YubiHSM 2 Product Overview

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CHAPTER

ONE

INTRODUCTION

1.1 What is YubiHSM 2?

The YubiHSM 2 is a Hardware Security Module that is within reach of all organizations. It provides advanced cryptography, including hashing, asymmetric and symmetric key cryptography, to protect the cryptographic keys that secure critical applications, identities, and sensitive data in an enterprise for certificate authorities, databases, code signing and more.

1.2 Documentation Overview

Note: YubiHSM 2 SDK documentation and usage guides are enhanced continuously. Please check back regularly to see what's new.

The purpose of this documentation is both to provide detailed descriptions of YubiHSM 2 concepts and to work as a reference for commands and APIs provided. Before setting up YubiHSM 2 for the first time, familiarize yourself with the basic concepts and terminology used in the product documentation contained within these pages as well as in the software itself.

- Releases provides access to release notes, downloads, and known issues and limitations.
- Product Overview (this section) gives a high-level description of the YubiHSM 2 offering; product specifications, contents of the SDK, and how to get help.
- Concepts explains the foundational concepts used; understanding of these concepts is necessary in order to use YubiHSM 2.
- Commands provides an inventory of all available commands, with yubihsm-shell usage examples.
- Component Reference is a collection of reference materials for the components included in the SDK: the core libraries, the PKCS#11 module, the Shell, the Key Storage Provider, and more.
- Usage Guides YubiHSM 2 Administration and Usage Tasks, YubiHSM 2 for Active Directory Certificate Services Guide, Introduction to YubiHSM 2 Windows Deployment Guide, YubiHSM 2 for MS Host Guardian Service Guide, and YubiHSM 2 for MS SQL Server Guide, contains a number of guides and examples for using YubiHSM 2.
- Backup and Restore informs about how to back up keys, and how to restore from backups.

1.3 System Requirements

The YubiHSM 2 SDK is built and provided for the following operating systems.

Operating System	Version	Architecture
CentOS	7	amd64
CentOS	8	amd64
Debian	9 Stretch (stable)	amd64
Debian	10 Buster	amd64
Debian	11 Bullseye	amd64
Fedora	33	amd64
Fedora	34	amd64
Ubuntu	14.04 Trusty Tahr	amd64
Ubuntu	16.04 Xenial Xerus	amd64
Ubuntu	18.04 Bionic Beaver	amd64
Ubuntu	20.04 Focal Fossa	amd64
Ubuntu	21.04 Hirsute Hippo	amd64
Ubuntu	21.10 Impish Indri	amd64
Windows	Server 2019	x64, x86
macOS	10.15 Catalina, 11 Big Sur	amd64, arm64, universal

1.4 License

The YubiHSM 2 SDK is intended for use in development and production environments in conjunction with YubiHSM 2, pursuant to Yubico Toolset Software License Agreement. By downloading and installing the SDK you agree to the terms of this license.

The released SDK source code is licensed under the Apache 2.0 license.

Third party software included in the YubiHSM 2 SDK, and their respective licenses, are listed in the licenses directory inside the SDK package.

1.5 The YubiHSM 2 device

The YubiHSM 2 is a USB-based, multi-purpose cryptographic device for servers. Its diminutive physical size is ideal for installation directly into internal or external server ports.

1.6 What's in the SDK

The SDK contains tools to interface with YubiHSM 2. For more information about each of the main components, please see the component reference section.

Resource	Description
bin/libcrpto-1_1-x64.dll	Pre-built OpenSSL (Windows only)
bin/yubihsm-setup	Deployment tool for YubiHSM 2
bin/yubihsm-wrap	A tool to create wrapped importable objects offline
bin/yubihsm-connector	The connector, a tool for providing a common interface to the device
bin/yubihsm-shell	The shell, a REPL-style tool for interacting with YubiHSM 2 (and the connector) See **Note (1)**
include/pkcs11/pkcs11.h	Common and standard PKCS#11 functions and constants definitions
include/pkcs11/pkcs11y.h	Yubico-specific PKCS#11 functions and constants definitions
include/yubihsm.h	Library functions and constants definitions
lib/libyubihsm.{dylib,so} or in/libyubihsm.dll	Library binary to interact with YubiHSM 2
lib/yubihsm_pkcs11.{dylib,so} or bin/yubihsm_pkcs11.dll	PKCS#11 module to interact with ubiHSM 2
python-noarch/*	Python implementation of the library
yubihsm-cngprovider-windows-amd64.msi	Installer for CNG/KSP for Windows ADCS (Windows only)
yubihsm-connector-windows-amd64.msi	Installer for the connector (Windows only)

Note (1) Read-Evaluation-Print-Loop, REPL

1.7 Getting Help

Documentation aiding in deploying and using the YubiHSM 2 is continuously updated on https://developers.yubico.com/YubiHSM2 (this site). Additional support resources are available in the Yubico Knowledge Base.

