IBM Americas, ATS, Washington Systems Center

An Integrated Cryptographic Service Facility (ICSF HCR77A0) for z/OS Update for zEC12

Share 12685

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QR Code

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Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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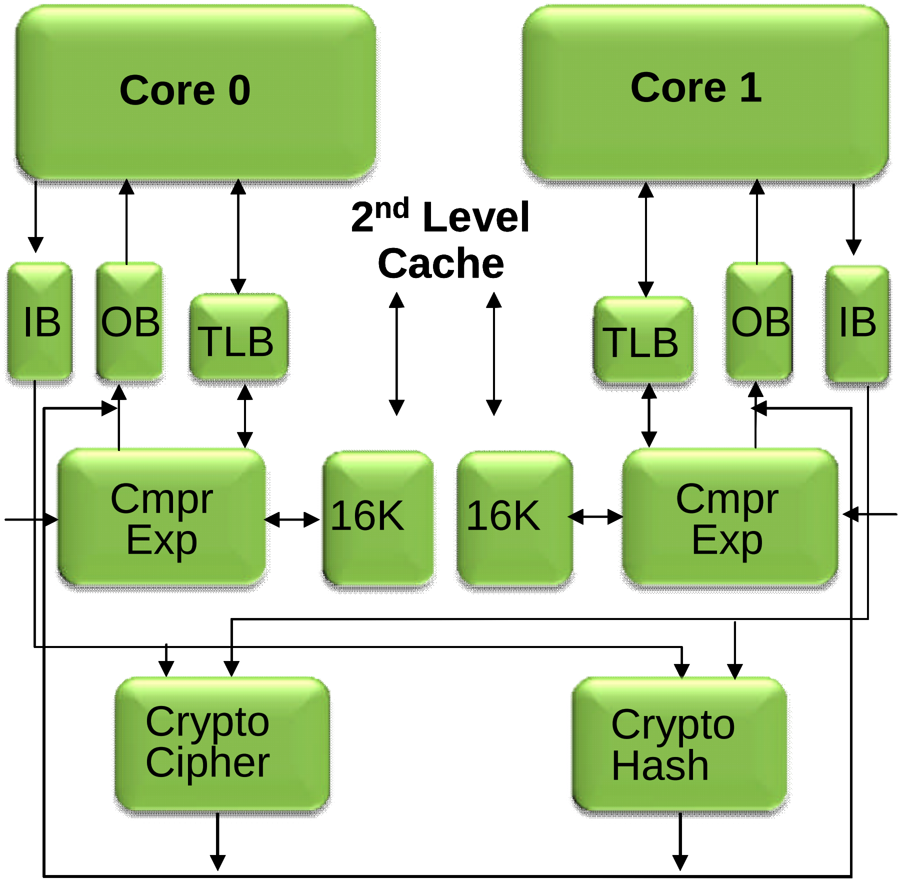
Agenda

- **zEC12 Hardware Changes**
  - –CPACF
  - –Crypto Express4S
- **TKE V7.2**
- **ICSF HCR77A0**
- **A couple of other things**

z196/z114/z10 Compression and Cryptographic Engine

- **Coprocessor dedicated to each core (Was shared by two cores on z196)**
  - Independent compression engine
  - Independent cryptographic engine
  - Available to any processor type
  - Owning processor is busy when it's coprocessor is busy
- **Data compression/expansion engine**
  - Static dictionary compression and expansion
- **CP Assist for Cryptographic Function**
  - 290-960 MB/sec bulk encryption rate
  - DEA (DES, TDES2, TDES3)
  - SHA-1 (160 bit)
  - SHA-2 (244, 256, 384, 512 bit)
  - AES (128, 192, 256 bit)
  - CPACF FC #3863 (No charge) is required to enable some functions and is also required to support Crypto Express4S or Crypto Express3 feature



