Contents

About this document iii
  Release information iii
  License iv
  References v
  Terms and abbreviations v
  Potential for change vi
  Conventions vii
    Typographical conventions vii
    Numbers vii
  Current status and anticipated changes vii
  Feedback vii

1 Introduction 9
  1.1 About Platform Security Architecture 9
  1.2 About the Attestation API 9

2 Use cases and rationale 10
  2.1 Device enrolment 10
  2.2 Identifying certification 11
  2.3 Integrity reporting 11

3 Initial Attestation report 12
  3.1 Information model 12
    3.1.1 Software components 14
  3.2 Report format and signing 15
    3.2.1 Token encoding 15
    3.2.2 Signing 16
    3.2.3 EAT standard claims 16
    3.2.4 EAT custom claims 16
4 API reference

4.1 API conventions

4.2 Status codes

4.3 General definitions
   4.3.1 PSA_INITIAL_ATTEST_API_VERSION_MAJOR (macro)
   4.3.2 PSA_INITIAL_ATTEST_API_VERSION_MINOR (macro)
   4.3.3 PSA_INITIAL_ATTEST_MAX_TOKEN_SIZE (macro)

4.4 Challenge sizes
   4.4.1 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_32 (macro)
   4.4.2 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_48 (macro)
   4.4.3 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_64 (macro)

4.5 Attestation
   4.5.1 psa_initial_attest_get_token (function)
   4.5.2 psa_initial_attest_get_token_size (function)

A Example header file

A.1 psa/inital_attestation.h

B Example report

C CDDL

D Document history
# About this document

## Release information

The change history table lists the changes that have been made to this document.

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Confidentiality</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2019</td>
<td>1.0 beta 0</td>
<td>Non-confidential</td>
<td>Initial publication.</td>
</tr>
<tr>
<td>June 2019</td>
<td>1.0.0</td>
<td>Non-confidential</td>
<td>First stable release with 1.0 API finalized. Uses the PSA Certified API common error status codes. Modified the API parameters to align with other PSA Certified APIs. Updated the claims and lifecycle to match the latest Platform Security Model. Updated CBOR example in the appendix.</td>
</tr>
<tr>
<td>August 2019</td>
<td>1.0.1</td>
<td>Non-confidential</td>
<td>Recommend type byte 0x01 for arm_psa_UEID. Remove erroneous guidance regarding EAT’s origination claim.</td>
</tr>
<tr>
<td>February 2020</td>
<td>1.0.2</td>
<td>Non-confidential</td>
<td>Clarify the claim number of Instance ID. Permit COSE-Mac0 for signing tokens (with appropriate warning). Update URLs.</td>
</tr>
<tr>
<td>October 2022</td>
<td>1.0.3</td>
<td>Non-confidential</td>
<td>Relicensed as open source under CC BY-SA 4.0. CDDL definition added to the appendices. Example header file added to the appendices. Minor corrections and clarifications.</td>
</tr>
</tbody>
</table>

The detailed changes in each release are described in *Document history on page 29*. 
PSA Certified Attestation API

Copyright © 2018-2020, 2022 Arm Limited and/or its affiliates. The copyright statement reflects the fact that some draft issues of this document have been released, to a limited circulation.

License

Text and illustrations

Text and illustrations in this work are licensed under Attribution-ShareAlike 4.0 International (CC BY-SA 4.0). To view a copy of the license, visit creativecommons.org/licenses/by-sa/4.0.

Grant of patent license. Subject to the terms and conditions of this license (both the CC BY-SA 4.0 Public License and this Patent License), each Licensor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Licensed Material, where such license applies only to those patent claims licensable by such Licensor that are necessarily infringed by their contribution(s) alone or by combination of their contribution(s) with the Licensed Material to which such contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Licensed Material or a contribution incorporated within the Licensed Material constitutes direct or contributory patent infringement, then any licenses granted to You under this license for that Licensed Material shall terminate as of the date such litigation is filed.

The Arm trademarks featured here are registered trademarks or trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere. All rights reserved. Please visit arm.com/company/policies/trademarks for more information about Arm's trademarks.

About the license

The language in the additional patent license is largely identical to that in section 3 of the Apache License, Version 2.0 (Apache 2.0), with two exceptions:

1. Changes are made related to the defined terms, to align those defined terms with the terminology in CC BY-SA 4.0 rather than Apache 2.0 (for example, changing “Work” to “Licensed Material”).

2. The scope of the defensive termination clause is changed from "any patent licenses granted to You" to "any licenses granted to You". This change is intended to help maintain a healthy ecosystem by providing additional protection to the community against patent litigation claims.

To view the full text of the Apache 2.0 license, visit apache.org/licenses/LICENSE-2.0.

Source code

Source code samples in this work are licensed under the Apache License, Version 2.0 (the “License”); you may not use such samples except in compliance with the License. You may obtain a copy of the License at apache.org/licenses/LICENSE-2.0.

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.

See the License for the specific language governing permissions and limitations under the License.
References
This document refers to the following documents.

### Table 2 Documents referenced by this document

<table>
<thead>
<tr>
<th>Ref</th>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>[PSA-STAT]</td>
<td>ARM IHI 0097</td>
<td>PSA Certified Status code API. arm-software.github.io/psa-api/status-code</td>
</tr>
<tr>
<td>[EAN-13]</td>
<td></td>
<td>International Article Number. <a href="http://www.gs1.org/standards/barcodes/ean-upc">www.gs1.org/standards/barcodes/ean-upc</a></td>
</tr>
</tbody>
</table>

Terms and abbreviations
This document uses the following terms and abbreviations.

