Project Veraison

[pronunciation: "verr-ayy-sjon"]

Attestation Verification Components

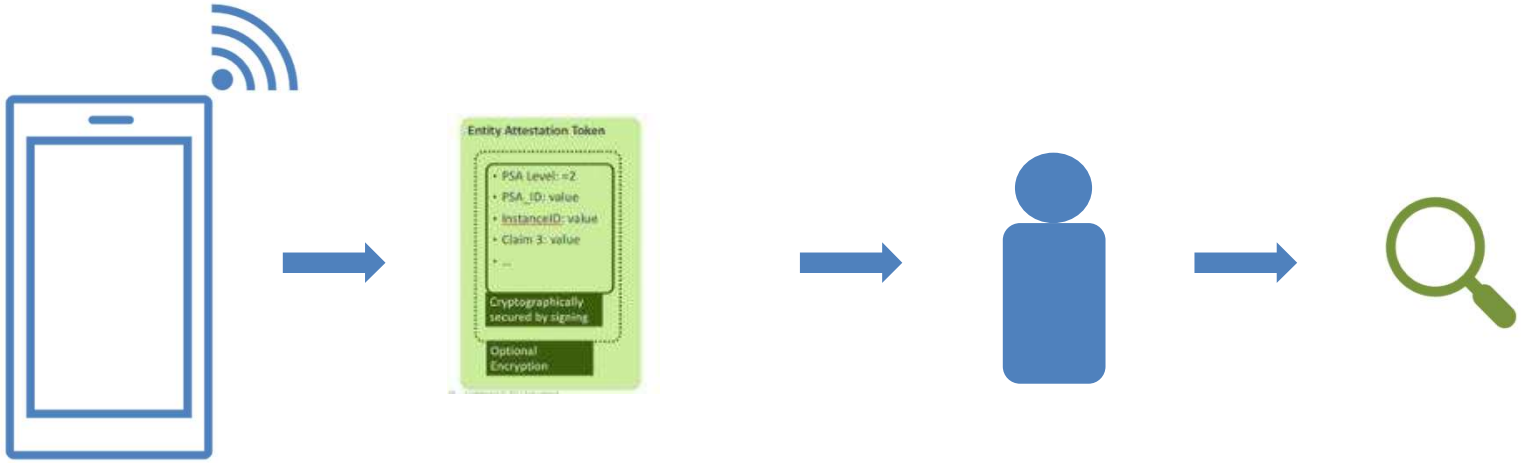
Agenda

- Introduction
- Need for Veraison
- Veraison Architecture
- Libraries and tooling provided by the Veraison Project

https://github.com/veraison

Attestation

- A means to establishing the trustworthiness of a TEE
- Produces a signed evidence about an entity
- Attestation report alone is insufficient
  - ➢ Must be verified by a trusted service
  - ➢ Verification is at the centre of any attestation flow



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Building Attestation Verification Service

Challenges:

- Due to specific needs of deployments, it is difficult for a single offering to serve all use cases
  - required business relationships
  - regulation / compliance / geo-specifics
- If Verifiers have to be custom, then
  - standardisation and quality levels suffer between deployments
  - the cost of building a trustworthy infrastructure becomes a notable barrier to entry
- Solution:
  - make common components available which make building Verification Services straightforward

