MAINFRAME CRYPTO

Data Set Encryption – An Update

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Agenda

- Pervasive Encryption or Data Set Encryption?
- How it works
- Operational Stuff (Key Management and Performance)
- Summary

Pervasive Encryption – A suite of products and solutions

- Full Disk Encryption
- Integrated Crypto Hardware
- Network Encryption
- **Data set and File Encryption**
- Coupling Facility Encryption
- Secure Service Container
- Key Management (EKMF – Enterprise Key Management Foundation)

Access Method Encryption

Standard Read/Write (BSAM/QSAM/VSAM)

vs

Non-Standard Read/Write (Track/Cylinder level)

Access Authority for Dataset Encryption

User

Storage Admin

- Dataset
  - Access list
- Key Label
  - Access list, PERMIT CLASS(CSFKEYS) ID(*) ACCESS (READ) WHEN(CRITERIA(SMS(DSNENCRYPTION)))
- API Access (to CSNBKRR2)
  - CHECKAUTH(NO)
  - Access list - PERMIT CLASS(CSFSERV) ID(*)
    ACCESS(READ)

Configuration requirements

- Machines (CEX Coprocessors with AES-MK Loaded!)
  - z196/z114 w/CEX3C
  - zEC12/zBC12 w/CEX3C or CEX4Cz13/z13s w/CEX5C
  - z14/z14s w/CEX6C
  - z15/z15s w/CEX7C
  - 16/z16s w/CEX8C
- Operating System
  - z/OS 2.5
  - z/OS 2.4
  - z/OS 2.3
  - z/OS 2.2 w/APAR OA50569
  - z/OS 2.1 w/APAR OA50569 (supports reading/writing an encrypted data set, but not creating an encrypted data set)
- ICSF
  - HCR77D2 (w/zOS2.5)
  - HCR77D1-HCR77C0
  - HCR77A0-HCR77B1 w/APAR OA50450

Supported filetypes

- Extended Format
  - Sequential BSAM/QSAM
  - VSAM (KSDS, ESDS, RRDS, VRRDS, LDS)

    DB2, IMS, logs
  - zFS

z/OS 2.4 Enhancements

- Basic & Large Format Data Sets (OA56622)
- PDSE (OA56324)
  - Data Set (not by member)

Restricted data sets

- Restrictions
  - DFSMSdss REBLOCK ignored on COPY and RESTORE
  - DFSMSdss VALIDATE ignored when backing up encrypted indexed VSAM

- Data sets used during IPL
- Catalogs, SHCDS, HSM data sets, ICSF Keystores
- Temporary, SORTWKxx, BLKSIZE<16 (can't be Extended Format)

Assigning the key (Key label)

- DFP Segment of the SAF data set profile
  - ALTDSD 'PROJECTA.DATA.*' UACC(NONE) DFP(DATAKEY(Key-Label for ProjectA))
- Manually at allocation
  - JCL, TSO Allocate (Dynamic Allocation)
    - DSKEYLBL=key-label
  - IDCAMS
    - DEFINE CLUSTER -
      (NAME(DSN1.EXAMPLE.ESDS1) -
      … -
      KEYLABEL (LABEL.FOR.DSN1))
- SMS Data Class

RDEFINE FACILITY STGADMIN.SMS.ALLOW.DATASET.ENCRYPT UACC(NONE)

Creating a ciphertext copy of a file (1 of 5)

PROD.CUSTDATA.**
ACCESS LIST

Cleartext file(s)

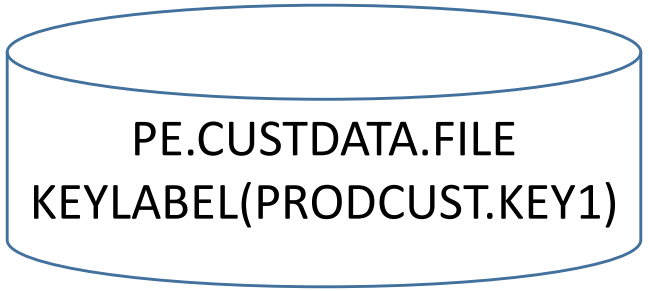
Creating a ciphertext copy of a file (2 of 5)

PROD.CUSTDATA.**
ACCESS LIST

PE. **
ACCESS LIST
DFP Segment
KEYLABEL(PRODCUST.KEY1)

