RATS Agenda – Thursday, July 29th – Session I

Room 8, RATS Session 2
Time zone: PDT (UTC-7)

12:00 : 12:05 **Agenda bash & logistics**
(5 min) Nancy Cam-Winget, Kathleen Moriarty, Ned Smith

12:05 : 12:10 **Open Mic**
(5 min)

12:10 : 12:35 **Attestation Results, Trusted Path Routing**
(25 min) Eric Voit
draft-voit-rats-attestation-results, draft-voit-rats-trustworthy-path-routing

12:35 : 12:40 **Attestation Event Stream Subscription**
(5 min) Henk Birkholz, Eric Voit
draft-birkholz-rats-network-device-subscription

12:40 – 13:00 **Trusted Identities**
(20 min) Meiling Chen

13:00 – 13:30 **Break**
(30 min)

IETF

Attestation Results and Trusted Path Routing

- Eric Voit

Attestation Results for Secure Interactions

draft-voit-rats-attestation-results-01

IETF 111, July 29th 2021, RATS WG

Eric Voit
Cisco
evoit@cisco.com

Henk Birkholz
Fraunhofer SIT
henk.birkholz@sit.fraunhofer.de

Thomas Hardjono
MIT
hardjono@mit.edu

Thomas Fossati
Arm Limited
Thomas.Fossati@arm.com

Vincent Scarlata
Intel
vincent.r.scarlata@intel.com

Summary

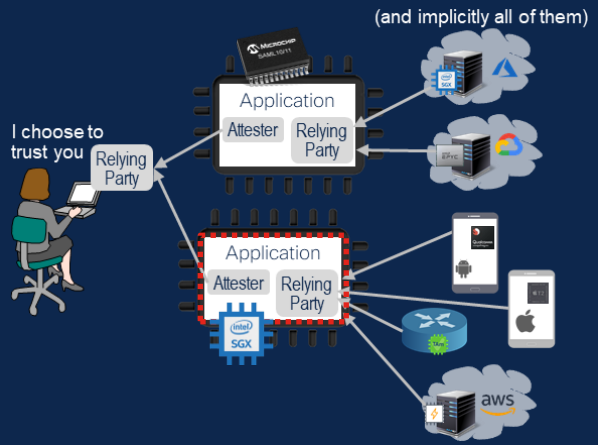
- Contents
  - Object definitions for Attestation Results (AR) to support Secure Interactions between Attester and Relying Party
  - How the Attester can augment AR to improve scale and speed of appraisal
  - State Machine for the Appraisal Policy for Attestation Results
- Two implementations
  - Trusted Path Routing (Proprietary – Cisco)
  - Veraison (Open Source – Confidential Compute Consortium)
- Ask: WG Adoption

Remote Attestation in a Heterogenous World

- Many types of Attesting Environments (AE)
- What may be trusted by Relying Party

Identity	Hardware type, software build, developer ....
Verifier Appraisals	Sw integrity, config ok, attester recognized, ...
Freshness	Nonce, trusted timestamp, ...

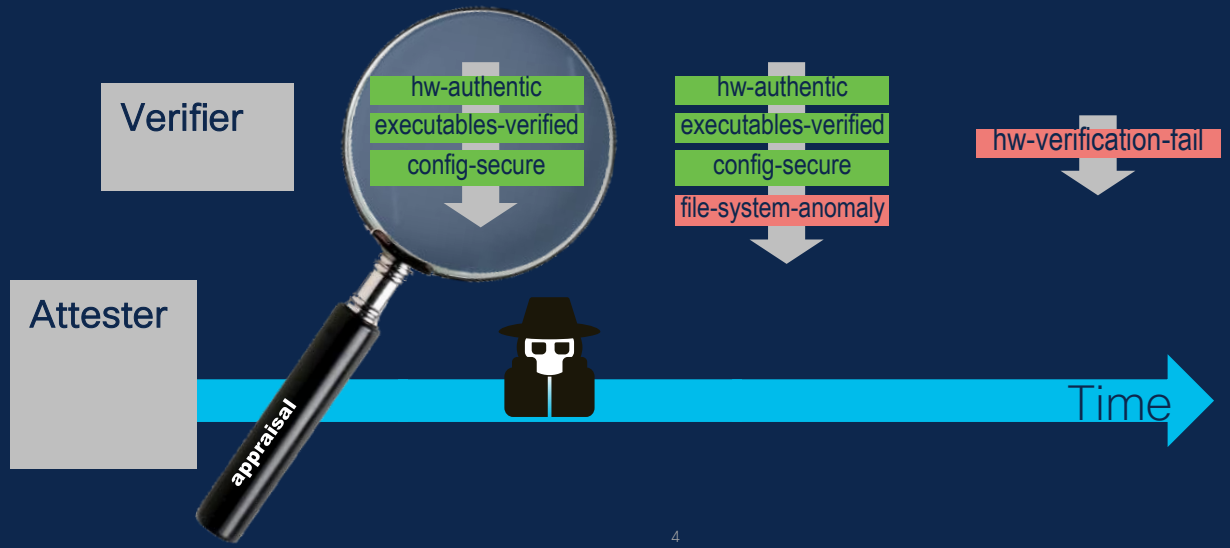
Support varies by AE chip type > Attester > Verifier



- Relying Party cannot support ∞ language permutations
  - And a mix and match across L1 ↔ L7 platforms is coming if IETF RATS succeeds
- Need: Shared definitions/structures for Verifier Appraisals coming to Relying Party
  - Will help scale and Interop
  - Reduce transcoding/mapping between sequentially bound sets of Attesters
  - Could be encoded in EAT, YANG, CDDL, etc...

Verifier Appraisal

- Periodic appraisal and generation of Attestation Results
- One to Many Trustworthiness Claims assigned during an appraisal cycle
- Attestation Results signed and returned to Attester (for scale/speed)