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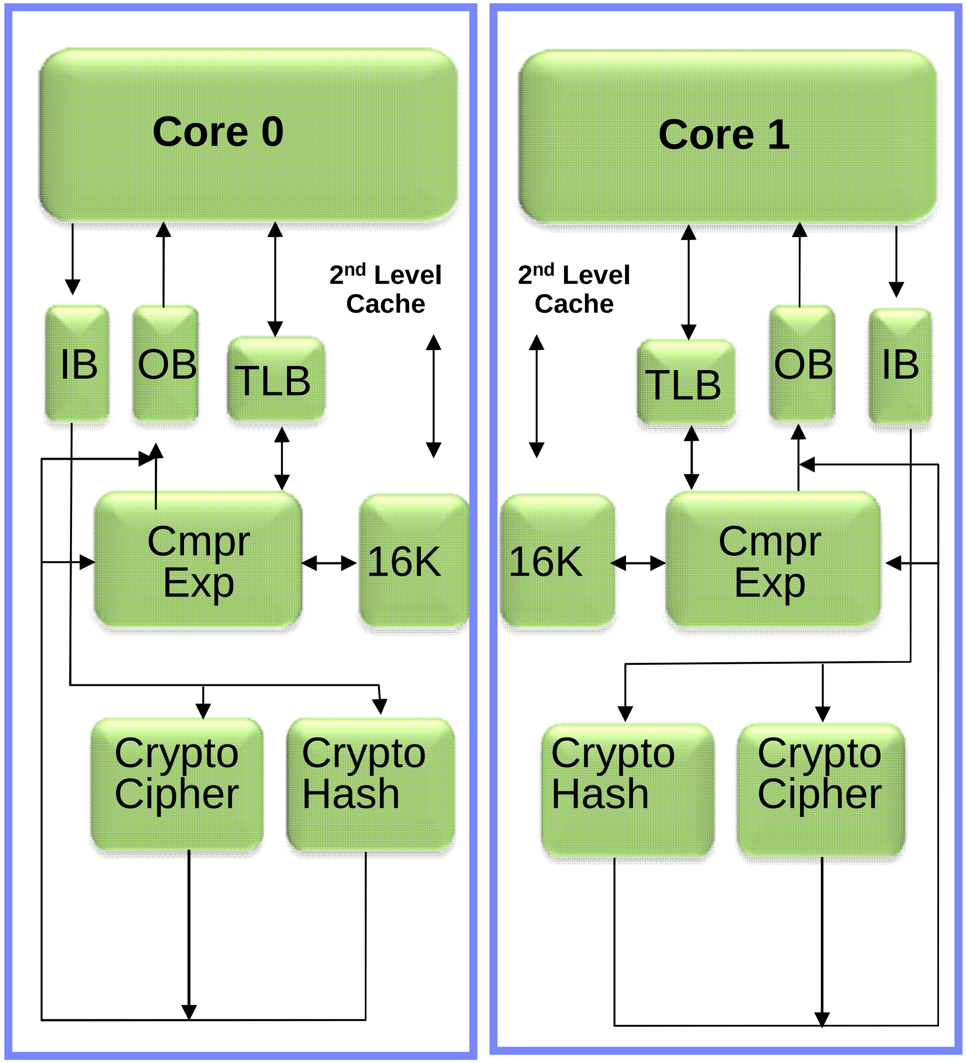
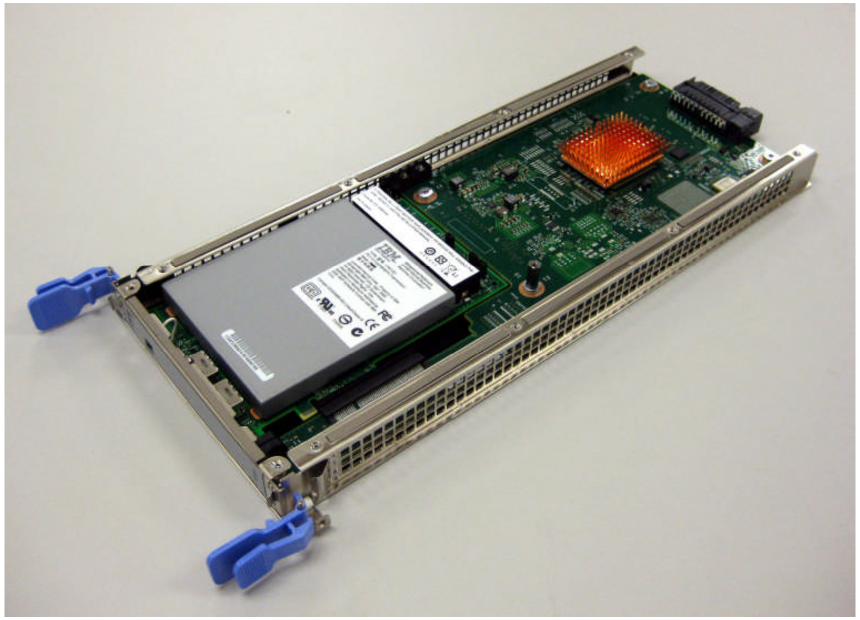


Crypto Express4S

- **One PCIe Adapter per feature**
  - **Initial order – 2 features**
- **Up to 16 features per server**
- **FIPS 140-2 Level 4**
- **Installed in the PCIe I/O Drawer**
- **Prerequisite: CPACF (#3863)**



- Only one configuration option can be chosen at any given time
- Switching between configuration modes will erase all card secrets
  - ✓ Exception: Switching from CCA to accelerator or vice versa
- Accelerator
  - ✓ For SSL acceleration
  - ✓ Clear key RSA operations
- Enhanced: Secure IBM CCA coprocessor (default)
  - ✓ Optional: TKE workstation (#0841) for security-rich flexible key entry or remote key management
- New: IBM Enterprise PKCS #11 (EP11) coprocessor
  - ✓ Designed to meet public sector requirements
    - ▫ Both FIPS and Common Criteria certifications
  - ✓ Required: TKE workstation (FC #0841) for management of the Crypto Express4S when defined as an EP11 coprocessor

