



NVIDIA DOCA with OpenSSL

User Guide

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Chapter 1. Introduction

The `doca_sha_offload_engine` is an OpenSSL dynamic engine with the ability of offloading SHA calculation. It can offload the OpenSSL one-shot SHA-1, SHA-256, and SHA-512. It supports synchronous mode and asynchronous mode by leveraging the OpenSSL `async_jobs` library. For more information on the `async_jobs` library, please refer to [official OpenSSL documentation](#).

This engine is based on the `doca_sha` library and the OpenSSL dynamic engine interface API. For more information on the OpenSSL dynamic engine, please refer to [official OpenSSL documentation](#).

This engine can be called by an OpenSSL application through the OpenSSL high-level algorithm call interface, `EVP_Digest`. For more information on the `EVP_Digest`, please refer to [official OpenSSL documentation](#).

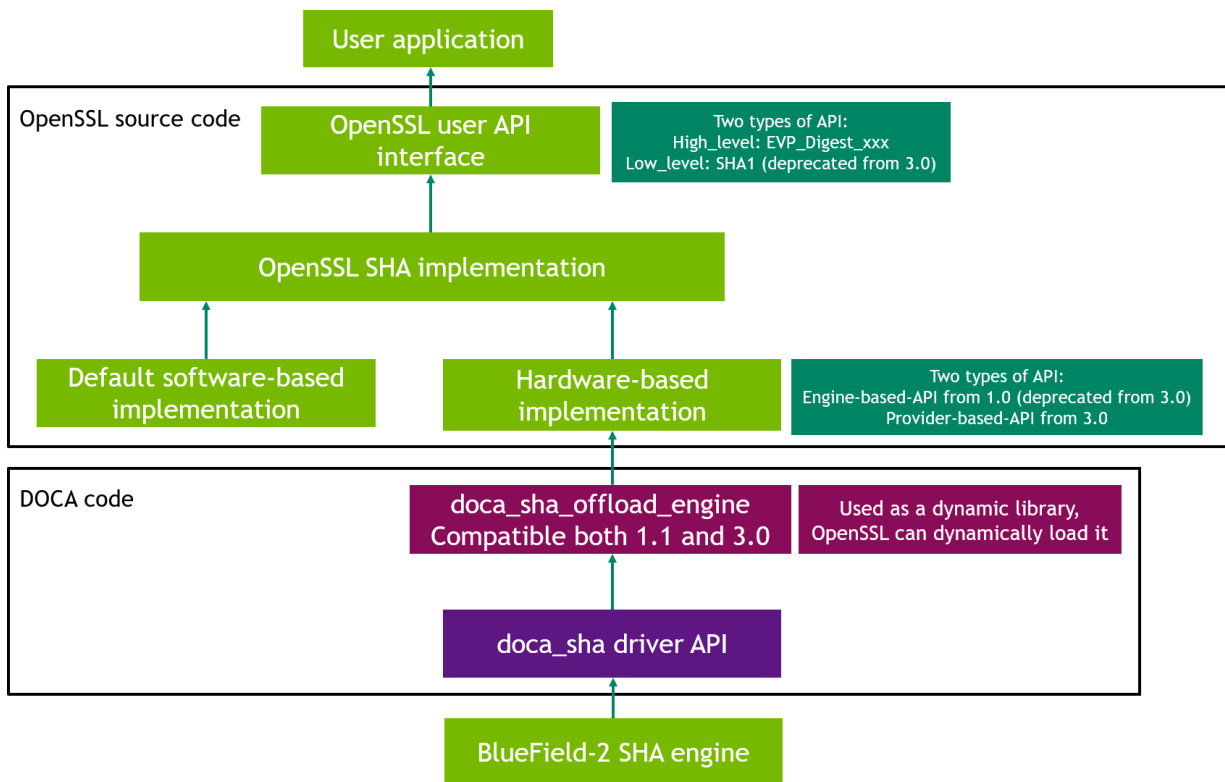
Chapter 2. Prerequisites

- ▶ Hardware-based `doca_sha` engine which can be verified by calling `doca_sha_get_hardware_supported()`
- ▶ Installed OpenSSL version $\geq 1.1.1$

Chapter 3. Architecture

The following diagram shows the software hierarchy of `doca_sha_offload_engine` and its location in the whole DOCA repository.

