MAINFRAME CRYPTO

Unscrambling the Complexity of Crypto!

Crypto Update
An Alternative View

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Agenda

- HCR77D2
- HCR77D1

z/OS: ICSF Version and FMID Cross Reference (TD103782)

FMID	External Name	Applicable z/OS Releases	Availa-bility	Planned EoS	Supported Servers
HCR77C0	Cryptographic Support for z/OS V2R1 – z/OS V2R2	z/OS V2.2; z/OS V2.1	Oct 2016	TBD	z9; z10; z196/z114; zEC12/zBC12; z13/z13s; z14/z14R1**,z15**
	z/OS 2.3	z/OS V2.3	Sep 2017	TBD	
HCR77C1	Cryptographic Support for z/OS V2R1 – z/OS V2R3	z/OS V2.3; z/OS V2.2; z/OS V2.1	Sep 2017	TBD	z9; z10; z196/z114; zEC12/zBC12;z13;z14, z15**
HCR77D0	Cryptographic Support for z/OS V2R2 – z/OS V2R3	z/OS 2.2; z/OS V2.3	Dec. 2018	TBD	z10; z196/z114; zEC12/zBC12;z13;z14,z15**
	z/OS 2.4	z/OS 2.4	Oct 2019	TBD	
HCR77D1	Cryptographic Support for z/OS V2R2 – z/OS V2R4	z/OS V2.2; z/OS V2.3	Sept 2019	TBD	z10; z196/z114; zEC12/zBC12;z13;z14,z15
HCR77D2	Cryptographic Support for z/OS V2R5	z/OS 2.5	Sept. 2021	TBD	z13, z13s; z14, z14 ZR1; z15

**Older versions of ICSF may need toleration maintenance installed to support newer hardware

Adapted from: https://www.ibm.com/support/pages/zos-icsf-version-and-fmid-cross-reference

HCR77D2

Common Record Format Large (KDSRL)
Common Record Format (KDSR)

- aka KDSR – Key Data Set Reformat
- Support longer keys
- Metadata fields
  - Fixed-length fields
  - Variable-length fields
    - Tag
    - Length
    - Data
- Conversion to either KDSR or KDSRL
  - ICSF Panels (under KDS Management CSFMKM10 panel)
  - Coordinated KDS Administration (CSFCRC) API

Keystore Data Set Definitions

- CKDS – Cryptographic Key Data Set
  - RECORDSIZE(372,32756) – HCR77D2 KDSRL format
  - RECORDSIZE(372,2048) – HCR77A1 KDSR format
  - RECORDSIZE(332,1024) – HCR7780 support HMAC variable length keys
  - RECORDSIZE(252,252) – pre HCR7780
- PKDS – PKA Key Data Set
  - RECORDSIZE(800,32756); DATA CISZ(32768) – HCR77D2 KDSRL
  - RECORDSIZE(800,3800); DATA CISZ(8192) – HCR77A1 KDSR format
  - RECORDSIZE(350,3800) – HCR7750 support longer RSA 4096-bit keys
  - RECORDSIZE(350,2800) – pre HCR7750*
- TKDS – Token Key Data Set
  - RECORDSIZE(2200,32756); DATA CISZ(32768) – HCR77D2 KDSRL
  - RECORDSIZE(2200,32756)

*HCR77B1 and earlier versions are no longer supported

KDSR Format (HCR77A1)

- Metadata
  - Reference date (STCKE & yyyymmdd format)
  - Additional metadata (w/HCR77B0)
    - Key material validity start date
    - Key material validity end date
    - Record archive flag
    - Record archive date
    - Record recall date
    - Record prohibit archive flag
    - Installation user data
    - Key fingerprint

KDSRL Format (HCR77D2)

- New IBM metadata fields
  - Last used Service Name
  - Last used class reference date
    - Tracked by TrackClassUsage
      - DD - DATADEC
      - DE - DATAENC
- TRACKCLASSUSAGE(class1,class2) – new ICSF Option
  - DATADEC
  - DATAENC
  - Reference day tracking must be enabled (KDSREFDAYS>0)

