Entity Attestation Token

draft-mandyam-rats-eat-00
(draft-mandyam-eat-01)

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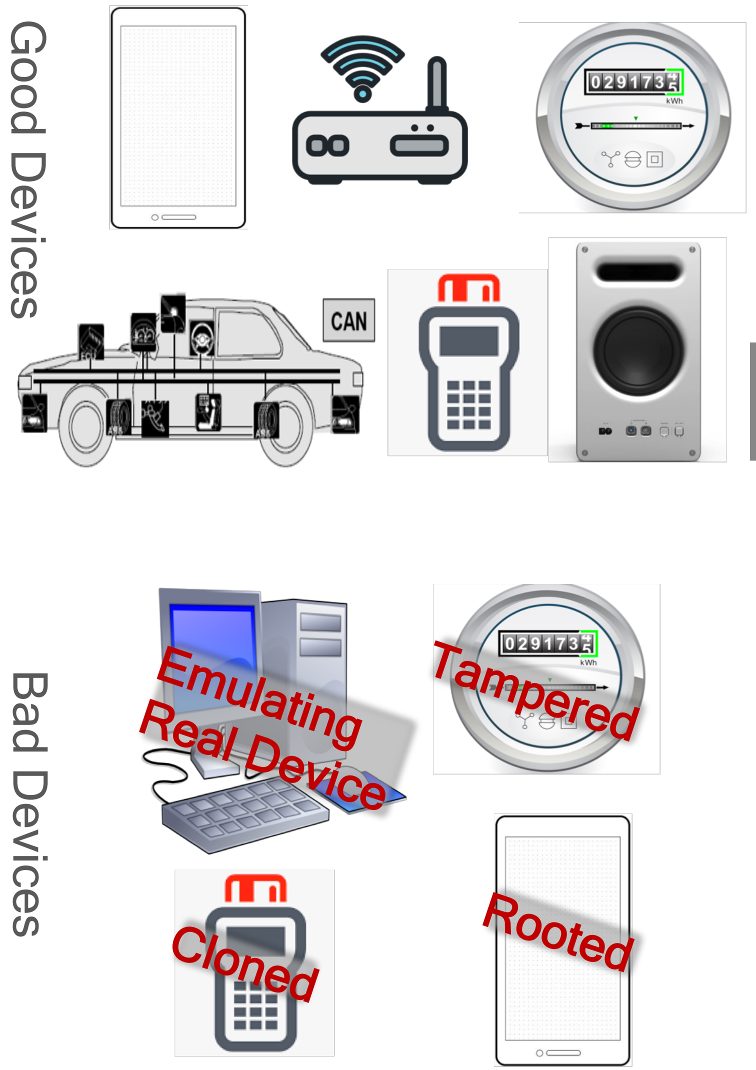
March 2019

