z/OS Positioning Software for zEnterprise EC12 Server

The IBM zEnterprise EC12 (zEC12) is the next generation in the evolution of hybrid computing. The IBM zEC12 has a central processor complex (CPC), the IBM zEnterprise Unified Resource Manager, and built-in support for the IBM zEnterprise BladeCenter® Extension (zBX) Model 003. The IBM zEC12 is designed with improved scalability, performance, security, and availability making this an ideal platform for cloud computing, running integrated OLTP and data warehousing and deploying IBM's smarter computing industry solutions. The new 101-core design delivers massive scale across all workloads and enables cost saving consolidation opportunities.

Software Support

All supported releases can run on the new servers and enhancements in SMP/E V3.5 and higher integrate the identification, verification, acquisition, and installation of required PTFs into standard SMP/E processing.

All supported z/OS releases can participate in a sysplex with a CF or operating system image on a zEC12 server. Not all zEC12 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.

The software support for the zEC12 server, similar to the IBM System z196 and z114 servers, differs by z/OS release level, and is provided by a combination of FMIDs and PTFs. The specific PTFs needed to be installed will depend on the z/OS release. In addition, exploitation of certain 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.

The following z/OS releases are supported on the zEC12:
- z/OS 1.13 + PTFs (Exploitation)
- z/OS 1.12 + PTFs (Exploitation)
- z/OS 1.11 + PTFs (Toleration only)
    Note: z/OS 1.11 Lifecycle Extension is required for defect support after September 30, 2012. Also required to obtain PTFs which became available after September 30, 2012.
- z/OS 1.10 + PTFs (Toleration only) **AND** the *z/OS 1.10 Lifecycle Extended Service* (5657-A01). **The Lifecycle Extension must be in place before a customer may obtain required PTFs for the zEC12.** There are no exceptions.

Notes:
1. z/OS releases no longer service supported are not supported on a zEC12 server, with the exception of those offering a Lifecycle Extension.
2. The functional capabilities increase with z/OS releases. That is, z/OS V1.13 has more capabilities than z/OS V1.11. For a list of z/OS releases and the functions supported for those releases, review table 1 under *z/OS Support for zEC12 by Release.*

Preventive Service Planning (PSP) Bucket Information

It is imperative all the appropriate Preventive Service Planning (PSP) buckets are obtained. In addition to the hardware PSP buckets, the software PSP buckets must also be obtained. IBM recommends using SMP/E 3.5 or higher to identify missing service; or ServiceLink to acquire PSP bucket service. (See SMP/E 3.5 below)

To assist in determining the recommended service (identified in these PSP buckets) installed on your system, use the SMP/E REPORT MISSINGFIX command in conjunction with the FIXCAT type of HOLDDATA, as follows:
- 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.

- 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.zEC12-2827**
  - **IBM.Device.Server.zEC12-2827.Exploitation**
  - **IBM.Device.Server.zEC12-2827.ParallelSysplexInfiniBandCoupling**
  - **IBM.Device.Server.zEC12-2827.ServerTimeProtocol**
  - **IBM.Device.Server.zEC12-2827.zHighPerformanceFICON**
  - **IBM.Device.Server.zEC12-2827.UnifiedResourceManager**

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* book.

- Periodically, acquire the latest HOLDDATA and rerun the *REPORT MISSINGFIX* command to find out if there are any new PTFs recommended for the zEC12 server.

- If the PSP buckets were reviewed some time ago, review them again to ensure any newly identified z/OS service has been installed

SMP/E 3.5 or **SMP/E 3.6** provides the function which greatly simplifies the identification, verification, acquisition, and installation tasks for service documented in PSP buckets by processing a new kind of HOLDDATA associating 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 or V3.6 processes FIXCAT ++HOLD statements (during RECEIVE processing) the resolving PTF identified on the ++HOLD statement is assigned an SMP/E SOURCEID matching the fix category on that statement. This enables specifying 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 or V3.6 can simplify your task.