Enterprise Public Key (EP11) Mode

- **PKCS #11 (from Wikipedia)**

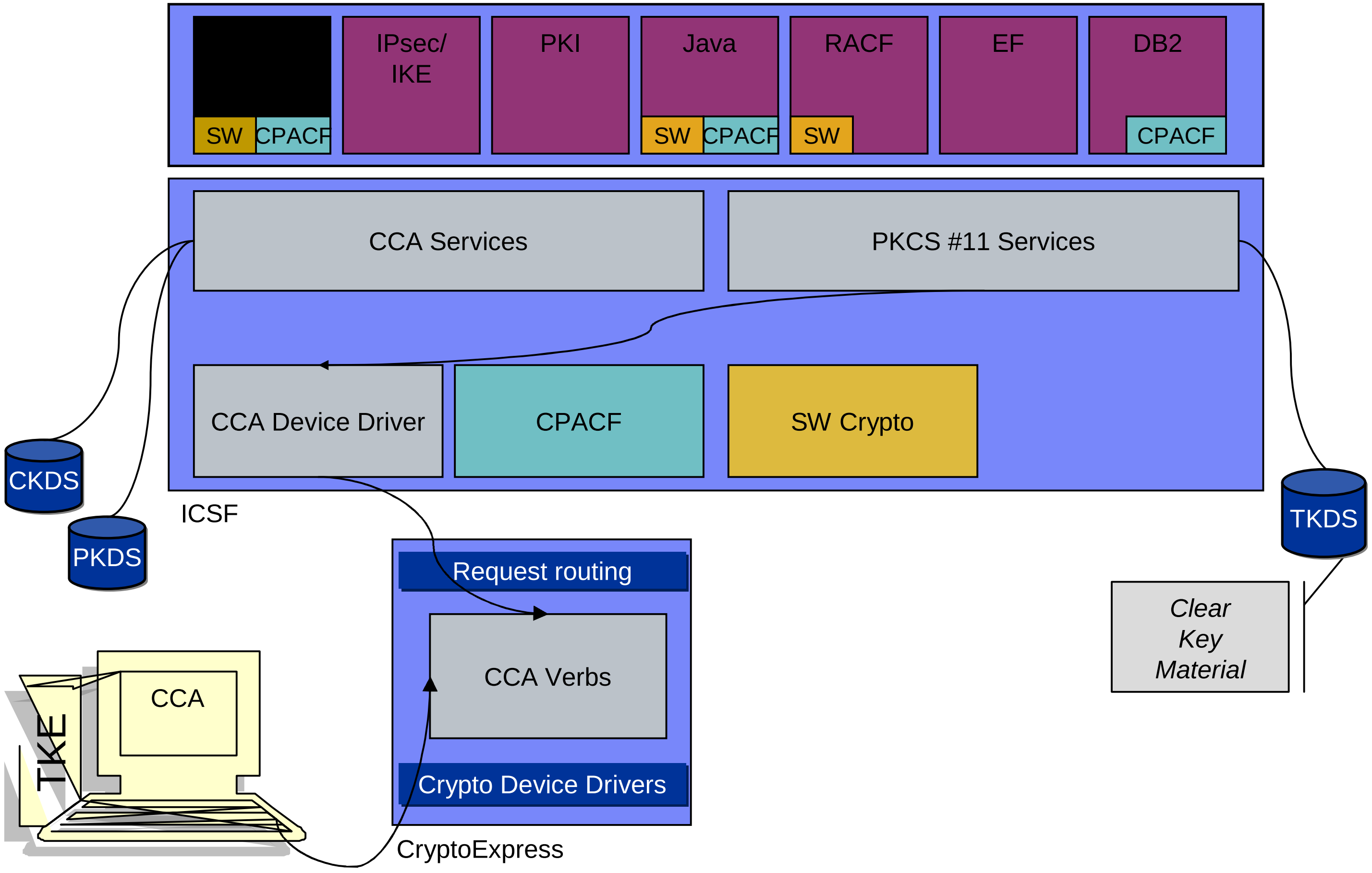
  Since there isn't a real standard for cryptographic tokens, this API has been developed to be an abstraction layer for the generic cryptographic token. **The PKCS #11 API defines most commonly used cryptographic object types (RSA keys, X.509 Certificates, DES/Triple DES keys, etc.) and all the functions needed to use, create/generate, modify and delete those objects.**

  PKCS #11 is largely adopted to access smart cards and HSMs. Most commercial Certification Authority software uses PKCS #11 to access the CA signing key or to enroll user certificates. Cross-platform software that needs to use smart cards uses PKCS #11, such as Mozilla Firefox and OpenSSL (using an extension).