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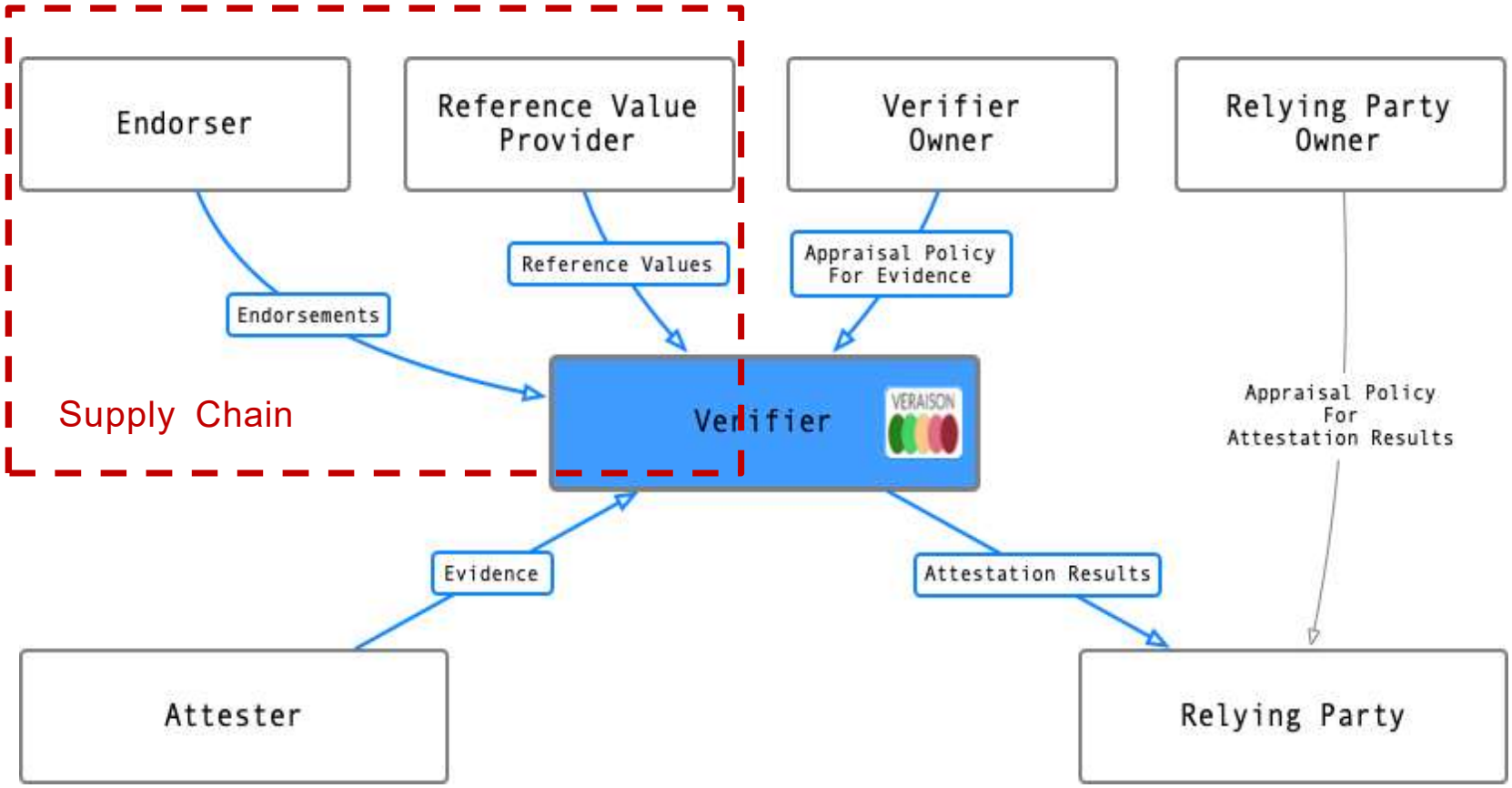
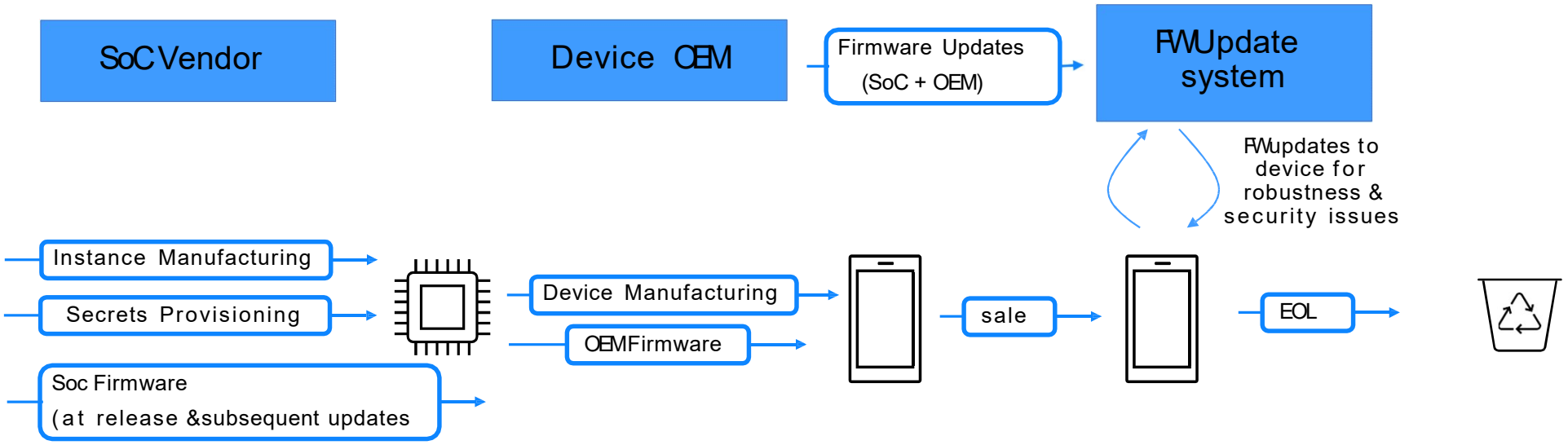
https://github.com/veraison/

RATS Architecture Model



RATS → **R**emote **AT**testation procedure**S (RFC 9334)**

Supply Chain & Lifecycle (somewhat idealised)



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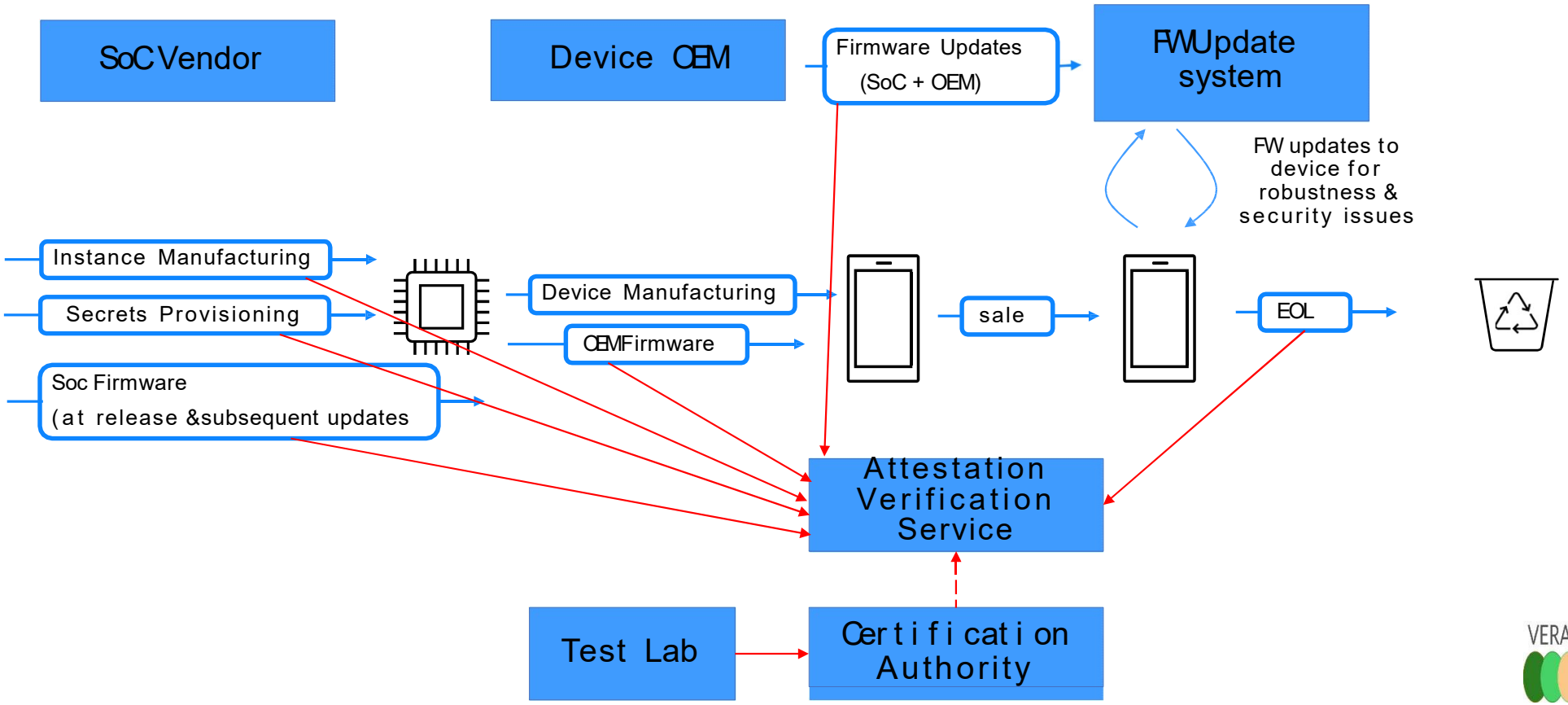
Information Flow for Verification