Create a new data set profile, referencing the new key label, PRODCUST.KEY1

Creating a ciphertext copy of a file (3 of 5)

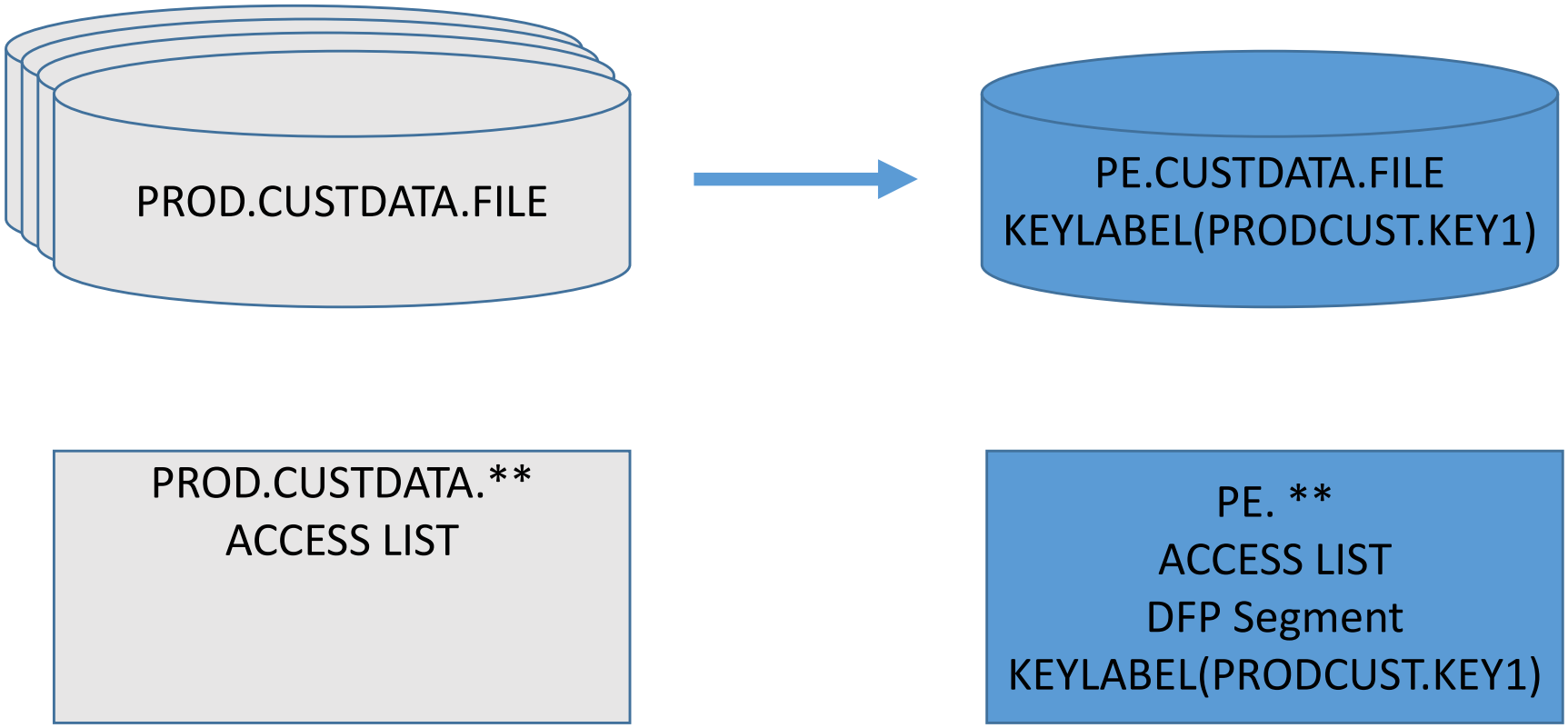


PROD.CUSTDATA.**
ACCESS LIST

PE. **
ACCESS LIST
DFP Segment
KEYLABEL(PRODCUST.KEY1)

Allocate the new file

Creating a ciphertext copy of a file (4 of 5)