- **PKCS #11 (from RSA, http://www.rsa.com/rsalabs/node.asp?id=2133)**

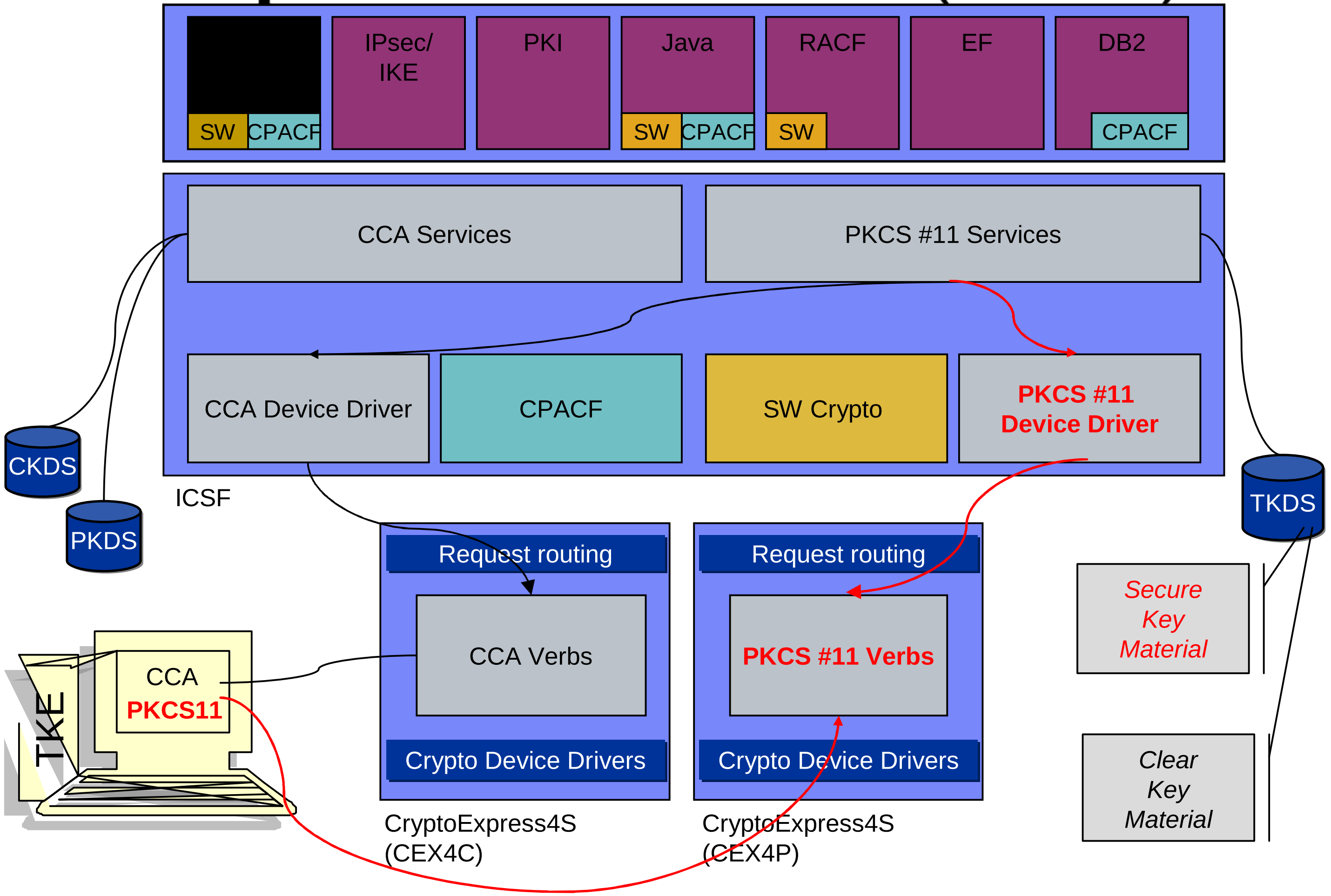
  This standard specifies an API, called Cryptoki, to devices which hold cryptographic information and perform cryptographic functions. **Cryptoki, pronounced crypto-key and short for cryptographic token interface, follows a simple object-based approach, addressing the goals of technology independence (any kind of device) and resource sharing (multiple applications accessing multiple devices), presenting to applications a common, logical view of the device called a cryptographic token.**

z/OS Security Stack (Current)



Problem: PKCS #11 support is clear key only

z/OS Security Stack – Enterprise PKCS #11 (EP11) Mode



EP11 enables Secure Key PKCS #11

zEC12 I/O Feature Cards

Features	Offered As	Maximum # of features	Maximum channels	Increments per feature	Purchase increments
FICON					
FICON Express8S	NB	**160**	**320 channels**	**2 channels**	**2 channels**
FICON Express8	CF*	**44**	**176 channels**	**4 channels**	**4 channels**
FICON Express4 10km LX, SX	CF*	**44**	**176 channels**	**4 channels**	**4 channels**
ISC-3 Coupling	CF*	**12**	**48 links**	**4 links**	**1 link**
OSA-Express					
OSA-Express4S 10 GbE	NB	**48**	**96 ports**	**1 port/1 channel**	**1 feature**
OSA-Express4S 1 GbE OSA-Express4S 1000BASE-T**	NB	**48**	**96 ports**	**2 ports/1 channel**	**1 feature**
OSA-Express3	CF*	**24**	**96 ports**	**2 (10 GbE) / 4 ports**	**1 feature**
Crypto					
Crypto Express4S**	NB	**16**	**16 PCIe adapters**	**1 PCIe adapter**	**1 feature *** **
Crypto Express3* **	CF*	**8**	**16 PCIe adapters**	**2 PCIe adapters**	**1 feature *** **
Special Purpose					
Flash Express**	NB	**8**	**8 PCIe adapters**	**1 PCIe adapter**	**2 features**

* CF - Carry forward ONLY

** NB – New Build (New on zEC12)

*** Two features initially, one thereafter

Not Supported – ESCON, Crypto Express2, FICON Express2 (or older FICON), OSA-Express2, and Power Sequence Control

IBM Enterprise PKCS #11 Model

- **Based on PKCS #11 specifications v2.20 and more recent amendments**
- **Supports secure PKCS #11 keys**
  - Keys that never leave the secure boundary of the coprocessor unencrypted
- **Designed to meet Common Criteria (EAL 4) standards and FIPS 140-2 Level 4 requirements**
  - Certifications tailored to meet requirements of this market place
- **Conforms to the Qualified Digital Signature (QDS) Technical Standards**
  - Becoming a mandate by the European Union
  - High qualiity electronic signatures
    - Trusted to the same extent as hand written signatures
  - Uses: Smart passports, national id cards …
- **Supported on Crypto Express4S only**
- **Requires a TKE Workstation with TKE 7.2 LIC**