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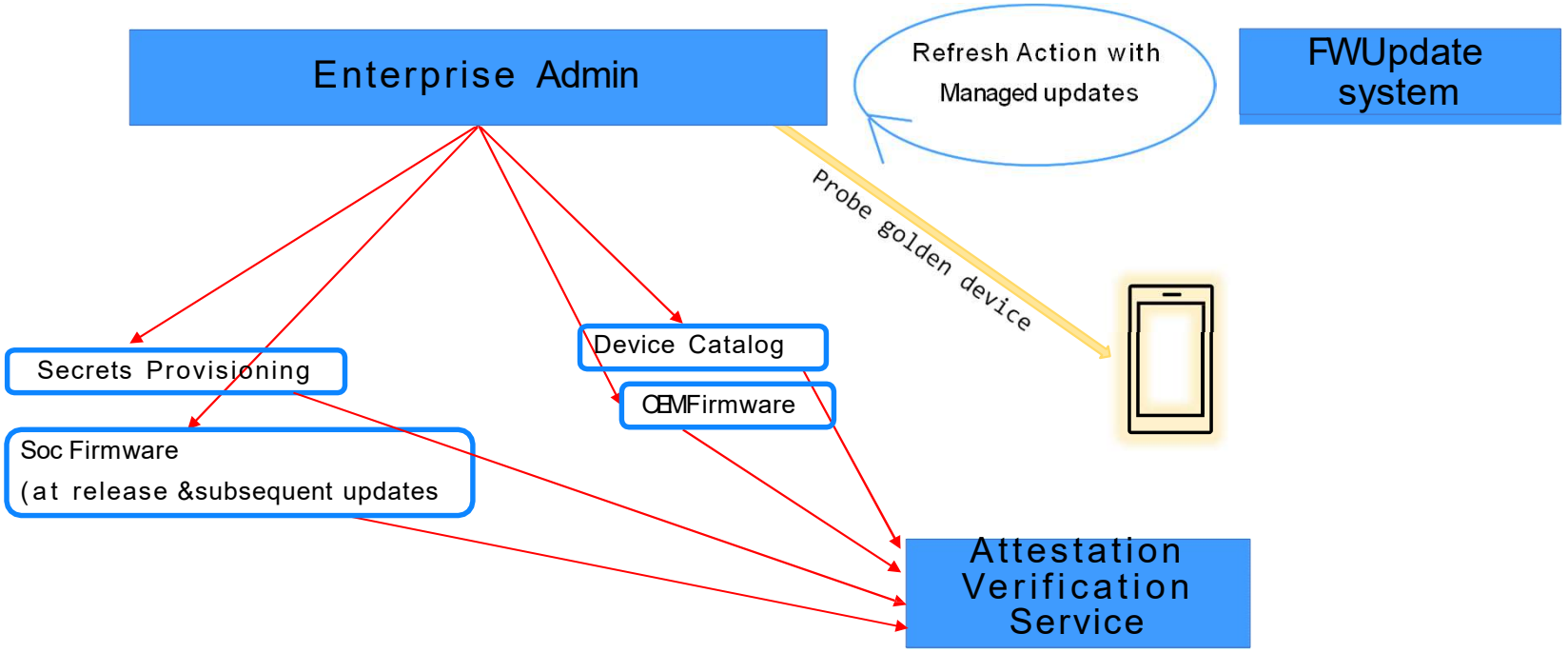
Information Flow for Verification (Enterprise)



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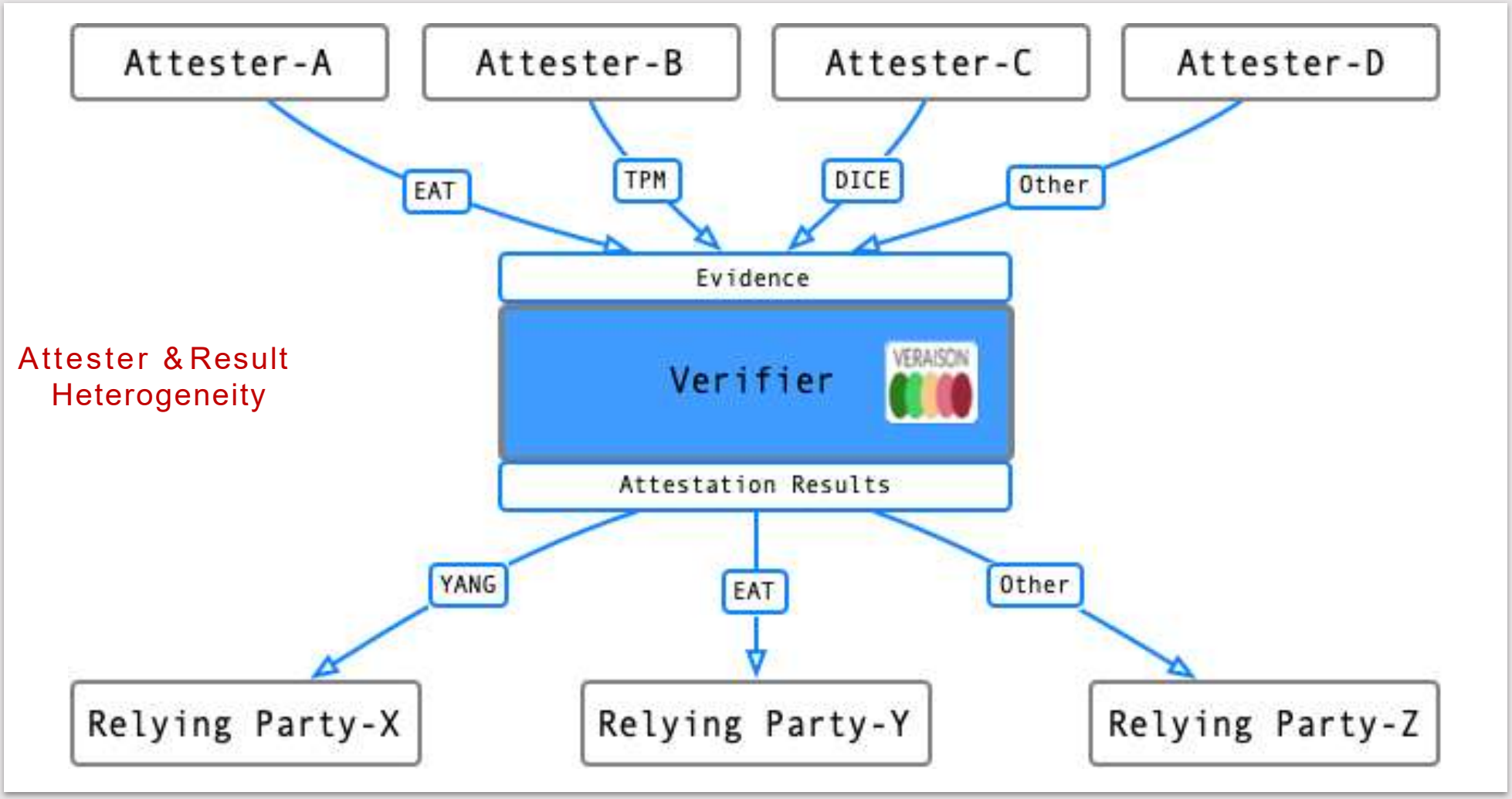
Attester & Result Heterogeneity



