jamf

Quo Vadis, certificates?

Matteo Bolognini

Product Specialist

skartek.dev

Agenda

- Understanding certificates
- Usage of certificates
- SCEP
- ACME

jamf

Understanding certificates

- A certificate is essentially an electronic "passport" that uses cryptographic techniques to prove the identity of the holder.

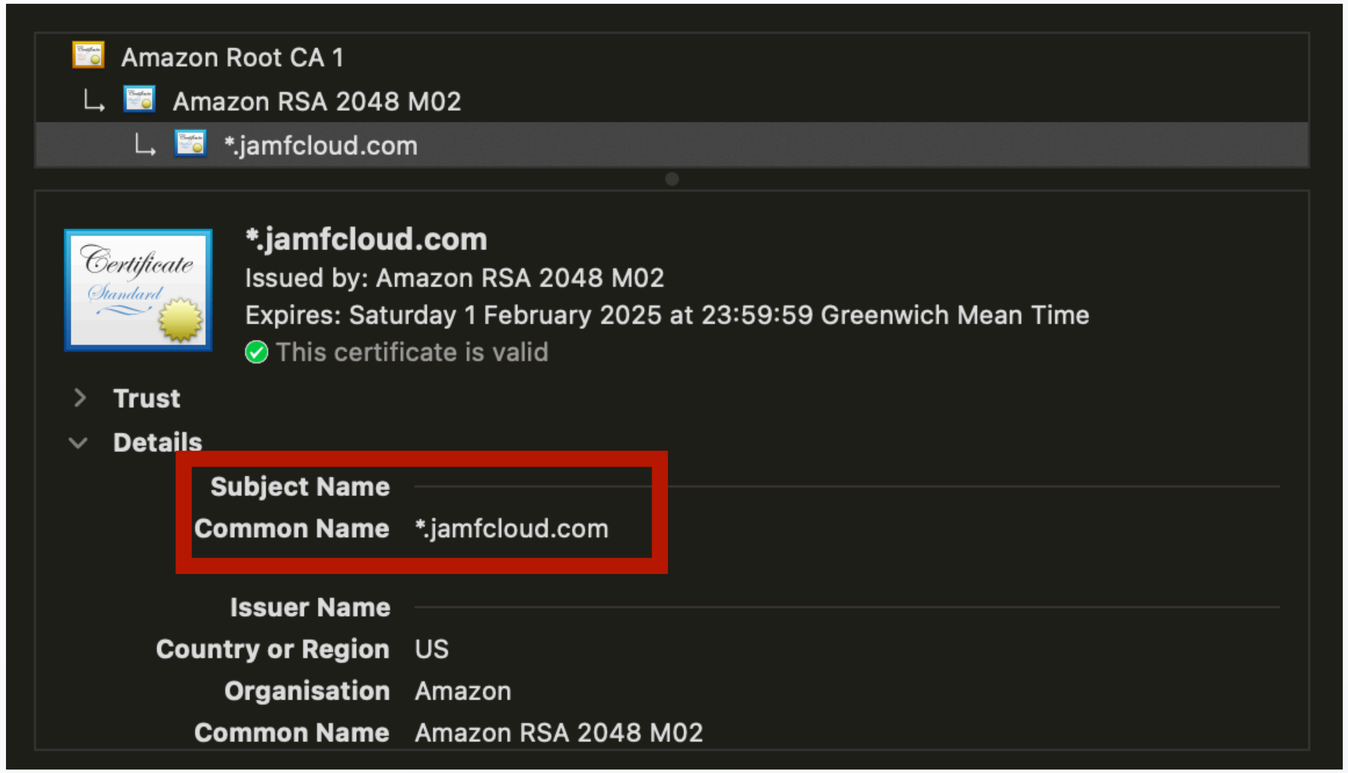
- It contains a **public key**, which is part of a cryptographic key pair, along with information about the key's owner (like their name, organization, and the certificate's validity period).

- The certificate is signed by a **Certificate Authority (CA)**, which is a trusted entity in the PKI.

Understanding certificates

- **Subject**: The entity (individual, server, etc.) to which the certificate belongs

Understanding certificates

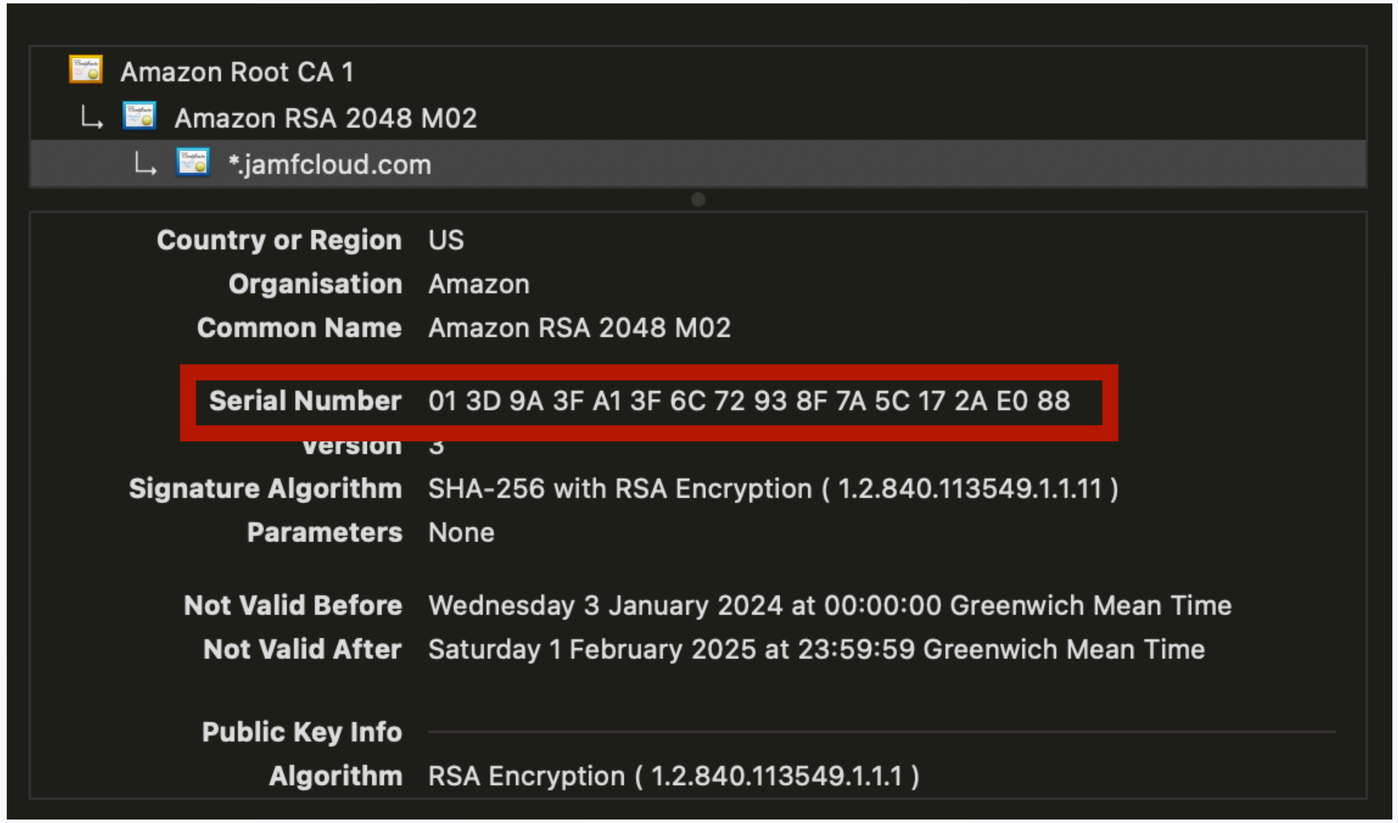


jamf

Understanding certificates

- **Subject**: The entity (individual, server, etc.) to which the certificate belongs
- **Serial Number**: A unique number identifying the certificate

Understanding certificates

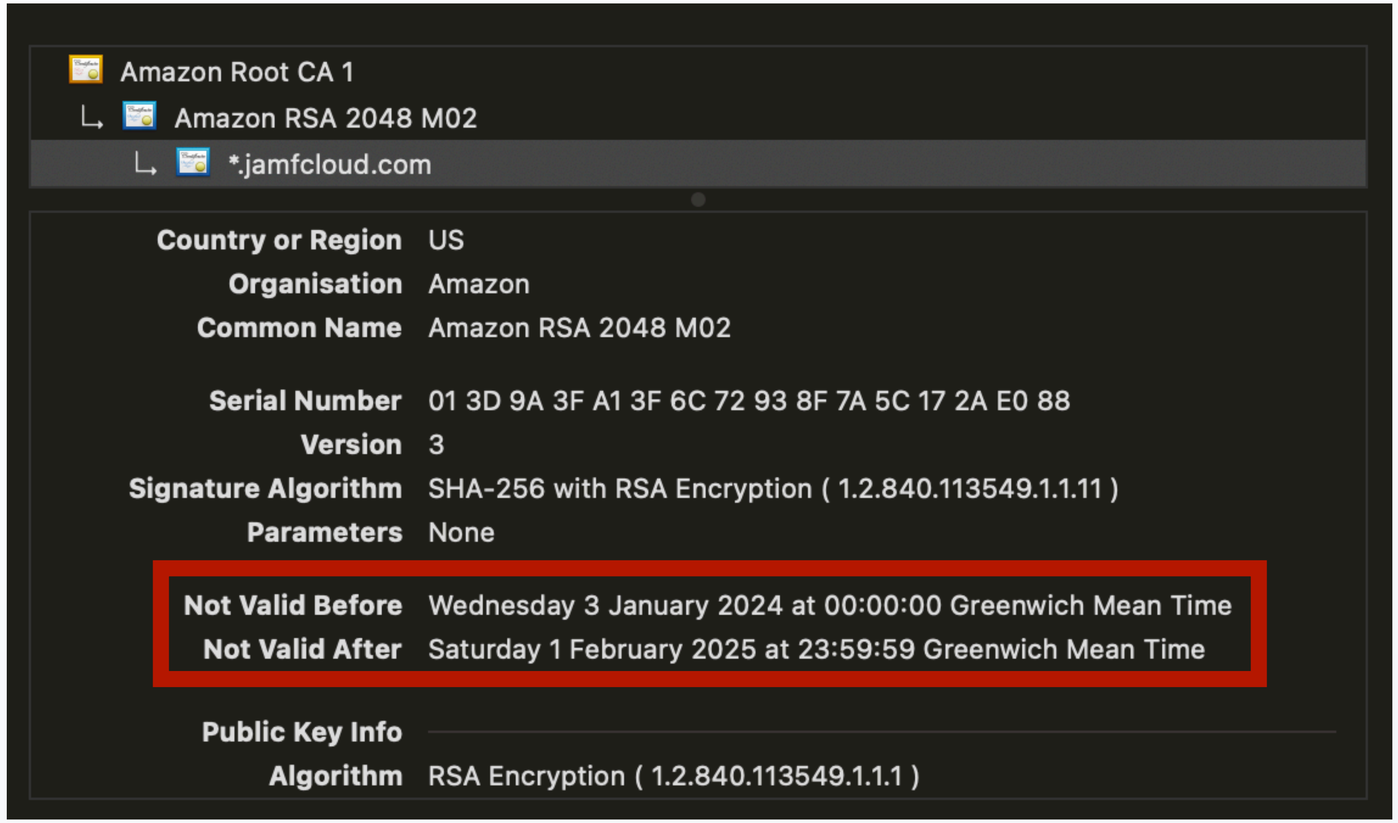


jamf

Understanding certificates

- **Subject**: The entity (individual, server, etc.) to which the certificate belongs
- **Serial Number**: A unique number identifying the certificate
- **Validity Period**: The time frame during which the certificate is considered valid