### Table 3 Terms and abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOR</td>
<td>See Concise Binary Object Representation.</td>
</tr>
<tr>
<td>Concise Binary Object Representation (CBOR)</td>
<td>A format for encoding binary objects in a bitstream, defined in Concise Binary Object Representation (CBOR) [STD94].</td>
</tr>
<tr>
<td>EAT</td>
<td>See Entity Attestation Token.</td>
</tr>
</tbody>
</table>
### Table 3 (continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entity Attestation Token (EAT)</td>
<td>A report format for attestation tokens, defined in <em>IETF Entity Attestation Token (EAT)</em> [EAT].</td>
</tr>
<tr>
<td>IAK</td>
<td>See <em>Initial Attestation Key</em>.</td>
</tr>
<tr>
<td>Immutable Platform Root of Trust</td>
<td>Part of the <em>Platform Root of Trust</em>, which is inherently trusted. This refers to the hardware and firmware that cannot be updated on a production device. See <em>Platform Security Model</em> [PSM].</td>
</tr>
<tr>
<td>IMPLEMENTATION DEFINED</td>
<td>Behavior that is not defined by this specification, but is defined and documented by individual implementations. Application developers can choose to depend on IMPLEMENTATION DEFINED behavior, but must be aware that their code might not be portable to another implementation.</td>
</tr>
<tr>
<td>Initial Attestation Key (IAK)</td>
<td>Typically, the Initial Attestation Key is a secret private key from an asymmetric key-pair accessible only to the Initial Attestation service within the <em>Platform Root of Trust</em>. See <em>Platform Security Model</em> [PSM].</td>
</tr>
<tr>
<td>Non-secure Processing Environment (NSPE)</td>
<td>This is the security domain outside of the <em>Secure Processing Environment</em>. It is the application domain, typically containing the application firmware and hardware.</td>
</tr>
<tr>
<td>NSPE</td>
<td>See <em>Non-secure Processing Environment</em>.</td>
</tr>
<tr>
<td>Platform Root of Trust (PRoT)</td>
<td>The overall trust anchor for the system. This ensures the platform is securely booted and configured, and establishes the secure environments required to protect security services. See <em>Platform Security Model</em> [PSM].</td>
</tr>
<tr>
<td>PRoT</td>
<td>See <em>Platform Root of Trust</em>.</td>
</tr>
<tr>
<td>PSA</td>
<td>Platform Security Architecture</td>
</tr>
<tr>
<td>Secure Processing Environment (SPE)</td>
<td>This is the security domain that includes the <em>Platform Root of Trust</em> domain.</td>
</tr>
<tr>
<td>SPE</td>
<td>See <em>Secure Processing Environment</em>.</td>
</tr>
</tbody>
</table>

**Potential for change**

The contents of this specification are stable for version 1.0. The following may change in updates to the version 1.0 specification:

- Small optional feature additions.
- Clarifications.

Significant additions, or any changes that affect the compatibility of the interfaces defined in this specification will only be included in a new major or minor version of the specification.
Conventions

Typographical conventions

The typographical conventions are:

- **italic**: Introduces special terminology, and denotes citations.

- **monospace**: Used for assembler syntax descriptions, pseudocode, and source code examples. Also used in the main text for instruction mnemonics and for references to other items appearing in assembler syntax descriptions, pseudocode, and source code examples.

- **SMALL CAPITALS**: Used for some common terms such as `IMPLEMENTATION DEFINED`. Used for a few terms that have specific technical meanings, and are included in the Terms and abbreviations.

- **Red text**: Indicates an open issue.

- **Blue text**: Indicates a link. This can be
  - A cross-reference to another location within the document
  - A URL, for example example.com

Numbers

Numbers are normally written in decimal. Binary numbers are preceded by `0b`, and hexadecimal numbers by `0x`.

In both cases, the prefix and the associated value are written in a monospace font, for example `0xFFFF0000`. To improve readability, long numbers can be written with an underscore separator between every four characters, for example `0xFFFF_0000_0000_0000`. Ignore any underscores when interpreting the value of a number.

Current status and anticipated changes

The token format defined within this specification has been superseded by the attestation token format defined in Arm’s Platform Security Architecture (PSA) Attestation Token [PSATOKEN]. A future update to this specification will incorporate the new token definition.

Feedback

We welcome feedback on the PSA Certified API documentation.

If you have comments on the content of this book, visit github.com/arm-software/psa-api/issues to create a new issue at the PSA Certified API GitHub project. Give:

- The title (Attestation API).
- The number and issue (IHI 0085 1.0.3).
- The location in the document to which your comments apply.
- A concise explanation of your comments.
We also welcome general suggestions for additions and improvements.
1 Introduction

1.1 About Platform Security Architecture

This document is one of a set of resources provided by Arm that can help organizations develop products that meet the security requirements of PSA Certified on Arm-based platforms. The PSA Certified scheme provides a framework and methodology that helps silicon manufacturers, system software providers and OEMs to develop more secure products. Arm resources that support PSA Certified range from threat models, standard architectures that simplify development and increase portability, and open-source partnerships that provide ready-to-use software. You can read more about PSA Certified here at www.psacertified.org and find more Arm resources here at developer.arm.com/platform-security-resources.

1.2 About the Attestation API

The interface described in this document is a PSA Certified API, that provides a verifiable report of the state of the platform. The platform attestation service is provided by the Platform Root of Trust and is described in Platform Security Model [PSM].

This document includes:

- A set of common use cases. See Use cases and rationale on page 10.
- Information about the attestation report and the format. See Initial Attestation report on page 12.

The Attestation API can be used either to directly produce verifiable evidence about the platform state in the context of a challenge-response interaction, or as a way to bootstrap trust in other attestation schemes. The PSA Certified framework provides the generic security features allowing OEM and service providers to integrate various attestation schemes on top of the Platform Root of Trust.

You can find additional resources relating to the Attestation API here at arm-software.github.io/psa-api/attestation, and find other PSA Certified APIs here at arm-software.github.io/psa-api.
2 Use cases and rationale

The following subsections describe the primary use cases that this version of Attestation API aims to support. Other use cases are also possible.