Project Veraison

- **VER**ific**A**t**I**on of atte**S**tati**ON**
- Open Source (Apache v2.0) & Open Governance
- Collection of libraries and tools for implementing a remote attestation verification service
- A Confidential Computing Consortium project
- Industry wide scope

Design Principles

- Multi architecture
- Model supply chain interaction with Verifier
- Flexible deployment models
  - Public, private, hybrid, multi cloud service
  - Single or multiple tenants
  - Potential to deploy `locally' e.g. in adjacent isolation such as Trust Zone
- Industry standards used where possible
  - IETF RATS Architecture & Information model
  - TCG DICE Endorsement data format working group

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Design Overview

- API driven
- Support for verification of multiple attestation formats
- Token Verification is flexible
  - policy driven or extensible via plugins
- Access to Provisioned Reference Values (Endorsements)
- Reference implementations: EAT – PSA Token, Arm CCA, DICE, TPM

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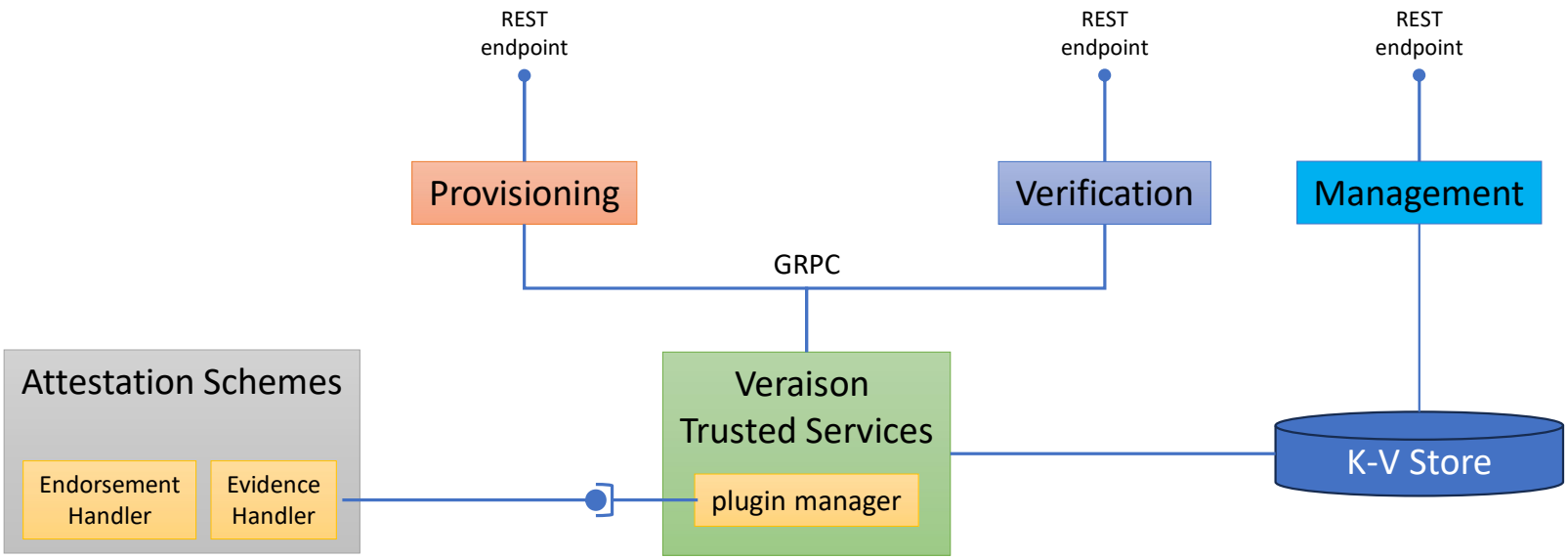
Veraison Architecture

Architecture Overview



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Provisioning

- Authorised supply chain actors (SoC Vendors, OEM, ISVs etc) need to supply Reference Values & Endorsements to the Verifier

- Veraison uses standards driven Information Model and Data Model to convey Reference Values and Endorsements. This enables
  - standard tooling
  - reduce fragmentation
  - lower barrier to entry for supply chain actors

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CoRIM

- **Co**ncise **R**eference **I**ntegrity **M**anifest
- A signed, **CBOR**-formatted document (**COSE**)
- Data is represented as statements, i. e. *subject-verb-object "triples " e.g.*

component "X" – has reference values – [list of values]