In the first scenario, you have all available PTFs applicable to your environment already RECEIVEd. To install all the PTFs needed for minimal support of a zEC12 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.zEC12-2827).

To include all support for the zEC12 optional functions, then the SOURCEID operand could either list all fix categories of interest, or use wildcarding to have SMP/E determine all applicable fix categories. This latter approach would automatically express interest in future zEC12 functions (should new fix categories be created). Specifying IBM.Device.Server.zEC12-2827*, or IBM.Device.Server.zEC12*, or just *2827* all result in similar results: an interest in the minimal support for zEC12 as well as exploitation of all optional functions. Furthermore, if you wanted the minimal support for either a

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zEC12 you could include the fix category in the SOURCEID parameter. In these examples the asterisk ('*') represents 0-n characters, while the percent sign ('%') (not shown) represents a single character. Based on the structured names of the fix categories for hardware support, you can use SOURCEIDs with wildcarding to ensure PTFs for multiple generations of servers are installed.

In the second scenario, you don't know if you have RECEIVEd all the PTFs needed since you only obtain PTFs right before installing them. You need to first obtain the latest HOLDDATA using your favorite method. (Example: 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(ZOSR13T)
          FIXCAT(IBM.Device.Server.zEC12-2827) .

Example: RECEIVE ORDER(CONTENT(HOLDDATA))...).

The REPORT MISSINGFIX command checks your GLOBAL zone for FIXCAT HOLDDATA matching 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 not resolved. In other words, it reports which PTFs (fixes) are missing for the specified fix categories. Furthermore, the command produces a customized job 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 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, use them periodically to ensure the latest PTFs specified in the hardware PSP bucket are installed (since PSP buckets can be updated daily). SMP/E V3.5 or V3.6 also provides an Explorer function which helps in identifying new fix categories which may be of interest. Go to this URL for a description of all the fix categories:
http://www-03.ibm.com/systems/z/os/zos/smpe/fixcategory.html

PSP Bucket Reference Table		
Upgrade	**Subset**	**Description**
2827DEVICE	2827/ZOS 2827/ZVM 2827/ZVSE	zEnterprise zEC12 Server
2817DEVICE	2817/ZOS 2817/ZVM 2817/ZVSE	zEnterprise z196 Server
2818DEVICE	2818/ZOS 2818/ZVM 2818/ZVSE	zEnterprise z114 Server
2097DEVICE	2097/ZOS 2097/ZVM 2097/ZVSE	z10 Enterprise Class
2098DEVICE	2098/ZOS 2098/ZVM 2098/ZVSE	z10 Business Class
2094DEVICE	2094/ZOS 2094Z/VM 2094VSE/ESA	z9 Enterprise Class
2096DEVICE	2096/ZOS 2096Z/VM 2096VSE/ESA	z9 Business Class

ZOSV1R13	BCP ICSF7780 ICSF7790 ICSF77A0	ICSF
ZOSV1R12	BCP ICSF7770 ICSF7780 ICSF7790 ICSF77A0	ICSF
ZOSV1R11	BCP ICSF7751 ICSF7770 ICSF7780 ICSF7790	ICSF
ZOSV1R10	BCP ICSF7751 ICSF7750 ICSF7770 ICSF7780	ICSF

CPU Measurement Facility (CPUMF) architecture: The CPU Measurement Facility is a hardware facility which consists of counters and samples. The facility provides a means to collect run-time data for software performance tuning with low overhead. The detailed architecture information for this facility can be found in the System zEC12, z196 or z114 Library in Resource Link.

The number of CPU measurement facility counters for the zEC12 is increased to 80. Common storage is increased by 128 bytes. The structure of the SMF 113 record does not change, however, the values, interpretations and frequency of certain sections do change. Formulas and use of these fields are documented in Techdocs:

- Available now for z10,z196 and z114 – *CPU MF – 2012 Updates and WSC Experiences* @ **http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TC000066**
- Available at announce for zEC12

Current tools using this data need to be updated for the zEC12 server.