Normalizing Trustworthiness Claims

Specific claim definitions, extensible

affirming

detracting

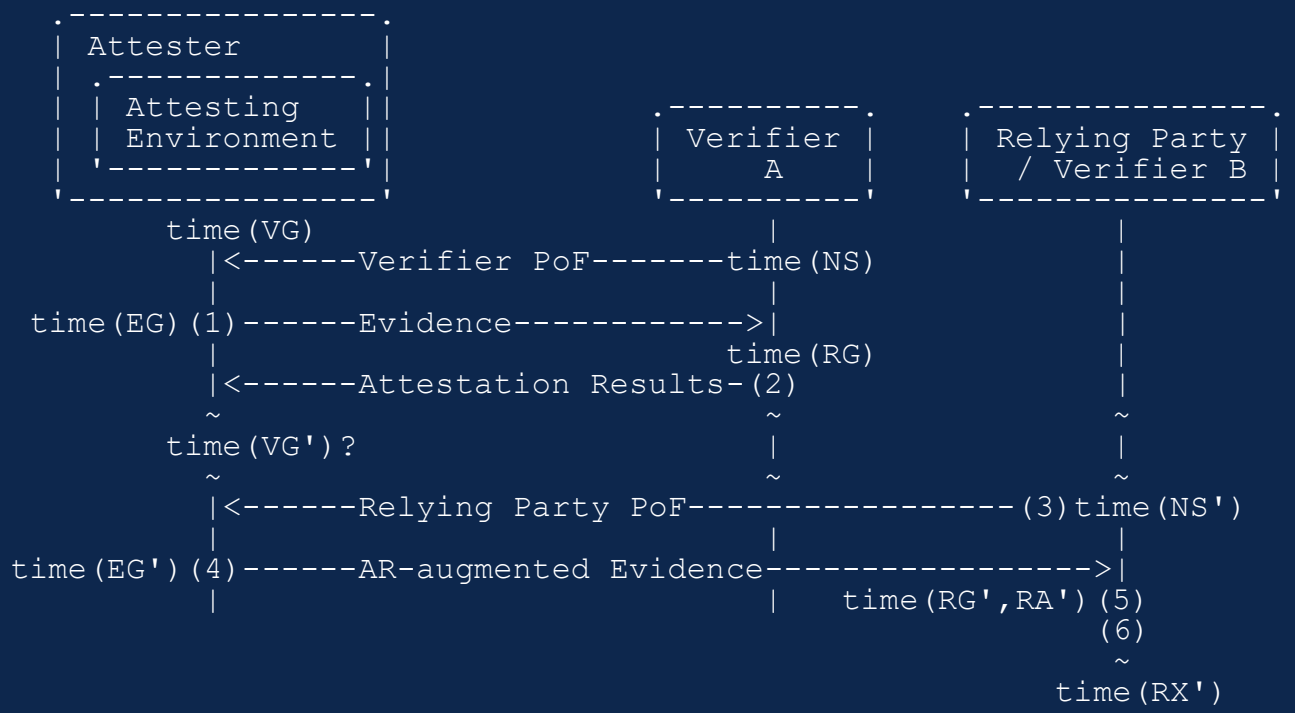
Trustworthiness Claim	Attesting Environments		
	Confidential Compute		HSM-based (TPM)
	Process-based (SGX, TrustZone)	VM-based (SEV, TDX, ACCA)	
ae-instance-recognized	Optional	Optional	Optional
ae-instance-unknown	Optional	Optional	Optional
hw-authentic	Implicit	Chip dependent	If PCR check ok
hw-verification-fail	Implicit if not ok	Chip dependent	If PCR don't check ok
executables-verified	Optional	Optional	If PCR check ok
executables-refuted	Optional	Optional	If PCR don't check ok
file-system-anomaly	n/a	Optional	Insufficient
source-data-integrity	Optional	Optional	Optional
config-secure	Optional	Optional	Optional
config-insecure	Optional	Optional	Optional
target-isolation	Implicit	Implicit	Optional
runtime-confidential	Implicit	Implicit	Insufficient
secure-storage	Implicit	Chip dependent	Very minimal space

Normalized Trustworthiness Claims ≠ the same Relying Party policy disposition

- Even with Normalized Trustworthiness Claims, Attesters need not be treated equivalently by the Relying Party
  - Variance in underlying protections of SGX, TrustZone, SEV, TPM, etc. could mean different disposition via the Appraisal Policy for Attestation Results.
  - Each Verifier, or Verifier version, or Verifier appraisal of a specific type of Attester may be trusted differently for different claims

