MAINFRAME CRYPTO

Unscrambling the Complexity of Crypto!

Transporting Crypto Keys

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THE Z EXCHANGE

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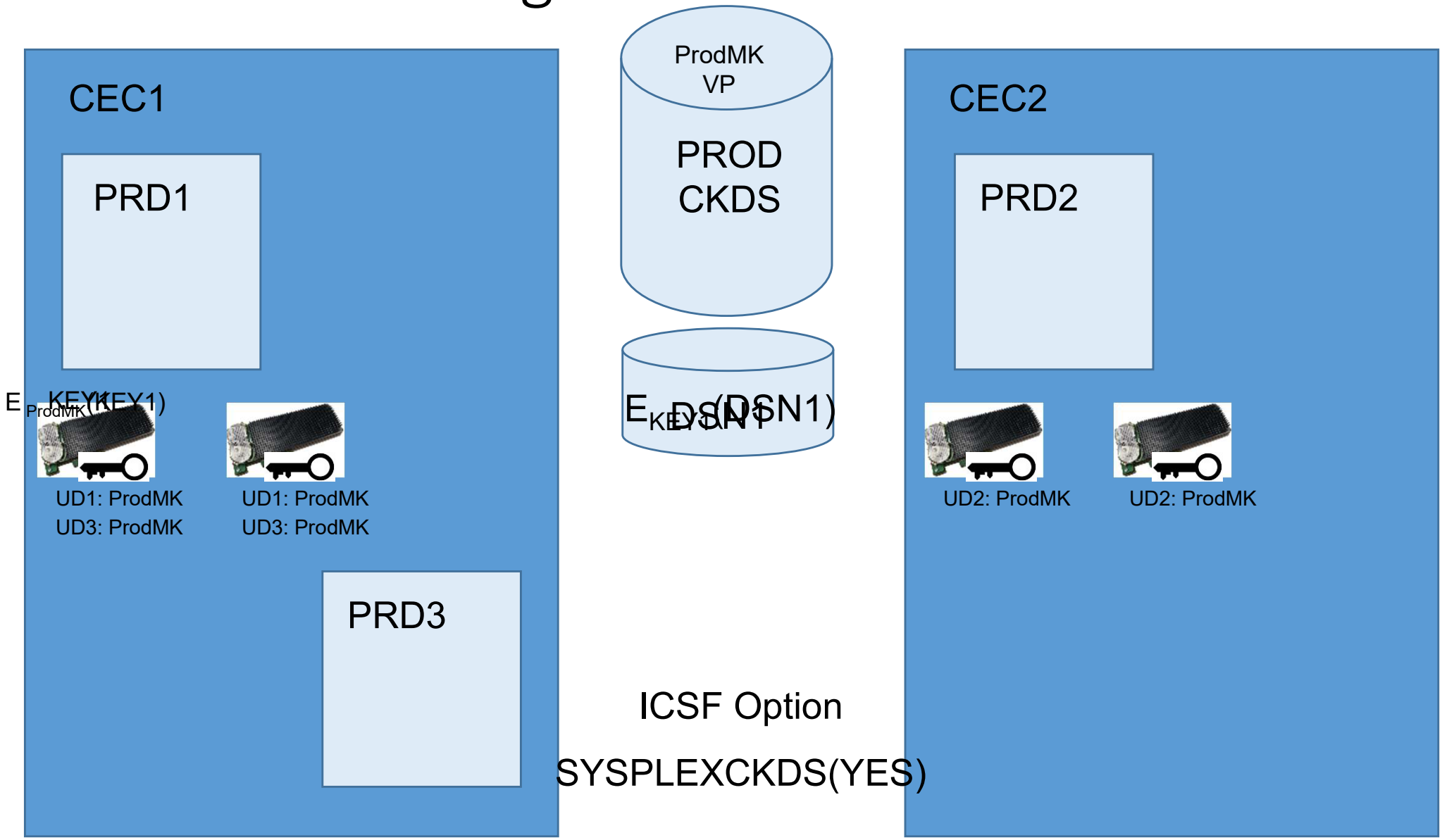
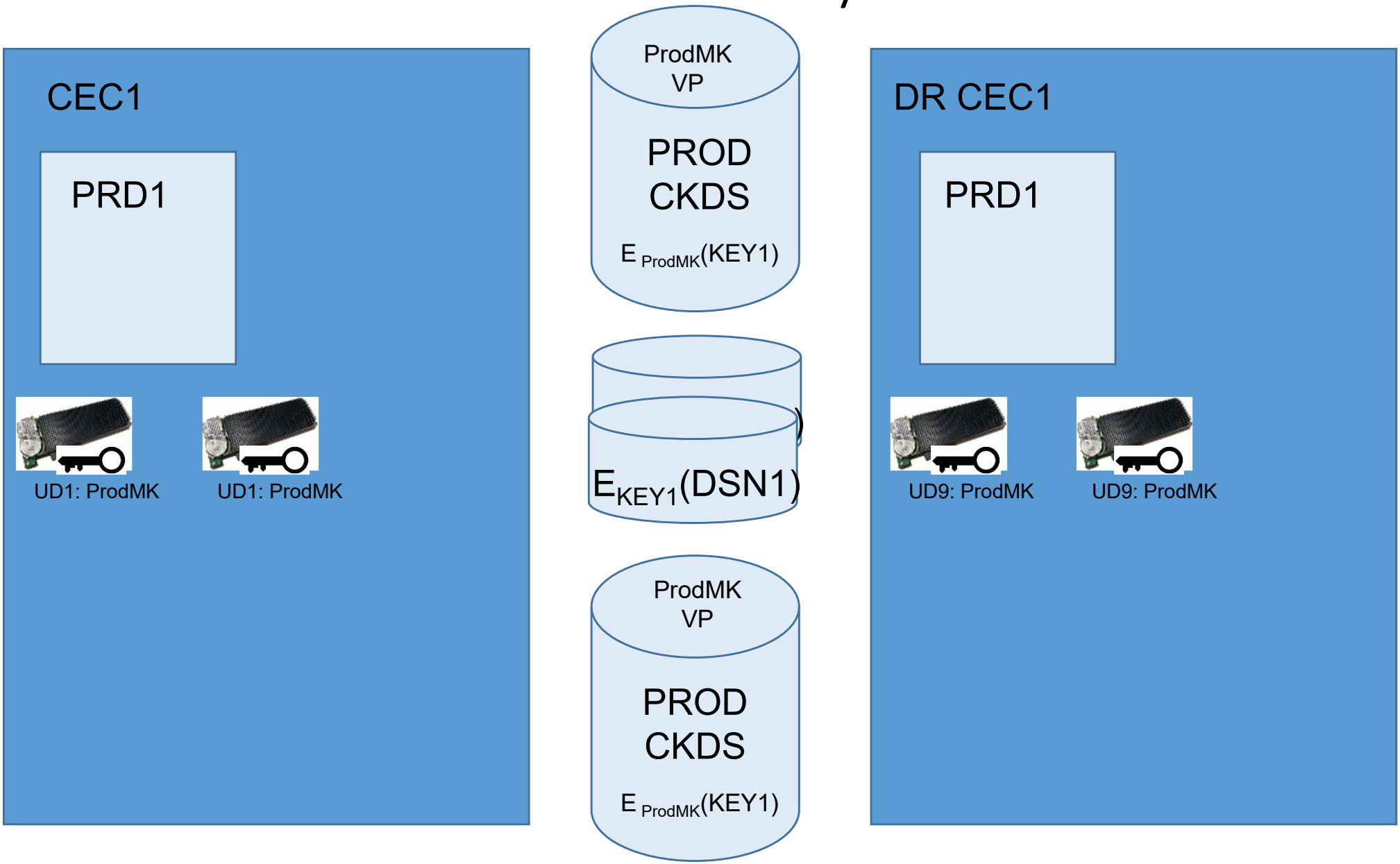
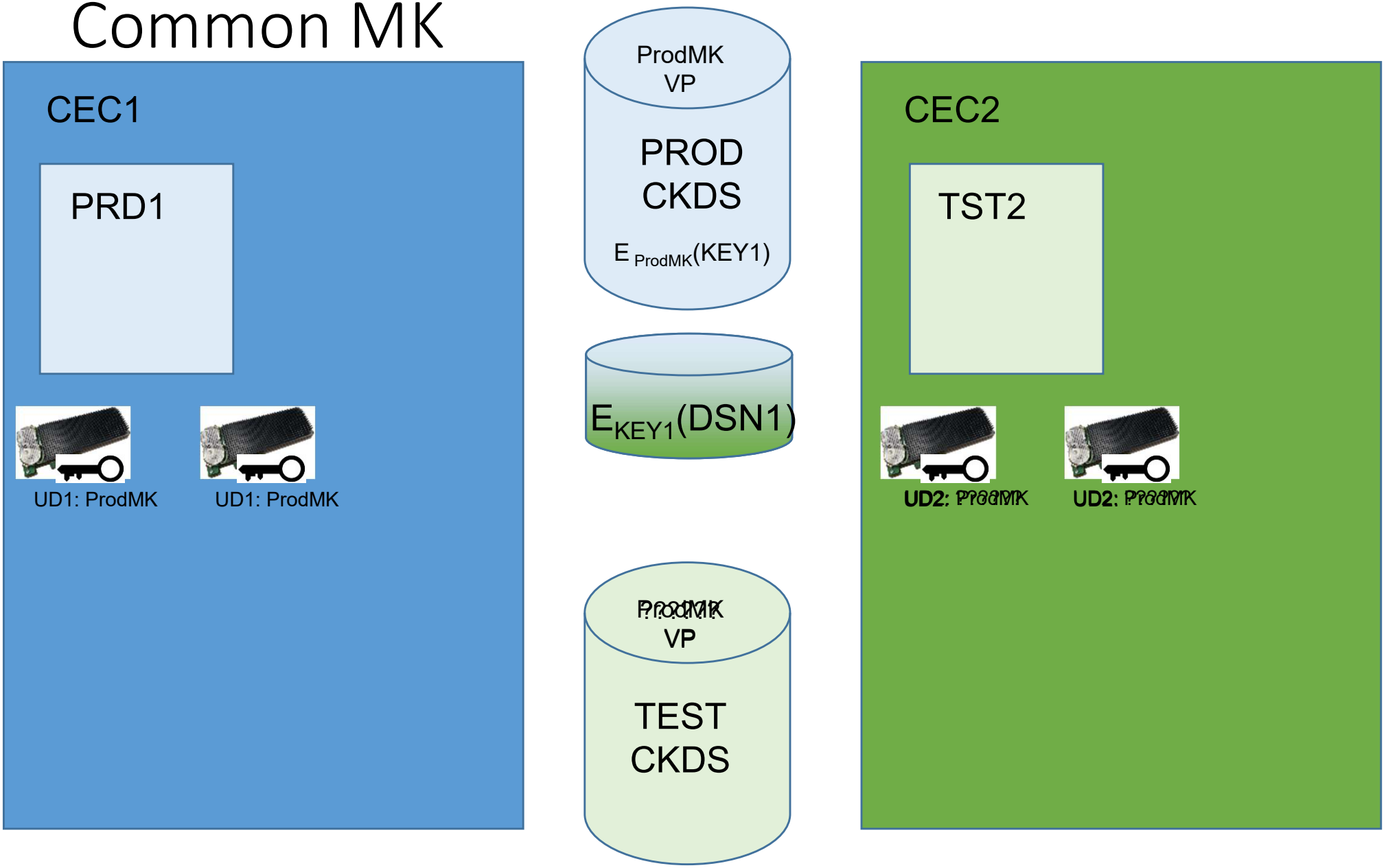
CSFPlex Sharing Data Sets



Also how Disaster Recovery Works



Shared Data, Unique key store, Common MK



Common master key - Copy the key

- IDCAMS REPRO
- KeyXfer Tool (GitHub)

IDCAMS REPRO

```
//SAVEKEYS EXEC PGM=IDCAMS,REGION=4M
//CKDSP    DD DSN=PROD.CSF.CSFCKDS,DISP=SHR          Primary PROD CKDS
//SEQP     DD DSN=savekey.dsn,DISP=(,CATLG),          Bkup key data set
//              SPACE=(TRK,(1,1)),UNIT=SYSALLDA,
//              DCB=(LRECL=372,BLKSIZE=2048,RECFM=VB)
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
   REPRO INFILE(CKDSP) OUTFILE(SEQP) –
         FROMKEY(key label to be copied) –
         COUNT(1)
```

