

FIDO Metadata Service

FIDO Alliance Proposed Standard 11 April 2017

This version:

https://fidoalliance.org/specs/fido-u2f-v1.2-ps-20170411/fido-metadata-service-v1.2-ps-20170411.html Previous version:

https://fidoalliance.org/specs/fido-uaf-v1.0-ps-20141208/fido-uaf-metadata-service-v1.0-ps-20141208.html **Editor:**

Rolf Lindemann, Nok Nok Labs, Inc.

Contributors:

Brad Hill, PayPal, Inc.

Davit Baghdasaryan, Nok Nok Labs, Inc.

The English version of this specification is the only normative version. Non-normative <u>translations</u> may also be available.

Copyright © 2013-2017 FIDO Alliance All Rights Reserved.

Abstract

The FIDO Authenticator Metadata Specification defines so-called "Authenticator Metadata" statements. The metadata statements contain the "Trust Anchor" required to validate the attestation object, and they also describe several other important characteristics of the authenticator.

The metadata service described in this document defines a baseline method for relying parties to access the latest metadata statements.

Status of This Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current FIDO Alliance publications and the latest revision of this technical report can be found in the <u>FIDO Alliance specifications index</u> at https://www.fidoalliance.org/specifications/.

This document was published by the $\underline{\mathsf{FIDO}}$ Alliance as a Proposed Standard. If you wish to make comments regarding this document, please $\underline{\mathsf{Contact}}$ Us. All comments are welcome.

Implementation of certain elements of this Specification may require licenses under third party intellectual property rights, including without limitation, patent rights. The FIDO Alliance, Inc. and its Members and any other contributors to the Specification are not, and shall not be held, responsible in any manner for identifying or failing to identify any or all such third party intellectual property rights.

THIS FIDO ALLIANCE SPECIFICATION IS PROVIDED "AS IS" AND WITHOUT ANY WARRANTY OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY EXPRESS OR IMPLIED WARRANTY OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This document has been reviewed by FIDO Aliance Members and is endorsed as a Proposed Standard. It is a stable document and may be used as reference material or cited from another document. FIDO Alliance's role in making the Recommendation is to draw attention to the specification and to promote its widespread deployment.

Table of Contents

- 1.1 Key Words
- 2. Overview
 - 2.1 Scope
 - 2.2 Detailed Architecture
- 3. Metadata Service Details
 - 3.1 Metadata TOC Format
 - 3.1.1 Metadata TOC Payload Entry dictionary
 - 3.1.1.1 Dictionary MetadataTOCPayloadEntry Members
 - 3.1.2 StatusReport dictionary
 - 3.1.2.1 Dictionary StatusReport Members
 - 3.1.3 AuthenticatorStatus enum
 - 3.1.4 RogueListEntry dictionary
 - 3.1.4.1 Dictionary RogueListEntry Members
 - 3.1.5 Metadata TOC Payload dictionary
 - 3.1.5.1 Dictionary MetadataTOCPayload Members
 - 3.1.6 Metadata TOC
 - 3.1.6.1 Examples
 - 3.1.7 Metadata TOC object processing rules
- 4. Considerations
- A. References
 - A.1 Normative references
 - A.2 Informative references

1. Notation

Type names, attribute names and element names are written ascode.

String literals are enclosed in "", e.g. "UAF-TLV".

In formulas we use "I" to denote byte wise concatenation operations.

The notation base64url(byte[8..64]) reads as 8-64 bytes of data encoded in base64url, "Base 64 Encoding with URL and Filename Safe Alphabet" [RFC4648] without padding.

Following [WebIDL-ED], dictionary members are optional unless they are explicitly marked as required.

WebIDL dictionary members must not have a value of null.

Unless otherwise specified, if a WebIDL dictionary member is DOMString, it must not be empty.

Unless otherwise specified, if a WebIDL dictionary member is a List, it must not be an empty list.

UAF specific terminology used in this document is defined in [FIDOGlossary].

All diagrams, examples, notes in this specification are non-normative.

NOTE

Note: Certain dictionary members need to be present in order to comply with FIDO requirements. Such members are marked in the WebIDL definitions found in this document, as required. The keyword required has been introduced by [WebIDL-ED], which is a work-in-progress. If you are using a WebIDL parser which implements [WebIDL], then you may remove the keyword required from your WebIDL and use other means to ensure those fields are present.

1.1 Key Words

The key words "must", "must not", "required", "shall", "shall not", "should", "should not", "recommended", "may", and "optional" in this document are to be interpreted as described in [RFC2119].