Copy the file

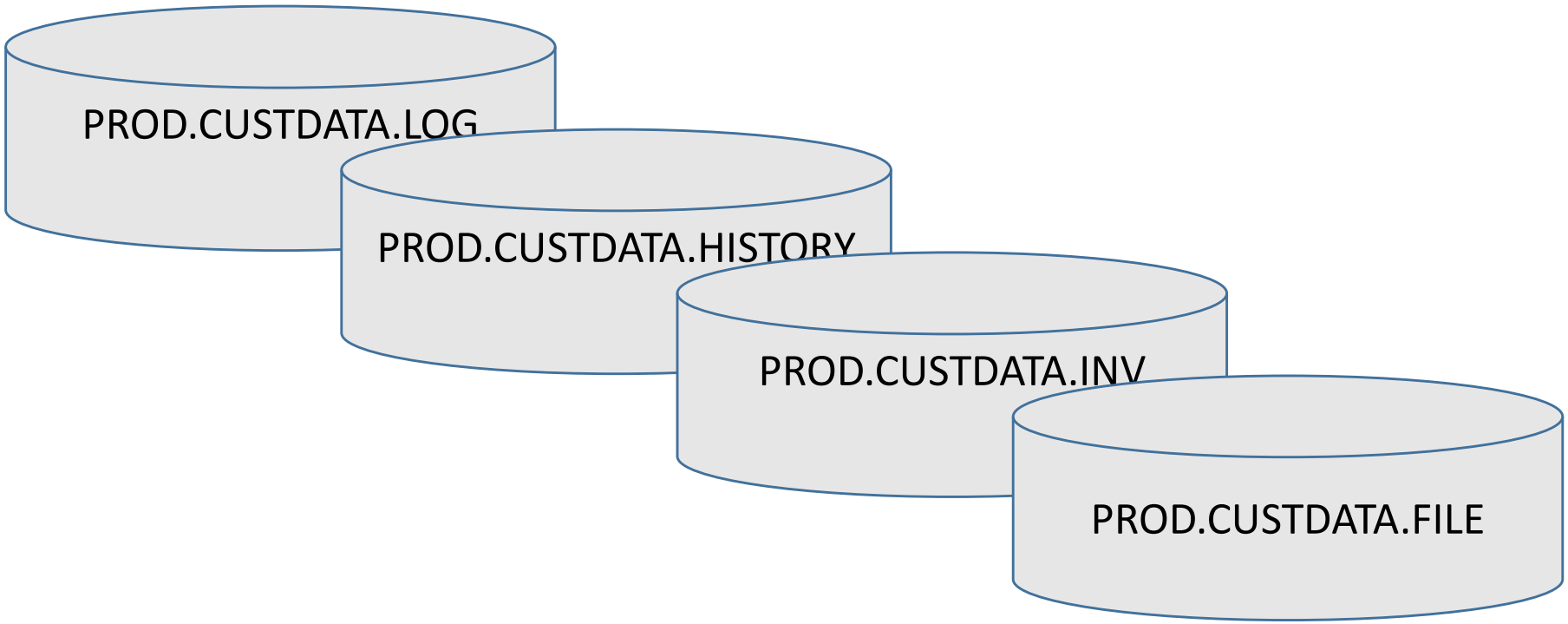
Creating a ciphertext copy of a file (5 of 5)

PROD.CUSTDATA.**
ACCESS LIST

PE. **
ACCESS LIST
DFP Segment
KEYLABEL(PRODCUST.KEY1)