- CoRIM has CoMIDs and CoSWIDs that carries RV and EV from Supply Chain
- Also contains metadata (provisioner identity, versioning, etc.)
- Veraison CoRIM is an implementation of CoRIM standards been developed in IETF RATS and TCG working groups
  - https://datatracker.ietf.org/doc/draft-ietf-rats-corim/
  - TCG Endorsement Architecture

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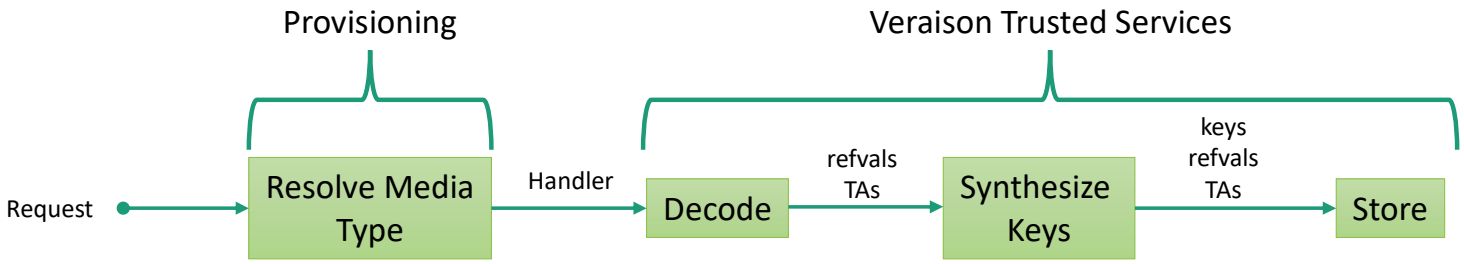
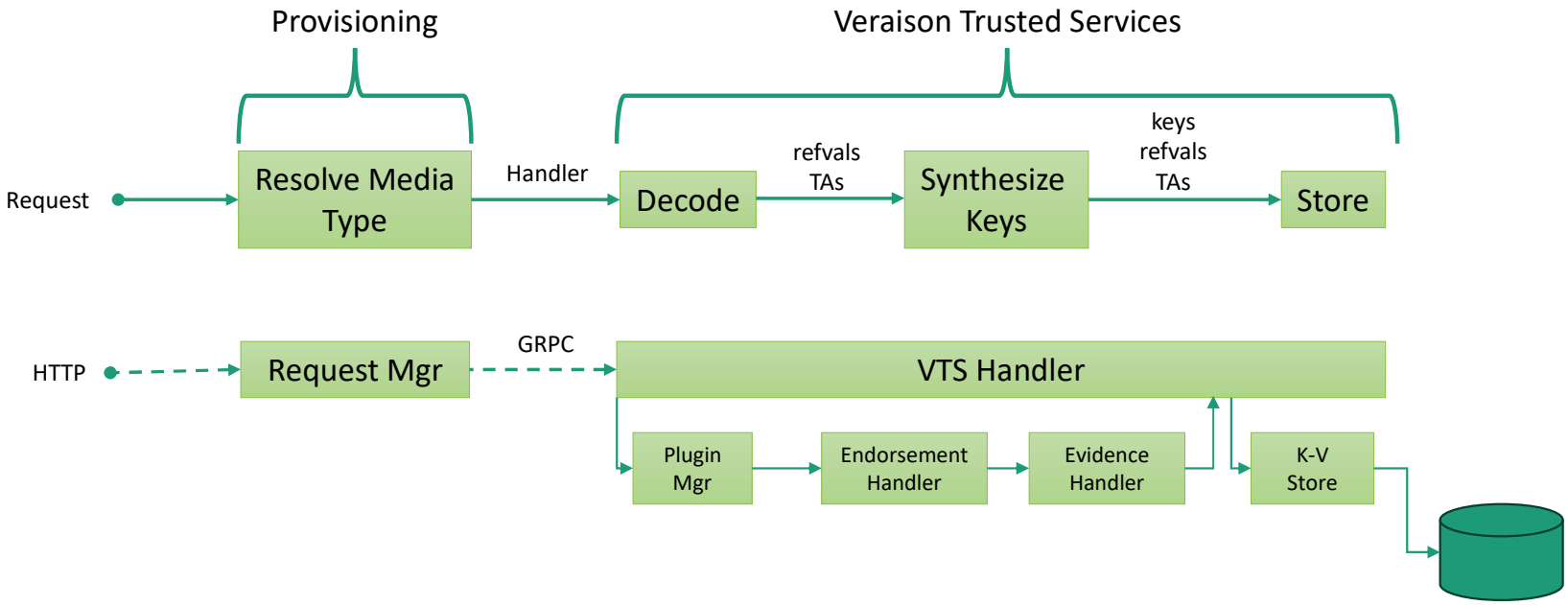
Provisioning Pipeline



