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AWS Key Management Services

INTEGRATION GUIDE
SAFENET LUNA HSM

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CONTENTS

PREFACE

This guide outlines the steps to integrate an AWS Key Management Services (KMS) with SafeNet Luna HSM and provides the necessary information to install, configure, and integrate AWS Key Management Services with SafeNet Luna HSM. This guide contains the following chapters:

- Getting Started describes the third-party applications, supported platforms, prerequisites, and guide to prepare the setup for AWS Key Management Services.
- Integrating AWS Key Management Services with SafeNet Luna HSM explains the steps involved in integrating AWS Key Management Services with SafeNet Luna HSM.

Audience

This document is intended to guide security administrators through the steps for integrating AWS Key Management Services with SafeNet Luna HSM.

All products manufactured and distributed by Gemalto, Inc. are designed to be installed, operated, and maintained by personnel who have the knowledge, training, and qualifications required to safely perform the tasks assigned to them. The information, processes, and procedures contained in this document are intended for use by trained and qualified personnel only.

Document Conventions

This section provides information on the conventions used in this document.

Notes

Notes are used to alert you to important or helpful information.

> **NOTE:** Take note. Notes contain important or helpful information.

Cautions

Cautions are used to alert you to important information that may help prevent unexpected results or data loss.

> **CAUTION!** Exercise caution. Caution alerts contain important information that may help prevent unexpected results or data loss.

Warnings

Warnings are used to alert you to the potential for catastrophic data loss or personal injury.

> ****WARNING** Be extremely careful and obey all safety and security measures. In this situation you might do something that could result in catastrophic data loss or personal injury**

Command Syntax and Typeface Conventions

Convention	Description
Bold	The bold attribute is used to indicate the following: > Command-line commands and options (Type dir /p.) > Button names (Click Save As.) > Check box and radio button names (Select the Print Duplex check box.) > Window titles (On the Protect Document window, click Yes.) > Field names (User Name: Enter the name of the user.) > Menu names (On the File menu, click Save.) (Click Menu > Go To > Folders.) > User input (In the Date box, type April 1.)
Italic	The italic attribute is used for emphasis or to indicate a related document. (See the *Installation Guide* for more information.)
Double quote marks	Double quote marks enclose references to other sections within the document.
<variable>	In command descriptions, angle brackets represent variables. You must substitute a value for command line arguments that are enclosed in angle brackets.
[optional] [<optional>]	Square brackets enclose optional keywords or <variables> in a command line description. Optionally enter the keyword or <variable> that is enclosed in square brackets, if it is necessary or desirable to complete the task.
[a | b | c] [<a> | <b> | <c>]	Square brackets enclose optional alternate keywords or variables in a command line description. Choose one command line argument enclosed within the braces, if desired. Choices are separated by vertical (OR) bars.
{ a | b | c } { <a> | <b> | <c> }	Braces enclose required alternate keywords or <variables> in a command line description. You must choose one command line argument enclosed within the braces. Choices are separated by vertical (OR) bars.

Support Contacts

If you encounter a problem while installing, registering, or operating this product, refer to the documentation. If you cannot resolve the issue, contact your supplier or Thales Customer Support.

Thales Customer Support operates 24 hours a day, 7 days a week. Your level of access to this service is governed by the support plan arrangements made between Thales and your organization. Please consult this support plan for further information about your entitlements, including the hours when telephone support is available to you.

Customer Support Portal

The Customer Support Portal, at https://supportportal.thalesgroup.com is a where you can find solutions for most common problems. The Customer Support Portal is a comprehensive, fully searchable database of support resources, including software and firmware downloads, release notes listing known problems

and workarounds, a knowledge base, FAQs, product documentation, technical notes, and more. You can also use the portal to create and manage support cases.

> **NOTE:** You require an account to access the Customer Support Portal. To create a new account, go to the portal and click on the **REGISTER** link.

Telephone Support

If you have an urgent problem, or cannot access the Customer Support Portal, you can contact Thales Customer Support by telephone at +1 410-931-7520. Additional local telephone support numbers are listed on the support portal.

Email Support

You can also contact technical support by email at technical.support.DIS@thalesgroup.com.

CHAPTER 1: Getting Started

This chapter covers the following topics:

About SafeNet Luna HSMs

SafeNet Luna HSM appliances are purposefully designed to provide a balance of security, high performance, and usability that makes them an ideal choice for enterprise, financial, and government organizations. SafeNet Luna HSMs physically and logically secure cryptographic keys and accelerate cryptographic processing. The SafeNet Luna HSM on premise offerings include the SafeNet Luna Network HSM, SafeNet PCIe HSM, and SafeNet Luna USB HSMs.

About AWS KMS Integration with SafeNet Luna HSM

The AWS BYOK solution enables customers to generate their own AES-256 bit key on SafeNet Luna HSMs and export this key to AWS KMS. As part of the export process, a public key (wrapping key) will be used to wrap off the AES-256 bit key. To export the AES-256 bit key from the HSM, the key must be generated with the exportable attribute set to true. In case an existing AES-256 bit key is to be exported, that key must have either the exportable attribute set to true or the modifiable attribute set to true.

Supported Wrapping Algorithms

> RSAES_PKCS1_V1_5

> RSAES_OAEP_SHA_1

> RSAES_OAEP_SHA_256

Prerequisites

Before beginning the integration, ensure you complete the following steps:

Configure the SafeNet Luna HSM

If you are using a SafeNet Luna HSM, complete the following:

1. Verify the HSM is set up, initialized, provisioned and ready for deployment. Refer to the *SafeNet Luna HSM Product Documentation* for more information.
2. Create a partition on the HSM that will be later used by AWS KMS.

3. If using a SafeNet Luna Network HSM, register a client for the system and assign the client to the partition to create an NTLS connection. Initialize the Crypto Officer and Crypto User roles for the registered partition.
4. Ensure that each partition is successfully registered and configured. The command to see the registered partitions is:

```
# /usr/safenet/lunaclient/bin/lunacm
lunacm (64-bit) v7.3.0-165. Copyright (c) 2018 SafeNet. All rights reserved.

Available HSMs:

Slot Id ->              0
Label ->                kms
Serial Number ->        1280780175949
Model ->                LunaSA 7.3.0
Firmware Version ->     7.3.0
Configuration ->        Luna User Partition With SO (PW) Key Export With
Cloning Mode
Slot Description ->     Net Token Slot
Current Slot Id: 0
```

> **NOTE:** Follow the *SafeNet Luna Network HSM Product Documentation* for detailed steps for creating the NTLS connection, initializing the partitions, and initializing the Security Officer, Crypto Officer, and Crypto User roles.