Rename the two files

RACF Profile Coverage



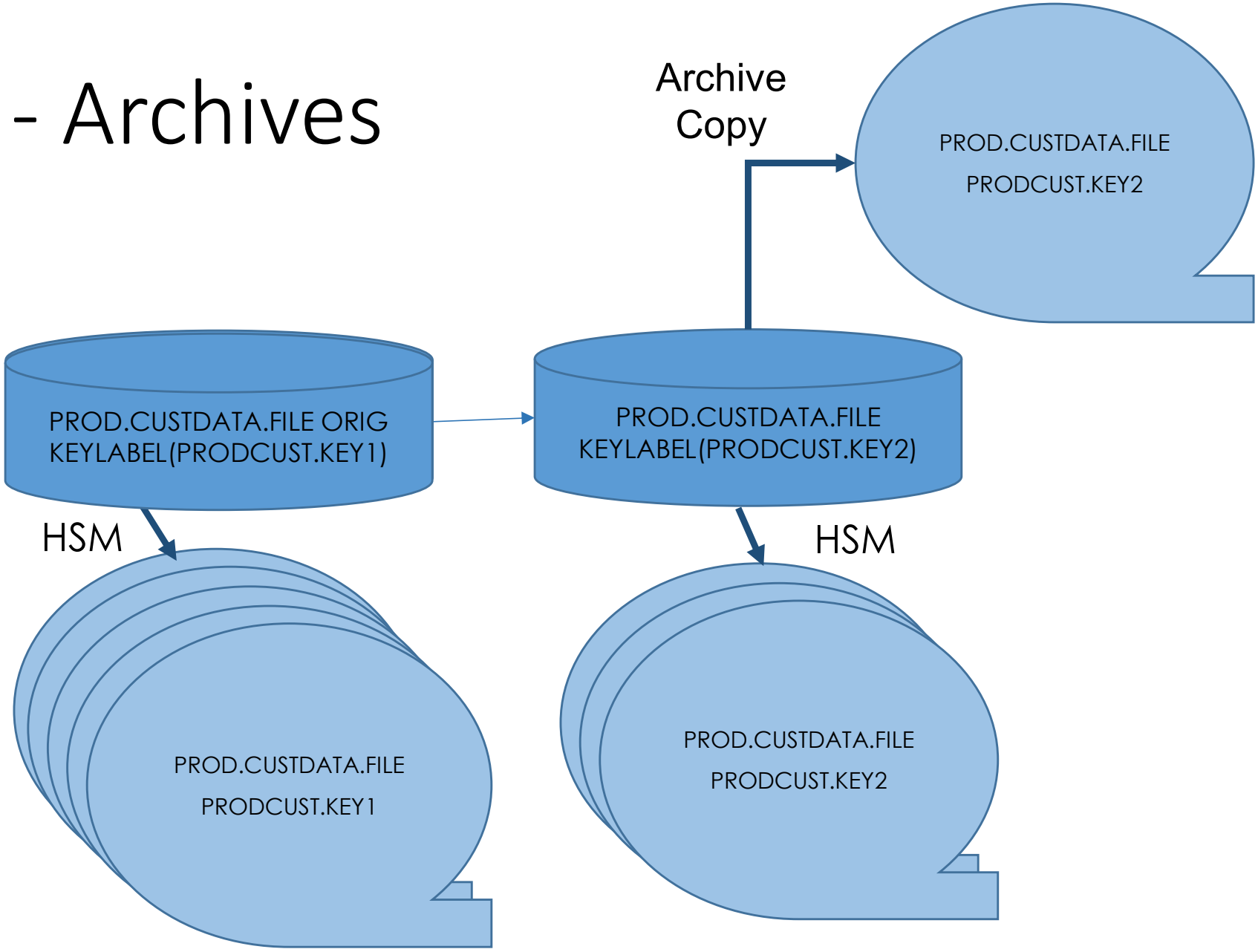
PROD.CUSTDATA.**
ACCESS LIST

DFP Segment
KEYLABEL(PRODCUST.KEY1)

Data set lifecycle vs Key lifecycle

- Backups, Replication
  - Still encrypted
- Migrated (in the storage hierarchy)
  - It's still encrypted!