Important: If you think you may have discovered a flaw in the product, Yubico welcomes your feedback. To report an issue that you suspect might be a bug, please submit a support request and provide as much detail as you can.

To submit a support request: https://support.yubico.com/hc/en-us

CHAPTER

TWO

SPECIFICATIONS

2.1 Cryptographic Interfaces

- PKCS#11 API version 2.40
- Yubico Key Storage Provider (KSP) to access Microsoft CNG. The KSP is provided as 64-bit and 32-bit DLLs
- Full access to device capabilities through Yubico's YubiHSM Core Libraries (C, Python)

2.2 RSA

- 2048, 3072, and 4096 bit keys (with e=65537)
- Signing using PKCS#1v1.5 and PSS
- Decryption using PKCS#1v1.5 and OAEP

2.3 Elliptic Curve Cryptography (ECC)

- **Curves**: secp224r1, secp256r1, secp256k1, secp384r1, secp521r, bp256r1, bp384r1, bp512r1, Ed25519
- **Signing**: ECDSA (all except Ed25519), EdDSA (Ed25519 only)
- **Derivation**: ECDH (all except Ed25519)

2.4 Hashing Functions

SHA-1, SHA-256, SHA-384, SHA-512

2.5 Key Wrap

Import and export using NIST-approved AES-CCM Wrap with 128, 196, and 256 bit keys

2.6 Random Numbers

On-chip True Random Number Generator (TRNG) used to seed NIST SP 800-90A Rev.1 AES-256 CTR_DRBG

2.7 Attestation

Asymmetric key pairs generated on-device may be attested using a device-specific Yubico attestation key and certificate, or using your own keys and certificates imported into the HSM.

2.8 Performance

Performance varies depending on usage. The accompanying Software Development Kit includes performance tools that can be used for additional measurements. Example metrics from an otherwise unoccupied YubiHSM 2:

- RSA-2048-PKCS1-SHA256: ~139ms
- RSA-3072-PKCS1-SHA384: ~504ms
- RSA-4096-PKCS1-SHA512: ~852ms
- ECDSA-P224-SHA1: ~64ms
- ECDSA-P256-SHA256: ~73ms
- ECDSA-P384-SHA384: ~120ms
- ECDSA-P521-SHA512: ~210ms
- EdDSA-25519-32Bytes: ~105ms
- EdDSA-25519-64Bytes: ~121ms
- EdDSA-25519-128Bytes: ~137ms
- EdDSA-25519-256Bytes: ~168ms
- EdDSA-25519-512Bytes: ~229ms
- EdDSA-25519-1024Bytes: ~353ms
- AES-(128|192|256)-CCM-Wrap: ~10ms
- HMAC-SHA-(1|256): ~4ms
- HMAC-SHA-(384|512): ~243ms

2.9 Storage Capacity

- All data stored as objects. 256 object slots, 126KB max total
- Stores up to 127 rsa2048 or 93 rsa3072 or 68 rsa4096 or 255 of any elliptic curve type, assuming only one authentication key is present
- Object Types: Authentication keys (used to establish sessions); Asymmetric private keys; Opaque binary data objects (e.g. x509 certificates); Wrap keys; HMAC keys

2.10 Management

- Mutual authentication and secure channel between applications and the YubiHSM 2
- M of N unwrap key restore via YubiHSM Setup Tool

2.11 Physical Characteristics

- **Form factor**: *nano* designed for confined spaces such as internal USB ports in servers
- **Dimensions:** 12mm x 13mm x 3.1mm
- **Weight:** 1g

2.12 Temperatures

- **Operational range:** 0°C - 40°C (32°F - 104°F)
- **Storage range:** -20°C - 85°C (-4°F - 185°F)

2.13 Host Interface

Universal Serial Bus (USB) 1.x Full Speed (12Mbit/s) Peripheral with bulk interface

CHAPTER

THREE

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