IBM recommendation is to enable CPUMF on the z10, z196, z114 or zEC12 servers and leave it enabled. The overhead to collect this data is minimal. It is required to collect this data to perform capacity planning on the zEC12 server. For additional education on the value and use of the CPUMF facility including a description of the SMF 113 records and a sample report use the following link: **http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS4922**

Power Savings Mode: There is a new SMFPRMxx PARMLIB option, MAXEVENTRECS, which allows governing the number of event interval records to be collected when the processor capacity changes. The default is zero. The default must be adjusted to collect extra records between intervals when the processor capacity changes. There is a new parameter to the Modify HIS command to override the default action when a CPU speed change is detected within the HIS (Hardware Instrumentation Services) component.

zAAPS on zIIPs
IBM continues to support running zAAP workloads on zIIP processors ("zAAP on zIIP"). IBM plans to provide a PTF for APAR OA38829 for z/OS V1.12 and z/OS V1.13 in September, 2012 to remove the restriction preventing zAAP-eligible work loads from running on zIIP processors when a zAAP is

installed on the server. This is intended only to help facilitate migration and testing of zAAP workloads on zIIP processors.

Real Storage Management (RSM) Enhancements (z/OS V1R13)

The RSM enhancements are delivered via a web *deliverable "z/OS V1R13 RSM Enablement Offering Web Deliverable"* (FMID JBB778H) for z/OS 1.13. (This is a z/OS 1.13 exclusive). Planned to be available December 14, 2012. This web deliverable will increase the nucleus size by roughly 380K (above the 16MB line) when IPLed. It also adds 24K (6 pages) of ESQA per CPU defined to an LPAR. Consider analyzing your private storage usage.

These enhancements are:
- Flash Express Support exploits Storage Class memory (SCM) technology for z/OS paging and SVC dumps. It is designed to help improve availability and handling of paging workload spikes when running z/OS 1.13. This can help availability by reducing latency from paging delays which can occur at the start of the workday or during other transitional periods. It should also help eliminate delays occurring when collecting diagnostic data during failures.
  - Updates to IEASYSxx in SYS1.PARMLIB
  - Command changes for D M=SCM and D ASM
  - Specification of PLPA and COMMON optional (target 1Q2013)
  - Dynamic reconfiguration for Flash Express (1Q2013)

- Pageable 1MB Large Page Support

1Q2013

z/OS V1.13 with PTFs **and** the *z/OS V1R13 RSM Enablement Offering* web deliverable, planned for availability in the first quarter of 2013, is designed to help improve processor performance by enabling:
- Middleware to use 2 GB pages
- Exploitation is planned for the IBM 31-bit SDK for z/OS, Java technology Edition, V7.0.0 (5655-W43) and SDK7 IBM 64-bit SDK for z/OS, Java Technology Edition, V7.0.0 (5655-W44
- Optional PLPA and COMMON page data set support, used only for quick and warm start IPLs.

IBM zAware (z/OS 1.13)

The IBM System z Advanced Workload Analysis Reporter (IBM zAware) provides a smart solution for detecting and diagnosing anomalies in z/OS systems. IBM zAware, which consists of an integrated set of analytic applications, creates a model of normal system behavior based on prior system data, and uses pattern recognition techniques to identify unexpected messages in current data from the z/OS systems it is monitoring. This analysis of events provides nearly real-time detection of anomalies which provide easy viewing through a graphical user interface (GUI). The GUI may be used to diagnose the cause of past or current anomalies.

This function requires a zEC12 server running z/OS 1.13. The firmware instance runs in its own LAPR and receives data from each z/OS image that is being monitored. IBM zAware can monitor operating system images on the same CPC or from other CPCs which are running z/OS 1.3 with the required PTFs.