DSE - Archives

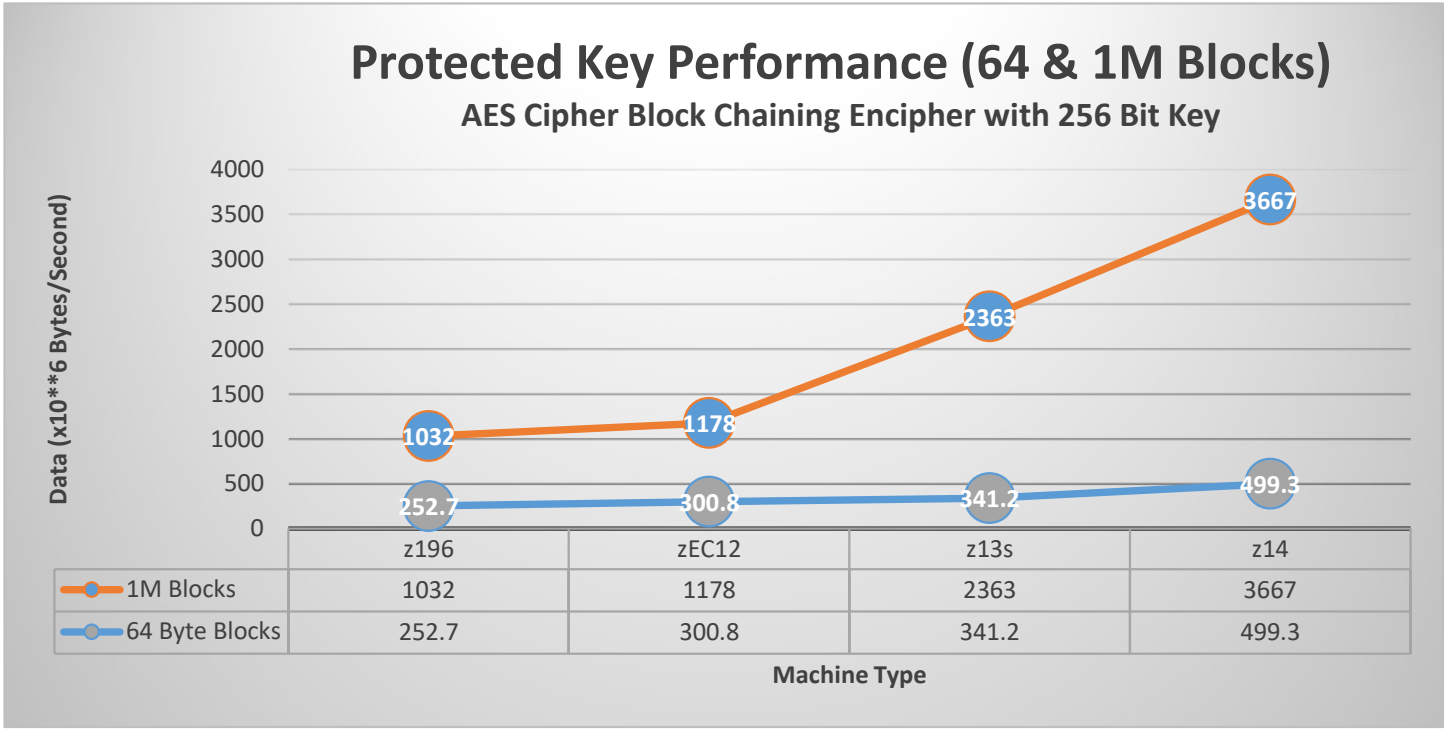


Compression

- Encryption impacts compression
  - May impact space savings
  - Compress, then encrypt

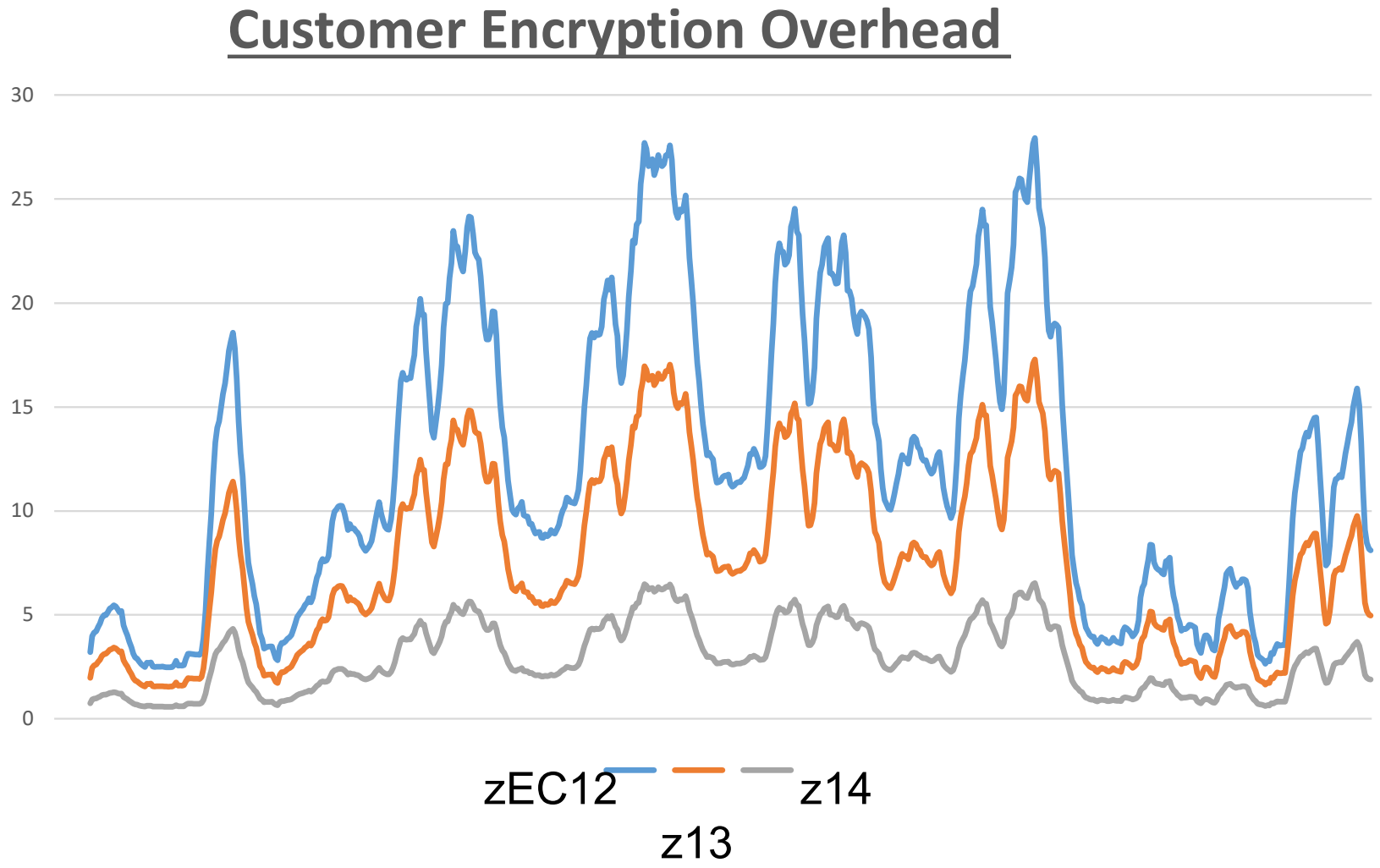
- IBM recommends compressing all data sets before encrypting