The Platform Root of Trust (PRoT) reports information, known as claims, that can be used to determine the exact implementation of the PRoT and its security state. If the PRoT loads other components then it also includes information about what it has loaded. Other components outside of the PRoT can add additional information to the report by calling the provided API, which will include and sign the additional information. The PRoT signs attestation reports using the Initial Attestation Key (IAK).

2.1 Device enrolment

Enrolment is the ability for an online service to enlist a device. For example, a generic connected sensor that becomes part of a company’s deployment. As part of the enrolment process, credentials need to be created for each device. However, the devices themselves need to be trustworthy to ensure that credentials are not leaked.

A common solution to this problem is to certify security hardware using third-party labs, who are trusted to deliver worthwhile certifications. By placing trust in evaluation reports (such as Common Criteria or PSA Certified), one can ascertain whether a Root of Trust exhibits important security properties. For example, one important property is the ability to generate a key pair of good quality (using a non-predictable random number generator) and store it in an isolated and tamper-proof area, which provides strong assurance that a device private key is only ever known by that device. Each device instance contains a protected attestation key that can be used to prove that they are a particular certified implementation.

During such an enrolment process, a device might generate a new key pair and create a Certificate Signing Request (CSR) or equivalent, containing:

- The public key of the generated key-pair.
- A proof of possession of the corresponding private key (in general this is the public key signed by the private key). This protects against man-in-the-middle attacks where an attacker can hijack the enrolment to insert their own public key into the device request.
- An initial attestation, in order for the recipient to assess how that particular combination of hardware and firmware can be trusted.

The CSR is then passed to a Certification Authority who can assign it an identity with the new service and then return an identity certificate signed using the private key of the Certification Authority. The Certification Authority may be operated by the company who owns the devices or operated by a trusted third party. Creating extra identities on devices is expected to be a routine operation.

If a device enforces a high level of isolation, where all applications execute within their own Secure Partition, then it allows several mutually-distrustful providers to install their applications side-by-side without having to worry about leaking assets from one application to another.

The attestation identity can be verified in an attestation process and checked against certification information. At the end of the process the credential manager can establish a secure connection to the attested endpoint, and deliver credentials. For example, these may be service access credentials.
2.2 Identifying certification

The combination of a hardware entity and the software installed on that entity can be certified to conform to some published security level.

Manufacturers of devices can advertise a security certification as an incentive to purchase their devices, or because it is a requirement from a regulator. To gain the certification a manufacturer can engage a test lab to verify the hardware and software combination of a device conforms to specific standards. Certification should not be declared by the device, instead it is a dynamic situation where the hardware and software state can be checked against the current known certification status for that combination.

The initial attestation report declares the state of the device to a verification service. The verification service can then:

- Verify the production status of the device identity. For example, to identify whether the device is in an inventory, and whether it is a secured production device or a development device.
- Verify the certification status of a device. This involves checking that all components are up to date, correctly signed, and certified to work together.

2.3 Integrity reporting

A party may want to check the received list of claims against a database of known measurements for each component in order to decide which level of trust should be applied. Additional information can be included, such as the version numbers for all software running on the device. As a minimum, the device provides a hash for each loaded component. Boot measurements are included in order to assess if there are obvious signs of tampering with the device firmware.

Initial attestation requires three services:

- Enrolment verification service enforcing policy as part of service enrolment of the device.
- Production verification service (OEM), providing the production state of an attestation identity
- Certification verification service (third party), verifying that all attested components are up to date, signed correctly, and certified to work together.

It is possible to further separate these roles. For example, there may be a separate software verification service.

These services can be hosted by different parties in online or offline settings:

- The first service requires generating a challenge, reading back the device's token, and validating the signature of the token.
- The second service may periodically log the current security state for all addressable devices and make that information available upon request. It does not require the knowledge of any pre-shared secret or a prior trust exchange with a device vendor. The various databases required for the full verification process may be local, replicated, or centralized, depending on the particular market.

Further information about using existing attestation protocols can be found in [PSM].
3 Initial Attestation report

This section begins with a description of the information model for the report and then describes the expected format.

3.1 Information model

The following table describes the mandatory and optional claims in the report:

<table>
<thead>
<tr>
<th>Claim</th>
<th>Mandatory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auth challenge</td>
<td>Yes</td>
<td>Input object from the caller. For example, this can be a cryptographic nonce or a hash of locally attested data. The length must be 32, 48, or 64 bytes. This is the auth_challenge parameter to \texttt{psa-initial-attest-get-token()}.</td>
</tr>
<tr>
<td>Instance ID</td>
<td>Yes</td>
<td>Represents the unique identifier of the instance:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When using an asymmetric key-pair for the \textit{Initial Attestation Key} (IAK), Arm recommends the Instance ID be a hash of the corresponding public key.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• When using a symmetric key for the IAK, Arm recommends that the Instance ID is always a double hash of the key, hence InstanceID = H(H(IAK)). This eliminates risks when exposing the key to different HMAC block size. For further information, read RFC2104.</td>
</tr>
<tr>
<td>Verification service indicator</td>
<td>No</td>
<td>A hint used by a relying party to locate a validation service for the token. The value is a text string that can be used to locate the service or a URL specifying the address of the service. A verifier may choose to ignore this claim in favor of other information.</td>
</tr>
<tr>
<td>Profile definition</td>
<td>No</td>
<td>Contains the name of a document that describes the ‘profile’ of the report. The document name may include versioning. The value for this specification is \texttt{PSA_IOT_PROFILE_1}.</td>
</tr>
<tr>
<td>Claim</td>
<td>Mandatory</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Implementation ID</td>
<td>Yes</td>
<td>Uniquely identifies the underlying Immutable Platform Root of Trust. A verification service can use this claim to locate the details of the verification process. Such details include the implementation's origin and associated certification state. The full definition is in [PSM].</td>
</tr>
<tr>
<td>Client ID</td>
<td>Yes</td>
<td>Represents the Partition ID of the caller. It is a signed integer whereby negative values represent callers from the NSPE and where positive IDs represent callers from the SPE. The value 0 is not permitted. The full definition of a Partition ID is provided by Arm® Platform Security Architecture Firmware Framework [PSA-FF-M]. It is essential that this claim is checked in the verification process to ensure that a security domain cannot spoof a report from another security domain.</td>
</tr>
</tbody>
</table>
| Security Lifecycle        | Yes       | Represents the current lifecycle state of the Platform Root of Trust (PRoT). The state is represented by an integer that is partitioned to convey a major state and a minor state. The major state is mandatory and defined by [PSM]. The minor state is optional and IMPLEMENTATION DEFINED. The PRoT security lifecycle state and implementation state are encoded as follows:  
  - version[15:8] — PRoT security lifecycle state  
  - version[7:0] — IMPLEMENTATION DEFINED state.  
  The PRoT security lifecycle states consist of the following values:  
    - PSA_LIFECYCLE_UNKNOWN (0x0000u)  
    - PSA_LIFECYCLE_ASSEMBLY_AND_TEST (0x1000u)  
    - PSA_LIFECYCLE_PSA_ROT_PROVISIONING (0x2000u)  
    - PSA_LIFECYCLE_SECURED (0x3000u)  
    - PSA_LIFECYCLE_NON_PSA_ROT_DEBUG (0x4000u)  
    - PSA_LIFECYCLE_RECOVERABLE_PSA_ROT_DEBUG (0x5000u)  
    - PSA_LIFECYCLE_DECOMMISSIONED (0x6000u)  
  For PSA Certified, a remote verifier can only trust reports from the PRoT when it has a major state that is SECURED or NON_PSA_ROT_DEBUG. |
| Hardware version          | No        | Provides metadata linking the token to the GDSII that went to fabrication for this instance. It can be used to link the class of chip and PRoT to the data on a certification website. It must be represented as a thirteen-digit [EAN-13]. |
### Table 4 (continued)

<table>
<thead>
<tr>
<th>Claim</th>
<th>Mandatory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boot seed</td>
<td>Yes</td>
<td>Represents a random value created at system boot time that can allow differentiation of reports from different boot sessions.</td>
</tr>
<tr>
<td>Software components</td>
<td>Yes (unless the No Software Measurements claim is specified)</td>
<td>A list of software components that represent all the software loaded by the PRoT. This claim is needed for the rules outlined in [PSM]. Each entry has the following fields: 1. Measurement type 2. Measurement value 3. Version 4. Signer ID 5. Measurement description The full definition of the software component is described in Software components. This claim is required to be compliant with [PSM].</td>
</tr>
<tr>
<td>No Software Measurements</td>
<td>Yes (if no software components specified)</td>
<td>In the event that the implementation does not contain any software measurements then the Software Components claim above can be omitted but instead it is mandatory to include this claim to indicate this is a deliberate state. This claim is intended for devices that are not compliant with [PSM].</td>
</tr>
</tbody>
</table>

#### 3.1.1 Software components

Each software component in the Software Components claim must include the required properties of the following table:

<table>
<thead>
<tr>
<th>Key ID</th>
<th>Type</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1      | Measurement type      | No       | A short string representing the role of this software component (e.g. 'BL' for boot loader). Expected types may include:  
  - BL (a bootloader)  
  - PRoT (a component of the Platform Root of Trust)  
  - ARoT (a component of the Application Root of Trust)  
  - App (a component of the NSPE application)  
  - TS (a component of a trusted subsystem) |
| 2      | Measurement value     | Yes      | Represents a hash of the invariant software component in memory at startup time. The value must be a cryptographic hash of 256 bits or stronger. |
| 3      | Reserved              | No       | Reserved                                                                                                                                 |

---

IHI 0085  
1.0.3  
Copyright © 2018-2020, 2022 Arm Limited and/or its affiliates  
Non-confidential  
Page 14
Table 5 (continued)

<table>
<thead>
<tr>
<th>Key ID</th>
<th>Type</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Version</td>
<td>No</td>
<td>The issued software version in the form of a text string. The value of this claim corresponds to the entry in the original signed manifest of the component.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This field must be present to be compliant with [PSM].</td>
</tr>
<tr>
<td>5</td>
<td>Signer ID</td>
<td>No</td>
<td>The hash of a signing authority public key for the software component. The value of this claim corresponds to the entry in the original manifest for the component.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This can be used by a verifier to ensure the components were signed by an expected trusted source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This field must be present to be compliant with [PSM].</td>
</tr>
<tr>
<td>6</td>
<td>Measurement description</td>
<td>No</td>
<td>Description of the software component, which represents the way in which the measurement value of the software component is computed. The value is a text string containing an abbreviated description (or name) of the measurement method which can be used to lookup the details of the method in a profile document. This claim may normally be excluded, unless there is an exception to the default measurement described in the profile for a specific component.</td>
</tr>
</tbody>
</table>

3.2 Report format and signing

This section describes the specific representation, encoding and signing of the information described in the Information Model.

3.2.1 Token encoding

The report is represented as a token, which must be formatted in accordance to *IETF Entity Attestation Token (EAT)* [EAT] draft specification. The token consists of a series of claims declaring evidence as to the nature of the instance of hardware and software. The claims are encoded with the *CBOR* format, defined in *Concise Binary Object Representation (CBOR)* [STD94].
3.2.2 Signing

The token is signed following the structure defined in CBOR Object Signing and Encryption (COSE): Structures and Process [STD96] specification:

- For asymmetric key algorithms, the signature structure must be COSE-Sign1. An asymmetric key algorithm is needed to achieve all the use cases defined in Use cases and rationale on page 10.
- For symmetric key algorithms, the structure must be COSE-Mac0.

