MOJALOOP CRYPTOGRAPHIC PROCESSING MODULE

Low Level Design Overview

CPM Objective

To begin to bring full transaction and data security into the Mojaloop Ecosystem, including the management of keys and signing/encryption of data approportionate to risk (For OSS) and/or as mandated by compliance requirements (For Hub Operators)

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Overview

The current Mojaloop system has been developed with limited built in security. The next phase requires that Mojaloop will conform to international norms as regards security. To achieve this a separate module will be developed that will interact with Mojaloop but will extract the necessary security operations from the current Mojaloop processing.
By having a separate module to handle all the security processing minimal changes will be required on the current Mojaloop system

This module will be able to interact with a key management system as necessary for the necessary encryption keys, as well as various HSMs to perform secure cryptographic operations. Should an external key management system or physical HSMs not be available the module will provide a key storage system as well as limited cryptographic operations performed in software.

This document will provide an overview of what will be included in the first version of the CPM. It should be noted that this list is to be discussed and agreed upon before moving onto the next phase where this will be expanded into a specification which will detail the full agreed functionality of the first phase of the CPM.

When designing and building the CPM the following will be taken into consideration:

1. There will be minimal or no cost in the running of a separate module to handle the security aspects of Mojaloop
2. The system will be designed is a way that hardware security will not be enforced provided the entity running the CPM understands and accepts any risks associated with this
3. Certain aspects of security will only be available under hardware security if by implementing it in software the integrity of any systems connection to the Mojaloop Instance

While the low-level document will give a detail specification of the CPM as known at that stage it must be considered a living document which could change during the development phase.

Although not documented here changes will be required to the main Mojaloop code in order to instruct it that all security functions need to be performed by the CPM. In phase one this can be done via a configuration setting in order not to force current users of the Mojaloop code to use the CPM immediately but rather switch over when they wish to do so. It should be encouraged that all new installations of Mojaloop use the CPM module once it becomes available.

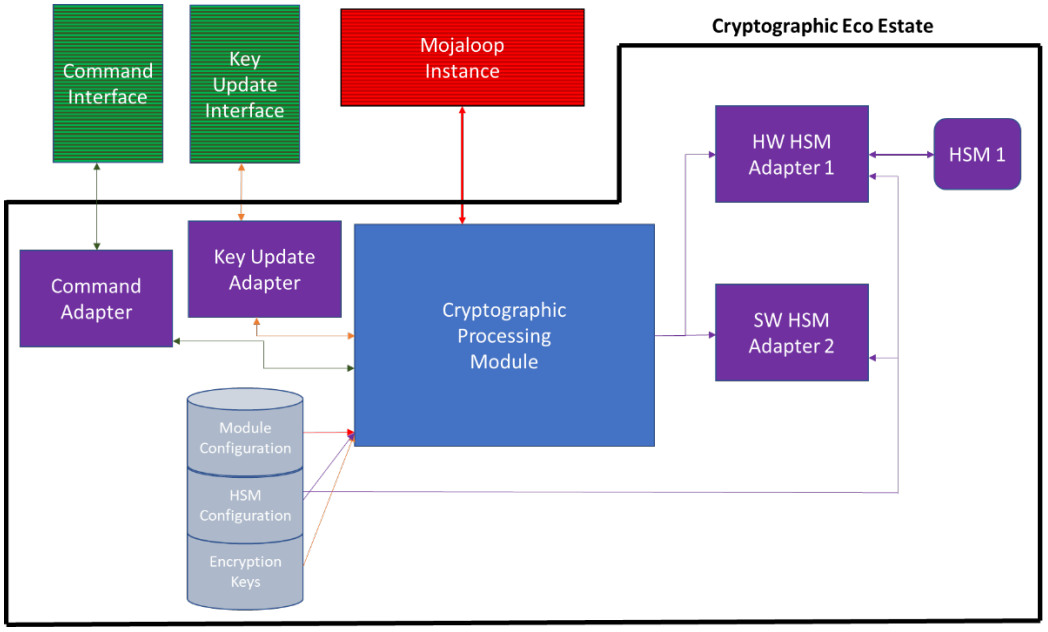
Glossary

Term	Definition
FSP	Financial Services Provider
CPM	Cryptographic Processing Module
HSM	Hardware Security Module
KMS	Key Management System

System

Overview

Below is a high-level system diagram of how the Cryptographic Eco Estate will be constituted for this first version of the CPM. Only modules within the Eco Estate border will be covered in this document.



The following sections give a high level list of what will be included in the low level design for the CPM

Message formats

1. From (and response) Mojaloop
2. To (and response) to HSM adapter
3. Message format (and response) to update keys – to be discussed
4. Commands to CPM messages

Commands Adapter

1. Start-up
2. Shutdown
3. Commands
    a. Shut down
    b. Refresh keys
    c. Refresh config

d. Status

Security Adapters

1. Start-up
2. Shutdown
3. Software – Move security code from Mojaloop core into the adapter controlled by the CPM
4. Define basic processing of HSM adapter
   a. Read DB config to obtain necessary information
   b. Connecting to HSM(s)
   c. Regular health messages to each configured HSM
   d. Accept message from CPM
   e. Build message to HSM
   f. Send message to HSM
   g. Accept response
   h. Send response to CPM

Key update Adapters

1. Start-up
2. Shutdown
3. Define basic processing of Key Update adapter
   a. Read DB config to obtain necessary information
   b. Accept message from external party
   c. Build message to CPM
   d. Send message to CPM
   e. Accept response
   f. Send response to external party

High level Flows

The following is a high-level flow for each part of the system. Once this has been agreed to a full flow will be documented.