IDCAMS REPRO

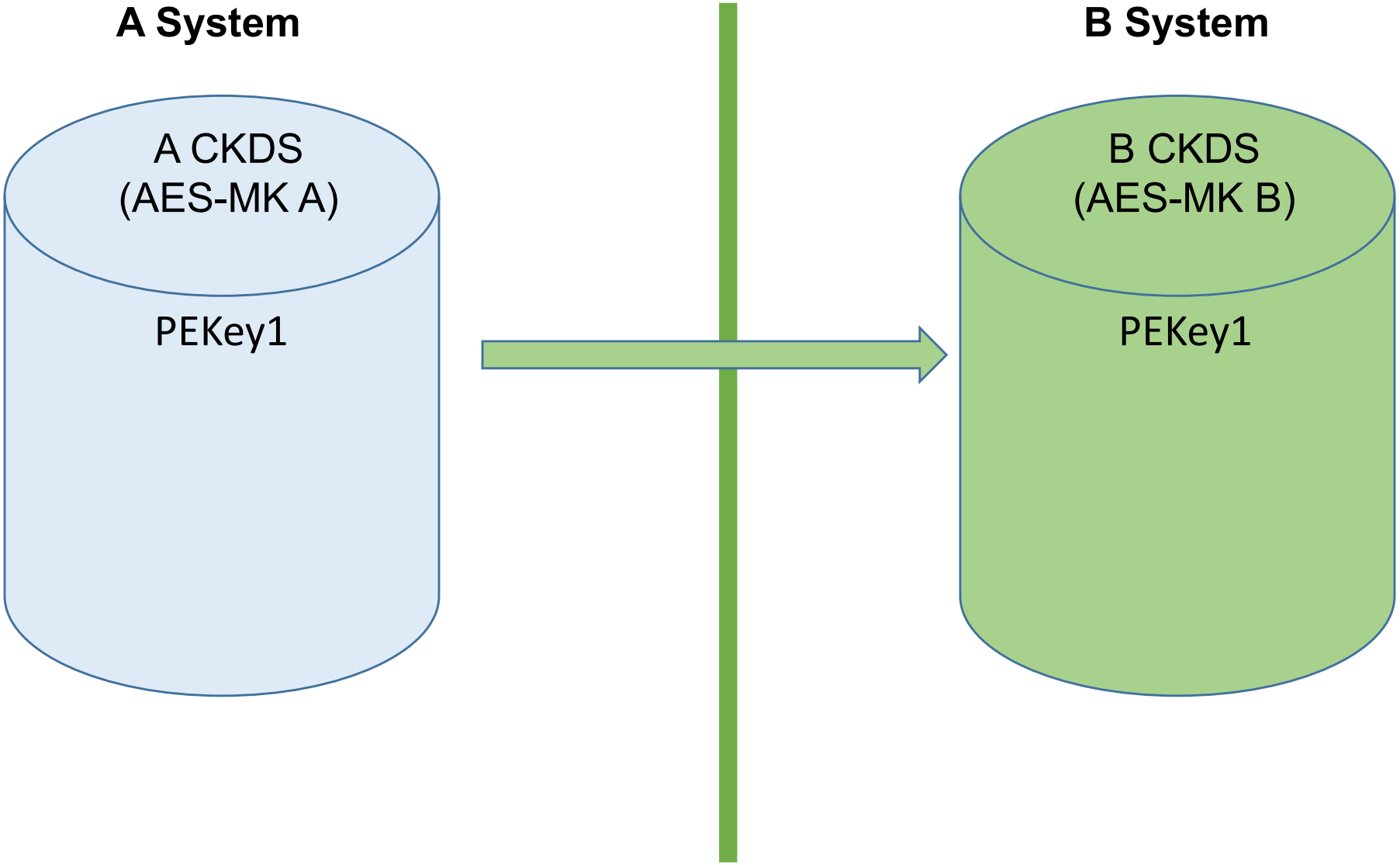
```
//RESTKEY EXEC PGM=IDCAMS,REGION=4M
//SEQT       DD  DSN=savekey.dsn,DISP=SHR                    Bkup key data set
//CKDST      DD  DSN=TEST.CSF.CSFCKDS,DISP=SHR               Primary CKDS
//SYSPRINT DD SYSOUT=*
//SYSIN      DD *
  REPRO INFILE(SEQT) OUTFILE(CKDST)
/*
```

KeyXfer Tool – REXX EXEC on GitHub

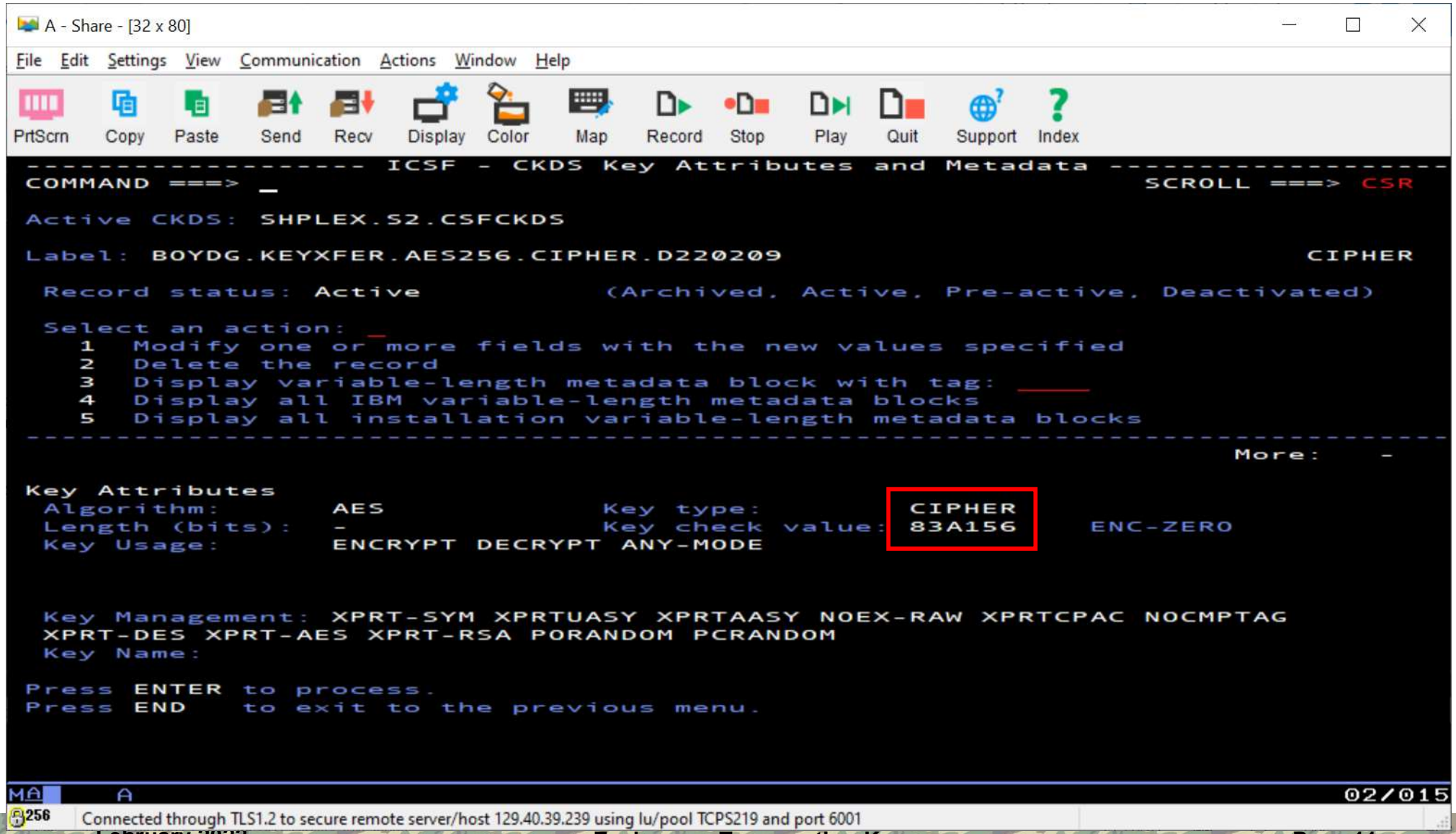
- KEYXFER OPER, LABEL, DSN, OPTION
  - OPER
    - WRITE_CKDS (read the key from the CKDS; write to file)
    - READ_CKDS (read from file; write to CKDS)
    - WRITE_PKDS (read the key from the PKDS; write to file)
    - READ_PKDS (read from file; write to PKDS)
  - LABEL – fully qualified key label
  - DSN – PS or PDS(member) to store the key for transfer

    > 01/23/22 6:35PM
    BOYDG.PE.KEY.20211221
    010000000400C082 … first 32 bytes of the key token
    C220FBC59BF … last 32 bytes of the key token
  - OPTION
    - OVERWRITE
    - DEBUG