Warning: A symmetric key is strongly discouraged due to the associated infrastructure costs for key management and operational complexities. It may also restrict the ability to interoperate with scenarios that involve third parties (see Use cases and rationale on page 10).

3.2.3 EAT standard claims

The token is modelled to include custom values that correspond to the following EAT standard claims (as expressed in the draft EAT proposal):

- nonce (mandatory); arm_psa_nonce is used instead
- UEID (mandatory); arm_psa_UEID is used instead

A future version of the profile, corresponding to an issued standard, might declare support for both custom and standard claims as a transitionary state towards exclusive use of standard claims.

3.2.4 EAT custom claims

The token can include the following EAT custom claims. Custom claims for the Attestation API have a root identity of -75000.

Some fields must be at least 32 bytes to provide sufficient cryptographic strength.

<table>
<thead>
<tr>
<th>Key ID</th>
<th>Type</th>
<th>Name</th>
<th>CBOR type</th>
</tr>
</thead>
<tbody>
<tr>
<td>-75000</td>
<td>Profile Definition</td>
<td>arm_psa_profile_id</td>
<td>Text string</td>
</tr>
<tr>
<td>-75001</td>
<td>Client ID</td>
<td>arm_psa_partition_id</td>
<td>Unsigned integer or Negative integer</td>
</tr>
<tr>
<td>-75002</td>
<td>Security Lifecycle</td>
<td>arm_psa_security_lifecycle</td>
<td>Unsigned integer</td>
</tr>
<tr>
<td>-75003</td>
<td>Implementation ID</td>
<td>arm_psaplementation_id</td>
<td>Byte string (&gt;=32 bytes)</td>
</tr>
<tr>
<td>-75004</td>
<td>Boot seed</td>
<td>arm_psa_boot_seed</td>
<td>Byte string (&gt;=32 bytes)</td>
</tr>
<tr>
<td>-75005</td>
<td>Hardware version</td>
<td>arm_psa_hw_version</td>
<td>Text string</td>
</tr>
<tr>
<td>Key ID</td>
<td>Type</td>
<td>Name</td>
<td>CBOR type</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------</td>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>-75006</td>
<td>Software components (compound map claim)</td>
<td>arm_psa_sw_components</td>
<td>Array of map entries. The map entries have the following types:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Text string (type)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Byte string (measurement, &gt;=32 bytes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Reserved</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Text string (version)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Byte string (signer ID, &gt;=32 bytes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. Text string (measurement description)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See Software components on page 14 for details.</td>
</tr>
<tr>
<td>-75007</td>
<td>No software measurements</td>
<td>arm_psa_no_sw_measurements</td>
<td>Unsigned integer (the recommended value is 1)</td>
</tr>
<tr>
<td>-75008</td>
<td>Auth challenge</td>
<td>arm_psa_nonce</td>
<td>Byte string</td>
</tr>
<tr>
<td>-75009</td>
<td>Instance ID</td>
<td>arm_psa_U Eid</td>
<td>Byte string (the type byte should be set to 0x01. The type byte is described in the [EAT] draft.)</td>
</tr>
<tr>
<td>-75010</td>
<td>Verification service indicator</td>
<td>arm_psa_origination</td>
<td>Text string</td>
</tr>
</tbody>
</table>

An example report can be found in Example report on page 24.
4 API reference

The Attestation API defines a header file that is provided by the implementation. The header is `psa/initial_attestation.h`.

All the elements are defined in the C language. The Attestation API makes use of standard C data types, including the fixed-width integer types from the ISO C99 specification update [C99].

4.1 API conventions

All functions return a status indication of type `psa_status_t`, which is defined by PSA Certified Status code API [PSA-STAT]. The value `0 (PSA_SUCCESS)` indicates successful operation, and a negative value indicates an error. Each API documents the specific error codes that might be returned, and the meaning of each error.

All parameters of pointer type must be valid, non-null pointers unless the pointer is to a buffer of length 0 or the function’s documentation explicitly describes the behavior when the pointer is null. For implementations where a null pointer dereference usually aborts the application, passing NULL as a function parameter where a null pointer is not allowed should abort the caller in the habitual manner.

Pointers to input parameters may be in read-only memory. Output parameters must be in writable memory. Output parameters that are not buffers must also be readable, and the implementation must be able to write to a non-buffer output parameter and read back the same value.

4.2 Status codes

The Attestation API uses the status code definitions that are shared with the other PSA Certified APIs. The following elements are defined in `psa/error.h` from PSA Certified Status code API [PSA-STAT] (previously defined in [PSA-FF-M]):

```c
typedef int32_t psa_status_t;
#define PSA_SUCCESS ((psa_status_t)0)
#define PSA_ERROR_GENERIC_ERROR ((psa_status_t)-132)
#define PSA_ERROR_INVALID_ARGUMENT ((psa_status_t)-135)
#define PSA_ERROR_BUFFER_TOO_SMALL ((psa_status_t)-138)
#define PSA_ERROR_SERVICE_FAILURE ((psa_status_t)-144)
```

These definitions must be available to an application that includes the `psa/initial_attestation.h` header file.

**Implementation note**

An implementation is permitted to define the status code interface elements within `psa/initial_attestation.h`, or to define them via inclusion of a `psa/error.h` header file that is shared with the implementation of other PSA Certified APIs.
4.3 General definitions

4.3.1 PSA_INITIAL_ATTEST_API_VERSION_MAJOR (macro)
The major version of this implementation of the Attestation API.

#define PSA_INITIAL_ATTEST_API_VERSION_MAJOR 1

4.3.2 PSA_INITIAL_ATTEST_API_VERSION_MINOR (macro)
The minor version of this implementation of the Attestation API.

#define PSA_INITIAL_ATTEST_API_VERSION_MINOR 0

4.3.3 PSA_INITIAL_ATTEST_MAX_TOKEN_SIZE (macro)
The maximum possible size of a token.

#define PSA_INITIAL_ATTEST_MAX_TOKEN_SIZE /* implementation-specific value */

The value of this constant is IMPLEMENTATION DEFINED.