PKDS support for QSA keys

- APIs
  - PKDS Key Record Create (CSNDKRC and CSNFKRC)
  - PKDS Key Record Delete (CSNDKRD and CSNKFRD)
  - PKDS Key Record Read/ Read2 (CSNDKRR/CSNDKRR2 and CSNFKRR/CSNFKRR2)
  - PKDS Key Record Write (CSNDKRW and CSFNFKRW)
- Requires KDSRL format PKDS
  - RC=8, RS=x'DDF' (3551) if LRECL is too short
- QSA Private key protected by ECC-MK
- PKDS Keys Utility

New Key Store Policy Controls

- Archived key for Data Decryption Use Control
  - XFACILIT profile CSF.KDS.KEY.ARCHIVE.DATA.DECRYPT
    - Allows a key with the ARCHIVE flag on, to be used, but only for decrypt operations
    - CKDS & TKDS; does not apply to PKDS

Control	Encrypt	Decrypt	Key Record Read2
CSF.KDS.KEY.ARCHIVE.USE	RC=8 (RC indicating archived)	RC=8 (RC indicating archived)	RC=8 RS=x'D10' (3344)
CSF.KDS.KEY.ARCHIVE.DATA.DECRYPT	RC=8, RS=x'D5E' (3422)	RC=0	RC=0, RS=x'D5F' (3423)

- CSFKEYS PKA ECC token private-key name checking control
  - XFACILIT profile CSF.CSFKEYS.ECC.PRIVATEKEYNAME.ENABLE

XFACILIT CSF.WRAPENH3.OVERRIDE

- DES Key Wrapping
  - ORIGINAL – WRAP-ECB Mode wrapping
  - ENHANCED – WRAP-ENH
    - HCR7780
    - SHA-1 based derivation key, CBC Mode
    - ANSI X9.24
  - WRAPENH2
    - HCR77C1 with APAR OA55184
    - SHA-256
  - WRAPENH3 -
    - OA60318 (back to z/OS V2.2) per z/OS 2.5 announcement letter
    - SHA-256 HMAC
- CSFCNV2 – utility to convert
- This new XFACILIT profile allows programs that use the WRAP-ENH API rule to default to WRAPENH3, instead of WRAPENH2

Regional Cryptographic Servers

- Removed CCA Support for Regional Cryptographic Servers
  - SOD in Announcement Letter 220-378 z/OS V2.4 3Q 2020 New Functions and Enhancements
  - SOD in Announcement Letter 221-213 z/OS V2.4 2Q 2021 Enhancements
- PKCS #11 Support still available

HCR77D1

z15 Hardware Support

- CPACF
  - New Compute Digital Signature Authentication (KDSA) instruction - Clear key ECC support
  - Protected key support for Elliptic Curve keys
- CEX7S
  - Single Port and Dual Port cards
  - EP11 Mode support for PKCS #11 v2.4 standard
  - QSA Support (PKCS #11 only)
  - Designed for 2X Performance improvement as a CCA card
  - Designed for 3X Performance improvement as an accelerator
  - Protected key support for Elliptic Curve keys

Crystals - Dilithium

- Crystals – Cryptographic Suite for Algebraic Lattices
- A lattice of numbers
  - Start with a list of 5 numbers
  - Add 3 of them together
  - Give you that sum
  - Can you figure out which 5 numbers I used?
- What if the list had a thousand numbers, each with thousands of digits and you have to pick 500?

HCR77D1 (and HCR77D0 via APAR OA57089)

- ANSI TR-34 Remote Key Loading
- PCI-HSM Compliance for AES & RSA keys
- New PIN APIs for DK Customers

New Subtype 49 (SMF Type 82)

- Master key event resulted in a new master key value being promoted to current
  - Name of the system that wrote the record
  - Event flags
  - KDS Name
  - KDS Type
  - Serial Numbers (of Coprocessors) affected
  - MKVPs affected (AES, DES, ECC, RSA, P11)
  - Domain affected
  - TOD (STCKE format)

New Health Checks

- ICSF_PKCS_PSS_Support
  - Detects whether the current hardware config supports PKCS-PSS algorithms
  - RSA-PSS signatures rely on keys that are (must be) protected by the ECC-MK, not the RSA-MK
  - RACDCERT command with RSA(PKDS) will fail for such a key, if the ECC-MK is not loaded
- ICSF_WEAK_CCA_KEYS
  - Lists the labels of records in the PKDS with keys that are cryptographically weak
    - Modulus size < 1024-bits
    - Process all keys (Archived or Inactive as well as Active keys)