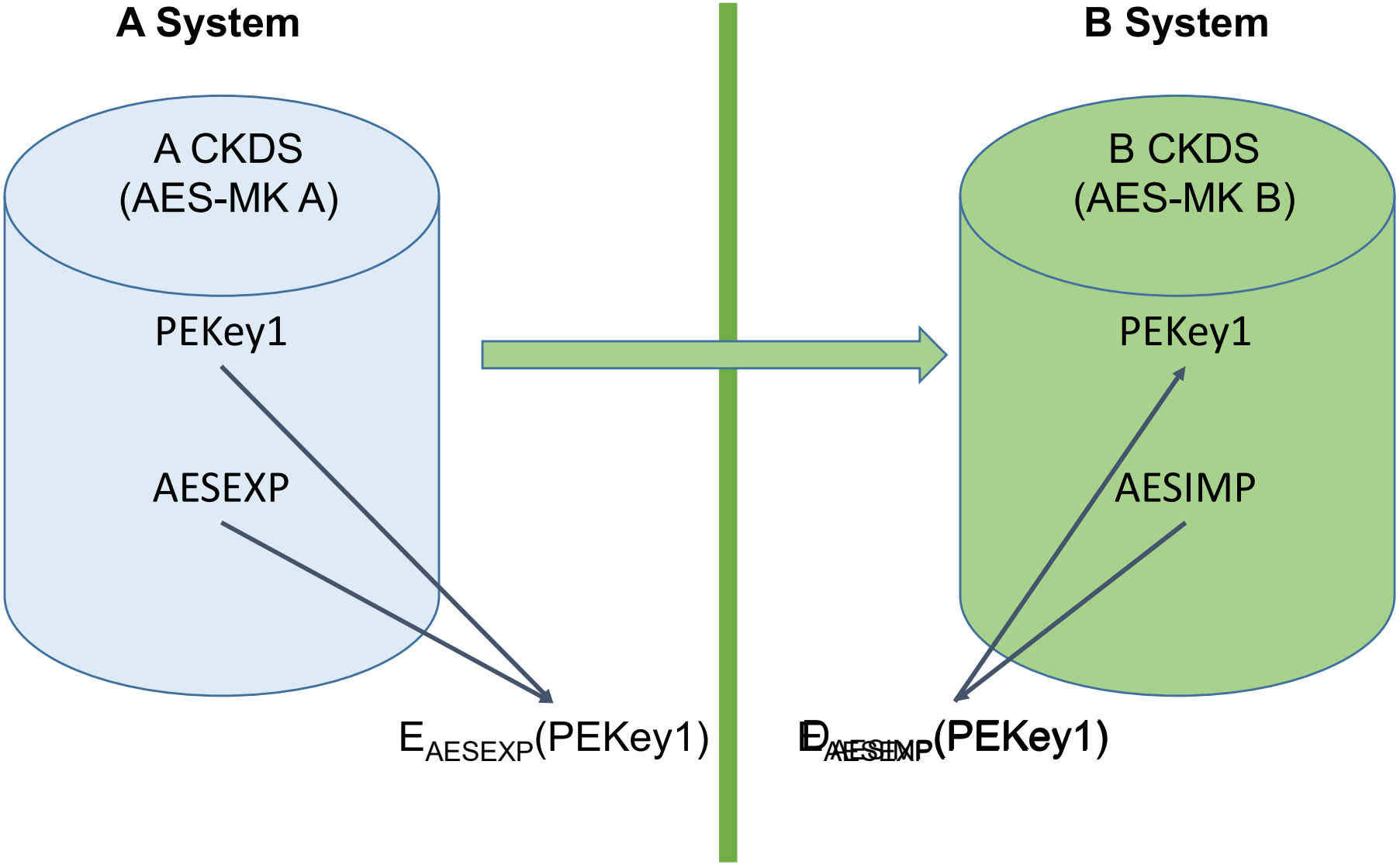
Moving keys between systems



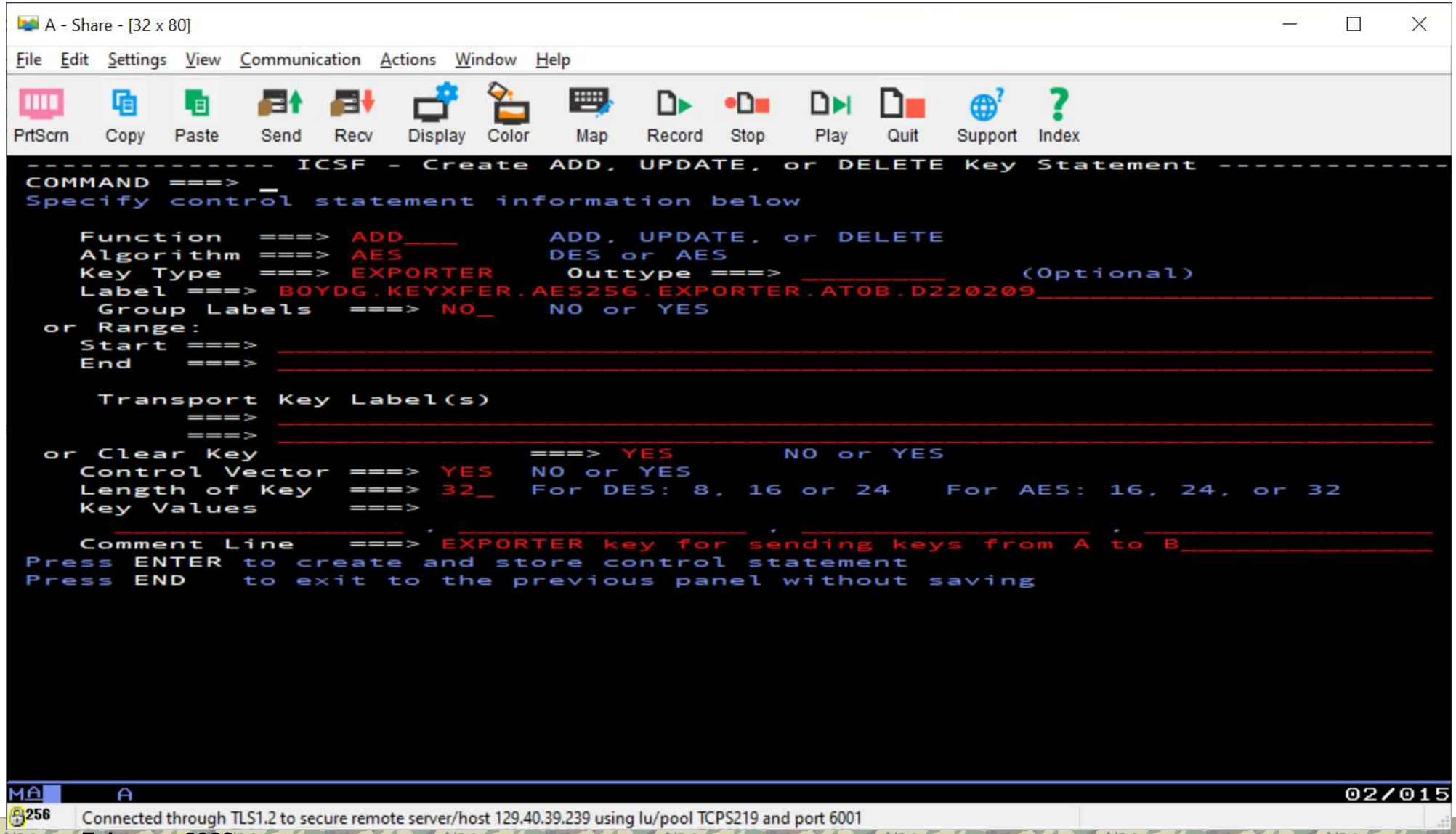
PEKEY1 – CIPHER key with KCV 83A156



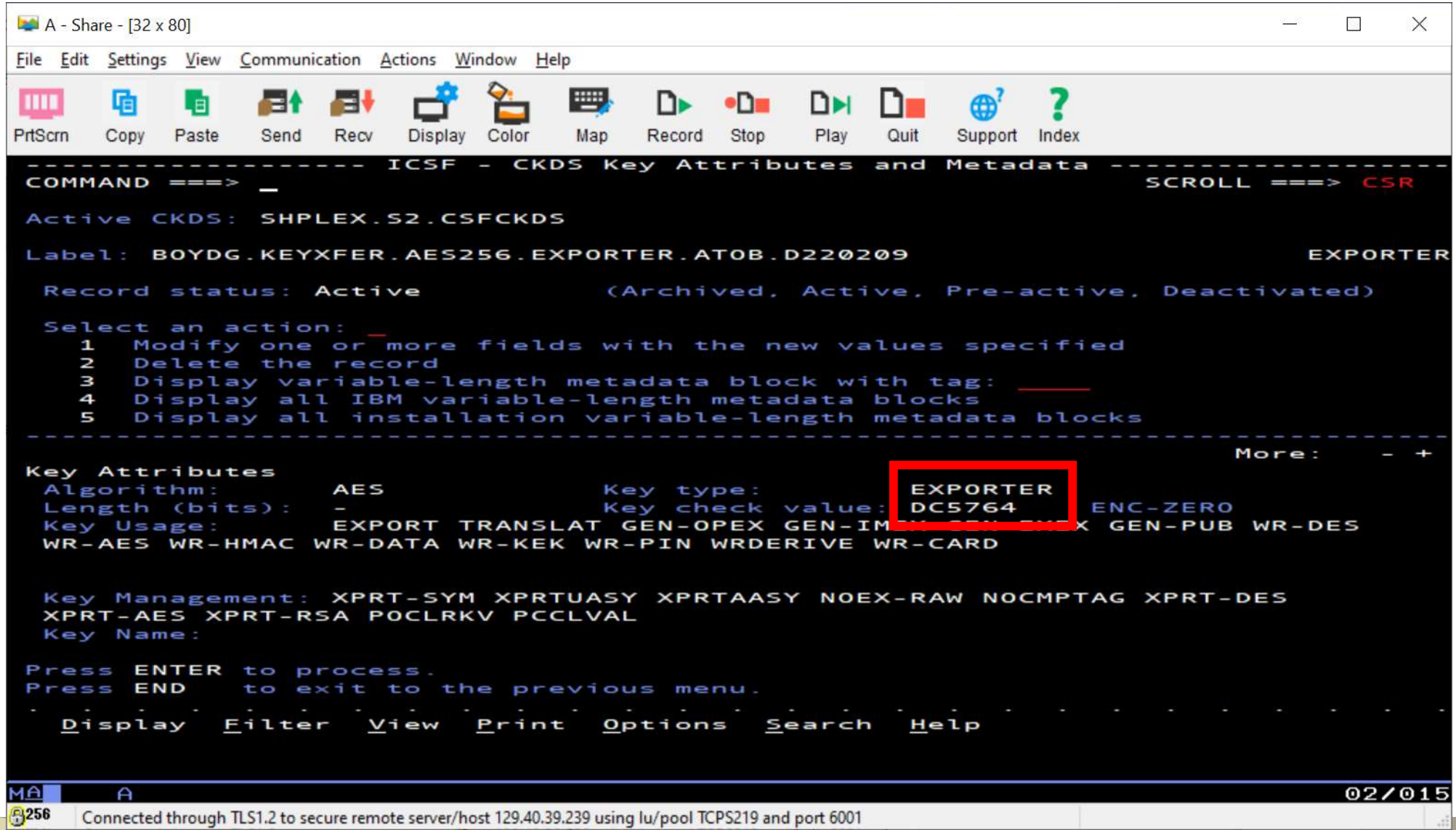
Moving keys between systems



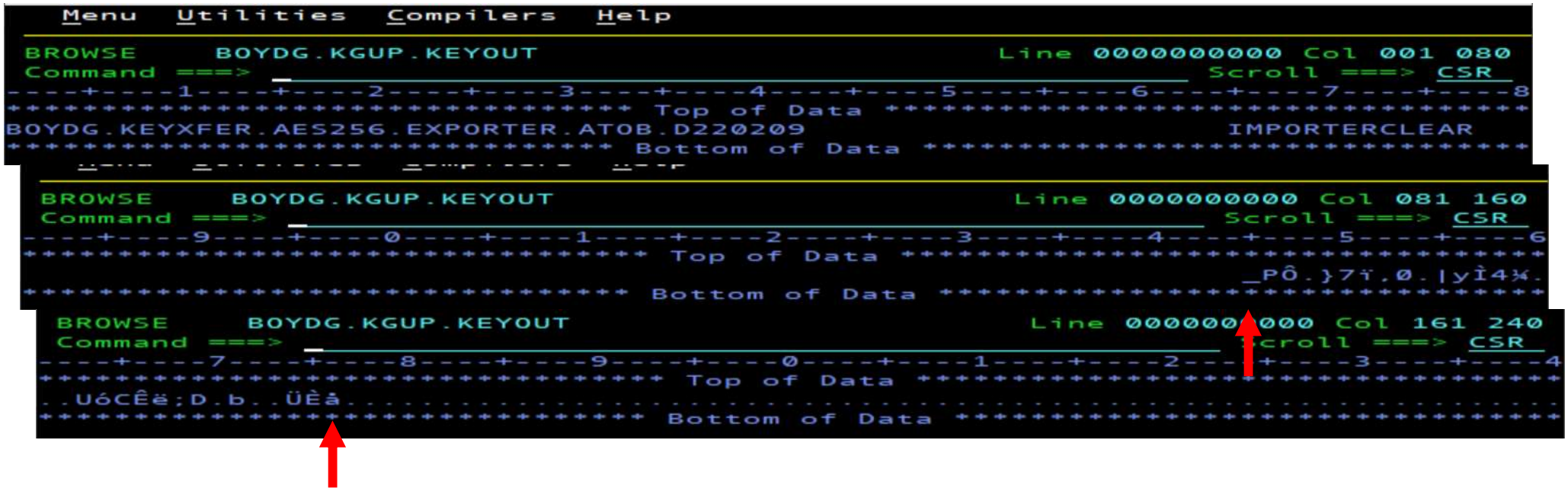
```
/* EXPORTER KEY FOR SENDING KEYS FROM A TO B */
ADD TYPE(EXPORTER) LENGTH(32) ALGORITHM(AES),
 CLEAR,
 LAB(BOYDG.KEYXFER.AES256.EXPORTER.ATOB.D220209)
```



CKDS Keys Utility View of Exporter Key



KEYOUT Data Set

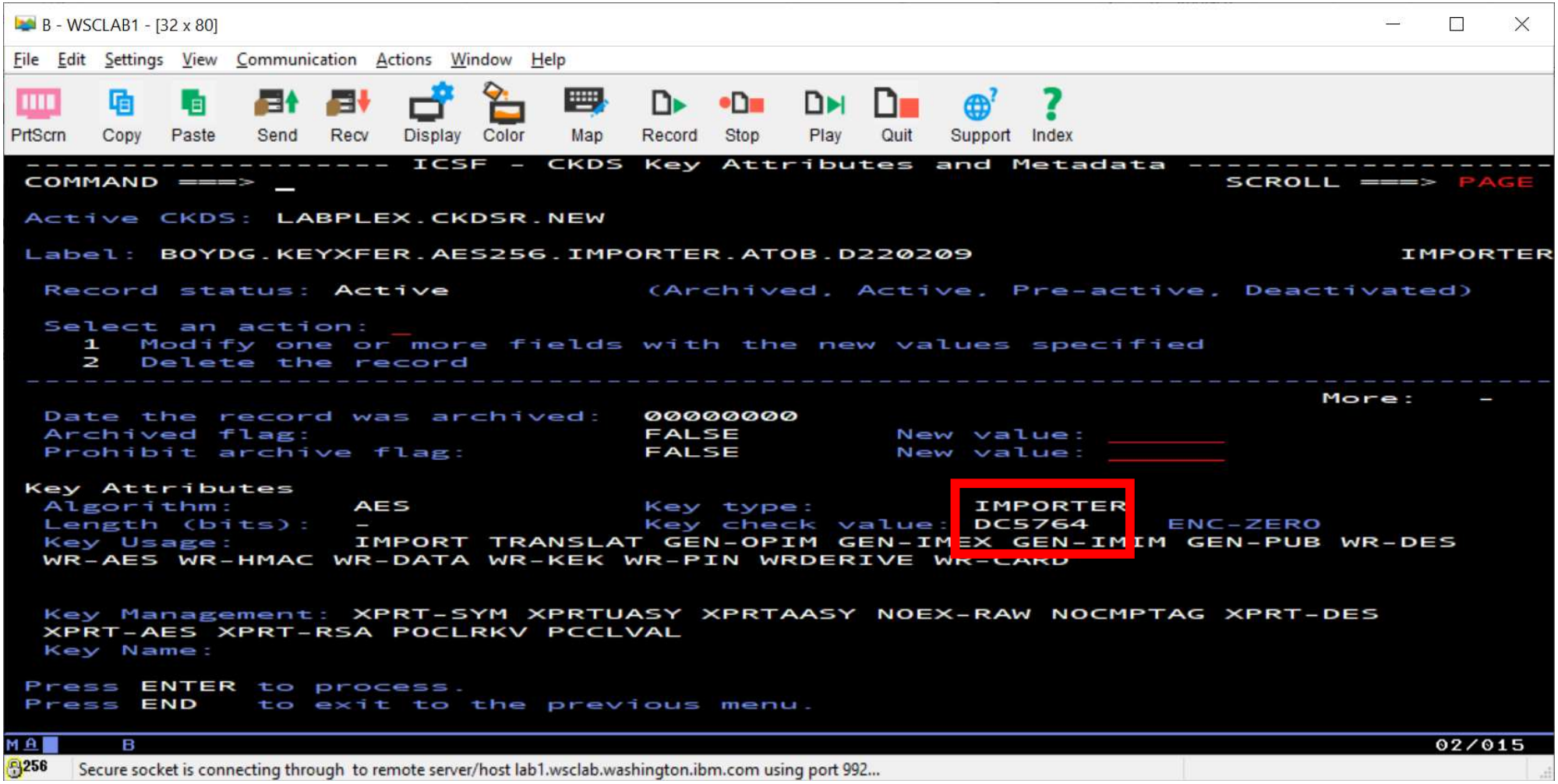


- 64 Bytes — Key Label
- 8 Bytes — Key Type
- 64 Bytes — Either the TRANSKEY label or CLEAR
- 8 Bytes — Key Type
- Variable Length — Key Token

Control Statements for Target system

ADD LABEL(BOYDG.KEYXFER.AES256.IMPORTER.ATOB.D220209) ,
TYPE(IMPORTER) CLEAR ,
ALGORITHM(AES) ,
KEY(6DD7EB29D0F7576B, 80094FA878F4B71A, 2D35E4CEC372535E,
C43A823337FC7447)

New Key Label, New Key Type, Same KCV



Transferring the operational key

- CSNBKEX – Key Export
  - Takes a key from being encrypted under a master key to being encrypted under an exporter key-encrypting key
- CSNBKIM – Key Import
  - Takes a key from being encrypted under an importer key-encrypting key to being encrypted under a master key
- CSNDSYX
  - Takes a symmetric key from being encrypted under a master key to being encrypted under an RSA public key or AES Exporter key
- CSNDSYI
  - Takes a symmetric AES or DES DATA key from being encrypted under an RSA public key to being encrypted under a master key
- CSNDSYI2
  - Takes a symmetric HMAC, AES or DES key from being encrypted under an RSA public key or an AES EXPORTER key to being encrypted under a master key

Transporting AES keys

- Multi-step process to wrap/unwrap an existing AES DATA key with AES IMPORTER/EXPORTER keys derived from an ECC Key Pair. https://community.ibm.com/community/user/ibmz-and-linuxone/viewdocument/drvaesmp?CommunityKey=6593e27b-caf6-4f6c-a8a8-10b62a02509c&tab=librarydocuments