Provisioning Pipeline



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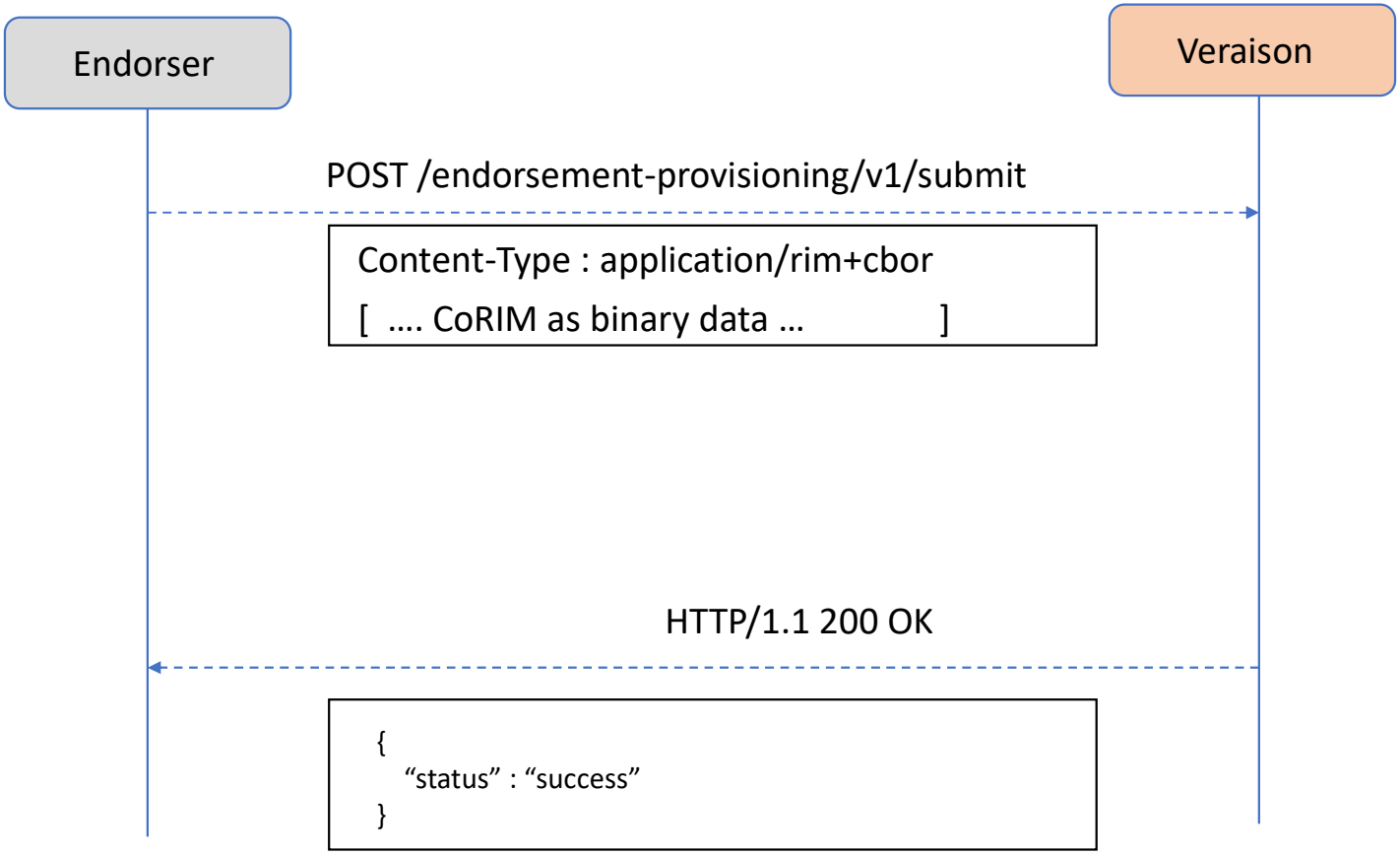
Provisioning



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CoRIM Template Excerpt

```
"entities": [{
 "name": "ACME Corp.",
 "regid": "https://acme.com",
 "roles": [ "tagCreator", "creator", "maintainer"]
 }],
 "triples": {
 "reference-values": [
  {
 "environment": { "instance": {"type":"uuid", "value": "7d<...>f1" }},
"measurements": [
 { "value": { "digests": [ "sha-256:h0KPxS<...>MTPJcc=" ] } }
  ]
  }
 }
```

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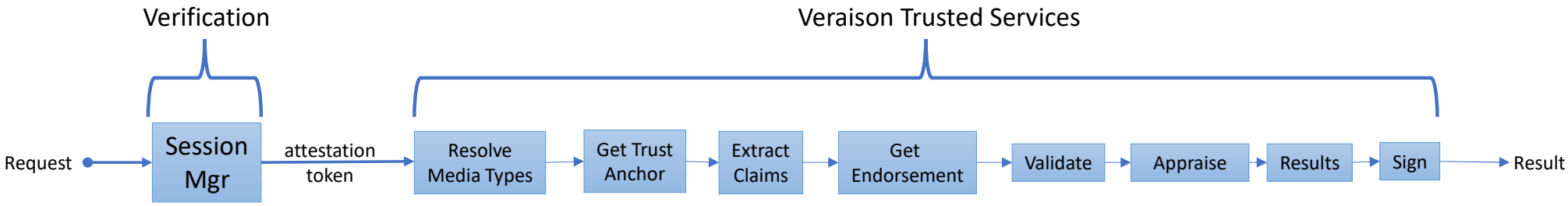
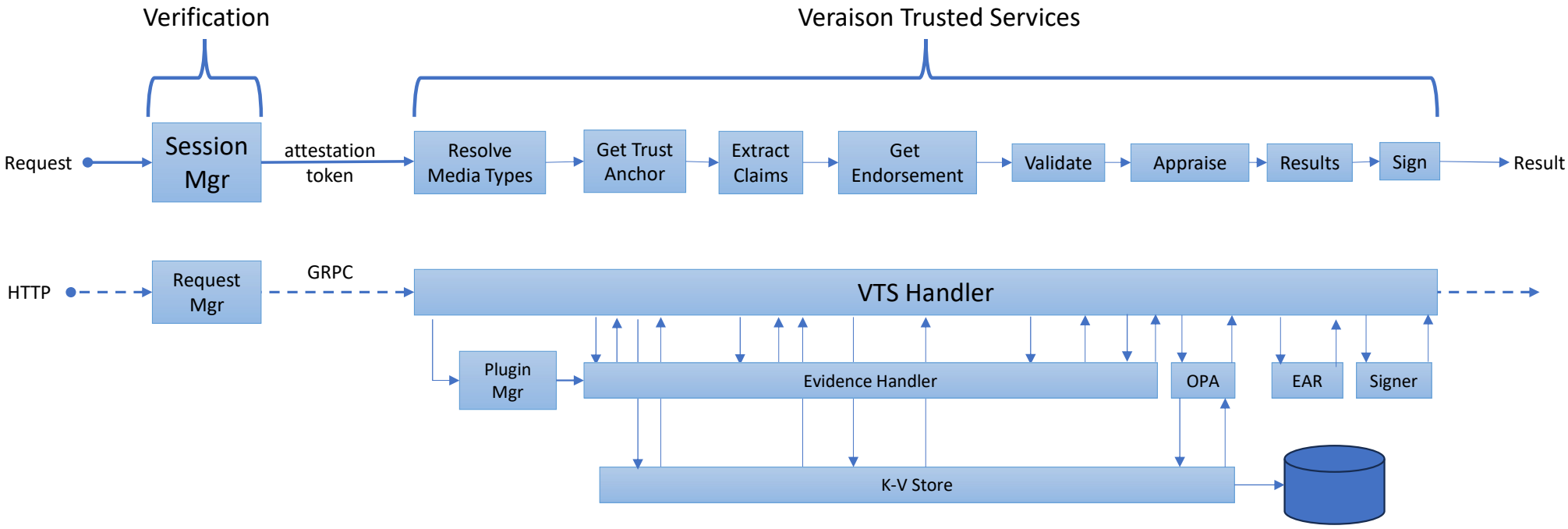
Verification