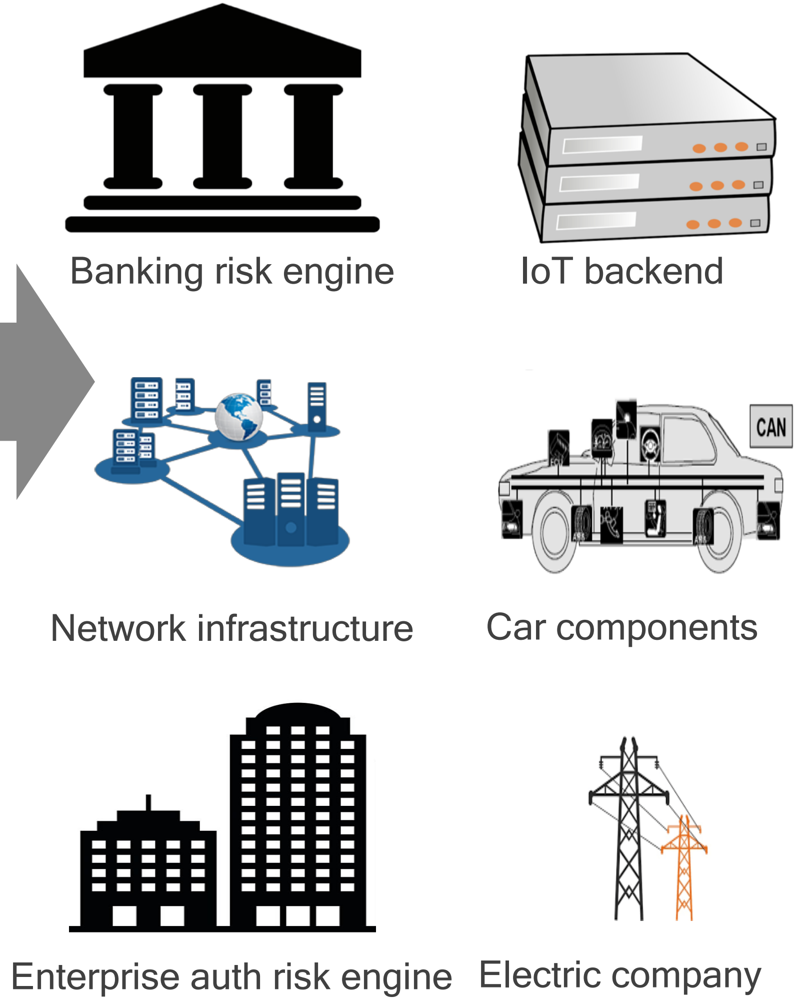


Entity Attestation Token

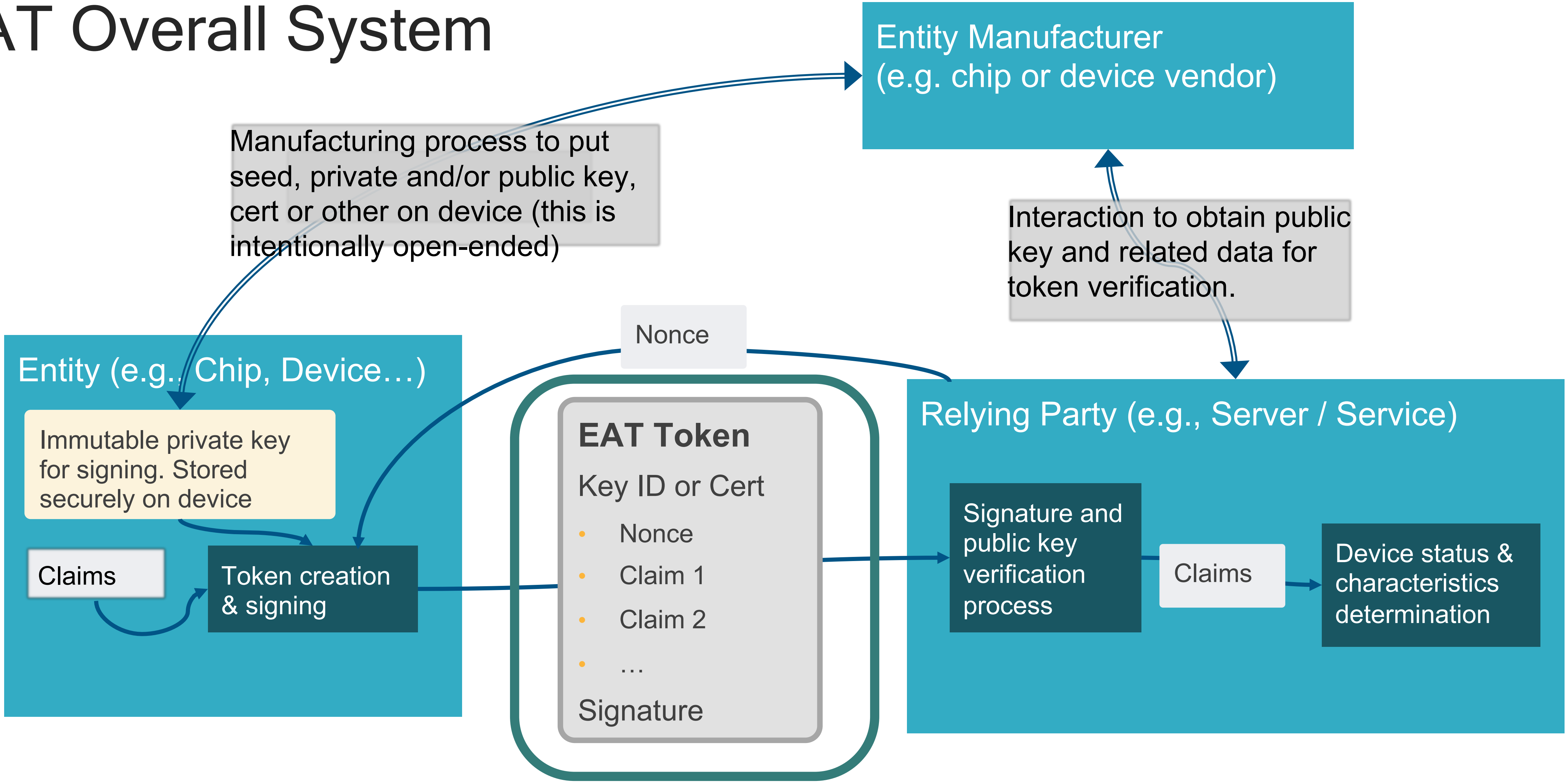
- Chip & device manufacturer
- Device ID (e.g. serial number)
- Boot state, debug state…
- Firmware, OS & app names and versions
- Geographic location
- Measurement, rooting & malware detection…

All Are Optional

Cryptographically secured by signing



EAT Overall System



EAT Target for standardization

EAT Format (basically CWT)