2. Overview

This section is non-normative.

[FIDOMetadataStatement] defines authenticator metadata statements.

These metadata statements contain the trust anchor required to verify the attestation object (more specifically the

KeyRegistrationData object), and they also describe several other important characteristics of the authenticator, including supported authentication and registration assertion schemes, and key protection flags.

These characteristics can be used when defining policies about which authenticators are acceptable for registration or authentication.

The metadata service described in this document defines a baseline method for relying parties to access the latest metadata statements.

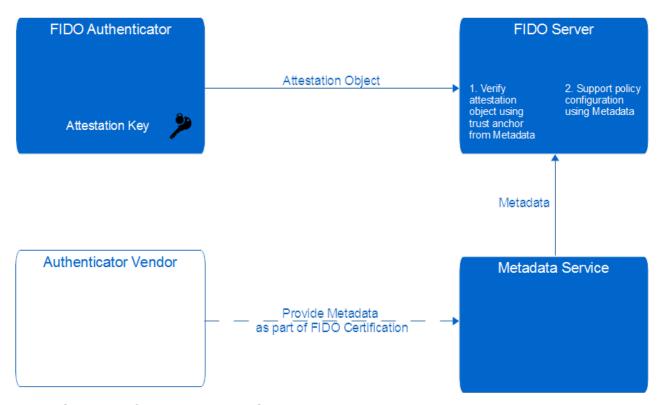


Fig. 1 FIDO Metadata Service Architecture Overview

2.1 Scope

This document describes the FIDO Metadata Service architecture in detail and it defines the structure and interface to access this service. It also defines the flow of the metadata related messages and presents the rationale behind the design choices.

2.2 Detailed Architecture

The metadata "table-of-contents" (TOC) file contains a list of metadata statements related to the authenticators known to the FIDO Alliance (FIDO Authenticators).

The FIDO Server downloads the metadata TOC file from a well-known FIDO URL and caches it locally.

The FIDO Server verifies the integrity and authenticity of this metadata TOC file using the digital signature. It then iterates through the individual entries and loads the metadata statements related to authenticator AAIDs relevant to the relying party.

Individual metadata statements will be downloaded from the URL specified in the entry of the metadata TOC file, and may be cached by the FIDO Server as required.

The integrity of the metadata statements will be verified by the FIDO Server using the hash value included in the related entry of the metadata TOC file.

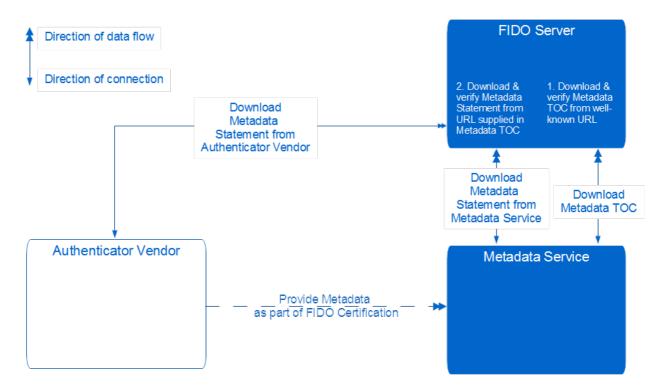


Fig. 2 FIDO Metadata Service Architecture

The single arrow indicates the direction of the network connection, the double arrow indicates the direction of the data flow.

NOTE

The metadata TOC file is freely accessible at a well-known URL published by the FIDO Alliance.

NOTE

The relying party decides how frequently the metadata service is accessed to check for metadata TOC updates.

3. Metadata Service Details

This section is normative.

NOTE

The relying party can decide whether it wants to use the metadata service and whether or not it wants to accept certain authenticators for registration or authentication.

The relying party could also obtain metadata directly from authenticator vendors or other trusted sources.

3.1 Metadata TOC Format

NOTE

The metadata service makes the metadata TOC object (see Metadata TOC) accessible to FIDO Servers.

This object is a "table-of-contents" for metadata, as it includes the AAID, the download URL and the hash value of the individual metadata statements. The TOC object contains one signature.

