are downloadable Web Deliverables, which are unpriced and can be downloaded at:

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

For a z196 CPC, PTFs are identified in the 2817DEVICE PSP bucket (Subset 2817/ZOS). For an IBM zEnterprise BladeCenter Extension (zBX) attached to your z196 CPC, either to support IBM Smart Analytics Optimizer for DB2 for z/OS, V1.1 (5697-AQT) or to support IBM POWER7 Blades, the PTFs are identified in the 2458DEVICE PSP bucket (Subset 2458/ZOS). In each PSP bucket, the content is dependent on the z/OS release you will run on the z196 server. If you reviewed the PSP buckets some time ago, review them again to ensure that any newly identified z/OS service has been installed. To assist you in determining if you have the recommended service (identified in these PSP buckets) installed on your system, you can use the SMP/E REPORT MISSINGFIX command in conjunction with the FIXCAT type of HOLDDATA, as follows:

- a. Acquire and RECEIVE the latest HOLDDATA onto your z/OS system(s). Use your normal service acquisition portals or download the two (2) year HOLDDATA directly from <http://service.software.ibm.com/holddata/390holddata.html>. Ensure you select **Full** from the Download NOW column (last 730 days) to receive the FIXCAT HOLDDATA, as the other files do not contain FIXCAT HOLDDATA.
- b. Run the SMP/E REPORT MISSINGFIX command on your z/OS systems and specify one or more of the following Fix Categories (FIXCAT):
  - IBM.Device.Server.z196-2817
  - IBM.Device.Server.z196-2817.ParallelSysplexInfiniBandCoupling
  - IBM.Device.Server.z196-2817.ServerTimeProtocol
  - IBM.Device.Server.z196-2817.zHighPerformanceFICON
  - IBM.Device.Server.zBX-2458
  - IBM.Device.Server.zBX-2458.ISAOPT

The report will identify any missing coexistence and fallback PTFs for that system. For complete information about the REPORT MISSINGFIX command, see *SMP/E Commands*.


- c. Periodically, you might want to acquire the latest HOLDDATA and rerun the REPORT MISSINGFIX command to find out if there are any new PTFs recommended for the z196 server.



# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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**z/OS Support Summary**



| Release                          | z900<br>WdFM | z800<br>WdFM | z990<br>WdFM | z890<br>WdFM | z9 EC<br>WdFM | z9 BC<br>WdFM | z10 EC | z10 BC | z196<br>CPC | z196<br>w/zBX | End of<br>Service   | Coexists<br>with<br>z/OS |
|----------------------------------|--------------|--------------|--------------|--------------|---------------|---------------|--------|--------|-------------|---------------|---------------------|--------------------------|
| z/OS V1.7 <sup>#</sup>           | X            | X            | X            | X            | X             | X             | X      | X      | X           |               | 9/08 <sup>1,2</sup> | V1.9                     |
| z/OS V1.7<br>w/zIIP <sup>#</sup> | X            | X            | X            | X            | X             | X             | X      | X      | X           |               | 9/08 <sup>1,2</sup> | V1.9                     |
| z/OS V1.8                        | X            | X            | X            | X            | X             | X             | X      | X      | X           |               | 9/09 <sup>1</sup>   | V1.10                    |
| z/OS V1.9                        | X            | X            | X            | X            | X             | X             | X      | X      | X           |               | 9/10 <sup>1,3</sup> | V1.11*                   |
| z/OS V1.10                       | X            | X            | X            | X            | X             | X             | X      | X      | X           | X             | 9/11*               | V1.12*                   |
| z/OS V1.11                       | X            | X            | X            | X            | X             | X             | X      | X      | X           | X             | 9/12*               | V1.13*                   |
| z/OS V1.12                       | X            | X            | X            | X            | X             | X             | X      | X      | X           | X             | 9/13*               | V1.14*                   |

Notes:  
<sup>#</sup> For HiperDispatch, z/OS 1.7 requires the zIIP Web Deliverable to be installed (but not a zIIP processor)  
<sup>1</sup> The IBM Lifecycle Extension for z/OS provides the ability for customers to purchase extended defect support for that release of z/OS for up to 24 months after the z/OS release's end of service date  
<sup>2</sup> The Lifecycle Extension for z/OS V1.7 is planned to be withdrawn on 10/1/2010. A GTS service contract is required after 9/2010  
<sup>3</sup> The IBM Lifecycle Extension for z/OS V1.9 will be required after 9/30/2010  
<sup>4</sup> System z9 withdrawal from marketing effective on 06/30/2010  
<sup>\*</sup> Planned. All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

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## z/OS Support Summary

All supported z/OS releases can run on a z196 server. Similarly, all supported z/OS releases can participate in a sysplex that has a CF or operating system image on a z196 server. Not all System z196 functions are available in every z/OS release. Other than the minimum support, there is no requirement to install either software or hardware first to exploit a specific function.

### IBM zEnterprise 196 requires at a minimum:

- z/OS V1.10 or higher with PTFs.
- z/OS V1.9<sup>1</sup> with PTFs.
- z/OS V1.8<sup>2</sup> with the IBM Lifecycle Extension for z/OS V1.8 (5638-A01) with required maintenance.
- z/OS V1.7<sup>3</sup> with the IBM Lifecycle Extension for z/OS V1.7 (5637-A01) with required maintenance.

### IBM zEnterprise Unified Resource Manager and IBM zEnterprise BladeCenter Extension (zBX) model 002 requires at a minimum:

- z/OS V1.10 with PTFs.


Older versions of z/OS will tolerate, but do not exploit, IBM zEnterprise Unified Resource Manager.

<sup>1</sup> z/OS V1.9 supports zEnterprise System, however, z/OS V1.9 support will be withdrawn September 30, 2010. After that date, the IBM z/OS Lifecycle Extension for z/OS V1.9 (5646-A01) is required for zEnterprise System. Talk to your IBM representative for details. No exploitation of new zEnterprise System functions is available with z/OS V1.9. Certain functions and features of the zEnterprise System require later releases of z/OS. For more information on the IBM Lifecycle Extension for z/OS V1.9 see Software Announcement 210-027 dated May 11, 2010.

<sup>2</sup> z/OS V1.8 support was withdrawn September 30, 2009. However, with the z/OS Lifecycle Extension (5638-A01), z/OS V1.8 supports the zEnterprise System. Talk to your IBM representative for details. No exploitation of new zEnterprise System functions is available with z/OS V1.8. Certain functions and features of the zEnterprise System require later releases of z/OS. For more information on the IBM Lifecycle Extension for z/OS V1.8 see Software Announcement 209-180 (RFA 53080) dated June 9, 2009.

<sup>3</sup> z/OS V1.7 support was withdrawn September 30, 2008. However, with the z/OS Lifecycle Extension (5637-A01), z/OS V1.7 supports the zEnterprise System. No exploitation of new zEnterprise System functions is available with z/OS V1.7. Certain functions and features of the zEnterprise System require later releases of z/OS. The z/OS Lifecycle Extension for z/OS V1.7 provided defect support until September 30, 2010. Contact your IBM representative if you need support passed that date. For more information on the IBM Lifecycle Extension for z/OS V1.7 see Software Announcement 208-283 (RFA 47640) dated August 12, 2008.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server



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## Supported z/OS Releases and ICSF Levels

- **z/OS V1.7 Crypto customers can run with:**
  - HCR7720 – Base z/OS V1.7 is not supported
  - HCR7731 – Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7
  - HCR7750 – Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8
  - HCR7751 – Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8
- **z/OS V1.8 Crypto customers can run with:**
  - HCR7731 – Base z/OS V1.8
  - HCR7750 – Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8
  - HCR7751 – Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8
- **z/OS V1.9 Crypto customers can run with:**
  - HCR7740 – Base z/OS V1.9
  - HCR7750 – Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8
  - HCR7751 – Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8
  - HCR7770 – Cryptographic Support for z/OS V1R9-V1R11
- **z/OS V1.10 Crypto customers can run with:**
  - HCR7750 – Base z/OS V1.10
  - HCR7751 – Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8
  - HCR7770 – Cryptographic Support for z/OS V1R9-V1R11
  - HCR7780 – Cryptographic Support for z/OS V1R10-V1R12
- **z/OS V1.11 Crypto customers can run with:**
  - HCR7751 – Base z/OS V1.11
  - HCR7770 – Cryptographic Support for z/OS V1R9-V1R11
  - HCR7780 – Cryptographic Support for z/OS V1R10-V1R12
- **z/OS V1.12 Crypto customers can run with:**
  - HCR7770 – Base z/OS V1.12
  - HCR7780 – Cryptographic Support for z/OS V1R10-V1R12

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## Supported z/OS Releases and ICSF Levels

The level of function provided for cryptographic toleration differs by z/OS release and the ICSF web deliverable that is installed. For z/OS V1.10 and higher, exploitation of z196 cryptographic support is provided by Cryptographic Support for z/OS V1R10-V1R12 (FMID HCR7780). Note that this level of ICSF is NOT integrated in z/OS V1.12 and will need to be downloaded and installed even after ordering a z/OS V1.12 ServerPac.

- a. Toleration PTFs are available for all z/OS releases, and all existing supported ICSF web deliverables.
- b. (For z/OS V1.7) Minimally you will have to install toleration PTFs on top of the Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7 web deliverable (FMID HCR7731). The level of ICSF initially shipped with z/OS V1.7 (FMID HCR7720) does not run on a z196 server.
- c. (For z/OS V1.7-z/OS V1.9) If you require Crypto Advanced Encryption Standard (AES) for 256-bit keys SHA-384 and 512 bit for message digest support, ISO Format 3 PIN blocks, support for RSA keys up to 4096 bits, Random Number Generator Long, or enhanced TKE Auditing, then you must install the Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 Web Deliverable (FMID HCR7750).
- d. (For z/OS V1.7-z/OS V1.10) If you require Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, or Key Token Policy support then you must install the Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 Web deliverable (FMID HCR7751).
- e. (For z/OS V1.9-z/OS V1.11) If you require protected key CP Assist for Cryptographic Function, new Crypto Express3 or Crypto Express3 -1P, then you must install the Cryptographic Support for z/OS V1R9-V1R11 Web deliverable (FMID HCR7770).
- f. (For z/OS V1.10-z/OS V1.12) If you require X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS Constraint Relief, PCI Audit, ECC HW Support, CBC Key Wrap, then you must install the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable (FMID HCR7780). The availability of this web deliverable was September 2010. The availability of HMAC support was first quarter 2011, with additional PTFs.

Note: While there are a lot of supported combinations of z/OS releases and ICSF supported levels, most likely you only have to be concerned with one (possibly two) bullets on the slide above. For more information regarding ICSF functionality available on each z/OS release, please see the "Backup Material" starting on page 62.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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## z/OS Supported Software Environments for the z196


- z/OS V1.12
- z/OS V1.11
- z/OS V1.10

z/OS V1.9 (The IBM Lifecycle Extension for z/OS V1.9 will provide the ability for customers to purchase extended defect support for z/OS V1.9 for at least 3 months and up to 24 months after the z/OS V1.9 end of service date)

- z/OS V1.8 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.8 provides the ability for customers to purchase extended defect support for z/OS V1.8 for at least 3 months and up to 24 months after the z/OS V1.8 end of service date)
- z/OS V1.7 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.7 provides the ability for customers to purchase extended defect support for z/OS V1.7 for at least 6 months and up to 24 months after the z/OS V1.7 end of service date. After Sept. 2010 extended support provided through GTS services)

**z/OS V1.6 is not supported on z196**

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## z/OS Toleration Software Support for z196

- **Provides same functionality as that on the IBM System z10**
  - HiperDispatch, OSA-Express3, FICON Express8, Parallel Sysplex InfiniBand (PSIFB) Coupling Links, CF Level 16, High Performance FICON, CPU Measurement Facility, Hardware Decimal Floating Point
    - z/OS V1.7 requires zIIP Web Deliverable to be installed (but not a zIIP processor)
  - (z/OS V1.9) Greater than 54 CPs for a single LPAR, Large Page Support, Capacity Provisioning, HiperSockets Multiple Write Facility, OSA-Express3 Double Port Density, STP Enhancements
  - Crypto Toleration (CP Assist for Cryptographic Functions and Configurable Crypto Express2, Key management for remote loading of ATM and Point of Sale (POS) keys,...)
    - Toleration requires a Cryptographic Web deliverable to be installed
  - Crypto Exploitation (Crypto Advanced Encryption Standard (AES) for 256-bit keys SHA-384 and 512 bit for message digest support, RSA keys up to 4096 bits in Length, Support for 13-digit through 19-digit PANs data, Secure Key AES Support, ...)
    - Exploitation varies depending on Cryptographic Web deliverable installed
- **Plus for z/OS V1.7, z/OS V1.8 and z/OS V1.9**
  - New MSU levels
  - New z/Architecture Instructions (new OPCODE support)
  - IFAURP Reporting
  - Toleration for >64 CPs on the server
  - Crypto toleration

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## z/OS Toleration Support for a z196 Server


z/OS V1.7 – z/OS V1.9 Support is included for the following functions on the z196:

- z196 new instruction mnemonic support,
- HiperDispatch (z/OS V1.7 requires the IBM zIIP Support for z/OS V1R6-V1R7 and z/OS.e V1R6-V1R7 web deliverable to be installed, but not a zIIP processor),





# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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## z/OS Supported Software Environments for the z196

- z/OS V1.12
- z/OS V1.11
- z/OS V1.10

- z/OS V1.9 z/OS V1.9 (The IBM Lifecycle Extension for z/OS V1.9 will provide the ability for customers to purchase extended defect support for z/OS V1.9 for at least 3 months and up to 24 months after the z/OS V1.9 end of service date)
- z/OS V1.8 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.8 provides the ability for customers to purchase extended defect support for z/OS V1.8 for at least 3 months and up to 24 months after the z/OS V1.8 end of service date)
- z/OS V1.7 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.7 provides the ability for customers to purchase extended defect support for z/OS V1.7 for at least 6 months and up to 24 months after the z/OS V1.7 end of service date. After Sept. 2010 extended support provided through GTS services)

**z/OS V1.6 is not supported on z196**

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## z/OS Exploitation Software Support for z196

- All functions listed for z/OS V1.7, z/OS V1.8 and z/OS V1.9 plus a few System z10 functions**
  - Dynamic adding a CPU to a z/OS LPAR without an IPL
  - New XL C/C++ Compiler Options
- Plus new z196 functions**
  - zBX Support for optimizers and IBM POWER7 blades**
  - IBM zEnterprise Unified Resource Manager**
    - Network Management
      - Intranode Management Network (INMN)
      - Intraensemble data network (IEDN)
    - Performance Management
  - RSM exploitation of new OPCODEs
  - HiperDispatch cache and affinity node changes
  - HiperDispatch performance and serviceability enhancements
  - Static Power Save Mode
  - Language Environment High Register Resolution
  - CPU Measurement Facility (Hardware Instrumentation Services)
  - CF Level 17
    - CFCC Diagnostics
    - Scalability improvements with up to 80 coupling links
    - Connectivity improvements with up to 2047 structures
    - Connectivity improvements with 128 CHPIDs per server
  - Removal of the 64k byte data transfer limit for zHPF multitrack operations
  - Three subchannel sets
  - Crypto Exploitation (ANSI X9.8 Pin security, enhanced Common Cryptographic Architecture (CCA), 64 Bit, CP Assist for Cryptographic Function (CPACF) enhancements, Secure Keyed-Hash Message Authentication Code (HMAC), CKDS Constraint Relief, PCI Audit, Elliptical Curve Cryptography (ECC) Digital Signature Algorithm, and CBC Key Wrap)
  - RMF Postprocessor Crypto Activity report support for 4096-bit
- z/OS V1.12 (only)**
  - XL C/C++ ARCH(9) and Tune(9) Options
  - zDAC support
  - New display command – D OSAINFO
  - OSA-Express3 Inbound Workload Queuing (IWQ)

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### z/OS Exploitation Support for a z196 Server

z/OS V1.10 – z/OS V1.12 support is included for the following functions on the z196:

- z196 toleration support: new instruction mnemonic support, HiperDispatch, OSA-Express3 (GbE LX and SX, 1000BASE-T, 10 GbE LR and SR), FICON Express8, Parallel Sysplex InfiniBand (PSIFB) Coupling Links, High Performance FICON for System z (zHPF), Usage Report Program (IFAURP) support, toleration for >64 CPs on the server, OSA-Express3 CHPID OSD maximum ports, RMF



## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

- z/OS V1.10 with PTFs.

**FICON Express8 (CHPID type FC)** for support of zHPF single-track operations requires at a minimum:

- z/OS V1.10 with PTFs.

**FICON Express8 (CHPID type FC)** for support of zHPF multitrack operations requires at a minimum:

- z/OS V1.10 with PTFs.

**FICON Express8 and FICON Express4 (CHPID type FC) supporting extension to zHPF multitrack operations** requires at a minimum:

- z/OS V1.10 with PTFs.

**Up to 32 HiperSockets (CHPID type IQD)** requires at a minimum:

- z/OS V1.10 with PTFs.

**CHPID type OSM for intranode management network** requires at a minimum:

- z/OS V1.10 with PTFs.

**CHPID type OSX for intraensemble data network** requires at a minimum:

- z/OS V1.10 with PTFs.

**12x InfiniBand and 1x InfiniBand coupling links** require at a minimum:

- z/OS V1.10 with PTFs.

**Coupling Facility Control Code Level 17** - Exploiting the new functions of Coupling Facility Control Code Level 17, including support for up to 2047 Coupling Facility structures, requires at a minimum:

- z/OS V1.10 with PTFs.

**Static power save mode** requires at a minimum:

- z/OS V1.10 with PTFs.

**z/OS discovery and autoconfiguration (zDAC)** for FICON Express8 and FICON Express4 channels (CHPID type FC) requires at a minimum:

- z/OS V1.12 with PTFs.

**Display OSAINFO** for OSA-Express3 CHPID types OSD, OSM (exclusive to IBM zEnterprise 196), and OSX (exclusive to IBM zEnterprise 196) on z196 and z10 requires at a minimum:

- z/OS V1.12 with PTFs.

**Inbound workload queuing (IWQ) for OSA-Express3 CHPID types OSD and OSX** requires at a minimum:

- z/OS V1.12 with PTFs.

**CP Assist for Cryptographic Function (CPACF) (#3863) enhancements** require at a minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable planned to be available September 10, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>

**Crypto Express3 enhancements** require at a minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable planned to be available September 10, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>

**Crypto Express3 (when defined as a coprocessor) supporting ANSI X9.8 PIN security** requires at a minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable planned to be available September 10, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>

**Crypto Express3 (when defined as a coprocessor) supporting Enhanced CCA key wrapping** requires at a minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable planned to be available September 10, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>

**Crypto Express3 (when defined as a coprocessor) supporting Secure Keyed-Hash Message**

**Authentication Code (HMAC)** requires at a minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable made available September 1, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>. Additional PTFs were made available in the first quarter 2011 which are also required for HMAC.

**Crypto Express3 (when defined as a coprocessor) supporting Elliptical Curve Cryptography (ECC)**

**Digital Signature algorithm** requires at minimum:

- z/OS V1.10, z/OS V1.11, or z/OS V1.12 with the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable planned to be available September 10, 2010. This may be obtained at:  
<http://www.ibm.com/systems/z/os/zos/downloads/>

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Migration Considerations

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## Hardware Migration Considerations

- The following features are not orderable on the System z196 models. If they are installed at the time of an upgrade to the System z196, they may be retained.
  - FICON Express4 10KM LX
  - FICON Express4 SX
  - FICON Express4 4KM LX
  - OSA-Express2 GbE LX
  - OSA-Express2 GbE SX
  - OSA-Express2 1000BASET
- The following will NOT be supported on System z196:
  - FICON Express
  - FICON Express2
  - Crypto Express2
  - OSA-Express2 10 GbE LR

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### Statements of Direction


**The IBM zEnterprise 196 will be the last high-end server to offer ordering of ESCON channels.** This applies to channel path identifier (CHPID) types CNC, CTC, CVC, and CBY. Enterprises should begin migrating from ESCON to FICON. Alternate solutions are available for connectivity to ESCON and parallel devices. IBM Global Technology Services offers an ESCON to FICON Migration solution, Offering ID #6948-97D, to help facilitate migration from ESCON to simplify and manage a single physical and operational environment while maximizing green-related savings.

**The IBM zEnterprise 196 will be the last high-end server to support FICON Express4 channels:**

Enterprises should begin migrating from FICON Express4 channel features (#3321, #3322, #3324) to FICON Express8 channels.

**The IBM zEnterprise 196 will be the last high-end server to support OSA-Express2 features:**

Enterprises should begin migrating from OSA-Express2 features (#3364, #3365, #3366) to OSA-Express3 features.



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## z196 General Migration Considerations

- **Software Changes**
  - z/OS releases do not require z196 server
  - z196 servers **ONLY** require software identified as ‘base’ support
    - z196 servers do **NOT** require any ‘functional’ software
- **Very few new migration issues identified (next chart)**
  - z990, z890, z9 EC, z9 BC, z10 EC, and z10 BC migration actions “inherited”
  - “Inherited” and new sysplex considerations
  - Many functions are enabled/disabled based on the presence or absence of the required hardware and software.
    - Some functions have exploitation or migration considerations (subsequent charts)

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### General Recommendations and Considerations

As you plan your migration to a z196 server, consider the following:


#### **z196 z/OS Software Support**

Not all System z196 functions are available in every z/OS release. Some functions have exploitation or migration considerations. Many functions are enabled or disabled, based on the presence or absence of the required hardware and software. Other than the minimum support, there is no requirement to install either software or hardware first to exploit a specific function.