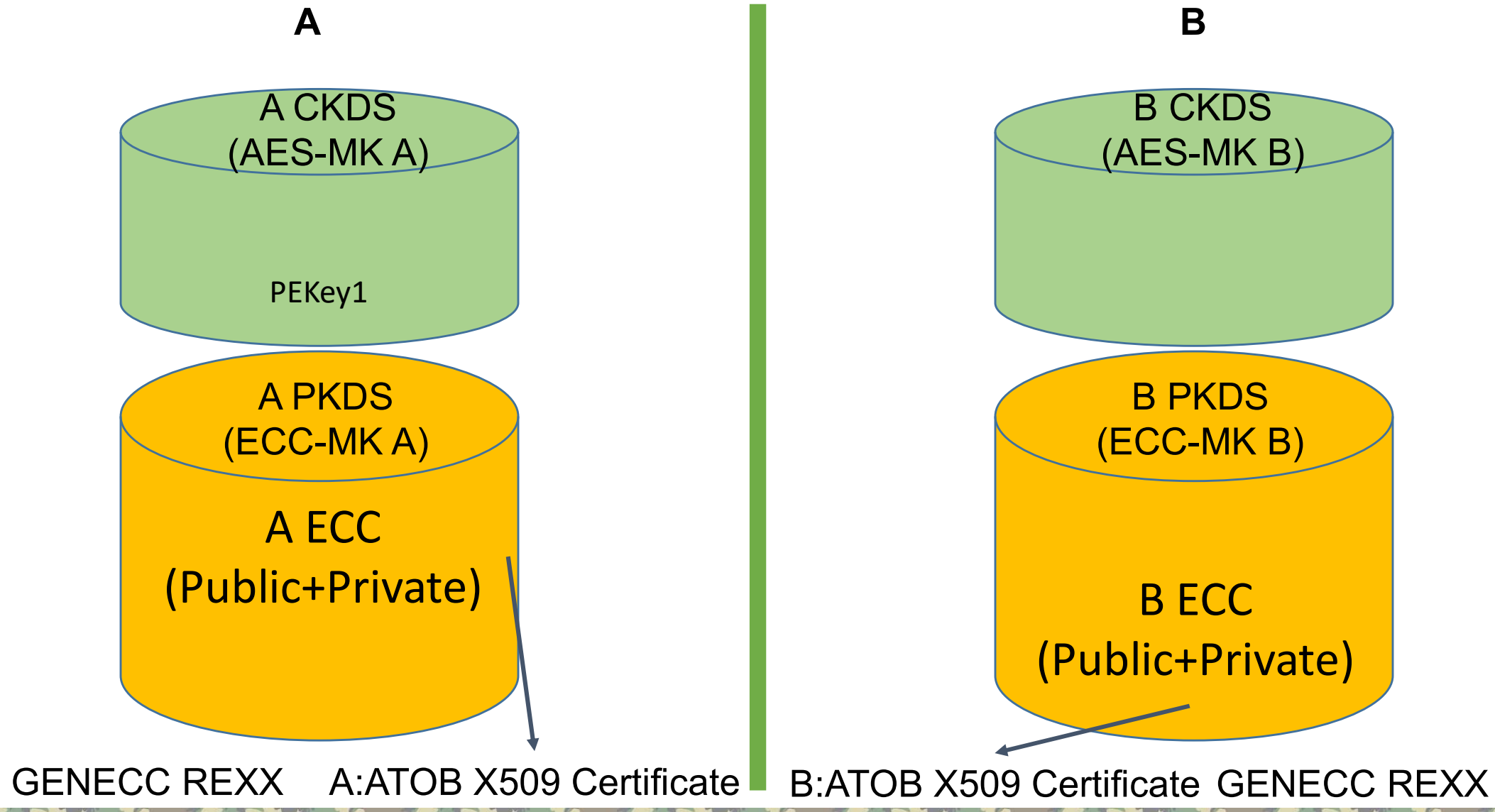
- Set of REXX EXECs to
  - GENECC2 - Create a public/private key pair on A and export the public key to B
  - GENECC2 - Create a public/private key pair on B and export the public key to A
  - IMPRTEC2 – On A, import B's public key
  - IMPRTEC2 – On B, import A's public key
  - DRVAESXP - On A, create an EXPORTER key using A's private key and B's public key
  - DRVAESMP - On B, create an IMPORTER key using B's private key and A's public key
  - ESPAES32 - On A, export the operational key using the EXPORTER key
  - IMPAES32 - On B, import the operational key using the IMPORTER key

Diffie-Hellman Key Exchange

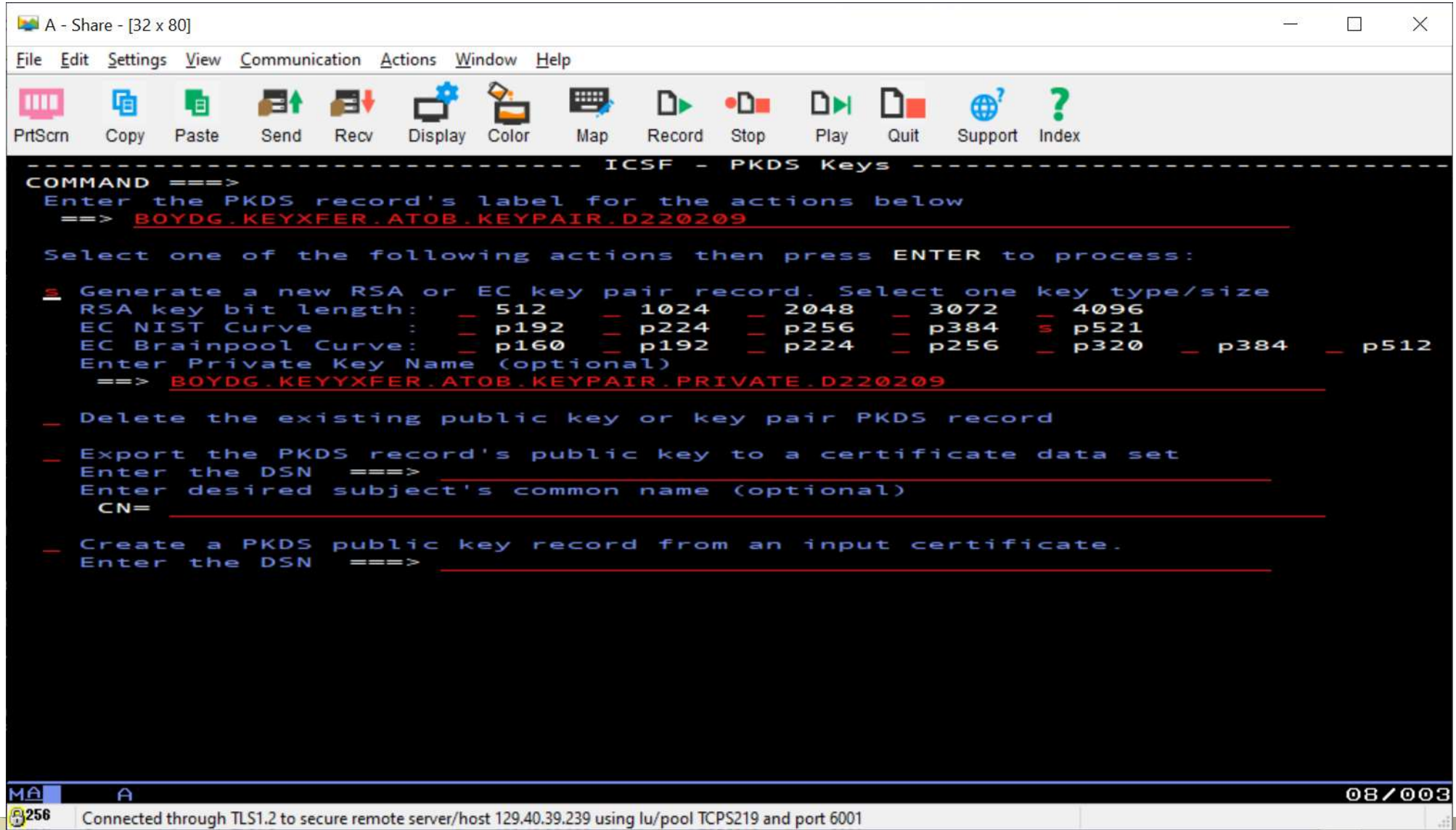
- Alice and Bob agree to use specific values for a modulus and base
  - Modulus p 23
  - Base g 5
- Alice selects a secret value … we'll use 4 and
  - Calculates $A = g^a \bmod p \Rightarrow A = 5^4 \bmod 23 = 4$
  - And shares A with Bob
- Bob selects a secret value … we'll use 3 and
  - Calculates $B = g^b \bmod p \Rightarrow B = 5^3 \bmod 23 = 10$
  - And shares B with Alice
- Alice computes the shared secret s
  - $s = B^a \bmod p \Rightarrow 10^4 \bmod 23 = 18$
- Bob computes their shared secret s
  - $S = A^b \bmod p \Rightarrow 4^3 \bmod 23 = 18$

From Wikipedia:
https://en.wikipedia.org/wiki/Diffie%E2%80%93Hellman_key_exchange

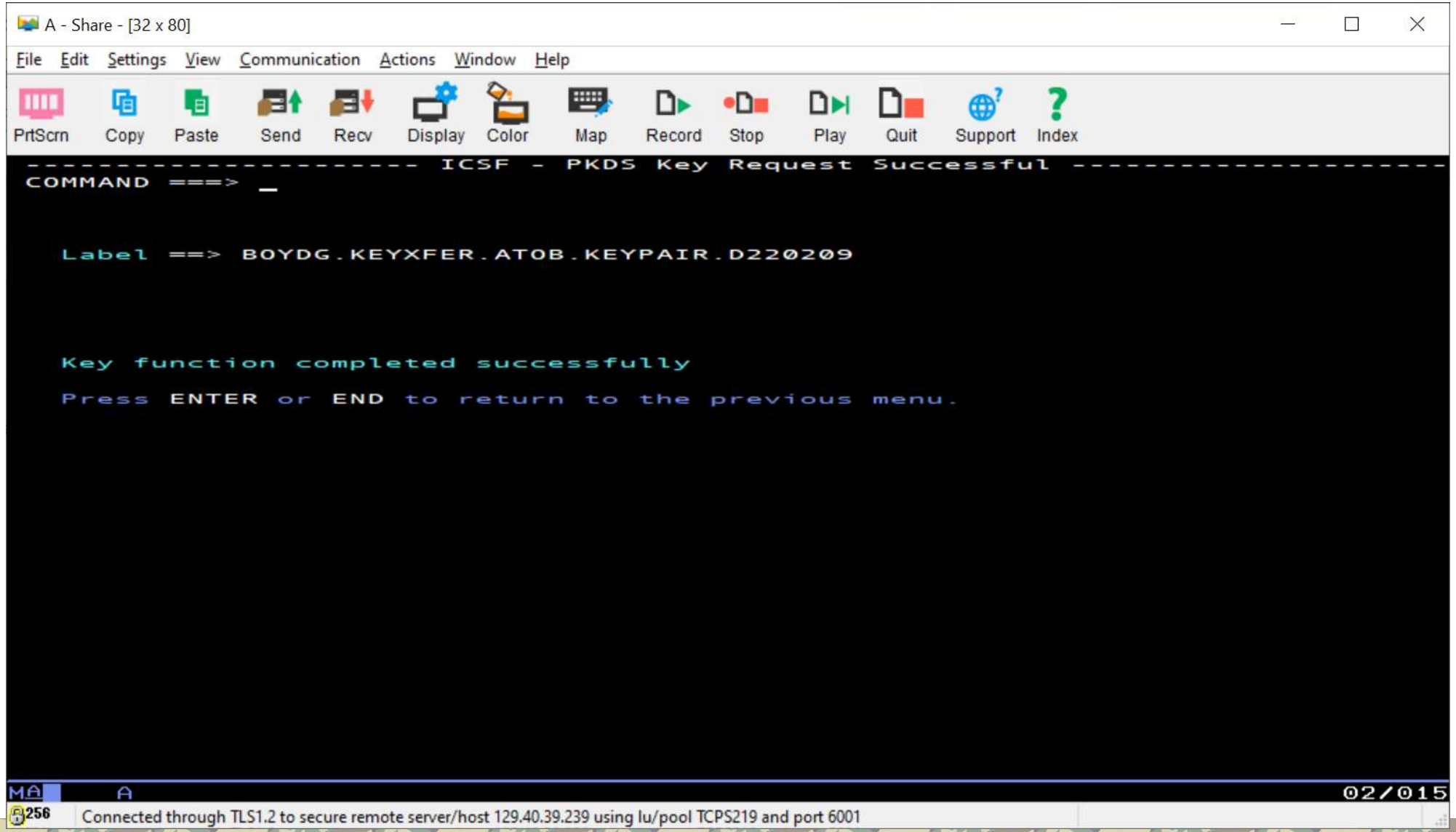
Create ECC Pair for AtoB and BtoA



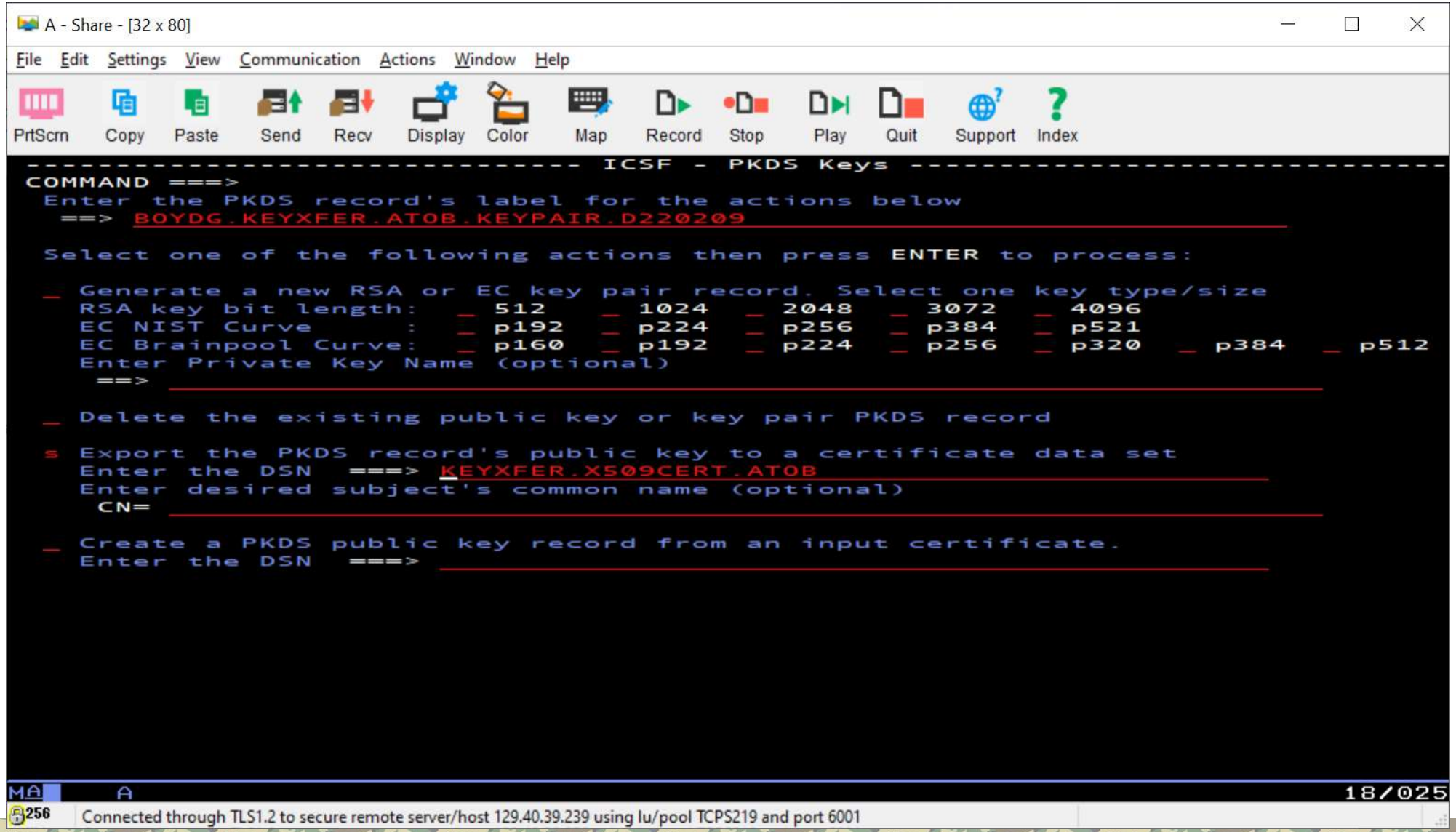
On A-Generate ECC Public/Private Key Pair