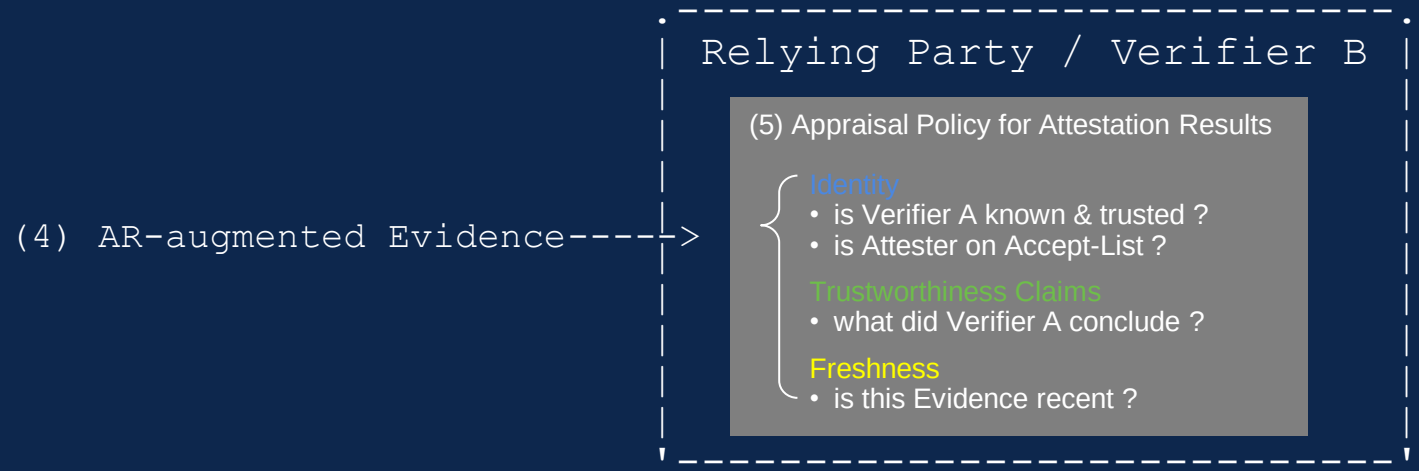
Trustworthiness Claim Delivery

Based on draft-ietf-rats-architecture: Passport Model

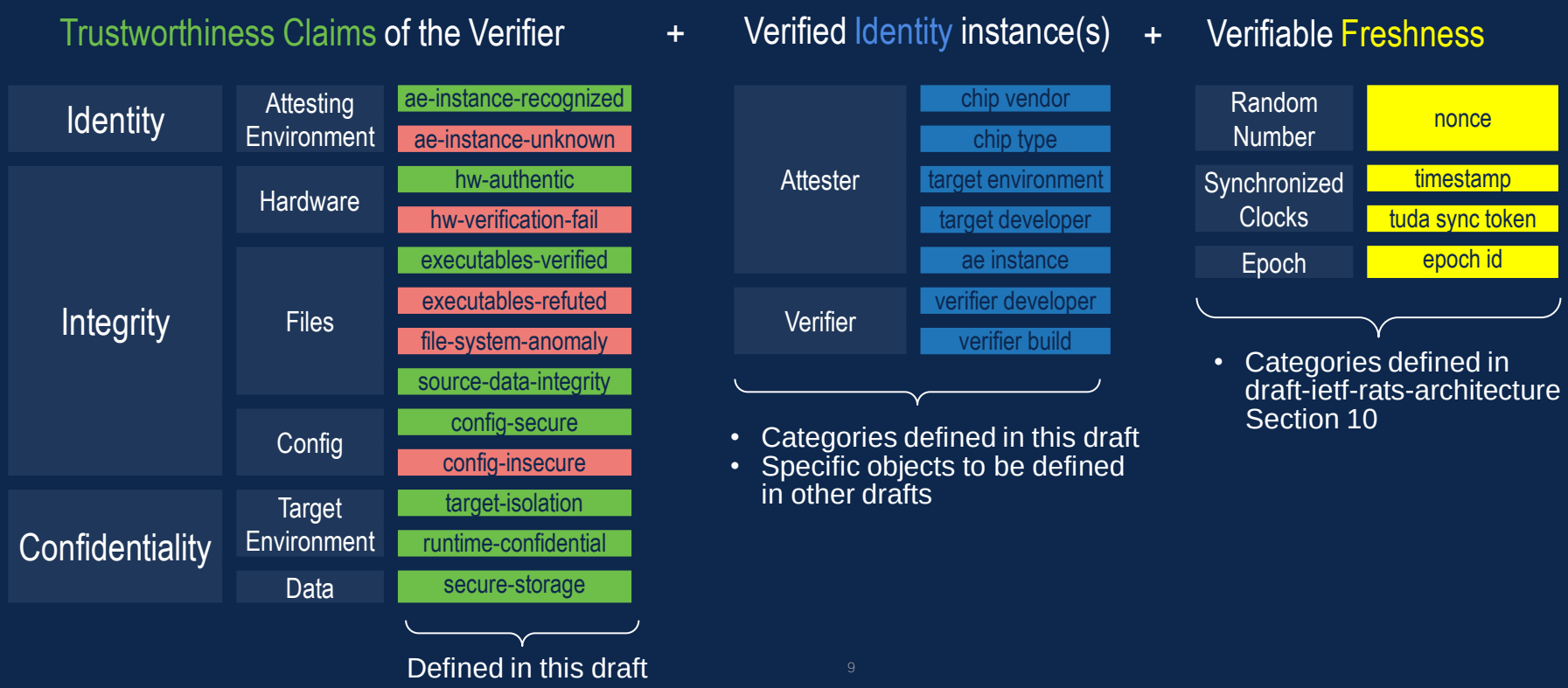


Attestation Results Augmented Evidence

- Input to Relying Party's Appraisal Policy for Attestation Results
- How to review the AR-augmented evidence to ensure no tampering



Attestation Results Augmented Evidence
objects needing specification



Current topics being worked by authors

- Categorizing ‘Trustworthiness Claims’ into ‘Endorsements’ and ‘Capabilities’ ?
- Datatype of ‘Trustworthiness Claims’ : move from identities to enumerations ?
- Follow-up drafts. E.g., Encoding in EAP for TLS transport

Summary

- Contents
  - Object definitions for Attestation Results (AR) to support Secure Interactions between Attester and Relying Party
  - How the Attester can augment AR to improve scale and speed of appraisal
  - State Machine for the Appraisal Policy for Attestation Results
- Two implementations
  - Trusted Path Routing (Proprietary – Cisco)
  - Veraison (Open Source – Confidential Compute Consortium)
- Ask: WG Adoption

Trusted Path Routing

draft-voit-rats-trustworthy-path-routing-03

IETF 111, July 29th 2021, RATS WG

Eric Voit
Cisco
evoit@cisco.com

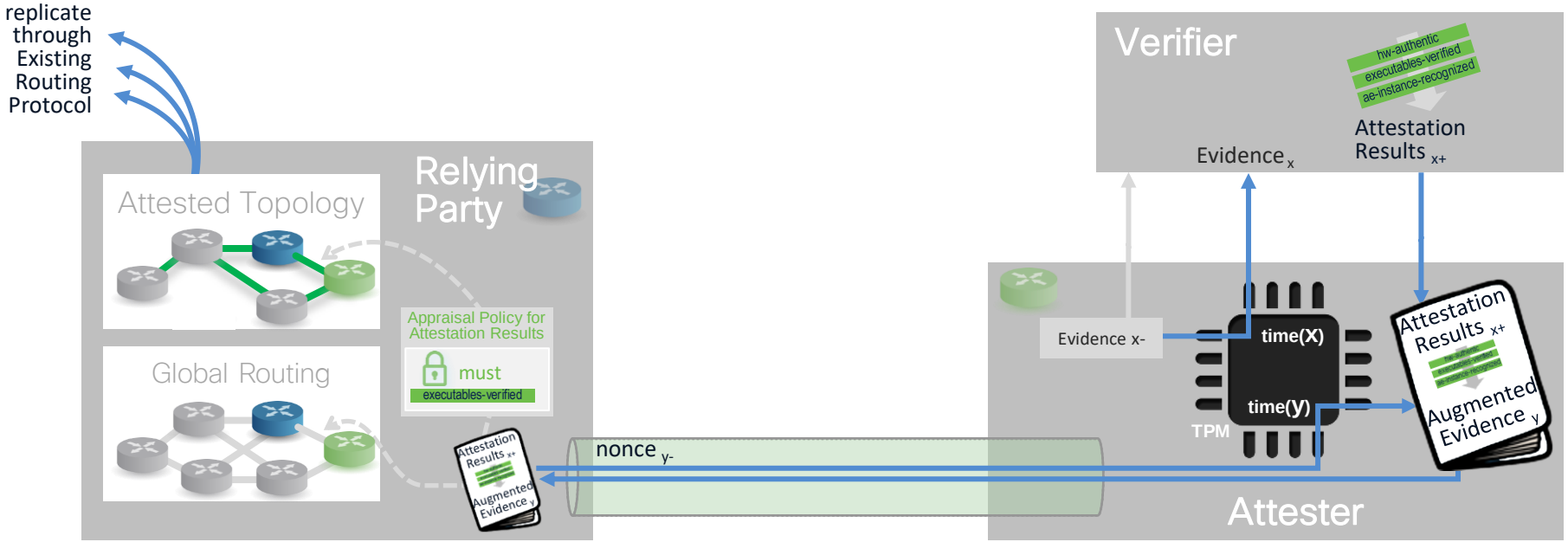
Chennakesava Reddy Gaddam
Cisco
chgaddam@cisco.com