#### **Relatively few migration actions are new when coming from a z10 EC or a z10 BC server**

Migration to a z196 server has, as its base, a migration to the z10 EC or z10 BC servers. This means that if you are migrating to a z196 server from a z10 EC or z10 BC server, and have performed the migration actions associated with the z10 EC or z10 BC, you have fewer migration actions than if you were migrating from a server prior to the z10 EC or z10 BC and have not yet performed the migration actions associated with these servers. There are, in fact, very few new migration actions to perform on z/OS for a z196 server if you have already migrated to a z10 EC or z10 BC server. It is important to note that you can migrate directly to a z196 server without installing the intermediate (prior to z10 EC and z10 BC) servers, but you still need to ensure that any migration considerations are satisfied for the servers that you “skipped.” To read about z10 EC and z10 BC server migration actions, see *z/OS Migration to the IBM System z10* (SA23-2242-00).





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## z196 Specific Migration Considerations

- **New z196 z/Architecture Machine Instructions**
  - New mnemonics
  - Use of XL C/C++ ARCH(9) and TUNE(9) options
- **Sysplex Considerations**
  - Server participation restriction in a Parallel Sysplex
  - Evaluate Coupling Links requirements
    - z196 does not support ICB-4 Coupling Links
  - Evaluate Sysplex Timer environment
    - z196 does not support connection to an ETR
      - A mixed CTN configuration is supported
        - » z10 and z9 servers using ETR or STP, z196 using STP
  - New CFCC Level
    - Evaluate structure sizes
- **Update SCRT to latest version**
  - Always required if you want to use vWLC

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## **z196 Specific Migration Considerations**

You can perform the following migration actions before you order or install your z196 server:

1. **Review the new mnemonics introduced for the z196 server.** The new mnemonics might collide with (be identical to) the names of assembler macro instructions you use or provide. In the event of such collisions, the HLASM's default opcode table (UNI) will treat specification of these names as instructions when APAR PK97799 is installed. This will probably cause assembler error messages and possibly cause generation of incorrect object code. See page 20 for more details.
2. **Review the sysplex configuration in which the z196 server will participate.** In particular, if you have any existing z900, z800, z990, or z890 z/OS images or coupling facility images in the sysplex, move those z/OS images or coupling facilities to later servers, such as a System z10 (z10 EC or z10 BC), System z9 (z9 EC or z9 BC), or later. This action is necessitated by the restriction that a z196 server cannot participate with prior-level servers in a sysplex.
3. **Migrate from ICB-4 to InfiniBand coupling links.** This action is necessitated because ICB-4 links are not supported on z196 servers. If desired, you can take this action after you order a z196, as you upgrade to the new server. See page 25 for more details.
4. **Implement STP (or a Mixed-CTN) timing network.** This action is necessitated because Sysplex Timers (9037-002) are not supported on a z196 server. See page 26 for more details.
5. **Migrate from unsupported hardware features to newer technology.** This action is necessitated because FICON Express, FICON Express2, Crypto Express2, and OSA-Express2 10 GbE LR are not supported on z196 servers.
6. **Run CFSIZER.** If you are moving your coupling facilities and the coupling facility structures will be on higher CFCC levels than they were previously, run the Coupling Facility Structure Sizer (CFSIZER) tool to find out if you have to increase coupling facility structure sizes. z196 servers shipped with CFCC Level 17; prepare to make the necessary changes as indicated by the tool. You can find the CFSIZER tool at <http://www.ibm.com/systems/support/z/cfsizer/>.
7. **Update SCRT to latest version.** If you use SCRT, make sure it is at the latest level. This is a requirement for vWLC, as well as when you upgrade servers. The latest level of SCRT can be downloaded from the SCRT Web site at <http://www.ibm.com/eserver/zseries/swprice/scrt/>.



## New z196 z/Architecture Machine Instructions

- **The new mnemonics may collide with (be identical to) the names of Assembler macro instructions you use**
  - If you write programs in Assembler Language, you should compare the list of new instructions to the names of Assembler macro instructions you use and/or provide
  - If a conflict is identified, take one of these actions:
    - **Change the name of your macro instruction.**
    - **Specify a separate assembler opcode table**
      - via PARM= , ASMAOPT, or ‘\*PROCESS OPTABLE....’ in source
    - **Use a coding technique that permits both use of a new instruction and a macro with the same name in an assembly**
- **Use of XL C/C++ ARCH(9) and TUNE(9) options**
  - See later chart

### New z/Architecture Instructions

The new mnemonics might collide with (be identical to) the names of assembler macro instructions you use or provide. In the event of such collisions, the HLASM’s default opcode table (UNI) will treat specification of these names as instructions when APAR PK97799 is installed. This will probably cause assembler error messages and possibly cause generation of incorrect object code.

If you write programs in Assembler Language, you should compare the list provided below and in *z/Architecture Principles of Operation* to the names of assembler macro instructions you use or provide, to identify any such conflicts or collisions that would occur following installation of HLASM APAR PK97799. If a conflict is identified, take one of the following actions:

- Change the name of your macro instruction.
- Specify PARM=’...OPTABLE(YOP)...’ (or some other earlier opcode table).
- Specify a separate ASMAOPT file containing assembler options, such as in the previous method (this method requires no changes to source code or JCL).
- Add, as the first statement of your source program, \*PROCESS OPTABLE(YOP).
- Specify the PROFILE option either in JCL or the ASMAOPT file, and the specified or default member of the SYSLIB data set is copied into the front of the source program.
- If you must use both a new instruction and a macro with the same name in an assembly, you can use the following technique (where XXX is a sample mnemonic):

```
* Assume the default OPTABLE(UNI) is in effect
XXX   a,b           new instruction
PUSH  ACONTROL     save current optable definition
ACONTROL OPTABLE(YOP)  switch optable dynamically
XXX   r,s,t        macro invocation
POP   ACONTROL     restore previous definition
XXX   c,d           new instruction
```

| <u>Instruction Name</u>                           | <u>Mnemonic</u> | <u>Format</u> | <u>OPCODE</u> |
|---|-----------------|---------------|---------------|
| <b>High-Word-Facility Instructions</b>            |                 |               |               |
| ADD HIGH (32)                                     | AHHHR           | RRF           | B9C8          |
| ADD HIGH (32)                                     | AHHLR           | RRF           | B9D8          |
| ADD IMMEDIATE HIGH (32)                           | AIH             | RIL           | CC8           |
| ADD LOGICAL HIGH (32)                             | ALHHR           | RRF           | B9CA          |
| ADD LOGICAL HIGH (32)                             | ALHLR           | RRF           | B9DA          |
| ADD LOGICAL WITH SIGNED IMMEDIATE HIGH (32) ALSIH |                 | RIL           | CCA           |



## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

|  |         |     |      |
|--|---------|-----|------|
| ADD LOGICAL WITH SIGNED IMMEDIATE HIGH (32)          | ALSIHN  | RIL | CCB  |
| BRANCH RELATIVE ON COUNT HIGH (32)                   | BRCTH   | RIL | CC6  |
| COMPARE HIGH (32)                                    | CHF     | RXY | E3CD |
| COMPARE HIGH (32)                                    | CHHR    | RRE | B9CD |
| COMPARE HIGH (32)                                    | CHLR    | RRE | B9DD |
| COMPARE IMMEDIATE HIGH (32)                          | CIH     | RIL | CCD  |
| COMPARE LOGICAL HIGH (32)                            | CLHF    | RXY | E3CF |
| COMPARE LOGICAL HIGH (32)                            | CLHHR   | RRE | B9CF |
| COMPARE LOGICAL HIGH (32)                            | CLHLR   | RRE | B9DF |
| COMPARE LOGICAL IMMEDIATE HIGH (32)                  | CLIH    | RIL | CCF  |
| LOAD BYTE HIGH (32 16)                               | LBH     | RXY | E3C0 |
| LOAD HALFWORD HIGH (32 16)                           | LHH     | RXY | E3C4 |
| LOAD HIGH (32)                                       | LFH     | RXY | E3CA |
| LOAD LOGICAL CHARACTER HIGH (32 16)                  | LLCH    | RXY | E3C2 |
| LOAD LOGICAL HALFWORD HIGH (32 16)                   | LLHH    | RXY | E3C6 |
| ROTATE THEN INSERT SELECTED BITS HIGH                | RISBHG  | RIE | EC5D |
| ROTATE THEN INSERT SELECTED BITS LOW                 | RISBLG  | RIE | EC51 |
| STORE CHARACTER HIGH (8)                             | STCH    | RXY | E3C3 |
| STORE HALFWORD HIGH (16)                             | STHH    | RXY | E3C7 |
| STORE HIGH (32)                                      | STFH    | RXY | E3CB |
| SUBTRACT HIGH (32)                                   | SHHHR   | RRF | B9C9 |
| SUBTRACT HIGH (32)                                   | SHHLR   | RRF | B9D9 |
| SUBTRACT LOGICAL HIGH (32)                           | SLHHHR  | RRF | B9CB |
| SUBTRACT LOGICAL HIGH (32)                           | SLHHLR  | RRF | B9DB |
| <b>Interlocked-Access-Facility Instructions</b>      |         |     |      |
| LOAD AND ADD (32)                                    | LAA     | RSY | EBF8 |
| LOAD AND ADD (64)                                    | LAAG    | RSY | EBE8 |
| LOAD AND ADD LOGICAL (32)                            | LAAL    | RSY | EBFA |
| LOAD AND ADD LOGICAL (64)                            | LAALG   | RSY | EBEA |
| LOAD AND AND (32)                                    | LAN     | RSY | EBF4 |
| LOAD AND AND (64)                                    | LANG    | RSY | EBE4 |
| LOAD AND EXCLUSIVE OR (32)                           | LAX     | RSY | EBF7 |
| LOAD AND EXCLUSIVE OR (64)                           | LAXG    | RSY | EBE7 |
| LOAD AND OR (32)                                     | LAO     | RSY | EBF6 |
| LOAD AND OR (64)                                     | LAOG    | RSY | EBE6 |
| LOAD PAIR DISJOINT (32)                              | LPD     | SSF | C84  |
| LOAD PAIR DISJOINT (64)                              | LPDG    | SSF | C85  |
| <b>Load/Store-on-Condition Facility Instructions</b> |         |     |      |
| LOAD ON CONDITION (32)                               | LOC     | RSY | EBF2 |
| LOAD ON CONDITION (32)                               | LROC    | RRF | B9F2 |
| LOAD ON CONDITION (64)                               | LGOC    | RSY | EBE2 |
| LOAD ON CONDITION (64)                               | LGROC   | RRF | B9E2 |
| STORE ON CONDITION (32)                              | STOC    | RSY | EBF3 |
| STORE ON CONDITION (64)                              | STGOC   | RSY | EBE3 |
| <b>Distinct-Operands-Facility Instructions</b>       |         |     |      |
| ADD (32)   | ARK     | RRF | B9F8 |
| ADD (64)   | AGRK    | RRF | B9E8 |
| ADD IMMEDIATE (32 16)                                | AHIK    | RIE | ECD8 |
| ADD IMMEDIATE (64 16)                                | AGHIK   | RIE | ECD9 |
| ADD LOGICAL (32)                                     | ALRK    | RRF | B9FA |
| ADD LOGICAL (64)                                     | ALGRK   | RRF | B9EA |
| ADD LOGICAL WITH SIGNED IMMEDIATE (32 16)            | ALHSIK  | RIE | ECDA |
| ADD LOGICAL WITH SIGNED IMMEDIATE (64 16)            | ALGHSIK | RIE | ECDB |
| AND (32)   | NRK     | RRF | B9F4 |
| AND (64)   | NGRK    | RRF | B9E4 |
| EXCLUSIVE OR (32)                                    | XRK     | RRF | B9F7 |
| EXCLUSIVE OR (64)                                    | XGRK    | RRF | B9E7 |
| OR (32)  | ORK     | RRF | B9F6 |

## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

|   |        |     |      |
|---|--------|-----|------|
| OR (64)                                       | OGRK   | RRF | B9E6 |
| SHIFT LEFT SINGLE (32)                        | SLAK   | RSY | EBDD |
| SHIFT LEFT SINGLE LOGICAL (32)                | SLLK   | RSY | EBDF |
| SHIFT RIGHT SINGLE (32)                       | SRAK   | RSY | EBDC |
| SHIFT RIGHT SINGLE LOGICAL (32)               | SRLK   | RSY | EBDE |
| SUBTRACT (32)                                 | SRK    | RRF | B9F9 |
| SUBTRACT (64)                                 | SGRK   | RRF | B9E9 |
| SUBTRACT LOGICAL (32)                         | SLRK   | RRF | B9FB |
| SUBTRACT LOGICAL (64)                         | SLGRK  | RRF | B9EB |
| <b>Population-Count-Facility Instruction</b>  |        |     |      |
| POPULATION COUNT                              | POPCNT | RRE | B9E1 |
| <b>Message Security Assist - Extension 4</b>  |        |     |      |
| CIPHER MESSAGE WITH CFB                       | KMF    |     | B92A |
| CIPHER MESSAGE WITH COUNTER                   | KMCTR  |     | B92D |
| CIPHER MESSAGE WITH OFB                       | KMO    |     | B92B |
| PERFORM CRYPTOGRAPHIC COMPUTATION             | PCC    |     | B92C |
| <b>Reset-Reference-Bit-Multiple Facility</b>  |        |     |      |
| RESET REFERENCE BIT MULTIPLE                  | RRBM   |     | B9AE |
| <b>Integer to/from Floating Point Convert</b> |        |     |      |
| CONVERT FROM FIXED (32 to extended BFP)       | CXFBRA | RRF | B396 |
| CONVERT FROM FIXED (32 to long BFP)           | CDFBRA | RRF | B395 |
| CONVERT FROM FIXED (32 to short BFP)          | CEFBRA | RRF | B394 |
| CONVERT FROM FIXED (64 to extended BFP)       | CXGBRA | RRF | B3A6 |
| CONVERT FROM FIXED (64 to long BFP)           | CDGBRA | RRF | B3A5 |
| CONVERT FROM FIXED (64 to short BFP)          | CEGBRA | RRF | B3A4 |
| CONVERT FROM LOGICAL (32 to extended BFP)     | CXLFBR | RRF | B392 |
| CONVERT FROM LOGICAL (32 to long BFP)         | CDLFBR | RRF | B391 |
| CONVERT FROM LOGICAL (32 to short BFP)        | CELFBR | RRF | B390 |
| CONVERT FROM LOGICAL (64 to extended BFP)     | CXLGBR | RRF | B3A2 |
| CONVERT FROM LOGICAL (64 to long BFP)         | CDLGBR | RRF | B3A1 |
| CONVERT FROM LOGICAL (64 to short BFP)        | CELGBR | RRF | B3A0 |
| CONVERT TO FIXED (extended BFP to 32)         | CFXBRA | RRF | B39A |
| CONVERT TO FIXED (long BFP to 32)             | CFDBRA | RRF | B399 |
| CONVERT TO FIXED (short BFP to 32)            | CFEBRA | RRF | B398 |
| CONVERT TO FIXED (extended BFP to 64)         | CGXBRA | RRF | B3AA |
| CONVERT TO FIXED (long BFP to 64)             | CGDBRA | RRF | B3A9 |
| CONVERT TO FIXED (short BFP to 64)            | CGEBRA | RRF | B3A8 |
| CONVERT TO LOGICAL (extended BFP to 32)       | CLFXBR | RRF | B39E |
| CONVERT TO LOGICAL (long BFP to 32)           | CLFDBR | RRF | B39D |
| CONVERT TO LOGICAL (short BFP to 32)          | CLFEBR | RRF | B39C |
| CONVERT TO LOGICAL (extended BFP to 64)       | CLGXBR | RRF | B3AE |
| CONVERT TO LOGICAL (long BFP to 64)           | CLGDBR | RRF | B3AD |
| CONVERT TO LOGICAL (short BFP to 64)          | CLGEBR | RRF | B3AC |
| DIVIDE TO INTEGER (short BFP)                 | DIEBR  | RRF | B353 |
| LOAD FP INTEGER (extended BFP)                | FIXBRA | RRF | B347 |
| LOAD FP INTEGER (long BFP)                    | FIDBRA | RRF | B35F |
| LOAD FP INTEGER (short BFP)                   | FIEBRA | RRF | B357 |
| LOAD ROUNDED (extended to long BFP)           | LDXBRA | RRF | B345 |
| LOAD ROUNDED (extended to short BFP)          | LEXBRA | RRF | B346 |
| LOAD ROUNDED (long to short BFP)              | LEDBRA | RRF | B344 |

### Explanation:

- RI instruction format.
- RIE instruction format.
- RIL instruction format.
- RRE instruction format.
- RRF instruction format.
- RSY instruction format.



## z/OS XL C/C++ Exploitation of z196 Machine Instructions

### ■ C/C++ ARCH(9) and TUNE(9) options:

– The ARCHITECTURE C/C++ compiler option selects the minimum level of machine architecture on which your program will run.

• ARCH(9) exploits instructions available on a z196 server

• The TUNE compiler option allows you to optimize your application for a specific machine architecture within the constraints imposed by the ARCHITECTURE option

o The TUNE level has to be at least the ARCH level

o If the TUNE level is lower than the specified ARCH level, the compiler forces TUNE to match the ARCH level or uses the default TUNE level, whichever is greater.

o For more information on the ARCHITECTURE and TUNE compiler options refer to the z/OS XL C/C++ User's Guide.

### ■ Exploitation Restriction:

– Code compiled with the C/C++ ARCH(9) option can only run on z196 servers, otherwise an operation exception will result

– This is a consideration for programs running on different level servers during development, test, production, and during fallback or DR

### C/C++ ARCH(9) and TUNE(9) options.

The ARCHITECTURE C/C++ compiler option selects the minimum level of machine architecture on which your program can run. Certain features provided by the compiler require a minimum architecture level. ARCH(9) exploits instructions available on z196 servers. For more information, refer to the ARCHITECTURE compiler option in *z/OS XL C/C++ User's Guide*. The TUNE compiler option allows you to optimize your application for specific machine architecture. The TUNE level has to be at the ARCH level, at a minimum. If the TUNE level is lower than the specified ARCH level, the compiler forces TUNE to match the ARCH level, or uses the default TUNE level, whichever is greater. For more information about the ARCHITECTURE and TUNE compiler options refer to *z/OS XL C/C++ User's Guide*.

**Exploitation restriction.** When programs exploit the ARCH(9) or TUNE(9) option, those programs can only run on z196 servers, or an operation exception will occur. This is a consideration for programs that will run on different server levels (z10 and z9 servers) during development, test, and production, as well as during fallback or disaster recovery.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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## Server Participation in a Parallel Sysplex

- **z196 does not support active participation in the same Parallel Sysplex with:**
  - IBM eServer zSeries 900 (z900), IBM eServer zSeries 800 (z800),
  - IBM eServer zSeries 990 (z990), IBM eServer zSeries 890 (z890),
  - and older System/390 Parallel Enterprise Server systems

**This means:**

- Configurations with z/OS on one of these servers can't add a z196 to their sysplex for either a z/OS image or a CF image
- Configurations with a CF on one of these servers can't add a z196 to their sysplex for either a z/OS image or a CF image

- **z196 does not support ICB-4 Coupling Links**
  - Customers should plan their coupling link technology
- **z196 does not support connection to an ETR**
  - Customers should migrate to STP prior to z196

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### z196 servers in a Parallel Sysplex

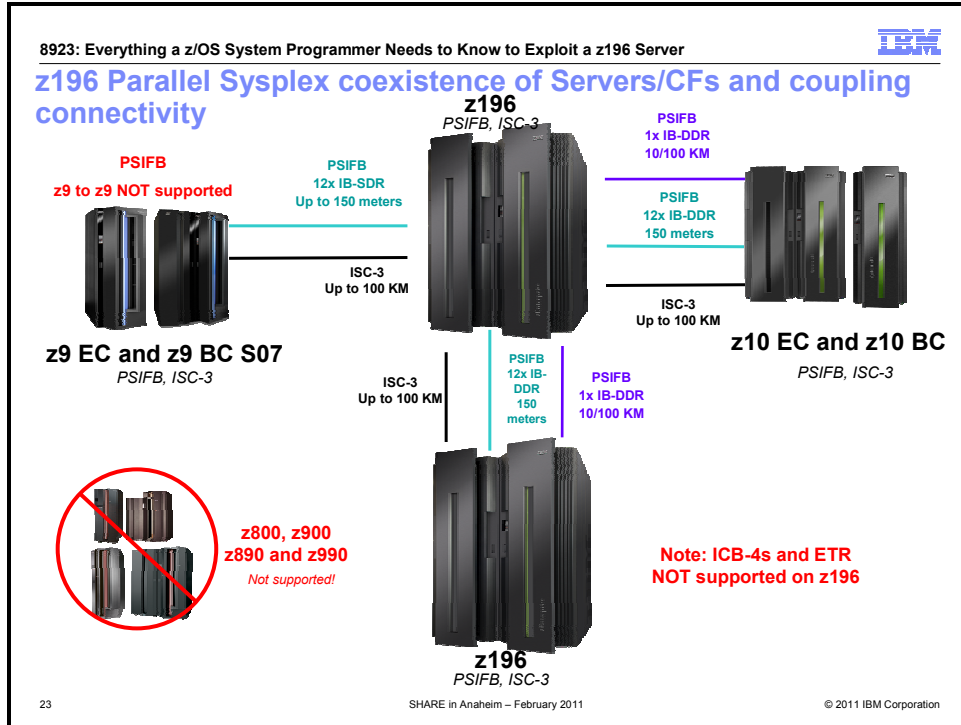
z196 servers are **only** supported in a parallel sysplex with other z196 servers, z10 EC and z10 BC servers, and z9 EC and z9 BC servers. If you are running z/OS on z900, z800, z990, or z890 servers, then you cannot add a z196 server to that sysplex. That is, you will not be able to perform rolling IPLs to introduce a z196 server if you have any of the earlier (pre-System z) servers either as z/OS images or coupling facility images in the sysplex. The earlier servers in the sysplex must be upgraded to System z9 or later to have z196 supported in the sysplex. If you have any z/OS images or coupling facility images on an earlier server, and you intend to introduce a z196 into that sysplex, you must migrate those images to a System z9 (or later) server prior to introducing the z196 server.