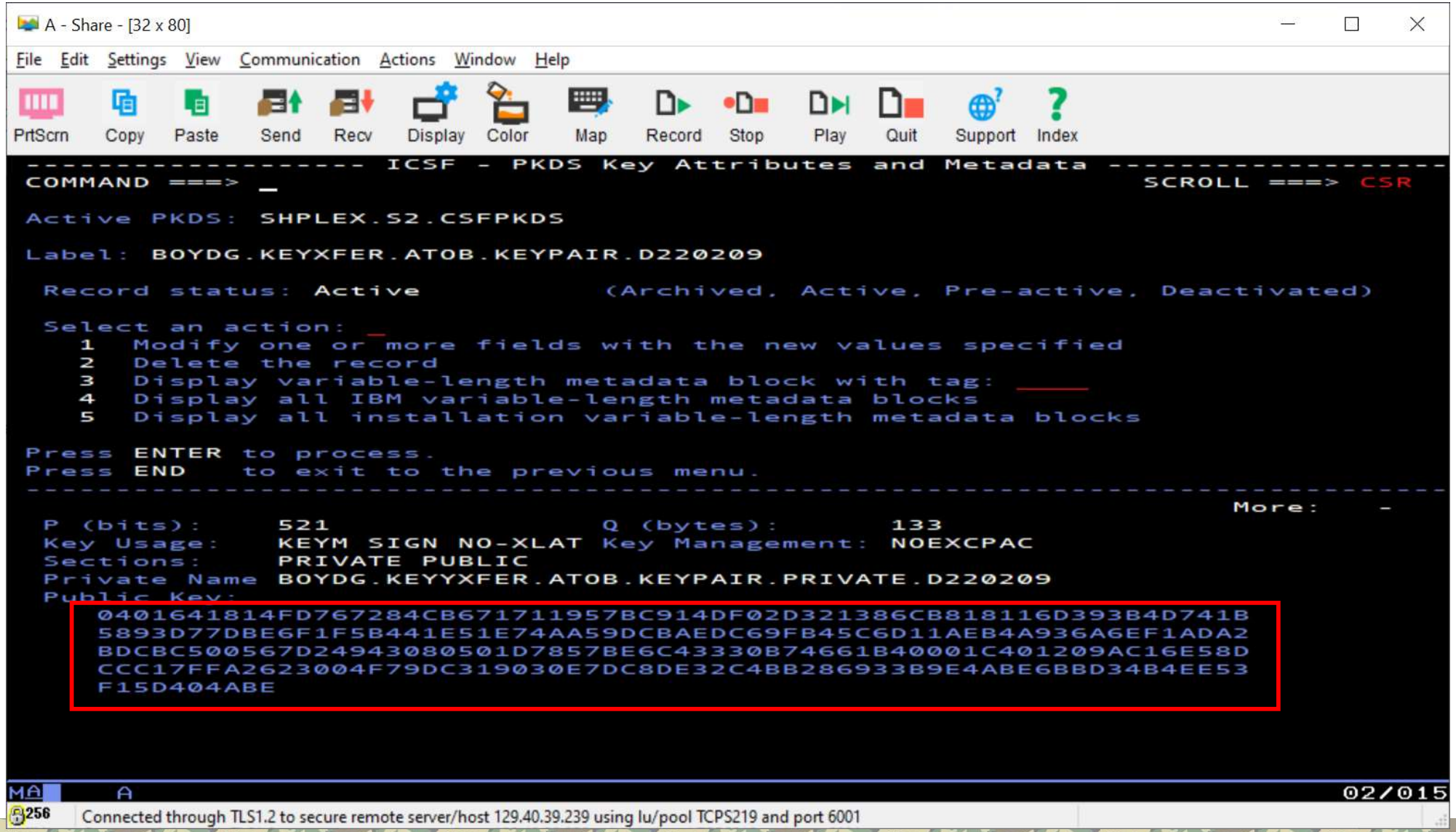
On A - Key Pair Generated Successfully



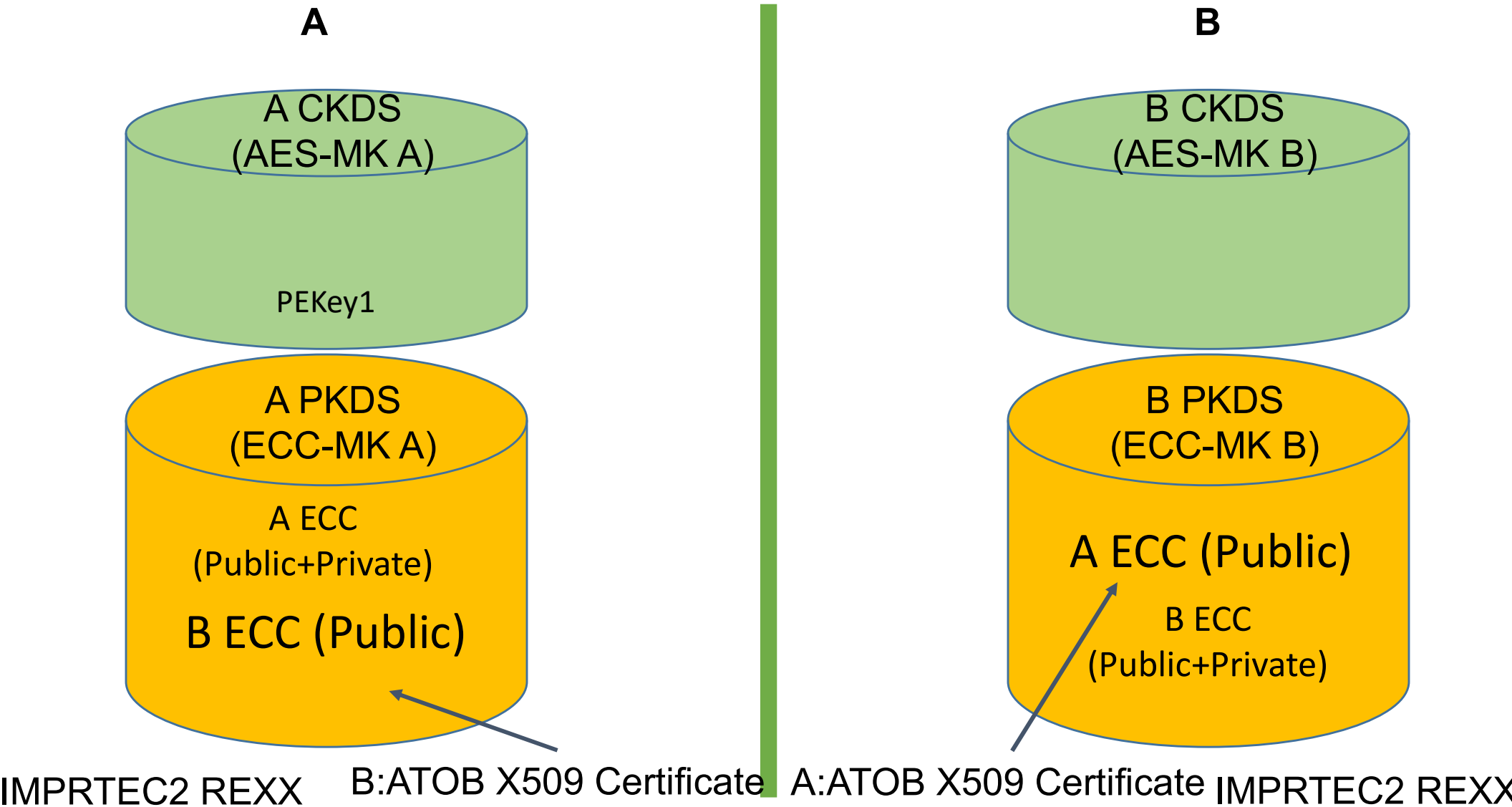
On A - Export the public key



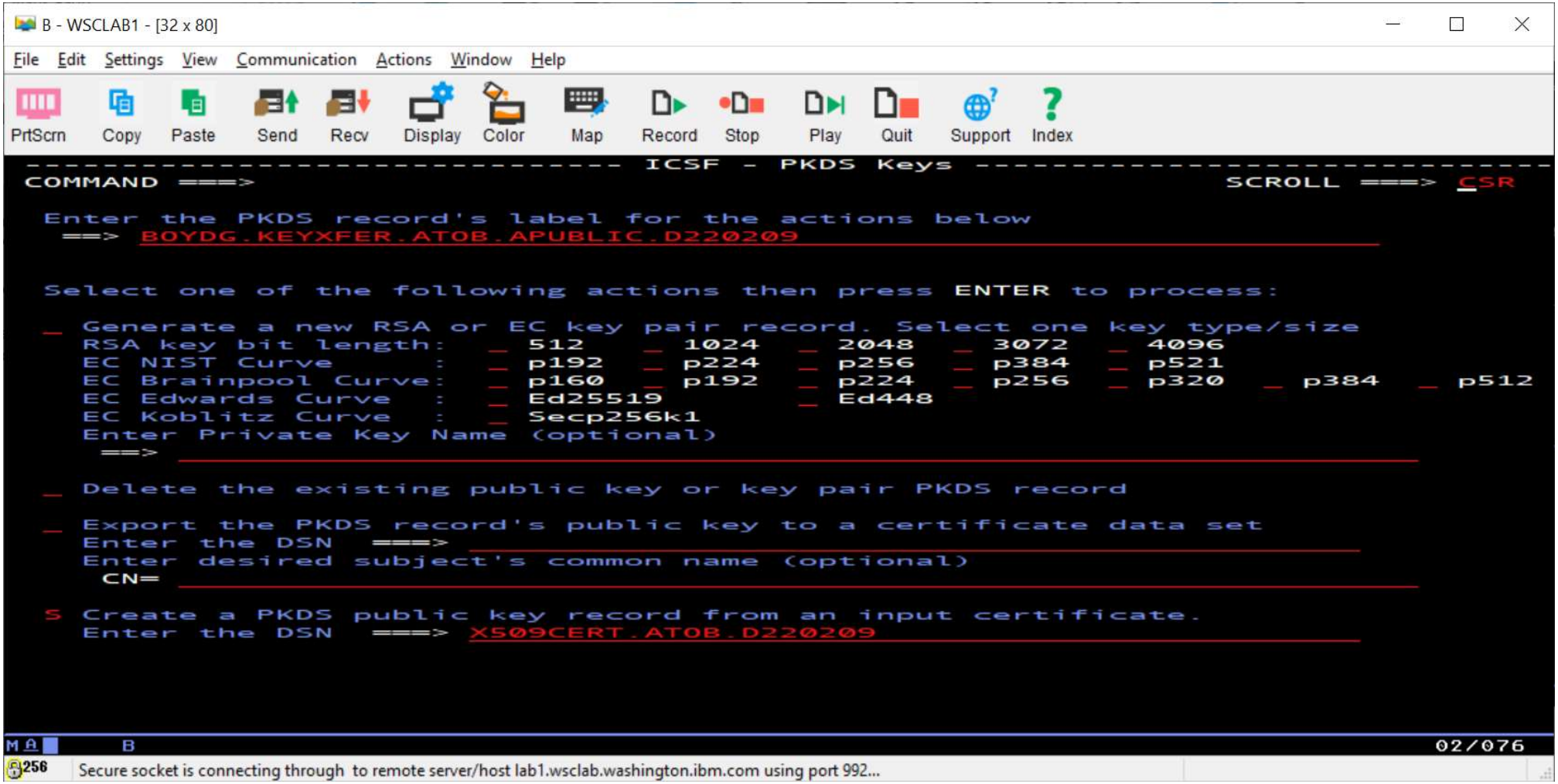
On A – PKDS Keys Utility



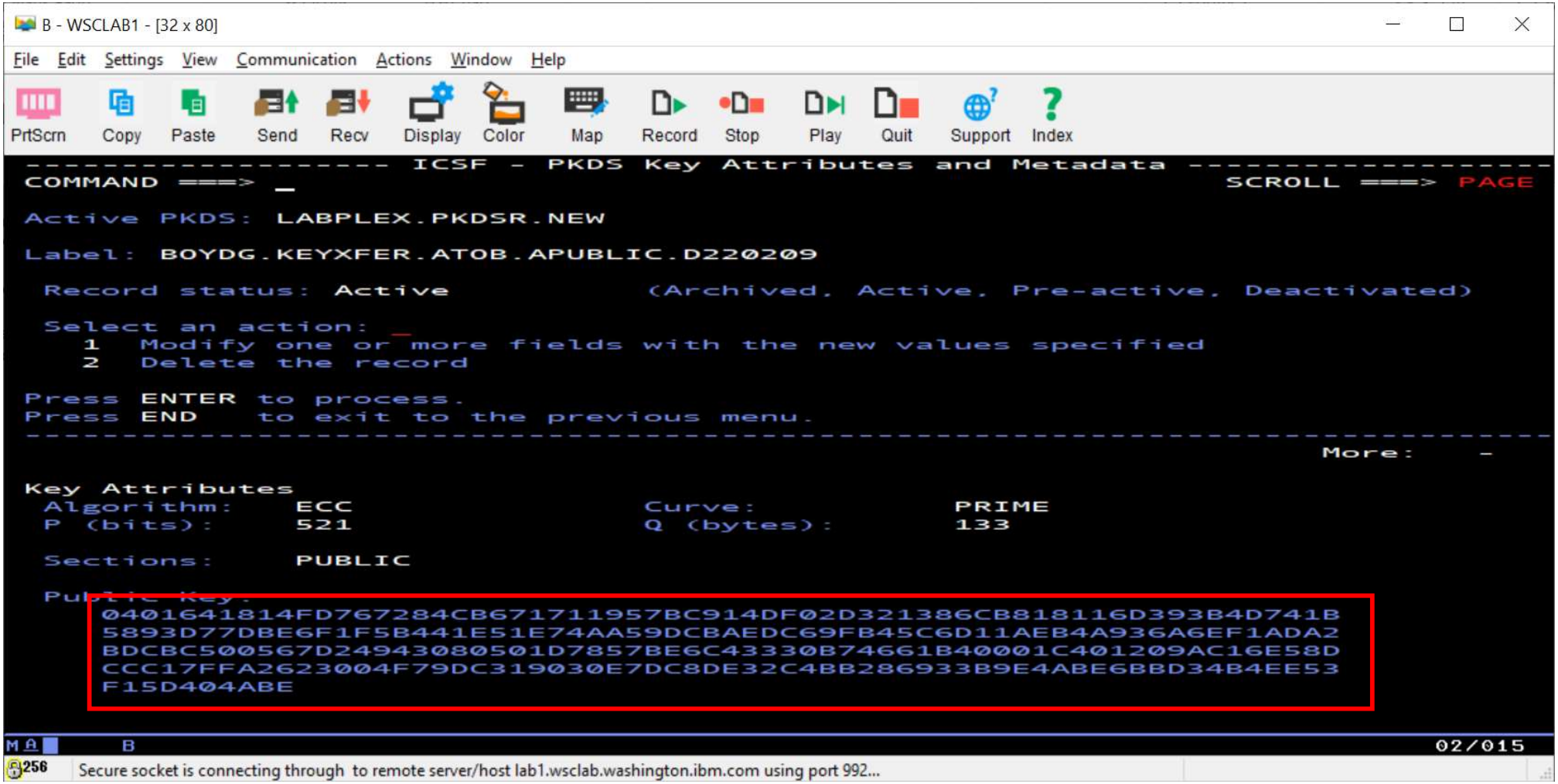
Import A's Public Key on B



On B - Import the Public key from A



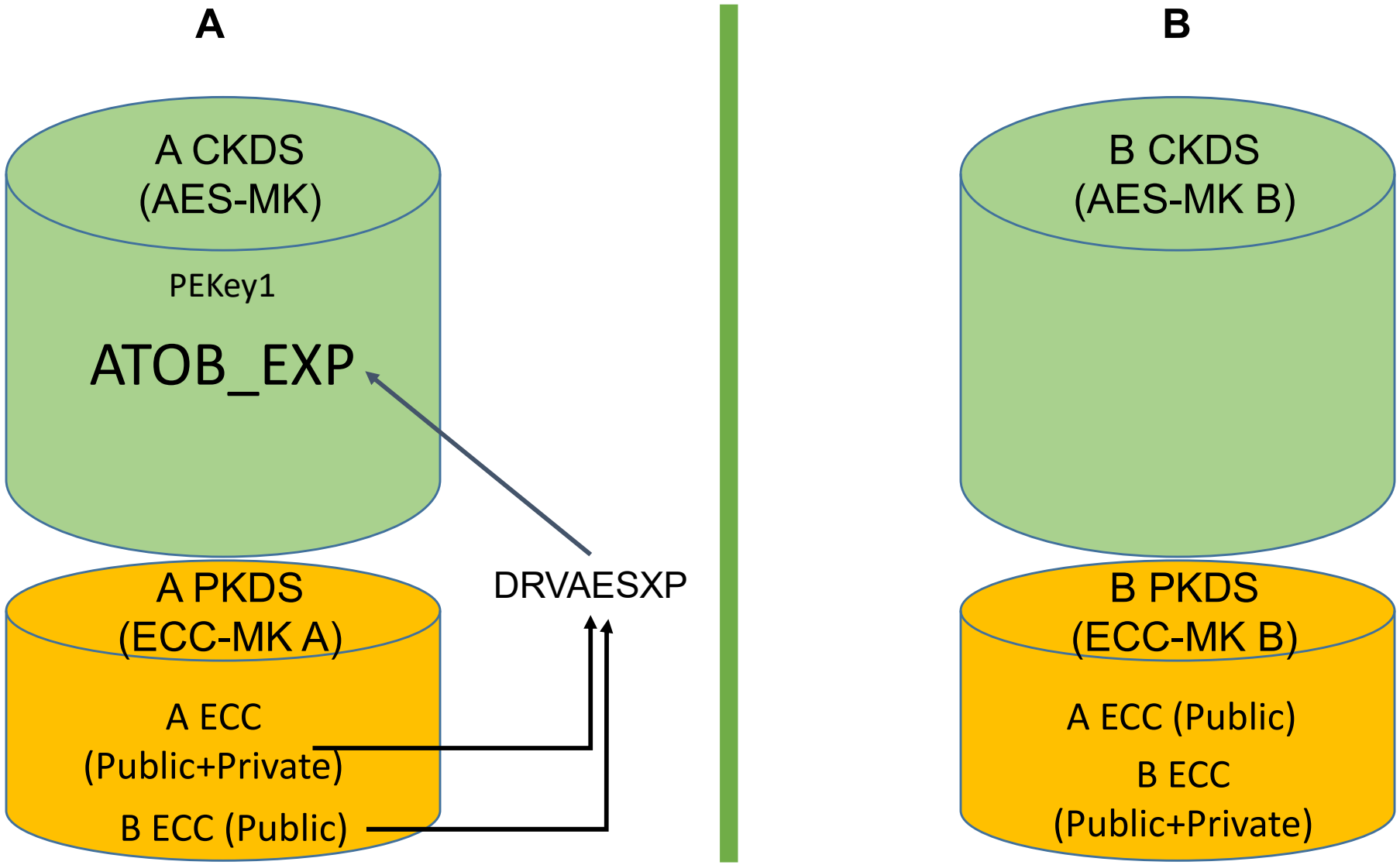
On B – A's Public key is available



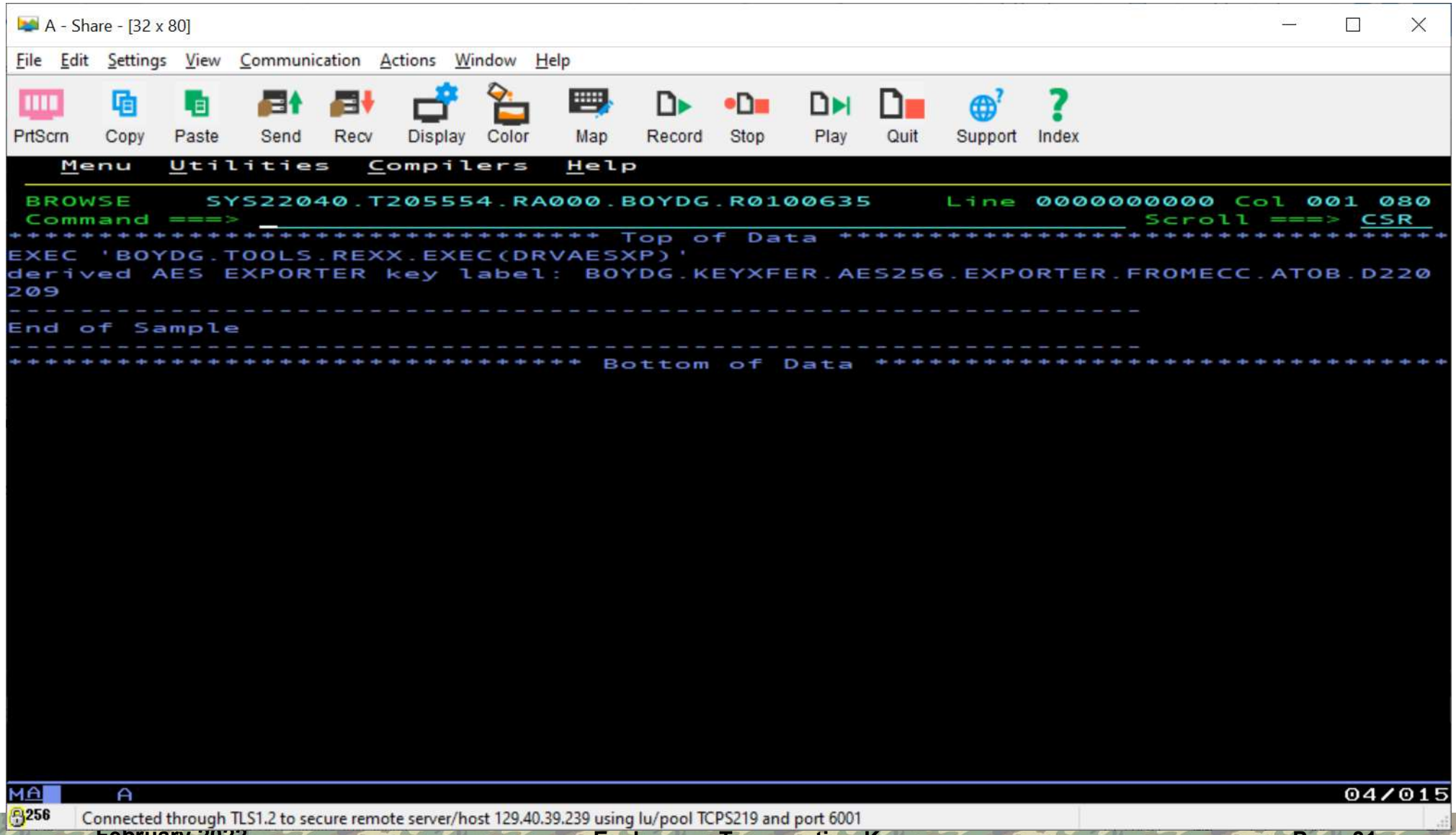
Repeat for B to A

- Generate a public/private key pair on B
- Export the public key from B to a file
- Move that certificate file to A
- Import the public key from B, on A