Guy Fedorkow
Juniper
gfedorkow@juniper.net

Henk Birkholz
Fraunhofer SIT
henk.birkholz@sit.fraunhofer.de

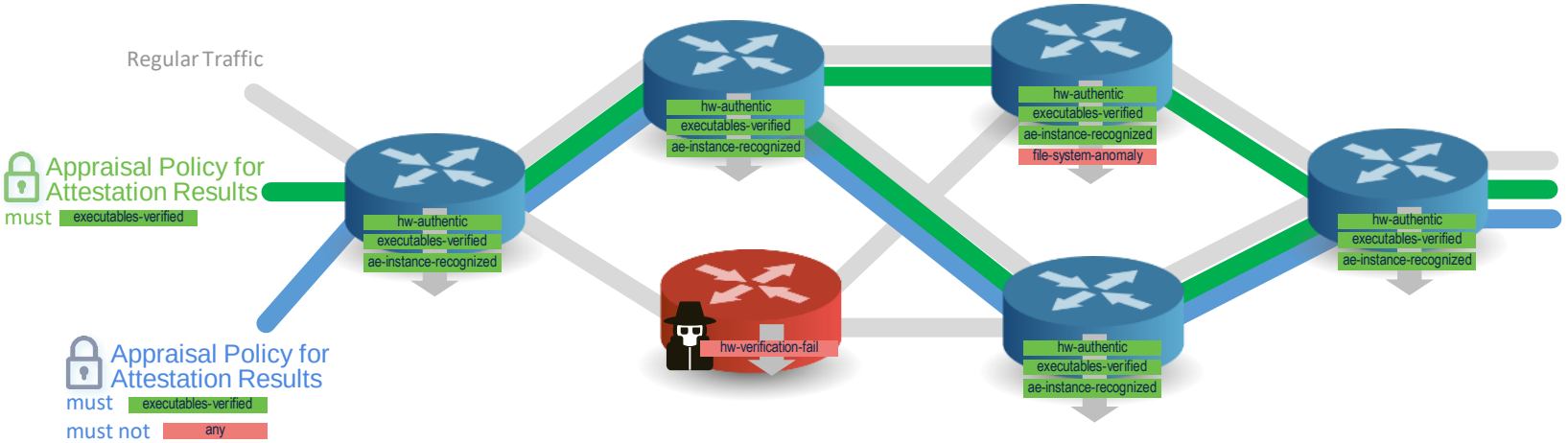
Trusted Path Routing

- Link adjacencies added to Trusted Topology based on latest Relying Party's appraisal of AR Augmented Evidence



Trusted Path Routing – Demo

- Custom topologies dynamically maintained based on Attestation Results



Changed since last draft version

- Extracted the elements to draft-voit-rats-attestation-results:
  - Trustworthiness Claims, Relying Party State Machine, Call Flow.
- Alignment of WGLC comments received on Charra YANG model
- Authorship updated

Next Steps

- Continued alignment with draft-voit-rats-attestation-results (e.g., Trustworthiness Claims structures)
- Definition of EAP payload (separate draft)
- No assertion to adopt until WG makes progress/ adopts draft-voit-rats-attestation-results

Attestation Event Stream Subscription

- Henk Birkholz
- Eric Voit

IETF

Trusted Identities

- Meiling Chen

Use TEE Identification in EAP-TLS

draft-chen-rats-tee-identification-01

IETF111-2021-RATS

Meiling Chen /China Mobile

Objective

- Uses TEE and EAP-TLS to create a secure and trusted procedure to authenticate a device’s identity.

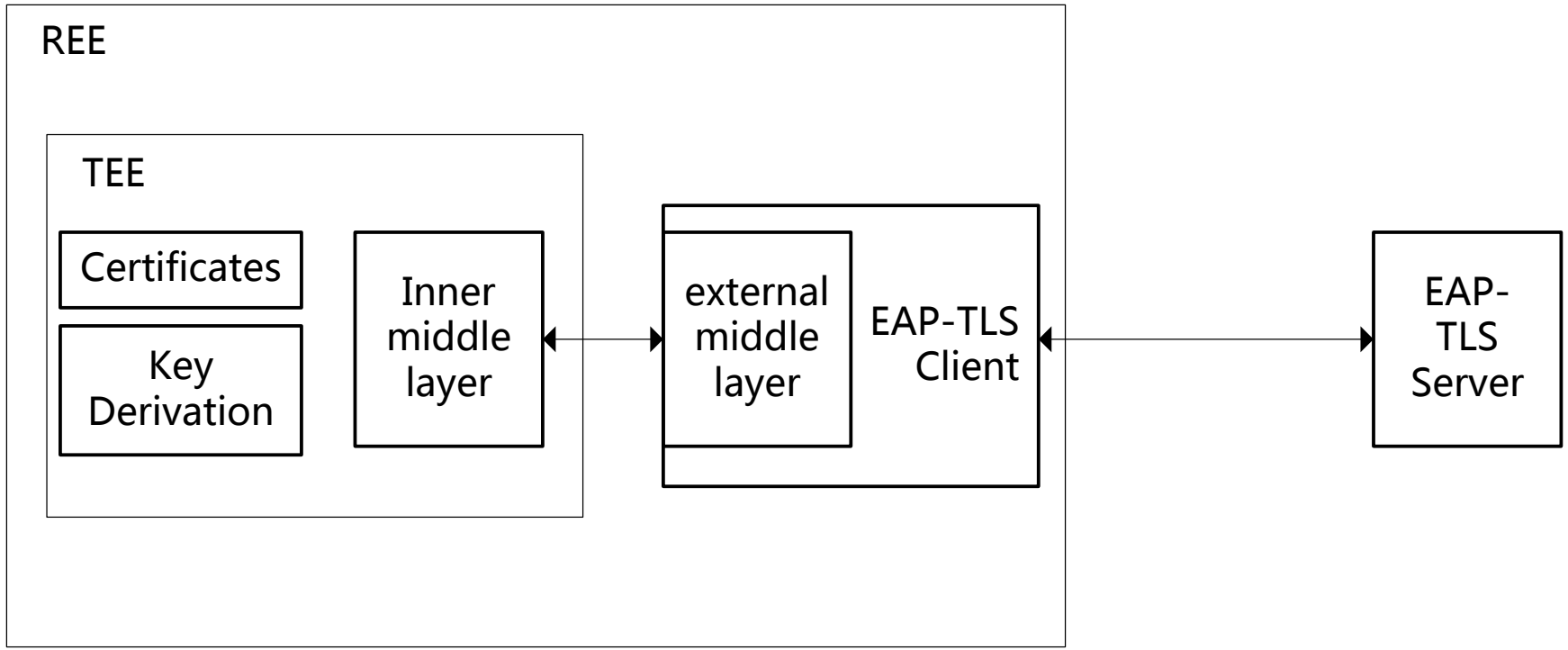
- Can be used in transport layer as identity authentication

- Can be used in link layer to determine if the access of network is permitted

Justifications

- RATs needs a mechanism to authenticate identity
- TLS protocol is secure, but the device that processes this protocol cannot be fully trusted

Architecture of TEE Identification use EAP-TLS



IML: Key derivation

Response to EML about EAP-TLS encryption and decryption relevant message.

EML: Communicate with EAP-TLS Server

Request encryption and decryption relevant messages from IML.