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## z196 – Parallel Sysplex Coexistence Considerations

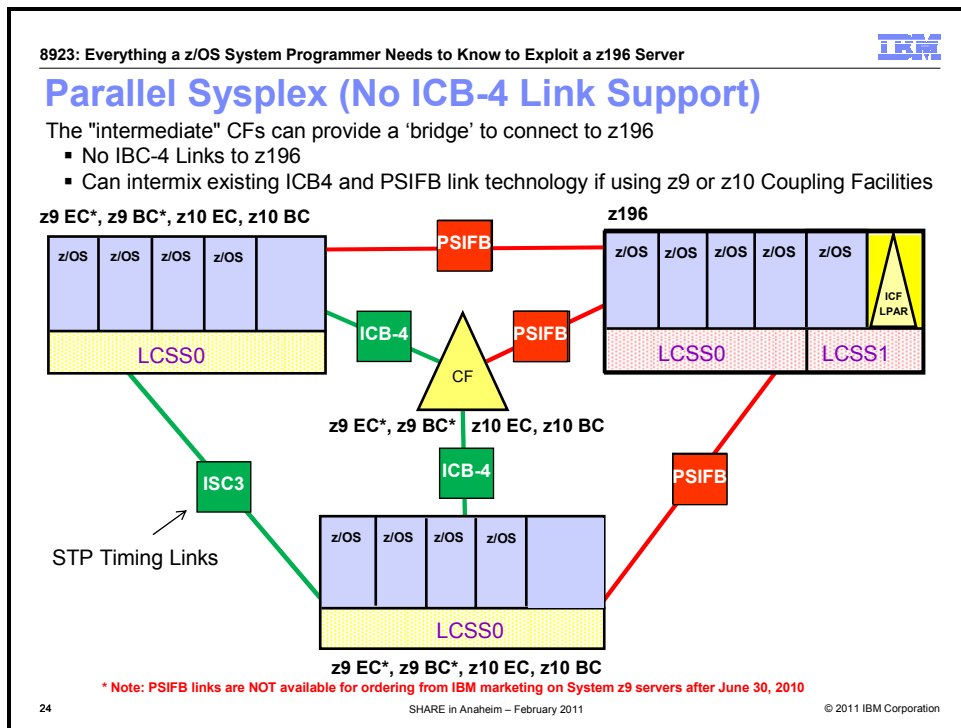
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# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server



## z196 does not support ICB-4 Coupling Links

The Integrated Cluster Bus 4 (ICB-4) Coupling Links are not supported on a z196 CPC. Use 12x InfiniBand coupling links, which are designed to replace Integrated Cluster Bus 4 (ICB-4), and to complement 1x InfiniBand and ISC-3 on a z196 server. InfiniBand coupling can provide significantly improved service times compared to ISC-3s for distances up to 150 meters (12x InfiniBand). You can read about InfiniBand coupling links in *IBM System z Connectivity Handbook* (SG24-5444).





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## STP Configurations

- Two types of Coordinated Timing Network (CTN) configurations possible:
  - Mixed CTN
    - Allows servers/CFs that can only be synchronized to a Sysplex Timer (ETR network) to coexist with servers/CFs that can be synchronized with CST in the “same” timing network
    - Sysplex Timer provides timekeeping information
    - CTN ID format
      - STP network ID concatenated with ETR network ID
  - STP-only CTN
    - All servers/CFs synchronized with CST
    - Sysplex Timer is NOT required
    - CTN ID format
      - STP network ID only (ETR network ID field has to be null)

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### STP - time synchronization for Parallel Sysplex

Server Time Protocol (STP) is designed to allow events occurring in different servers to be properly sequenced in time. STP is designed for servers that have been configured in a Parallel Sysplex or a basic sysplex (without a coupling facility), as well as servers that are not in a sysplex but need time synchronization. STP is a server-wide facility that is implemented in the Licensed Internal Code (LIC), presenting a single view of time to Processor Resource/Systems Manager (PR/SM). STP uses a message-based protocol in which timekeeping information is passed over externally defined coupling links between servers. The coupling links that can be used to transport STP messages include 12x or 1x InfiniBand (IFB) links and InterSystem Channel-3 (ISC-3) links configured in peer mode. These can be the same links that already are being used in a Parallel Sysplex for coupling facility (CF) message communication. STP can also use ICB-3 and ICB-4 links on servers that support them.

The STP design introduced a concept called Coordinated Timing Network (CTN). A Coordinated Timing Network (CTN) is a collection of servers and coupling facilities that are time-synchronized to a time value called Coordinated Server Time. A CTN can be configured in two ways:

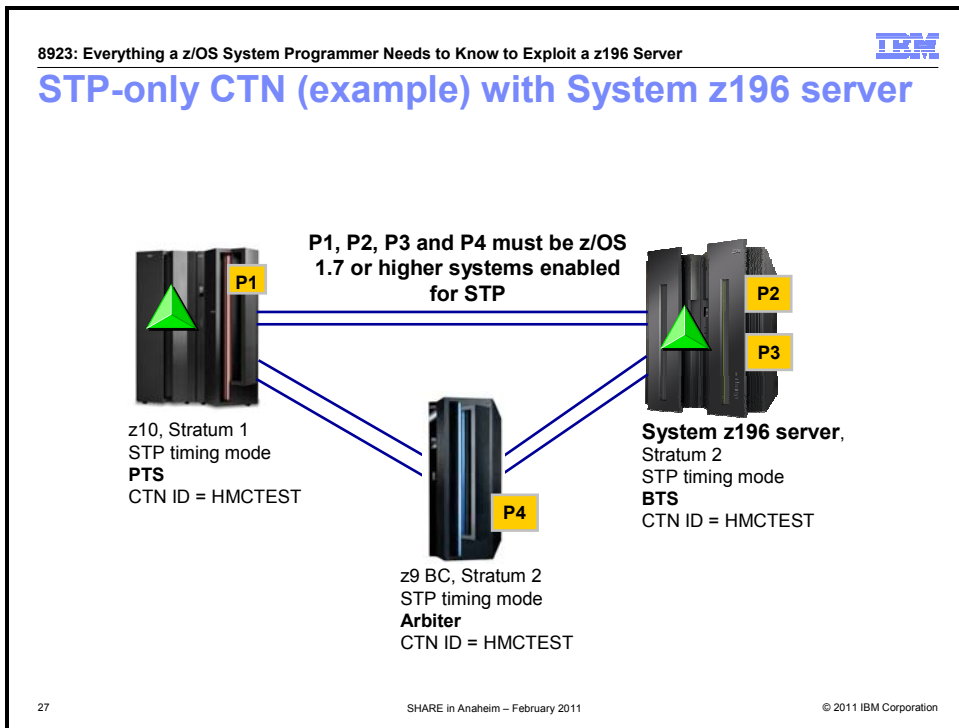
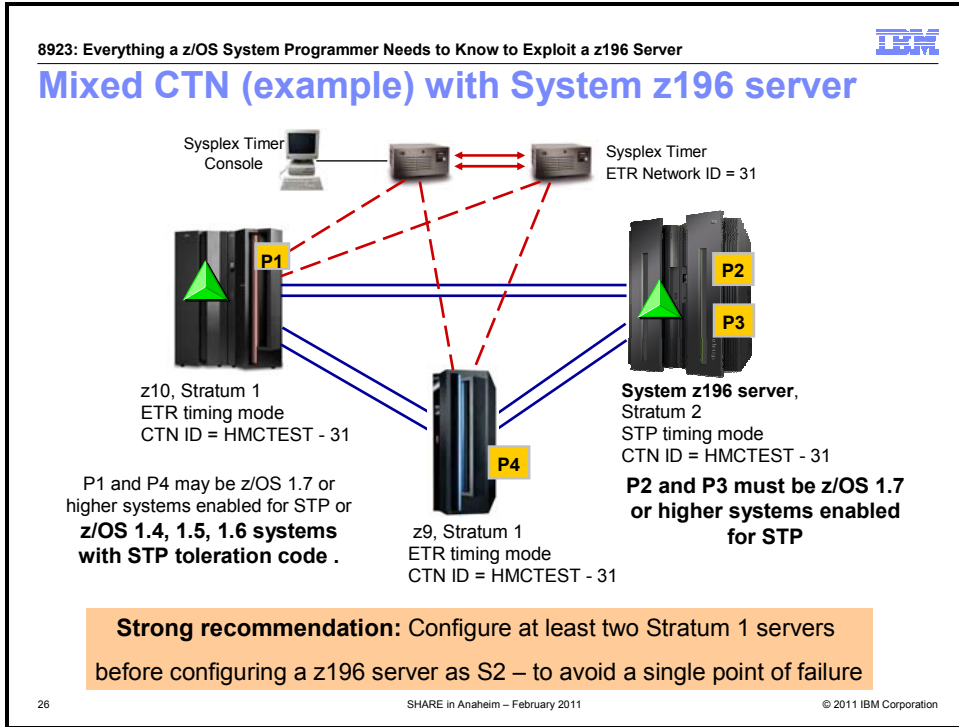
- STP-only CTN which does not require a Sysplex Timer.
- Mixed CTN (External Time Reference (ETR) and STP) which requires a Sysplex Timer. The Sysplex Timer provides the timekeeping information in a Mixed CTN.


### z196 does not support connection to an ETR

The z196 server **cannot** be connected to a Sysplex Timer (9037-002). The Server Time Protocol (STP) feature is the follow-on to the Sysplex Timer. STP is designed to allow multiple servers and coupling facilities to maintain time synchronization with each other without requiring a Sysplex Timer. STP is a hardware feature of the z196, z10 EC, z10 BC, z9 EC, z9 BC, z990, and z890 servers. To implement STP, see the STP Web site and the publications and other resources listed there. The STP Web site is at <http://www.ibm.com/systems/z/ps0/stp.html>.

Even though the z196 does not support attachment to a Sysplex Timer, it can participate in a Mixed-CTN that has either a z10 or z9 server synchronized to the Sysplex Timer. This maintains the capability for enterprises to concurrently migrate from an existing External Time Reference (ETR) to a Mixed-CTN and from a Mixed-CTN to an STP-only CTN.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

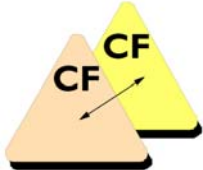




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## System z CFCC Level 17

- **CFCC Level 17 allows:**
  - Up to 2047 CF structures (CFCC 16 allowed 1023).  
Allowing more CF structures to be defined and used in a sysplex permits more discrete data sharing groups to operate concurrently, and can help environments requiring many structures to be defined, such as to support SAP or service providers
  - Improved CFCC Diagnostics & Link Diagnostics
- **Structure and CF Storage Sizing with CFCC level 17**
  - May increase storage requirements when moving from:
    - CF Level 16 (or below) to CF Level 17
  - CF Sizer Tool recommended
    - <http://www.ibm.com/systems/z/cfsizer/>
- **Greater than 1023 CF Structures requires a new version of the CFRM CDS**
  - All systems in the sysplex need to be at z/OS V1.12 or have the coexistence/preconditioning PTF installed.
  - Falling back to a previous level (without coexistence PTF installed) is NOT supported without sysplex IPL



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## Parallel Sysplex Enhancements

**Connectivity improvements with up to 80 coupling links:** The IBM zEnterprise 196 increases the number of external coupling links allowed from 64 to 80. This allows the full configuration of 32 PSIFB links and 48 ISC-3 links to be used. In addition, one can also configure up to 32 (internal) IC links for coupling between images defined on the same server. Having more coupling links is important to provide sufficient coupling connectivity for larger single Parallel Sysplexes, as well as for configurations where the same server hosts multiple Parallel Sysplexes and Coupling Facility images.

**Connectivity improvements with 128 CHPIDs per server:** To support larger Parallel Sysplexes with ever-increasing amounts of data sharing traffic to the Coupling Facility, the throughput and capacity of more coupling CHPIDs are also required. With z196, we have increased the number of coupling CHPIDs per server from 64 to 128. Since IFB links allow for multiple (logical) CHPIDs over the same (physical) link, this can also allow for larger Parallel Sysplexes without requiring more coupling link hardware.


## Coupling Facility Control Code (CFCC) Level 17

**Connectivity improvements with up to 2047 structures:** CFCC Level 17 increases the number of structures that can be allocated in a CFCC image from 1023 to 2047. Allowing more CF structures to be defined and used in a sysplex permits more discrete data sharing groups to operate concurrently, and can help environments requiring many structures to be defined, such as to support SAP or service providers. z196 and CFCC level 17 provide improved serviceability of Coupling Facilities with enhanced data collection and triggering of nondisruptive CF dumps.

**Larger coupling facility structure sizes might be necessary.** When you change coupling facility control code (CFCC) levels, your coupling facility structure sizes might change. z196 servers initially ship with CFCC level 17. If, as part of your migration to a z196 server, you change CFCC levels (either by placing a coupling facility on the z196 server or by moving the coupling facility to a z10 EC or z10 BC at a later CFCC level), you might have larger structure sizes than you did previously. In this case you should run the Coupling Facility Structure Sizer (CFSIZER) tool to find out if you have to increase coupling facility structure sizes. Prepare to make the necessary changes as indicated by the tool. You can find the CFSIZER tool at <http://www.ibm.com/systems/support/z/cfsizer/>.

**Note:** The PTFs to support CFCC Level 17 have coexistence (or sysplex preconditioning) PTFs that require installation throughout your sysplex prior to implementing CFCC Level 17.



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## Customization / Activation (Power Save Mode)

- **The new SMFPRMxx PARMLIB option**  
**MAXEVENTINTRECS**
  - Allows governing the number of event interval records to be collected when the processor capacity changes.
  - The default is zero
  - To collect extra records between regular intervals when the processor capacity changes, the default must be adjusted.
  
- **CPU Measurement Facility (HIS)**
  - A new parameter to the MODIFY HIS command is necessary to override the default action to take when a CPU speed change is detected within the HIS component
  - Parameter: { STATECHANGE | SC } = { SAVE | STOP | IGNORE }

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## Static Power Save Mode

With the introduction of static power save mode, IBM is continuing to help provide energy management capabilities to facilitate energy savings. You now have the ability to reduce the power consumption of the IBM zEnterprise 196.

Static power save mode is designed to reduce power consumption on z196 when full performance is not required. It can be switched on and off during runtime with no disruption to currently running workloads, aside from the change in performance. On air-cooled models, Static power save mode can be entered once in a calendar day.

Using the Hardware Management Console (HMC), as well as the Active Energy Manager (AEM), you can use static power save mode for:

- Periods of lower utilization - weekends, third shift
- Capacity backup systems - systems used for emergency backup; keep them "running" but reduce energy consumption. Systems can quickly be brought back to full performance.

This could result in a 20% - 30% reduction in power consumption (depending on system configuration). If you have also implemented dynamic control of cooling (for example, through the integration of Active Energy Manager with facility management applications) the air conditioning for the cooling zone can be turned down and additional energy can be saved.

There is a new SMFPRMxx parmlib option, MAXEVENTINTRECS, that allows governing the number of event interval records to be collected when the processor capacity changes. The default is zero. To collect extra records between regular intervals when the processor capacity changes, the default must be adjusted.

If you are using the CPU Measurement Facility (Hardware Instrumentation Services), there is a new parameter on the MODIFY *hisproc* command. You can use this parameter, STATECHANGE, to override the default action to take when a CPU speed change is detected within the HIS component.

- STATECHANGE is an optional parameter specifying the action to take when a significant change to the system is detected. An example of a significant state change would be if the capability of a CPU has changed. When a state change is detected, the following actions are allowed:
  - **STOP** - When you specify STOP, the current run of hardware event data collection for a system is ended as if the DURATION of the run has expired.
  - **IGNORE** - When you specify IGNORE, the current run of hardware event data collection continues as if no state change had been detected.
  - **SAVE** - When you specify SAVE, the current run of hardware event data collection will first save all data collected as if the DURATION of the run has expired, then it will resume collecting hardware event data in the new state for the remaining DURATION of the current collection run. (Default).



## Customization / Activation for Cache and Affinity Node Changes

### ■ z196 uses chip level cache more efficiently

- Allows 3 physical CPs from same chip to form affinity node
  - Note: A z10 uses HiperDispatch book cache support and 4 physical CPs from same book

### ■ z/OS now forces HiperDispatch=YES for LPARs with >64 CPs

- On LPARs with >64 CPUs defined on z196 with IEAOPTxx specifying HIPERDISPATCH=NO during IPL / SET OPT=xx after IPL:
  - System forced / continues running with HIPERDISPATCH=YES
  - New Message:
    - IRA865I HIPERDISPATCH=YES FORCED DUE TO GREATER THAN 64 LPS DEFINED
- LPARs in HD=NO with <64 CPUs can dynamically add more CPUs and continue to run in HD=NO. Results in the following:
  - New Message:
    - ISN012E HIPERDISPATCH MUST BE ENABLED TO CONFIGURE CPU IDS GREATER THAN 3F ONLINE
  - Attempts to configure CPUs >64 online in HD=NO rejected with message:
    - IEE241I CPU(x) NOT RECONFIGURED ONLINE - REQUIRES HIPERDISPATCH ENABLED
  - Once an LPAR with >64 CPUs goes to HD=YES, it cannot go back to HD=NO
    - Treated as if IPLed with HD=YES once HD=YES activated

## HiperDispatch cache and affinity node changes

This function is enhanced to exploit the z196 architecture and now allows three physical CPs from same chip to form affinity node. A z10 uses HiperDispatch book cache support and four physical CPs from same book.

To realize the benefits of HiperDispatch, z/OS has been changed to force HiperDispatch=YES for LPARs with greater than 64 CPUs. On LPARs with greater than 64 CPUs defined on a z196 server with IEAOPTxx specifying HIPERDISPATCH=NO during IPL (or SET OPT=xx after IPL), the system generates a message but continues to run with HIPERDISPATCH=YES. The new message is IRA865I HIPERDISPATCH=YES FORCED DUE TO GREATER THAN 64 LPS DEFINED.

On LPARs in which HIPERDISPATCH=NO is specified with less than 64 CPUs, you can dynamically add more CPUs and continue to run in HIPERDISPATCH=NO. However, you may see the new message ISN012E HIPERDISPATCH MUST BE ENABLED TO CONFIGURE CPU IDS GREATER THAN 3F ONLINE.

Any attempt to configure CPUs greater than 64 CPUs online in HIPERDISPATCH=NO will be rejected with message IEE241I CPU(x) NOT RECONFIGURED ONLINE - REQUIRES HIPERDISPATCH ENABLED.

An LPAR with greater than 64 CPUs that dynamically changed to HIPERDISPATCH=YES cannot go back to HIPERDISPATCH=NO. It will be treated as if it was IPLed with HIPERDISPATCH=YES after HIPERDISPATCH=YES is activated.

To assist with warning when you are getting close to 64 CPUs and running with HIPERDISPATCH=NO, the IBM Health Checker for z/OS check, SUP\_HiperDispatchCPUConfig, is added in z/OS V1R12 and available on z/OS V1R11 and z/OS V1R10 with APAR OA30476. The check always succeeds for LPAR in HIPERDISPATCH=YES (all CPU configurations supported). When an LPAR is running with HIPERDISPATCH=NO, the check raises an exception when the number of CPUs is close to forcing the LPAR to IPL with HIPERDISPATCH=YES. The CPUSLEFTB4NEEDHD parameter indicates the minimum number of CPUs that can be installed and activated on an LPAR running in HIPERDISPATCH=NO. When CPUSLEFTB4NEEDHD=0, the check always succeeds. The default is 8, with values 0-63 accepted. The system redrives the check when the HIPERDISPATCH state changes or CPUs are dynamically added.

Possible IBM Health Checker for z/OS messages:

- IEAVEH080I CPU configuration supported with HiperDispatch *curstate*
- IEAVEH081E CPU configuration supported with HiperDispatch disabled.

*numcpus* more CPU(s) can be added with HiperDispatch disabled.




## Customization / Activation for Cache and Affinity Node Changes

- **On z196, SUP\_HiperDispatchCPUConfig Health Check added**
  - Always succeeds for LPAR in HD=YES (all CPU configurations supported)
  - When LPAR in HD=NO, raises an exception when # of CPUs is “close” to forcing the LPAR to IPL with HD=YES.
    - CPUSLEFTB4NEEDHD (default 8, 0-63 accepted) parameter indicates the minimum number of CPUs that can be installed and activated on an LPAR running in HD=NO.
      - When CPUSLEFTB4NEEDHD=0, the check always succeeds.
  - System rechecks check when HD state changes or CPU(s) dynamically added
- **Healthchecker Messages:**
  - IEAVEH080I CPU configuration supported with HiperDispatch *curstate*
  - IEAVEH081E CPU configuration supported with HiperDispatch disabled. *numcpus* more CPU(s) can be added with HiperDispatch disabled.