Access AWS Key Management Services

You need an AWS account to access AWS Key Management Services.

CHAPTER 2: Integrating AWS Key Management Services with SafeNet Luna HSM

Integrating AWS Key Management Services with SafeNet Luna HSMs involves the following steps:

> Creating Wrapping Key and Import Token

> Importing Wrapping Key to SafeNet Luna HSM

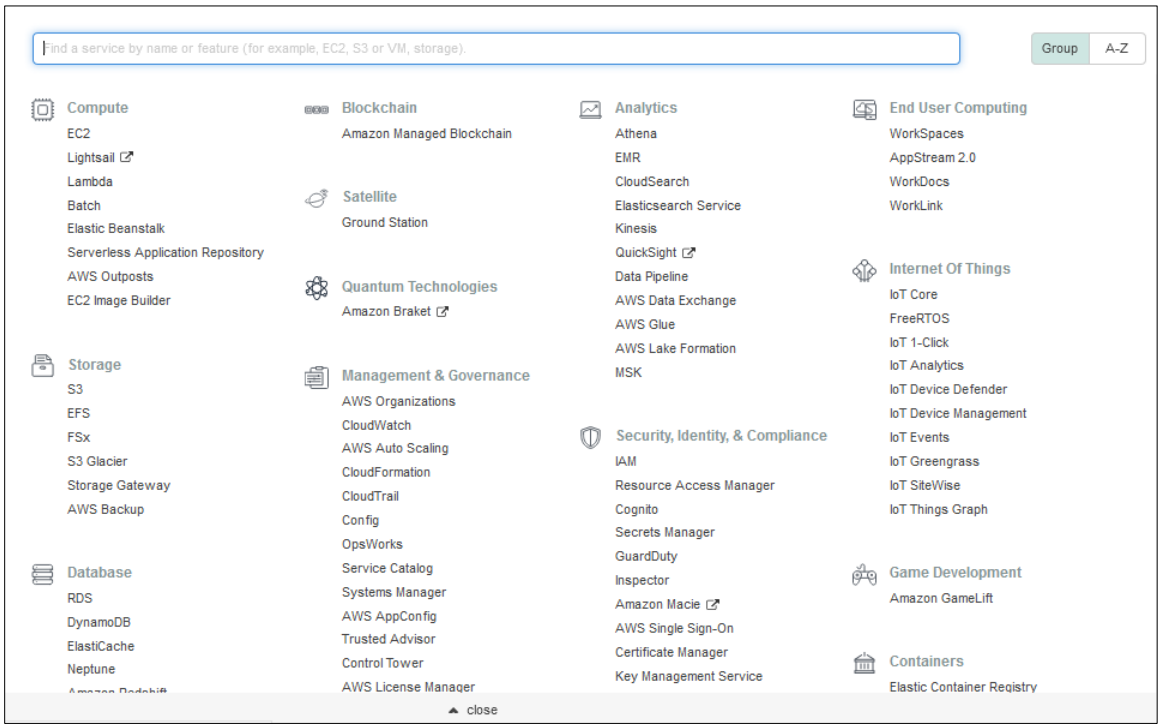
> Generating Encrypted Key Material

> Uploading Encrypted Key Material to AWS KMS

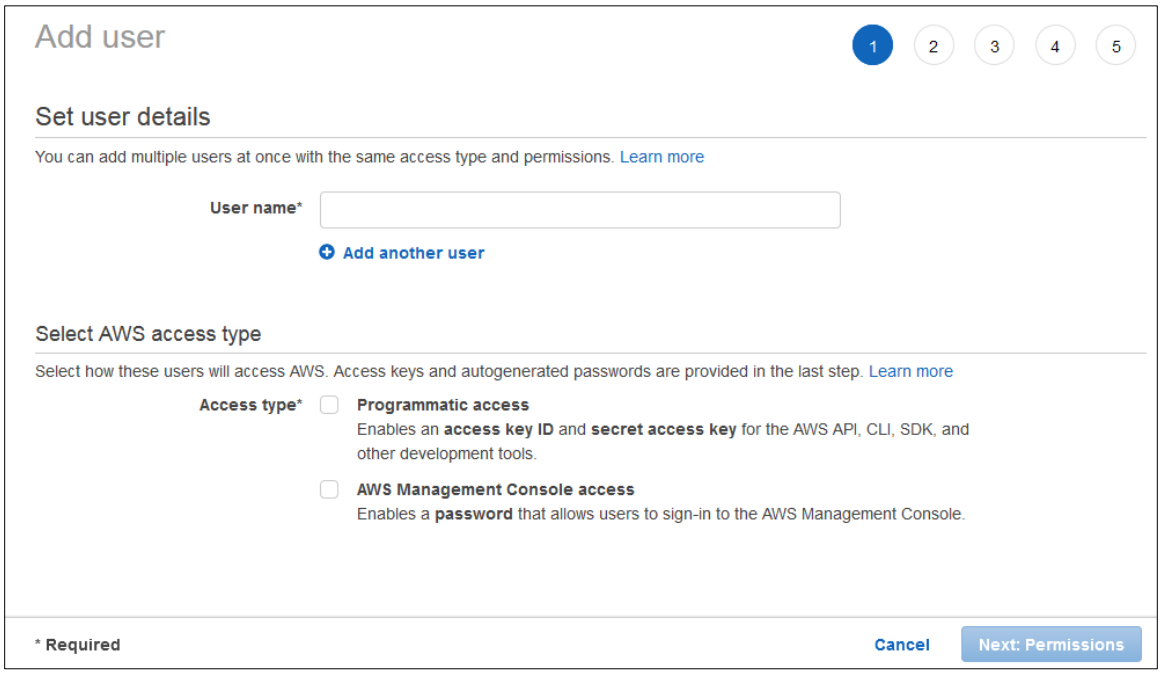
Creating Wrapping Key and Import Token

The process of creating the wrapping key and import token is as follows:

