Key Rotation – Who? What When? Where? Why?

(but not necessarily in that order)

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Agenda – Key Rotation

- Why?
- When?
- Which?
- Who?
- Where/How?

Why rotate keys?

- **Because the standards say so!**
- **PCI DSS v4.0 Section 3.7.4**

  Key management policies and procedures are implemented for cryptographic key changes for keys that have reached the end of their cryptoperiod, as defined by the associated application vendor or key owner, and based on industry best practices and guidelines, including the following:

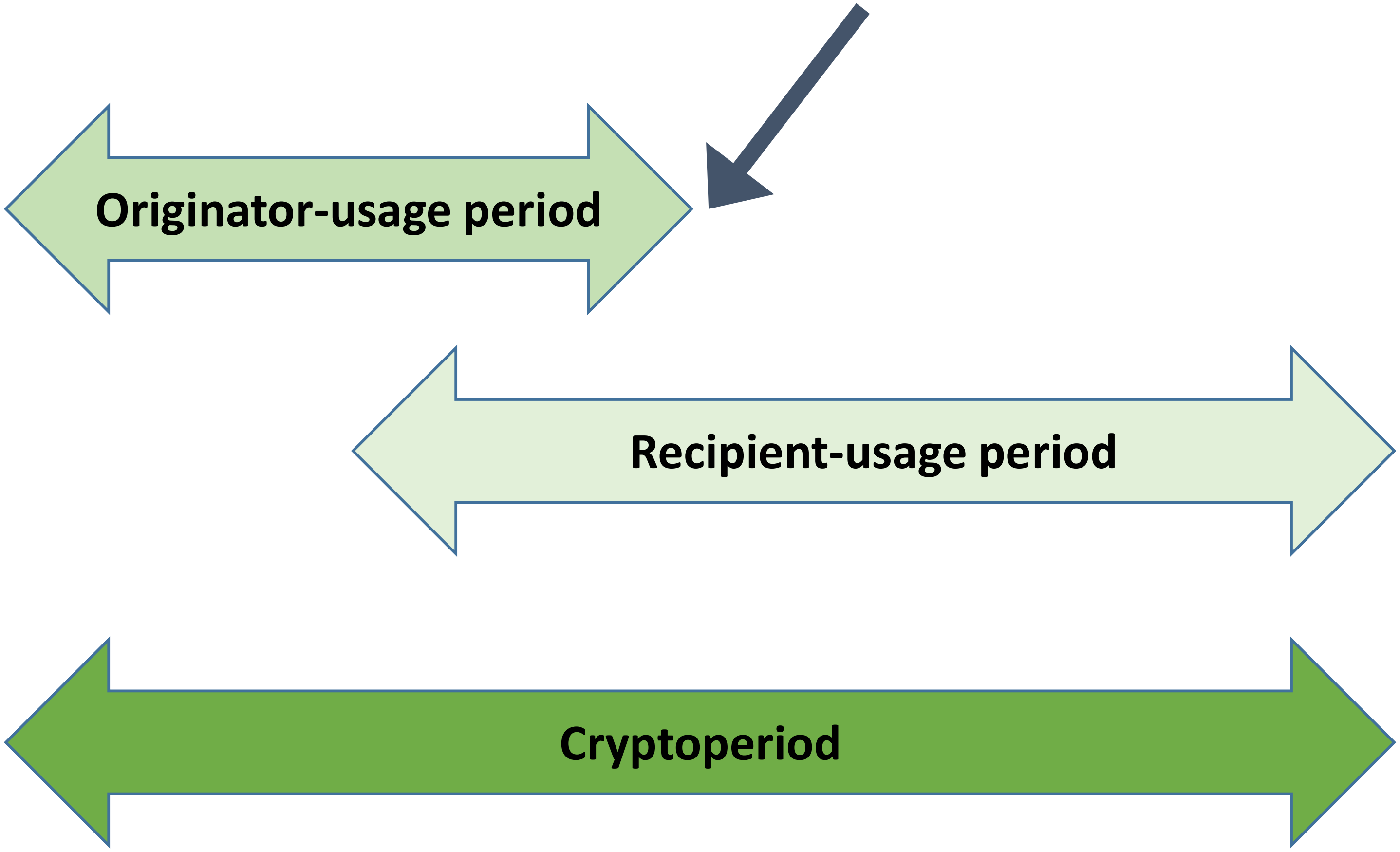
  - A defined cryptoperiod for each key type in use.
  - A process for key changes at the end of the defined cryptoperiod.
  - **Guidance**
    - A cryptoperiod is the time span during which a cryptographic key can be used for its defined purpose. Cryptoperiods are often defined in terms of
      - the period for which the key is active and/or
      - the amount of cipher-text that has been produced by the key.