Middle Layer Message

```
                    enum{
        Random;
        keyshareExtension;
        PreSharedKeyExchange
        CertificateList
        CertificateVerify
        Finished
        NewSessionTicket
        ApplicationData
        Alert
    }ParameterType

                Struct{
  bool request//true:request; false response. If it's request message, then th
     ParameterType type
     uint24 length
     select(type){
       case Random randomValue
       case KeyshareExtension keyshareextensionValue
       case PreSharedKeyExchange value;
       case CertificateList
       case CertificateVerify
       case Finished
       case NewSessionTicket
       case ApplicationData
       case Alert
}
}MiddleLayerMessage
```

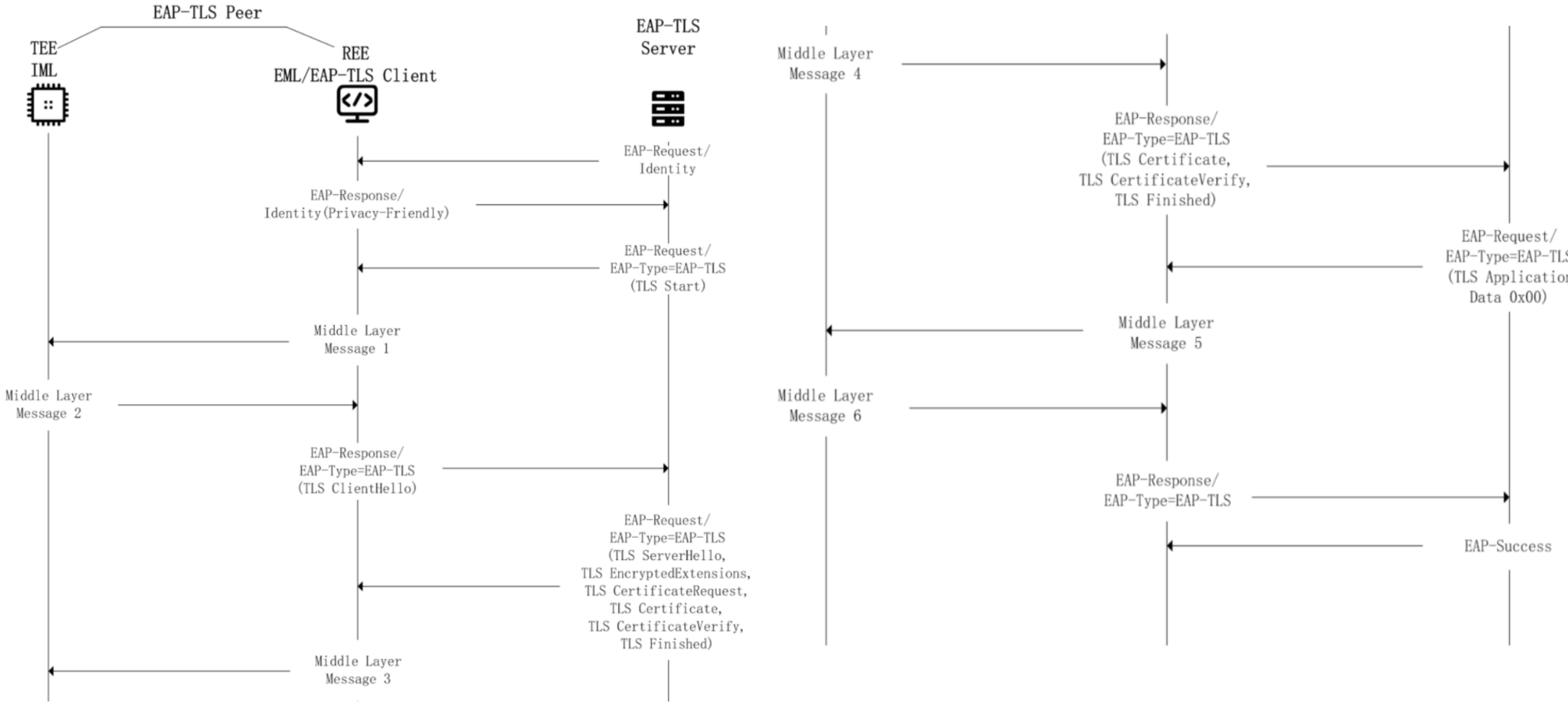
Information pre-stored in TEE

Certificate that complies with X509.3 or other. If using EAP-TLS as the authentication protocol, then the ID of the TEE enabled device is the certificate complies X509.3.

Key derivation process in TEE

Key derivation process must be executed in TEE.

Procedure detail



- Message 1: KeyShareExtension request from EML to IML.
- Message 2: responses to message1 and returns the KeyShareExtension response to EML.
- Message 3: includes plaintext ServerHello message and encrypted Server Params and Auth, also includes the entire handshake context which will be used to create CertificateVerify and Finished context.

- Message 4: encrypted TLS Client Certificate, TLS CertificateVerify and TLS Finished Message will be included.
- Message 5: encrypted application data 0x00 will be sent to IML to decode.
- Message 6: plaintext will be sent to EML. Then EML will make the determination if the authentication procedure is finished.

Other branches of EAP-TLS procedure

- Ticket Establishment message 5
- Resumption message 1 for request, message 2 for response
- Termination message 4/6
- HelloRetry Request plaintext from Server to Client

Message1-6 also contains the branches of TLS procedure

Security Consideration

1. Exhausitive attack from REE

   prioritized problem need to be solved, one possible solution :

   use a counter or timer to limited the access frequency from REE to TEE

2. Deny of Service

   the integrity of encrypted message could be tampered by malicious REE or other parties.

ToDo

- Prevent or mitigate exhaustive attack from REE.
- How to identify if the device enables TEE function.

Thank You!

RATS Agenda – Thursday, July 29th – Session II

Room 8, RATS Session 3
Time zone: PDT (UTC-7)

13:00 – 13:30 **Break**
(30 min)

13:30 – 13:50 **SUEID and EAT's relation to IDevID**
(20 min) Laurence Lundblade

13:50 : 14:10 **Claims to carry Attestation Results to Relying Parties**
(20 min) Laurence Lundblade

14:10 – 14:20 **TEEP requirements for EAT**
(10 min) Dave Thaler

14:20 – 14:30 **Open Mic**
(10 min)

SUEID and EAT relation to DevID

- Laurence Lundblade

SUEID and IDevID

UEID and SUEID (Semi-permanent UEID) device identifiers

- Both UEID and SUEID have the same format, one of these:
  - 16, 24 or 32-byte binary string[1] created with a crypto-quality random number generator or equivalent
  - 6, 8-byte binary string[1] that is an IEEE EUI – a MAC address is an IEEE EUI
  - 14-byte binary string[1] that is an IMEI – a mobile phone serial number