The processor, storage and memory resource requirements will vary by installation. See the *System z Advanced Workload Analysis Reporter (IBM zAware) Guide*, (SC27-2623-00)

The zEC12 Server for IBM zAware host system requires:
- An IFL or general purpose CP

- Runs in a new "zAware" type LPAR
- OSA OSD CHPIDs to gather instrumentation data to provide outbound alerts requires a dedicated IP address for the server partition
- Ninety days of historical SYSLOG or formatted OPERLOG data to prime zAware
  - A "bulk loader" is provided to push historical data to the zAware server to create a model using archived "syslogs". Sample JCL is provided in SYS1.SAMPLIB(AIZBLK).

The z/OS systems to be monitored clients of IBM zAware server must meet these requirements:
- The z/OS system must be running on a supported System z server:
  - A zEC12
  - A IBM zEnterprise 196 (z196) or z114
  - A System z10® Enterprise Class (z10™ EC) or Business Class (z10 BC)
- The system must be configured as a single-system sysplex (monoplex), a system in a multisystem sysplex, or a member of a Parallel Sysplex®.
- The system must be running z/OS Version 1 Release 13 (V1R13) with the following PTFs, or a later release.
  - The PTF for system logger APAR OA38747 and its prerequisite APAR OA38613
  - The PTF for z/OS bulk load client for IBM zAware APAR OA39256
- The system must be using the operations log (OPERLOG) as the hardcopy medium
- To use the IBM zAware graphical user interface (GUI), you must use one of the following browsers:
  - Mozilla Firefox Extended Support Release (ESR) 10 with available updates
  - Microsoft Windows Internet Explorer 9

Migration Considerations

Because the zEC12 has, as its basis, the technology used on the z196 family of servers, there are only a few additional steps required to migrate from a z196 or z114 server to the zEC12 server. Not all System zEC12 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 first install either software or hardware to exploit a specific function. The delta (from a z196) minimum support for a zEC12 server is delivered by software PTFs. Exploitation of some cryptographic functions on the zEC12 server is provided via a web deliverable (FMID). Depending on the cryptographic support provided, and the z/OS release running, you may need to download and install a different ICSF Web deliverable. RSM enhancements are delivered via a separate web download for z/OS V1R13.

Migration from an older server (z10, z9, z890, z990, z900, z800 or earlier) requires performing the migration steps associated with the "skipped" servers, however it does not mean those intervening servers must be installed, only the migration considerations must be satisfied.

Also, refer to *the z/OS Migration to the IBM zEnterprise System Version 1 Releases 11, 10, 9, 8 and 7* (pdf version) for more information. htttp://publibz.boulder.ibm.com/zoslib/pdf/e0z2g120.pdf

Plan for the Fixed HSA on zEC12 Server: On a zEC12, (like z196 servers), preplanning requirements are minimized by offering a fixed HSA and introduction of the ability to seamlessly include such events as creation of LPARs, inclusion of logical subsystems, changing logical processor definitions in an LPAR, and introduction of cryptography into an LPAR. This fixed HSA is designed to improve availability by avoiding outages. It also minimizes the preplanning requirements. The zEC12 has a fixed 32GB Hardware System Area (HSA) which is managed separately from customer memory.

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SCRT: If Sub-Capacity Charging is implemented the SCRT level must be upgraded to process zEC12 SMF data. SCRT V20.2.10 or higher provides support for the zEC12 server. If you collect SMF data on a System zEC12 server which will be processed by SCRT, you must minimally use SCRT V20.2.10 to generate the SCRT reports. If you do not need to process SMF data from a zEC12 server, you are not required to download or use SCRT. SCRT levels are available from the SCRT website at: http://ibm.com/zseries/swprice/scrt

New zArchitecture Instructions

In support of the zEC12 server there are new machine instructions. The new machine instructions (mnemonics) may collide with (be identical to) the names of Assembler macro instructions you use. In the event of such collisions, the Assembler's default opcode table (UNI) will treat specification of these names as instructions when APAR PM49761 is installed, probably causing Assembler error messages and possibly causing generation of incorrect object code. If you write programs in Assembler Language, compare the names of Assembler macro instructions used to the new machine instructions (documented in the latest *Principles of Operation* SA22-7832) to identify any such conflicts or collisions which would occur. Identical names will cause Assembler errors or the generation of incorrect object code when you assemble your programs.