## Customization / Activation for HiperDispatch Serviceability

- **Provides HiperDispatch knobs, SIGP data, and suspend lock data needed to debug performance problems**
  - **z/OS Version 1 Release 11**
    - System suspend lock instrumentation data collection
    - Count SIGPs contributing to LPAR overheads data collection
  - **z/OS Version 1 Release 12**
    - System latch contention instrumentation data collection
    - Data collection for RMF for WEB Queue Distribution
- **There are no actions required to enable most of the functions**
  - Data is always collected
  - RMF can be configured to report some of the data



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## Customization / Activation for Crypto Exploitation

- **Crypto Exploitation (software installation)**
  - **New ICSF web deliverable required for support**
    - Cryptographic Support for z/OS V1R10-V1R12 Web deliverable (HCR7780)
      - Became availability September 1, 2010
      - **NOT** integrated in ServerPac (even for z/OS V1.12)
      - Only required to exploit z196 function
      - To exploit secure keyed HMAC – CKDS must be a variable length VSAM data set
        - » All images sharing this CKDS must be at HCR7780
      - ICSF pubs will be updated with HCR7780 function
        - » Available online: <http://www.ibm.com/systems/z/os/zos/bkserv>
    - z/OS PTFs needed for some z10 GA3 and z196 functions
    - New ICSF toleration PTFs needed when sharing keys in a sysplex
      - ECC Master Key (in PKDS)
      - CBC Key Wrap Support (in CKDS)
      - New SMP/E Fix Category will be created for ICSF coexistence
        - IBM.Coexistence.ICSF.z/OS\_V1R10-V1R12-HCR7780
    - TKE 7.0 is required for X9.8 Pin processing to enable access control points
    - For z/OS V1.7 customers, Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7 web deliverable is still downloadable from the z/OS download page

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### CP Assist for Cryptographic Function (CPACF) enhancements:

The following are exploitation of Message-Security-Assist Extension 4:

New instructions:

1. Cipher Message with CFB (KMF)
2. Cipher Message with Counter (KMCTR)
3. Cipher Message with OFB (KMO)

New function codes for existing instructions:

- Compute intermediate Message Digest (KIMD) adds KIMD, an extension for GHASH

More information on CPACF can be found in "IBM System z10 - Delivering security rich offerings to protect your data", Hardware Announcement 109-678, (RFA51029) dated October 20, 2009.

### Crypto Express3 enhancements

Crypto Express3 represents the newest-generation cryptographic feature designed to complement the cryptographic functions of CP Assist for Cryptographic Function (CPACF). The Crypto Express3 feature, residing in the I/O cage or I/O drawer of the z196, continues to support all of the cryptographic functions available on Crypto Express3 on z10.

For more information on Crypto Express3 refer to "IBM System z10 – Delivering security-rich offerings to protect your data" Hardware Announcement 109-678, (RFA51029) dated October 20, 2009.

When one or both of the two PCIe adapters of a Crypto Express3 feature are configured as a coprocessor, the following cryptographic enhancements are supported:

- **ANSI X9.8 PIN security**, which facilitates compliance with the processing requirements defined in the new version of the ANSI X9.8 and ISO 9564 PIN Security Standards and provides added security for transactions that require Personal Identification Numbers (PINs). This Crypto function is exclusive to z196 and is supported by z/OS and z/VM.
- **Enhanced Common Cryptographic Architecture (CCA) - a key wrapping to comply with ANSI X9.24-1 key bundling requirements**, a Common Cryptographic Architecture (CCA) key token wrapping method using Cipher Block Chaining (CBC) mode in combination with other techniques to satisfy the key bundle compliance requirements in standards including ANSI X9.24-1 and the recently published Payment Card Industry Hardware Security Module (PCI HSM) standard. This Crypto function is exclusive to z196 and is supported by z/OS and z/VM.

## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

- **Secure Keyed-Hash Message Authentication Code (HMAC)** - a method for computing a message authentication code using a secret key and a secure hash function. HMAC is defined in the standard FIPS (Federal Information Processing Standard) 198, "The Keyed-Hash Message Authentication Code ". The new CCA functions support HMAC using SHA-1, SHA-224, SHA-256, SHA-384, and SHA-512 hash algorithms. The HMAC keys are variable-length and are securely encrypted so that their values are protected. This Crypto function is exclusive to z196 and is supported by z/OS and z/VM. For z/OS support is to be made available with the Cryptographic Support for z/OS V1.10 through z/OS V1.12 Web deliverable with the additional PTF for APAR OA33260 which was made available February 2011.
- **Elliptical Curve Cryptography Digital Signature Algorithm** - an emerging public-key algorithm to eventually replace RSA cryptography in many applications. ECC is capable of providing digital signature functions and key agreement functions. The new CCA functions provide ECC key generation and key management and provide digital signature generation and verification functions compliance with the ECDSA method described in ANSI X9.62 "Public Key Cryptography for the Financial Services Industry: The Elliptical Curve Digital Signature Algorithm (ECDSA)". ECC uses keys that are shorter than RSA keys for equivalent strength-per-key-bit. With RSA impractical at key lengths with strength-per-key-bit equivalent to AES-192 and AES-256, the strength-per-key-bit is substantially greater in an algorithm that uses elliptic curves. This Crypto function is exclusive to z196 and is supported by z/OS and z/VM.

When one or both of the two PCIe adapters of a Crypto Express3 feature are configured as an accelerator, the following cryptographic enhancement is supported:

- **Modulus Exponent (ME) and Chinese Remainder Theorem (CRT)**, RSA encryption and decryption with key lengths greater than 2048-bits and up to 4096-bits. This Crypto function is exclusive to z196 and is supported by z/OS and z/VM.

### Trusted Key Entry 7.0 Licensed Internal Code (LIC)

- **ECC Master Key Support:** From the Trusted Key Entry (TKE) workstation, administrators can generate key material, load or clear the new ECC master key register, or clear the old ECC master key register. The ECC key material can be stored on the TKE or on a smart card.
- **CBC Default Settings Support:** The TKE provides function that allows the TKE user to set the default key wrapping method used by the host crypto module.
- **TKE Audit Record Upload Configuration Utility Support:** The TKE Audit Record Upload Configuration Utility allows TKE workstation audit records to be sent to a System z host and saved on the host as z/OS System Management Facilities (SMF) records. The SMF records have a record type of 82 (ICSF) and a subtype of 29. TKE workstation audit records are sent to the same TKE Host Transaction Program that is used for Trusted Key Entry operations.
- **USB Flash Memory Drive Support:** The TKE workstation now supports a USB flash memory drive as a removable media device. When a TKE application displays media choices, the application allows you to choose a USB flash memory drive if the IBM-supported drive is plugged into a USB port on the TKE and it has been formatted for the specified operation.
- **Stronger PIN Strength Support:** TKE smart cards created on TKE 7.0 require a 6-digit PIN rather than a 4-digit PIN. TKE smart cards that were created prior to TKE 7.0 continue to use 4-digit PINs and will work on TKE 7.0 without changes. You can take advantage of the stronger PIN strength by initializing new TKE smart cards and copying the data from the old TKE smart cards to the new TKE smart cards.
- **Stronger Password Requirements for TKE Passphrase User Profile Support:** New rules are required for the passphrase used for passphrase logon to the TKE workstation crypto adapter. The passphrase must:
  - Be 8 to 64 characters long
  - Contain at least 2 numeric and 2 non-numeric characters
  - Not contain the user ID

These rules are enforced when you define a new user profile for passphrase logon, or when you change the passphrase for an existing profile. Your current passphrases will continue to work.



## z196 Crypto Express3 – UDX

### ▪ UDX (User Defined eXtension)

- Extends the functionality of IBM's CCA (Common Cryptographic Architecture) application program
  - Customized cryptographic verb controls per customer
- UDX interfaces using HW control blocks and ICSF CB, therefore if hw platform changes or ICSF level changes or both, then UDX must updated for the new control blocks
  - If a customer has UDX, they would already know this



## Customization / Activation for I/O Exploitation

### ■ Three Subchannel Sets

- Extension of Alternate Subchannel Set supports introduced in z/OS 1.7 and 1.10
- Same restrictions and considerations
  - PPRC-pair secondaries must either all be in subchannel set 1 or all be in subchannel set 2.
    - o Reminder: A PPRC-pair are where the primary is in one subchannel set and the secondary is in another subchannel set with the same device number
  - Aliases can appear in the same subchannel set as the PPRC-pair secondary devices.
  - Aliases can appear in all subchannel sets (0, 1, and 2).
  - Only PAV-alias (3390A), PPRC Secondary (3390D) or SAN back-up (3390S) devices
  - After a HyperSwap, Special PPRC pair of 3390B and 3390D must be added, deleted or changed together during a Dynamic Activate
  - A primary PPRC device found in a different subchannel set than the one being used for system IPL will be box'ed (\* no longer box'ing with APAR OA31443 \*)
- IODF statement of LOADxx
  - Allows the installation to select the subchannel set from which to bring primary PPRC devices online
    - o SCHSET parameter now allows values '0', '1' or '2'
    - o Can also be specified via operator prompt during IPL

### Third subchannel set

You now have the ability to extend the amount of addressable storage capacity to help facilitate storage growth with the introduction of a third subchannel set - an additional 64K subchannels - to help complement other functions such as "large" or extended addressing volumes and HyperPAV. This may also help to facilitate consistent device address definitions, simplifying addressing schemes for congruous devices.

The first subchannel set (SS0) allows definitions of any type of device (such as bases, aliases, secondaries, and those other than disk that do not implement the concept of associated aliases or secondaries). The second and third subchannel sets (SS1 and SS2) can now both be designated for use for disk alias devices (of both primary and secondary devices) and/or Metro Mirror secondary devices only.

The third subchannel set applies ESCON, FICON and zHPF protocols, and is supported by z/OS and Linux on System z.

Definitions for the third subchannel set are similar to those for the second subchannel set and can be made with HCD.

The IODF statement of LOADxx allows the installation to select the subchannel set from which to bring primary PPRC devices online. The SCHSET parameter now allows values **0**, **1**, or **2**. It can also be specified through an operator prompt during IPL.





## Customization / Activation for I/O Exploitation

- **z/OS FICON Discovery and AutoConfiguration (zDAC)**
  - zDAC is invoked through HCD and HCM
  - Provides automatic discovery for FICON DASD and TAPE control units
  - Reduces level of IT skill and time required to configure new I/O devices
  - Ensures system (host) and control unit definitions are compatible with each other
- **zDAC can**
  - Display a list of discovered FICON DASD and TAPE controllers
    - Indicates whether the controller is new (ie., no existing devices/control units defined on the controller in the target IODF)
  - Discover new devices for existing logical control units on a controller
  - Discover new devices and new logical control units on a controller, and propose new paths for each new logical control unit found
    - New devices and control units are displayed for either inclusion or exclusion in the target IODF
- **Through HCD or HCM, the user establishes a policy for the discovery operation**
  - Can limit the scope of the discovery
  - Can limit the proposal information
  - Can indicate the desired number of paths to discovered logical control units
  - Can indicate the method used for device and control unit numbering

### **z/OS Discovery and AutoConfiguration (zDAC) for FICON Channels:**


A new IBM System z Discovery and AutoConfiguration (zDAC) function, available with z/OS V1.12 on IBM zEnterprise 196 server, can help simplify the configuration for new and changed disk and tape I/O configuration changes. zDAC can save time by discovering new and changed fabric-attached devices, and suggesting configurations aligned with best practices for availability and with the I/O policies that you set. For example, with zDAC, adding new controllers to an existing I/O configuration can take as little as a few minutes. When new controllers are added to an I/O configuration or changes are made to existing controllers, the system is designed to discover them and propose configuration changes based on a policy you define in the hardware configuration dialog (HCD). Your policy can include preferences for availability and bandwidth including parallel access volume (PAV) definitions, control unit numbers, and device number ranges.

zDAC is designed to perform discovery for a single system or for all the systems in a sysplex that support the function and does not alter your existing configuration until you have accepted or modified the proposed changes. zDAC proposes configurations that incorporate not only the current contents of your work I/O definition file (IODF) with additions for new and changed controllers and devices, but also IBM best practices for I/O high availability. zDAC is designed to help simplify I/O configuration on z196 running z/OS and reduce complexity and setup time.

zDAC applies to all FICON features supported on z196 when configured as CHPID type FC and is supported by z/OS. zDAC is exploited by the IBM System Storage DS8700 which is designed to improve discovery performance. zDAC is supported by all FICON-attached IBM System Storage tape and disk control units.

To use zDAC, you must first establish a policy for the discovery operation. This is done through HCD or HCM. You can limit the scope of the discovery, limit the proposal information, indicate the desired number of paths to discovered logical control units, and indicate the method used for device and control unit numbering. After controllers and devices are discovered, you can select which controllers to be defined and accept or override the proposed values for control units and devices.




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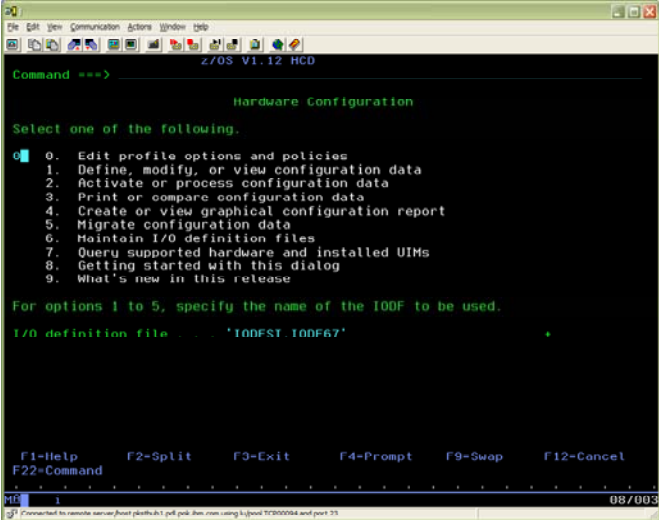
## Customization / Activation for I/O Exploitation

- **z/OS FICON Discovery and AutoConfiguration (zDAC)**
  - zDAC is defined using the HCD Panels.
  - In order to run zDAC, each TSO userid has to have a HCD Profile set up.
  - The HCD profile is accessed HCD Profile Options and Policies (Option 0)
    - The Autoconfiguration Policy is Option 0,2 (next chart)
    - To add or edit Autoconfiguration Logical Partition Groups is Option 0,3
      - The LPARs specified in the LP Group can span z196 CECs
      - **All members of the group must be running z/OS V1.12 or else the function will not work.**
    - To add or edit Autoconfiguration Operating System Groups is Option 0,4
      - Multiple OS's can be targeted for zDAC discovery.

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## z/OS Discovery and AutoConfiguration Policy



```
Command ===>

Hardware Configuration

Select one of the following.

0. Edit profile options and policies
1. Define, modify, or view configuration data
2. Activate or process configuration data
3. Print or compare configuration data
4. Create or view graphical configuration report
5. Migrate configuration data
6. Maintain I/O definition files
7. Query supported hardware and installed UIMs
8. Getting started with this dialog
9. What's new in this release

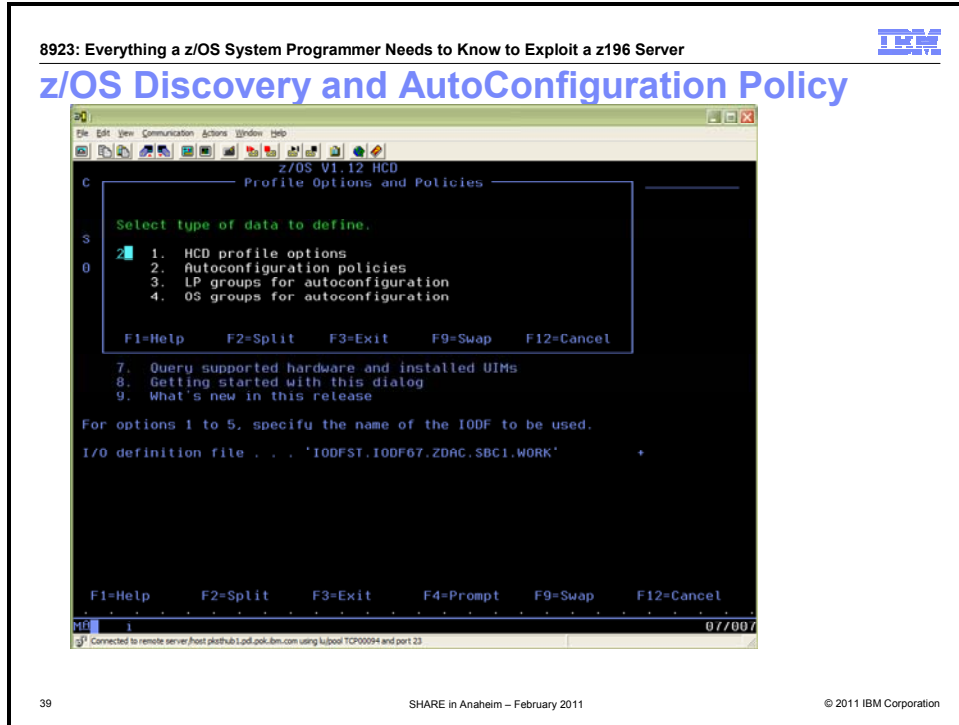
For options 1 to 5, specify the name of the IOF to be used.

I/O definition file      'IOFST IOF67'

F1=Help      F2=Split      F3=Exit      F4=Prompt      F9=Swap      F12=Cancel
F22=Command

MS 1 08/003
[Connected to remote server /host/plateau31.pdl.pdl.ibm.com using /j/ibm/TC3000064 and port 33]
```

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|   |   |
|---|---|
| <p>Specifies whether for autoconfiguration definitions a control unit number should match the base device number.</p> <ul style="list-style-type: none"> <li>• If you specify Yes (which is the default), the first base device is set to the same number as the control unit.</li> <li>• If No is specified, the device number of the first base device and the control unit number do not necessarily need to match.</li> </ul> | <p>Specifies the ID of the subchannel set in which newly discovered alias devices will be defined.</p> <p>Defines the schema for assigning device numbers to PAV alias devices in an alternate subchannel set. Supported schemas are:</p> <ul style="list-style-type: none"> <li>• CONSECUTIVE - The alias device numbers in an alternate subchannel set are consecutive to the base device numbers.</li> </ul> <p>Specifies the range of control unit numbers from which numbers for auto-defined control units will be taken. If no value is specified, range 0001-FFFE is taken as default. FFFE is the highest</p>  |
| <p>Specifies the number of static channel paths to be assigned to a control unit definition, if it is auto-defined. At least one and not more than 8 static channel paths should be defined. The default is 2.</p>  | <p>Specifies the range of device numbers from which device numbers for auto-defined devices will be taken. If no value is specified, range 0001-FFFF</p> <p>Specifies the number of dynamically managed channel paths allowed on a control unit definition, if it is auto-defined. A maximum number of 7 channel paths is allowed. The default is 6.</p> <p>Specifies the the name of a group of logical</p> <p>Specifies the name of a group of OS configurations to which auto-defined devices will be assigned. If no name is set, devices will be assigned to all OS configurations which correspond to the active LP group.</p> <p>When pressing F4=Prompt a selection of all OS configuration groups defined in the currently accessed IODF is displayed.</p> |

HCD Profile :

| Policy keyword        | Value   |
|-----------------------|---------|
| AUTO_MATCH_CU_DEVNUM  | YES     |
| AUTO_SS_ALTERNATE     | 1       |
| AUTO_SS_DEVNUM_SCHEME | PAIRING |
| AUTO_SUG_CU_RANGE     | 0001-FF |
| AUTO_SUG_DEV_RANGE    | 0001    |
| AUTO_SUG_DYN_CHPIIDS  | 6       |
| AUTO_SUG_LPGROUP      |         |
| AUTO_SUG_OSGROUP      |         |
| AUTO_SUG_STAT_CHPIIDS |         |

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**AUTO\_MATCH\_CU\_DEVNUM** - Specifies whether for autoconfiguration definitions a control unit number should match the base device number.

- If you specify Yes (which is the default), the first base device is set to the same number as the control unit.
- If No is specified, the device number of the first base device and the control unit number do not necessarily need to match.

## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

**AUTO\_SS\_ALTERNATE** - Specifies the ID of the subchannel set in which newly discovered alias devices will be defined during an auto-definition process, provided that free device numbers are available in this subchannel set, and processors that have access to the device range, support alternate subchannels. The default subchannel set ID is 1.

**AUTO\_SS\_DEVNUM\_SCHEME** - Defines the schema for assigning device numbers to PAV alias devices in an alternate subchannel set. Supported schemas are:

- **CONSECUTIVE** - The alias device numbers in an alternate subchannel set are consecutive to the base device numbers.
- **DENSE** - The device numbers in an alternate subchannel set are densely assigned, that is the next free device numbers in the assigned device number range will be used.
- **PAIRING** - Base and alias device numbers are assigned alternatively starting with for example device numbers xx00 and xx80 versus xx80 and xx00. **PAIRING** is the default.

**AUTO\_SUG\_CU\_RANGE** - Specifies the range of device numbers from which device numbers for auto-defined devices will be taken. If no value is specified, range 0001-FFFF is taken as default.


**AUTO\_SUG\_DEV\_RANGE** - Specifies the range of control unit numbers from which numbers for auto-defined control units will be taken. If no value is specified, range 0001-FFFE is taken as default. FFFE is the highest supported control unit number. Specify the range according to the following syntax: nnnn-mmmm where nnnn is the lower range boundary, and mmmm is the upper range boundary.

**AUTO\_SUG\_DYN\_CHPID** - Specifies the number of dynamically managed channel paths allowed on a control unit definition, if it is auto-defined. A maximum number of 7 channel paths is allowed. The default is 6.