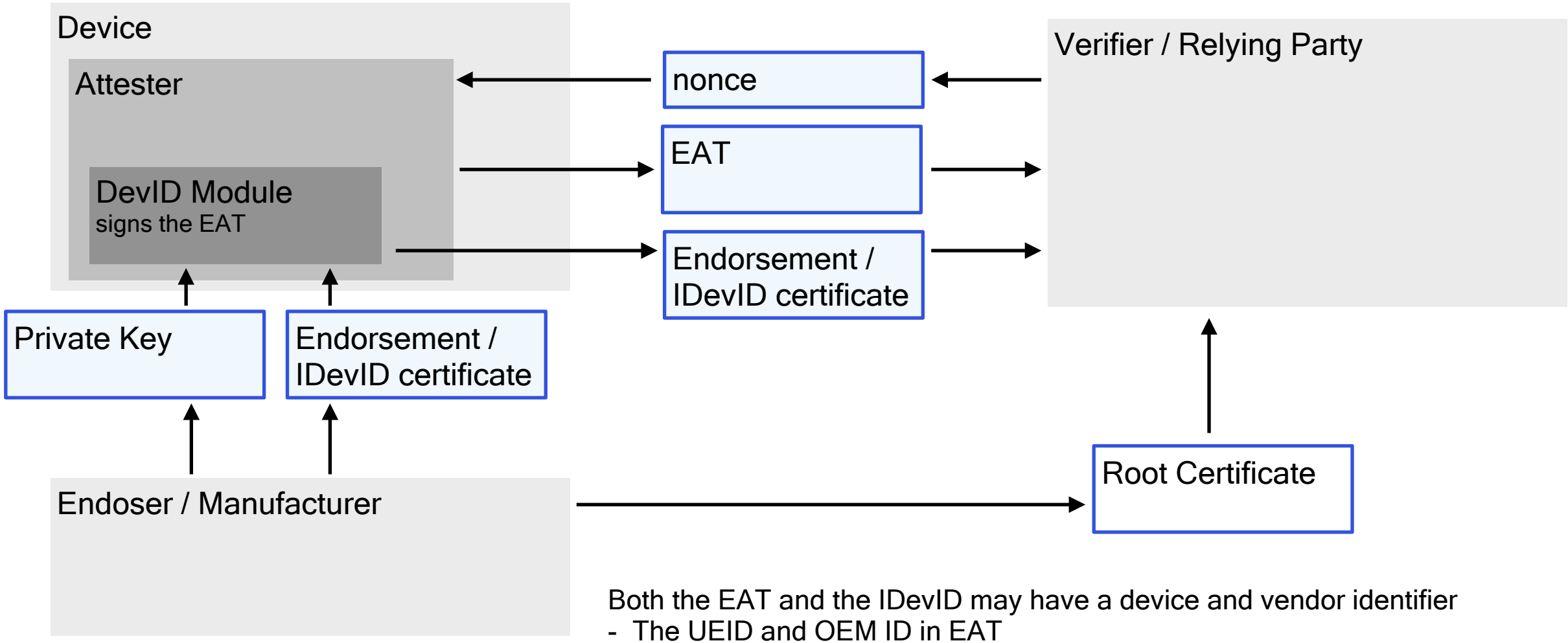
UEID	SUEID
One per device (or none)	One or more per device (or none)
Assigned at manufacture and never changes	Created and destroyed in device life-cycle events like ownership change and factory reset
No label	A simple string label to distinguish one from another
Like an IDevID	Like an LDevID

[1]There is one additional type byte, so the actual lengths are: 17, 25, 33, 7, 9 or 15 bytes

Three ways EAT implementations relate to IDevID implementations

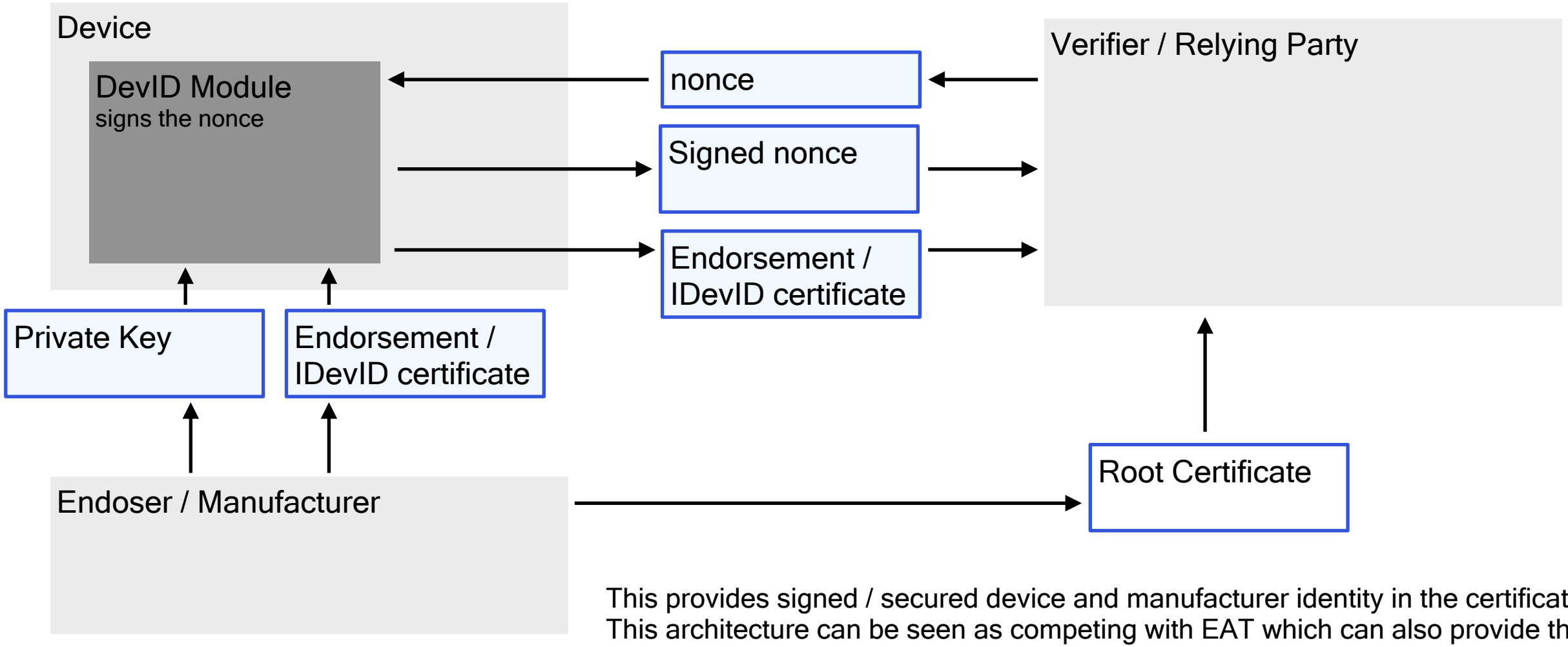
- The EAT protocol is used with an IDevID – Both are implemented and work together
- EAT as a competitor to IDevID to provide identity and manufacturer info – It's one or the other
- EAT claims are added into an IDevID – Parts of EAT are stuffed into an IDevID implementation

The EAT protocol used with an IDevID



Both the EAT and the IDevID may have a device and vendor identifier
- The UEID and OEM ID in EAT
- In the X.509 subject field in the Endorsement/IDevID
- These should probably be made identical or one derived from the other

IDevID used for identity – can be thought of as a competitor to EAT



This provides signed / secured device and manufacturer identity in the certificate
This architecture can be seen as competing with EAT which can also provide this