4.4 Challenge sizes

The following constants define the valid challenge sizes that must be supported by the function
psa_initial_attest_get_token() and psa_initial_attest_get_token_size().
An implementation must not support other challenge sizes.

4.4.1 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_32 (macro)
A challenge size of 32 bytes (256 bits).

#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_32 (32u)

4.4.2 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_48 (macro)
A challenge size of 48 bytes (384 bits).

#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_48 (48u)
4.4.3 PSA_INITIAL_ATTEST_CHALLENGE_SIZE_64 (macro)

A challenge size of 64 bytes (512 bits).

#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_64 (64u)

4.5 Attestation

4.5.1 psa_initial_attest_get_token (function)

Retrieve the Initial Attestation Token.

```c
psa_status_t psa_initial_attest_get_token(const uint8_t *auth_challenge,
                                         size_t challenge_size,
                                         uint8_t *token_buf,
                                         size_t token_buf_size,
                                         size_t *token_size);
```

Parameters

- **auth_challenge**: Buffer with a challenge object. The challenge object is data provided by the caller. For example, it may be a cryptographic nonce or a hash of data (such as an external object record).
  
  If a hash of data is provided then it is the caller’s responsibility to ensure that the data is protected against replay attacks (for example, by including a cryptographic nonce within the data).

- **challenge_size**: Size of the buffer `auth_challenge` in bytes. The size must always be a supported challenge size. Supported challenge sizes are defined in `Challenge sizes on page 19`.

- **token_buf**: Output buffer where the attestation token is to be written.

- **token_buf_size**: Size of `token_buf`. The expected size can be determined by using the `psa_initial_attest_get_token_size` function.

- **token_size**: Output variable for the actual token size.

Outputs

- `*token_buf`: On success, the attestation token.

- `*token_size`: On success, the number of bytes written into `token_buf`.

Returns: `psa_status_t`

- **PSA_SUCCESS**: Action was performed successfully.

- **PSA_ERROR_SERVICE_FAILURE**: The implementation failed to fully initialize.

- **PSA_ERROR_BUFFER_TOO_SMALL**: `token_buf` is too small for the attestation token.

- **PSA_ERROR_INVALID_ARGUMENT**: The challenge size is not supported.

- **PSA_ERROR_GENERIC_ERROR**: An unspecified internal error has occurred.
**Description**
Retrieves the Initial Attestation Token. A challenge can be passed as an input to mitigate replay attacks.

**4.5.2 psa_initial_attest_get_token_size (function)**
Calculate the size of an Initial Attestation Token.

```c
psa_status_t psa_initial_attest_get_token_size(size_t challenge_size,
                                              size_t *token_size);
```

**Parameters**
- **challenge_size**
  - Size of a challenge object in bytes. This must be a supported challenge size as specified in [Challenge sizes on page 19](#).
- **token_size**
  - Output variable for the token size.

**Outputs**
- **token_size**
  - On success, the maximum size of an attestation token in bytes when using the specified `challenge_size`.

**Returns:**
- **psa_status_t**
  - **PSA_SUCCESS**
    - Action was performed successfully.
  - **PSA_ERROR_SERVICE_FAILURE**
    - The implementation failed to fully initialize.
  - **PSA_ERROR_INVALID_ARGUMENT**
    - The challenge size is not supported.
  - **PSA_ERROR_GENERIC_ERROR**
    - An unspecified internal error has occurred.

**Description**
Retrieve the exact size of the Initial Attestation Token in bytes, given a specific challenge size.
Appendix A: Example header file

Each implementation of the Attestation API must provide a header file named `psa/initial_attestation.h`, in which the interface elements in this specification are defined.

This appendix provides an example of the `psa/initial_attestation.h` header file with all of the API elements. This can be used as a starting point or reference for an implementation.

---

Note:

Not all of the API elements are fully defined. An implementation must provide the full definition. The header will not compile without these missing definitions, and might require reordering to satisfy C compilation rules.

---

A.1 psa/initial_attestation.h

```c
/* This file is a reference template for implementation of the
 * PSA Certified Attestation API v1.0.3
 */

#ifndef PSA_INITIAL_ATTESTATION_H
#define PSA_INITIAL_ATTESTATION_H

#include <stddef.h>
#include <stdint.h>

#ifdef __cplusplus
extern "C" {
#endif

#define PSA_INITIAL_ATTEST_API_VERSION_MAJOR 1
#define PSA_INITIAL_ATTEST_API_VERSION_MINOR 0
#define PSA_INITIAL_ATTEST_MAX_TOKEN_SIZE /* implementation-specific value */
#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_32 (32u)
#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_48 (48u)
#define PSA_INITIAL_ATTEST_CHALLENGE_SIZE_64 (64u)

psa_status_t psa_initial_attest_get_token(const uint8_t *auth_challenge,
                                           size_t challenge_size,
                                           uint8_t *token_buf,
                                           size_t token_buf_size,
                                           size_t *token_size);

psa_status_t psa_initial_attest_get_token_size(size_t challenge_size,
                                                size_t *token_size);

#ifdef __cplusplus
}
#endif
```