**AUTO\_SUG\_LPGROUP** - Specifies the name of a group of logical partitions to which auto-defined devices will be assigned. If no name is set, devices will be assigned to all partitions of the active sysplex. Reserved group name ALL signals this during autoconfiguration processing. When pressing F4=Prompt a selection of all logical partition groups defined in the currently accessed IODF is displayed.

**AUTO\_SUG\_OSGROUP** - Specifies the name of a group of OS configurations to which auto-defined devices will be assigned. If no name is set, devices will be assigned to all OS configurations which correspond to the active LP group. When pressing F4=Prompt a selection of all OS configuration groups defined in the currently accessed IODF is displayed.

**AUTO\_SUG\_STAT\_CHPID** - Specifies the number of static channel paths to be assigned to a control unit definition, if it is auto-defined. At least one and not more than 8 static channel paths should be defined. The default is 2.

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## zDAC – HCD Add AutoConfiguration LP Group

```
Autoconfiguration LP Group List
C
C      Add Autoconfiguration LP Group
T
S      Specify name and description for new LP group.
t
O      / LP group name . . . . .
*      * Description . . . . .

      F1=Help   F2=Split   F3=Exit   F5=Reset   F9=Swap
      F12=Cancel

F
I      F1=Help   F2=Split   F3=Exit   F4=Prompt
      F7=Backward F8=Forward  F9=Swap   F11=Add
      F12=Cancel
```

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## zDAC – HCD Add AutoConfiguration OS Group

```
Autoconfiguration OS Group List
C
C      Add Autoconfiguration OS Group
T
S      Specify name and description for new OS group.
t
O      / OS group name . . . . .
*      * Description . . . . .

      F1=Help   F2=Split   F3=Exit   F5=Reset   F9=Swap
      F12=Cancel

F
I      F1=Help   F2=Split   F3=Exit   F4=Prompt
      F7=Backward F8=Forward  F9=Swap   F11=Add
      F12=Cancel
```

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## Customization / Activation for I/O Exploitation

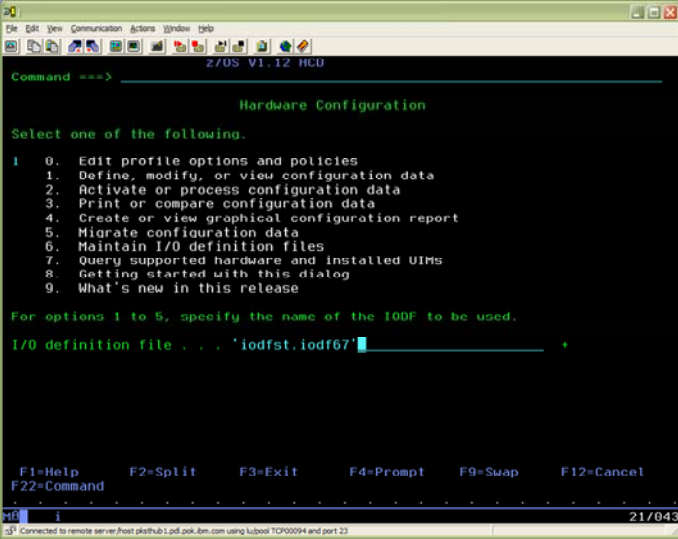
### zDAC

- zDAC discovery process is invoked via HCD panel Options 1,6.
- There are two phases of zDAC discovery:
  1. Fabric Discovery Phase
    - ▶ This phase interrogates the switches (MdData, Brocade and CISCO) and discovers all of the TAPE and DASD Nodes that are logged in to the fabric.
    - ▶ Once this step is executed, a list of nodes is presented for the next phase of discovery.
  2. Controller Discovery Phase
    - ▶ This phase interrogates the Node, Tape or DASD, when selected for discovery. It determines CU and Device numbering based on the CU configuration, and the paths to be used for access.
    - ▶ A proposal will be presented and when accepted, the IODF workfile will contain the entries for the newly discovered node(s).
- Nodes that are discovered during the Fabric Discovery Phase are characterized as either NEW=YES or NEW=NO.
  - NEW=YES means that none of the devices on that Node have been defined in the IODF used for Discovery.
  - NEW=NO means that one or more devices on that Node are currently defined in the IODF used for discovery.

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## z/OS Discovery and AutoConfiguration Request

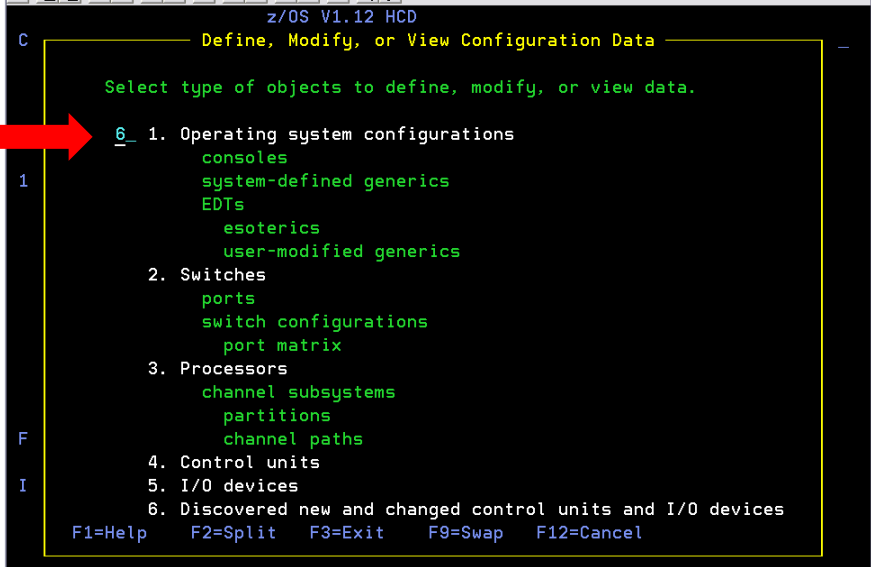


The screenshot shows a terminal window titled 'z/OS V1.12 HCD'. The main display area shows the 'Hardware Configuration' dialog box. It prompts the user to 'Select one of the following' and lists nine options: 0. Edit profile options and policies, 1. Define, modify, or view configuration data, 2. Activate or process configuration data, 3. Print or compare configuration data, 4. Create or view graphical configuration report, 5. Migrate configuration data, 6. Maintain I/O definition files, 7. Query supported hardware and installed UIMS, 8. Getting started with this dialog, and 9. What's new in this release. Below the list, it asks for the IODF name for options 1 to 5, with 'iodfst.iodf67' entered. At the bottom, function key shortcuts are listed: F1=Help, F2=Split, F3=Exit, F4=Prompt, F9=Swap, F12=Cancel, and F22=Command. A status bar at the bottom indicates '21/043' and a connection message.

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## zDAC – Discovery Process




```
z/OS V1.12 HCD
Define, Modify, or View Configuration Data

Select type of objects to define, modify, or view data.

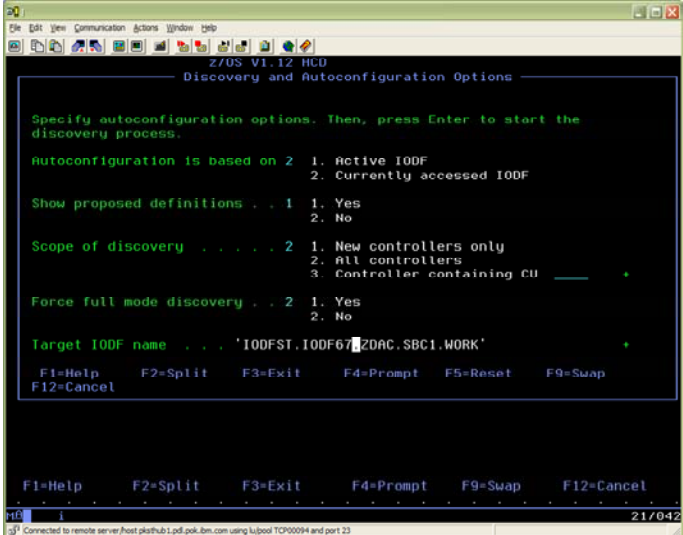
6_ 1. Operating system configurations
   consoles
   system-defined generics
   EDTs
   esoterics
   user-modified generics
2. Switches
   ports
   switch configurations
   port matrix
3. Processors
   channel subsystems
   partitions
   channel paths
4. Control units
5. I/O devices
6. Discovered new and changed control units and I/O devices

F1=Help  F2=Split  F3=Exit  F9=Swap  F12=Cancel
```

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## z/OS Discovery and AutoConfiguration Request



```
z/OS V1.12 HCD
Discovery and Autoconfiguration Options

Specify autoconfiguration options. Then, press Enter to start the
discovery process.

Autoconfiguration is based on 2 1. Active IODF
                               2. Currently accessed IODF

Show proposed definitions . . . 1 1. Yes
                               2. No

Scope of discovery . . . . . 2 1. New controllers only
                               2. All controllers
                               3. Controller containing CU _____ +

Force full mode discovery . . . 2 1. Yes
                               2. No


Target IODF name . . . 'IODFST,IODF67,2DAC,SBC1,WORK' _____ +

F1=Help  F2=Split  F3=Exit  F4=Prompt  F5=Reset  F9=Swap
F12=Cancel

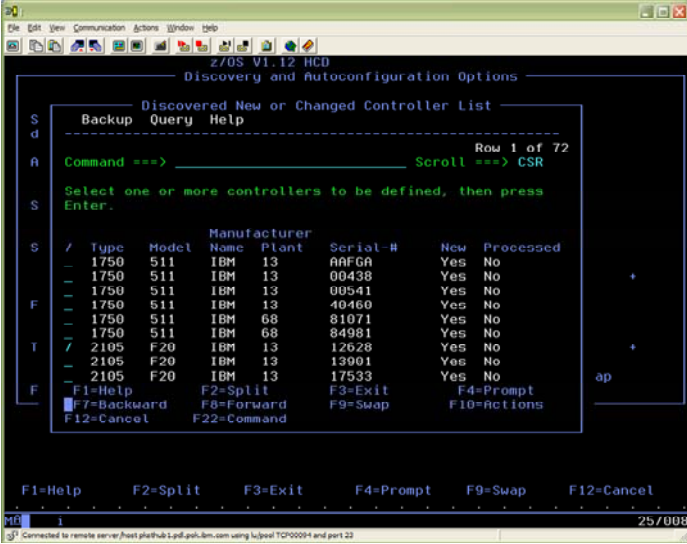
F1=Help  F2=Split  F3=Exit  F4=Prompt  F9=Swap  F12=Cancel

21/042
Connected to remote server host plathub1.pdf.pok.ibm.com using luqool TCP00094 and port 23
```

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## z/OS Discovery and AutoConfiguration

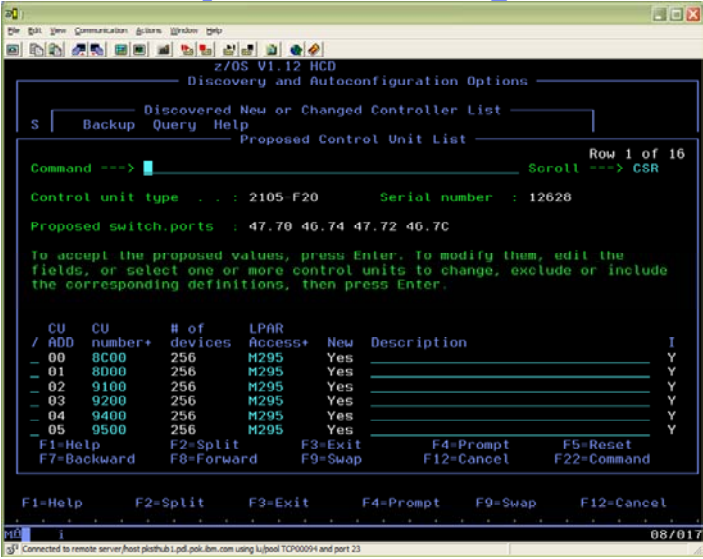


The screenshot shows the 'Discovery and Autoconfiguration Options' screen in z/OS V1.12 HCD. It displays a 'Discovered New or Changed Controller List' with columns for Type, Model, Name, Plant, Serial-#, New, and Processed. The list includes several IBM controllers (Type 1750, 2105) with various serial numbers and plant codes. The screen also shows a command prompt and various function key options (F1-F12).

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## z/OS Discovery and AutoConfiguration



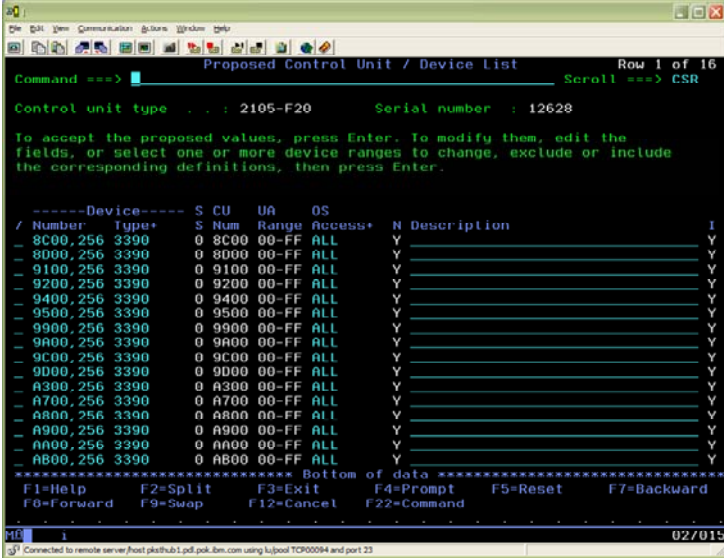
The screenshot shows the 'Discovery and Autoconfiguration Options' screen in z/OS V1.12 HCD, displaying a 'Proposed Control Unit List'. It shows control unit details such as type (2105 F20), serial number (12628), and proposed switch ports (47.70, 46.74, 47.72, 46.7C). Below this, there is a table of control units with columns for CU number, # of devices, LPAR, Access, New, and Description. The screen also shows a command prompt and various function key options (F1-F12).

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## z/OS Discovery and AutoConfiguration




```

Command ==>
Proposed Control Unit / Device List          Row 1 of 16
                                           Scroll ==> CSR
Control unit type      : 2105-F20          Serial number : 12628

To accept the proposed values, press Enter. To modify them, edit the
fields, or select one or more device ranges to change, exclude or include
the corresponding definitions, then press Enter.

-----Device----- S CU  UA  OS
/ Number  Type+  S Num Range Access+  N Description  I
- 8C00,256 3390  0 8C00 00-FF ALL  Y _____  Y
- 8000,256 3390  0 8000 00-FF ALL  Y _____  Y
- 9100,256 3390  0 9100 00-FF ALL  Y _____  Y
- 9200,256 3390  0 9200 00-FF ALL  Y _____  Y
- 9400,256 3390  0 9400 00-FF ALL  Y _____  Y
- 9500,256 3390  0 9500 00-FF ALL  Y _____  Y
- 9900,256 3390  0 9900 00-FF ALL  Y _____  Y
- 9A00,256 3390  0 9A00 00-FF ALL  Y _____  Y
- 9C00,256 3390  0 9C00 00-FF ALL  Y _____  Y
- 9D00,256 3390  0 9D00 00-FF ALL  Y _____  Y
- A300,256 3390  0 A300 00-FF ALL  Y _____  Y
- A700,256 3390  0 A700 00-FF ALL  Y _____  Y
- A800,256 3390  0 A800 00-FF ALL  Y _____  Y
- A900,256 3390  0 A900 00-FF ALL  Y _____  Y
- AA00,256 3390  0 AA00 00-FF ALL  Y _____  Y
- AB00,256 3390  0 AB00 00-FF ALL  Y _____  Y
***** Bottom of data *****
F1=Help      F2=Split    F3=Exit     F4=Prompt   F5=Reset    F7=Backward
F8=Forward   F9=Swap     F12=Cancel  F22=Command
  
```


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## z/OS Discovery and AutoConfiguration



- **Hardware Dependencies**
  - zDAC uses new capabilities in the z196 processor for fabric discovery
  - Explores FICON channels attached to switches
    - FICON Express8 or FICON Express4 (CHPID type: FC)
  - Dynamic I/O Enabled Partitions
  - Up to date controller microcode designed to improve discovery performance
    - Tested with IBM 2107 Controller level R12p.9b090910b - Bundle 64.30.87.0
  - Controller that registers with the fabric name server
    - All IBM FICON-attached tape and disk supported
  - Up to date switch microcode (see notes)
    - Tested with:
      - o Brocade Firmware Version: V6.2.0e
      - o McData Firmware Version : 09.09.00
- **Software Dependencies**
  - All target systems must be at z/OS R1.12 or higher
    - Mixed level SYSPLEXes are allowed, but only R1.12 can participate in discovery processing
  - Suggested use of Dynamic Channel path Management (DCM) for performance

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## z196 OSA-Express3 Channel Types

- Two new OSA-Express3 CHPID types to support new types of z196 networks
- A z196 System can have up to 6 types of OSA-Express3 CHPID's
  - External (customer managed) networks
    - Defined as OSC, OSD, OSE, & OSN
    - Existing customer provided and managed OSA ports used for access to the current customer external networks - no changes
  -  – Intranode management network (INMN)
    - Defined as CHPID type OSM, OSA-Express for Unified Resource Manager
      - When the PCIe adaptor on 1000BASE-T is defined as CHPID type OSM, the second port cannot be used for anything else
    - OSA-Express3 1000BASE-T configured as CHPID type OSM for connectivity to INMN from z196 to Unified Resource Manager functions
    - OSA connection via the Bulk Power Hub (BPH) on the z196 to the Top of the Rack (TORs) switches on zBX
  -  – Intraensemble data networks (IEDN)
    - Defined as CHPID OSX, OSA-Express for zBX
    - OSA-Express3 10 GbE configured as CHPID type OSX for connectivity and access control to IEDN from z196 to zBX
- **Functions Supported:**
  - Dynamic I/O support
  - HCD
  - CP Query capabilities
  - Ensemble Management for these new channel paths and their related subchannels.

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## New OSA-Express3 Channel Types

The new zEnterprise System unifies the zEnterprise 196 server and the zEnterprise BladeCenter Extension, through the use of two new "internal" networks. Configured through OSA-Express3 adapters, the intranode management network (INMN) is used to provide system management functions and the intraensemble data network (IEDN) can be used to send data between the systems.

- The intranode management network (INMN) is a private and physically isolated OSA-Express3 1000BASE-T Ethernet internal management network operating at 1 Gbps, that connects all zEnterprise System resources (CPCs, Blade Centers, blades, top-of-rack switches, power distribution units, and hypervisors) for management purposes. This INMN is pre-wired, internally switched, configured, and managed with full redundancy for high availability. These characteristics of the INMN enable simplified and secure management with no effect on your application data traffic. The INMN is exclusive to zEnterprise System, and is configured with a CHPID type of OSM.
- Intraensemble data network (IEDN) is a private OSA-Express3 10 Gigabit Ethernet that connects all elements of a zEnterprise System ensemble. The IEDN is access-controlled using integrated virtual local area network (VLAN) provisioning. This requires no external customer-managed switches or routers, which helps to reduce the need for firewalls and encryption, and simplifies network configuration and management, while providing full redundancy for high availability. IEDN management provides enforcement of strict access control across heterogeneous environments, further augmenting security and simplicity. The intraensemble data network is exclusive to zEnterprise System, and is configured with a CHPID type of OSX.

## IBM zEnterprise Unified Resource Manager

IBM zEnterprise 196 provides a smarter business infrastructure through the introduction of the IBM zEnterprise Unified Resource Manager, which manages **System z ensembles** - collections of one or more zEnterprise System nodes in which each node is comprised of a z196 and its optionally attached IBM zEnterprise BladeCenter Extension (zBX) model 002. An ensemble can consist of a single z196 with no zBX attached, using an OSA loopback cable, or two to eight CPCs where at least one of the z196s has a zBX attached. The resources of a zEnterprise System ensemble are managed and virtualized as a single pool of resources integrating system and workload management across the multisystem, multitier, multiarchitecture environment. Management actions for the ensemble are conducted from a designated primary Hardware Management Console. This HMC must be paired with an alternate HMC also designated to manage the ensemble, that can take over if the primary fails, in order to improve availability. The functions of the Unified

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

Resource Manager are grouped into two suites of tiered functionality that enable different levels of capability - **Manage suite** and **Automate suite**.


The Unified Resource Manager is designed to provide the following **initial Manage suite functions**:

- Monitoring and trend reporting of CPU energy efficiency, which can be helpful in managing the costs of deployed workloads
- Delivery of system activity using a new user interface monitors dashboard (augmenting the existing System Activity Display), enabling a broader and more granular view of system resource consumption

The Unified Resource Manager is designed to provide the following **enhanced Manage suite functions**:

- Integrated hardware management, including operational controls, which provides a single point of control, a consistent interface, and comprehensive insight across the elements of the system to better manage operations, change control, and service
- Enhanced Monitoring and reporting of CPU energy efficiency with the ability to query maximum potential power
- Fully automatic and coherent integrated resource discovery and inventory for all elements of the system without requiring user configuration, deployment of discovery libraries or sensors, or user scheduling of resource discovery. These integrated functions enable a simplified deployment methodology, decreasing complexity, and increasing accuracy and completeness for discovery and inventory.