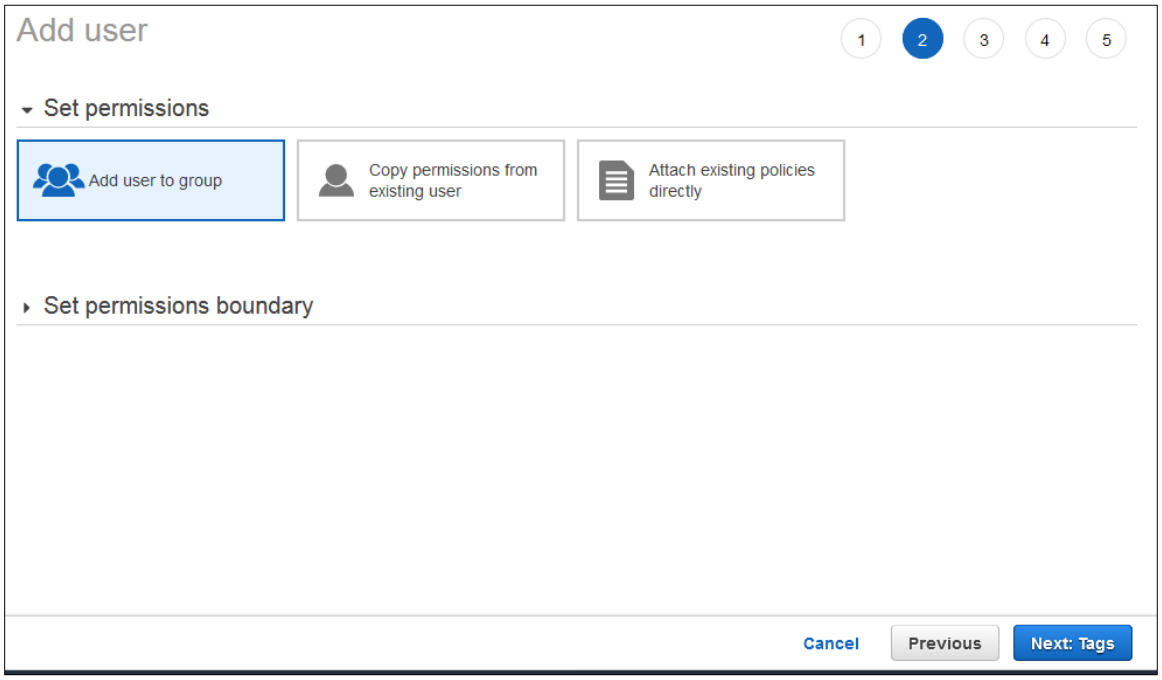
1. Login to the AWS console at https://aws.amazon.com.
2. Click **IAM** under **Security, Identity & Compliance**.



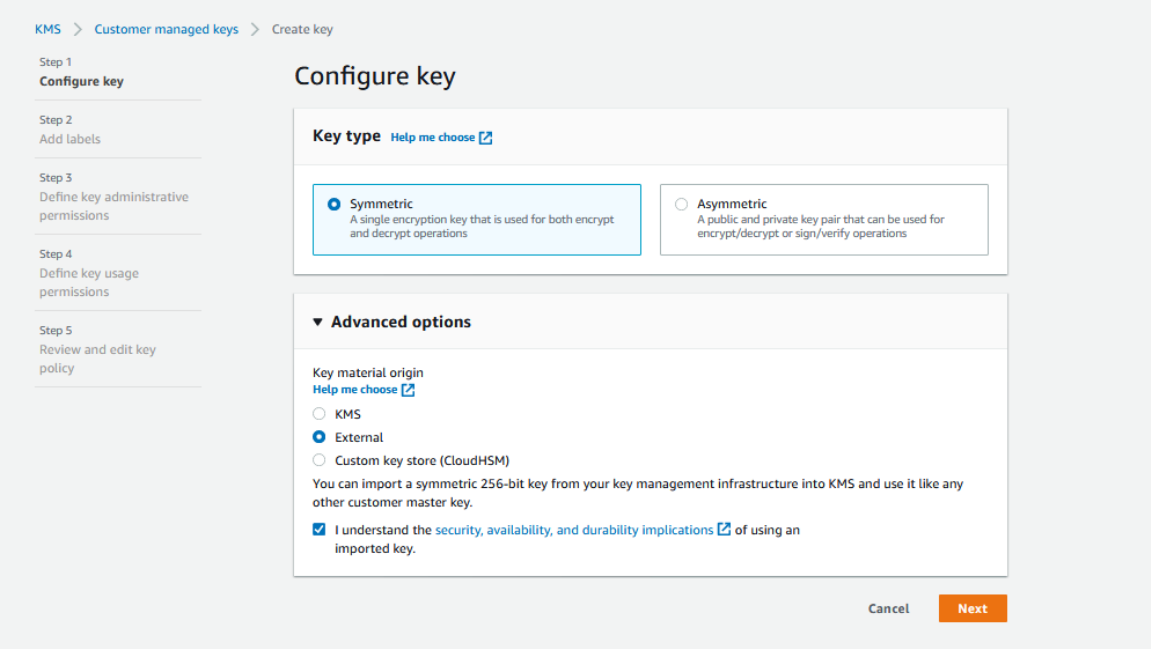
3. Click **Users** and then **Add User**. Enter User name and select Programmatic access in Access type. Click **Next: Permissions** button to continue.



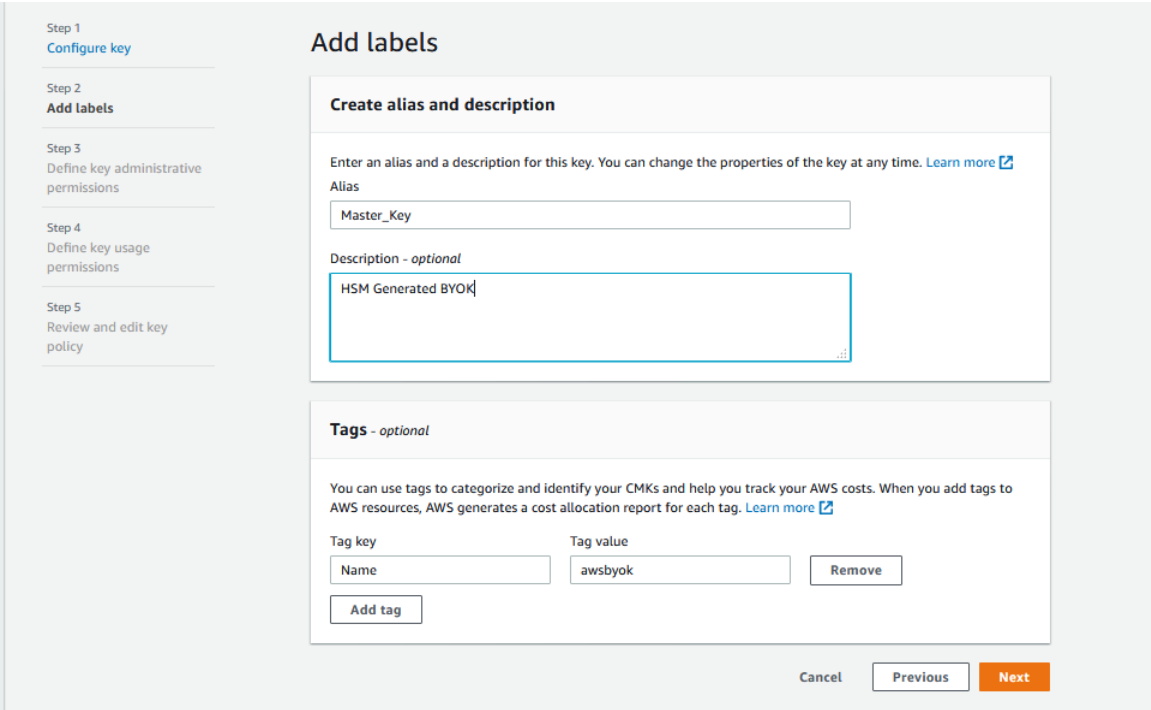
4. Click **Attach existing policies directly**, select **AdministratorAccess** in **Policy type** list and then click **Next: Tags** to continue. You can add **Tags** but it is optional.



