MAINFRAME CRYPTO

Unscrambling the Complexity of Crypto!

ICSF

Part 1 of 2

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THE Z EXCHANGE

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Agenda - ICSF

- ICSF – Part 1 of 2
  - z/OS Component
  - Started Task
  - Always Up!
  - Key stores
  - Options
- ICSF – Part 2 of 2
  - Operator Commands
  - ISPF Panels
    - Master Keys
    - KGUP
    - Keys Panels
  - Security & Key Store Policies
  - SMF
  - HealthChecks
  - APIs

ICSF

- Interface to the hardware
  - CPACF APIs (invoke the native instructions)
  - CEX APIs (the only interface to the CEX cards)
  - Other APIs (query, key definition/management)
- Crypto management
  - ISPF interface (view/manage devices and master keys, manage key repositories, view options, etc.)
  - Operator commands
- Key Security & Integrity
  - Master key loading
  - Invoke KGUP
- SAF
  - Operational Keys
  - APIs
  - Key store policies

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

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

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

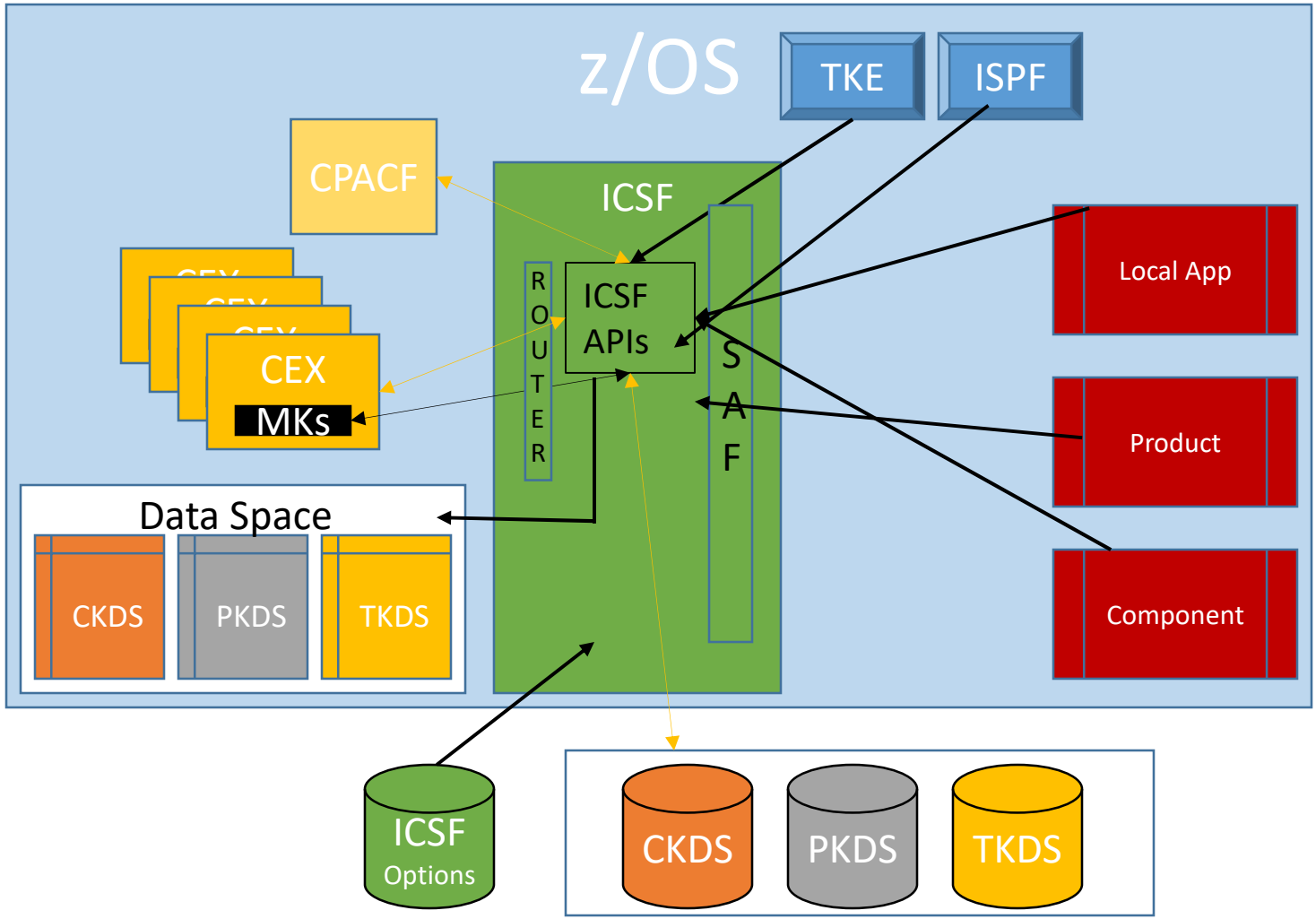
ICSF Levels

- HCR77D1
  - z15 and CEX7S Exploitation, including Quantum Safe algorithms
  - ANSI TR-34 support
  - New health check for Probabilistic Signature Scheme (PSS) support
  - New PIN services for DK support
- HCR77D0
  - Dynamic maintenance
  - ICSF start-up early in IPL
  - Dynamic Browser for PKDS
  - New triple-length key types
  - DK Key Diversification
  - ChaCHa20 & Poly1305 algorithms
  - ISO-4 PIN block support

ICSF Levels

- HCR77C1
  - z14 and CEX6S exploitation, including SHA-3 hashing, a True Random Number Generator and AES-GCM performance improvements
  - PCI-HSM Compliance
  - ICSF Counters
  - CKDS Keys Browser
- HCR77C0
  - More auditing
  - Options Data set refresh
  - GA2 support for CEX5S

ICSF Started Task



SYS1.SAMPLIB(CSF)

