Attestation Result for Secure Interactions (AR4SI)

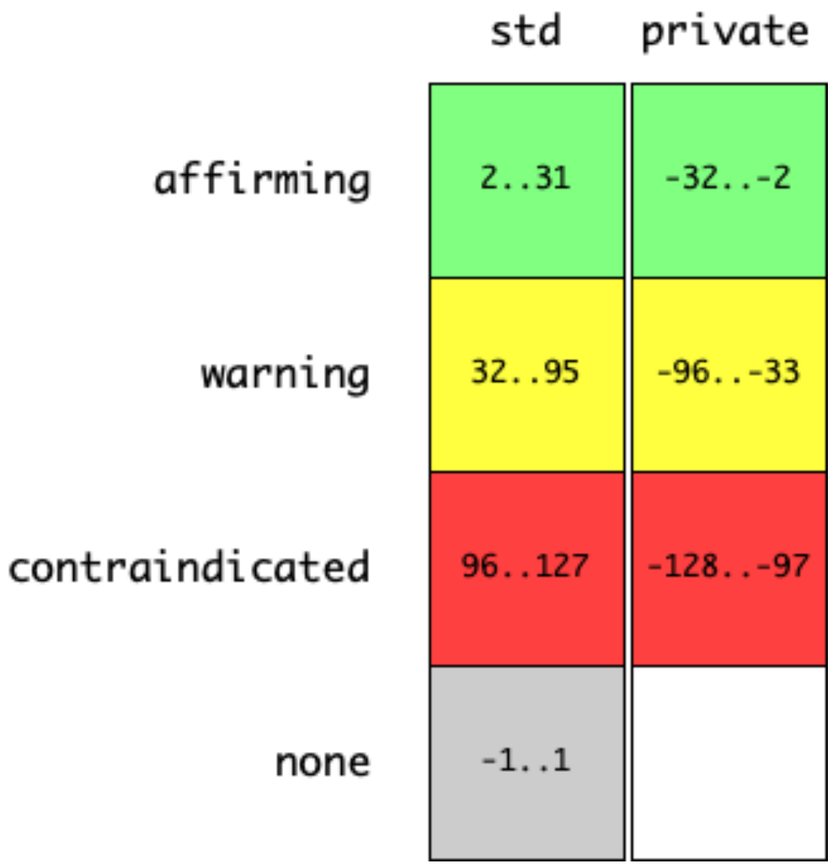
An EAT Profile

AR4SI recap

- RATS I-D draft-ietf-rats-ar4si
- Goal is to define an *info model* for conveying *normalised* attestation result
- The core construct is the trustworthiness vector:
  - 8x256 matrix of pre-defined + customisable semantics
  - set of rules for computing the vector's values

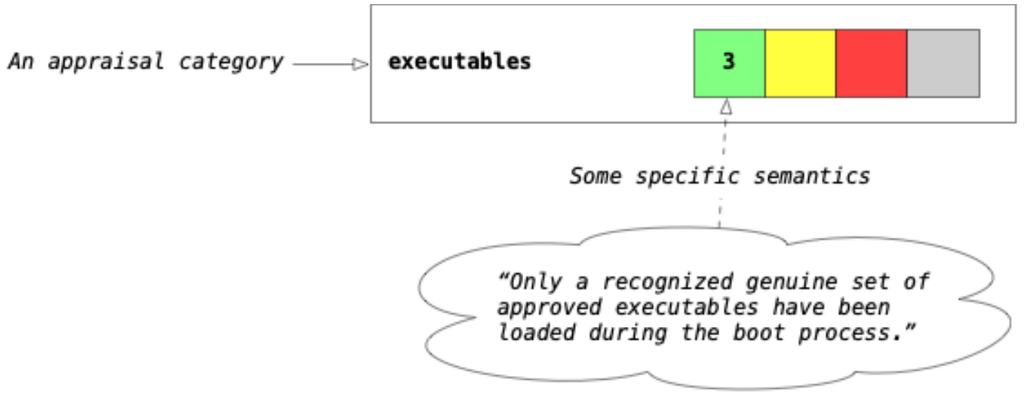
Trustworthiness Tiers

- y: 256 code-point space (8b signed int) organised in four tiers
- x: two sub-spaces (standard, private)