Risks that affect Cryptoperiod

- Strength of the crypto mechanism (algorithm, key length, block length, mode)
- Security of the crypto module (FIPS 140 Level 4) vs software
- Operating environment (secure facility vs open office environment vs publicly accessible terminal)
- Volume of information (number of bytes or transactions)
- Lifecycle of the data
- Security function (data encryption, digital signature, key protection)
- Rekeying method (human intervention vs PKI vs key management system)
- Key update or key-derivation process
- Number of nodes that share the key
- Number of copies of the key and the distribution process
- Personnel turnover
- Value of the data to attackers
- Threat to the data from new, disruptive technologies

NIST SP 800-57 Part 1 Revision 5
Recommendation for Key Management Part 1 - General

When to rotate keys?



NIST SP 800-57 Part 1 Revision 5
Recommendation for Key Management Part 1 - General

Cryptoperiod - Symmetric

Key Type	Originator-Usage Period (OUP)	Recipient-Usage Period
Symmetric Authentication	<=2 years	<=OUP + 3 years
Symmetric Data Encryption	<=2 years	<=OUP + 3 years
Symmetric Key Wrapping	<=2 years	<=OUP + 3 years
Symmetric RBG	See SP800-90	--
Symmetric Master/Key Derivation Key	About 1 year	--
Symmetric Key Agreement	1 to 2 years	
Symmetric Authorization	<=2 years	