```
//CSF PROC
//CSF EXEC PGM=CSFINIT,REGION=0M,TIME=1440,MEMLIMIT=NOLIMIT
//* When using CSFPARM DD, the installation options data set must be
//* a partitioned data set on systems running HCR77D0 or later.
//CSFPARM DD DSN=USER.PARMLIB(CSFPRM00),DISP=SHR
```

- 'S CSF' from the console or in COMMNDxx or Auto Operations
- 'S CSF,SUB=MSTR' (to start it before JES)
- 'START CSF,SUB=MSTR,REUSASID=YES' (to reuse the ASID)

- P CSF or FORCE CSF,ARM to stop the ICSF address space
  - After omvs is stopped (to allow update to an encrypted file system to complete)
  - After JES is shutdown, if encrypting JES spool data sets

ICSF Always Up – CSF Proc w/OA55378

- OA55378 (for z/OS 2.3) introduced support to start ICSF via a RIM
- New parms in IEASYSxx
  - ICSFPROC – the name of the ICSF started procedure, in PROCLIB
  - ICSF=xx – the suffix for the ICSF Options member that is referenced by CSFPARM in the started task
- SYS1.SAMPLIB(CSF)

```
//CSF PROC PRM=00
 …
//CSFPARM DD DSN=USER.PARMLIB(CSFPRM&PRM),DISP=SHR
```

  - AUTOR policy for BCF005A and BCF006A
  - See http://www.ibm.com/support/docview.wss?uid=isg1OA55378
  - Don't forget to disable current auto start (COMMNDxx or AutoOps)

SYS1.SAMPLIB(CSF2) (HCR77D0)

```
//CSF2 PROC PRM=00
//CSF2 EXEC PGM=CSFINIT,PARM=&PRM,REGION=0M,TIME=1440,MEMLIMIT=NOLIMIT
```

- CSFPARM2 DD is used internally
- Options data set must be a CSFPRMxx member of the PARMLIB concatenation
- ICSFPROC=CSF2 in IEASYSxx

CSF Started Task

- SAF access to the Options data set and the keystores (if specified)
  - Assign a userid via the Started-procedures table (ICHRIN03)
  - Assign an omvs segment, IF using Regional Cryptographic Servers

- ARM Policy

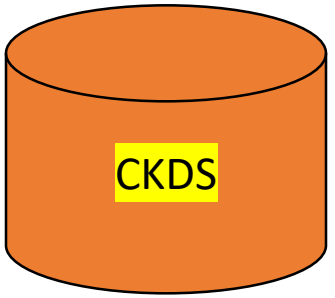
  DATA TYPE(ARM)
  DEFINE POLICY NAME(CSFPOL) REPLACE(YES)
  RESTART_GROUP(ICSFGROUP)
  TARGET_SYSTEM(*)
  ELEMENT(**SYSICSF_***)
  RESTART_METHOD(BOTH,PERSIST)