Performance



- IBM z14 Performance of Cryptographic Operations (Cryptographic Hardware: CPACF, CEX6S)
  - https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=ZSL03607USEN
- IBM z13 Performance of Cryptographic Operations (Cryptographic Hardware: CPACF, CEX5S)
  - https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=ZSW03283USEN
- IBM zEnterprise EC12 Performance of Cryptographic Operations (Cryptographic Hardware: CPACF, CEX4S)
- IBM zEnterprise 196 Performance of Cryptographic Operations (Cryptographic Hardware: CPACF, CEX3C, CEX3A)

4-Hour Rolling Average



IBM z Systems Batch Network Analyzer (zBNA) Tool

- Enhanced to estimate the impact of enabling data set encryption
  - PC Based
  - Analyzes SMF data

- http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5132

Summary (of Data Set Encryption)

- Traditional access methods
  - Allocation will flag a data set for pervasive encryption and assign a key to that data set
  - If that flag is on,
    - Access to the Data set is not sufficient
    - Also need access to CSNBKRR2 and the key label associated with the data set
- Non-Traditional access methods (Utilities that manage the data set, not the data work differently)
  - Work on the ciphertext

Summary (operational impact)

- From a crypto perspective, business as usual, but …
  - Criticality of keys
  - Volume of keys
  - Performance
- From an operational perspective
  - Potential data set conversion (i.e. making sure PII data sets are extended format)
  - Assigning key labels
  - Key assigned at allocation
  - Performance impact

How do I get there?

Crypto Config
- ICSF Options
- STC Always Up
- Keystore Layout
- RACF Security
  - CSFKEYS
  - CSFSERV
  - Keystore Policies
- MKs Loaded/Recoverable

Identify Target data sets
- Compression enabled?
- Extended Format
- Convert to Extended Format
- Basic/Large Format
- Identify RACF Profiles

Develop
- Key labeling conventions
- Key rotation policies
- Key management procedures

→ Enable DSE & Test

References

- OA50569 Data Set Encryption PDF

http://publibz.boulder.ibm.com/zoslib/pdf/OA50569.pdf

- OA56622 Data set encryption for for seq basic and large format data sets

https://public.dhe.ibm.com/eserver/zseries/zos/DFSMS/ENCRYPTION/OA56622/OA56622.pdf

- IBM Community

https://community.ibm.com/community/user/home

- Redbook

SG24-8410 Getting Started with z/OS Data Set Encryption

Questions?