Understanding certificates

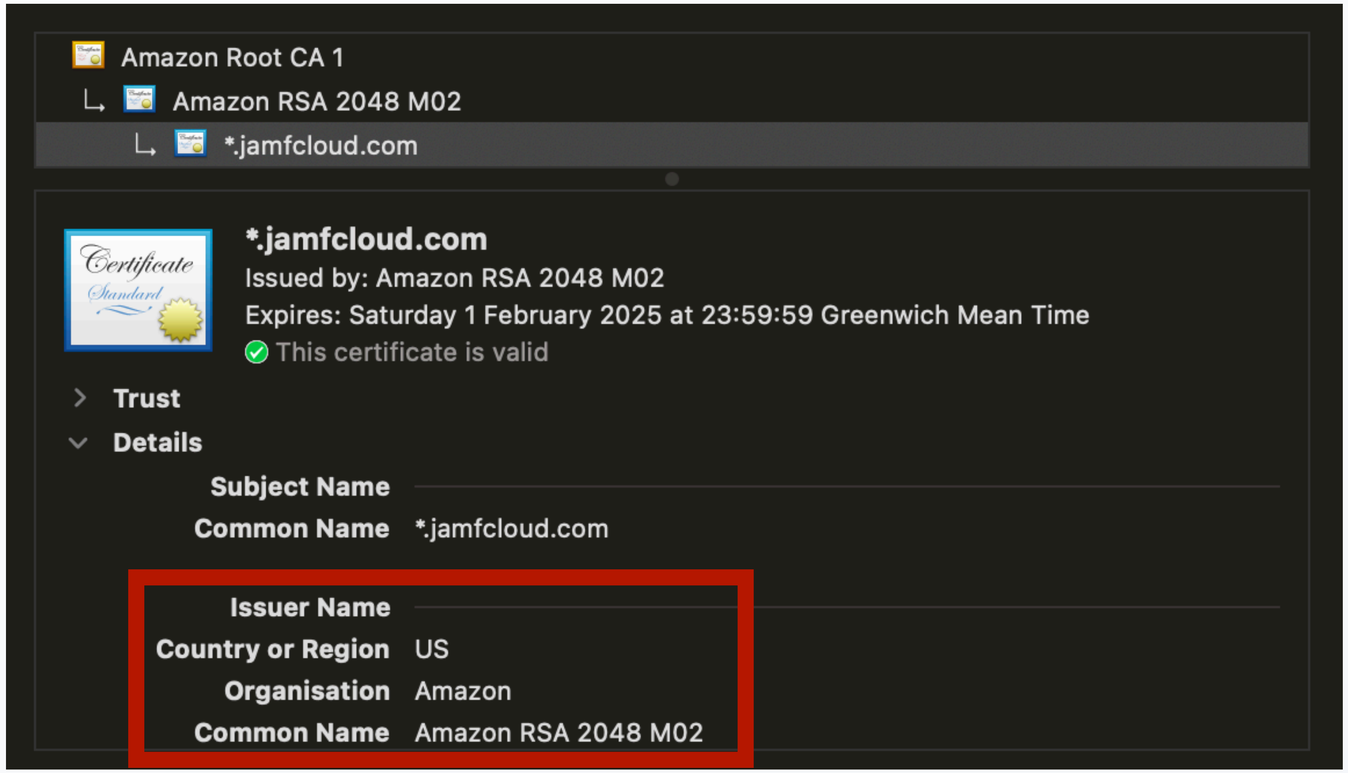


jamf

Understanding certificates

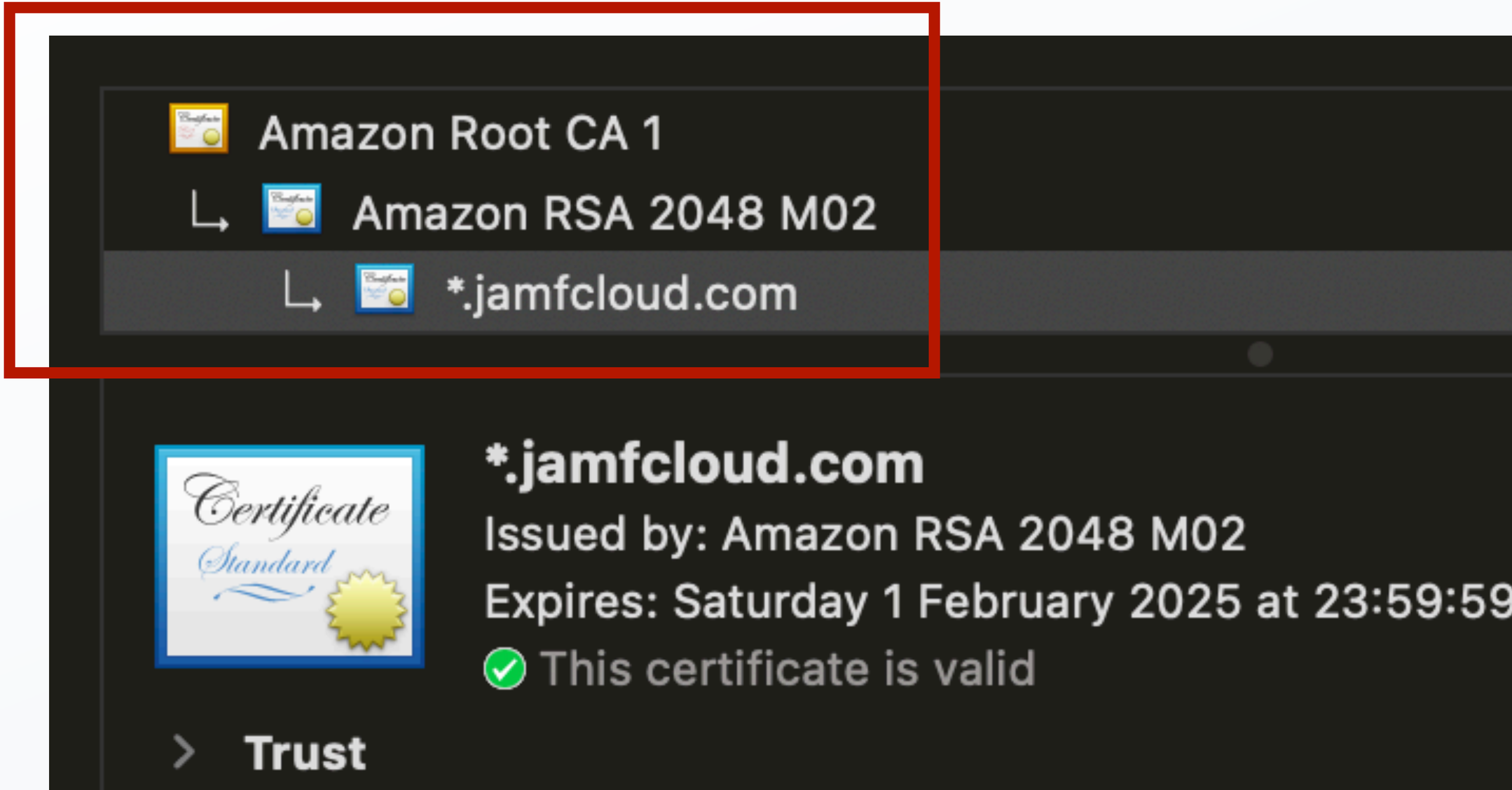
- **Subject**: The entity (individual, server, etc.) to which the certificate belongs
- **Serial Number**: A unique number identifying the certificate
- **Validity Period**: The time frame during which the certificate is considered valid
- **Issuer**: The CA that issued and signed the certificate.

Understanding certificates



jamf

Understanding certificates



jamf

Understanding certificates

- **Root Certificate**

- **Intermediate Certificate**

- **Server or Client Certificate**

Usage of certificates

- **802.1x:** Authenticate on a network

Usage of certificates

- **802.1x:** Authenticate on a network
- **VPN**: Authenticate to access a network

Usage of certificates

- **802.1x:** Authenticate on a network
- **VPN**: Authenticate to access a network
- **S/MIME**: Encrypt email

Usage of certificates

- **802.1x:** Authenticate on a network
- **VPN**: Authenticate to access a network
- **S/MIME**: Encrypt email
- **Code Signing**: Sign packages

jamf

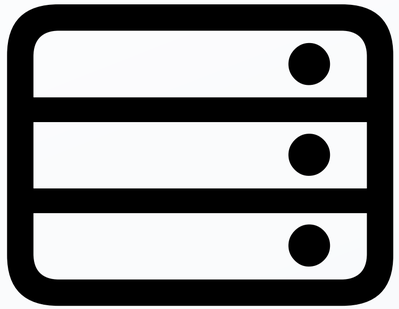
Usage of certificates

jamf

SCEP

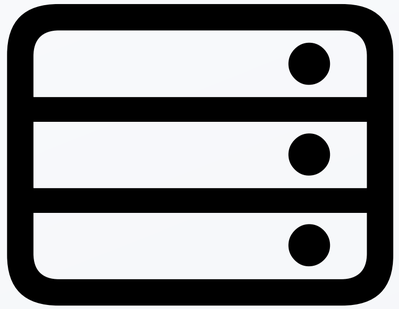
- Simple Certificate Enrollment Protocol
- Developed in the late 1990s by Cisco Systems, publicly available around 2000
- The initial use cases was securing network devices such as routers, switches, and firewalls
- HTTP