3.1.1 Metadata TOC Payload Entry dictionary

Represents the MetadataTOCPayloadEntry

WebIDL

```
dictionary MetadataTOCPayloadEntry {
    AAID
    AAGUID
                            aaguid;
    DOMString[]
                             attestationCertificateKeyIdentifiers;
    required DOMString
                            hash;
    required DOMString
                            url:
    required StatusReport[] statusReports;
    required DOMString
                             timeOfLastStatusChange;
    DOMString
                            rogueListURL;
    DOMString
                            rogueListHash;
};
```

3.1.1.1 Dictionary MetadataTOCPayloadEntry Members

aaid of type AAID

The AAID of the authenticator this metadata TOC payload entry relates to. See [UAFProtocol] for the definition of the AAID structure. This field must be set if the authenticator implements FIDO UAF.

NOTE

FIDO UAF authenticators support AAID, but they don't support AAGUID.

aaguid of type AAGUID

The Authenticator Attestation GUID. See FIDOKeyAttestation] for the definition of the AAGUID structure. This field must be set if the authenticator implements FIDO 2.

NOTE

FIDO 2 authenticators support AAGUID, but they don't support AAID.

attestationCertificateKeyIdentifiers Of type array of DOMString

A list of the attestation certificate public key identifiers encoded as hex string. This value must be calculated according to method 1 for computing the keyldentifier as defined in [RFC5280] section 4.2.1.2. The hex string must not contain any non-hex characters (e.g. spaces). All hex letters must be lower case. This field must be set if neither aaid nor aguid are set. Setting this field implies that the attestation certificate(s) are dedicated to a single authenticator model.

NOTE

FIDO U2F authenticators do not support AAID nor AAGUID, but they use attestation certificates dedicated to a single authenticator model.

hash of type required DOMString

```
base64url(string[1..512])
```

The hash value computed over the base64url encoding of the UTF-8 representation of the JSON encoded metadata statement available at url and as defined in [FIDOMetadataStatement]. The hash algorithm related to the signature algorithm specified in the JWTHeader (see Metadata TOC) must be used.

NOTE

This method of base64url encoding the UTF-8 representation is also used by JWT [JWT] to avoid encoding ambiguities.

url of type required DOMString

Uniform resource locator (URL) of the encoded metadata statement for this authenticator model (identified by its AAID, AAGUID or attestationCertificateKeyIdentifier). This URL must point to the base64url encoding of the UTF-8 representation of the JSON encoded metadata statement as defined in [FIDOMetadataStatement].

This method of the base64url encoding the UTF-8 representation is also used by JWT [JWT] to avoid encoding ambiguities.

statusReports of type array of required StatusReport

An array of status reports applicable to this authenticator.

timeOfLastStatusChange Of type required DOMString

ISO-8601 formatted date since when the status report array was set to the current value.

rogueListurL of type DOMString

URL of a list of rogue (i.e. untrusted) individual authenticators.

rogueListHash of type DOMString base64url(string[1..512])

The hash value computed over the Base64url encoding of the UTF-8 representation of the JSON encoded rogueList available at rogueListURL (with type rogueListEntry[]). The hash algorithm related to the signature algorithm specified in the JWTHeader (see Metadata TOC) must be used.

This hash value must be present and non-empty whenever rogueListurL is present.

NOTE

This method of base64url-encoding the UTF-8 representation is also used by JWT [JWT] to avoid encoding ambiguities.

EXAMPLE 1: UAF Metadata TOC Payload

NOTE

The character # is a reserved character and not allowed in URLs RFC3986]. As a consequence it has been replaced by its hex value %x23.

The authenticator vendors can decide to let the metadata service publish its metadata statements or to publish metadata statements themselves. Authenticator vendors can restrict access to the metadata statements they publish themselves.

3.1.2 StatusReport dictionary

NOTE

Contains an AuthenticatorStatus and additional data associated with it, if any.

New StatusReport entries will be added to report known issues present in firmware updates.

The latest statusReport entry must reflect the "current" status. For example, if the latest entry has status USER_VERIFICATION_BYPASS, then it is recommended assuming an increased risk associated with all authenticators of this AAID; if the latest entry has status UPDATE_AVAILABLE, then the update is intended to address at least all previous issues reported in this StatusReport dictionary.

WebIDL

```
dictionary StatusReport {
    required AuthenticatorStatus
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
    DOMString
};
```

3.1.2.1 Dictionary **StatusReport** Members

status of type required AuthenticatorStatus

Status of the authenticator. Additional fields may be set depending on this value.

effectiveDate of type DOMString

ISO-8601 formatted date since when the status code was set, if applicable. If no date is given, the status is assumed to be effective while present.

certificate of type DOMString

Base64-encoded [RFC4648] (not base64url!) DER [ITU-X690-2008] PKIX certificate value related to the current status, if applicable.