Table 1, Suggested cryptoperiods for key types

NIST SP800-57 Part 1 Revision 5

Recommendation for Key Management: Part 1 - General

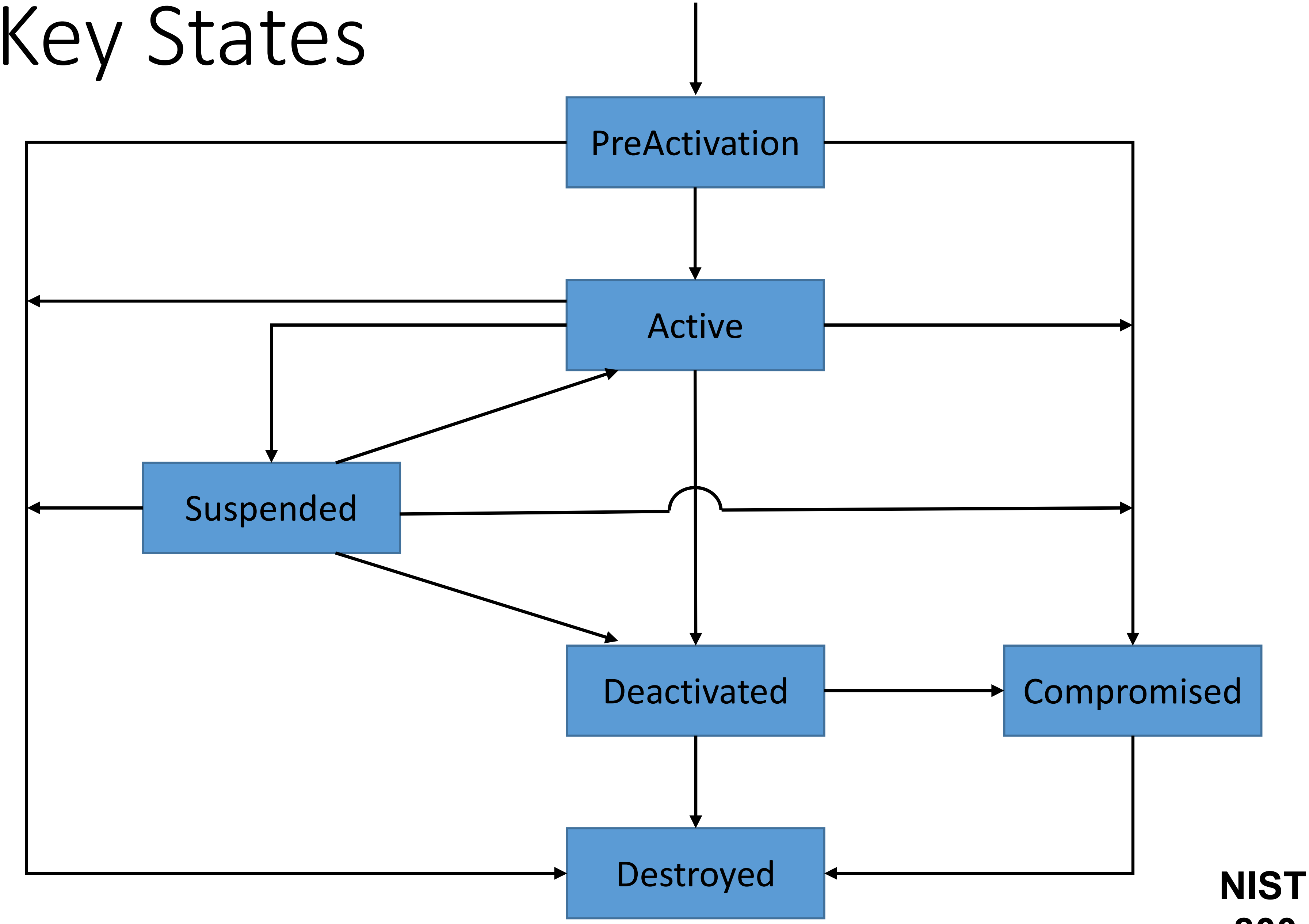
Cryptoperiod - Asymmetric

Key Type	Originator-Usage Period (OUP)	Recipient-Usage Period
Private Signature	1 to 3 years	--
Public Signature-Verification	Several years (depends on key size)	
Private Authentication	1 to 2 years	
Public Authentication	1 to 2 years	
Private Key Transport	<=2 years	
Public Key Transport	1 to 2 years	
Private Static Key Agreement	1 to 2 years	
Public Static Key Agreement	1 to 2 years	
Private Ephemeral Key Agreement	One key-agreement transaction	
Public Ephemeral key Agreement	One key-agreement transaction	
Private Authorization	<=2 years	
Public Authorization	<=2 years	