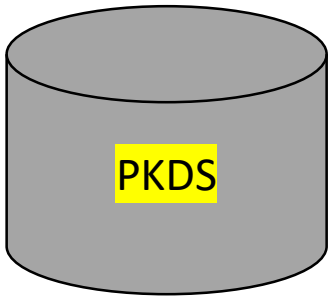
ICSF Options

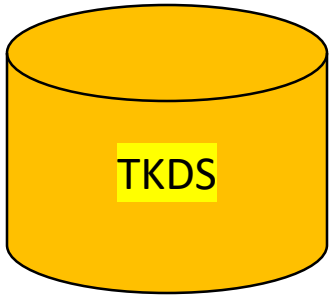
- Data set
  - PARMLIB, PDS or Sequential file
  - PARMLIB (only with HCR77D0)
  - System Variables
- Contents
  - CKDSN, PKDSN, TKDSN
    - SAF protect them!
  - DOMAIN(n)
  - First time start-up
    - SSM(YES)
    - COMPAT(NO)

Key Stores

- CKDS – Cryptographic Key Data Set
  - AES keys
  - DES/TDES keys
- PKDS – PKA Key Data Set
  - ECC keys
  - RSA keys
  - Trusted PIN Blocks
- TKDS – Token Key Data Set
  - Cryptographic Objects (AES, DES/TDES, ECC, RSA keys in a PKCS #11 format or architecture)







Keystore Data Set Definitions

- CKDS – Cryptographic Key Data Set
  - RECORDSIZE(252,252) – pre HCR7780
  - RECORDSIZE(332,1024) – optional beginning with HCR7780 for HMAC variable length keys
  - RECORDSIZE(372,2048) – optional beginning with HCR77A1 (KDSR format)
- PKDS – PKA Key Data Set
  - RECORDSIZE(350,2800) – pre HCR7750*
  - RECORDSIZE(350,3800) – HCR7750 to HCR77A0 (longer RSA keys)
  - RECORDSIZE(800,3800) – HCR77A1 and later (KDSR format)
- TKDS – Token Key Data Set
  - RECORDSIZE(2200,32756)

*HCR77B1 and earlier versions are no longer supported

KDSR Format (HCR77A1)

- Metadata (up to 250 bytes)
  - REFDATE STCKE – Store Clock Extended Timestamp
  - REFDATE - yyyymmdd
  - Additional metadata (w/HCR77B0)
    - Validity Dates - yyyymmdd
      - Start Date - Key material can't be used before the start date
      - End Date - Key material can't be used after the end date
      - **Last reference date**
      - Archive & Recall dates
    - IBM & installation metadata blocks
- CSFKDSL Key Data Set List API can search for records based on the metadata
- SMF Type 82 Subtype 30 Keystore Policy Archived and Inactive Checking
- KEYARCHMSG ICSF Option – generate a message when an archived key is referenced

Key Labels – VSAM KSDS Index

- CKDS
  - Key label (64 characters*)
  - Key type (8 bytes)**
    - DATA, CIPHER, PINGEN/PINVER, OPINENC/IPINENC, EXPORTER/IMPORTER, MAC …
- PKDS
  - Key label (64 characters*)
  - Reserved (8 bytes)
- TKDS
  - Token name (32 characters)
  - Sequence number (8 bytes, in EBCDIC)
  - Category (1 byte) - ‘T’ for clear, ‘Y’ for secure, blank for token, … || 3 blanks
  - 28 bytes of binary 0s

- * - 1 Alphabetic or National and Up to 63 Alphanumeric, national or period; Left-justified, padded with blanks
- ** - Left-justified, padded with blanks

Always Up - Dynamic Service Update
(HCR77D0)

- Without stopping ICSF
  - Activate new service
    - SCSFMOD0 – ICSF modules
    - SIEALNKE – CSFINPV2 (validates integrity for FIPS 140-2 compliance)
  - Recycle – restart without shutting down
  - Pick up Options (those that aren't picked up by SETICSF OPTIONS,REFRESH)
- Dynamic Service cannot be used to upgrade the ICSF release
- Dynamic Service update discards all PKCS #11 session objects and they need to be recreated

Dynamic Service Update (HCR77D0)