- A session is established with an agreed upon **nonce**
- Attester/Relying Party submits Evidence to the Verification service
- Gets a signed **Attestation Results** as an EAR document
- https://github.com/veraison/docs/blob/main/api/challenge-response/README.md

Verification Pipeline



Verification Pipeline



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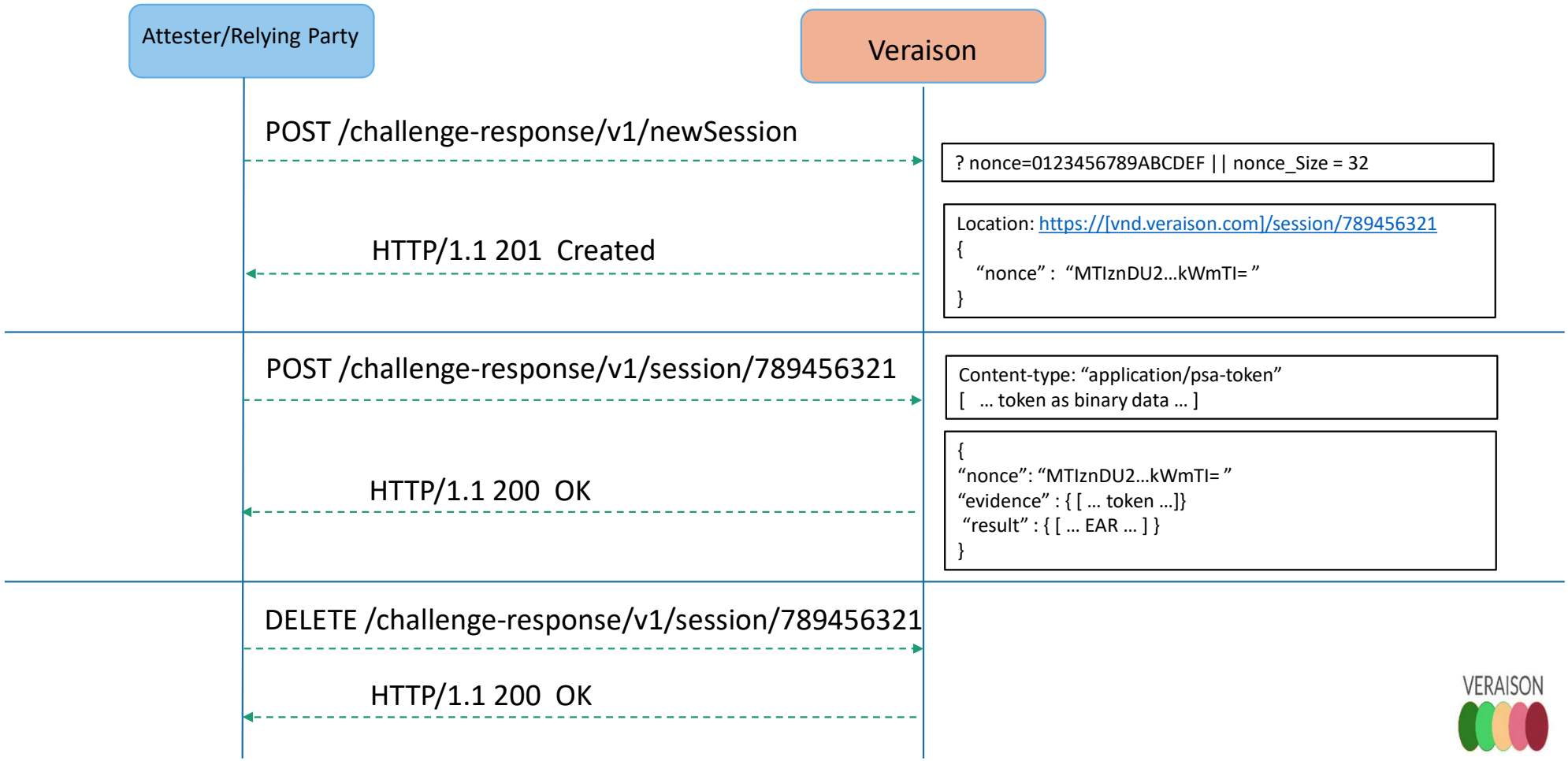
Verification



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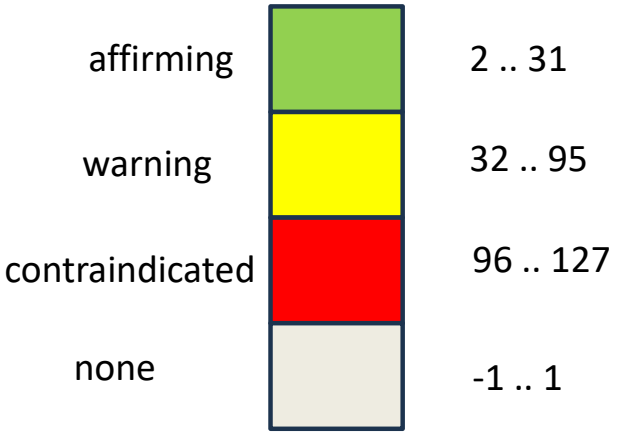
Attestation Results

- IETF Standard AR4SI defines Trustworthiness Vector
- A format to represent attestation results in a normalized way, e.g.



configuration	2			
executables	3			
file-system				0
hardware	2			
instance-identity	2			
runtime-opaque		32		
sourced-data				0
storage-opaque				0

AR4SI ➔ Attestation Results for Secure Interaction
https://datatracker.ietf.org/doc/draft-ietf-rats-ar4si/

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EAR

- EAT Attestation Results
- A signed JSON Document (**JWT**) containing
  - An overall status and an AR4SI Trust Vector
  - Annotated Evidence
  - Policy Claims
  - Time of appraisal
  - Identity of the Verifier
- https://datatracker.ietf.org/doc/draft-fv-rats-ear/