Other factors (when)

- Operational/Cost Impact
  - Outage required?
  - Performance impact?
  - What if there is a problem?

Key States



NIST SP 800-57

Which keys?

- All keys … but the cryptoperiod will be different
    - Symmetric Keys
    - Signing Keys
    - Key Management Keys

- Only master keys?
    - No, a master key is just a data key, where the encrypted data is … other keys

Who? It Depends …

- On the ‘owner’ of the data
  - DB2 databases – DBAs
  - Application files
    - Data Set Encryption
      - Application owner
      - Production control
      - Storage Admins
    - Application encrypted – Application owner
  - Public/private keys (Digital certificates)
    - PKI
    - Security Admin

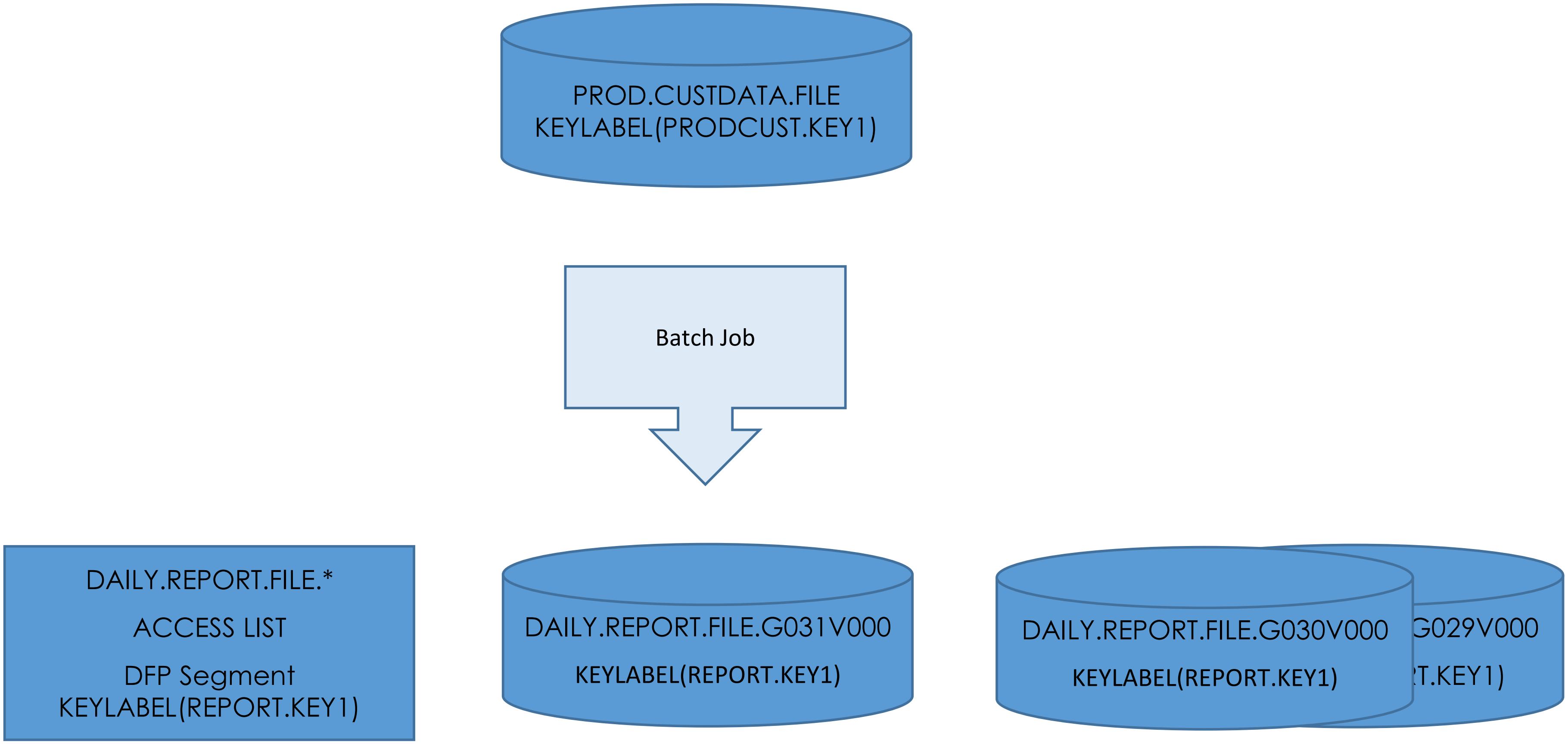
How (Utility)?