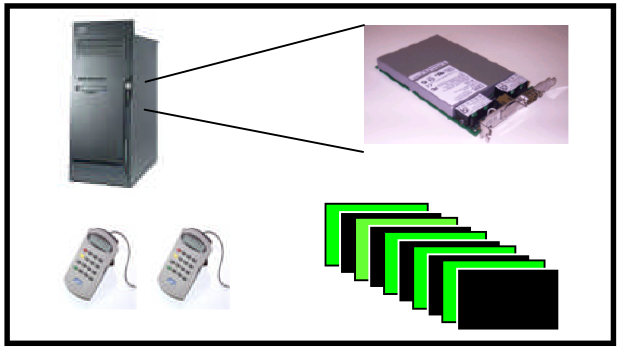
IBM Common Cryptographic Architecture (CCA) Enhancements

- **Wrap weaker keys with stronger keys for security standards compliance**
  - 24-Byte DES-MK
- **Secure Cipher Text Translate (CIPHERXI, CIHPERXL, CIPHERXO key types)**
- **Derived Unique Key per Transaction (DUKPT) for derivation of MAC and Encryption Keys**
- **Compliance with new Random Number Generator standards**
- **Europay, Mastercard and Visa (EMV) enhancements for applications supporting American Express cards**

Trusted Key Entry (TKE) Workstation

Components

- **Workstation with a 4765 Cryptographic Coprocessor**
- **TKE 7.2 LIC**
- **Smart card readers and smart cards**
  - Required if using Enterprise PKCS #11 LIC
  - Optional if using IBM CCA LIC

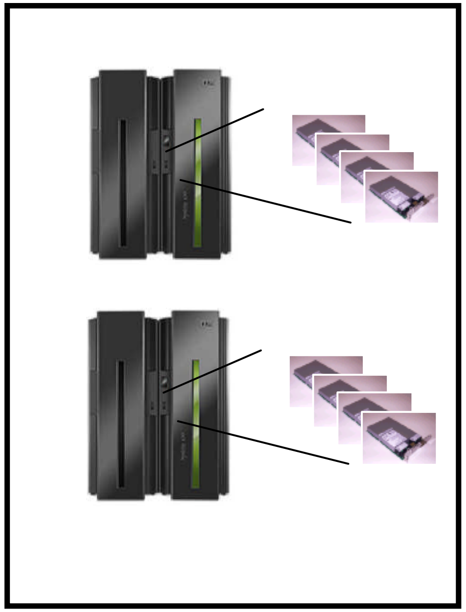


Purpose

- **Used to manage multiple Cryptographic Coprocessors and keys on various generations of System z (zEC12, z196, z114 and z10 EC/BC) from a single point of control**
  - Support requirements for standards
  - Simplification of tasks

Trusted Key Entry (TKE) 7.2

- **Support of new hardware or firmware functions**
  - Support for Crypto Express4S defined as a CCA processor
  - Required for Crypto Express4S defined as an Enterprise PKCS #11 coprocessor
  - New DES operational keys
  - New AES Cipher key attribute
  - Allow creation of corresponding keys
  - Support 4 smart card readers
- **Support requirements for standards**
  - Stronger key wrapping



TKE 7.2 – Support up to four smart card readers

- EP11 host crypto module administration requires use of smart cards.
- EP11 host crypto modules command signing structure different from CCA.
  - Up to 8 signatures required. (User configured 1-8)
  - Each signer must have a unique smart card.
- The amount of smart card swapping could be very high, if reader count limited to 2.
  - Swapping implies constant PIN re-entry.
  - Potential usability issue even with low signature requirement.
- Support 2, 3, or 4 smart card readers on the TKE. The minimum of 2 will not change.
- Because of the “shortage” of USB ports on the workstation, you can install an unpowered or powered USB hub.

Smart Card part 74Y0551

- **Smart cards used to**
  - Hold credentials
  - Hold key material
  - Perform encryption functions.
- **TKE has 6 different uses for smart cards**
  - Certificate Authority – used to define TKE Zones
  - TKE – for managing CCA adapters
  - EP11 – for managing EP11 adapters
  - MCA (Migration Certificate Authority) - for defining zones associated with the migration wizard
  - Key Part Holder – for holding parts of a master key being transported
  - Injection Authority – for injecting master keys into new adapters

HCR77A0

- **Coordinated Key Administration Extended to RSA-MK, ECC-MK and PKDS**
- **Random Number Cache**
- **FIPS on Demand (to verify FIPS 140-2 Level 1 compliance)**
- **Key Generation Utility Program (KGUP) Enhancements**

Coordinated KDS Administration:

Coordinated CKDS Master Key Change and Coordinated CKDS Refresh

- Simplified process for performing ICSF CKDS administration in both a single system environment and more importantly in a sysplex environment.
- In a sysplex environment coordinated CKDS refreshes and coordinated CKDS change-mk operations are driven from a single ICSF instance across the sysplex.
- CKDS sysplex communication protocol level 2 provides better sysplex communication performance, uses less overhead, and is more serviceable then the prior release sysplex communication protocol.