SCEP



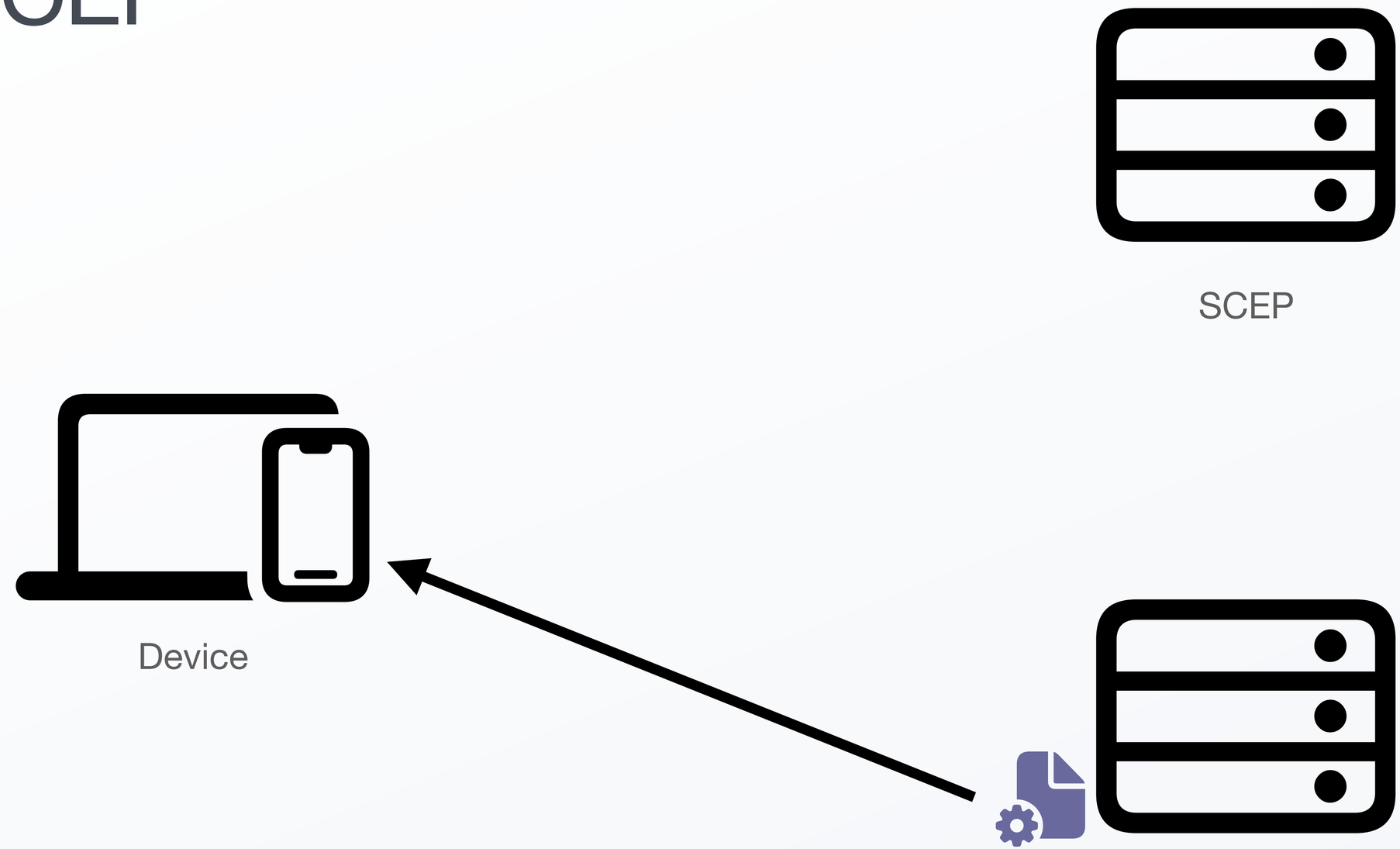
SCEP

Device

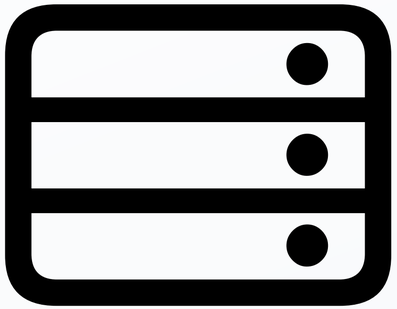


Jamf Pro

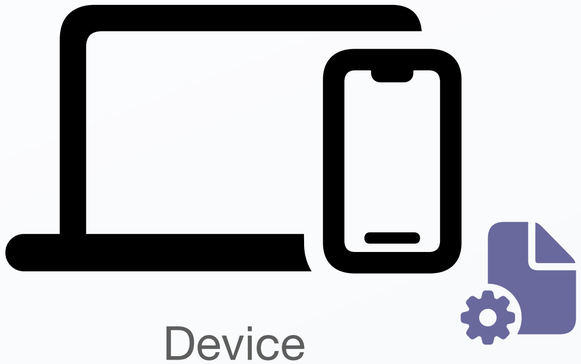
SCEP



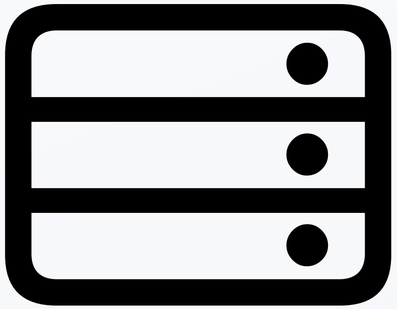
SCEP



SCEP



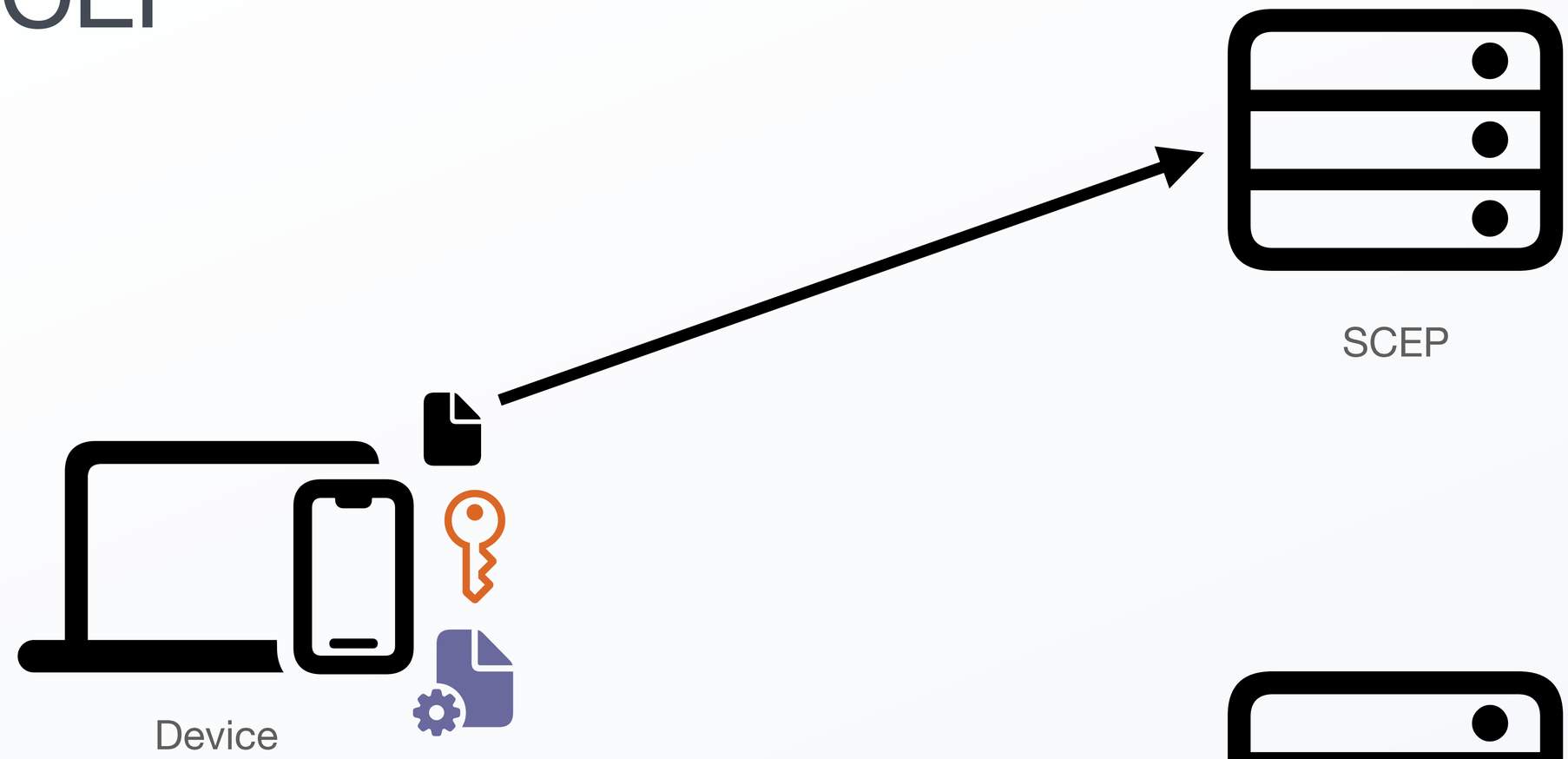
Device



Jamf Pro

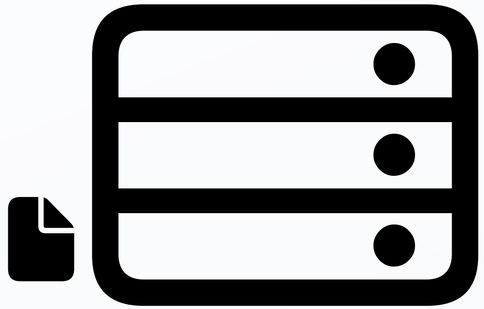
jamf

SCEP

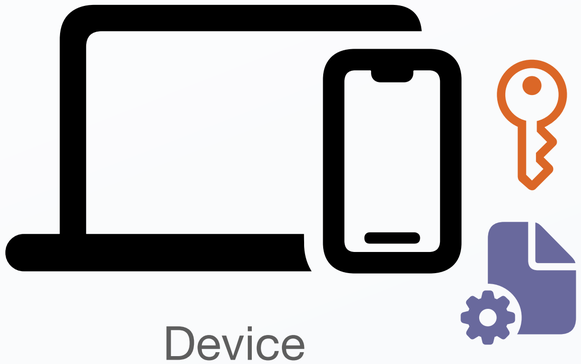


jamf

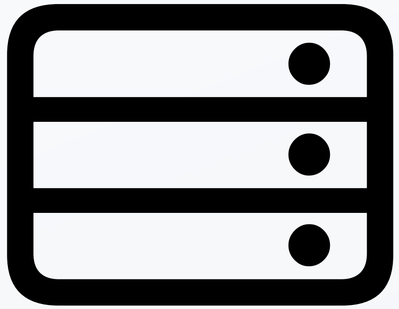
SCEP



SCEP

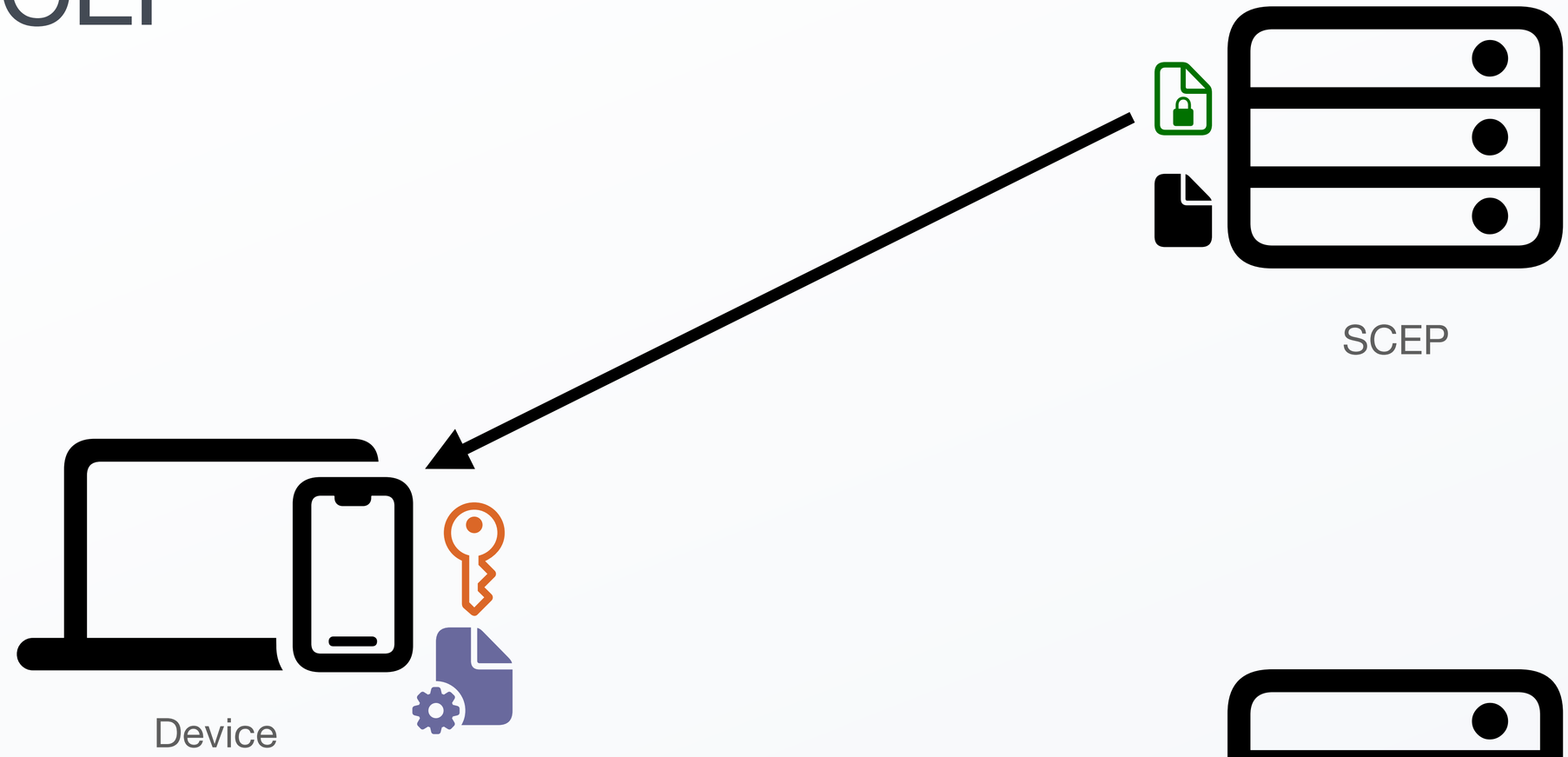


Device



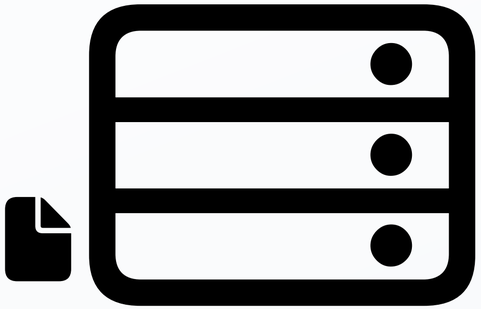
Jamf Pro

SCEP

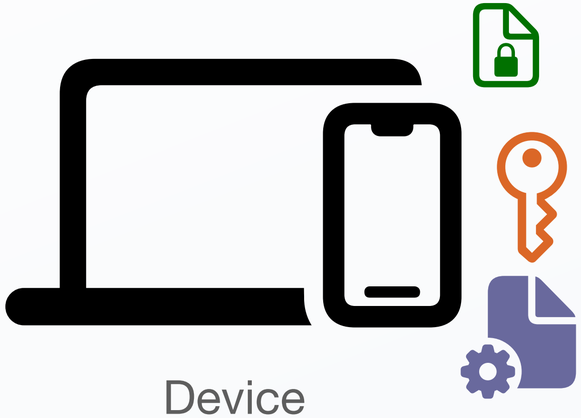


jamf

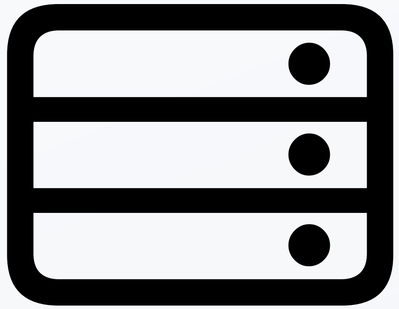
SCEP



SCEP



Device



Jamf Pro

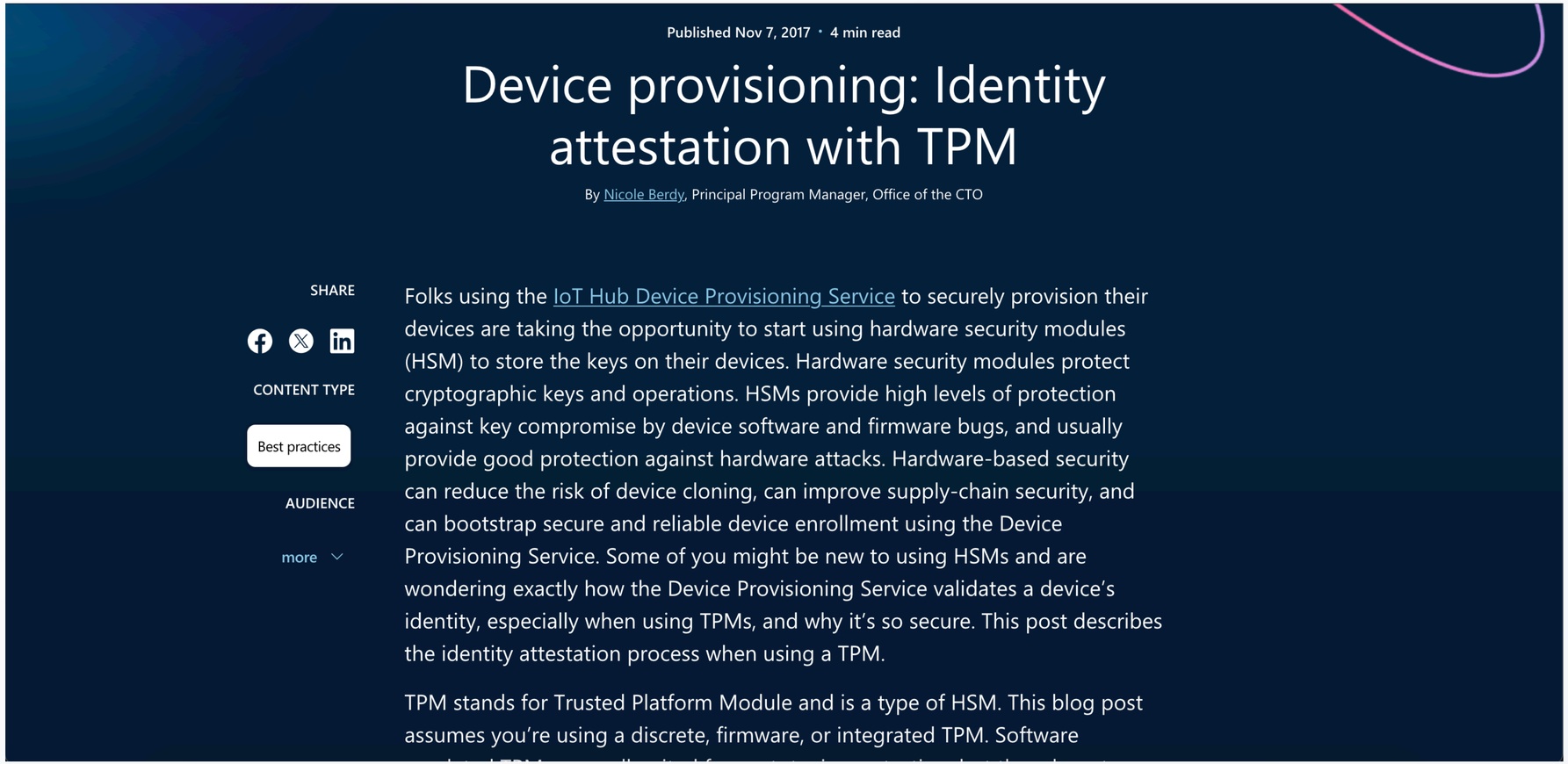
ACME

- Automatic Certificate Management Environment
- Developed by Internet Security Research Group (ISRG)
- 2015 adopted by Let's Encrypt
- WWDC 2022 - Managed Device Attestation

ACME

Microsoft

jamf



Published Nov 7, 2017 · 4 min read

Device provisioning: Identity attestation with TPM

By Nicole Berdy, Principal Program Manager, Office of the CTO

SHARE

CONTENT TYPE

Best practices

AUDIENCE

more

Folks using the IoT Hub Device Provisioning Service to securely provision their devices are taking the opportunity to start using hardware security modules (HSM) to store the keys on their devices. Hardware security modules protect cryptographic keys and operations. HSMs provide high levels of protection against key compromise by device software and firmware bugs, and usually provide good protection against hardware