Also, an "as is" tool can be used to assist in identifying any conflicts. Available with this document on the Techdocs web site. The author of this tool is documented within the tool.

If a conflict is identified, take one of these 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
```

Global Resource Serialization (GRS)

A zEC12 does not support ESCON. Therefore a GRS Ring ESCON CTC is not supported on a zEC12 Server. Previously GRS could not directly manage FICON CTCs. Two unrecommended GRS Ring configurations affected are:
- A GRS Ring complex larger than one Sysplex
- A GRS Ring not utilizing Sysplex signaling

The migration options are two fold. Convert to a Parallel Sysplex exploiting GRS Star. (GRS Star is recommended over GRS Ring). Or, convert to a Basic Sysplex exploiting XCF signaling for GRS Ring. Choosing not to convert to XCF signaling requires a GRS toleration PTF (APAR OA38230) to enable GRS to use FICON for a GRS Ring configuration. This toleration support does not enhance the robustness of GRS-managed CTS. This toleration must be installed across the GRS Complex and is rolled back to z/OS 1.10 for customers having the Lifecycle Extension for z/OS V1.10.

z/OS XL C/C++ Exploitation of zEC12 Machine Instructions (z/OS V1R13 and higher)

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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(10) exploits instructions available on zEC12 servers. For more information, refer to the ARCHITECTURE compiler option in *z/OS XL C/C++ User's Guide.* The TUNE compiler option allows the optimization of an 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.*

Once programs exploit the ARCH(10) or TUNE(10) options, those programs can only run on a System zEC12 server, or an operation exception will occur. This is a consideration for programs running on different server levels (System z196, z10 and z9 servers) during development, test, and production, as well as during fallback or disaster recovery.

Sysplex

z/OS on z9EC, z9BC z900, z800, z990, or z890 servers cannot participate in a Sysplex with a zEC12 server.

zEC12 server is **only** supported in a parallel sysplex with other zEC12, z196, z114 servers, z10 EC and z10 BC. If you are running z/OS on z9EC, z9BC, z900, z800, z990, or z890 servers, then you cannot add a zEC12 server to that sysplex. That is, you will not be able to perform rolling IPLs to introduce a zEC12 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 z10 or later to have zEC12 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 zEC12 into that sysplex, you must migrate those images to a System z10 (or later) server prior to introducing the zEC12 server.

When changing coupling facility control code (CFCC) levels, the coupling facility structure sizes might change. System zEC12 servers initially ship with CFCC Level 18. If, as part of your migration to a zEC12 server, you change CFCC levels (either by placing a coupling facility on the System zEC12 server or by moving the coupling facility to another supported server, (at a higher CFCC level), you may require larger structure sizes than previously. If your CFCC levels are identical, structure sizes are not expected to change when you migrate from a previous server to a zEC12 server. Use the CFSIZER tool (http://www-03.ibm.com/systems/z/cfsizer/) to determine appropriate structure sizes.

IBM DB2 10 for z/OS (5605-DB2) with the PTF for APAR PM70575 running on z/OS V1.12 or z/OS V1.13 with the PTF for APAR OA37550 on IBM zEnterprise EC12 (zEC12) servers with CFLEVEL 18 is planned to exploit new z/OS function to allow batched updates to be written directly to disk without being cached in the Coupling Facility in a Parallel Sysplex. This is designed to keep the data in the cache used by online transactions more current, which is expected to help improve performance during batch update periods. Also, this can help avoid application stalls that might sometimes occur during large concurrent batch updates. This function is also planned to be made available on IBM zEnterprise 196 (z196) servers with CFLEVEL 17 and an MCL.