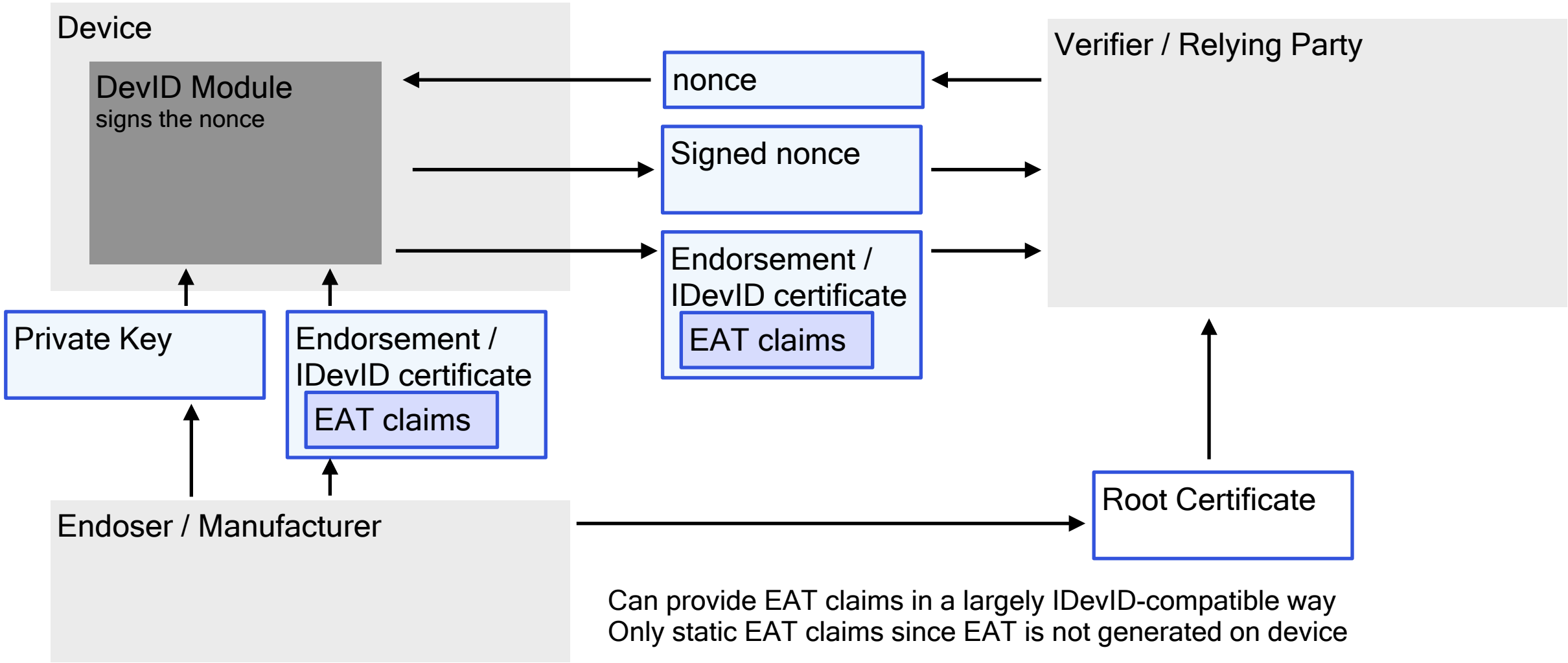
EAT inside a DevID Certificate

- EAT claims can be put into an X.509 v3 extension in a DevID certificate
  - Option 1: define ASN.1 syntax and OID for each EAT claim that is to be included
  - Option 2: one OID that contains a CBOR/UCCS format EAT

Note:

- Only works for static EAT claims because DevIDs are not generated on device
  - For example, can’t work with GPS location, debug status, some SW measurements
- EAT is not functioning as the protocol between device and relying party that proves the identity of the device, some message/protocol is still required

IDevID expanded with EAT claims



Can provide EAT claims in a largely IDevID-compatible way
Only static EAT claims since EAT is not generated on device

Claims to carry Attestation Results to Relying Parties

- Laurence Lundblade

IETF

Attestation Results

Purpose of Attestation

- The end purpose of RATS is to give results to the Relying Party
  - The Relying Party makes the decision to allow the financial transaction, to allow the device on the network, to believe the data received,…
  - RATS exists to serve the Relying Party
    - Relying party may use machine learning and want every scrap of information of even remote value

- EATis a relatively obvious choice to convey Attestation Results to the Relying Party
  - Supports JSON, a common representation for the server side
  - Flexible security options: EAT/CWT or UCCS + TLS or UCCS + other
  - Many claims are appropriate to pass directly through the Verifier to the Relying Party

Claims that are useful to pass-through Verifier to Relying Party

Nonce	Must have a nonce from the relying party
UEID, SUEID	Relying parties like device identification when privacy policy allows
OEM ID	Identifies manufacturer of device
HW Version	Sometimes useful to relying party
Boot and debug status	Useful when higher security is required
Location	Often useful to relying party
Uptime and boot seed	Sometimes useful to relying party
Software manifest	Contain software versions
Software results – The results of a software measurement (in a Github, not yet in an EAT draft)	Some (TEE-based) Attesters can measure AND validate subsystems and thus measurement results can go directly from Attester to Relying Party
Key material, particularly a public key	This may enable further protocols between the device and Relying Party (e.g., FIDO, payments, Android key store…)
Submodules	For example, many submodules (the TEE, the HLOS, the Secure Element) may participate in a payment

Claims Generated by the Verifier for the Relying Party

Token ID	Identifies the particular report to the RP
Time stamp	When the results were generated
Nonce	Freshness between Verifier and Relying Party
Security Level	If the Attester doesn't include the claim, the Verifier may have information to know the security level and report it
Software Results (described only in Github document, not yet in a published EAT draft)	RP will be very interested in the results of the measurement comparison to reference values
Digital Letter of Authorization – List of certifications received by device (described only in Github document, not yet in a published EAT draft)	Lists certifications granted to the device. For example, Common Criteria or Global Platform certifications

A DLOA

Digital Letter of Approval (format is XML)		
Field	Description	Example
`Authority_Label`	Names the authority that issued the certification	EMVCo
`LOA_Identifier`	More or less a serial number for the certification	PCN0156.13
`LOA_Scope`	Scope of the LOA	(unable to find example)
`Platform_Label`	Manufacturer identied by OID plus product identified by text string	`1.2.840.114283/ My_Platform_Label_1a`
`Issuance_Date`	Date issued	19 Jun 2018
`Expiration_Date`	Date of expiration	19 Jun 2022
Digitally signed with XML signature		

- A digital instantiation of the letter of approval typically issued by a certification authority
- Always retrieved by URL from a DLOA registrar

DLOA Claim

- An array of one or more references to a DLOA
- Each DLOA reference contains
  - Fields to construct URL to fetch DLOA
    - Registrar URI
    - Platform Label
    - Application Label if DLOA is for an application, not a platform
- DLOA claim must only be present if certification was granted
- A DLOA's scope is limited to the submodule it is in

```
dloas-claim = (
    dloas => [ + dloa-type ]
)

dloa-type = [
    dloa_registrar: ~uri
    dloa_platform_label: text
    ? dloa_application_label: text
]
```

The `swresult` Claim

A high-level summary report of the verification of a software measurement

Each claim may contain multiple results

An individual result is an array of three or four items	
The name of the measurement system or scheme (required)	Text string describing the measurement product, the measurment standard, scheme or such
objective – what software measured (required)	Enumerated type that is one of: • all • firmware • kernel • privileged • system-libs • partial
verification result (required)	Enumerated type that is one of: • verification-not-run • verification-indeterminite • verification-failed • fully-verified • partially-verified
objective name (optional)	Textual name of the objective. For example, “Android kernel”