attacks. Hardware-based security can reduce the risk of device cloning, can improve supply-chain security, and can bootstrap secure and reliable device enrollment using the Device Provisioning Service. Some of you might be new to using HSMs and are wondering exactly how the Device Provisioning Service validates a device's identity, especially when using TPMs, and why it's so secure. This post describes the identity attestation process when using a TPM.

TPM stands for Trusted Platform Module and is a type of HSM. This blog post assumes you're using a discrete, firmware, or integrated TPM. Software

ACME

Microsoft

Google

jamf

README | Code of conduct | Apache-2.0 license | Security

Go-Attestation

reference

Go-Attestation abstracts remote attestation operations across a variety of platforms and TPMs, enabling remote validation of machine identity and state. This project attempts to provide high level primitives for both client and server logic.

Talks on this project:

- *"Making Device Identity Trustworthy"* - Open Source Summit Europe - October 2019 - (Slides)
- *"Using TPMs to Cryptographically Verify Devices at Scale"* - Open Source Summit North America - September 2019 - (Video 39min)
- *"Making Remote Attestation Useful on Linux"* - Linux Security Summit - September 2019 - (Video 26min)

Status

Go-Attestation is under active development. Expect API changes at any time.

Please note that this is not an official Google product.

TPM 1.2 support is best effort, meaning we will accept fixes for TPM 1.2, but testing is not covered by CI.