ICSF Coprocessor Management Panel

```
 --------------------------------------------------------------------------------
|                                                                                |
|  CSFGCMP0 ---------------- ICSF Coprocessor Management ---------------------  |
|  COMMAND ===>                                                                  |
| Select the coprocessors to be processed and press ENTER.                       |
| Action characters are: A, D, E, K, R, and S. See the help panel for details.  |
|                 Serial                                                         |
|   CoProcessor     Number         Status      AES    DES    ECC    RSA    P11   |
|   -----------    ---------       ------      ---    ---    ---    ---    ---   |
|  __ H01                          ACTIVE                                        |
|  __ G02          24778902        ACTIVE       A      A      A      A           |
|  __ G05          98001236        OFFLINE                                       |
|  __ SP08         97006090        ACTIVE                                  A     |
|  __ SA09         97006094        ACTIVE                                        |
|  __ SC14         97006062        ACTIVE       A      A      A      A           |
|                                                                                |
 ----------------------------------------------------------------------------
```

CEX4S prefix values:

- **SA – Accelerator**
- **SC – CCA Coprocessor**
- **SP – Enterprise PKCS #11 Coprocessor**

Software support at GA

z/OS Support :

- z/OS V1 R13 with PTFs (Exploitation plus Flash Express and IBM zAware Support)
- z/OS V1R12 with PTFs (Exploitation)
- z/OS V1R11 with PTFS (Toleration, Lifecycle Extension required after September 30, 2011)
- z/OS V1R10 (Toleration, Lifecycle Extension Required)

z/VM Support :

- VM65007 – Compatibility support for CEX4SA

z/VSE Support:

- z/VSE 5.1 with DY47414 – Provides support for zEC12 and CEX4S (in accelerator or coprocessor mode)
- z/VSE 5.1 with DY47397 & UD53864 provides OpenSSL support
- z/VSE 4.3 will run on zEC12, but will not recognize a CEX4S; it can use a CEX3 on the zEC12

TPF Support:

- PJ40362 – Support for CEX4S (accelerator mode only)
- PJ40387 – Support for local IPTE (nothing to do with crypto)

Linux on System z Support:

- IBM intends to support zEC12 with the following distributions:
  - SUSE SLES 10 and SLES 11,
  - Red Hat RHEL 5 and RHEL 6

Toleration Maintenance – HCR7770, HCR7780 or HCR7790 on zEC12

- **CEX4S Toleration – OA39075**
  - Versions of ICSF prior to HCR77A0 require this APAR to use the CEX4S in toleration mode (it treats the CEX4S like a CEX3)
- **VM Toleration – OA40267**
  - Timing issue with VM

Toleration Maintenance – HCR7750*, HCR7751*

- **CEX3 Toleration – OA29839**
  - Toleration support for CEX3

*These versions of ICSF are out of support

Toleration Maintenance – Sharing a PKDS

- **HCR7770, HCR7780, HCR7790 require toleration maintenance if they will share a key repository with HCR77A0**
  - Weak key wrapping – OA39484
    - New RSA private key section can't be used by earlier releases

Sharing a KDS (old news) - but still applies

- **Prior versions of ICSF introduced new key tokens**
  - HCR7770
    - New TKDS record - OA29997
  - HCR7790
    - X9.24 CBC Key Wrapping – OA33320
    - Variable Length AES keys – OA36718