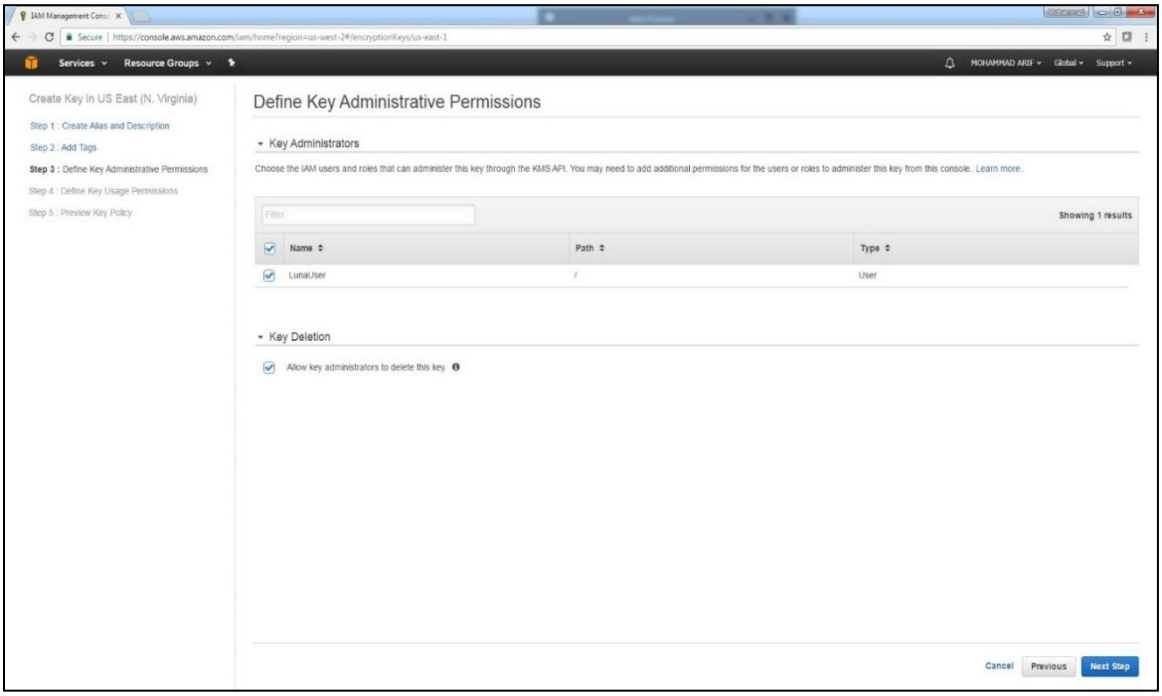
5. Click **Next:Review** and then click **Create user**. It will create an IAM user that will be used later for assigning the permissions on the Master Key.
6. Click **Key Management Services** and then click **Create key** to continue.
7. Select the **Key type** as **Symmetric**.
8. Click **Advanced Options** and select **External** for **Key Material Origin**. Select the **I understand the security, availability and durability implications of using an imported key** check box and then click **Next**.



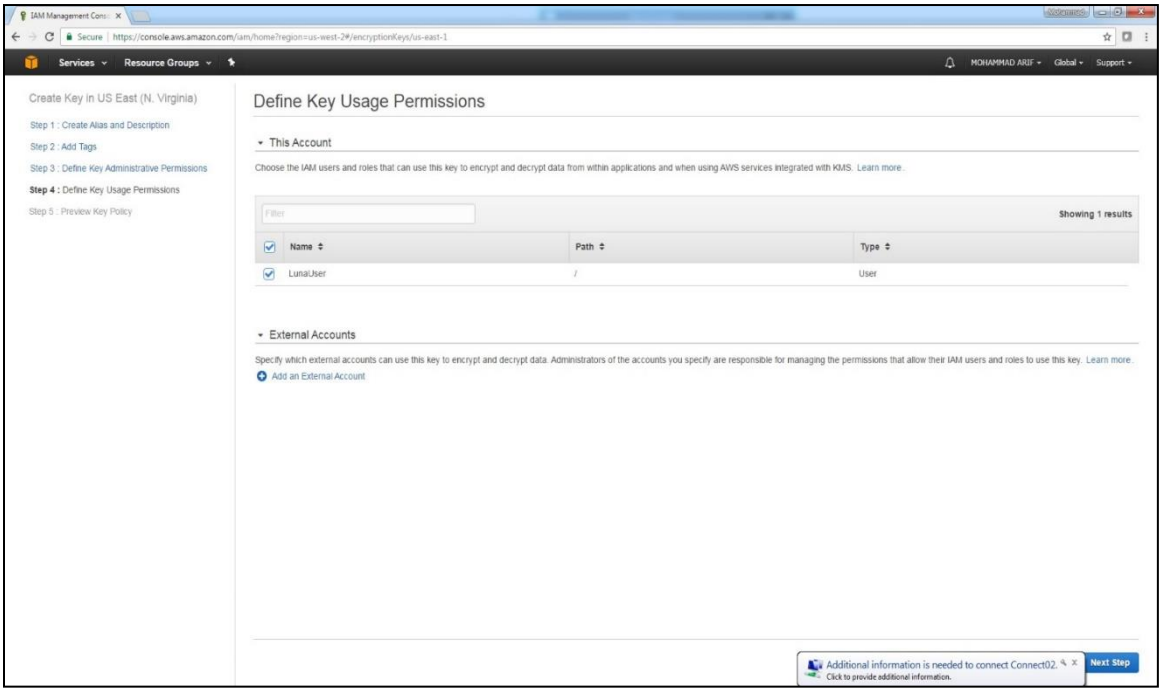
9. Enter the name of the key in **Alias** text box and provide **Description**. On the **Add Tags**, enter the **Tag key** and **Tag Value**. Click **Next**.