Trustworthiness Claim

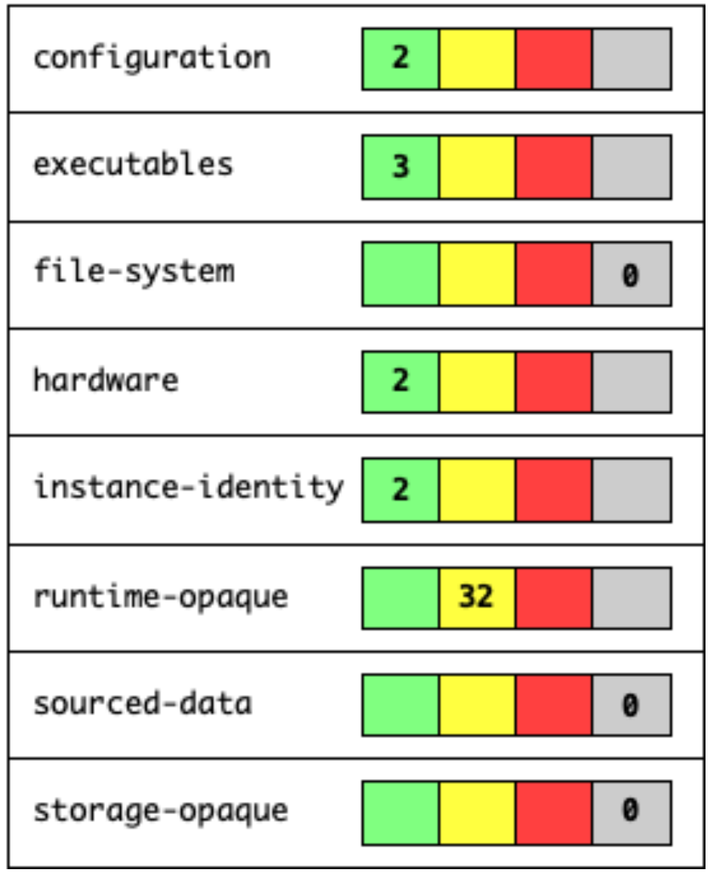
Each "trustworthiness claim" is associated to an appraisal category and, for that category, the claim defines its own semantics.



Trustworthiness Vector

The "trustworthiness vector" is a collection of 8 pre-defined "trustworthiness claims".

A missing entry is equivalent to 0 (i.e., no claim in this category).



Info vs Data Model

AR4SI only provides the semantic core of the appraisal result.

However, a RP also needs other metadata, e.g.:

- identity of the verifier (e.g., cryptographic identity, software identity)
- time of the appraisal
- an identifier of the appraisal policy
- maybe evidence about the verifier's execution environment (e.g., in TEE)

Besides, AR4SI does not define a *data model*.

An EAT-based Serialisation

We (Veraison) have defined a serialisation:

```
ar4si-trustworthiness-vector = non-empty<{
  ? instance-identity => $ar4si-trustworthiness-claim
  ? configuration => $ar4si-trustworthiness-claim
  ? executables => $ar4si-trustworthiness-claim
  ? file-system => $ar4si-trustworthiness-claim
  ? hardware => $ar4si-trustworthiness-claim
  ? runtime-opaque => $ar4si-trustworthiness-claim
  ? storage-opaque => $ar4si-trustworthiness-claim
  ? sourced-data => $ar4si-trustworthiness-claim
}>

$ar4si-trustworthiness-claim = -128..127
```

And wrapped it into a top-level EAT Claims-Set called EAR (EAT Attestation Result)

```
EAR = {
  ear.status => $ar4si-trust-tier
  eat_profile => "tag:github.com/veraison/ar4si,2022-10-17"
  ? ear.trustworthiness-vector => ar4si-trustworthiness-vector
  ? ear.raw-evidence => ear-bytes
  iat => numeric-date
  ? ear.appraisal-policy-id => text
  * $$ear-extension
}
```

JSON / JWT Example


```
{
  "eat_profile": "tag:github.com/veraison/ar4si,2022-10-17",
  "ear.status": "contraindicated",
  "ear.trustworthiness-vector": {
    "instance-identity": 32,
    "configuration": 32,
    "executables": 96,
    "hardware": 2
  },
  "ear.appraisal-policy-id": "https://veraison.example/policy/1/60a0068d",
  "iat": 1666529184
}
```

CBOR / CWT Example

```
{
  265: "tag:github.com/veraison/ar4si,2022-10-17",
  1000: 96,
  1001: {
    0: 32,
    1: 32,
    2: 96,
    4: 2
  },
  1003: "https://veraison.example/policy/1/60a0068d",
  6: 1666529184
}
```