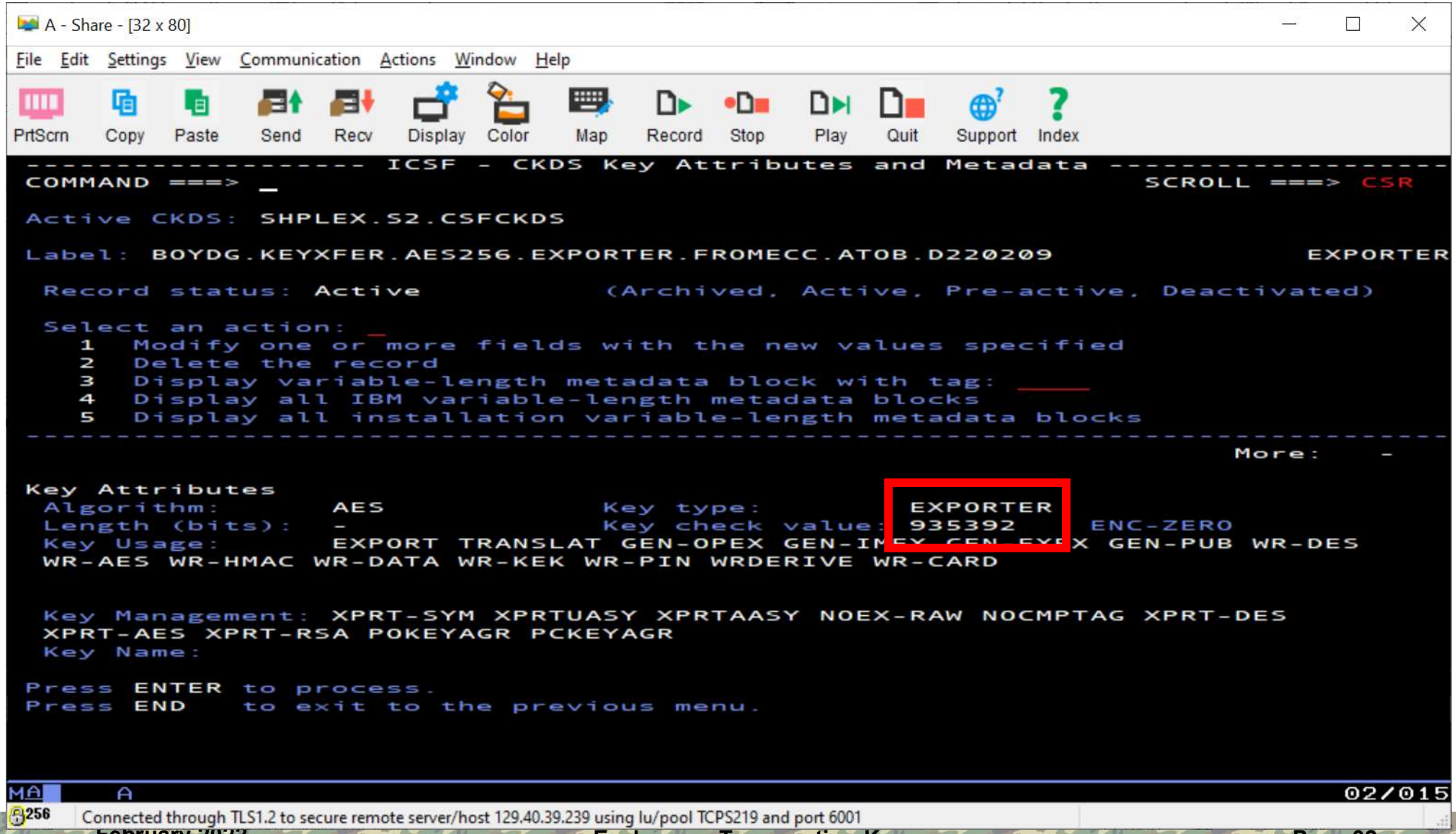
Create AES Exporter on A



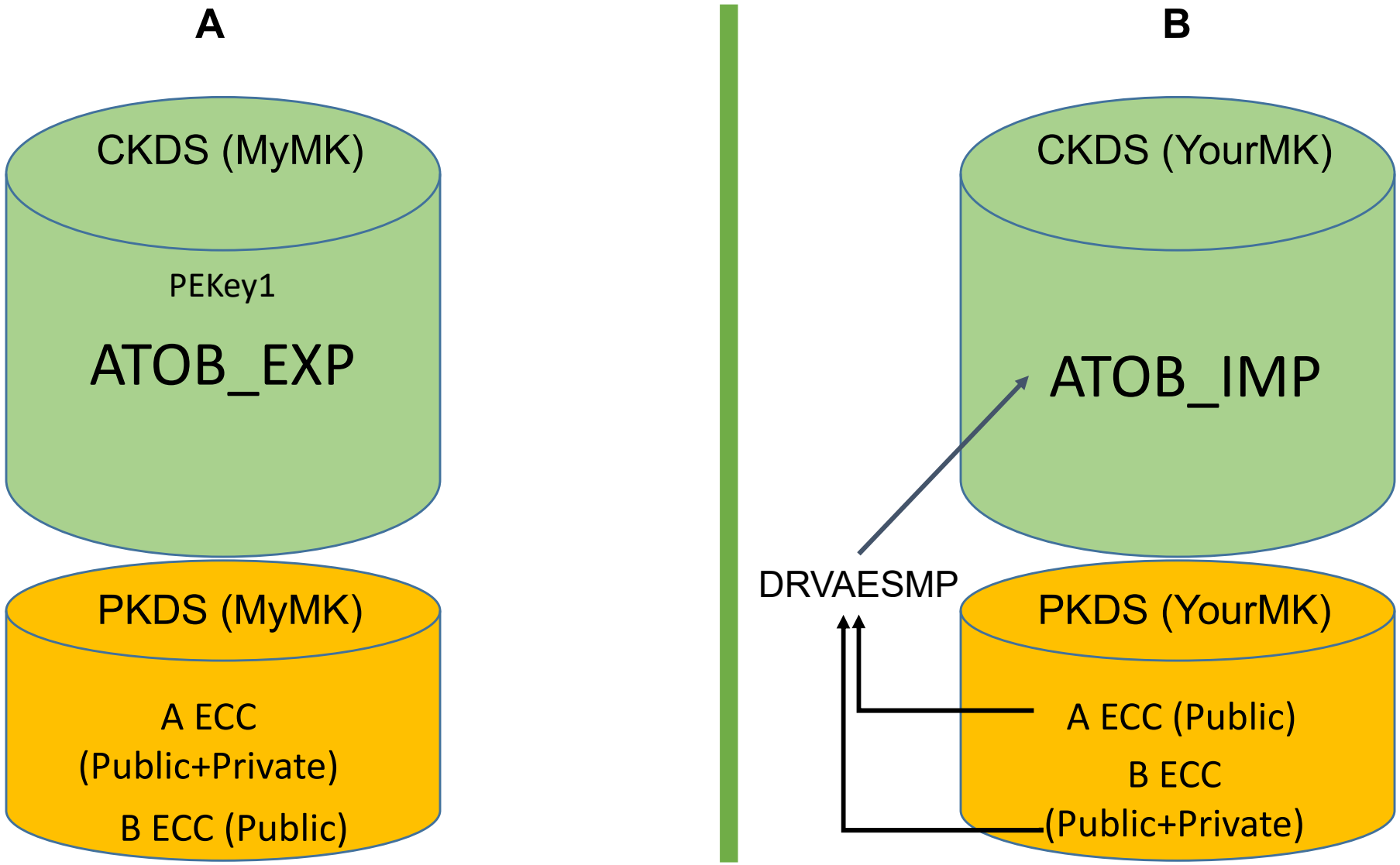
On A – Execute DRVAESXP REXX to Create the Exporter key