Ensemble membership requires that the z196 have two OSA-Express3 1000BASE-T features defined as CHPID type OSM for connectivity to the intranode management network (INMN). Communication across the INMN is exclusively for the purpose of enabling the Unified Resource Manager of the Hardware Management Console (HMC) to perform its various management disciplines (such as performance management, network virtualization management, energy management, etc.).

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|--|--|---|
| <b>z196 OSA-Express3 CHPID Types</b>   |  |   |
| CHPID type   | Purpose / Traffic  | Operating Systems                               |
| <b>OSD</b><br>All OSA features<br>z196, z10, z9, zSeries   | Supports Queue Direct Input/Output (QDIO) architecture<br>TCP/IP traffic when Layer 3 (uses IP address)<br>Protocol-independent when Layer 2 (uses MAC address)  | z/OS, z/VM<br>z/VSE, z/TPF<br>Linux on System z |
| <b>OSE</b><br>1000BASE-T<br>z196, z10, z9, zSeries   | Non-QDIO; for SNA/APPN/HPR traffic<br>and TCP/IP "passthru" traffic  | z/OS, z/VM<br>z/VSE                             |
| <b>OSC</b><br>1000BASE-T<br>z196, z10, z9, z990,<br>z890   | OSA-Integrated Console Controller (OSA-ICC)<br>Supports TN3270E, non-SNA DFT to IPL CPCs & LPs   | z/OS, z/VM<br>z/VSE                             |
| <b>OSM</b><br>1000BASE-T<br>z196 exclusive   | OSA-Express for Unified Resource Manager<br>Connectivity to intranode management network (INMN)<br>from z196 to Unified Resource Manager functions   | z/OS, z/VM<br>Linux on System z*                |
| <b>OSN</b><br>GbE, 1000BASE-T<br>z196, z10, z9<br>exclusive  | OSA-Express for NCP<br>Appears to OS as a device supporting CDLC protocol<br>Enables Network Control Program (NCP) channel-related functions<br>Provides LP-to-LP connectivity<br>OS to IBM Communication Controller for Linux (CCL) | z/OS, z/VM<br>z/VSE, z/TPF<br>Linux on System z |
| <b>OSX</b><br>10 GbE<br>z196 exclusive   | OSA-Express for zBX<br>Connectivity and access control to intraensemble data network<br>(IEDN) from z196 to zBX  | z/OS, z/VM<br>Linux on System z*                |

\*IBM is working with its Linux distribution partners to include support in future Linux on System z distribution releases.

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## z196 Ensemble 'Network' Configuration

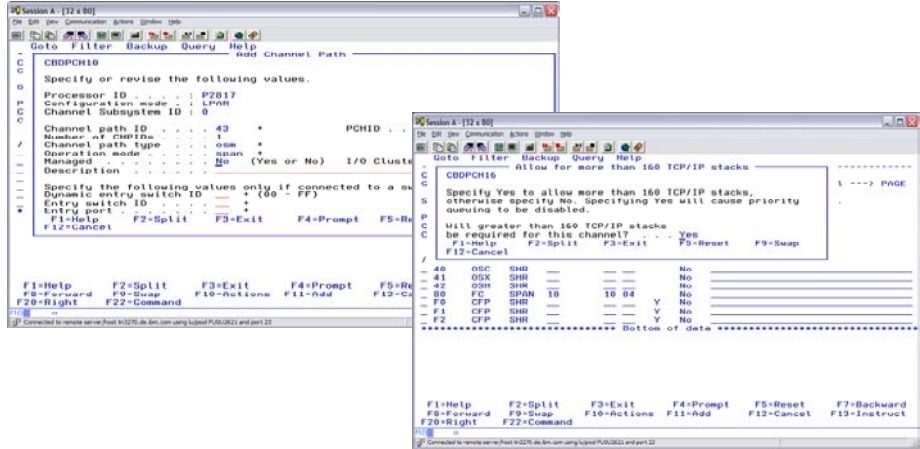
- **Each Ensemble requires**
  - Customer managed Management Network
    - A pair of (Primary & Alternate/Backup) HMCs for the Unified Resource Manager.
    - To control and manage the Ensemble.
    - Only one pair of Unified Resource Manager HMCs per Ensemble.
    - For high availability, one is a mirrored backup, and cannot be used as a Unified Resource Manager HMC, until fail-over
    - Both are attached to the Customer Managed Management Network.
- **Depending on the System z applications, each ensemble might require: (these are required if there is a zBX present)**
  - Intranode management network
    - Used for internal node hardware management. It is provided and managed by IBM
    - Connects the CPC's BHPs to the management port of the customer procured switch or the TOR switches in the zBX
  - Intraensemble data network
    - A pair of OSA-Express-3 10 GbE adapters, for redundancy.
    - To allow the System z applications to communicate between OS images to share data
    - To allow the System z application to communicate to the zBX
    - Ensemble zBX to zBX communications.
  - Customer managed data network
    - A pair of 10 Gb connections
    - Must provide the MAC address for each device
- **External customer networks (example OSC, OSD, OSE, and OSN connections) are outside the ensemble, and not included**

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## Usage & Invocation (HCD)



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## Additional OSA-Express3 Support for z196

- **OSA-Express3**
  - New display command – D OSAINFO
    - Similar to OSA/SF
  - Used to monitor and verify current OSA configuration
  - Exclusive to CHPID types OSD, OSM and OSX
- **OSA-Express3 Inbound Workload Queuing (IWQ)**
  - Communication Server configuration is required to enable Multiple Inbound Data Queues

Also available on z10

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### **For Network Performance- Inbound Workload Queuing:**

OSA-Express3 introduces inbound workload queuing (IWQ), which creates multiple input queues and allows OSA to differentiate workloads "off the wire" and then assign work to a specific input queue (per device) to z/OS. With each input queue representing a unique type of workload, each having unique service and processing requirements, the IWQ function allows z/OS to preassign the appropriate processing resources for each input queue. This approach allows multiple concurrent z/OS processing threads to then process each unique input queue (workload), avoiding traditional resource contention. In a heavily mixed workload environment, this "off the wire" network traffic separation provided by OSA-Express3 IWQ reduces the conventional z/OS processing required to identify and separate unique workloads, which results in improved overall system performance and scalability.


A primary objective of IWQ is to provide improved performance for business-critical interactive workloads by reducing contention created by other types of workloads. The types of z/OS workloads that are identified and assigned to unique input queues are:

1. z/OS Sysplex Distributor traffic - Network traffic that is associated with a distributed dynamic virtual IP address (DVIPA) is assigned a unique input queue allowing, the Sysplex Distributor traffic to be immediately distributed to the target host.
2. z/OS bulk data traffic - Network traffic that is dynamically associated with a streaming (bulk data) TCP connection is assigned to a unique input queue allowing, the bulk data processing to be assigned the appropriate resources and isolated from critical interactive workloads.


### **For Network Management - Query and Display OSA Configuration:**

Previously, OSA-Express system architecture introduced the capability for operating systems to dynamically register the OSA configuration. This approach significantly improved the OSA-Express usability by reducing the burden placed on the system administrator to manually configure OSA-Express for each unique operating system configuration. Traditionally, the Open Systems Adapter Support Facility (OSA/SF) has provided the administrator with the ability to monitor the OSA configuration. As additional complex functions have been added to OSA, the ability for the system administrator to display, monitor, and verify the specific current OSA configuration unique to each operating system has become more complex. OSA-Express3 introduces the capability for the operating system to directly query and display the current OSA configuration information (similar to OSA/SF). z/OS exploits this new OSA capability by introducing a new TCP/IP operator command called **Display OSAINFO**. Display OSAINFO allows the operator to monitor and verify the current OSA configuration, which helps to improve the overall management, serviceability, and usability of OSA-Express3.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server


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## Customization / Activation zManager Performance Management

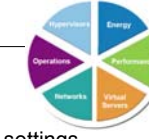


- Create ensemble and add CPC to ensemble
- Configure GPMP
  - The guest platform management provider (GPMP) is the interface between the z196 intranode management network (INMN) and the z/OS Workload Manager
  - GPMP provides policy information to WLM about the platform wide performance goals of workloads in which the z/OS is participating
  - WLM supports the GPMP by:
    - configuring the GPMP with the WLM ISPF Application
    - managing the GPMP address space (start, stop, and restart)
    - displaying GPMP status information
    - collecting and aggregating performance measurements
- Start /Stop GPMP

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## GPMP Configuration and Management



- On **policy activation**
  - WLM checks whether the service definition has valid GPMP settings
  - If activate=yes and system name not specified on excluded-list, GPMP is started automatically
- Also, you can use the **MODIFY WLM** command. The syntax of the command is:
  - **F WLM,GPMP,START**
    - Indicates that you want to start the GPMP
  - **F WLM,GPMP,STOP**
    - Indicates that WLM stops the currently active GPMP instance
  - **F WLM,GPMP,TRACE=NONE|LOW|MEDIUM|HIGH,DEST=FILE|MEMORY**
    - Enables you to change the GPMP internal tracing level “on the fly” and to change the destination of the trace (file or memory)
- Once you stopped the GPMP manually, the GPMP switches into “manual mode”. It is not automatically restarted even if a WLM policy with a valid GPMP configuration gets activated

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Concerning the **START** command:

- If the GPMP is already active, message IWM077E is issued.
- If ARM is disabled or the h/w does not support the GPMP, message IWM078E is issued.

Concerning the **STOP** command:

- WLM does not automatically restart the GPMP even if the WLM policy contains a valid GPMP configuration (i.e. activate=yes and system not in excluded-list). The GPMP is restarted only if the MODIFY WLM,GPMP,START command is issued from the MVS console. Even in the case of an activation of a new policy that contains a valid GPMP configuration, it is not restarted. The DISPLAY WLM,SYSTEMS operator command indicates that situation with a status of “STOPPED”.
- When the GPMP terminates unexpectedly or when too many errors occur, the GPMP state in the DISPLAY WLM,SYSTEMS command is set to “FAILED”.





## General Recommendations and Considerations


- **z196 is based on existing System z technology**
  - z/Architecture (z900/z800)
  - Multiple Logical Channel Subsystems (z990/z890)
  - OSA-Express2, FICON Express4, Crypto Express2 (z9 EC/z9 BC)
  - HiperDispatch, Large Page, zHPF (z10 EC, z10 BC)
- **z196 capabilities differ depending on z/OS release**
  - Web deliverables are needed for some functions on some releases
- **Don't migrate software releases and hardware at the same time**
- **Migrate to STP or Mixed-CTN network prior to introducing a z196 into a sysplex**
- **Keep members of the sysplex at the same software level other than during brief migration periods**
- **Review any restrictions and migration considerations prior to creating upgrade plan**

### General Recommendations and Considerations

As you plan your migration to a z196 server, consider the following:

1. **Relatively few migration actions are new when coming from a z10 EC or a z10 BC server.** Migration to a z196 server has, as its base, a migration to the z10 EC or z10 BC servers. This means that if you are migrating to a z196 server from a z10 EC or z10 BC server, and have performed the migration actions associated with the z10 EC or z10 BC, you have fewer migration actions than if you were migrating from a server prior to the z10 EC or z10 BC and have not yet performed the migration actions associated with these servers. There are, in fact, very few new migration actions to perform on z/OS for a z196 server if you have already migrated to a z10 EC or z10 BC server. It is important to note that you can migrate directly to a z196 server without installing the intermediate (prior to z10 EC and z10 BC) servers, but you still need to ensure that any migration considerations are satisfied for the servers that you “skipped.”
2. **Support is delivered by service (and FMID Web deliverables for ICSF).** The delta (from a z10 EC or z10 BC) support for a z196 server, excluding cryptographic support, is delivered by service (PTFs). The cryptographic support for the z196 server continues to be FMIDs, many of which are still available in Web deliverables. Different ICSF Web deliverables, providing different levels of support, are available for different releases of z/OS.
3. **Use the same software level throughout a sysplex.** Having members of a sysplex at the same software level (other than during brief migration periods) is good software management policy.
4. **Migrate hardware and software at different times.** To minimize the amount of change (and therefore risk) that you experience at one time, do not migrate your software release level at the same time that you migrate your hardware.
5. **Review the sysplex configuration in which the z196 server will participate.** In particular, if you have any existing z900, z800, z990, or z890 z/OS images or coupling facility images in the sysplex, move those z/OS images or coupling facilities to later servers, such as a System z10 (z10 EC or z10 BC), System z9 (z9 EC or z9 BC), or later. This action is necessitated by the restriction that a z196 server cannot participate with prior-level servers in a sysplex.
6. **Implement STP (or a Mixed-CTN) timing network.** This action is necessitated because Sysplex Timers (9037-002) are not supported on a z196 server.
7. **Migrate from ICB-4 to InfiniBand coupling links.** This action is necessitated because ICB-4 links are not supported on z196 servers. If desired, you can take this action after you order a z196, as you upgrade to the new server.
8. **Migrate from unsupported hardware features to newer technology.** This action is necessitated because FICON Express, FICON Express2, Crypto Express2, and OSA-Express2 10 GbE LR are not supported on z196 servers.





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## SMP/E V3.5's support for FIXCAT HOLDDATA For Hardware PSP Bucket Verification

- A new HOLDDATA type FIXCAT (fix category) to associate an APAR to a particular category of fix

```
++HOLD(HBB7770) FMID(HBB7770) REASON(AA32478) FIXCAT
CATEGORY(IBM.Device.Server.z196-2817) RESOLVER(UA54038) .
```
- A SOURCEID of the FIXCAT name will be added by SMP/E to the resolving PTF
- This SOURCEID can be used on APPLY or ACCEPT commands
  - **If ALL available applicable PTFs RECEIVED, can use APPLY CHECK to identify what needs to be installed**

```
SET BDY(ZOS19T)
APPLY CHECK GROUPEXTEND BYPASS(HOLDSYS)
SOURCEID(IBM.Device.Server.*2817*,IBM.Device.Server.zBX*).
```
- New REPORT MISSINGFIX command can be used to identify what needs to be installed, even if the PTFs are not yet RECEIVED

```
SET BDY(GLOBAL)
REPORT MISSINGFIX ZONES(ZOS19T)
FIXCAT(IBM.Device.Server.*2817*,IBM.Device.Server.zBX*).
```

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## PSP Buckets

For a z196 CPC, PTFs are identified in the 2817DEVICE PSP bucket (Subset 2817/ZOS). For an IBM zEnterprise BladeCenter Extension (zBX) attached to your z196 CPC, either to support IBM Smart Analytics Optimizer for DB2 for z/OS, V1.1 (5697-AQT) or to support IBM POWER7 Blades, the PTFs are identified in the 2458DEVICE PSP bucket (Subset 2458/ZOS). In each PSP bucket, the content is dependent on the z/OS release you will run on the z196 server. If you reviewed the PSP buckets some time ago, review them again to ensure that any newly identified z/OS service has been installed. To assist you in determining if you have the recommended service (identified in these PSP buckets) installed on your system, you can use the SMP/E REPORT MISSINGFIX command in conjunction with the FIXCAT type of HOLDDATA, as follows:

- a. Acquire and RECEIVE the latest HOLDDATA onto your z/OS system(s). Use your normal service acquisition portals or download the two (2) year HOLDDATA directly from <http://service.software.ibm.com/holdata/390holddata.html>. Ensure you select **Full** from the Download NOW column (last 730 days) to receive the FIXCAT HOLDDATA, as the other files do not contain FIXCAT HOLDDATA.
- b. Run the SMP/E REPORT MISSINGFIX command on your z/OS systems and specify one or more of the following Fix Categories (FIXCAT):
  - IBM.Device.Server.z196-2817
  - IBM.Device.Server.z196-2817.ParallelSysplexInfiniBandCoupling
  - IBM.Device.Server.z196-2817.ServerTimeProtocol
  - IBM.Device.Server.z196-2817.zHighPerformanceFICON
  - IBM.Device.Server.zBX-2458
  - IBM.Device.Server.zBX-2458.ISAOPT

The report will identify any missing coexistence and fallback PTFs for that system. For complete information about the REPORT MISSINGFIX command, see *SMP/E Commands*.

- c. Periodically, you might want to acquire the latest HOLDDATA and rerun the REPORT MISSINGFIX command to find out if there are any new PTFs recommended for the z196 server.

If you are skipping a server generations, review the PSP buckets for the servers you skipped, as follows:

- For System z10, see Upgrade 2097DEVICE, Subset 2097/ZOS.
- For System z9, see Upgrade 2094DEVICE, Subset 2094/ZOS/1.
- For System z990 or z890, see Upgrade 2084DEVICE, Subset 2084/ZOS/1.

## Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

SMP/E 3.5 (also part of z/OS V1.10 – which became available September 26, 2008) provided a new function that can greatly simplify the identification, verification, acquisition, and installation tasks for service documented in PSP buckets by processing a new kind of HOLDDATA that associates PTFs to fix categories. Each ++HOLD statement identifies an APAR and its resolving PTF needed to provide support for the fix category. The new FIXCAT HOLDDATA is now being delivered with existing ERROR HOLDDATA. Fix categories have been defined for hardware devices, new software FMIDs, and selected hardware and software functions.

When SMP/E V3.5 processes FIXCAT ++HOLD statements (during RECEIVE processing) the resolving PTF identified on the ++HOLD statement is assigned an SMP/E SOURCEID that matches the fix category on that statement. This enables you to specify fix categories as part of the SOURCEID operand on APPLY, ACCEPT, and LIST commands.

Many customers fall into one of two camps when it comes to acquiring and installing service:

1. You choose to RECEIVE all available applicable PTFs and filter which PTFs get installed using parameters on the APPLY command; or
  2. You only acquire PTFs you need when you want to install them
- No matter which approach you use, SMP/E V3.5 can simplify your task.

In the first scenario, you have all available PTFs that are applicable to your environment already RECEIVED. To install all the PTFs needed for minimal support of a z196 server, you could use something like the following command. You don't have to access the PSP bucket, nor download any extra files.

```
APPLY CHECK GROUPEXTEND BYPASS(HOLDSYS)
SOURCEID(IBM.Device.Server.z196-2817, IBM.Device.Server.zBX-2458).
```

If you wanted to include all support for the z196 optional functions, then the SOURCEID operand could either list all fix categories that you are interested in, or use wildcarding to have SMP/E determine all applicable fix categories. This latter approach would automatically express interest in future z196 functions (should new fix categories be created). Specifying IBM.Device.Server.z196-2817\*, or IBM.Device.Server.z196\*, or just \*2817\* all result in similar results: an interest in the minimal support for z196 as well as exploitation of all optional functions. In these examples the asterisk (\*) represents 0-n characters, while the percent sign (%) could be used to represent a single character. Based on the structured names of the fix categories for hardware support, you can use SOURCEIDs with wildcarding to ensure that PTFs for multiple generations of servers are installed.

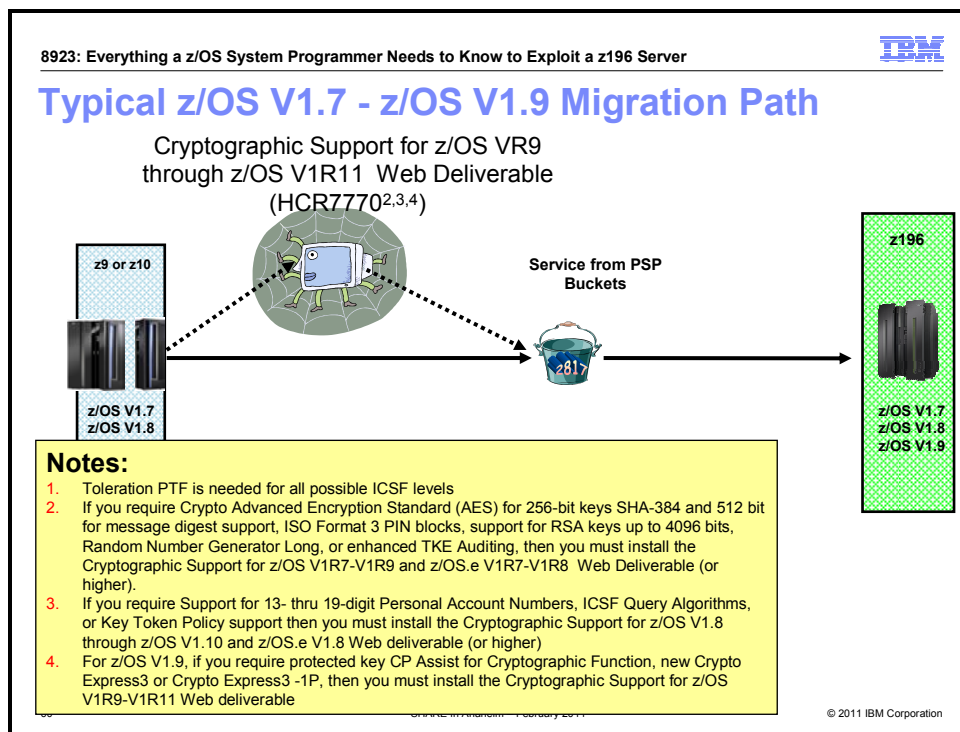
In the second scenario, you don't know if you have RECEIVED all the PTFs that you need since you only obtain PTFs right before you want to install them. You need to first obtain the latest HOLDDATA using your favorite method (mine is RECEIVE ORDER(CONTENT(HOLDDATA))...). Then you can use the new REPORT MISSINGFIX command to identify PTFs missing from your system. For example:

```
SET BDY(GLOBAL).
REPORT MISSINGFIX ZONES(ZOSR12T)
FIXCAT(IBM.Device.Server.z196-2817, IBM.Device.Server.zBX-2458) .
```

The REPORT MISSINGFIX command checks your GLOBAL zone for FIXCAT HOLDDATA that matches the FIXCAT values specified on the command. The command then compares the APARs identified in that FIXCAT HOLDDATA with the PTFs installed in the specified zones, and produces a report to identify any APARs that are not resolved. In other words, it reports which PTFs (fixes) are missing for the specified fix categories. Furthermore, the command produces a customized job that can be used to obtain any PTFs not already RECEIVED via the RECEIVE ORDER command, and install any missing service via the APPLY CHECK command. Please note that the FIXCAT operand on the REPORT MISSINGFIX command can list multiple fix categories, as well as using the same wildcarding techniques described above for the SOURCEID operand.