Installation

The go-attestation package is installable using go get: `go get github.com/google/go-attestation/attest`

TPM1.2

Used by 168

+ 160

Contributors 36

+ 22 contributors

Languages

Go 98.0% Shell 2.0%

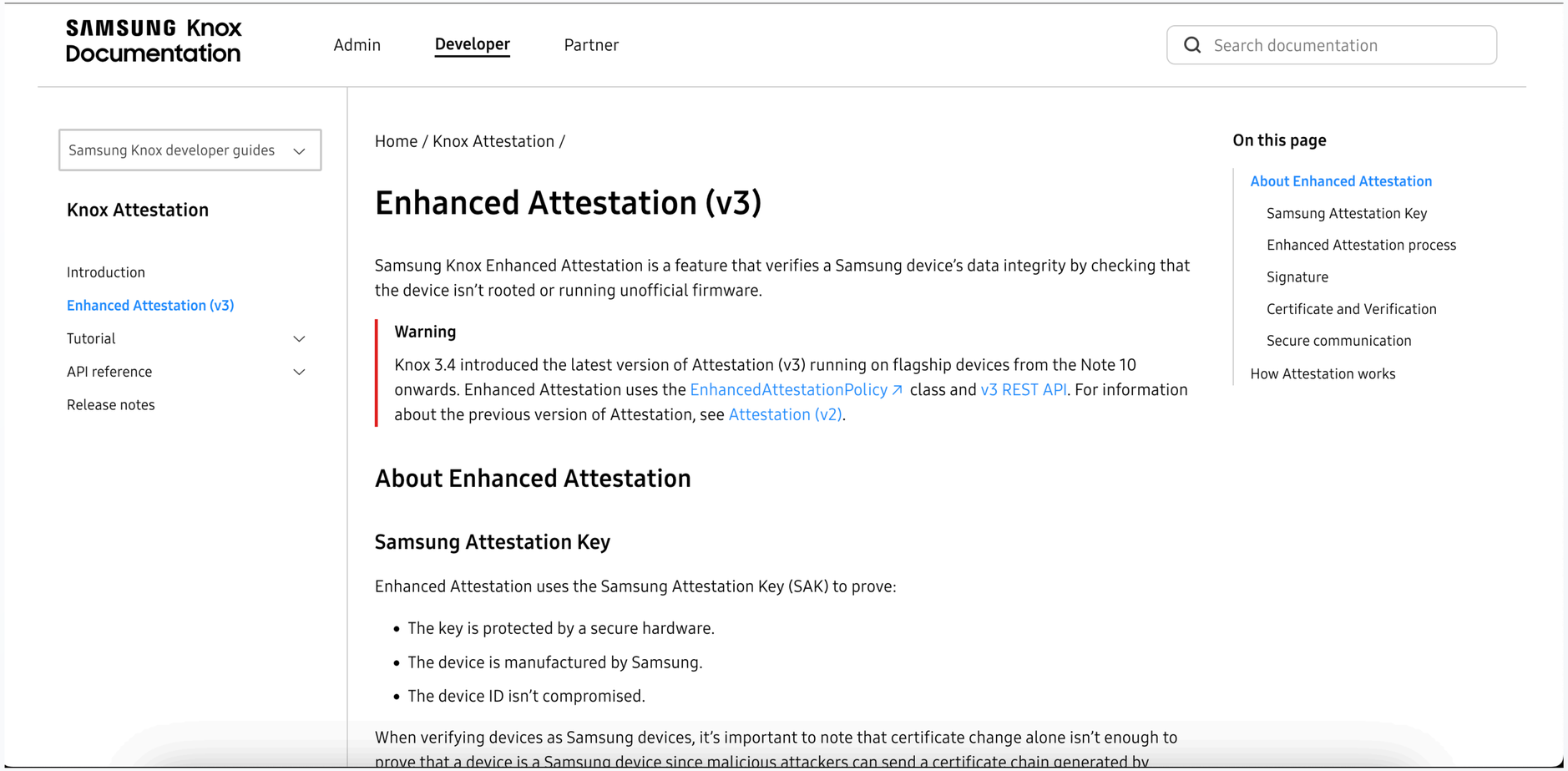
ACME

Microsoft

Google

jamf

SAMSUNG



SAMSUNG Knox Documentation

Admin | Developer | Partner

Search documentation

Samsung Knox developer guides

Knox Attestation

- Introduction
- Enhanced Attestation (v3)
- Tutorial
- API reference
- Release notes

Home / Knox Attestation /

Enhanced Attestation (v3)

Samsung Knox Enhanced Attestation is a feature that verifies a Samsung device's data integrity by checking that the device isn't rooted or running unofficial firmware.

> **Warning**
>
> Knox 3.4 introduced the latest version of Attestation (v3) running on flagship devices from the Note 10 onwards. Enhanced Attestation uses the EnhancedAttestationPolicy ↗ class and v3 REST API. For information about the previous version of Attestation, see Attestation (v2).

About Enhanced Attestation

Samsung Attestation Key

Enhanced Attestation uses the Samsung Attestation Key (SAK) to prove:

- The key is protected by a secure hardware.
- The device is manufactured by Samsung.
- The device ID isn't compromised.

When verifying devices as Samsung devices, it's important to note that certificate change alone isn't enough to prove that a device is a Samsung device since malicious attackers can send a certificate chain generated by

On this page

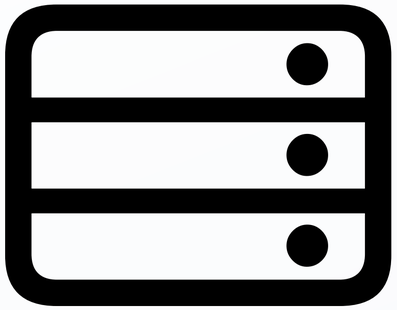
- About Enhanced Attestation
  - Samsung Attestation Key
  - Enhanced Attestation process
  - Signature
  - Certificate and Verification
  - Secure communication
- How Attestation works

ACME

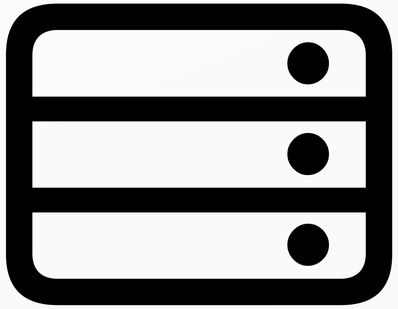
```
https://datatracker.ietf.org/doc/html/draft-acme-device-attest
```

jamf

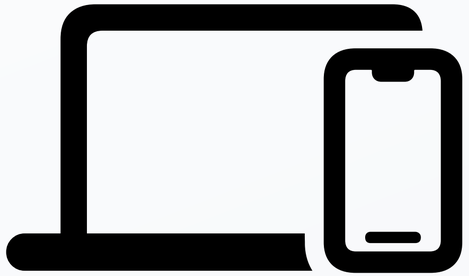
ACME



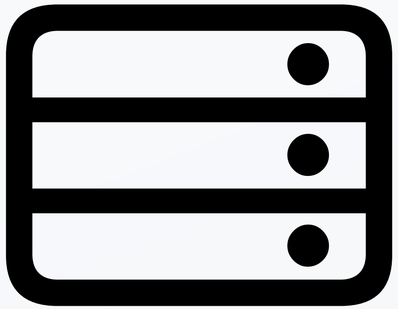
Attestation Server



ACME Server



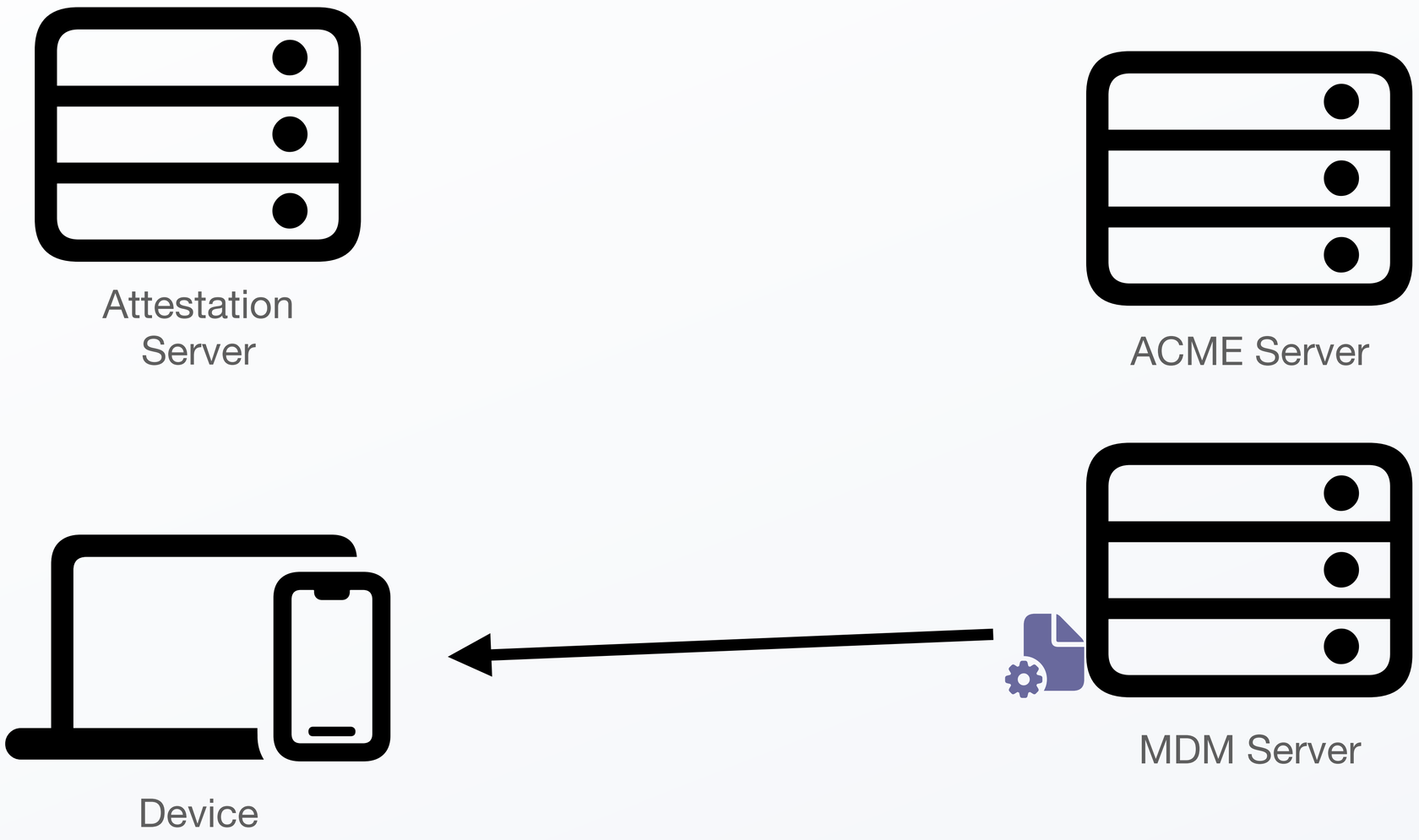
Device



MDM Server

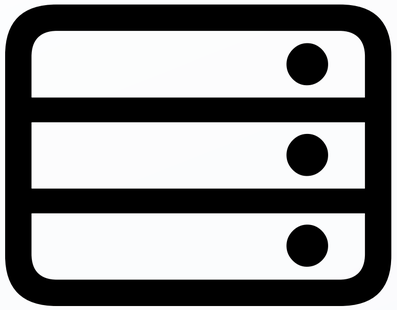
jamf

ACME

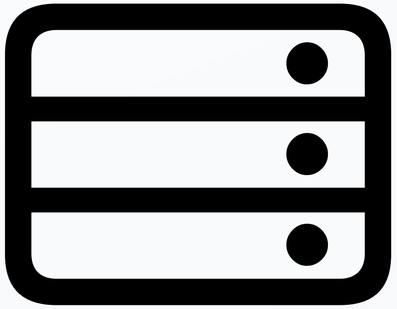


jamf

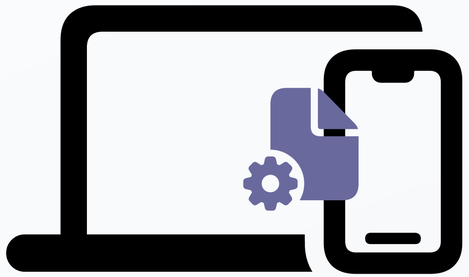
ACME



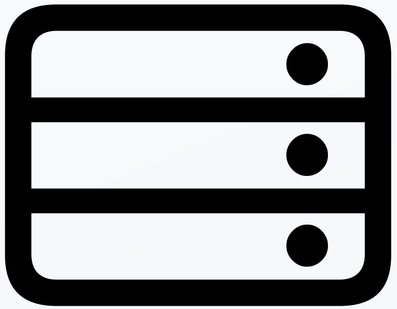
Attestation Server



ACME Server



Device



MDM Server

jamf

ACME

Payload keys

```
PayloadType com.apple.security.acme
```

Usage of certificates

Payload keys

```
PayloadType com.apple.security.acme
```

Key properties

```
KeyType
KeySize
HardwareBound
```

Certificate request

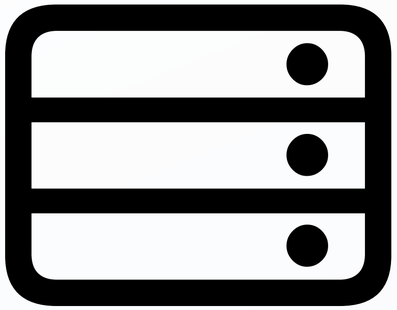
```
KeyUsage
ExtendedKeyUsage
Subject
SubjectAltName
```

