Ephemeral Diffie-Hellman Algorithm User Guide

Version 1.20 BETA

For use with Ephemeral Diffie-Hellman (EDH) Algorithm module versions 1.06 and above

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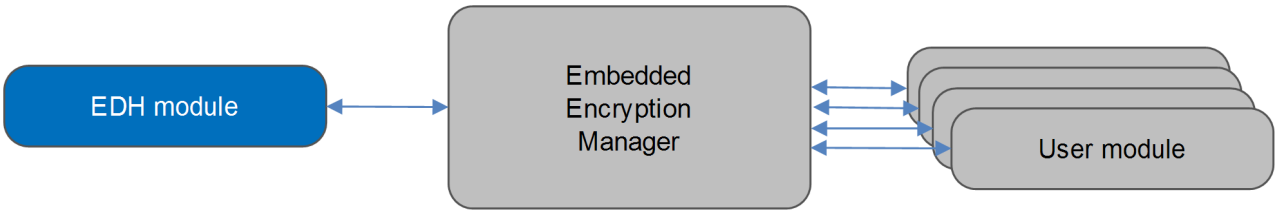
1 System Overview

1.1 Introduction

This guide is for those who want to implement encryption using the Ephemeral Diffie-Hellman (EDH) Algorithm. The EDH algorithm is a signature (key exchange) algorithm. The method is used by two parties that were previously unknown to each other to establish a shared secret key over an insecure channel. This key is used to encrypt communications over a public network using a symmetric key cipher.

You register the EDH module with HCC's Embedded Encryption Manager (EEM), making it usable by other applications (for example, HCC's TLS/SSL) through a standard interface. The EEM is the core component of HCC's encryption system.

The system structure is shown below:



Note:

- Although every attempt has been made to simplify the system's use, to get the best results you must understand clearly the requirements of the systems you design.
- HCC Embedded offers hardware and firmware development consultancy to help you implement your system; contact sales@hcc-embedded.com.

1.2 Feature Check

The main features of the EDH module are the following:

- Conforms to the HCC Advanced Embedded Framework.
- Conforms to the HCC Coding Standard including full MISRA compliance.
- Designed for integration with both RTOS and non-RTOS based systems.
- Conforms to the HCC Embedded Encryption Manager (EEM) standard and is compatible with the EEM.
- Can be verified by using the HCC Encryption Test Suite.

1.3 Packages and Documents

Packages

The table below lists the packages that you need in order to use this module.

Package	Description
hcc_base_docs	This contains the two guides that will help you get started.
enc_base	The EEM base package.
enc_edh	The EDH package described in this document.

Documents

For an overview of HCC verifiable embedded network encryption, see Product Information on the main HCC website.

Readers should note the points in the HCC Documentation Guidelines on the HCC documentation website.

HCC Firmware Quick Start Guide

This document describes how to install packages provided by HCC in the target development environment. Also follow the *Quick Start Guide* when HCC provides package updates.

HCC Source Tree Guide

This document describes the HCC source tree. It gives an overview of the system to make clear the logic behind its organization.

HCC Embedded Encryption Manager User Guide

This document describes the base EEM.

HCC Big Number Arithmetic Library API Specification

This document describes the big number arithmetic functions, some of which are used by this module.

HCC Ephemeral Diffie-Hellman Algorithm User Guide

This is this document.

1.4 Change History

This section includes recent changes to this product. For a list of all the changes, refer to the file **src/history /enc/enc_edh.txt** in the distribution package.

Version	Changes
1.06	Corrected key length check in function **edh_decode_params()**.
1.05	Removed mutex clearing during initialization. This could cause an OS compile error.
1.04	Corrected checking of output buffer length. Corrected writing out of buffer boundaries.
1.03	Changes for big number arithmetic.
1.02	Changed module to work with big-endian architecture.

2 Source File List

This section describes all the source code files included in the system. These files follow the HCC Embedded standard source tree system, described in the *HCC Source Tree Guide*. All references to file pathnames refer to locations within this standard source tree, not within the package you initially receive.

> **Note:** Do not modify any files except the configuration file.

2.1 API Header File

The file **src/api/api_enc_sw_edh.h** is the only file that should be included by an application using this module. It defines the edh_init_fn() function.

2.2 Configuration File

The file **src/config/config_enc_sw_edh.h** contains the configurable parameters of the system. Configure this as required. This is the only file in the module that you should modify.

2.3 System File

The file **src/enc/software/edh/edh.c** contains the source code. **This file should only be modified by HCC** .

2.4 Version File

The file **src/version/ver_enc_sw_edh.h** contains the version number of this module. This version number is checked by all modules that use this module to ensure system consistency over upgrades.

3 Configuration Options

Set the system configuration options in the file **src/config/config_enc_sw_edh.h**.

EDH_INSTANCE_NR

The maximum number of EDH instances. The default is 2.

EDH_BUF_LEN

The EDH buffer size (the maximum supported key size). The default is 128.

4 Application Programming Interface

This section describes the single Application Programming Interface (API) function and the error codes.

4.1 edh_init_fn

Use this function to forward the structure containing EDH functions to the EEM.

Format

```
t_enc_ret edh_init_fn( t_enc_driver_fn const * * const pp_encdriver )
```

Arguments

Parameter	Description	Type
pp_encdriver	A pointer to a structure containing EDH functions.	t_enc_driver_fn * *

Return Values

Return value	Description
ENC_SUCCESS	Successful execution.
ENC_INVALID_ERR	The module has already been initialized.

4.2 Error Codes

The table below lists the error codes that may be generated by the API call.

Error code	Value	Meaning
ENC_SUCCESS	0	Successful execution.
ENC_INVALID_ERR	1	The module has already been initialized.

5 Integration

The module is designed to be as open and as portable as possible. No assumptions are made about the functionality, the behavior, or even the existence, of the underlying operating system. For the system to work at its best, perform the porting outlined below. This is a straightforward task for an experienced engineer.

5.1 OS Abstraction Layer

The module uses the OS Abstraction Layer (OAL) that allows it to run seamlessly with a wide variety of RTOSes, or without an RTOS.

The module uses the following OAL components:

OAL Resource	Number Required
Tasks	0
Mutexes	1
Events	0

5.2 PSP Porting

The Platform Support Package (PSP) is designed to hold all platform-specific functionality, either because it relies on specific features of a target system, or because this provides the most efficient or flexible solution for the developer. For full details of these elements, see the *HCC Base Platform Support Package User Guide*.

The module makes use of the following standard PSP macro:

Macro	Package	Element	Description
PSP_RD_BE16	psp_base	psp_endianness	Reads a 16 bit value stored as big-endian from a memory location.

The module uses the following big number arithmetic functions from the Big Number Arithmetic Library API.

Note: To improve performance, you can replace these functions with optimized or hardware-supported versions. For details, see the *Big Number Arithmetic Library API Specification*.

Function	Description
bn_assign_be_buf()	Assigns a little-endian buffer to a big number, based on a big-endian buffer.
bn_get_be_buf()	Exports a big number to a big-endian buffer.
bn_get_power_modulo()	Calculates *p_a* raised to the power of *p_e*, modulo *p_m*, and stores the result in *p_r*.