TEEP Requirements for EAT

- Dave Thaler

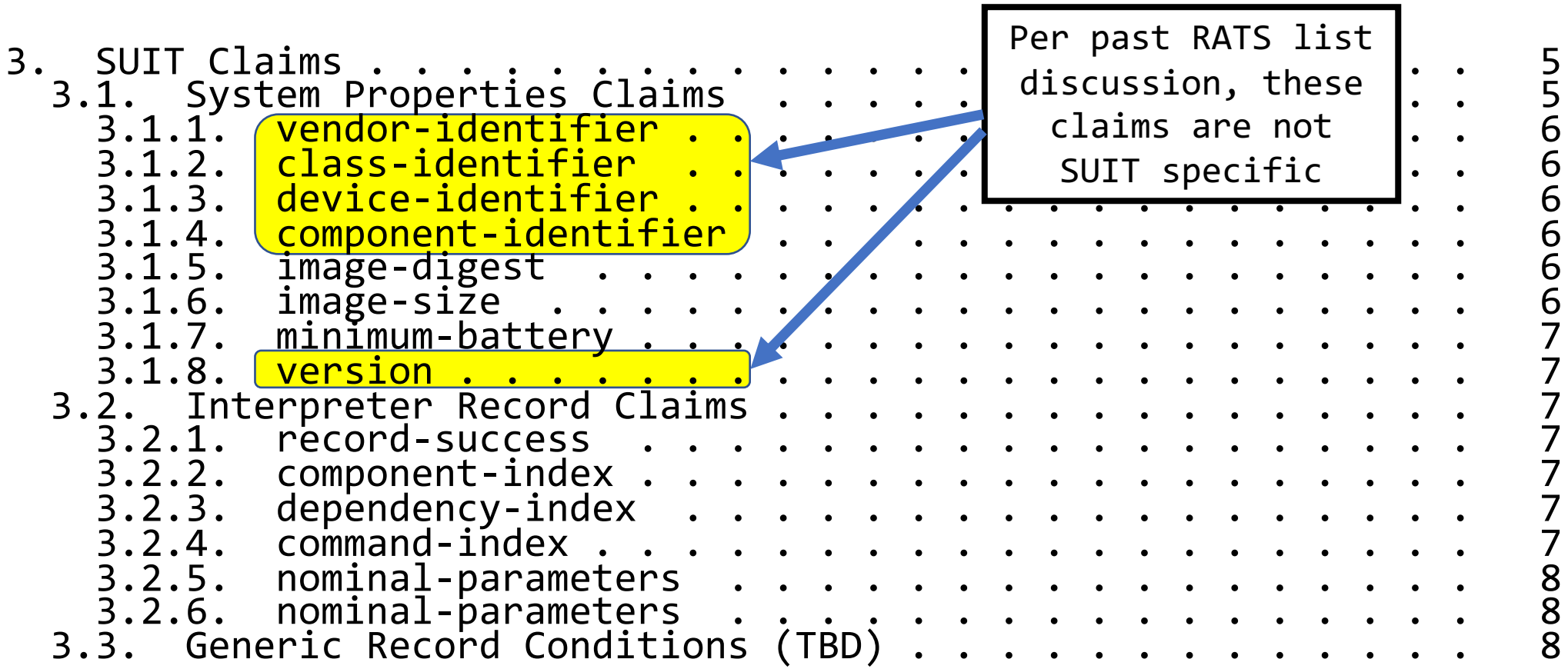
TEEP Requirements for EAT

Dave Thaler <dthaler@microsoft.com>

TEEP WG has requirements for abstract data in Attestation Results (e.g., to do remediation)

Requirement	Claim	Reference
Device unique ID	device-identifier	draft-birkholz-rats-suit-claims, §3.1.3
Vendor of the device	vendor-identifier	draft-birkholz-rats-suit-claims, §3.1.1
Class of the device	class-identifier	draft-birkholz-rats-suit-claims, §3.1.2
TEE hardware type	chip-version-scheme	draft-ietf-rats-eat, §3.7
TEE hardware version	chip-version-scheme	draft-ietf-rats-eat, §3.7
TEE firmware (e.g., TF-A) ID	component-identifier	draft-birkholz-rats-suit-claims, §3.1.4
TEE firmware version	version	draft-birkholz-rats-suit-claims, §3.1.8
TEE software (e.g., OP-TEE) ID	component-identifier	draft-birkholz-rats-suit-claims, §3.1.4
TEE software version	version	draft-birkholz-rats-suit-claims, §3.1.8
Freshness proof (nonce)	nonce	draft-ietf-rats-eat, §3.3
Freshness proof (timestamp)	iat	draft-ietf-rats-eat, §3.2
Freshness proof (epoch ID)	?	?

draft-birkholz-rats-suit-claims



Dispatch: draft-birkholz-rats-suit-claims

Options:

A. RATS WG, even if some claims are SUIT specific
B. SUIT WG, even if some claims are not SUIT specific
C. Split doc: SUIT WG for SUIT claims, RATS WG for general claims

My preference: option C with general claims **added into EAT spec**

- "System Properties Claims" fall under RATS charter item for "claims which provide information about system components characteristics scoped by the specified use-cases"

TEEP implementation requirements

- From draft-ietf-teep-protocol D.3.1 example:

```
/ eat-claim-set = /
{
    / issuer /                    1: "joe",
    / timestamp (iat) /           6: 1(1526542894)
    / nonce /                    10: h'948f8860d13a463e8e',
    / secure-boot /              15: true,
    / debug-status /             16: 3, / disabled-permanently /
    / security-level /           14: 3, / secure-restricted /
    / device-identifier /    <TBD>: h'e99600dd921649798b013e9752dcf0c5',
    / vendor-identifier /    <TBD>: h'2b03879b33434a7ca682b8af84c19fd4',
    / class-identifier /     <TBD>: h'9714a5796bd245a3a4ab4f977cb8487f',
    / chip-version-scheme /  <TBD>: "MyTEE v1.0",
    / component-identifier / <TBD>: h'60822887d35e43d5b603d18bcaa3f08d',
    / version /              <TBD>: "v0.1"
}
```

- Need early assignment to unblock implementations

draft-ietf-rats-eat

chip-version-scheme-claim = (

chip-version-scheme => $version-scheme

)

“The hardware version is a simple text string the format of which is set by each manufacturer. The structure and sorting order of this text string can be specified using the version-scheme item from CoSWID [CoSWID].”

draft-ietf-sacm-coswid:

$version-scheme /= multipartnumeric

$version-scheme /= multipartnumeric-suffix

$version-scheme /= alphanumeric

$version-scheme /= decimal

$version-scheme /= semver

$version-scheme /= uint / text

draft-birkholz-rats-suit-claims

- version => version-value
  - Should probably be $version-scheme
  - Can this replace (be renamed from) **chip-version-scheme-claim?**
- device-identifier => RFC4122_UUID
- vendor-identifier => RFC4122_UUID
- class-identifier => RFC4122_UUID
- class-identifier => [+ identifier]
  - “A binary identifier can represent a CoSWID [I-D.ietf-sacm-coswid] tag-id.”

Thank You!