Because both of these techniques are simple and integrated into basic SMP/E commands, you can use them periodically to ensure that you have the latest PTFs specified in the hardware PSP bucket installed (since PSP buckets can be updated daily). You can even perform these same checks as you upgrade z/OS releases to ensure that you have the appropriate PTFs for your existing hardware installed for your new z/OS release.

# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server



## Migration steps if you are running z/OS V1.7, z/OS V1.8, or z/OS V1.9

The steps for migrating from z/OS V1.7, z/OS V1.8, or z/OS V1.9 on your current server to z/OS V1.7, z/OS V1.8, z/OS V1.9 on a z196 server, are:

1. Ensure that you are licensed for the IBM Lifecycle Extension for z/OS V1.7 (5637-A01), the IBM Lifecycle Extension for z/OS V1.8 (5638-A01), or the IBM Lifecycle Extension for z/OS V1.9 (required as of October 2010). With the Lifecycle Extension, z/OS V1.7, V1.8, and V1.9 support the z196 server.
2. Install the necessary z/OS service, as indicated in PSP buckets. For a z196 CPC, PTFs are identified in the 2817DEVICE PSP bucket (Subset 2817/ZOS). For an IBM zEnterprise BladeCenter Extension (zBX) attached to your z196 CPC, either to support IBM Smart Analytics Optimizer for DB2 for z/OS, V1.1 (5697-AQT) or to support IBM POWER7 Blades, the PTFs are identified in the 2458DEVICE PSP bucket (Subset 2458/ZOS). In each PSP bucket, the content is dependent on the z/OS release you will run on the z196 server.
3. Ensure that you have the *IBM zIIP Support for z/OS and z/OS.e V1R6/V1R7* Web Deliverable installed if you are running z/OS V1.7. You do not need to have a zIIP processor, only the FMID installed. This will enable you to use HiperDispatch. If you don't want to use HiperDispatch, you don't need to have the Web deliverable installed.
4. Determine the level of cryptographic function that you want to use. Cryptographic toleration support is provided by PTFs installed on one of the Web deliverables listed below. The support varies depending on the Web deliverable that is installed. Note that you must also install the PTFs identified in the program directory that comes with the Web deliverables and the PTFs that are recommended in the appropriate ICSF PSP bucket.
  - If you are running z/OS V1.7, minimally you will have to install toleration PTFs on top of the *Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7* Web deliverable (FMID HCR7731).
  - Install the *Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8* Web deliverable (HCR7750) or higher if you are running z/OS V1R7, z/OS V1R8, or z/OS V1R9 and you require Crypto Advanced Encryption Standard (AES) for 256-bit keys SHA-384 and 512-bit for message digest support, ISO Format 3 PIN blocks, support for RSA keys up to 4096 bits, Random Number Generator Long, or enhanced TKE Auditing.
  - Install the *Cryptographic Support for z/OS V1R8-V1R10 and z/OS.e V1R8* Web deliverable (HCR7751) or higher if you are running z/OS V1R7, z/OS V1R8, and z/OS V1R9 and you require

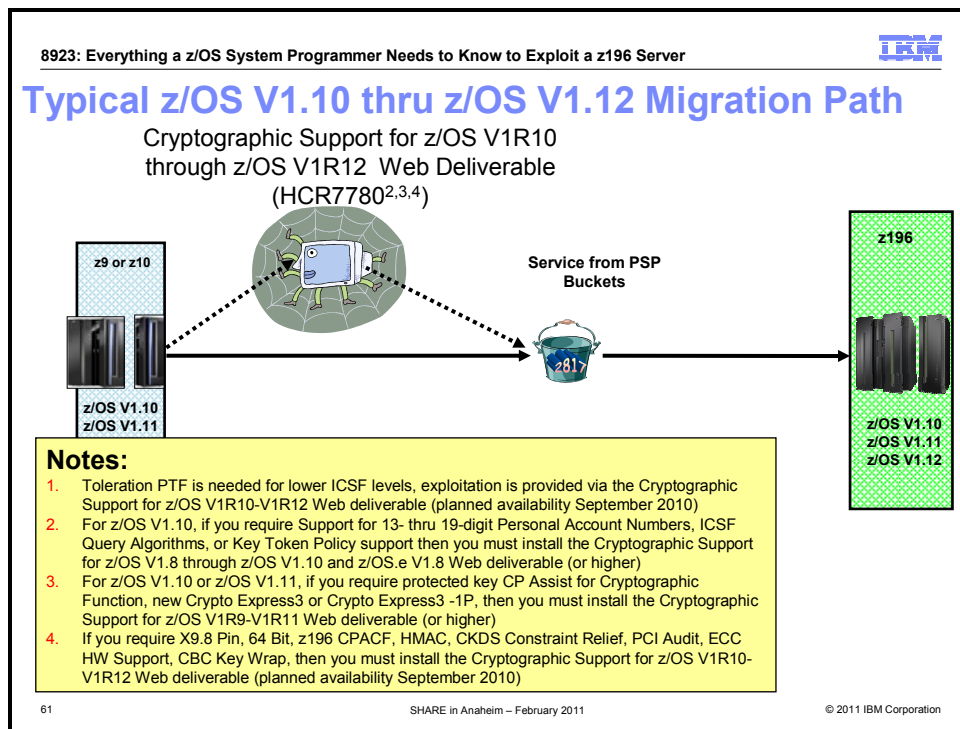
# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, or Key Token Policy support.

- Install the *Cryptographic Support for z/OS V1R9-V1R11 Web deliverable* (HCR7770) or higher if you are running z/OS V1R9 and you require protected key CP Assist for Cryptographic Function, new Crypto Express3 or Crypto Express3 -1P.

## Please note

1. APARs/PTFs are required to support the Cryptographic Express3 Coprocessor (CEX3C). These were also required on a z10 server that had a Cryptographic Express3 Coprocessor. Alternatively for z/OS V1.9, you can install the *Cryptographic Support for z/OS V1R9-V1R11 Web deliverable* (FMID HCR7770).
2. If you are sharing keys with a z/OS V1.10 or higher system that is using the Cryptographic Support for z/OS V1R10-V1R12 Web Deliverable (FMID HCR7780), then the z/OS V1.7-z/OS V1.9 systems will need coexistence PTFs. To assist in identifying the coexistence service, you could use the Fix Category: IBM.Coexistence.ICSF.z/OS\_V1R10-V1R12-HCR7780



## Migration steps if you are running z/OS V1.10 or z/OS V1.11 or z/OS V1.12

The steps for migrating from z/OS V1.10, z/OS V1.11, or z/OS V1.12 on your current server to z/OS V1.10, z/OS V1.11, or z/OS V1.12 on a z196 server are:


1. Install the necessary z/OS service, as indicated in PSP buckets. For a z196 CPC, PTFs are identified in the 2817DEVICE PSP bucket (Subset 2817/ZOS). For an IBM zEnterprise BladeCenter Extension (zBX) attached to your z196 CPC, either to support IBM Smart Analytics Optimizer for DB2 for z/OS, V1.1 (5697-AQT) or to support IBM POWER7 Blades, the PTFs are identified in the 2458DEVICE PSP bucket (Subset 2458/ZOS). In each PSP bucket, the content is dependent on the z/OS release you will run on the z196 server.

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2. Determine the level of cryptographic function that you want to use. Cryptographic toleration support is provided by PTFs installed on one of the Web deliverables listed below. The support varies depending on the Web deliverable that is installed. Note that you must also install the PTFs identified in the program directory that comes with the Web deliverables and the PTFs that are recommended in the appropriate ICSF PSP bucket.
  - Install the *Cryptographic Support for z/OS V1R8-V1R10* Web deliverable (FMID HCR7751) or higher if you are running z/OS V1.10 and require support for 13- through 19-digit Personal Account Numbers, ICSF Query Algorithms, or Key Token Policy support.
  - Install the *Cryptographic Support for z/OS V1R9-V1R11* Web deliverable (FMID HCR7770) or higher if you are running z/OS V1.10 or z/OS V1.11 and you require protected key CP Assist for Cryptographic Function, new Crypto Express3 or Crypto Express3 -1P.
  - Install the *Cryptographic Support for z/OS V1R10-V1R12* Web deliverable (FMID HCR7780) if you are running z/OS V1.10, z/OS V1.11, or z/OS V1.12 and you require X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS Constraint Relief, PCI Audit, ECC HW Support, CBC Key Wrap. The availability of this Web deliverable was September 2010. The availability of HMAC support was first quarter 2011, with additional PTFs.


### Please note

1. For z/OS V1.10 and z/OS V1.11 APARs/PTFs are required to support the Cryptographic Express3 Coprocessor (CEX3C). These were also required on a z10 server that had a Cryptographic Express3 Coprocessor. Alternatively, you can install either the *Cryptographic Support for z/OS V1R9-V1R11* Web deliverable (FMID HCR7770) or the *Cryptographic Support for z/OS V1R10-V1R12* Web deliverable (FMID HCR7780).
  2. If you are sharing keys with a z/OS V1.10 or higher system that is using the Cryptographic Support for z/OS V1R10-V1R12 Web Deliverable (FMID HCR7780), then the z/OS V1.10-z/OS V1.12 systems will need coexistence PTFs. To assist in identifying the coexistence service, you could use the Fix Category: IBM.Coexistence.ICSF.z/OS\_V1R10-V1R12-HCR7780
3. You can define an Ensemble and exploit the IBM zEnterprise Unified Resource Manager. See *System z Ensemble Planning and Configuration Guide* (GC27-2608) for a detailed description of the steps required to define an Ensemble.

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## Summary

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### Supported IBM zEnterprise System Migration Scenarios

- 1. Existing System z server to new z196 server**
  - Toleration versus exploitation differs by release
  - ICSF web deliverable needed for function required
- 2. Existing z9 or z10 sysplex replaced by z196 (or z196 added to existing sysplex)**
  - Coupling Link technology (no ICB-4 to z196)
  - Only STP or Mixed CTN supported (no ETR connections to a z196)
- 3. All existing z9 or z10 z/OS images replaced by z196 images**
  - If you want an ensemble
    - z/OS releases must be z/OS V1.10 or higher
    - Configure an Ensemble from the HMC
- 4. Exploit a z196 with zBX using IBM Blades**
  - z/OS releases must be z/OS V1.10 or higher
  - Configure OSM OSA CHPIDs for Intranode Management Network (INMN)
  - Configure OSX OSA CHPIDs for Intraensemble Data Networks (IEDN)
  - User responsible for AIX OS and application provisioning
- 5. Exploit z196 with zBX using IBM Smart Analytics Optimizer**
  - z/OS releases must be z/OS V1.10 or higher; DB2 releases V9.1 or higher
  - Configure OSM OSA CHPIDs for Intranode Management Network (INMN)
  - Configure OSX OSA CHPIDs for Intraensemble Data Networks (IEDN)


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# Everything a z/OS Systems Programmer Needs to Know to Exploit a z196 Server

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**Summary: z/OS Software Support for IBM zEnterprise 196**

- **z/OS V1.7, z/OS V1.8 and z/OS V1.9**
  - New MSU levels
  - New z/Architecture Instructions (and new OPCODE support)
  - FAURP Reporting
  - Tolerance for >64 CPs on the server
  - Crypto toleration
- **z/OS V1.10 and z/OS V1.11**
  - zBX Support for optimizers and IBM POWER7 blades
  - IBM zEnterprise Unified Resource Manager
    - Network Management
      - Intranode Management Network (INMN)
      - Intraensemble data network (IEDN)
    - Performance Management
  - RSM exploitation of new OPCODEs
  - HiperDispatch cache and affinity node changes
  - HiperDispatch performance and serviceability enhancements
  - Static Power Save Mode
  - Language Environment High Register Resolution
  - CPU Measurement Facility (Hardware Instrumentation Services)
  - CF Level 17
    - CFCC Diagnostics
    - Scalability improvements with up to 80 coupling links
    - Connectivity improvements with up to 2047 structures
    - Connectivity improvements with 128 CHPIDs per server
  - Removal of the 64k byte data transfer limit for zHPF multitrack operations
  - Three subchannel sets
  - Crypto Exploitation (ANSI X9.8 Pin security, enhanced Common Cryptographic Architecture (CCA), 64 Bit, CP Assist for Cryptographic Function (CPACF) enhancements, Secure Keyed-Hash Message Authentication Code (HMAC), CKDS Constraint Relief, PCI Audit, Elliptical Curve Cryptography (ECC) Digital Signature Algorithm, and CBC Key Wrap)
  - RMF Postprocessor Crypto Activity report support for 4096-bit
- **z/OS V1.12**
  - XL C/C++ ARCH(9) and Tune(9) Options
  - zDAC support
  - New display command – D OSAINFO
  - OSA-Express3 Inbound Workload Queuing (IWQ)



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|                               |            | z196 PSP Bucket – 2817DEVICE 2817ZOS        |                         |              |                        |                    |   |                       |                     |                       |  |                       |                 |                             |                              |   |                   |                                |   |                                      |               |                                |                    |                   |                           |                                |                   |  |  |                  |
|-------------------------------|------------|---|-------------------------|--------------|------------------------|--------------------|---|-----------------------|---------------------|-----------------------|--|-----------------------|-----------------|-----------------------------|------------------------------|---|-------------------|--------------------------------|---|--------------------------------------|---------------|--------------------------------|--------------------|-------------------|---------------------------|--------------------------------|-------------------|--|--|------------------|
|                               |            | Base Support                                |                         |              |                        |                    |   |                       |                     |                       |  | Explicit z/OS Support |                 |                             |                              |   |                   |                                |   |                                      |               |                                |                    |                   |                           |                                |                   |  |  |                  |
|                               |            | OSA-Express3 Inbound Workload Queuing (IWQ) | New OSA Display Command | zDAC Support | Performance Management | Network Management | IBM zEnterprise Bracenter Extension (ZBX) Support | Up to 32 HiperSockets | Crypto Exploitation | Three Subchannel Sets | Extensions to zHPF Multitrack Operations | CF Level 17           | Power Save Mode | LE High Register Resolution | HiperDispatch Serviceability | HiperDispatch Cache and Affinity Node Changes | > 64 CPs per LPAR | CPU Measurement Facility (HIS) | RMF Postprocessor Crypto Activity report - 4096-bit | OSA-Express3 CHPID OSD maximum ports | HiperDispatch | Crypto Toleration <sup>1</sup> | >64 CPs per Server | IF/AURP Reporting | FICON Express8 (CHPID FC) | Up to 128 Coupling Link CHPIDs | IB Coupling Links | New z/Architecture Instructions <sup>3</sup> | OSA-Express3 (GBE LX and SX, 1000BASE-T, 10 GBE LR and SR) | Base GAI Support |
| Release                       | 8923: Ever |   |                         |              |                        |                    |   |                       |                     |                       |  |                       |                 |                             |                              |   |                   |                                |   |                                      |               |                                |                    |                   |                           |                                |                   |  |  |                  |
| z/OS V1.7 <sup>1</sup>        |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V1.7 <sup>1</sup> w/ZIIP |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V1.8 <sup>2</sup>        |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V1.9 <sup>2</sup>        |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V1.10                    |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V.1.11                   |            | P   | P                       | P            | P                      | P                  | P   | P                     | P                   | P                     | P  | P                     | P               | P                           | P                            | P   | P                 | P                              | P   | P                                    | P             | P                              | P                  | P                 | P                         | P                              | P                 | P  |  |                  |
| z/OS V.1.12                   |            | B   | B                       | B            | B                      | B                  | B   | B                     | B                   | B                     | B  | B                     | B               | B                           | B                            | B   | B                 | B                              | B   | B                                    | B             | B                              | B                  | B                 | B                         | B                              | B                 | B  |  |                  |

<sup>1</sup> – The Lifecycle Extension for z/OS V1.7 or z/OS V1.8 is required for support

<sup>2</sup> – The IBM Lifecycle Extension for z/OS V1.9 will be required after 9/30/2010

<sup>3</sup> – Support differs by release. z/OS V1.12 includes XL C/C++ support for ARCH(9) and TUNE(9) Options

<sup>4</sup> – A Crypto Web Deliverable is NOT required, but toleration PTF is needed even if a web deliverable is installed

<sup>5</sup> – Toleration PTFs needed to detect Power Saving Mode

<sup>6</sup> – PTFs recognize crypto control block, AND provide updated reports

B – FMIIn Base product


W – FMIDs shipped in a Web Deliverable

P – PTFs are required, P<sup>1</sup> – Support differs by release

P<sup>2</sup> – PTF required for toleration, N – Not Supported


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## Backup Material

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## Additional Information

- z/OS Home Page  
<http://www.ibm.com/servers/eserver/zseries/zos/>
- zFavorites for System z  
<http://www.ibm.com/servers/eserver/zseries/zos/zfavorites/>
- z/OS Internet Library  
<http://www.ibm.com/servers/eserver/zseries/zos/bkserv/>
- IBM System z  
<http://www.ibm.com/systems/z/>
- IBM Resource Link  
<https://app-06.www.ibm.com/servers/resourcelink/hom03010.nsf>
- IBM Redbooks – How-To Books (also Redpieces)  
<http://www.redbooks.ibm.com/>
- Preventive Service Planning buckets  
<http://www14.software.ibm.com/webapp/set2/psp/srchBroker>
- Enhanced HOLDDATA  
<http://service.boulder.ibm.com/390holddata.html>

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| DB2*           | IBM*         | Parallel Sysplex*     | RMF            | System Storage* | System z10 Business Class | z10 EC      |
| ESCON*         | IBM (logo)   | POWER7                | ServerPac*     | System z        | zArchitecture*            | z/OS*       |
| FICON Express* | Infiniband*  | RACF*                 | Sysplex Timer* | System z9       | z9*                       | zEnterprise |
|                |              |                       |                |                 | z10                       | zSeries*    |

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## z/OS Support For z10 Servers

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## z/OS Support Summary for z10 Support

- z/OS V1.7 (with the IBM Lifecycle Extension for z/OS V1.7)
  - Parallel Sysplex InfiniBand (PSIFB) Coupling Links
  - OSA-Express3 10 Gigabit Ethernet
  - 65535 MP Factors
  - Crypto Toleration
    - CP Assist for Cryptographic Functions and Configurable Crypto Express2, Remote loading of ATM and Point of Sale (POS) keys,...
  - Crypto Exploitation
    - Crypto Advanced Encryption Standard (AES) for 256-bit keys SHA-384 and 512 bit for message digest support, RSA keys up to 4096 bits in Length, Dynamically Add Crypto to Logical Partition, Support for 13-19 digit PANs data, Secure Key AES Support, ...
  - HiperDispatch (Requires zIIP Web Deliverable to be installed (but not a zIIP processor))
  - Decimal Floating Point (High Level Assembler support only)
  - High Performance FICON
  - CF Level 16
- z/OS V1.8 and z/OS.e V1.8 (with the IBM Lifecycle Extension for z/OS V1.8)
  - Large Memory > 128GB (up to 1 TB on z10 EC)
  - Additional support for Decimal Floating Point (HLASM, LE, DBX, and CDA RTLE)
    - XL C/C++ support if you download and install the z/OS V1.9 XL C/C++ Compiler
  - OSA-Express3 Double Port Density
  - CPU Measurement Facility
  - Worldwide port name (WWPN) tool for advance SAN preplanning
- z/OS V1.9
  - Additional support for Decimal Floating Point (XL C/C++ Compiler)
  - z/OS XL C/C++ Exploitation of z10 EC Machine Instructions
  - Greater than 54 CPs for a single LPAR
  - Large Page Support
  - Capacity Provisioning
  - RMR FICON Enhancements
  - HiperSockets Multiple Write Facility
  - OSA-Express3 Double Port Density
  - STP Enhancements
- z/OS V1.10
  - Dynamic add logical CPs
- z/OS V1.11
  - New XL C/C++ Compiler Options
  - Large Page Support in Language Environment
  - BCPii Activation Profile Support