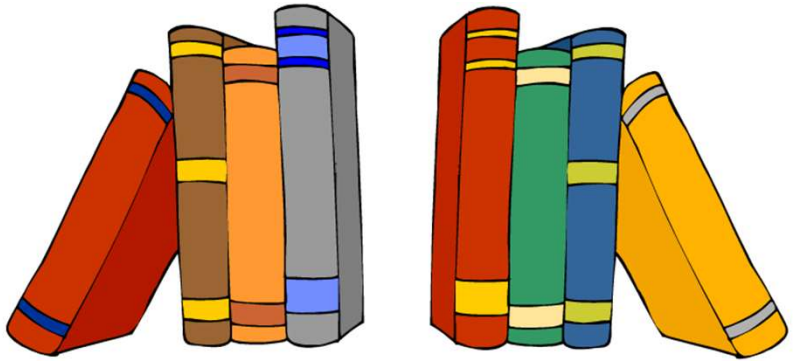
Deprecated callable services

Old API	New API
Clear key Import (CSNBCKI/CSNECKI)	Multiple Clear Key Import (CSNBCKM/CSNECKM)
Key Translate (CSNBKTR/CSNEKTR)	Key Translate2 (CSNBKTR2/CSNEKTR2)
Prohibit Export (CSNBPEX/CSNEPEX)	Restrict Key Attribute (CSNBKRA/CSNEKRA)
Prohibit Export Extended (CSNBPEXX/CSNEPEXX)	Restrict Key Attribute (CSNBKRA/CSNEKRA)
Secure Key Import (CSNBSKI/CSNESKI)	Multiple Secure Key Import (CSNBSKM/CSNESKM)
Decode (CSNBDCO/CSNEDCO)	Symmetric Key Decipher (CSNBSYD/CSNBSYD1/CSNESYD/CSNESYD1)
Encode (CSNBECO/CSNEECO)	Symmetric Key Encipher (CSNBSYE/CSNBSYE1/CSNESYE/CSNESYE1)
Encrypted PIN Translate (CSNBPTR/CSNEPTR)	Encrypted PIN Translate2 (CSNBPTR2/CSNEPTR2)

Announcement Letters

- 121-029 z15
  - https://www.ibm.com/downloads/cas/US-ENUS121-029-CA/name/US-ENUS121-029-CA.PDF
- 118-075 z14
  - https://www.ibm.com/common/ssi/rep_ca/5/897/ENUS118-075/ENUS118-075.PDF
- 221-260 z/OS V2.5
  - https://www.ibm.com/downloads/cas/US-ENUS221-260-CA/name/US-ENUS221-260-CA.PDF
- 221-213 z/OS V2.4 2Q 2021
  - https://www.ibm.com/downloads/cas/US-ENUS221-213-CA/name/US-ENUS221-213-CA.PDF
- 220-378 z/OS V2.4 3Q 2020
  - https://www.ibm.com/downloads/cas/US-ENUS220-378-CA/name/US-ENUS220-378-CA.PDF

References



- IBM Manuals
  - SC14-7505 ICSF Overview
  - SC14-7506 ICSF Administrator's Guide
  - SC14-7507 ICSF System Programmer's Guide
  - SC14-7508 ICSF Application Programmer's Guide
  - SC14-7509 ICSF Messages
  - SC14-7510 ICSF Writing PKCS #11 Applications
  - GI11-9478-08 Program Directory for Cryptographic Services for z/OS V2R2 – z/OS V2R4
  - SA23-2211 ICSF Trusted Key Entry Workstation User's Guide

On the Web

- Techdocs – www.ibm.com/support/techdocs
  - TD103782 – z/OS: ICSF Version and FMID Cross Reference
  - Or search on 'Crypto'
- z/OS Downloads – Cryptographic Support Downloads
  - https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosDownloads?OpenDocument
- Crypto Cards
  - https://www.ibm.com/security/cryptocards

Questions