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Taxonomy of Composite Attesters
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Abstract

This document further refines different kinds of RFC 9334 Composite Attesters.

About This Document

This note is to be removed before publishing as an RFC.

Status information for this document may be found at <https://datatracker.ietf.org/doc/draft-richardson-rats-composite-attesters/>.

Discussion of this document takes place on the rats Working Group mailing list (<mailto:rats@ietf.org>), which is archived at <https://mailarchive.ietf.org/arch/browse/rats/>. Subscribe at <https://www.ietf.org/mailman/listinfo/rats/>.

Source for this draft and an issue tracker can be found at <https://github.com/richardson/rats-composite-attesters>.

Status of This Memo

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1. Introduction

This document clarifies and extends the meaning of Composite Attester from [RFC9334], Section 3.3.

1.1. Caveats of Current Definition

[RFC9334], Section 3.3 says:

''' A composite device is an entity composed of multiple sub-entities such that its trustworthiness has to be determined by the appraisal of all these sub-entities.

Each sub-entity has at least one Attesting Environment collecting the Claims from at least one Target Environment. Then, this sub-entity generates Evidence about its trustworthiness; therefore, each sub-entity can be called an "Attester". Among all the Attesters, there may be only some that have the ability to communicate with the Verifier while others do not. ``

In this description, it was left vague as to whether or not each Attesting Environment signs the Evidence that it generates, and whether or not the Evidence is evaluated by a Verifier operated by the Lead Attester, or if it's passed by the Lead Attester along with the Evidence from the Lead Target Environment.

1.2. Terminology

Lead Attester: This term is from RFC9334, and includes the (Lead) Attesting Environment, and the (Lead) Target Environment.

Target Environment: This term is from RFC9334, this refers to the environment for which evidence is gathered.

Attesting Environment: This term is from RFC9334, this refers to the thing which gathers the evidence.

Component: This is the pieces which are attached to the Lead Attester. There are one to many of these, typically each with their own application specific processor.

Component Attesting Environment: This term is new, and refers to an Attesting Environment residing inside a component of the whole.

Component Target Environment: This term is new, and refers to an environment for which evidence is collected.

1.3. Level 0 Composite Attester

In this first, somewhat degenerate scenario, the Lead Attester has access to the entire memory/environment of all of the components. Examples of situations like this include classic PCI-buses, ISA-buses, VME, S100/IEEE 696-1983. In these situations, secondary components might not boot on their own. (It might even be that the lead environment (the chassis) will place code into RAM for these systems, with no ROM at all) In this case, it is possible for the Lead Attesting Environment to collect Evidence about each of the components without the components having to have their own Attesting Environment.

At some level, all of these components can be considered part of the same system. In the classic PCI or ISA environment, the components are hard drive interfaces, video interfaces, and network interfaces. For many such systems considering the system to be a composite is unnecessary additional complexity.

The benefit of applying the composite mechanism in this case is that it is no longer necessary to consider the exhaustive combinatorics of all possible components being attached to the lead attester: it is already the case the reference values for a target environment may change depending upon how much memory is installed.

In this Level 0 Composite Attester, the evidence gathered about the components would be included in the Lead Attester's signed Evidence (such as an EAT), as sub-components in UCCS form [RFC9781]. The signature from the Lead Attester applies to all the Evidence, but the Verifier can evaluate each component separately.

More modern buses like PCIe, InfiniBand, Thunderbolt, DisplayPort, USB, Firewire and others do not provide direct electrical access to target component system memory. They are serialized versions of the old I/O buses, using a protocol akin to a network. They require non-trivial deserialization at each end, requiring configuration via firmware that itself might not be trustworthy. A system with such an interface would be a level 1.

1.4. Level 1 Composite Attester

RFC 9334 gives the following example:

For example, a carrier-grade router consists of a chassis and multiple slots. The trustworthiness of the router depends on all its slots' trustworthiness. Each slot has an Attesting Environment, such as a TEE, collecting the Claims of its boot process, after which it generates Evidence from the Claims.

As described in this case, each component or slot produces its own signed Evidence. The Lead Attester simply relays the Evidence along with its own:

Among these slots, only a "main" slot can communicate with the Verifier while other slots cannot. However, other slots can communicate with the main slot by the links between them inside the router. The main slot collects the Evidence of other slots, produces the final Evidence of the whole router, and conveys the final Evidence to the Verifier. Therefore, the router is a composite device, each slot is an Attester, and the main slot is the lead Attester.

Note that the Lead Attester does not evaluate the evidence, and does not run its own Verifier.

1.5. Level 2 Composite/Hybrid Attester

In this scenario, the Components relay their Evidence to the Lead Attester. The Lead Attester operates a Verifier itself. It evaluates the Components' Evidence against Reference Values, Endorsements, etc. producing Attestation Results. These Attestation Results (or their selectively disclosed version: SD-CWT/SD-JWT) are then included as part of the Lead Attester's Evidence to its Verifier.

The Verifier's signing credentials may be part of the same Attesting Environment as the Evidence signing credential used by the Lead Attesting environment. Or they could be in a different environment, such as in a different TEE.

1.6. Level 3B Composite Background-Check Attester

In this scenario, the Components relay their Evidence to the Lead Attester. The Lead Attester does not operates a Verifier itself.

Instead, the Lead Attester, conveys the Evidence to the Lead Verifier along with its own Evidence. The Component Evidence is not placed within the Lead Attester's Evidence (DEBATE). The Lead Attester needs to communicate how each component is attached, and that would be within its Evidence.

The Lead Verifier, acting a Relying Party, connects to Verifiers capable of evaluating the Component Evidence, retrieving Attestation Results from those Verifiers as part of evaluating the Lead Attester.

This case is similar to Level 1, however the integration of the component attestation results in level 1 is not included in the Evidence, while in this case, it is.

1.7. Level 3P Composite Passport-Model Attester

In this scenario, the Components relay their Evidence to the Lead Attester. The Lead Attester does not operates a Verifier itself. Instead, the Lead Attester, acting as a Presenter (term To-Be-Defined), connects to an appropriate Verifier, in passport mode. It retrieves an Attestation Result from the Verifier, which it then includes within the Evidence that the Lead Attester produces.

The Lead Attester's Verifier considers that the Component during its assessment. It needs to consider if the component has been assessed by a Verifier it trusts, if the component is appropriately connected to the Lead Attester, and if there are an appropriate number of such components.

For instance, when accessing a vehicle such as a car, where each tire is its own component, then a car with three wheels is not trustworthy. Most cars should have four wheels. A car with five wheels might be acceptable, if at least one wheel is installed into the "spare" holder. (And, it may be of concern if the spare is flat, but the car can still be operated)

A more typical digital use case would involve a main CPU with a number of attached specialized intelligent components that contain their own firmware, such as Graphical Processors (GPU), Network Processors (NPU).

2. Attestation Results as Evidence

In cases 2, 3B and 3P Attestation Results are included as Evidence. This results in a Verifier that must evaluate these results. It must be able to validate the signatures on the Evidence.

This creates `_stacked_` Remote Attestation. This is very much different and `_distinct_` from [RFC9334], Section 3.2 Layered Attestation.

Layered Attestation produces a `_single_` set of Evidence, with claims about different layers.

3. Privacy Considerations

YYY

4. Security Considerations

ZZZ

5. IANA Considerations

6. Acknowledgements

Hello.

7. Changelog

8. References

8.1. Normative References

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