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| Release                      | Included in Base z/OS Support |                     |                            |                  |                      |                                |               |  |                           |  |                      |                      |                        |                                     | Explicit z/OS Support |                                  |                      |                                     |                          |                                  |                      |                       |                                      |                  |                     |                                  |                                    |                               |                          |   |
|------------------------------|-------------------------------|---------------------|----------------------------|------------------|----------------------|--------------------------------|---------------|--|---------------------------|--|----------------------|----------------------|------------------------|-------------------------------------|-----------------------|----------------------------------|----------------------|-------------------------------------|--------------------------|----------------------------------|----------------------|-----------------------|--------------------------------------|------------------|---------------------|----------------------------------|------------------------------------|-------------------------------|--------------------------|---|
|                              | z10 EC GA1 Support            | OSA-Express3 10 GBE | OSA-Express3 4-port OSA/IC | 65535 MP Factors | z10 mnemonic support | Crypto Toleration <sup>1</sup> | HiperDispatch | Large Memory > 128GB (1 TB) <sup>2</sup> | C/C++ ARCH(8) and TUNE(8) | Dynam. Add Logical CPs Greater than 54 CPs (64) <sup>3</sup> | Usage Report Program | PSIFB Coupling Links | High Performance FICON | Decimal Floating Point <sup>4</sup> | CF Level 16           | Crypto Exploitation <sup>5</sup> | Layer 3 VMAC Support | Service Ads Support for Large Dumps | CPU Measurement Facility | OSA-Express3 Double Port Density | WWPN prediction tool | Capacity Provisioning | HiperSockets Multiple Write Facility | STP Enhancements | Protected Key CPACF | OSA Optimized Latency Mode (OLM) | OSA QDIO data connection Isolation | New XL C/C++ Compiler Options | BCPii Activation Profile |   |
| z/OS 1.7 <sup>6</sup>        | P                             | B                   | B                          | P                | P                    | W                              | N             | N  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | P                                | W                    | N                                   | N                        | N                                | N                    | N                     | N                                    | N                | N                   | N                                | N                                  | N                             | N                        | N |
| z/OS 1.7 <sup>6</sup> w/zIIP | P                             | B                   | B                          | P                | P                    | W                              | N             | N  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | P                                | W                    | N                                   | N                        | N                                | N                    | N                     | N                                    | N                | N                   | N                                | N                                  | N                             | N                        | N |
| z/OS 1.8 <sup>6</sup>        | P                             | B                   | B                          | P                | P                    | P                              | B             | W  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | P                                | W                    | P                                   | P                        | P                                | P                    | N                     | N                                    | N                | N                   | N                                | N                                  | N                             | N                        | N |
| z/OS 1.9                     | P                             | B                   | B                          | P                | P                    | P                              | B             | B  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | W                                | B                    | P                                   | P                        | P                                | P                    | B                     | B                                    | P                | P                   | W                                | N                                  | N                             | N                        | N |
| z/OS 1.10                    | P                             | B                   | B                          | P                | P                    | P                              | B             | B  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | W                                | B                    | B                                   | P                        | P                                | P                    | B                     | B                                    | B                | P                   | W                                | N                                  | N                             | N                        | N |
| z/OS 1.11                    | P                             | B                   | B                          | P                | P                    | P                              | B             | B  | N                         | N  | N                    | N                    | P                      | P                                   | P                     | W                                | B                    | B                                   | B                        | B                                | B                    | B                     | B                                    | B                | B                   | W                                | P                                  | P                             | P                        | P |

1 – New cryptographic toleration required for GA3 (Y4)      5 – Crypto Exploitation differs by release and web deliverable installed


2 - Up to 1 Terabyte on a z10 EC, and up to 248 GB on a z10 BC      6 - The IBM Lifecycle Extension for z/OS is required after Sept. 2009


3 – Only on a z10 EC

4 – Decimal Floating Point Support differs by release

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## ICSF


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| Operating System                    | Level Shipped in Base Product | Level Required for Secure or Clear Key or Enhanced Secure Key Support and 64 bit addressing caller support | Level Required for AES, PRNG, and SHA-256 and CEX2n exploitation | Level required for Remote Key Loading for ATMs and POSs | Level Required for 4096-RSA keys, ISO-3 PIN Support | Level Required for CPACF support for SHA-384 and SHA-512 Support | Level Required for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, Secure Key AES and Key Token Policy support | *Crypto Express3, Crypto Express3 1P, and Protected Key CPACF | X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap |
|-------------------------------------|-------------------------------|--|--|---|---|--|---|---|---|
| z/OS 1.7 <sup>1</sup> or z/OS.e 1.7 | HCR7720                       | Integrated in z/OS base level  | HCR7730  | HCR7731   | HCR7750   | HCR7750  | HCR7751   | N/A   | N/A   |
| z/OS 1.8 <sup>1</sup> or z/OS.e 1.8 | HCR7731                       | Integrated in z/OS base level  | Integrated in z/OS base level                                    | Integrated in z/OS base level                           | HCR7750   | HCR7750  | HCR7751   | N/A   | N/A   |
| z/OS 1.9 <sup>1</sup>               | HCR7740                       | Integrated in z/OS base level  | Integrated in z/OS base level                                    | Integrated in z/OS base level                           | HCR7750   | HCR7750  | HCR7751   | HCR7770   | N/A   |
| z/OS 1.10                           | HCR7750                       | Integrated in z/OS base level  | Integrated in z/OS base level                                    | Integrated in z/OS base level                           | Integrated in z/OS base level                       | Integrated in z/OS base level                                    | HCR7751   | HCR7770   | HCR7780   |
| z/OS 1.11                           | HCR7751                       | Integrated in z/OS base level  | Integrated in z/OS base level                                    | Integrated in z/OS base level                           | Integrated in z/OS base level                       | Integrated in z/OS base level                                    | Integrated in z/OS base level   | HCR7770   | HCR7780   |
| z/OS V1.12                          | HCR7770                       | Integrated in z/OS base level  | Integrated in z/OS base level                                    | Integrated in z/OS base level                           | Integrated in z/OS base level                       | Integrated in z/OS base level                                    | Integrated in z/OS base level   | Integrated in z/OS base level                                 | HCR7780   |

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## z/OS Crypto Toleration Support (1 of 2)

| z/OS Release           | Crypto Web Download  | FMID    | Comments   |
|------------------------|--|---------|--|
| z/OS V1.7 <sup>1</sup> | N/A – In z/OS base product   | HCR7720 | <ul style="list-style-type: none"> <li>▪ <b>NO Toleration Support on z196</b></li> </ul>   |
|                        | [09/2005] Cryptographic Support for z/OS V1R6/R7 and z/OS.e V1R6/R7 (web download no longer available)         | HCR7730 | <ul style="list-style-type: none"> <li>▪ Enhancements to CPACF (AES, PRNG, and SHA-256) and Crypto Express2 exploitation</li> <li>▪ <b>NO Toleration Support on z196</b></li> </ul>                        |
|                        | [09/2005] Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7 (web download no longer available) | HCR7731 | <ul style="list-style-type: none"> <li>▪ CPACF and Crypto Express2 exploitation</li> <li>▪ Enhancements include Remote Key Loading for ATMs and POSs</li> </ul>  |
|                        | [11/2007] Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 web deliverable                        | HCR7750 | <ul style="list-style-type: none"> <li>▪ 4096-bit RSA keys, ISO-3 PIN Support, CPACF support for SHA-394 and SHA-512, Reduced support of retained private key in ICSF</li> </ul>                           |
|                        | [11/2008] Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable               | HCR7751 | <ul style="list-style-type: none"> <li>▪ Support for 13- thru 19-digit Personal Account Numbers</li> <li>▪ ICSF Query Algorithms,</li> <li>▪ Key Token Policy support</li> <li>▪ Secure Key AES</li> </ul> |

<sup>1</sup> The IBM Lifecycle Extension for z/OS is required for support after general support is withdrawn

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## z/OS Crypto Toleration Support (2 of 2)

| z/OS Release           | Crypto Web Download  | FMID    | Comments   |
|------------------------|--|---------|--|
| z/OS V1.8 <sup>1</sup> | N/A – In z/OS base product   | HCR7731 | <ul style="list-style-type: none"> <li>▪ CPACF and Crypto Express2 exploitation</li> <li>▪ Enhancements include Remote Key Loading for ATMs and POSs</li> </ul>  |
|                        | [11/2007] Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 web deliverable          | HCR7750 | <ul style="list-style-type: none"> <li>▪ 4096-bit RSA keys, ISO-3 PIN Support, CPACF support for SHA-394 and SHA-512, Reduced support of retained private key in ICSF</li> </ul>                           |
|                        | [11/2008] Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable | HCR7751 | <ul style="list-style-type: none"> <li>▪ Support for 13- thru 19-digit Personal Account Numbers</li> <li>▪ ICSF Query Algorithms,</li> <li>▪ Key Token Policy support</li> <li>▪ Secure Key AES</li> </ul> |
| z/OS V1.9 <sup>1</sup> | N/A – In z/OS base product   | HCR7740 | <ul style="list-style-type: none"> <li>▪ PKCS11 Support</li> </ul>   |
|                        | [11/2007] Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 web deliverable          | HCR7750 | <ul style="list-style-type: none"> <li>▪ 4096-bit RSA keys, ISO-3 PIN Support, CPACF support for SHA-394 and SHA-512, Reduced support of retained private key in ICSF</li> </ul>                           |
|                        | [11/2008] Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable | HCR7751 | <ul style="list-style-type: none"> <li>▪ Support for 13- thru 19-digit Personal Account Numbers</li> <li>▪ ICSF Query Algorithms,</li> <li>▪ Key Token Policy support</li> <li>▪ Secure Key AES</li> </ul> |
|                        | [11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable                              | HCR7770 | <ul style="list-style-type: none"> <li>▪ Protected Key CP Assist for Cryptographic Function</li> <li>▪ New Crypto Express3 and Crypto Express3 -1P</li> </ul>  |

<sup>1</sup> The IBM Lifecycle Extension for z/OS is required for support after general support is withdrawn

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## z/OS Crypto Toleration and Exploitation Support

| z/OS Release | Crypto Web Download  | FMID    | Comments   |
|--------------|--|---------|--|
| z/OS V1.10   | N/A – In z/OS base product   | HCR7750 | ▪All of the above  |
|              | [11/2008] Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable | HCR7751 | ▪Support for 13- thru 19-digit Personal Account Numbers<br>▪ ICSF Query Algorithms.<br>▪ Key Token Policy support<br>▪Secure Key AES |
|              | [11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable                              | HCR7770 | ▪Protected Key CP Assist for Cryptographic Function<br>▪New Crypto Express3 and Crypto Express3 -1P                                  |
|              | [planned 9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable                      | HCR7780 | ▪X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS<br>Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap                |
| z/OS V1.11   | N/A – In z/OS base product   | HCR7751 | ▪All of the above  |
|              | [11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable                              | HCR7770 | ▪Protected Key CP Assist for Cryptographic Function<br>▪New Crypto Express3 and Crypto Express3 -1P                                  |
|              | [planned 9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable                      | HCR7780 | ▪X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS<br>Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap                |
| z/OS V1.12   | N/A – In z/OS base product   | HCR7770 | ▪All of the above  |
|              | [planned 9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable                      | HCR7780 | ▪X9.8 Pin, 64 Bit, z196 CPACF, HMAC, CKDS<br>Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap                |

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| External Name   | FMID    | Applicable z/OS Releases  | Avail   | EoM             |
|---|---------|---|---------|-----------------|
| z/OS or z/OS.e V1.3 or V1.4   | HCR7706 | z/OS V1.3 and z/OS V1.4   | 3/2002  | 9/2004*         |
| z990 Cryptographic CP Assist Support for z/OS V1.3 <sup>1</sup>                                     | HCR7708 | z/OS V1.3   | 6/2003  | 10/2003         |
| z/OS V1.4 z990 Compatibility Support or z/OS.e z990 Coexistence                                     | HCR7708 | z/OS V1.4   | 6/2003  | 10/2003         |
| z/OS V1.4 z990 Exploitation Support or z/OS.e Coexistence Update feature                            | HCR7708 | z/OS V1.4   | 10/2003 | 12/2006         |
| z990 Cryptographic Support <sup>2</sup>   | HCR770A | OS390 V2.10, z/OS 1.2, z/OS 1.3, z/OS V1.4, any z/OS V1.4 features, and z/OS V1.5 | 9/2003  | 5/2004          |
| z/OS or z/OS.e V1.5   | HCR7708 | z/OS V1.5   | 3/2004  | 9/2004          |
| z/OS or z/OS.e V1.6   | HCR770A | z/OS V1.6   | 9/2004  | 10/2005*        |
| z990 and z890 Enhancements to Cryptographic Support <sup>3</sup>                                    | HCR770B | OS390 V2.10, z/OS V1.2, z/OS V1.3, z/OS V1.4 and z/OS V1.5                        | 5/2004  | 12/2006         |
| ICSF 64-bit Virtual Support for Z/OS V1.6 and z/OS.e V1.6 <sup>4</sup>                              | HCR7720 | z/OS V1.6   | 12/2004 | 9/2005          |
| z/OS or z/OS.e V1.7   | HCR7720 | z/OS V1.7   | 9/2005  | 10/2006         |
| Cryptographic Support for z/OS V1R6/R7 and z/OS.e V1R6/R7 <sup>5</sup>                              | HCR7730 | z/OS V1.6 and z/OS V1.7   | 9/2005  | 5/2006          |
| Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7 <sup>6</sup>                      | HCR7731 | z/OS V1.6 and z/OS V1.7   | 5/2006  | 11/2007         |
| z/OS or z/OS.e V1.8   | HCR7731 | z/OS V1.8   | 9/2006  | 10/2007         |
| z/OS V1.9   | HCR7740 | z/OS V1.9   | 9/2007  | 10/2008         |
| Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 web deliverable <sup>7</sup>          | HCR7750 | z/OS V1.7, z/OS V1.8 and z/OS V1.9  | 9/2007  | 11/2008         |
| z/OS V1.10  | HCR7750 | z/OS V1.10  | 9/2008  | 10/2009         |
| Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable <sup>8</sup> | HCR7751 | z/OS V1.7*, z/OS V1.8, z/OS V1.9, z/OS V1.10                                      | 11/2008 | 11/2009         |
| z/OS V1.11  | HCR7751 | z/OS V1.11  | 9/2009  | 10/2010         |
| Cryptographic Support for z/OS V1R9-V1R11 Web deliverable <sup>9</sup>                              | HCR7770 | z/OS V1.9, z/OS V1.10, z/OS V1.11   | 11/2009 | 9/2010          |
| z/OS V1.12  | HCR7770 | z/OS V1.12  | 9/2010  | Planned 10/2011 |
| Cryptographic Support for z/OS V1R10-V1R12 Web deliverable <sup>10</sup>                            | HCR7780 | z/OS V1.10, z/OS V1.11, z/OS V1.12  | 9/2010  | TBD             |

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## STP Planning

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## STP References and Additional Information

- **Redbooks**
  - Server Time Protocol Planning Guide, SG24-7280
    - <http://www.redbooks.ibm.com/redpieces/abstracts/sg247280.html>
  - Server Time Protocol Implementation Guide, SG24-7281
    - <http://www.redbooks.ibm.com/redpieces/abstracts/sg247281.html>
- **Education**
  - Introduction to Server Time Protocol (STP)
    - Available on Resource Link at General Availability (GA)
    - [www.ibm.com/servers/resourcelink/hom03010.nsf?OpenDatabase](http://www.ibm.com/servers/resourcelink/hom03010.nsf?OpenDatabase)
- **STP Web site**
  - [www.ibm.com/systems/z/pso/stp.html](http://www.ibm.com/systems/z/pso/stp.html)
- **Systems Assurance**
  - The IBM team is required to complete a Systems Assurance Review (SAPR Guide, SA06-012) and to complete the Systems Assurance Confirmation Form via Resource Link
  - <http://w3-03.ibm.com/support/assure/assur30i.nsf/WebIndex/SA779>

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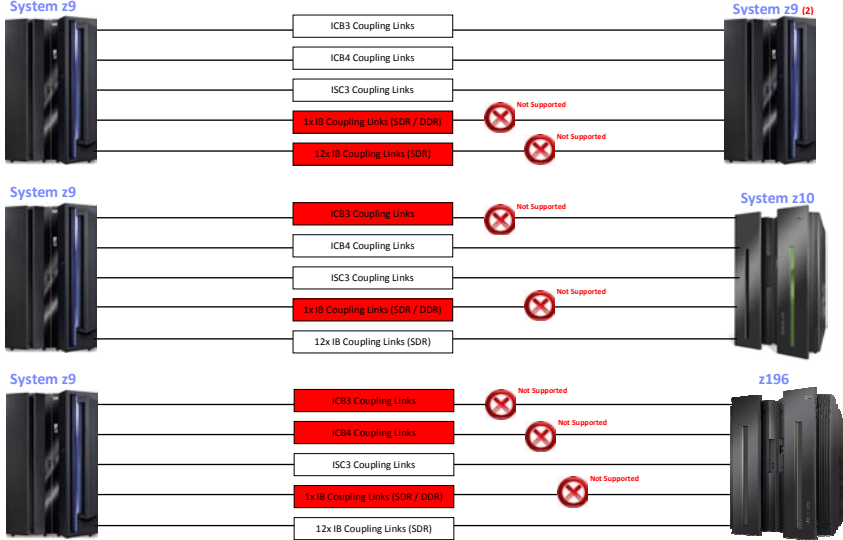
# CF Link Connectivity

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## System z9 Link Connectivity to z9, z10, z196



The diagram illustrates the supported and unsupported link types between different z-series systems:


- System z9 to System z9 (2):** ICB3, ICB4, and ISC3 Coupling Links are supported. 1x IB Coupling Links (SDR / DDR) and 12x IB Coupling Links (SDR) are not supported.
- System z9 to System z10:** ICB3 Coupling Links and 1x IB Coupling Links (SDR / DDR) are not supported. ICB4, ISC3, and 12x IB Coupling Links (SDR) are supported.
- System z9 to z196:** ICB3 and ICB4 Coupling Links are not supported. ISC3 Coupling Links and 12x IB Coupling Links (SDR) are supported. 1x IB Coupling Links (SDR / DDR) are not supported.

1. System z9 (and higher) connectivity to 9672 servers or older is NOT supported  
 2. System z9 withdrawal from marketing effective on 06/30/2010, new feature s will no longer be available for ordering after this date

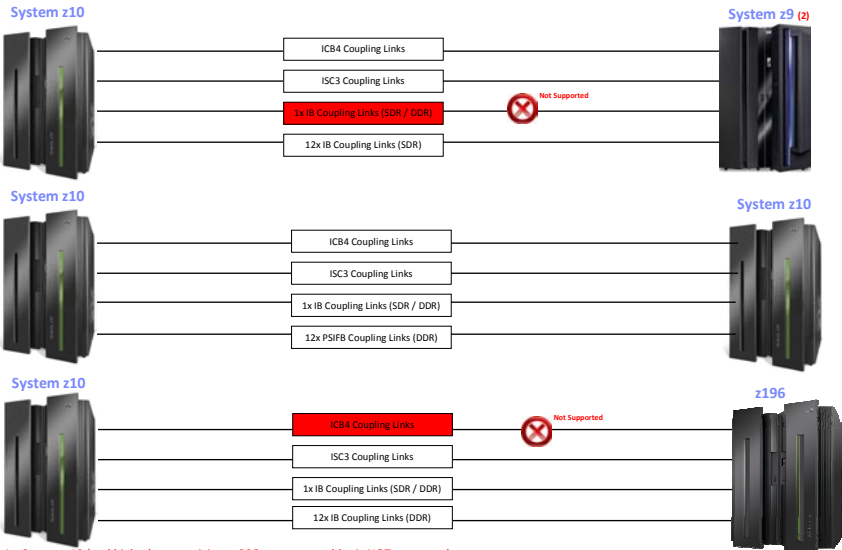
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## System z10 Link Connectivity to z9, z10, z196




The diagram illustrates three scenarios of System z10 link connectivity:

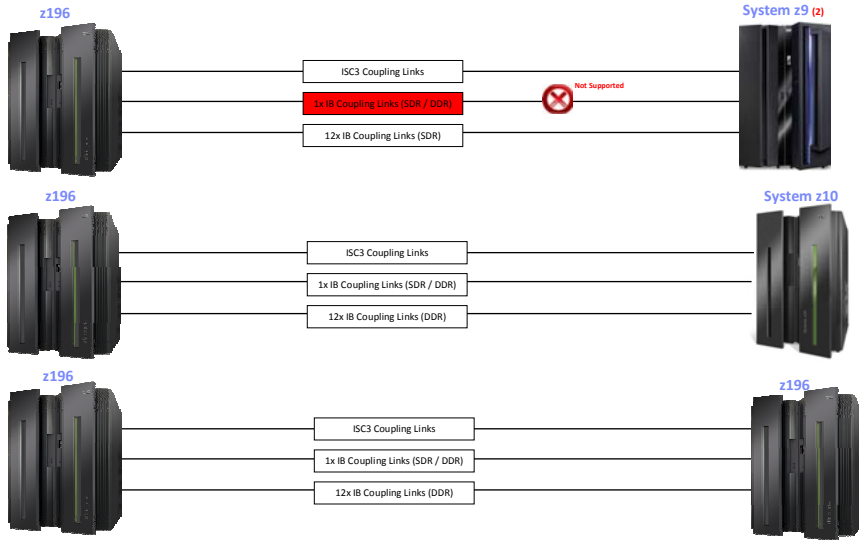
- System z10 to System z9 (z):** Shows ICB4, ISC3, 1x IB, and 12x IB coupling links. The 1x IB link is marked as 'Not Supported'.
- System z10 to System z10:** Shows ICB4, ISC3, 1x IB, and 12x PSIFB coupling links.
- System z10 to z196:** Shows ICB4, ISC3, 1x IB, and 12x IB coupling links. The ICB4 link is marked as 'Not Supported'.

- System z10 (and higher) connectivity to 206x servers or older is NOT supported
- System z9 withdrawal from marketing effective on 06/30/2010, new feature s will no longer be available for ordering after this date

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## System z196 Link Connectivity to z9, z10, z196




The diagram illustrates three scenarios of System z196 link connectivity:


- z196 to System z9 (z):** Shows ISC3, 1x IB, and 12x IB coupling links. The 1x IB link is marked as 'Not Supported'.
- z196 to System z10:** Shows ISC3, 1x IB, and 12x IB coupling links.
- z196 to z196:** Shows ISC3, 1x IB, and 12x IB coupling links.

- z196 connectivity to 208x servers or older is NOT supported
- System z9 withdrawal from marketing effective on 06/30/2010, new feature s will no longer be available for ordering after this date

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**zEnd**

**The Future Runs on System z**

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