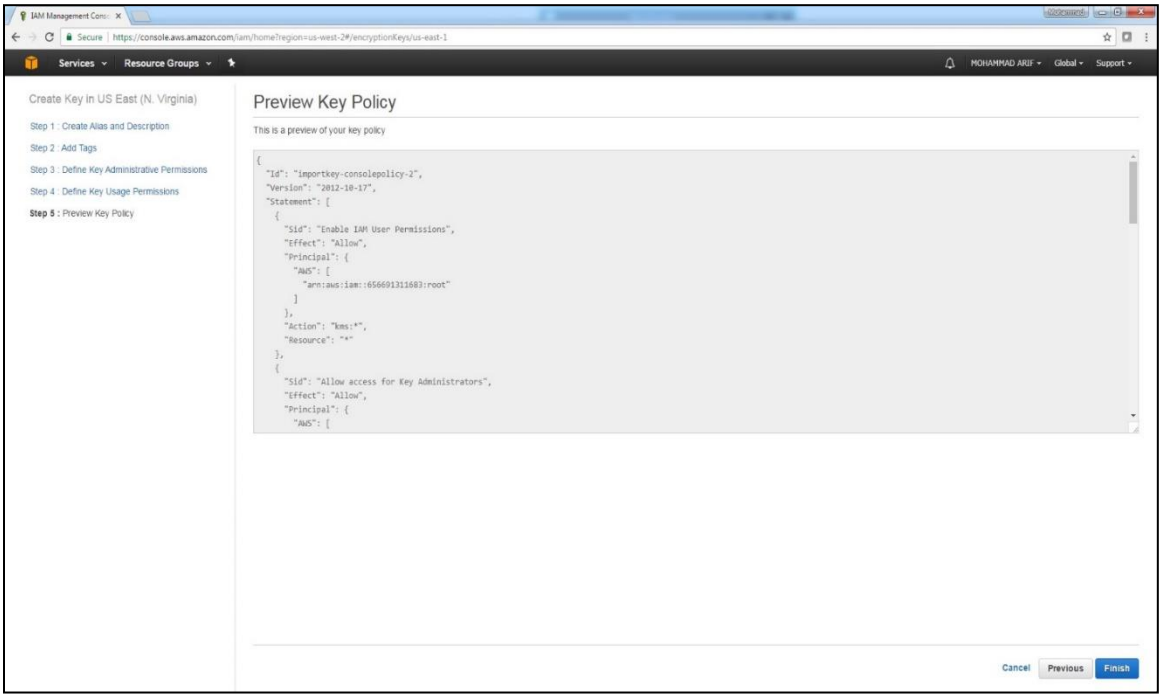
10. On the **Define Key Administrative Permissions** page, select **Name** of IAM user whom you want to provide the key access and select **Allow key administrators to delete this key.** After that, click **Next**.



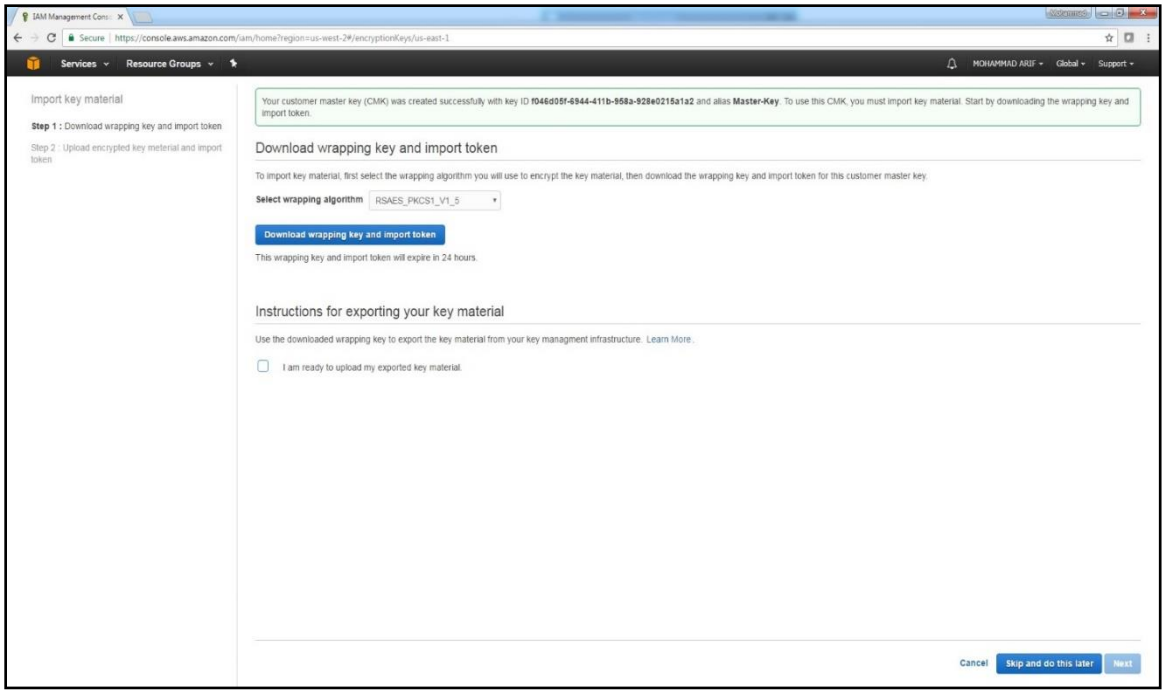
11. On the **Define Key Usage Permissions** page, select IAM user created by you and click **Next**.



12. On the **Preview Key Policy** page, the key policy is displayed. Click **Finish**.



13. On the **Download wrapping key and import token** page, select the wrapping algorithm you want to use from the **Select wrapping algorithm** drop down, and then click **Download wrapping key and import token**. A zip file named ImportParameters.zip will be downloaded.



14. Extract the **ImportParameters.zip** file. It contains the wrapping key and import token. Now import the wrapping key (RSA Public Key) on the HSM.