- Data set type
  - Sequential – IEBGENER
  - PDSE - IEBCOPY
  - VSAM - IDCAMS
  - Application encryption - Local application

How (Operationally)?

- How is the data used
  - Output files
  - Online
  - Batch

Output Files (1 of 2)



PROD.CUSTDATA.FILE
KEYLABEL(PRODCUST.KEY1)

Batch Job

DAILY.REPORT.FILE.*

ACCESS LIST

DFP Segment
KEYLABEL(REPORT.KEY1)

DAILY.REPORT.FILE.G031V000

KEYLABEL(REPORT.KEY1)

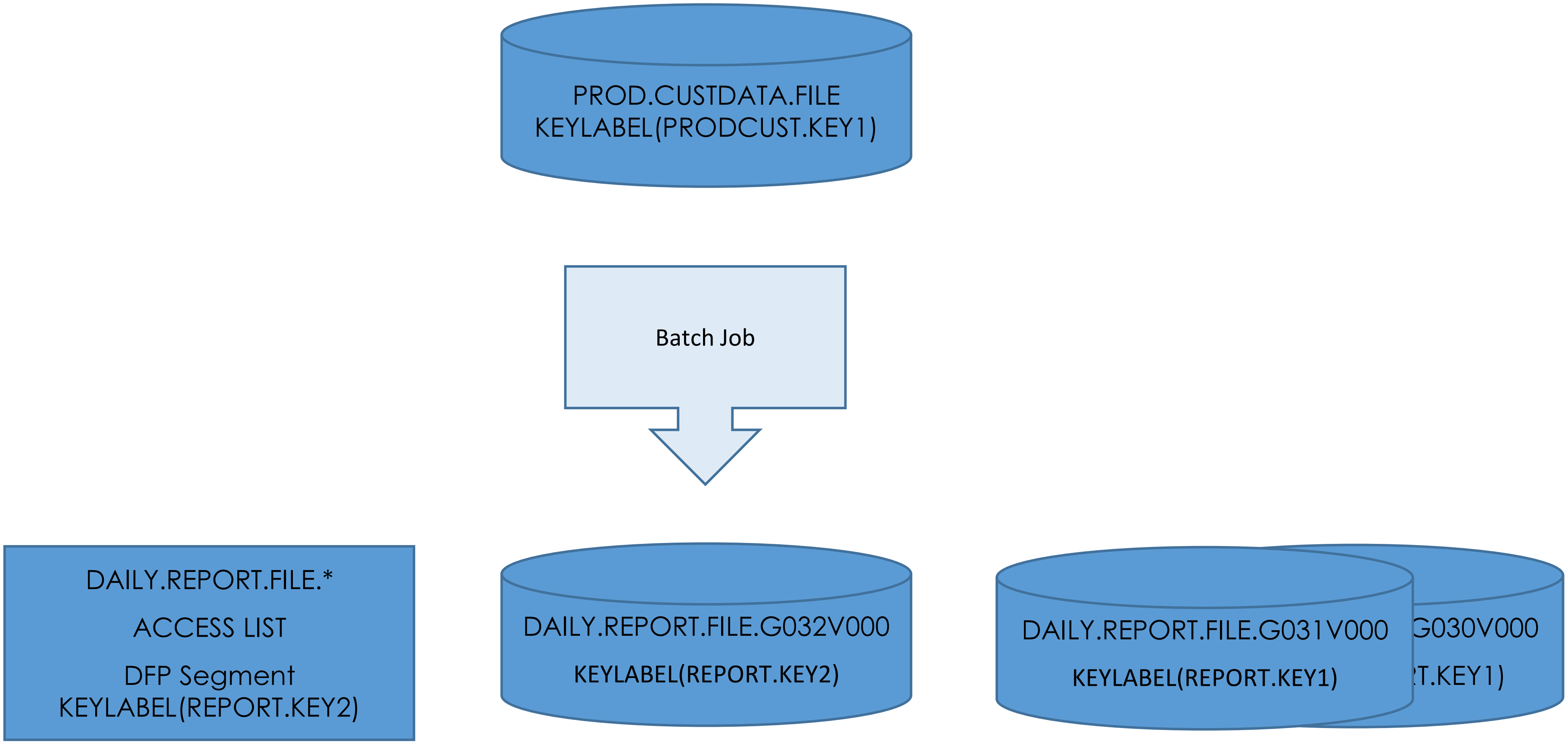
DAILY.REPORT.FILE.G030V000

KEYLABEL(REPORT.KEY1)

G029V000

T.KEY1)

Output Files (2 of 2)



PROD.CUSTDATA.FILE
KEYLABEL(PRODCUST.KEY1)

Batch Job

DAILY.REPORT.FILE.*

ACCESS LIST

DFP Segment
KEYLABEL(REPORT.KEY2)

DAILY.REPORT.FILE.G032V000

KEYLABEL(REPORT.KEY2)

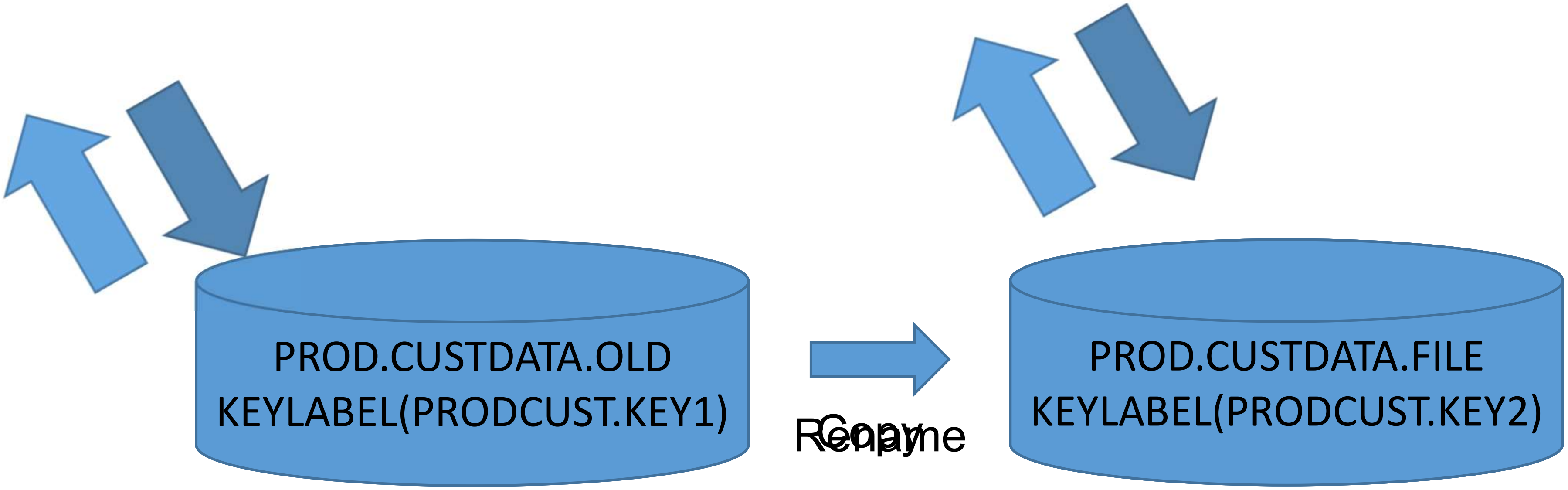
DAILY.REPORT.FILE.G031V000

KEYLABEL(REPORT.KEY1)