- Update ICSF Options data set
  - SERVICELIBS(YES/**NO**)
  - SERVSCSFMOD0(dsn, volser)
  - SERVSIEALNKE(dsn, volser)
- SETICSF PAUSE
  - ICSF will wait for current requests to complete, monitoring the number of active requests. When the number of active requests hasn't changed for 10 seconds, ICSF will terminate
- Restart ICSF
  - After CSFM401I CRYPTOGRAPHY - SERVICES ARE NO LONGER AVAILABLE message

STATS & STATSFILTER (HCR77C1)

- ICSF Options
  - STATS(ENG,SRV,ALG)
    - ENG – track cryptographic engines
    - SRV – track cryptographic services
    - ALG – track cryptographic algorithms
  - STATSFILTER – level of aggregation (for high volume apps)
- SMF Type 82 Subtype 31
  - The jobs and tasks that are using the various cryptographic engines.
  - The cryptographic card types that are getting the most requests.
  - If any cryptographic requests are being handled in software.
  - The peak periods of cryptographic usage.
  - The ICSF services that are being started by other z/OS components.
  - The jobs and tasks that are using out-of-date algorithms or key sizes.

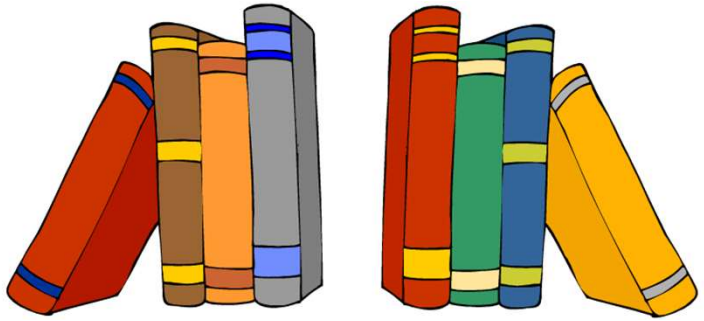
Cryptographic Key Usage Statistics

Subtype=001F Crypto Usage Statistics
Written periodically to record crypto usage counts
7 Mar 2018 11:30:30.00
TME... 003F3798 DTE... 0118066F SID... MFC1 SSI... 00000000 STY... 001F
INTVAL_START.. 03/07/2018 16:20:30.000330
INTVAL_END.... 03/07/2018 16:30:30.000548
USERID_AS..... GBOYD
USERID_TK.....
JOBID..... TSU13812
JOBNAME..... BOYDG
JOBNAME2.....
PLEXNAME..... MFCPLEX
DOMAIN..... 12
ENG...CARD...5C01/DV53K342... 50
ENG...CARD...5C03/DV53G424... 50
ENG...CPACF... 100
ALG...AES256..... 200
SRV...CSFSYE..... 100
SRV...CSFSAD..... 100

Performance Monitoring

- RMF
  - Crypto Hardware Activity Report
    - RMF Processor Activity (SMF Type 70, Subtype 2)
  - RMF Monitor III
    - CRYOVW – Crypto hardware overview (CRO)
    - CRYACC – Crypto accelerator activity (CRA)
    - CRYPKC – Crypto PKCS11 coprocessor activity (CRP)
  - RMF Overview Report (Type 70, Subtype 1)
    - OVW(ENCRMSU(LACSCR))
  - Workload Activity (SMF Type 72, Subtype 3)
    - Samples the TCBs executing and waiting on Crypto APs
- CPU Measurement Facility
- ICSF STATS

IBM Manuals



- SC14-7505-08 ICSF Overview
- SC14-7506-08 ICSF Administrator's Guide
- SC14-7507-08 ICSF System Programmer's Guide
- SC14-7508-08 ICSF Application Programmer's Guide
- SC14-7509-07 ICSF Messages
- SC14-7510-06 ICSF Writing PKCS #11 Applications
- GI11-9478-08 Program Directory for Cryptographic Services for z/OS V2R2 – z/OS V2R4

ICSF Web References

- ICSF Cross Reference (old TechDoc)
  - https://www.ibm.com/support/pages/node/6354701
    - https://www.ibm.com/support/pages/system/files/inline-files/ICSF%20Version%20and%20FMID%20Cross%20Reference%20Oct2020.pdf
- z/OS Web Download site
  - http://www.ibm.com/systems/z/os/zos/tools/downloads/index.html

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  - Security & Key Store Policies
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  - HealthChecks
  - APIs

Questions