Importing Wrapping Key to SafeNet Luna HSM

For importing the wrapping key to SafeNet Luna HSM, you need to undertake the following steps:

1. Convert wrapping key to pem format using openssl.

   ```
   # openssl rsa -in wrappingKey_f046d05f-6944-411b-958a-928e0215a1a2_0426062751 -inform DER -out pub_key.pem -outform PEM -pubin -pubout

   writing RSA key
   ```

   It will save the Public key in the **pub_key.pem** file.

2. Import the **pub_key.pem** on the HSM using the **CMU** utility provided with Luna Client.

   ```
   # ./cmu import -inputfile=pub_key.pem -pubkey=pub_key.pem -label "AWS Public Key"

   Please enter password for token in slot 0: ********
   ```

   Provide the HSM partition password when prompted.

3. Run the **cmu list** command to ensure the key is imported successfully.

   ```
   # ./cmu list

   Please enter password for token in slot 0: ********

   handle=228      label=AWS Public Key
   ```

   Provide the HSM partition password when prompted and note down the handle of the public key.

4. Ensure the Public Key attributes (Encrypt, Verify, Wrap) are set to true using the **cmu** utility below:

   ```
   # ./cmu getattribute -handle=228

   Please enter password for token in slot 0: ********

   class=publicKey

   token=true

   private=true

   label=AWS Public Key

   keytype=RSA

   subject=

   id=

   encrypt=false

   wrap=false

   verify=true

   derive=false

   startdate=

   enddate=

   modulus=b699afb4d7afa2ce540b0cf0d78e78e39da61c872b5cf22f1b65b3de9e5ce75ebb89533
   ea91b5f07a9c50ba8d1bd69de49285555c3fa1f096a0f9f3c41719e1a059ec4d109c262e98e6105
   9e4be6ec3776c10fcd7926c051c35fa6896bf939dc76dac32c99c93dca90a1c0287a6a1f6d36572
   ```

```
656cb044a184136f4ec6ee362cccadaa5aedaf36166a564640d90ac6877f36f735d7dca4af08d57
60937bba2c017939ef7e352a8fe52a3fa2740174c1b179946ba1e98e01d397043cfaf0deb8c4284
0799e1d140a0a10238fb39fb87f4c7fa03e7a76e64e414cf23f19808c0946420e82e7f3541179cd
231e97493ed0df50276b07647bcd1c1854a98346bc0c11

modulusbits=2048

publicexponent=010001

local=false

modifiable=true
```

Where handle is the key handle of the public key. Provide the partition password when prompted.

5. If the attributes (Encrypt, Verify, Wrap) are not true, then set them by using the below command:

```
# ./cmu setattribute -handle=228 -wrap=True -encrypt=True

Please enter password for token in slot 0: ********
```

Where handle is the key handle of the public key. Provide the partition password when prompted.

Generating Encrypted Key Material

Following are the steps to generate the encrypted key material:

1. Create an AES256 key on the HSM partition that will be used as CMK in AWS KMS. To generate the key, run the **ckdemo** utility provided with Luna Client.

```
# ckdemo

 (1) Open Session

Enter your choice: 1

Status: Doing great, no errors (CKR_OK)

(3) Login

Enter your choice : 3

Partition SO      [0]

Crypto Officer    [1]

Crypto User       [2]: 1

Enter PIN            : ********

Status: Doing great, no errors (CKR_OK)

(45)  Simple Generate Key

Enter your choice: 45

Select type of key to generate

[ 1] DES     [ 2] DES2    [ 3] DES3             [ 5]  CAST3

[ 6] Generic [ 7] RSA     [ 8] DSA    [ 9] DH    [10]  CAST5

[11] RC2     [12] RC4     [13] RC5    [14] SSL3  [15]  ECDSA

[16] AES     [17] SEED    [18] KCDSA-1024    [19] KCDSA-2048
```

```
[20] DSA Domain Param    [21] KCDSA Domain Param
[22] RSA X9.31           [23] DH X9.42         [24] ARIA
[25] DH PKCS Domain Param [26] RSA 186-3 Aux Primes
[27] RSA 186-3 Primes     [28] DH X9.42 Domain Param
[29] ECDSA with Extra Bits [30] EC Edwards
[31] EC Montgomery
> 16
Enter Key Length in bytes (16, 24, 32): 32
Enter Is Token Attribute [0-1]: 1
Enter Is Sensitive Attribute [0-1]: 1
Enter Is Private Attribute [0-1]: 1
Enter Is Modifiable Attribute [0-1]: 1
Enter Encrypt Attribute [0-1]: 1
Enter Decrypt Attribute [0-1]: 1
Enter Sign Attribute [0-1]: 1
Enter Verify Attribute [0-1]: 1
Enter Wrap Attribute [0-1]: 1
Enter Unwrap Attribute [0-1]: 1
Enter Derive Attribute [0-1]: 1
Enter Extractable Attribute [0-1]: 1
Generated AES Key:        231 (0x000000e7)
Status: Doing great, no errors (CKR_OK)
```

Where 231 is the handle of generated AES Key.

2. Change OAEP hash algorithm to **selectable** in **CKDEMO.** Skip this step if you are using wrapping key algorithm as **RSAES_PKCS1_V1_5**.

```
Status: Doing great, no errors (CKR_OK)
(98) Options
Enter your choice : 98
Options:
1 - Open Session Type          : Always R/W and Serial
2 - Display Help               : Always
3 - PIN path                   : user supplies ASCII password
4 - Echo input                 : Disabled
5 - Sleep for n seconds after writing special instructions to stderr
6 - KCV Default                : user supplies KCV Domain
```

```
7 - MofN path                  : user supplies MofN path
8 - Show Response Code         : SHOW_RESPONSE_BEFORE_AND_AFTER_MENU
9 - Input data for sign/derive : input from keyboard
10 - Object Usage Counters      : disabled
11 - GCM IV Source              : external
12 - ECIES Parameters           : use default (XOR with HMAC_SHA1)
13 - X9.31 Signatures           : allow X9.31 generated keys only
14 - Multipart enc/dec/sig/ver  : use single part operations
15 - Use Old Enc/Dec Menu       : use old menu
16 - Role Support               : enhanced roles
17 - OAEP Hash Params           : use default (SHA1 Digest and MGF1)
18 - Array Template Attributes  : use array template attributes
19 - Specify Number of Objects Handles to Find per Update call? : No
20 - Specify Number of Objects to Create/Keys to generate? : No
21 - Prompt for CKA_CHECK_VALUE during key unwrap/derive? : No
0 – Finished
Enter option to change: 17
Options:
1 - Open Session Type          : Always R/W and Serial
2 - Display Help               : Always
3 - PIN path                   : user supplies ASCII password
4 - Echo input                 : Disabled
5 - Sleep for n seconds after writing special instructions to stderr
6 - KCV Default                : user supplies KCV Domain
7 - MofN path                  : user supplies MofN path
8 - Show Response Code         : SHOW_RESPONSE_BEFORE_AND_AFTER_MENU
9 - Input data for sign/derive : input from keyboard
10 - Object Usage Counters      : disabled
11 - GCM IV Source              : external
12 - ECIES Parameters           : use default (XOR with HMAC_SHA1)
13 - X9.31 Signatures           : allow X9.31 generated keys only
14 - Multipart enc/dec/sig/ver  : use single part operations
15 - Use Old Enc/Dec Menu       : use old menu
16 - Role Support               : enhanced roles
17 - OAEP Hash Params           : selectable
18 - Array Template Attributes  : use array template attributes
19 - Specify Number of Objects Handles to Find per Update call? : No
```

```
20 - Specify Number of Objects to Create/Keys to generate? : No
21 - Prompt for CKA_CHECK_VALUE during key unwrap/derive? : No
0 - Finished
Enter option to change: 0
```