NOTE

As an example, this could be an Attestation Root Certificate (see [FIDOMetadataStatement]) related to a set of compromised authenticators (ATTESTATION_KEY_COMPROMISE).

url of type DOMString

HTTPS URL where additional information may be found related to the current status, if applicable.

NOTE

For example a link to a web page describing an available firmware update in the case of status update_available, or a link to a description of an identified issue in the case of status USER VERIFICATION BYPASS.

3.1.3 AuthenticatorStatus enum

This enumeration describes the status of an authenticator model as identified by its AAID and potentially some additional information (such as a specific attestation key).

WebIDL

```
enum AuthenticatorStatus {
    "NOT_FIDO_CERTIFIED",
    "FIDO_CERTIFIED",
    "USER_VERIFICATION_BYPASS",
    "ATTESTATION_KEY_COMPROMISE",
    "USER_KEY_REMOTE_COMPROMISE",
    "USER_KEY_PHYSICAL_COMPROMISE",
    "UPDATE_AVAILABLE",
    "REVOKED",
    "SELF_ASSERTION_SUBMITTED",
    "FIDO_SECURITY_CERTIFIED_L1",
    "FIDO_SECURITY_CERTIFIED_L2",
    "FIDO_SECURITY_CERTIFIED_L3",
    "FIDO_SECURITY_CERTIFIED_L4"
};
```

Enumeration description	
NOT_FIDO_CERTIFIED	This authenticator is not FIDO certified - no functional and no security certification.
FIDO_CERTIFIED	This authenticator has passed FIDO functional certification.
USER_VERIFICATION_BYPASS	Indicates that malware is able to bypass the user verification. This means that the authenticator could be used without the user's consent and potentially even

	without the user's knowledge.
ATTESTATION_KEY_COMPROMISE	Indicates that an attestation key for this authenticator is known to be compromised. Additional data should be supplied, including the key identifier and the date of compromise, if known.
USER_KEY_REMOTE_COMPROMISE	This authenticator has identified weaknesses that allow registered keys to be compromised and should not be trusted. This would include both, e.g. weak entropy that causes predictable keys to be generated or side channels that allow keys or signatures to be forged, guessed or extracted.
USER_KEY_PHYSICAL_COMPROMISE	This authenticator has known weaknesses in its key protection mechanism(s) that allow user keys to be extracted by an adversary in physical possession of the device.
UPDATE_AVAILABLE	A software or firmware update is available for the device. Additional data should be supplied including a URL where users can obtain an update and the date the update was published.
	When this code is used, then the field authenticatorversion in the metadata Statement [FIDOMetadataStatement] must be updated, if the update fixes severe security issues, e.g. the ones reported by preceding StatusReport entries with status code user_verification_bypass, attestation_key_compromise, user_key_remote_compromise, user_key_physical_compromise, revoked.
	NOTE Relying parties might want to inform users about available firmware updates.
REVOKED	The FIDO Alliance has determined that this authenticator should not be trusted for any reason, for example if it is known to be a fraudulent product or contain a deliberate backdoor.
SELF_ASSERTION_SUBMITTED	The authenticator vendor has completed and submitted the self-certification checklist to the FIDO Alliance. If this completed checklist is publicly available, the URL will be specified in <pre>StatusReport.url</pre> .
FIDO_SECURITY_CERTIFIED_L1	The authenticator has passed a sanctioned third party security validation according to FIDO level 1.
FIDO_SECURITY_CERTIFIED_L2	The authenticator has passed a sanctioned third party security validation according to FIDO level 2.
FIDO_SECURITY_CERTIFIED_L3	The authenticator has passed a sanctioned third party security validation according to FIDO level 3.
FIDO_SECURITY_CERTIFIED_L4	The authenticator has passed a sanctioned third party security validation according to FIDO level 4.

More values might be added in the future. FIDO Servers must silently ignore all unknown AuthenticatorStatus values.

3.1.4 RogueListEntry dictionary

NOTE

Contains a list of individual authenticators known to be rogue.

New RogueListEntry entries will be added to report new individual authenticators known to be rogue.

Old RogueListEntry entries will be removed if the individual authenticator is known to not be rogue any longer.

WebIDL

```
dictionary RogueListEntry {
    required DOMString sk;
    required DOMString date;
};
```

3.1.4.1 Dictionary RogueListEntry Members

sk of type required DOMString
Base64url encoding of the rogue authenticator's secret key (sk value, see [FIDOEcdaaAlgorithm], section ECDAA Attestation).

