STM32 header for binary files

Contents

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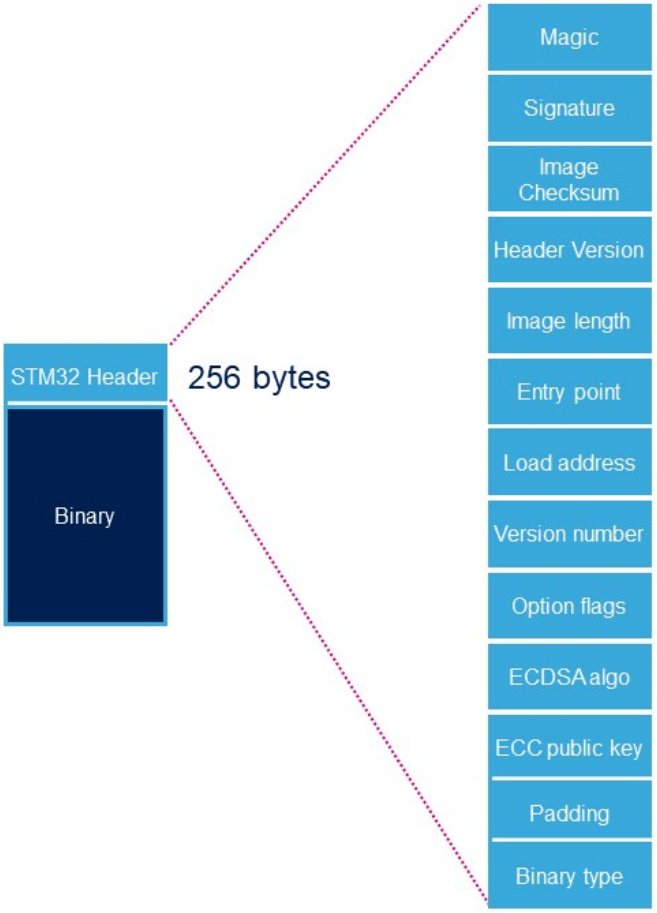
A quality version of this page, accepted on *24 March 2021*, was based off this revision.

The STM32 header is a STMicroelectronics header needed for binaries loaded by ROM code.

Description

Each binary image (signed or not) loaded by ROM code need to include a specific STM32 header added on top of the binary data. The header includes the authentication information.



Name	Length	Byte Offset	Description
Magic number	32 bits	0	4 bytes in big endian: 'S', 'T', 'M', 0x32 = 0x53544D32
Image signature	512 bits	4	ECDSA signature for image authentication[Note 1]
Image checksum	32 bits	68	Checksum of the payload[Note 2]
Header version	32 bits	72	Header version v1.0 = 0x00010000 Byte0: reserved Byte1:major version = 0x01 Byte2: minor version = 0x00 Byte3: reserved
Image length	32 bits	76	Length of image in bytes[Note 3]
Image entry Point	32 bits	80	Entry point of image

Name	Length	Byte Offset	Description
Reserved1	32 bits	84	Reserved
Load address	32 bits	88	Load address of image[Note 4]
Reserved2	32 bits	92	Reserved
Version number	32 bits	96	Image Version (monotonic number)[Note 5]
Option flags	32 bits	100	b0=1: no signature verification[Note 6]
ECDSA algorithm	32 bits	104	1: P-256 NIST ; 2: brainpool 256
ECDSA public key	512 bits	108	ECDSA public key to be used to verify the signature.[Note 7]
Padding	83 Bytes	172	Reserved padding bytes[Note 8]. Must all be set to 0
Binary type	1 Byte	255	Used to check the binary type 0x10-0x1F: TF-A 0x30: Copro

- Signature is calculated from first byte of header version field to last byte of image given by image length field.
- 32-bit sum of all payload bytes accessed as 8-bit unsigned numbers, discarding any overflow bits. Used to check the downloaded image integrity when signature is not used (if b0=1 in Option flags).
- Length is the length of the built image, it does not include the length of the STM32 header.
- This field is not used by ROM code.
- Image **version number** is an anti rollback monotonic counter. The ROM code checks that it is higher or equal to the monotonic counter stored in OTP.
- Enabling signature verification is mandatory on secure closed chips.
- This field is an extract of PEM public key file that only kept the ECC Point coordinates *x* and *y* in a raw binary format (RFC 5480). This field will be hashed with SHA-256 and compared to the **Hash of pubKey** that is stored in OTP.
- This padding forces STM32 header size to 256 bytes (0x100).

The OTP used for the **Version number** and the **Hash of pubKey** are defined in the chapter “OTP configuration“ of the ROM code overview.

Elliptic Curve Digital Signature Algorithm

Trusted Firmware for Arm® Cortex®-A

Read Only Memory

One Time Programmed

Privacy Enhanced Mail (File format for storing and sending cryptographic keys, certificates, and other data)

Elliptic curve cryptography

Error Correction Capability

Secure Hash Algorithm

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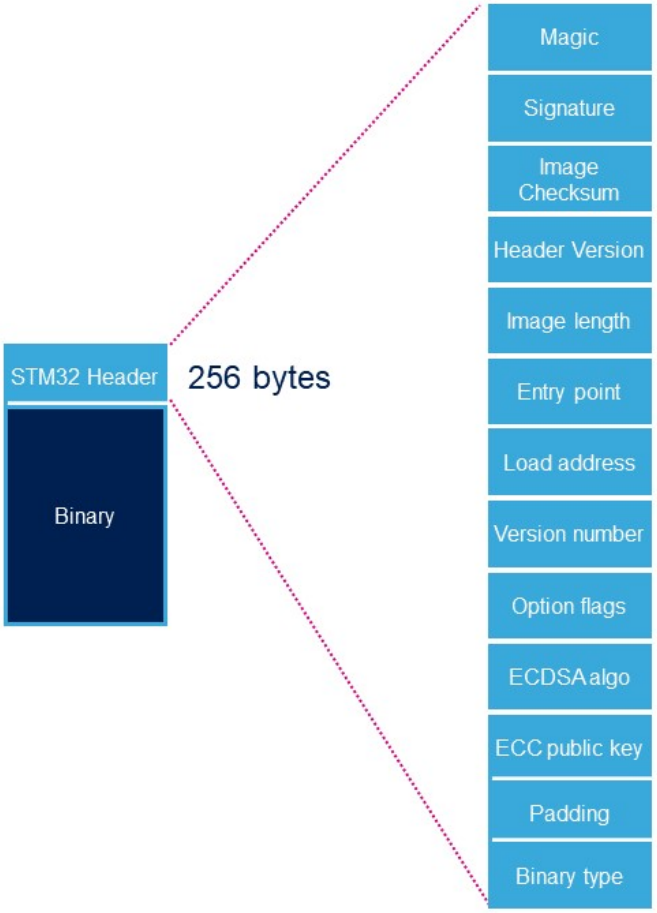

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