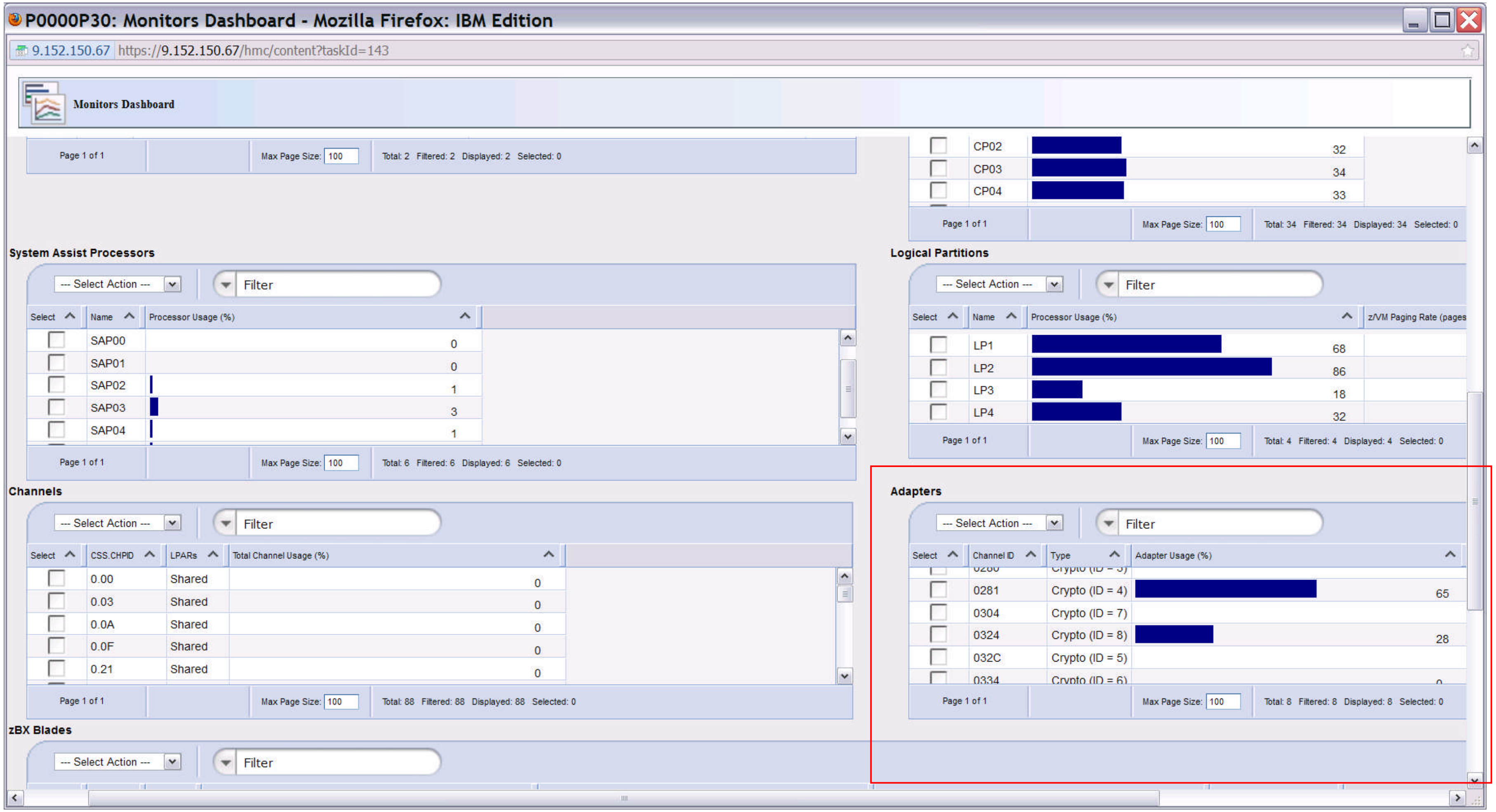
A Couple of Other Things

- **SPE for Encryption Facility for z/OS**
- **Monitor Dashboard**
- **Flash Express**
- **Time Source STP**

IBM Encryption Facility for z/OS (5655-P97) – OA40664

- **RFC 4880 Support in the IBM Encryption Facility**
  - Speculative Key ID Support
  - Multiple recipients with Symmetrically Encrypted Integrity Protected Data Packet
  - Support for notation Data Sub-packets containing raw binary data
- **Batch Key Generation and Batch Public Key Export**

Monitor Dashboard Support for Crypto



P0000P30: Monitors Dashboard - Mozilla Firefox: IBM Edition
9.152.150.67 https://9.152.150.67/hmc/content?taskId=143
Monitors Dashboard

Page 1 of 1 | Max Page Size: 100 | Total: 2 Filtered: 2 Displayed: 2 Selected: 0

Select	Name	Processor Usage (%)
□	CP02	32
□	CP03	34
□	CP04	33

Page 1 of 1 | Max Page Size: 100 | Total: 34 Filtered: 34 Displayed: 34 Selected: 0

System Assist Processors

--- Select Action ---
Filter

Select	Name	Processor Usage (%)
□	SAP00	0
□	SAP01	0
□	SAP02	1
□	SAP03	3
□	SAP04	1

Page 1 of 1 | Max Page Size: 100 | Total: 6 Filtered: 6 Displayed: 6 Selected: 0

Logical Partitions

Select	Name	Processor Usage (%)	z/VM Paging Rate (pages
□	LP1	68	
□	LP2	86	
□	LP3	18	
□	LP4	32	

Page 1 of 1 | Max Page Size: 100 | Total: 4 Filtered: 4 Displayed: 4 Selected: 0

Channels

Select	CSS.CHPID	LPARs	Total Channel Usage (%)
□	0.00	Shared	0
□	0.03	Shared	0
□	0.0A	Shared	0
□	0.0F	Shared	0
□	0.21	Shared	0

Page 1 of 1 | Max Page Size: 100 | Total: 88 Filtered: 88 Displayed: 88 Selected: 0

Adapters

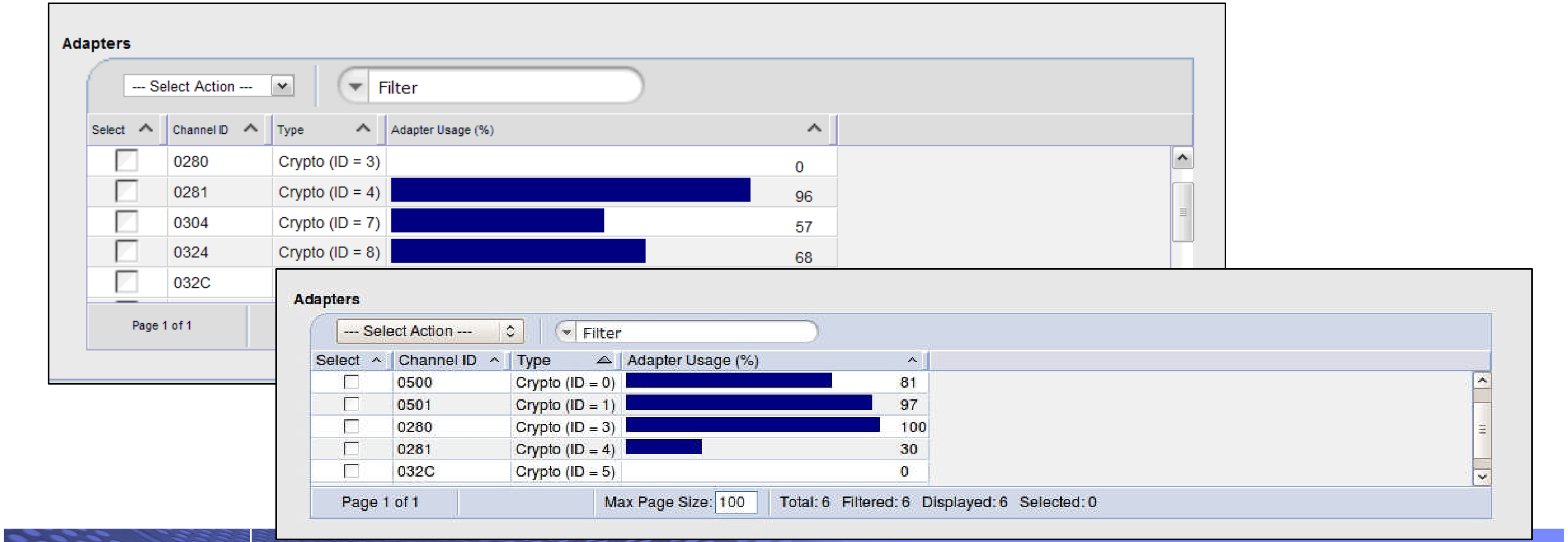
Select	Channel ID	Type	Adapter Usage (%)
□	0280	Crypto (ID = 3)	
□	0281	Crypto (ID = 4)	65
□	0304	Crypto (ID = 7)	
□	0324	Crypto (ID = 8)	28
□	032C	Crypto (ID = 5)	
□	0334	Crypto (ID = 6)	0