(continues on next page)
#endif

#endif // PSA_INITIAL_ATTESTATION_H
Appendix B: Example report

An example report is included here in extended CBOR diagnostic form for illustrative purposes:

```
18(  
   / protected / h'a10126' / {  
     \ alg \ 1: -7 \ ECDSA 256 \  
   } /,  
   / unprotected / {},  
   / payload / h'a93a000124fb5280000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f3a000124fa5820000102030405060708090a0b0c0d0e0 
0f101112131415161718191ab1bc1d1e1f3a000124fd8a4025820000102030405060  
708090a0b0c0d0e0f101112131415161718191ab1bc1d1e1f0465332e312e34055820 
000102030405060708090a0b0c0d0e0f101112131415161718191ab1c1d1e1f01624  
2ca4025820000102030405060708090a0b0c0d0e0f101112131415161718191ab1c1 
1d1e1f0463312e3165582000102030405060708090a0b0c0d0e0f101112131415161 
718191ab1bc1d1e1f01645052e3f544a02582000102030405060708090a0b0c0d0e0f 
030405060708090a0b0c0d0e0f101112131415161718191ab1bc1d1e1f046332e320 
5582000102030405060708090a0b0c0d0e0f101112131415161718191ab1c1d1e1f0 
0613417073a000124ff51930003a000124ff5820000102030405060708090a0b0c0d0 
e0f101112131415161718191ab1bc1d1e1f3a0001250116c7073615f766572696669 
666572696665726966657269666572696665726966657269666572696665726966657 
23a000124f8203a00012500582101000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f3a000124ff7715053415f496f545f5024f4694c455f 
31' /,  
   / arm_psa_boot_seed / -75004: h'000102030405060708090a0b0c0d0e0f10 
1112131415161718191ab1bc1d1e1f',  
   / arm_psa_implementation_id / -75003: h'000102030405060708090a0b0c0 
0d0e0f101112131415161718191ab1bc1d1e1f',  
   / arm_psa_sw_components / -75006: [  
     {  
       / measurement / 2: h'000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f',  
       / version / 4: "3.1.4",  
       / signerID / 5: h'000102030405060708090a0b0c0d0e0f101112131 
415161718191ab1bc1d1e1f',  
       / type / 1: "BL"  
     },  
     {  
       / measurement / 2: h'000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f',  
       / version / 4: "1.1",  
       / signerID / 5: h'000102030405060708090a0b0c0d0e0f101112131 
415161718191ab1bc1d1e1f',  
       / type / 1: "PRoT"  
     },  
     {  
       / measurement / 2: h'000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f',  
       / version / 4: "2.0",  
       / signerID / 5: h'000102030405060708090a0b0c0d0e0f101112131 
415161718191ab1bc1d1e1f',  
       / type / 1: "CBT"  
     },  
     {  
       / measurement / 2: h'000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f',  
       / version / 4: "0.1",  
       / signerID / 5: h'000102030405060708090a0b0c0d0e0f101112131 
415161718191ab1bc1d1e1f',  
       / type / 1: "CBT"  
     },  
     {  
       / measurement / 2: h'000102030405060708090a0b0c0d0e0f1011121 
31415161718191ab1bc1d1e1f',  
       / version / 4: "0.1",  
       / signerID / 5: h'000102030405060708090a0b0c0d0e0f101112131 
415161718191ab1bc1d1e1f',  
       / type / 1: "CBT"  
     }  
   }  
(continues on next page)
```
131415161718191a1b1c1d1e1f',
/ version / 4: "1.0",
/ signerID / 5: h'000102030405060708090a0b0c0d0e0f101112
415161718191a1b1c1d1e1f',
/ type / 1: "ARoT"
},
{
/ measurement / 2: h'000102030405060708090a0b0c0d0e0f101112
131415161718191a1b1c1d1e1f',
/ version / 4: "2.2",
/ signerID / 5: h'000102030405060708090a0b0c0d0e0f101112
415161718191a1b1c1d1e1f',
/ type / 1: "App"
}
],
/ arm_psa_security_lifecycle / -75002: 12288 / SECURED /
/ arm_psa_nonce / -75008: h'000102030405060708090a0b0c0d0e0f101112
2131415161718191a1b1c1d1e1f',
/ arm_psa_origination / -75010: "psa_verifier",
/ arm_psa_partition_id / -75001: -1,
/ arm_psa_UEID / -75009: h'01000102030405060708090a0b0c0d0e0f101112
1231415161718191a1b1c1d1e1f',
/ arm_psa_profile_id / -75005: "PSA_IOT_PROFILE_1"
}]
)
Appendix C: CDDL

The Concise Data Definition Language (CDDL) [RFC8610] definition of the PSA token is included here for reference:

```cddl
psa-token = {
    psa-nonce-claim,
    psa-client-id,
    psa-instance-id,
    psa-implementation-id,
    psa-hardware-version,
    psa-lifecycle,
    psa-boot-seed,
    ( psa-software-components // psa-no-sw-measurement ),
    psa-profile,
    psa-verification-service-indicator,
}

arm_psa_profile_id = -75000
arm_psa_partition_id = -75001
arm_psa_security_lifecycle = -75002
arm_psa_implementation_id = -75003
arm_psa_boot_seed = -75004
arm_psa_hw_version = -75005
arm_psa_sw_components = -75006
arm_psa_no_sw_measurements = -75007
arm_psa_nonce = -75008
arm_psa_U Eid = -75009
arm_psa_origination = -75010

psa-boot-seed-type = bytes .size 32
psa-hash-type = bytes .size 32 / bytes .size 48 / bytes .size 64

psa-boot-seed = (arm_psa_boot_seed => psa-boot-seed-type)

psa-client-id-nspe-type = -2147483648...0
psa-client-id-spe-type = 1..2147483647

psa-client-id-type = psa-client-id-nspe-type / psa-client-id-spe-type

psa-client-id = (arm_psa_partition_id => psa-client-id-type)

psa-hardware-version-type = text .regexp "^[0-9]\{13\}"
```