G030V000

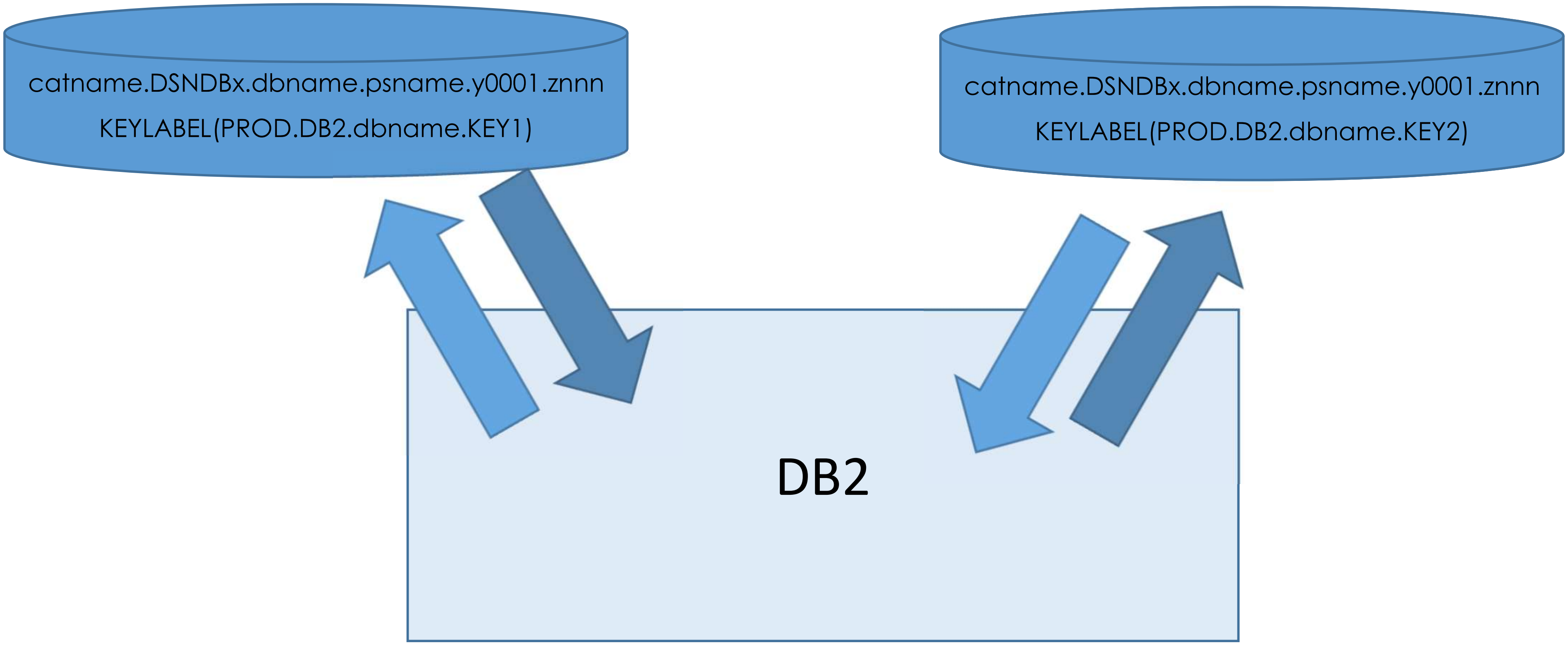
T.KEY1)

Online Files



PE. **
ACCESS LIST
DFP Segment
KEYLABEL(PRODCUST.KEY2)

DB2 Databases - Reorg



catname.DSNDBx.dbname.psname.y0001.znnn

KEYLABEL(PROD.DB2.dbname.KEY1)