Veraison-specific Extensions

Plug into the `$$ear-extension` socket

→ Easy-to-consume breakdown of the evidence claims-set

```
ear-veraison-processed-evidence = {
  + ear-label => any
}
```

→ Any claim "derived" by the Verifier during appraisal (e.g., the certification status of a device)

```
ear-veraison-verifier-added-claims = {
  + ear-label => any
}
```

Example


```
{
  "eat_profile": "tag:github.com/veraison/ar4si,2022-10-17",
  "ear.status": "affirming",
  "ear.trustworthiness-vector": {
    "instance-identity": 2,
    "configuration": 2,
    "executables": 2,
    "hardware": 2
  },
  "iat": 1666529284,
  "ear.appraisal-policy-id": "https://veraison.example/policy/1/60a0068d",
```

Example (cont.)

```
[...]
"ear.veraison.processed-evidence": {
  "eat-profile": "http://arm.com/psa/2.0.0",
  "psa-client-id": 1,
  "psa-security-lifecycle": 12288,
  "psa-implementation-id": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA=",
  "psa-software-components": [
    {
      "measurement-value": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA=",
      "signer-id": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA="
    },
    {
      "measurement-value": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA=",
      "signer-id": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA="
    }
  ],
  "psa-nonce": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyA=",
  "psa-instance-id": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyAh",
  "psa-certification-reference": "1234567890123-12345"
},
```

Example (cont.)

```
  [...]
  "ear.veraison.verifier-added-claims": {
    "psa-certified": {
      "certificate-number": "1234567890123-12345",
      "date-of-issue": "23/06/2022",
      "test-lab": "Riscure",
      "certification-holder": "ACME Inc.",
      "certified-product": "RoadRunner",
      "hardware-version": "Gizmo v1.0.2",
      "software-version": "TrustedFirmware-M v1.0.6",
      "certification-type": "PSA Certified Level 1 v2.1",
      "developer-type": "PSA Certified - Device"
    }
  }
}
```

Adding TEEP support

Section 4.3.1 of I-D.ietf-teep-protocol:

When an EAT is used, the following claims can be used to meet those requirements, whether these claims appear in Attestation Results, or in Evidence for the Verifier to use when generating Attestation Results of some form:

Requirement	Claim	Reference
Freshness proof	nonce	Section 4.1 of [I-D.ietf-rats-eat]
Device unique identifier	ueid	Section 4.2.1 of [I-D.ietf-rats-eat]
Vendor of the device	oemid	Section 4.2.3 of [I-D.ietf-rats-eat]
Class of the device	hardware-model	Section 4.2.4 of [I-D.ietf-rats-eat]
TEE hardware type	hardware-version	Section 4.2.5 of [I-D.ietf-rats-eat]
TEE hardware version	hardware-version	Section 4.2.5 of [I-D.ietf-rats-eat]
TEE firmware type	manifests	Section 4.2.15 of [I-D.ietf-rats-eat]
TEE firmware version	manifests	Section 4.2.15 of [I-D.ietf-rats-eat]

Table 1

Adding TEEP support (CDDL)

```
$$ear-extension //= (
  ear.teep.claims => ear-teep-claims
)

ear-teep-claims = non-empty<{
  ? eat.nonce => eat.nonce-type
  ? eat.ueid => eat.ueid-type
  ? eat.oemid => eat.oemid-type
  ? eat.hardware-model => eat.hardware-model-type
  ? eat.hardware-version => eat.hardware-version-type
  ? eat.manifests => eat.manifests-type
}>
```

Example


```
{
  "eat_profile": "tag:github.com/veraison/ar4si,2022-10-17",
  "ear.status": "affirming",
  "ear.trustworthiness-vector": {
    "instance-identity": 2,
    "configuration": 2,
    "executables": 2,
    "hardware": 2
  },
  "iat": 1666529284,
  "ear.appraisal-policy-id": "https://veraison.example/policy/1/60a0068d",
  "ear.teep.claims": {
    "nonce": "80FH7byS7VjfARIq0_KLqu6B9j-F79QtV6p",
    "ueid": "AQIDBAUGBwgJCgsMDQ4PEBESExQVFhcYGRobHB0eHyAh",
    "oemid": "Av8B",
    "hwmodel": "fJYq",
    "hwversion": ["1.2.5", 16384]
  }
}
```

Implementation

Golang package and (work-in-progress) CLI:

github.com/veraison/ar4si

- v0.0.1
- Apache 2.0
- pkg.go.dev/github.com/veraison/ar4si