ACME request

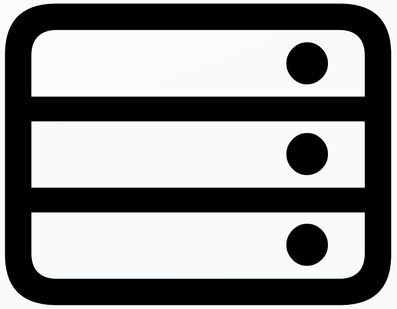
```
DirectoryURL
ClientIdentifier
Attest
```

jamf

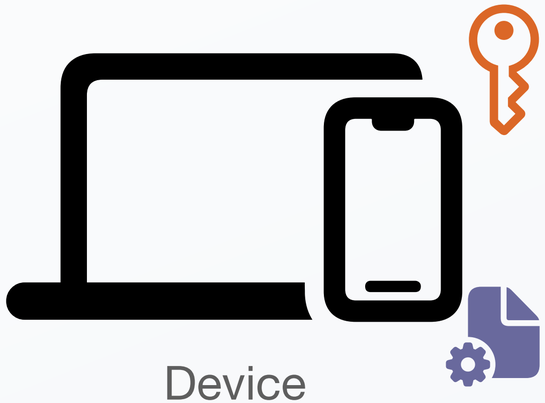
ACME



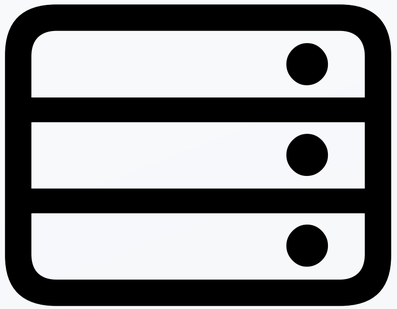
Attestation Server



ACME Server



Device



MDM Server

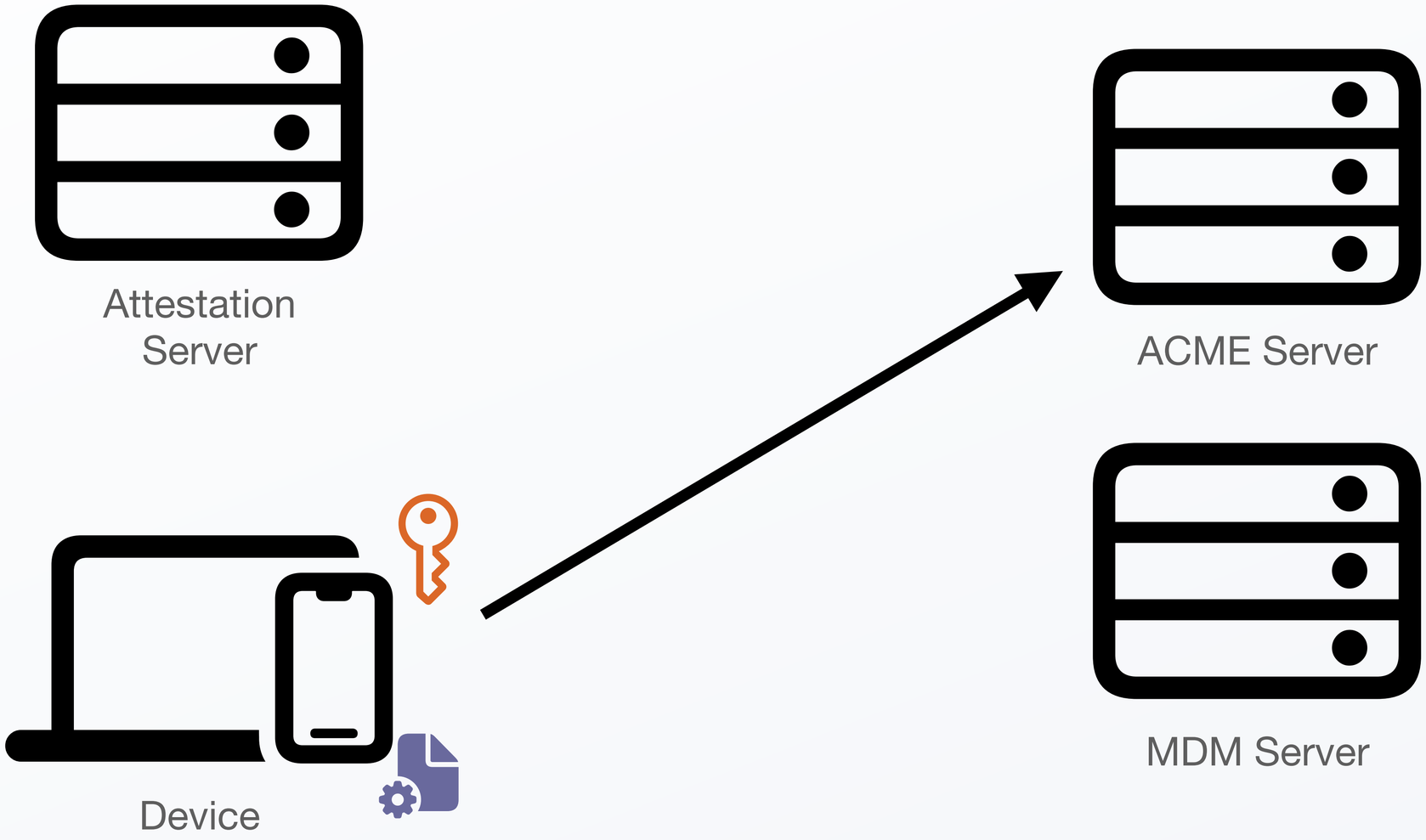
jamf

ACME

- Attestation required hardware-bound key
- ACME payload support **RSA** and **ECSECPrimeRandom**
- Hardware-bound keys requires **ECSECPrimeRandom**

jamf

ACME



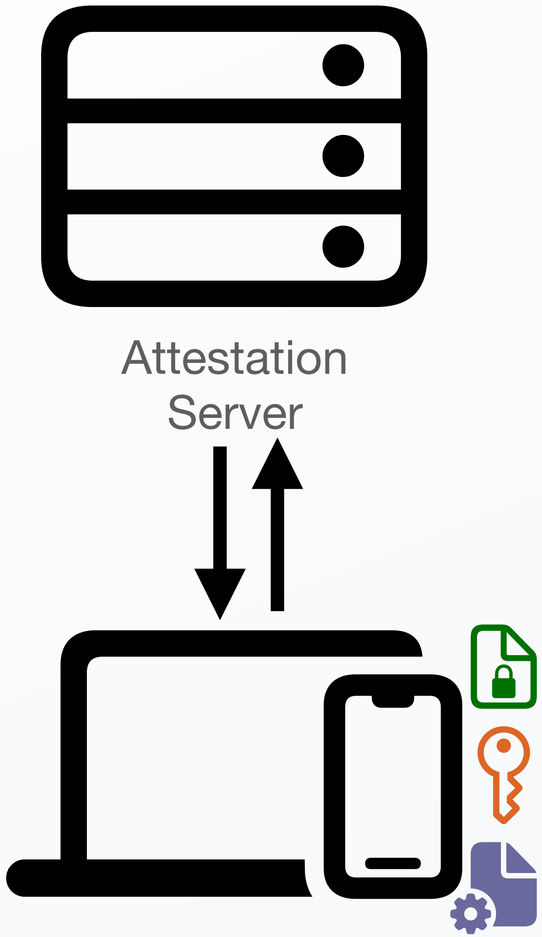
jamf

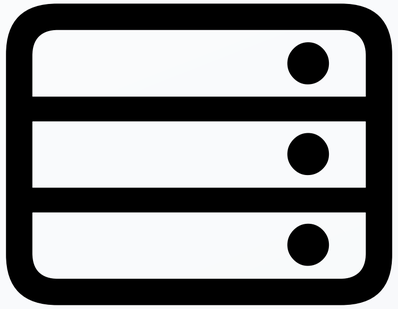
ACME

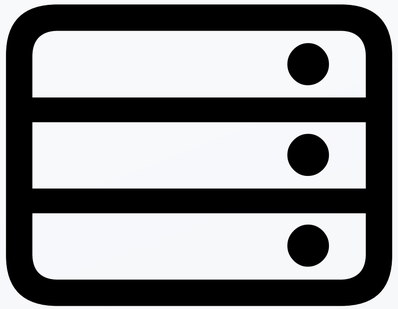
- Resolve DirectoryURL
- Account and order creation
- device-attest-01 validation type
- Generate nonce token