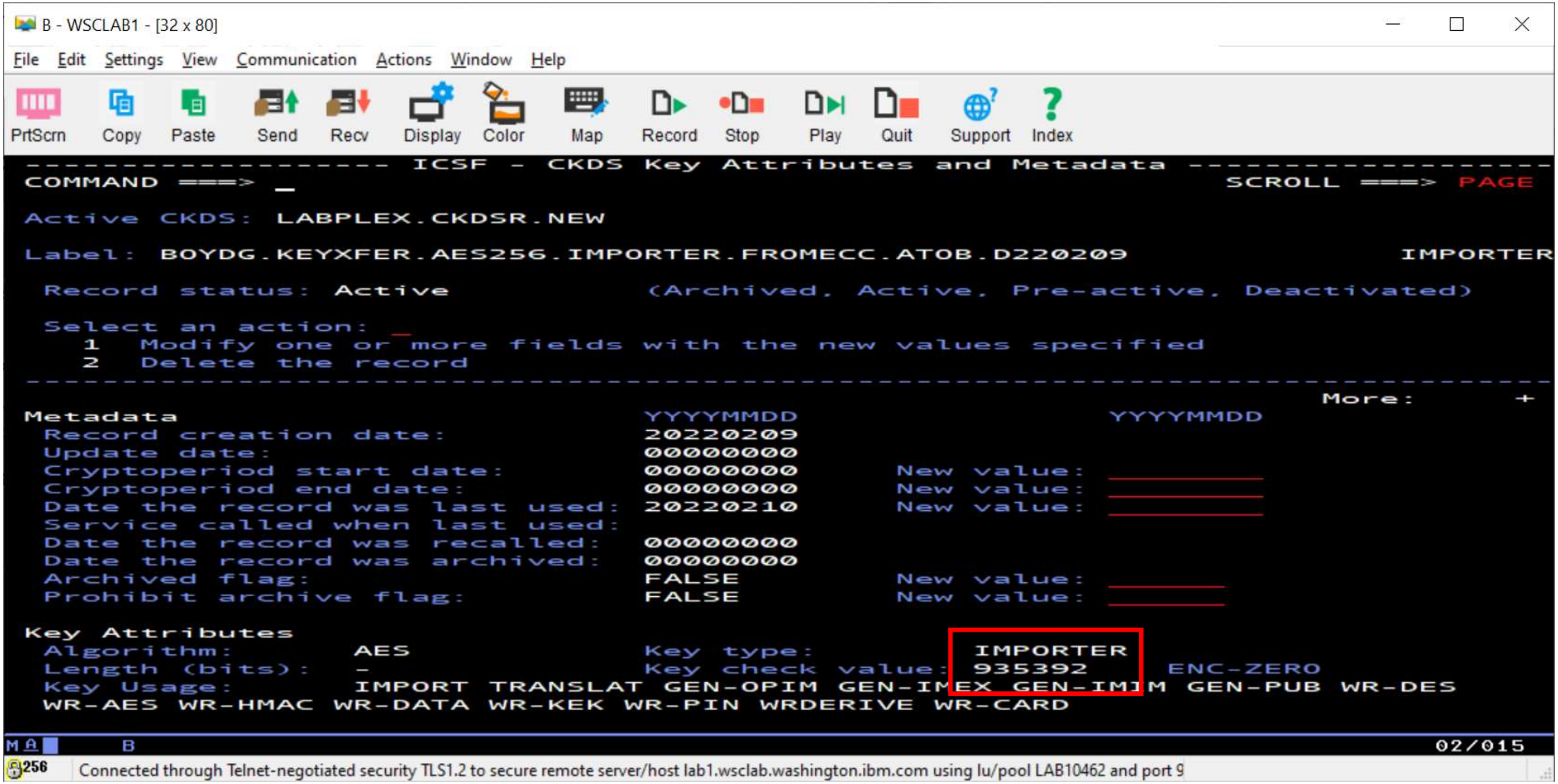
On A – Exporter key KCV=935392



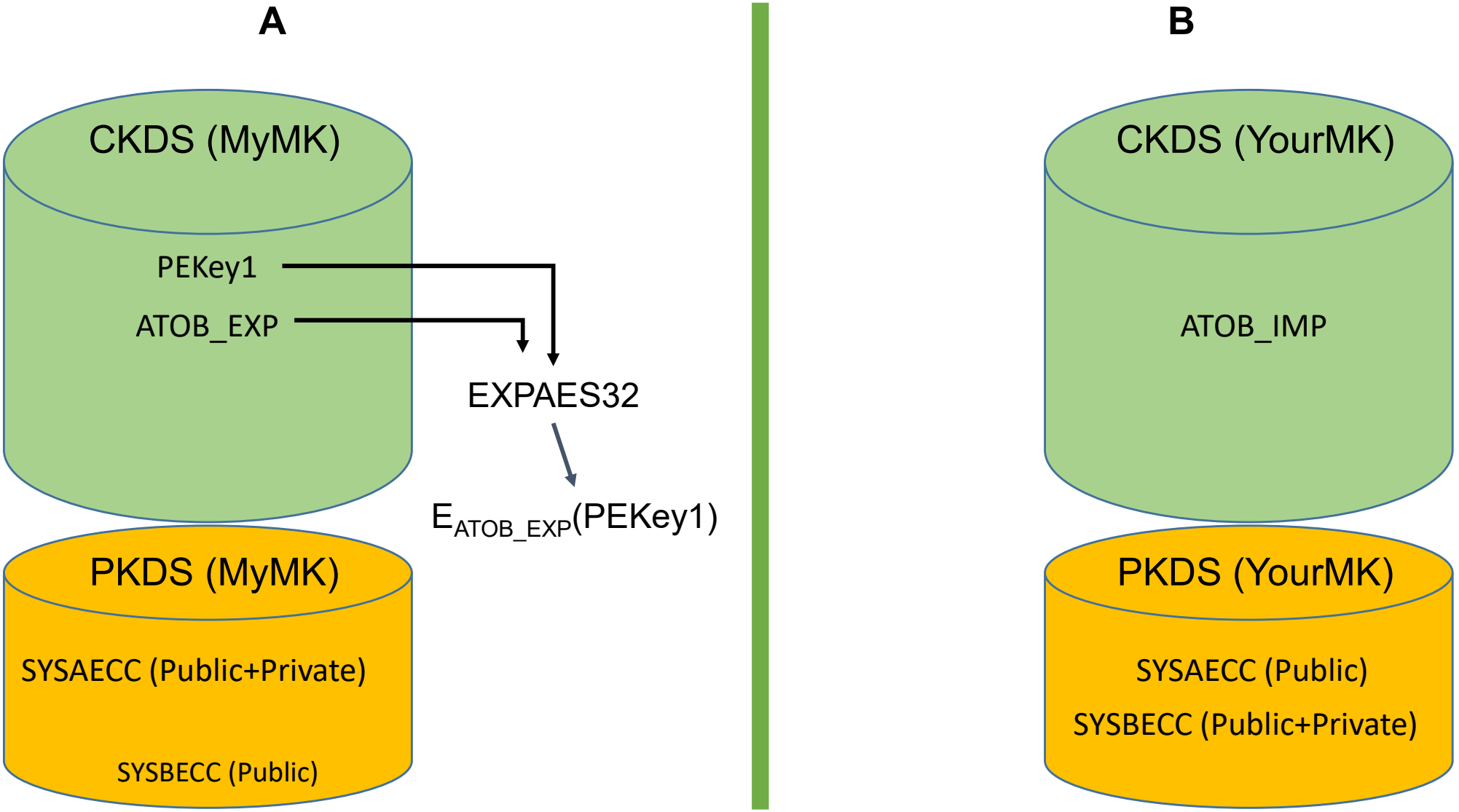
Create AES Importer on B



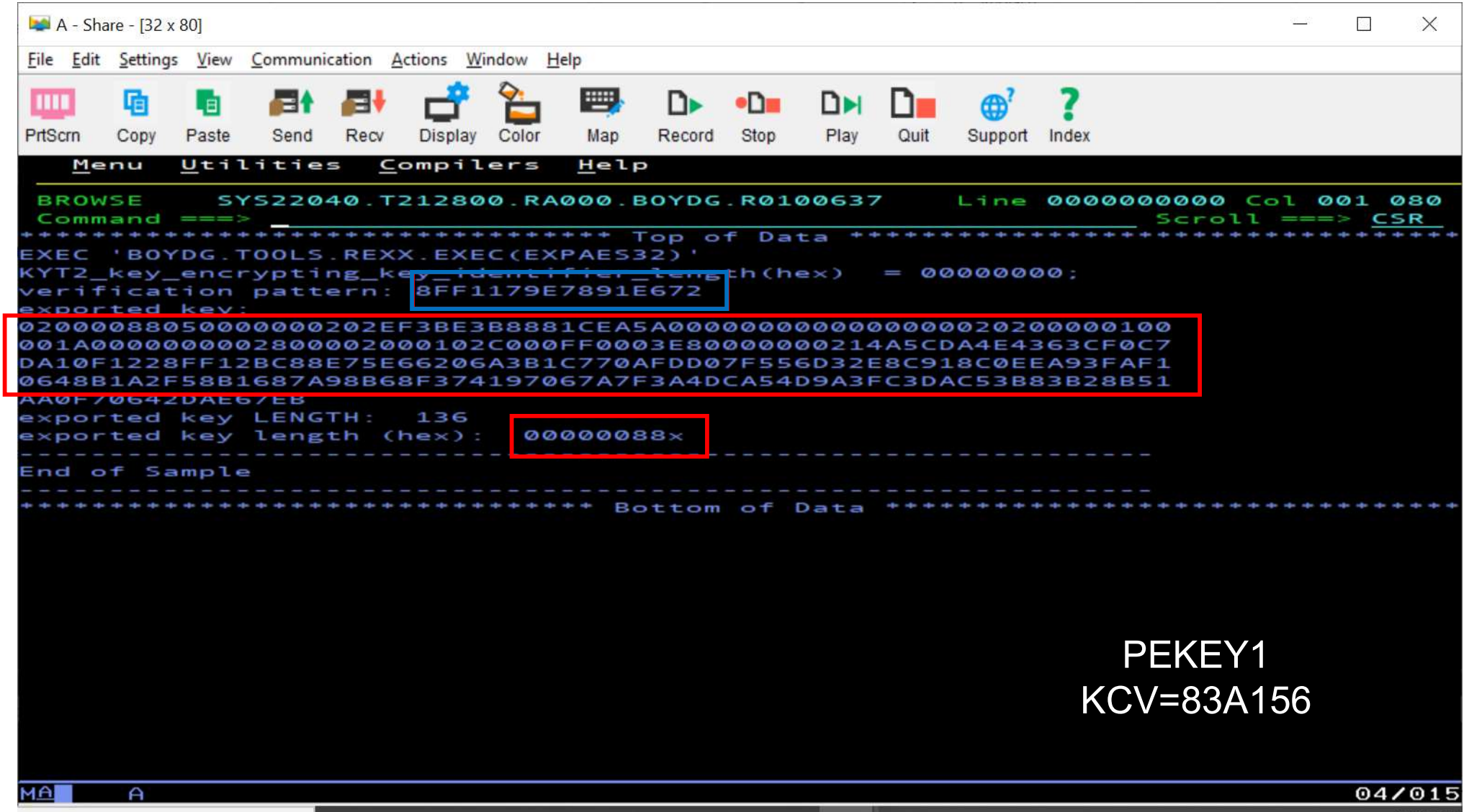
On B – Importer key KCV=935392



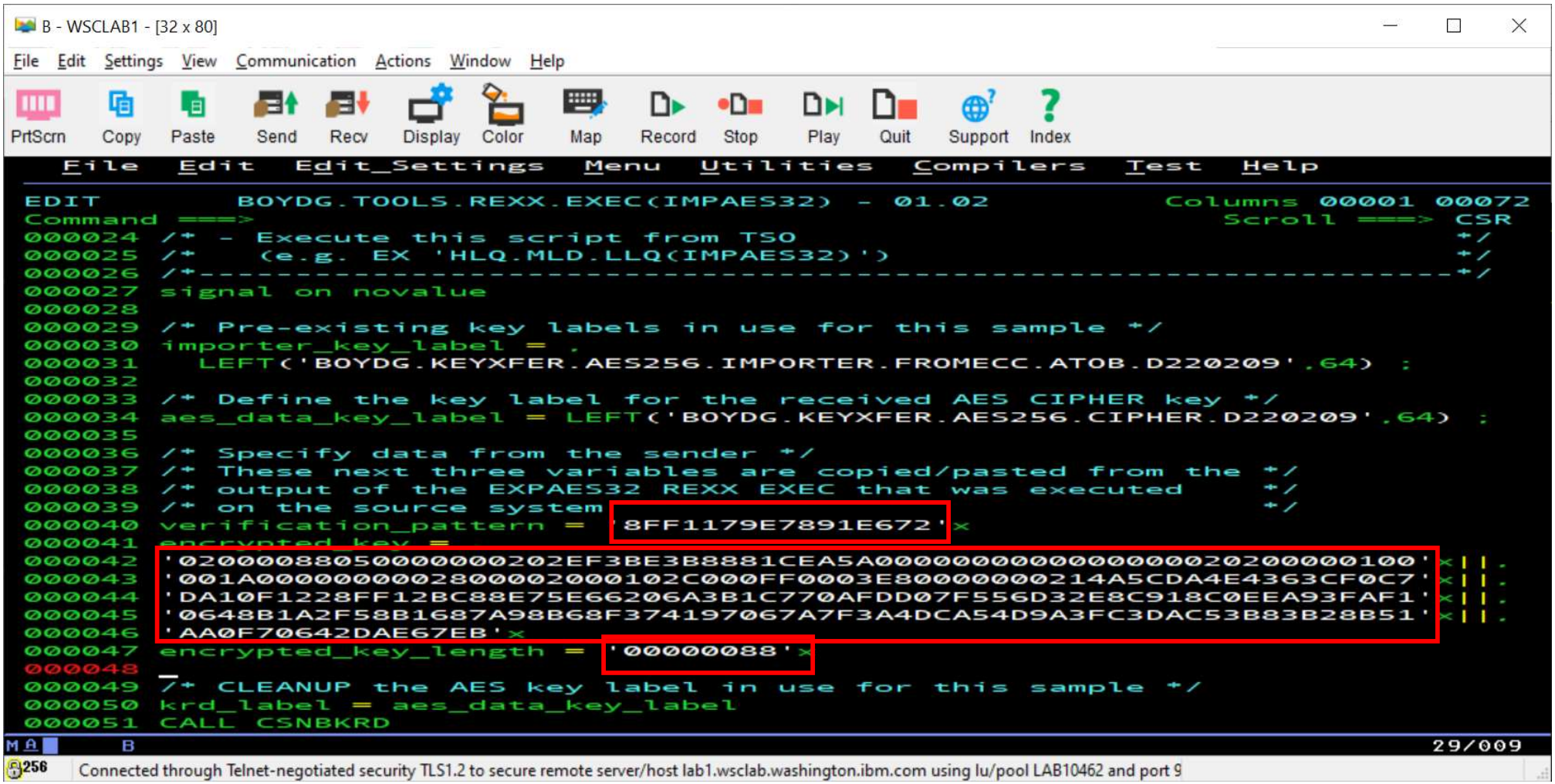
A: Export PEKey1 & B: Import PEKey1



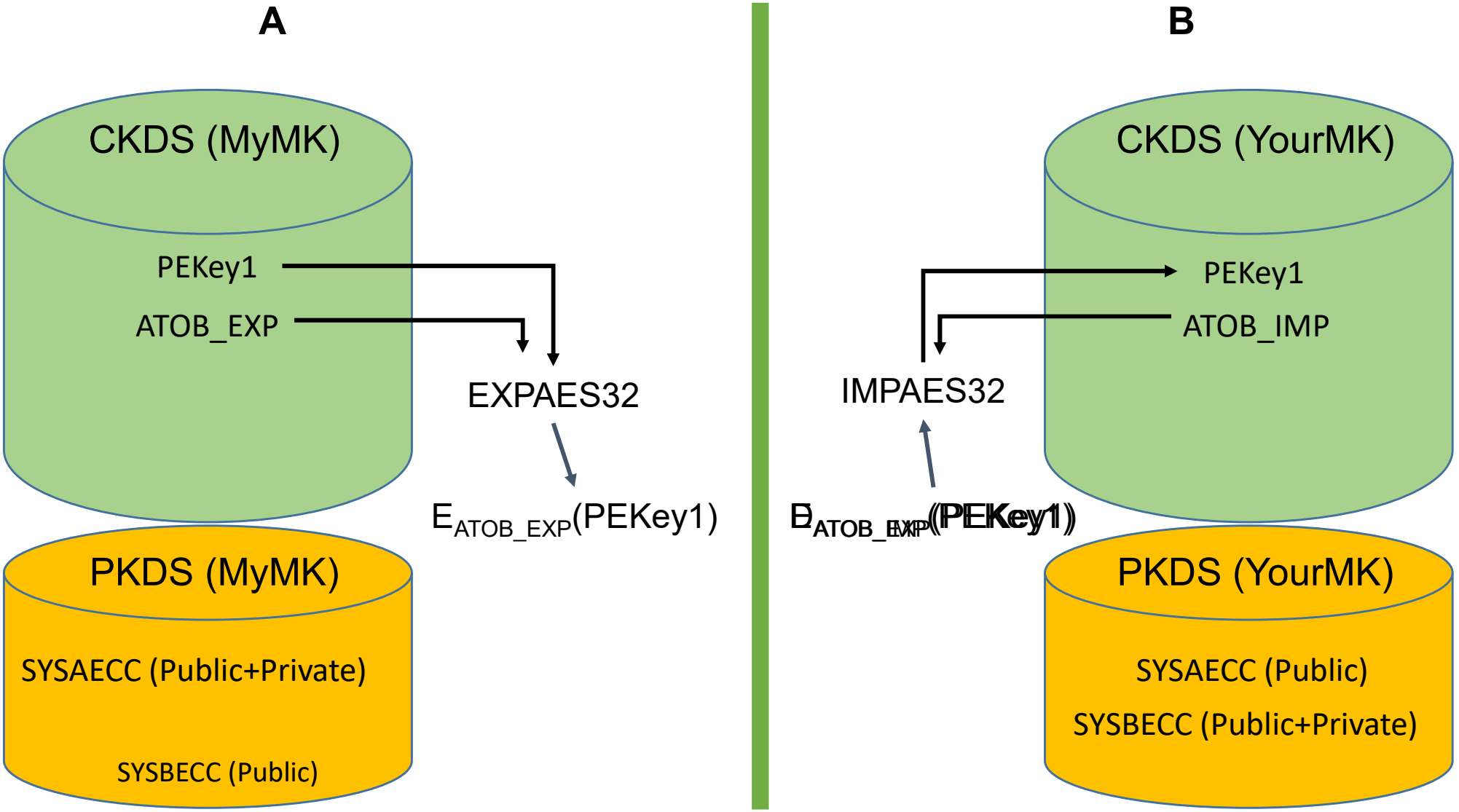
On A – Export the CIPHER key



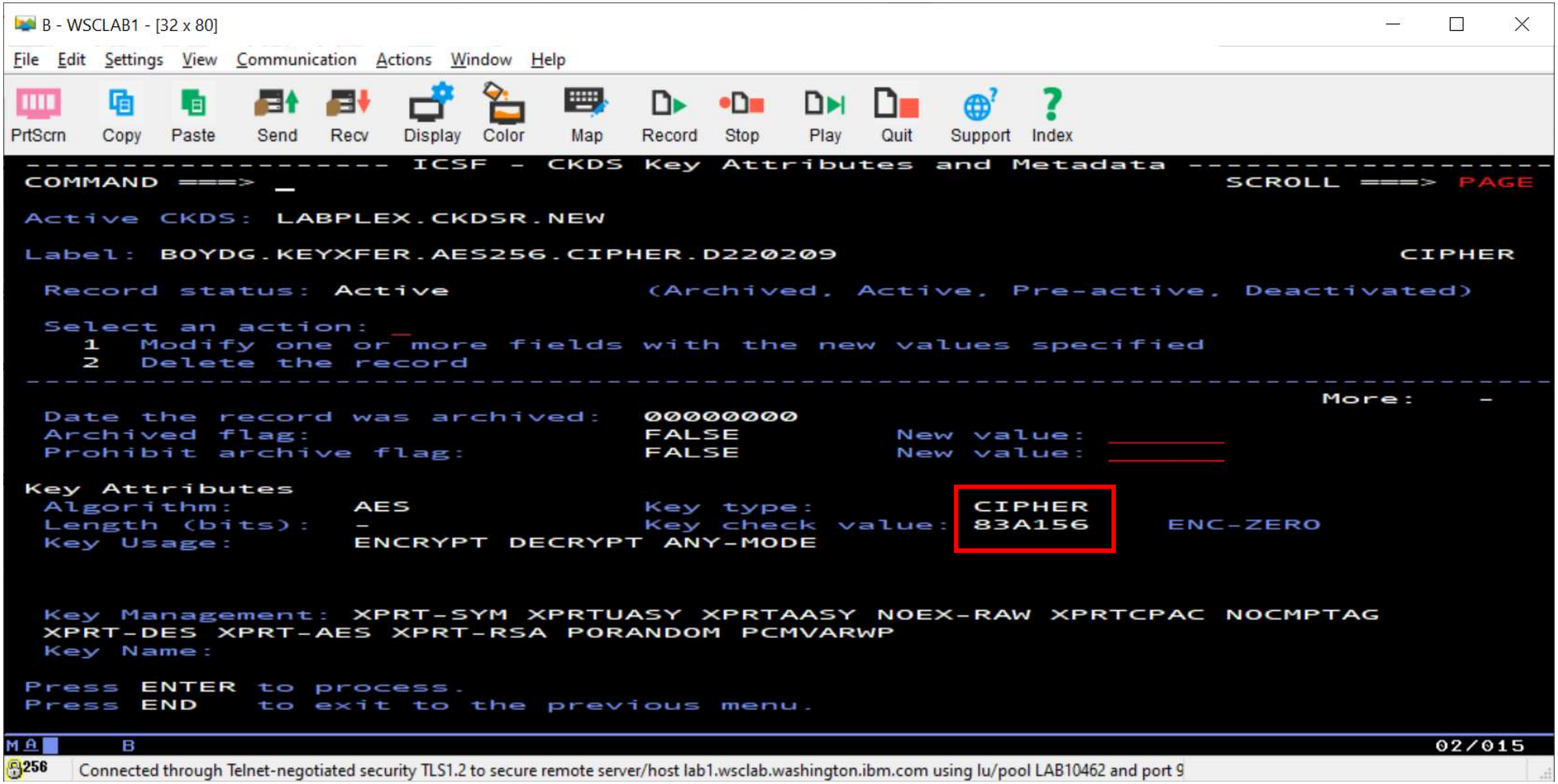
On B – Import the CIPHER key



A: Export PEKey1 & B: Import PEKey1



On B – Our copy of the CIPHER key



Summary

- With common master keys, process is simpler, but you may have to bypass some of the security protocols
- Establishing the EXPORTER/IMPORTER keys between two systems does not have to be done every time you need to transfer keys
- There are now tools (CKDS/PKDS Keys Utility) to validate the process

- My goal here was not to intimidate …
  - Key Management is important

References

- TechDoc - Transporting AES encrypted data keys from one z/OS host to another by Philippe Richard
  - https://www.ibm.com/support/pages/system/files/inline-files/Transporting_AES_DATA_keys_new.pdf
- IBM Community - Transporting AES Keys
  - https://community.ibm.com/community/user/ibmz-and-linuxone/viewdocument/drvaesmp?CommunityKey=6593e27b-caf6-4f6c-a8a8-10b62a02509c&tab=librarydocuments
- GitHub KeyXfer
  - http://ftpmirror.your.org/pub/misc/ftp.software.ibm.com/s390/zos/tools/keyxfer/

Questions