Server Time Protocol - time synchronization for Parallel Sysplex
The zEC12 does not support connection to an External Time Reference (ETR). The zEC12 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 zEC12, z196, z114, 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/pso/stp.html. Although the zEC12 does not support attachment to a Sysplex Timer, it can participate in a Mixed-CTN having a z10 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. **Note: The zEC12 will be the last high-end server to support connections to a STP Mixed-CTN.**

Customers must migrate to STP prior to migrating to a zEC12. Customers may run the SMP/E REPORT MISSINGFIX command on their z/OS systems and specify the FIXCAT category for IBM.Device.Server.zEC12-2827.ServerTimeProtocol to obtain required service.

Migrate from ICB-4 to InfiniBand coupling links: The Integrated Cluster Bus 4 (ICB-4) Coupling Links are not supported on a zEC12 CPC. The 12x InfiniBand coupling links 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 the *IBM System z Connectivity Handbook* (SG24-5444).

Customers may run the *SMP/E REPORT MISSINGFIX* command on their z/OS systems and specify the FIXCAT category for IBM.Device.Server.z196-2827.ParallelSysplexInfiniBandCoupling to obtain required service.

Cryptography

The **required** minimum level of ICSF is HCR7770 on a zEC12. If you are running z/OS 1.10 or 1.11 with the ICSF level shipped in those releases you must download and install a later version of ICSF. ISCF web downloads are located at: http://www-03.ibm.com/systems/z/os/zos/downloads

In addition, there are toleration PTFs required so older versions of ICSF (FMIDs HCR7770, HCR7780 or HCR7790) will recognize the Crypto Express4S (CE4XS) as a Crypto Express3 (CEX3).

If you upgrade versions of ICSF as part of your migration to the zEC12, **and** you will be sharing a key repository (CKDS, PKDS or TKDS) with an older version of ICSF there will likely be toleration maintenance that must be installed on those older systems. Most every version of ICSF introduces new key types (such as new TKDS records introduced in HCR7770 or variable length AES HMAC keys introduced in HCR7780 or X9.24 key wrapping support introduced in HCR7790). If you plan on using these new key types and will be sharing the key repository with an older version of ICSF, then you must install the toleration maintenance on the older version so it will not choke on the new key types. For example, if you create a new TKDS record on you zEC12 system, running HCR77A0 and that TKDS is shared with a HCR7751 system, the toleration maintenance on HCR7751 will tell ICSF to ignore that record in the TKDS. So the specific toleration maintenance will depend on what versions of ICSF will be sharing the key repositories and which new record types you will be leveraging.

A FIXCAT category for this level of ICSF is available for identifying fixes allowing prior levels of ICSF to coexist with, and fallback from, the *Cryptographic Support for z/OS V1.11-V1.13* web deliverable (FMID HCR77A0). Category: IBM.Coexistence.ICSF.z/OS_V1R12-V1R13-HCR77A0

Exploitation of the Crypto Express4S requires a web deliverable (*Cryptographic Support for z/OS V1R12-V1R13* (HCR77A0) on z/OS 1.12 or higher. This web deliverable is not integrated in z/OSV1R13 ServerPac orders. The web download and updated ICSF publications are available on

the download site for HCR77A0 in PDF format and on ResourceLink. The URL for the web download is:

http://www-03.ibm.com/systems/z/os/zos/downloads/

All systems sharing a PKDS must be at HCR77A0 to exploit the new PKDS/TKDS Coordinated Administration support.

See Table 2 for a summary of ICSF Toleration and Table 3 for ICSF Exploitation.

UDX
A UDX is custom code installed in the secure hardware of the Crypto Express card. It allows customers to implement their own unique code within the tamper resistant hardware. On System z, the UDX code is always developed based on customer specs by IBM (either the Crypto Competence Center in Denmark or IBM Global Services in the US) and delivered to the customer for installation inside the Crypto Card. There is also a service offering, called DKMS, from the Crypto Competence Center which may require a UDX depending, on the customer environment.