catname.DSNDBx.dbname.psname.y0001.znnn

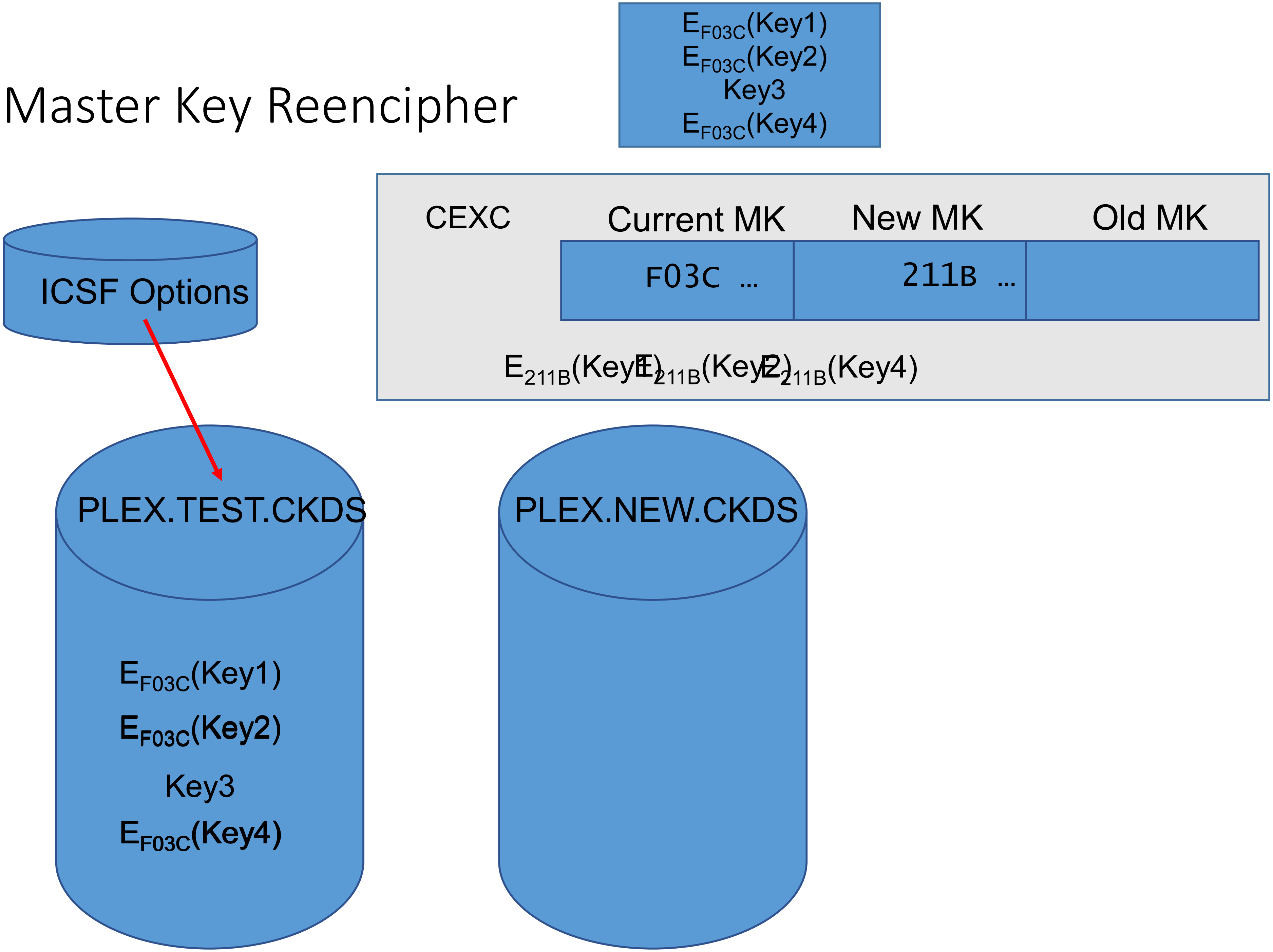
KEYLABEL(PROD.DB2.dbname.KEY2)

catname.DSNDBx.dbname.**

ACCESS LIST

DFP Segment
KEYLABEL(PROD.DB2.DBNAME.KEY2)

Master Key Reencipher



E_{F03C}(Key1)
E_{F03C}(Key2)
Key3
E_{F03C}(Key4)

CEXC

Current MK	New MK	Old MK
F03C …	211B …	

E_{211B}(Key1) E_{211B}(Key2) E_{211B}(Key4)