In order to revoke an individual authenticator, its secret key (sk) must be known.

date of type required DOMString

ISO-8601 formatted date since when this entry is effective.

3.1.5 Metadata TOC Payload dictionary

Represents the MetadataTOCPayload

WebIDL

3.1.5.1 Dictionary MetadataTOCPayload Members

no of type required Number

The serial number of this UAF Metadata TOC Payload. Serial numbers must be consecutive and strictly monotonic, i.e. the successor TOC will have a no value exactly incremented by one.

nextUpdate of type required DOMString

ISO-8601 formatted date when the next update will be provided at latest.

```
entries of type array of required MetadataTOCPayloadEntry
```

List of zero or more MetadataTOCPayloadEntry objects.

3.1.6 Metadata TOC

The metadata table of contents (TOC) is a JSON Web Token (see JWT] and JWS]).

It consists of three elements:

- The base64url encoding, without padding, of the UTF-8 encoded JWT Header (see example below),
- the base64url encoding, without padding, of the UTF-8 encoded UAF Metadata TOC Payload (see example at the beginning of section <u>Metadata TOC Format</u>),
- and the base64url-encoded, also without padding, JWS Signature [JWS] computed over the to-be-signed payload, i.e.

```
\verb|tbsPayload| = \verb|EncodedJWTHeader| | "." | EncodedMetadataTOCPayload|
```

All three elements of the TOC are concatenated by a period ("."):

```
MetadataTOC = EncodedJWTHeader | "." | EncodedMetadataTOCPayload | "." | EncodedJWSSignature
```

The hash algorithm related to the signing algorithm specified in the JWT Header (e.g. SHA256 in the case of "ES256") must also be used to compute the hash of the metadata statements (see section Metadata TOC Payload Entry Dictionary).

3.1.6.1 Examples

This section is non-normative.