Because UDX interfaces directly with the Crypto card and with ICSF (the z/OS component providing the software interface to the crypto hardware), the UDX must be rebuilt anytime either a new crypto hardware device is installed or the version of ICSF changes. If a customer will be migrating from one hardware device to another (for example, from a CEX2 on a z10 to a CEX3 on a z196 or a CE4XS on a zEC12) or upgrading the version of ICSF on their new machine, the UDX will need to be rebuilt. You can check whether a UDX is loaded into a card using the UDX Status column on the Crypto Configuration panel on the HMC. In addition, the UDX must be defined to the specific ICSF environment via the UDX statement in the ICSF Options data set.

In many cases, the contract with the Services organization covers rebuilding for new hardware and software platforms, so it is simply a matter of contacting the appropriate organization to have the UDX updated and tested, however you should build time into the install schedule for getting the updated UDX's from IBM. Additionally, if the customer's support contract for the UDX has lapsed, there may be additional time required to get the paperwork in place.

TKE
To exploit new cryptography function (especially EP11 mode support) on the zEC12 the new TKE LIC 7.2 LIC and HCR77A0 are required. However, if you simply want to load keys securely, TKE V7.0 or higher LIC is required. The TKE 7 LIC also requires TKE 7 hardware (FC #0841).

Additional Cryptographic Support
See *Table 2* for the ICSF FMID shipped with the base operating system and level of cryptographic support.

Review the following WSC technical documents on Crypto at www.ibm.com/support/techdocs

TD103782   z/OS: ICSF Version and FMID Cross Reference

WP100810   A Synopsis of System z Crypto Hardware

TD105523   REXX EXECs to Query the z/OS ICSF/Crypto Environment

PRS4216   CFSTINF – Display the names of ICSF key stores

z/OS Positioning Software for zEnterprise EC12 Server

Table 1: z/OS Support for EC12 Server by Release

| Release | zEC12 PSP Bucket – 2827DEVICE 2827/z/OS | | | | | | | | | | | | | | | | | | |
| | Base Support | | | | | | | | | Exploitation Support | | | | | | | | | |
	Base zEC12 Support	OSA-Express4S (Gbe LX and SR, 1000BASE-T, 10 Gbe LR and SR)	FICON Express8S (CHPID FC)	IFB Coupling Links	Crypto Express4S Toleration[2]	High Performance FICON (zHPF)	CPU Measurement Facility (HIS)	GRS FICON CTC Toleration	New z/Architecture Instructions	CF Level 18	Crypto Express4S Exploitation[3]	XL C/C++ ARCH(10)/TUNE(10)	IBM zAware (z/OS Monitoring)	Java exploitation of the Transactional Execution Facility	Flash Express (Storage Class Memory - SCM)	Pageable Large Pages	Dynamic reconfiguration support for Flash Express[4]	2 GB Large Page[4]	Optional PLPA/ COMMON page data set support[4]
z/OS V1.10[1]	P	P	P	P	WP	P	P	P	P	N	N	N	N	N	N	N	N	N	N
z/OS V1.11[1]	P	P	P	P	WP	P	P	P	P	N	N	N	N	N	N	N	N	N	N
z/OS V1.12	P	B	B	B	WP	P	P	P	P	P	W	N	N	N	N	N	N	N	N
z/OS V1.13	P	B	B	B	WP	P	P	P	P	P	W	P	P	P	WP	WP	WP	WP	WP
z/OS V2.1[4,5]	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

[1] – The Lifecycle Extension for z/OS V1.10 (5656-A01) is required to acquire toleration PTFs and for support. The Lifecycle Extension for z/OS V1.11 (5657-A01) is required for support after September 30, 2012

[2] – A Crypto Web Deliverable (HCR7770 or higher) AND a PTF is required for toleration. Support differs depending on the Crypto Web Deliverable installed

[3] – Crypto Exploitation differs based on the Crypto Web Deliverable installed

[4] - Planned target 1Q2013. All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

[5] - z/OS V2.1 announced as an IBM Statement of Direction

B – FMID shipped in Base product   P – PTF is required   W – FMID shipped in a Web Deliverable

Table 2: z/OS Crypto Support – Toleration