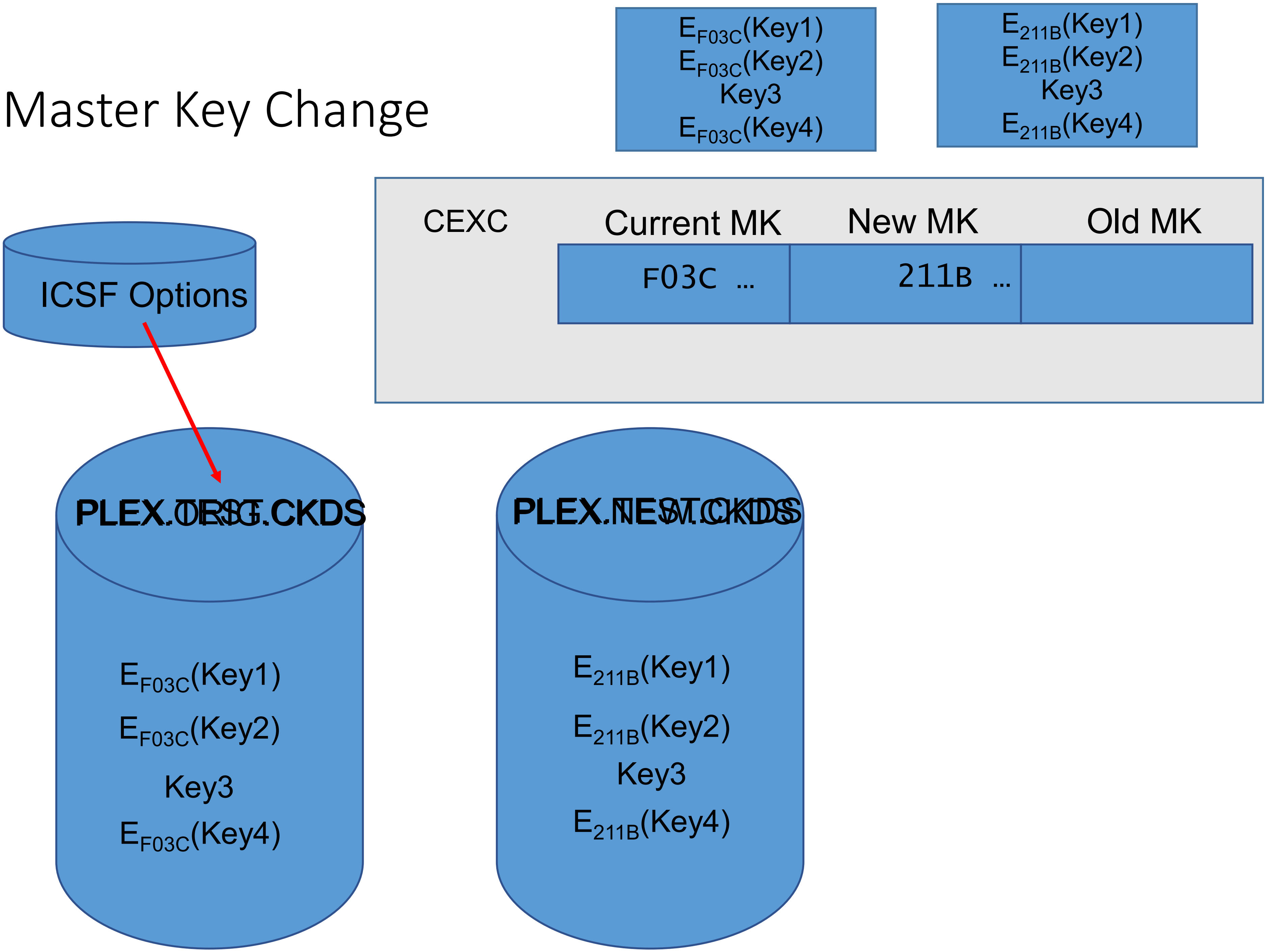
ICSF Options

PLEX.TEST.CKDS

E_{F03C}(Key1)
E_{F03C}(Key2)
Key3
E_{F03C}(Key4)

PLEX.NEW.CKDS

Master Key Change



E_{F03C}(Key1)
E_{F03C}(Key2)
Key3
E_{F03C}(Key4)

E_{211B}(Key1)
E_{211B}(Key2)
Key3
E_{211B}(Key4)

CEXC

Current MK	New MK	Old MK
F03C …	211B …	

E_{F03C}(Key1)
E_{F03C}(Key2)
Key3
E_{F03C}(Key4)

E_{211B}(Key1)
E_{211B}(Key2)
Key3
E_{211B}(Key4)

Wrap-Up

- Key Management Policies
  - Which keys apply to which data
    - Key label conventions
  - Key lifecycles
    - By application
    - By key type
    - By audit requirement
  - Key rotation
    - Routine
    - Non-routine
  - Key rotation processes
    - By application? By data set?

References

- NIST SP 800-57 Part 1 Rev 5 Recommendation for Key Management, Part 1: General
  - https://csrc.nist.gov/publications/detail/sp/800-57-part-1/rev-5/final
- PCI DSS 4.0
  - https://www.pcisecuritystandards.org/document_library
- NIST SP 800-90A Rev. 1 Recommendations for Random Number Generation Using Deterministic Random Bit Generators
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- RACF-L 'Key Management' post
  - https://listserv.uga.edu/scripts/wa-UGA.exe?A2=RACF-L;7cc763d7.2204&S=
- NewEra write up from the RACF-L
  - https://www.newera.com/INFO/Key_Mgmt_04-22.pdf