jamf

ACME




ACME Server


MDM Server

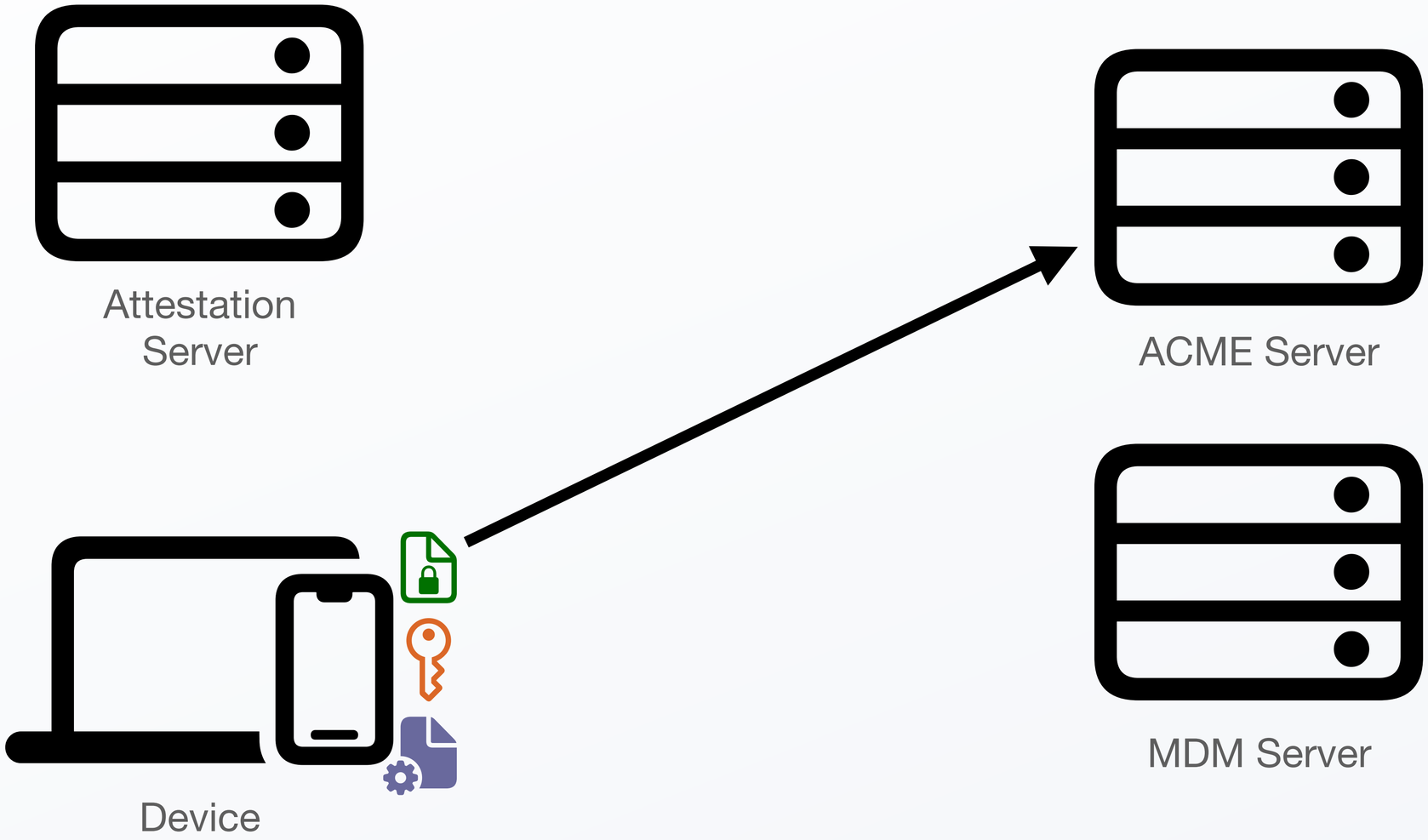
jamf

ACME

- Nonce hashed (SHA-256) before embedding in attestation
- OIDs - Device-Identifying are omitted for User Enrollments
- Nonce from ACME server, not MDM
- Private key is the one the device generated
- Certificate can be used only for Attestation