3. Wrap your key using the public key downloaded from AWS KMS console. To wrap the key, use the same **CKDEMO** session and provide the choices to wrap the AES key.

```
(60) Wrap key
Enter your choice : 60
[1]DES-ECB          [2]DES-CBC          [3]DES3-ECB         [4]DES3-CBC
                                        [7]CAST3-ECB        [8]CAST3-CBC
[9]RSA              [10]TRANSLA         [11]DES3-CBC-PAD    [12]DES3-CBC-PAD-IPSEC
[13]SEED-ECB        [14]SEED-CBC        [15]SEED-CBC-PAD    [16]DES-CBC-PAD
[17]CAST3-CBC-PAD   [18]CAST5-CBC-PAD   [19]AES-ECB         [20]AES-CBC
[21]AES-CBC-PAD     [22]AES-CBC-PAD-IPSEC [23]ARIA-ECB      [24]ARIA-CBC
[25]ARIA-CBC-PAD    [26]RSA_OAEP        [27]SET_OAEP        [28]AES-CTR
[29]DES3-CTR        [30]AES-KW          [31]AES-KWP         [34]AES-KEY-WRAP
Select mechanism for wrapping: 26
```

> **NOTE:** Select Option 9 if your wrapping key algorithm is **RSAES_PKCS1_V1_5**.

```
Mechanism to use:
[1]SHA-1  [2]SHA224 [3]SHA256 [4]SHA384 [5]SHA512 : 3
```

> **NOTE:** Option 3 is for Wrapping key Algorithm **RSAES_OAEP_SHA_256**. Select Option 1 if your wrapping key algorithm is **RSAES_OAEP_SHA_1**.

```
Enter filename of OAEP Source Data [0 for none]:
Enter handle of wrapping key (0 to list available objects): 228
Enter handle of key to wrap (0 to list available objects): 231
Wrapped key was saved in file wrapped.key
Status: Doing great, no errors (CKR_OK)
```

Where **228** and **231** is the handle of **Public Key** and **AES256 key** respectively.

> **NOTE:** wrapped.key is the encrypted key material that contains the wrapped AES256 key.

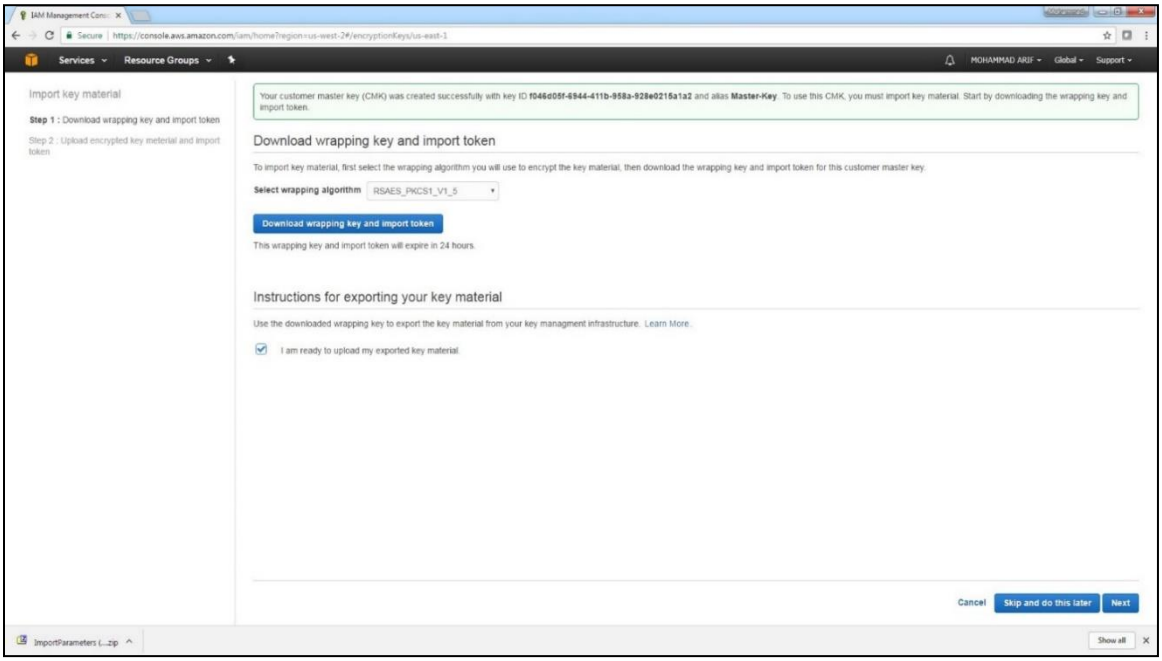
4. Exit from **ckdemo** session now by providing the choice as 0.

```
Enter your choice: 0
```