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EAR Example

```
{
"ear.status": "affirming",
 "ear.trustworthiness-vector": {
 "configuration": 0,
 "executables": 2,
 [ ... ]
 },
 "ear.veraison.annotated-evidence": {
 "firmware-version": 7,
 "pcr-selection": [1, 2, 3, 4],
 "pcr-digest": "h0KPxSKAPTEGXnvOPPA/5HUJZjHl4Hu9eg/eYMTPJcc=",  [ ... ]
  }
}
```

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Attestation Scheme

- Defines
  - Evidence token structure
  - What Reference Values, Endorsements and Trust Anchors are expected
  - How the Evidence is appraised
- Implemented via pluggable interfaces
- May be augmented via deployment-specific policies

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Policies

- Allow “post-processing” of attestation results generated by scheme
  - Override Appraisal Decisions
  - Insert additional claims
- Implemented using **O**pen **P**olicy **A**gent (**OPA**) engine
- Written in **Rego** language
- Policies are handled via Management Interface

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Policy Example

```
# This sets executables trust vector value to AFFIRMING iff BL version is # 3.5 or greater, and to
failure otherwise.
executables = "AFFIRMING" {

# there exists some `I',  such that...
some i

# ...the i'th software component has type "BL", and...
evidence["psa-software-components"][i]["measurement-type"] == "BL"

# … the version of this software component is greater than or equal to 3.5
# (semver_cmp is defined by the policy package. It returns 1 if the first parameter is
# greater than the second, -1 if it is less than the second and 0 if they are equal

semver_cmp(evidence["psa-software-components"][i].version, "3.5") >= 0
} else = "CONTRAINDICATED"  # unless the above condition is bet return “CONTRAINDICATED”
```

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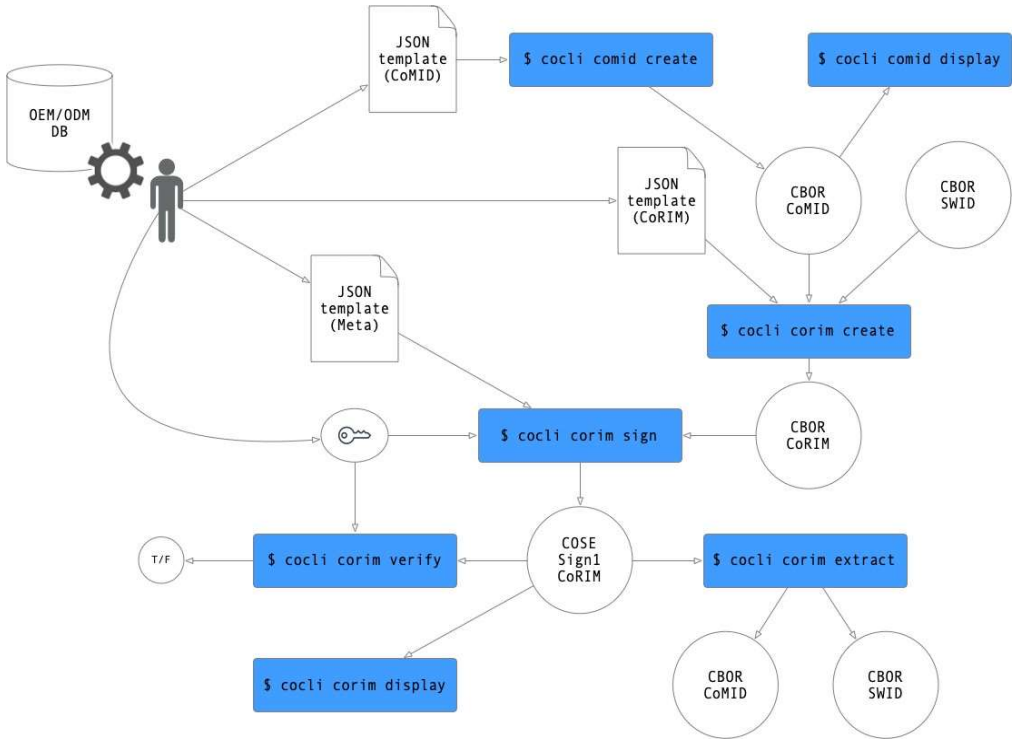
Libraries and Tooling

Tooling for the supply chain

[veraison/corim/cocli]



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Other tools

Tool	Purpose
evcli	A handy tool to manipulate Evidence to/from CBOR using JSON Claims and a crypto key Also allows exchanging Evidence with Veraison (acting as Attester or Relying Party)
arc	A CLI tool to manipulate Attestation Results
pocli	A CLI tool to manage Policies, i. e. Create, Activate, Deactivate & list Policies for a scheme
gen-corim	A handy CLI tool to generate CoRIM Endorsements from Evidence token

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Current Status

- REST APIs for Access to Services
- Support for Multiple Attestation technologies
  - Implemented : PSA , CCA, TPM, DICE { OpenDICE, TCG DICE }
  - Work In Progress (AMD-SEV-SNP)
- Multi-tenancy roles and Authorization support
- Container deployment
- First implementation of standards : CoRIM/EAT Claims + Attestation Results
- Support for CoRIM Extensions – for multiple schemes { TDX, AMD-SEV-SNP}
- Deployable appraisal policy
- PoC deployment ‘in TEE’ with proofs

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On the Roadmap

- Options to deploy without (external) plugin framework to reduce TCB
- Support for further Attestation Architectures – e.g. Intel TDX
- Inline Endorsements
- Support for Event Logs
- Exploring constrained deployment in local TEE

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Out of Scope

- It is not intended to look at other aspects of verification e.g.
  - Unification of Attestation Token formats
  - Normalising how a Relying Party requests Attestation
  - Common Attestation protocol

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Get Involved

- We would be very interested in collaboration from this skilled & knowledgeable Community
  - Principles/Assumptions
  - Design Aspects
  - Extend Veraison to support a new scheme to match the use case
  - Consumption/Reference deployments

- Joins us on Zulip at https://veraison.zulipchat.com/
- Welcome to discuss @ Weekly Community Meet (every Tuesday 4PM UK)

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https://github.com/veraison/