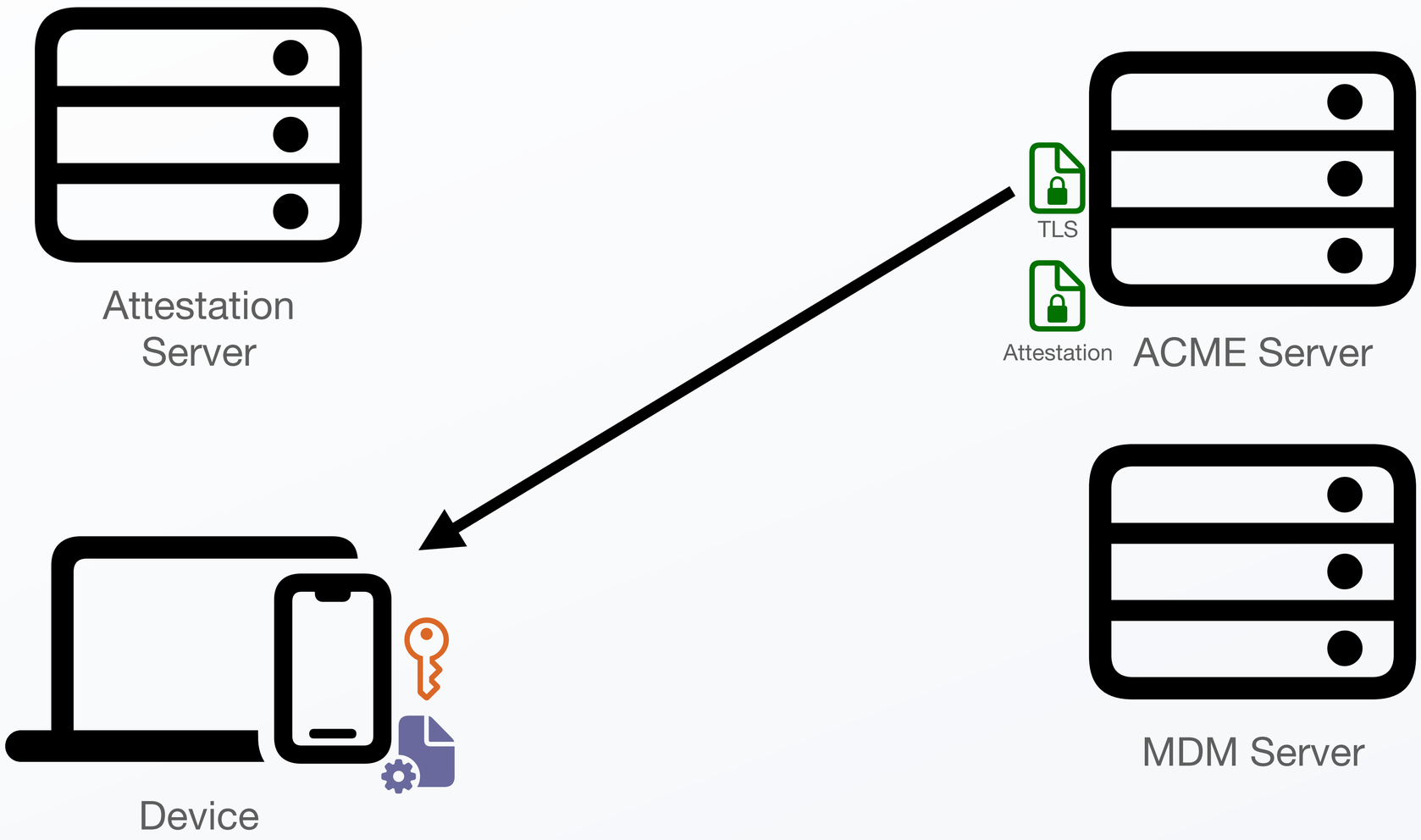
jamf

ACME



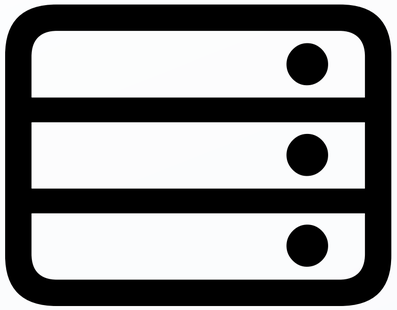
jamf

ACME

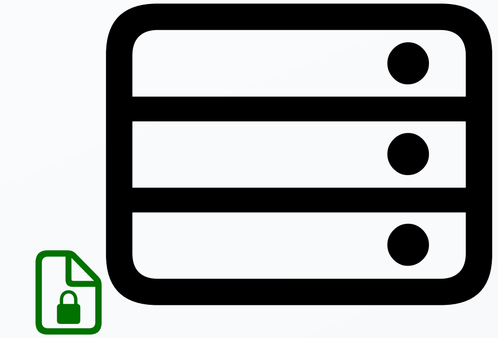

Attestation Server
TLS
Attestation
ACME Server
MDM Server
Device

jamf

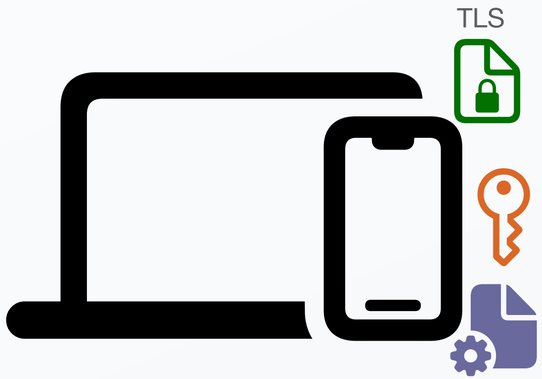
ACME



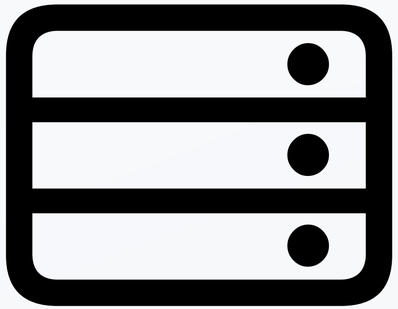
Attestation Server



ACME Server



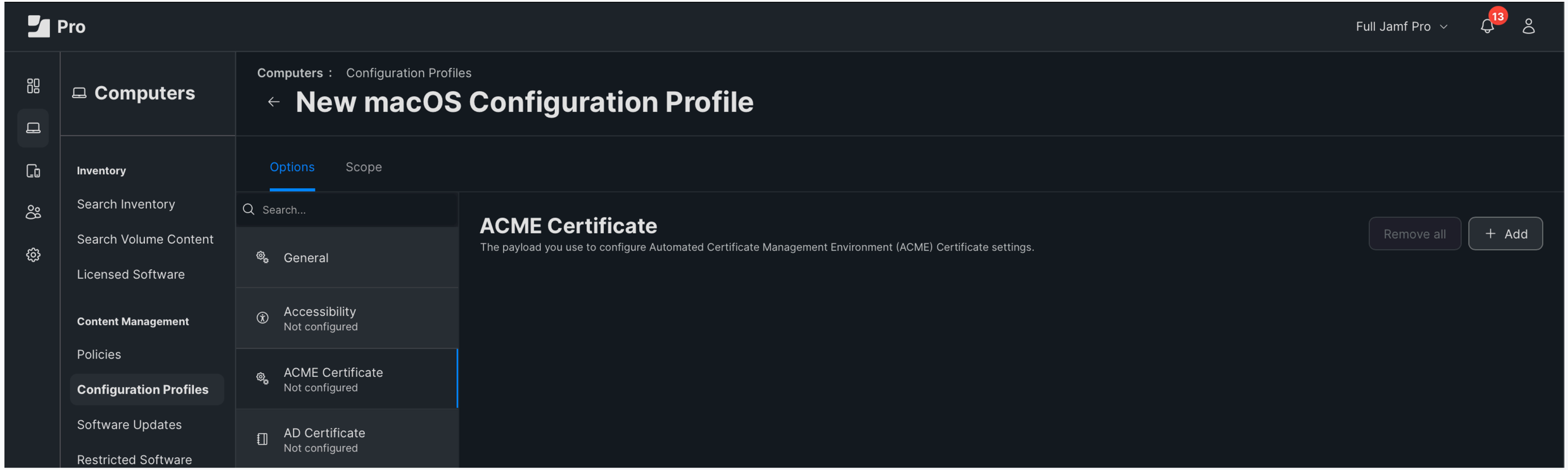
Device



MDM Server

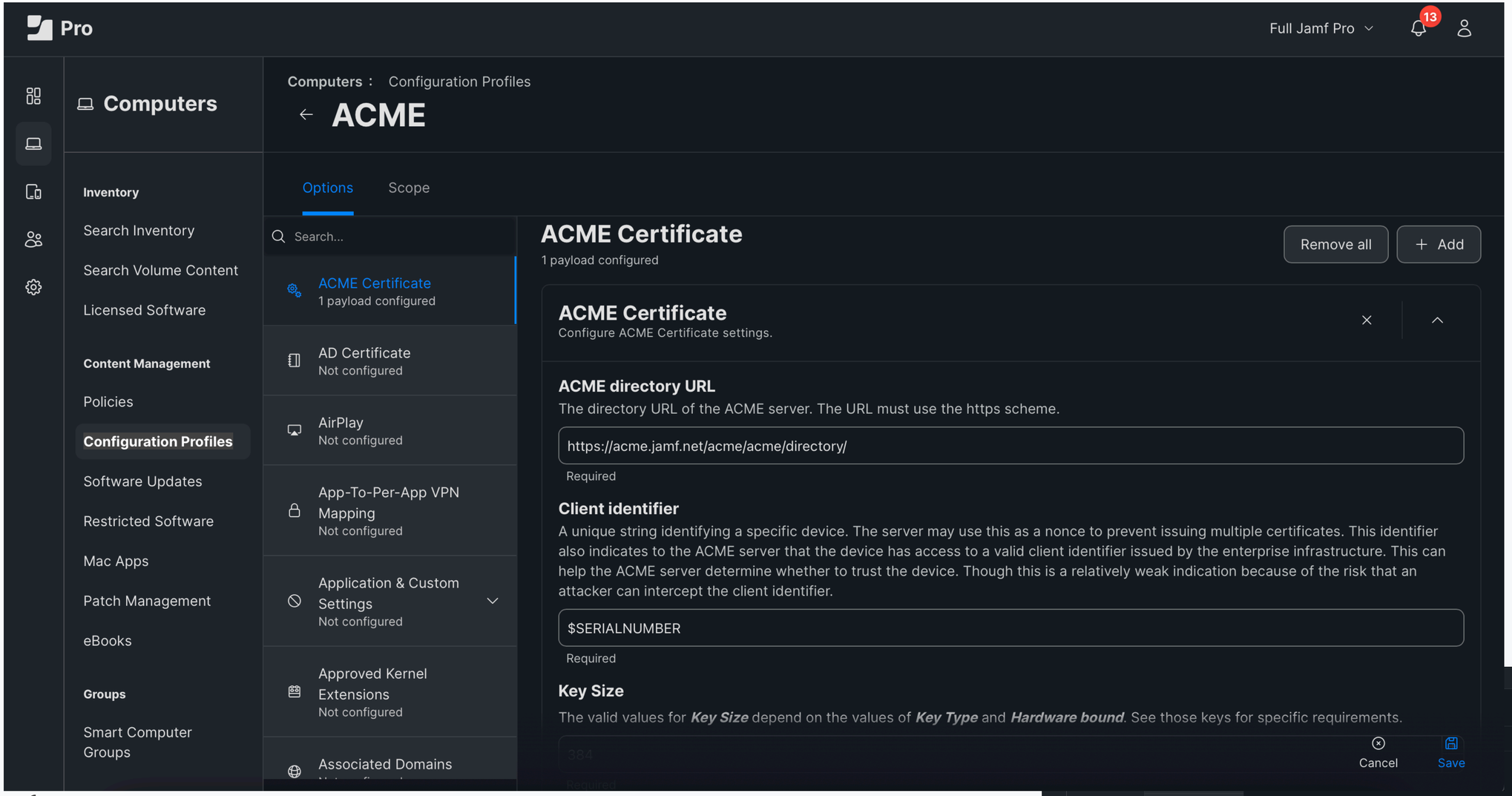
jamf

ACME with Jamf Pro



jamf

ACME with Jamf Pro



jamf

ACME with Jamf Pro

ACME Certificate

Configure ACME Certificate settings.

ACME directory URL

The directory URL of the ACME server. The URL must use the https scheme.

https://acme.jamf.net/acme/acme/directory/

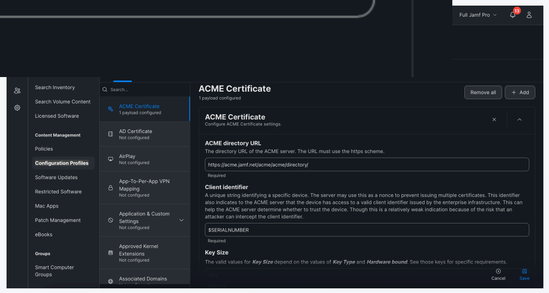
Required

Client identifier

A unique string identifying a specific device. The server may use this as a nonce to prevent issuing multiple certificates. This identifier also indicates to the ACME server that the device has access to a valid client identifier issued by the enterprise infrastructure. This can help the ACME server determine whether to trust the device. Though this is a relatively weak indication because of the risk that an attacker can intercept the client identifier.

$SERIALNUMBER

Required



jamf

ACME with Jamf Pro

Key Type

The type of key pair to generate.

- `RSA`: Specifies an RSA key pair. RSA key pairs must have a ***Key Size*** in the range `[1024..4096]` inclusive and a multiple of 8, and ***Hardware Bound*** must be `false`.
- `ECSECPrimeRandom`: Specifies a key pair on the P-192, P-256, P-384 or P-521 curves as defined in FIPS Pub 186-4. ***Key Size*** defines the particular curve, which must be `192`, `256`, `384` or `521`. ***Hardware bound*** keys only support values of `256` and `384`.

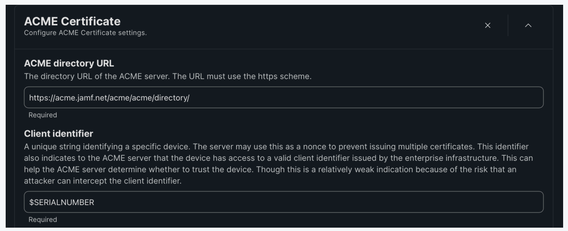
Note that the key size is `521`, not `512`, even though the other key sizes are multiples of 64.

ECSECPrimeRandom

Hardware Bound

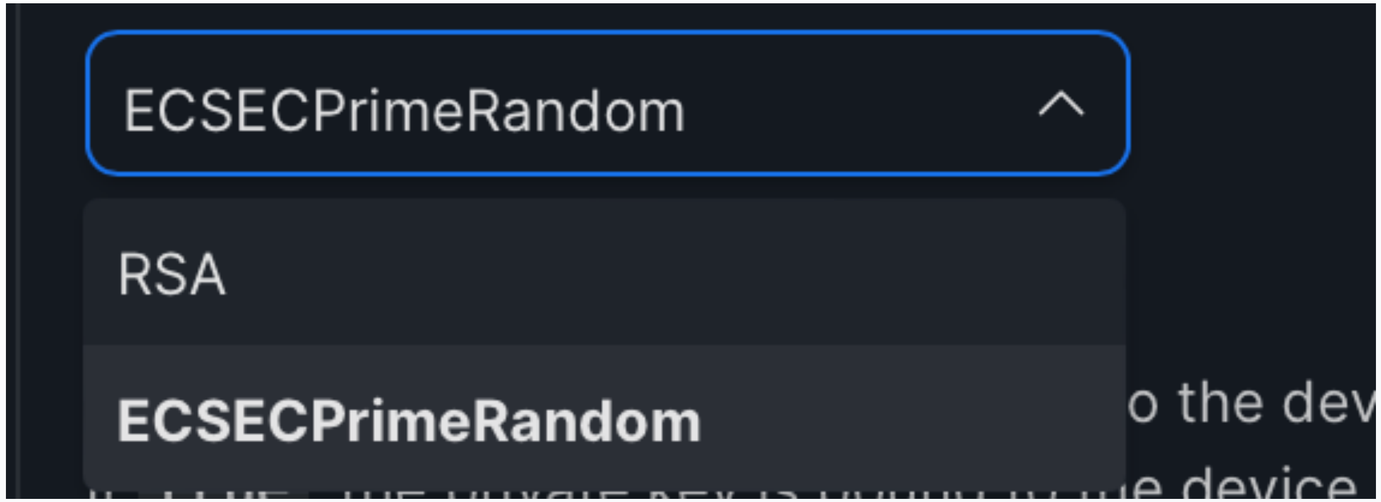
If `false`, the private key isn't bound to the device.
If `true`, the private key is bound to the device.
The Secure Enclave generates the key pair, and the private key is cryptographically entangled with a system key. This prevents the system from exporting the private key. If `true`, ***Key Type*** must be `ECSECPrimeRandom` and ***Key Size*** must be `256` or `384`. Setting this key to `true` is supported as of macOS 14 on Apple silicon and Intel devices that have a T2 chip. Older macOS versions or other Mac devices require this key but it must have a value of `false`.

True | False



jamf

Jamf ACME with Jamf Pro



Key Type

The type of key pair to generate.

- `RSA`: Specifies an RSA key pair. RSA key pairs must have a ***Key Size*** in the range `[1024..4096]` inclusive and a multiple of 8, and ***Hardware Bound*** must be `false`.
- `ECSECPrimeRandom`: Specifies a key pair on the P-192, P-256, P-384 or P-521 curves as defined in FIPS Pub 186-4. ***Key Size*** defines the particular curve, which must be `192`, `256`, `384` or `521`. ***Hardware bound*** keys only support values of `256` and `384`.

Note that the key size is `521`, not `512`, even though the other key sizes are multiples of 64.

ECSECPrimeRandom

Hardware Bound

If `false`, the private key isn't bound to the device.
If `true`, the private key is bound to the device.
The Secure Enclave generates the key pair, and the private key is cryptographically entangled with a system key. This prevents the system from exporting the private key. If `true`, ***Key Type*** must be `ECSECPrimeRandom` and ***Key Size*** must be `256` or `384`. Setting this key to `true` is supported as of macOS 14 on Apple silicon and Intel devices that have a T2 chip. Older macOS versions or other Mac devices require this key but it must have a value of `false`.

True | False

jamf

Jamf ACME with Jamf Pro

Attest

If `true`, the device provides attestations describing the device and the generated key to the ACME server. The server can use the attestations as strong evidence that the key is bound to the device, and that the device has properties listed in the attestation. The server can use that as part of a trust score to decide whether to issue the requested certificate.
When ***Attest*** is `true`, ***Hardware Bound*** must also be `true`.
Setting this key to `true` is supported as of macOS 14 on Apple silicon and Intel devices that have a T2 chip. Older macOS versions or other Mac devices require this key but it must have a value of `false`.

True | False

Allow All Apps Access

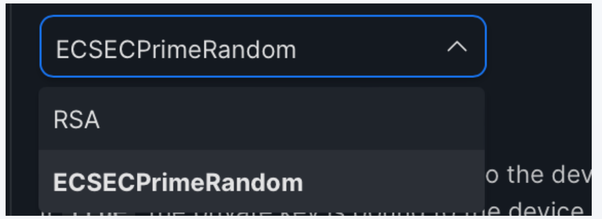
If `true`, all apps have access to the private key.

True | False

Key Is Extractable

If `true`, the private key of the identity needs to be tagged as “non-extractable” in the keychain.

True | False



jamf

Recap

- Understanding certificates
- Usage of certificates
- SCEP
- ACME

jamf

Resources

Slides:

jamf


That's all Folks!