Key Add/Update/Delete Flow

Add/Update Key

1. Adapter Accepts message
2. Adapter sends messages to CPM
3. If translation needed
    a. Send to HSM Adapter
    b. Receive message back from adapter
4. If translation successful
    a. If key exists
        i. Update Key
        ii. Else Add key
5. Respond to Adapter with result
6. Adapter responds with result

Delete Key

1. Adapter Accepts message
2. Adapter sends messages to CPM
3. If key exists
    a. Delete Key
4. Respond to Adapter with result
5. Adapter responds with result

Hardware HSM adapter Flow

Start-up

1. Read DB for configuration parameters for Adapter
2. For each defined HSM
    a. Connect to HSM
    b. Send status message to HSM
    c. Log status message
    d. Mark each HSM as available
3. Go to wait for message stage

Shut-down

1. Mark adapter for shut-down

2. Stop accepting new messages, and respond with “Closing” if any received
3. For each defined HSM
    a. Check for outstanding messages
    b. Once all outstanding messages have been received from HSM disconnect from HSM
    c. Log message
4. Respond with “closed message”
5. Close all DB connections
6. Shut down adapter

Process Message

1. Accept message from CPM
2. Check for Available HSM, if no HSM active recline message
3. Validate input message
4. Translate message from input format into HSM specific format
5. Choose HSM to process message
6. Send to HSM
7. Accept response from HSM
8. Translate message to input format from HSM specific format
9. Respond to CPM

Health Checks

1. Based on the interval set in the configuration send a message to the HSM to confirm it is still connected and functional
2. If Health Check unsuccessful remove HSM from active list
3. If Health Check successful and HSM was in the in-active list move to active list

Software HSM adapter Flow

Start-up

1. Read DB for configuration parameters for Adapter
2. Go to wait for message stage

Shut-down

1. Mark adapter for shut-down
2. Stop accepting new messages, and respond with “Closing” if any received
3. Once all outstanding messages have been processed and responded to log message
4. Respond with “closed message”
5. Close all DB connections
6. Shut down adapter

Process Message

1. Accept message from CPM

2. Validate input message
3. Process message
4. Translate message to input format
5. Respond to CPM

Command Adapter Flow

Start-up

1. Read DB for configuration parameters for Adapter
2. Set up listen on appropriate port
3. Go to wait for connection stage

Shut-down

1. Mark adapter for shut-down
2. Stop accepting new messages, and respond with “Closing” if any received
3. Once all outstanding commands have processed respond with “closed message”
4. Close all DB connections
5. Shut down adapter

Process

1. Accept connection
2. Check source IP is acceptable IP (from config)
3. Accept and validate input message
4. Format from external message format to internal format
5. Send message to CPM
6. Wait for response
7. Respond to sender of message

Cryptographic Processing Module

Start-up

1. Read DB for configuration parameters
2. Set up Adapters
3. Go to wait for connection stage

Shut-down

1. Mark CPM for shut-down
2. Send Shut down to all adapters
3. Stop accepting new messages, and respond with “Closing” if any received
4. Once all outstanding messages have processed respond with “closed message”

5. Close all DB connections
6. Shut down adapter

Process

Commands

1. Accept command from adapter
2. Process command as required
3. Respond to adapter with result

Key Update

1. Accept command from adapter
2. Verify message fields
3. Update/Add/Delete key as necessary in DB
4. Refresh keys in memory
5. Respond to adapter with result

Message

1. Accept message
2. Verify fields
3. Check adapter definitions for match on FSP and security command to determine the correct HSM adaptor
4. Format from message format to internal HSM format
5. Send to appropriate adapter
6. Wait for response
7. Respond to sender of message

Database Configurations

The following is a suggested layout for the basic database configuration for each part of the system. Once this has been agreed it will be documented in more detail.

Adapter Configuration

1. Adapter Name
2. Adapter Specific Information

Hardware HSM Configurations

1. Adapter Name – Key
2. Adapter type
3. HSM type – Informational
    a. HSM1
        i. Name
        ii. IP
        iii. Port
        iv. Header type
        v. Priority
        vi. Health Message interval (seconds) – 0 = no health message
        vii. Message timeout
        viii. HSM Specific information
    b. HSM..n
        i. Name
        ii. IP
        iii. Port
        iv. Header type
        v. Priority
        vi. Health Message interval (seconds) – 0 = no health message
        vii. Message timeout
        viii. HSM Specific information

Software HSM Configurations

1. Adapter Name – Key
2. Adapter type

Message configuration

1. FSP name - Key
2. Message type – Key
3. Enabled – True/False
4. Adapter

Command configuration

1. Whitelist IPs
2. User
    a. User ID
    b. User Group
3. User Groups
4. Commands per group

CPM Configuration

1. Common Name
2. Adapters

Key Configuration

1. FSP
2. Key Name
3. Date created
4. Date updated
5. Created by
6. Updated by
7. Key type
8. Key Expiry type
9. Key Use
10. Key Specific details