From the perspective of OpenSSL, this engine is an instantiation of the OpenSSL dynamic engine interface API by leveraging the `doca_sha` library.



Chapter 4. Capabilities and Limitations

- ▶ Only one-shot OpenSSL SHA is supported
- ▶ The maximum message length \leq 2GB, the same as `doca_sha` library

Chapter 5. OpenSSL Command Line Verification

Verify that the engine can be loaded:

```
$ openssl engine dynamic -pre NO_VCHECK:1 -pre SO_PATH:${DOCA_DIR}/infrastructure/
doca_sha_offload_engine/libdoca_sha_offload_engine.so -pre LOAD -vvv -t -c
(dynamic) Dynamic engine loading support
[Success]: SO_PATH:${DOCA_DIR}/infrastructure/doca_sha_offload_engine/
libdoca_sha_offload_engine.so
[Success]: LOAD
Loaded: (doca_sha_offload_engine) Openssl SHA offloading engine based on doca_sha
[SHA1, SHA256, SHA512]
  [ available ]
    set_pci_addr: set the pci address of the doca_sha_engine
      (input flags): STRING
```

► **For SHA-1:**

```
$ echo "hello world" | openssl dgst -sha1 -engine {DOCA_DIR}/infrastructure/
doca_sha_offload_engine/libdoca_sha_offload_engine.so -engine_impl
```

► **For SHA-256:**

```
$ echo "hello world" | openssl dgst -sha256 -engine {DOCA_DIR}/infrastructure/
doca_sha_offload_engine/libdoca_sha_offload_engine.so -engine_impl
```

► **For SHA-512:**

```
$ echo "hello world" | openssl dgst -sha512 -engine {DOCA_DIR}/infrastructure/
doca_sha_offload_engine/libdoca_sha_offload_engine.so -engine_impl
```

Chapter 6. OpenSSL Throughput Test

`openssl-speed` is the OpenSSL throughput benchmark tool. For more information, consult [official OpenSSL documentation](#). `doca_sha_offload_engine` throughput can also be measured using `openssl-speed`.

- ▶ SHA-1, each job 10000 bytes, using engine:

```
$ openssl speed -evp sha1 -bytes 10000 -elapsed --engine {DOCA_DIR}/  
infrastructure/doca_sha_offload_engine/libdoca_sha_offload_engine.so
```

- ▶ SHA-256, each job 10000 bytes, using engine, `async_jobs=256`:

```
$ openssl speed -evp sha256 -bytes 10000 -elapsed --engine {DOCA_DIR}/  
infrastructure/doca_sha_offload_engine/libdoca_sha_offload_engine.so -async_jobs  
256
```

- ▶ SHA-512, each job 10000 bytes, using engine, `async_jobs=256`, `threads=8`:

```
$ openssl speed -evp sha512 -bytes 10000 -elapsed --engine {DOCA_DIR}/  
infrastructure/doca_sha_offload_engine/libdoca_sha_offload_engine.so -async_jobs  
256 -multi 8
```

Chapter 7. Using DOCA SHA Offload Engine in OpenSSL Application

More information on the dynamic engine usage can be found in the [official OpenSSL documentation](#).

- ▶ To load the `doca_sha_offload_engine` (optionally, set engine PCIe address):

```
ENGINE *e;
const char *doca_engine_path = "${DOCA_DIR}/infrastructure/
doca_sha_offload_engine/libdoca_sha_offload_engine.so";
const char *default_doca_pci_addr = "03:00.0";
ENGINE_load_dynamic();
e = ENGINE_by_id(doca_engine_path);
ENGINE_ctrl_cmd_string(e, "set_pci_addr", doca_engine_pci_addr, 0);
ENGINE_init(e);
ENGINE_set_default_digests(e);
```

- ▶ To perform SHA calculation by calling the OpenSSL high-level function `EVP_XXX`:

```
const EVP_MD *evp_md = EVP_sha1();
EVP_MD_CTX *mdctx = EVP_MD_CTX_create();
EVP_DigestInit_ex(mdctx, evp_md, e);
EVP_DigestUpdate(mdctx, msg, msg_len);
EVP_DigestFinal_ex(mdctx, digest, digest_len);
EVP_MD_CTX_destroy(mdctx);
```

- ▶ To unload the engine:

```
ENGINE_unregister_digests(e);
ENGINE_finish(e);
ENGINE_free(e);
```

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