(continues on next page)
psa-hardware-version = (
    ? arm_psa_hw_version => psa-hardware-version-type
)  

psa-implementation-id-type = bytes .size 32

psa-implementation-id = (  
    arm_psa_implementation_id => psa-implementation-id-type
)

psa-instance-id-type = bytes .size 33

psa-instance-id = (  
    arm_psa_UUID => psa-instance-id-type
)

psa-no-sw-measurements-type = 1

psa-no-sw-measurement = (  
    arm_psa_no_sw_measurements => psa-no-sw-measurements-type
)

psa-nonce-claim = (  
    arm_psa_nonce => psa-hash-type
)

psa-profile-type = "PSA_IOT_PROFILE_1"

psa-profile = (  
    ? arm_psa_profile_id => psa-profile-type
)

psa-lifecycle-unknown-type = 0x0000..0x00ff
psa-lifecycle-assembly-and-test-type = 0x1000..0x10ff
psa-lifecycle-psa-rot-provisioning-type = 0x2000..0x20ff
psa-lifecycle-secured-type = 0x3000..0x30ff
psa-lifecycle-non-psa-rot-debug-type = 0x4000..0x40ff
psa-lifecycle-recoverable-psa-rot-debug-type = 0x5000..0x50ff
psa-lifecycle-decommissioned-type = 0x6000..0x60ff

psa-lifecycle-type =  
    psa-lifecycle-unknown-type /  
    psa-lifecycle-assembly-and-test-type /  
    psa-lifecycle-psa-rot-provisioning-type /  
    psa-lifecycle-secured-type /  
    psa-lifecycle-non-psa-rot-debug-type /  
    psa-lifecycle-recoverable-psa-rot-debug-type /  
    psa-lifecycle-decommissioned-type

psa-lifecycle = (  
    arm_psa_security_lifecycle => psa-lifecycle-type
)

(continues on next page)
psa-software-component = {
    ? 1 => text, ; measurement type
    2 => psa-hash-type, ; measurement value
    ? 4 => text, ; version
    5 => psa-hash-type, ; signer id
    ? 6 => text, ; measurement description
}

psa-software-components = (
    arm_psa_sw_components => [ + psa-software-component ]
)

psa-verification-service-indicator-type = text

psa-verification-service-indicator = (
    ? arm_psa_origination => psa-verification-service-indicator-type
)

# Appendix D: Document history

<table>
<thead>
<tr>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-02-25</td>
<td>1.0 Beta 0</td>
</tr>
<tr>
<td></td>
<td>- First public version for review</td>
</tr>
<tr>
<td>2019-06-12</td>
<td>1.0 Release 0 (1.0.0)</td>
</tr>
<tr>
<td></td>
<td>- First stable release</td>
</tr>
<tr>
<td></td>
<td>- The API functions now use the shared psa_status_t return type.</td>
</tr>
<tr>
<td></td>
<td>- Error values now use shared error codes, which are now defined in psa/error.h.</td>
</tr>
<tr>
<td></td>
<td>- Input parameters are now separate from output parameters. There are no longer any in/out parameters.</td>
</tr>
<tr>
<td></td>
<td>- Size types have been replaced with size_t instead of uint32_t.</td>
</tr>
<tr>
<td></td>
<td>- Some parameter names have been changed to improve legibility.</td>
</tr>
<tr>
<td></td>
<td>- The description of the Implementation ID claim has been rewritten to better match the definition in PSM.</td>
</tr>
<tr>
<td></td>
<td>- Signer ID is no longer a mandatory part of the Software Components claim.</td>
</tr>
<tr>
<td></td>
<td>- However, it is needed for PSM compliance.</td>
</tr>
<tr>
<td></td>
<td>- Explicitly describe which optional claims are required for PSM compliance.</td>
</tr>
<tr>
<td></td>
<td>- Added lifecycle state (PSA_LIFECYCLE.Assembly_and_TEST).</td>
</tr>
<tr>
<td></td>
<td>- Clarifications and improvements to the description of some API elements and to the structure of the document.</td>
</tr>
<tr>
<td></td>
<td>- Updated CBOR example in the appendix.</td>
</tr>
<tr>
<td></td>
<td>- Added macro PSA_INITIAL_ATTEST_MAX_TOKEN_SIZE.</td>
</tr>
<tr>
<td>2019-08-16</td>
<td>1.0 Release 1 (1.0.1)</td>
</tr>
<tr>
<td></td>
<td>- Fixed typos and descriptions based on feedback.</td>
</tr>
<tr>
<td></td>
<td>- Recommend type byte 0x01 for arm_psa_U Eid.</td>
</tr>
<tr>
<td></td>
<td>- Remove erroneous guidance regarding EAT’s origination claim - it should not be used to find a verification service.</td>
</tr>
<tr>
<td>2020-02-06</td>
<td>1.0 Release 2 (1.0.2)</td>
</tr>
<tr>
<td></td>
<td>- Clarify the claim number of Instance ID</td>
</tr>
<tr>
<td></td>
<td>- Permit COSE-Mac0 for signing tokens (with appropriate warning)</td>
</tr>
<tr>
<td></td>
<td>- Update URLs</td>
</tr>
<tr>
<td>Date</td>
<td>Changes</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2022-10-17</td>
<td><strong>1.0 Release 3 (1.0.3)</strong></td>
</tr>
<tr>
<td></td>
<td>- Relicensed the document under Attribution-ShareAlike 4.0 International with a patent license derived from Apache License 2.0. See License on page iv.</td>
</tr>
<tr>
<td></td>
<td>- Fix CBOR type of arm_psa_origination to text string. Spec and example were in conflict, and the example was correct.</td>
</tr>
<tr>
<td></td>
<td>- Added CDDL definition to the appendices, which can be helpful to developers.</td>
</tr>
<tr>
<td></td>
<td>- Instance ID definition for symmetric keys has been improved. The specific constructions are now recommended rather than normative.</td>
</tr>
<tr>
<td></td>
<td>- Clarified the optionality of map entries in the Software Components claim. See EAT custom claims on page 16.</td>
</tr>
</tbody>
</table>