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Overall structure: COSE_Sign1

protected headers

Algorithm -- Examples: ECDSA 256, RSA 2048, ECDAA

Signing Scheme -- Examples: IEEE IDevID, EPID, X.509 Hierarchy

unprotected headers

Key ID -- identifies the key needed to verify signature

Certs (optional) -- to chain up to a root for some signing schemes

Signed payload

- CBOR formatted map of claims that describe device and its disposition
- Few and simple or many, complex, nested…
- All claims are optional -- no minimal set
- The format and meaning of a basic set of claims should be standardized for interoperability
- Should be adaptable to cover many different use cases from tiny IoT devices to complex mobile phones
- Privacy issues must be taken into account

sig

signature -- Examples: 64 byte ECDSA signature, 256 byte RSA signature

- COSE format for signing
- Small message size for IoT
- Allows for varying signing algorithms, carries headers, sets overall format

- CBOR format for claims
- Small message size for IoT
- Labelling of claims
- Very flexible data types for all kinds of different claims.
- Translates to JSON

- Signature proves device and claims (critical)
- Accommodate different end-end signing schemes because of device manufacturing issues
- Privacy requirements also drive variance in signing schemes

COSE Signing Scheme Flexibility

EAT does not define any signing schemes, key types or such so the claims it defines can be used with lots of signing schemes

Claims and signing schemes are orthogonal

- Many standard algorithms already supported
  - RSA, ECDSA and Edwards-Curve Signing (public key)
  - HMAC and AES-based MACs (symmetric key)
- Extensible for future algorithms
  - IANA registry for algorithms exists today
- Extensible for special case schemes
  - Proprietary simple HMACs schemes, perhaps HW based
  - Possibly Intel EPID
  - (non-standard algorithms will of course be less interoperable)

Example Token

COSE binary ~130 bytes including sig

COSE ECDSA signing overhead is about 87 bytes: 23 for headers and structure, 64 bytes for ECDSA sig

JSON text ~500 bytes including a JOSE sig

CBOR diagnostic representation of binary data of full signed token

```
[
  / protected / << {
    / alg / 1: -7 / ECDSA 256 /
  } >>,
  / unprotected / {
    / kid / 4: h'4173796d6d657472696345434453413536'
  },
  / payload / << {
    / UEID / 8: h'5427c1ff28d23fbad1f29c4c7c6a55',
    / secure boot enabled / 13: true
    / debug disabled / 15: true
    / integrity / -81000: {
       / status / -81001: true
       / timestamp / 21: 1444064944,
    },
    / location / 18: {
       / lat  / 19: 32.9024843386,
       / long / 20: -117.192956976
    },
 } >>,
  / signature / h'5427c1ff28d23fbad1f29c4c7c6a555e601d6fa29f9179bc3d7438bacaca5acd08c8
                  d4d4f96131680c429a01f85951ecee743a52b9b63632c57209120e1c9e30'
]
```

Payload Translated to JSON

- Integer labels mapped to strings
- Binary data base 64 encoded
- Floating point numbers turned into strings


```
{
   "UEID" : "k8if9d98Mk979077L38Uw34kKFRHJgd18f==",
   "secureBoot" : true,
   "debugDisable" : true,

   "integrity": {
       "status": true,
       "timestamp": "2015-10-5T05:09:04Z",
   },
   "location": {
       "lat": "32.9024843386",
       "long": "-117.192956976",
   },
}
```

Privacy

- Entity Attestation Tokens are intended for many use cases with varying privacy requirements
  - Some will be simple with only 2 or 3 claims, others may have 100 claims
  - Simple, single-use IoT devices, have fewer privacy issues and may be able to include claims that complex devices like Android phones cannot

- Options for handling privacy
  - Omit privacy-violating claims
  - Redesign claims especially to work with privacy regulation
  - Obtain user permission to include claims that would otherwise be privacy-violating

- Some signing schemes will be privacy-preserving (e.g. group key, ECDAA) and some will not (e.g., per-device ECDSA signing key).

EAT Defines an Initial Set of Claims

Claim	Description	Category
UEID	Identify a particular individual device, similar to a serial number	Basic
OEM ID	Identify the manufacturer of the device	Basic
Boot and debug state	Is secure/trusted/authenticated boot turned on? Is debug disabled?	Basic
Geographic location	GPS coordinates, speed, altitude	Basic
Security level	Rich OS, TEE, secure element…	Basic
Nonce	Token freshness	Basic
Origination	Identifies authority that can verify the token	Basic
Time stamp	Time and / or age of the token	Basic
Submodules	How to deal with claims from different subcomponents of a module. For example, the TEE and Rich OS are separate submodules.	Submods
Nested tokens	Putting one EAT inside another as a way of handling subcomponents	Submods

Intended only as initial set. Expansion should include SW components, measurement, public keys (similar to Android attestation) and other.