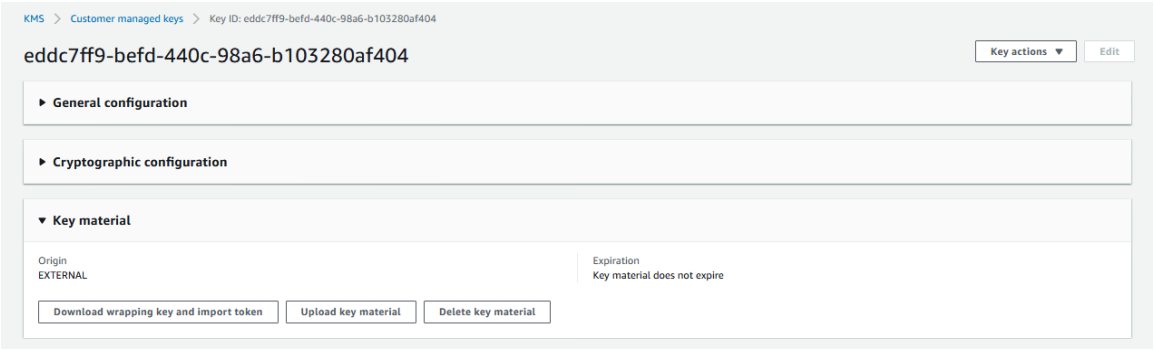
Uploading Encrypted Key Material to AWS KMS

After generating the encrypted key material, you need to complete the following steps to upload it to AWS KMS:

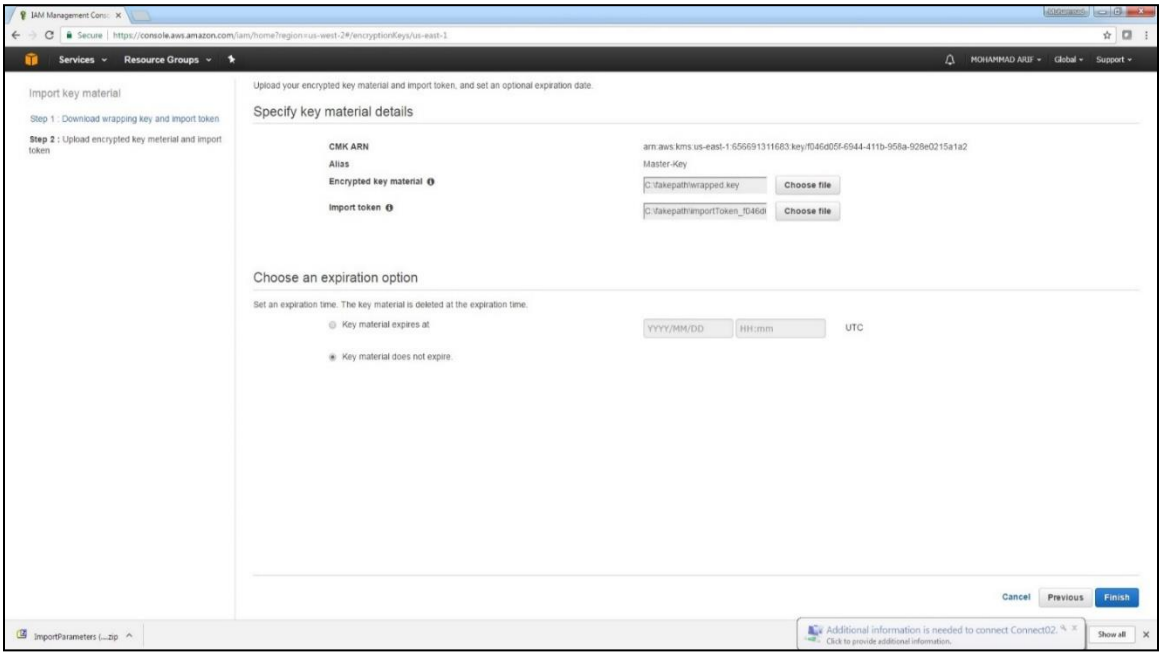
1. Open the AWS KMS console where you left after downloading the wrapping key and import token. Select the **I am ready to upload my exported key material** check box and click **Next**.



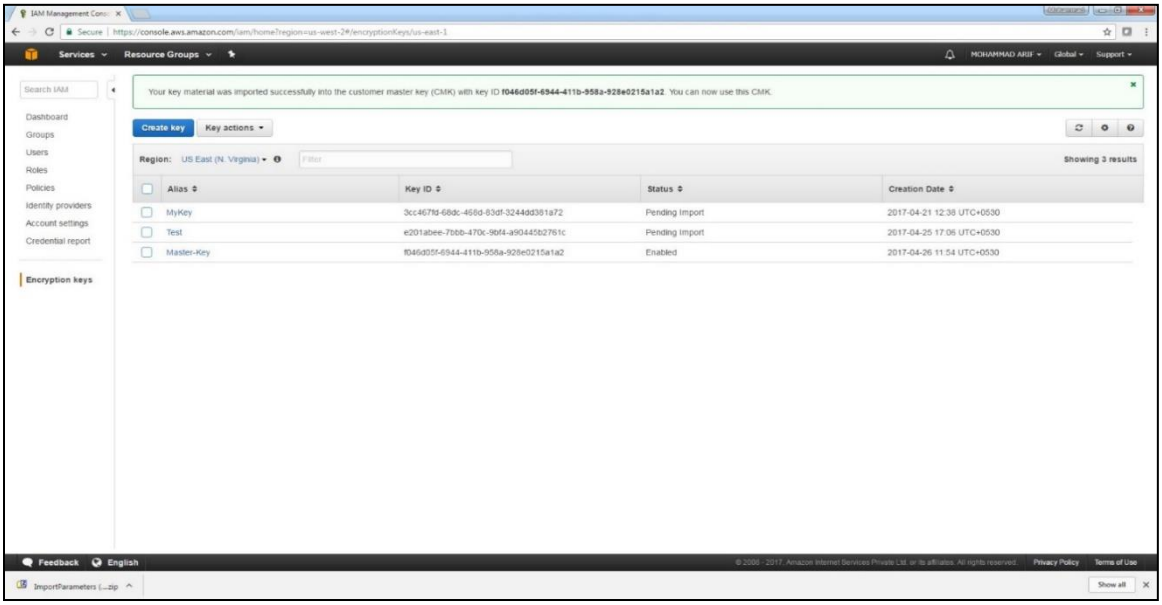
Or, go to **Customer managed keys** and click on the key ID or alias of the CMK for which you downloaded the wrapping key and import token and then select **Upload Key Material** under **Key material** section.



2. From the **Specify key material details** section:
    i. Click **Choose file** for **Encrypted key material** and select the wrapped AES key file.
    ii. Click **Choose file** for **Import token** and then select the importToken file.
3. From the **Choose an expiration option** section, check the **Key material does not expire** option and then click **Finish**.



4. A message for successfully imported key will appear on the screen and the key will be listed under the **Encryption keys** panel with status as **Enabled**.



This completes the integration of AWS Key Management Services with SafeNet Luna HSM.