Page 1 of 1 | Max Page Size: 100 | Total: 8 Filtered: 8 Displayed: 8 Selected: 0

zBX Blades

Monitor Dashboard support for crypto

- **Monitors Dashboard on the HMC and SE was enhanced with a new Adapters table for System zEC12**
- **Will provide information about Utilization rate per Crypto Processor**
  - System wide utilization (not LPAR specific)
  - Shown per Crypto #
- **Source: collected Crypto performance measurement data (as used by RMF)**



Adapters

Select	Channel ID	Type	Adapter Usage (%)
□	0280	Crypto (ID = 3)	0
□	0281	Crypto (ID = 4)	96
□	0304	Crypto (ID = 7)	57
□	0324	Crypto (ID = 8)	68
□	032C		

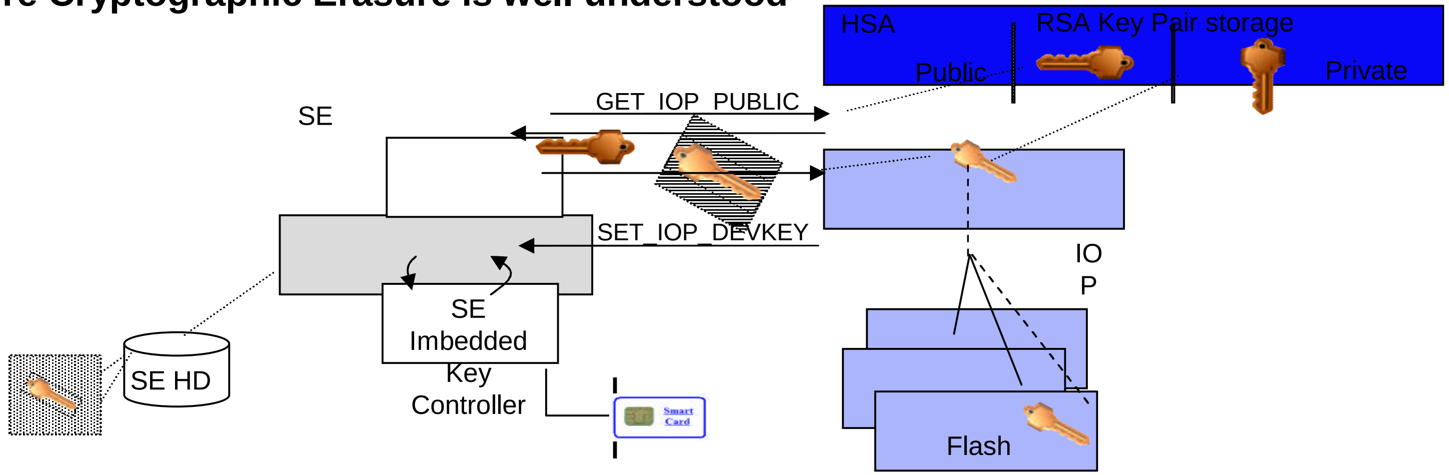
Adapters

Select	Channel ID	Type	Adapter Usage (%)
□	0500	Crypto (ID = 0)	81
□	0501	Crypto (ID = 1)	97
□	0280	Crypto (ID = 3)	100
□	0281	Crypto (ID = 4)	30
□	032C	Crypto (ID = 5)	0

Page 1 of 1 Max Page Size: 100 Total: 6 Filtered: 6 Displayed: 6 Selected: 0

Security of Data on Flash Express

- **System z internal flash can be used for paging, dumping and …**
  - It can contain all data, including audited personally identifiable data
- **Client data on flash is protected by strong encryption**
  - Done using hardware encryption at the device, like IBM's Disk and Tape encryption
- **Key management is provided based on a Smart Card in each Support Element**
- **End of life Audit is based on access to the Smart Card, not access to Flash Memory**
- **Secure Cryptographic Erasure is well understood**



HMC – STP (Server Time Protocol) Broadband Security

- **Network Time Protocol (NTP) Authentication – Added to the HMC's NTP communication with external NTP time servers**
  - Symmetric key authentication – described in RFC-1305 (made available in NTP Version 3)
  - Autokey (using public key cryptography) – described in RFC-5906 (made available in NTP Version 4)

Questions

QR Code