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.10[1]	N/A – In z/OS base product	HCR7750	Prior release plus: 4096-bit RSA keys, ISO-3 PIN Support, CPACF support for SHA-394 and SHA-512, Reduced support of retained private key in ICSF
	[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, ICSF Query Algorithms, Key Token Policy support, and Secure Key AES
	[11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable	HCR7770	Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC[1], CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
z/OS V1.11	N/A – In z/OS base product	HCR7751	Prior release plus: Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, Key Token Policy support, and Secure Key AES
	[11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable	HCR7770	Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC[1], CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, and additional Elliptic Curve Cryptography (ECC) functions.

Table 3: z/OS Crypto Support – Exploitation 1 of 2

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.12	N/A – In z/OS base product	HCR7770	Prior release plus: Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC*, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, and additional Elliptic Curve Cryptography (ECC) functions.
	[10/2012] Cryptographic Support for z/OS V1R12-V1R13 Web deliverable	HCR77A0	Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys

Table 3: z/OS Crypto Support – Exploitation 2 of 2

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.13	N/A – In z/OS base product	HCR7780	Prior release plus: X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, additional and Elliptic Curve Cryptography (ECC) functions.
	[10/2012] Cryptographic Support for z/OS V1R12-V1R13 Web deliverable	HCR77A0	Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
z/OS V2.1	N/A – In z/OS base product	HCR77A0	Prior release plus: Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys

Additional Documentation

IBM zEnterprise zEC12 Technical Introduction (Redbook)	SG24-8050
IBM zEnterprise zEC12 Technical Guide (Redbook)	SG24-8049
IBM System z Connectivity Handbook (Redbook)	SG24-5444
CHPID Mapping Tool User's Guide	GC28-6900
zArchitecture Principles of Operation	SA22-7832
zEnterprise System Introduction to Ensembles)	GC27-2609
Multiple Subchannel Sets: An Implementation View (Red Paper)	REDP-4387
Server Time Protocol Planning Guide (Redbook)	SG24-7280
Server Time Protocol Implementation Guide (Redbook)	SG24-7281
Server Time Protocol Recovery Guide (Redbook)	SG24-7380
IBM zEnterprise zEC12 Configuration Setup	SG24-8034

Software Checklist

__ Identify Server migrating from:
- 1. z800 or z900
- 2. z890 or z990
- 3. z9 EC or z9 BC
- 4. z10 EC or z10 BC
- 5. z196 or z114

__ Identify z/OS release
- 1. z/OS 1.10 - requires z/OS 1.10 Lifecycle Extended Service (5656-A01 for defect support **and** for acquiring required PTF service.
- 2. z/OS 1.11 - requires z/OS 1.11 Lifecycle Extended Service (5657-A01 for defect support after September 30, 2012.
- 3. z/OS 1.12 or z/OS 1.13

__ Identify cryptographic requirements
    __ Web download (if applicable)

__ Identify zIIP and zAAP requirements
    __ Install all zIIP service based on function exploiting

__ Review Sysplex configuration

__ Migrate from unsupported hardware features to newer technology

__ Review and plan GRS configuration (ESCON no longer supported)

__ Pull Hardware PSP buckets

__ Pull Software PSP buckets

__ Identify exploitation functions

__ Identify service requirements – Use SMP/E FIXCAT

__ Identify CFCC level
    __ Run CFSIZER (if applicable)

__ Accommodate functions for the EC12 server to be discontinued on future servers

__ Order PTF service

__ Install PTF service

__ Review new mnemonics introduced

__ Implement STP (or a Mixed-CTN) timing network

__ Migrate from ICB-4 to InfiniBand coupling links

__ Turn on CPU Measurement Facility

__ Pull WSC Documents
    __ FLASH10236 (if applicable – pre z990 and z890 Server)
    __ FLASH10477 if applicable - z9 Server)
    __ WP101229 (Hiperdispatch)
    __ TD105581 (z196 and z114)

__ Schedule Systems Assurance Review