EXAMPLE 3: Encoded Metadata Statement

Z05WOkFNTOOKRiFOaGJYOnNaU0JCZEhSbGMzUmhkR2x2YmlCU2TvOTBNU113RkFZRFZRUUtEOTFH U1VSUE1FRNNiR2xoYm10bA0KTVJFd0R3WURWUVFMREFoV1FVWWdWRmRITERFU01CQUdBMVVFQnd3 SlvHRnNieUJCYkhSdk1Rc3dDUv1Ev1FRSQ0KREFKRFFURUxNQWtHQTFVRUJoTUNWVk13SGhjTk1U UXdOakU0TVRNek16TX1XaGNOTkRFeE1UQXpNVE16TXpNeQ0KV2pCN01TQXdIZ11EV1FRRERCZFRZ VzF3YkdVZ1FYUjBaWE4wWVhScGIyNGdVbT12ZERFV01CUUdBMVVFQ2d3Tg0KUmtsRVR5QkJiR3hw WVc1alpURVJNQThHQTFVRUN3d01WVUZHSUZSWFJ5d3hFakFRQmdOVkJBY01DVkJoYkc4Zw0KUVd4 MGJ6RUxNQWtHQTFVRUNBd0NRMEV4Q3pBSkJnTlZCQVlUQWxWVE1Ga3dFd1lIS29aSXpqMENBUVlJ S29aSQ0KemowREFRY0RRZ0FFSDhodjJEMEhYYTU5L0JtcFE3UlplaEwvRk1HekZkMVFCZz12QVVw TlozYWpudVE5NFBSNw0KYU16SDMzb1VTQnI4ZkhZRHJxT0JiNThweEdxSEpSeVgvNk5RTUU0d0hR WURWUjBPQkJZRUZQb0hBM0NMaHhGYg0KQzBJdDd6RTR3OGhrNUVKL01COEdBMVVkSXdRWU1CYUFG UG9IQTNDTGh4RmJDME10N3pFNHc4aGs1RUovTUF3Rw0KQTFVZEV3UUZNQU1CQWY4d0NnWU1Lb1pJ emowRUF3SURTQUF3U1FJaEFKMDZRU1h0OWloSWJFS11LSWpzUGtyaQ0KVmRMSWd0ZnNiRFN1N0Vy SmZ6cjRBaUJxb11DWmYwK3pJNTVhUWVBSGpJekE5WG02M3JydUF4Qlo5cHM5ejJYTg0KbFE9PSIs DQOGICJEZXNjcmlwdGlvbiI6ICJGSURPIEFsbGlhbmNlIFNhbXBsZSBVQUYgQXV0aGVudGljYXRvciIsDQogICJVc2VyVmVyaWZpY2F0aW9uTWV0aG9kcyI6IDIsDQogICJWYWxpZEF0dGFjaGllbnRU eXBlcyI6IDEsDQogICJLZXIQcm90ZWN0aW9uIjogNiwNCiAgIk1hdGNoZXJQcm90ZWN0aW9uIjog MiwNCiAgIlNlY3VyZURpc3BsYXkiOiA0LA0KICAiU2VjdXJlRGlzcGxheUNvbnRlbnRUeXBlcyI6 IFsiaWlhZ2UvcG5n1l0sDQogICJTZWN1cmVEaXNwbGF5UE5HQ2hhcmFjdGVyaXN0aWNzIjogW1sw LDASMSw2NCwwLDASMSwyMjQsMTYsMiwwLDASMF1dLA0KICAiaXNTZWNvbmRGYWN0b3JPbmx5IjogImzhbHnlIiwNCiAgIkljb24iOiAiZGF0YTppbWFnZS9wbmc7YmFzZTY0LGlWQk9SdzBLR2dvQUFB QU5TVWhFVWdBQUFFOEFBQUF2Q0FZQUFBQ213SmZjQUFBQUFYT1NSME1BcnM0YzzRQUFBQVJuUVUxQkFBQ3gNCmp3djhzUVVBQUFBSmNFaFpjd0FBRHNNQUFBN0RBY2R2cUdRQUFBYWhTVVJCVkdoRDdacjVieFJsR01mOUt6VE14QU0vWUVoRTJXN3ANClFaY1dLS0JjbFNwSEFUbEVMQVJFN2tORUNDQTNGa1dLMENLS1NDRk1zS0JjZ1zDRFdHTkVTZEFZaWR3Z2dnSkJpUmlNaEZjLzR3eTqNCjq4NHp10U5k bG5HVGZaSlAybjNuTysrODg5MzNmdmVCQngrUHFDekprVFV2QmJMbXBVRFd2Q1RJbXBjQ1NadlhM Q2RYOVIwNVNrMrkNCmJiNWF0zjU5OWZHKy9lckE1NDFxNDdhUDFMTFzhOVNJeVZOVWk4SWk4ZDVr R1RzaTMwTkZ2N2Fp0W43UVpQTXdiZH1zMmVyVTJYTXENC1VkeTgrWmNhTm1HaW1F0H1YTjNSVWQz
YTE4bkYwZ1Vsb3ZaKzBDVHpXcGQyVmorzU9tMwJFeXk2RHg0aTVwVU1HV3Z1bzUwNnEyMjcNCmR0
dVdCSXVmZn12b1dwVjBGUE5MaG93MTc1MU5tMjFMdlBIM3JWdFdqZno2NkxmcWw4dFg3R1JsOV1G
U1hzbVNzZWI5Y2VPR2JZazcNCk1OVWNHUGc4WnNiTWU5cmZRVWFhVi9KTVg5c3FkekRDU3ZwMGta SG1UWmc5eDdiTEhjTW5UaGIxNmVKK21WZ1FxOHlhVVpRTkc2NGkNClhaKzAva3E2dU9aRk8wUXRh dGRXS2ZYblJROTlCajkxUjVPSUZuazU0ak4wbWtVaXFsTzNYRFcrTWwrOThtS0I2dFc3cldwWmNQ YysNCjB6ZzR0THJZbFVjODZFNmVHRGpJTXViVnBjdXN1YXJmZ01ZR1JrNmJyaFpWci9KY0h6b29M NzU1MGplzExFeG9wV2NBcGkyWlVxaHUNCjdKTHZyVnNRVTgxemt6T1BlzW1NU112VnVRc1g3UGJp RFFZNUp2Wm9uZnRLKzFWWThIOXV0eDUzMGgwb2Iram1SWXFqNm91YV12RWUNCm5XL1dsWWpwOGN3Yk1tNjgydFB3cVcxUjR0ai8yU0gxM01SS1lsNG1vWnZYcG1TcURyN2RYdFFIeGEvUEszLytCV3NL MWRUZOhlN1YNCjhOUJozYndGa3dwRnJVT1E1MHMxcjNsZXZtOHpaY3ExNytCQmF3N0s4bEVLNXF6 alllYXJrOUE4cDdQM0d6REsrbmQzRFFvdys2VUMNCjhTVk44MmlldjM4aW03TnRhWHRWMUNWcTZS Z3c0cGtzbWJkaTNidTJEZTdZZmFCQnhjcWZ2cVByVWpGUU5UUTIybGZkVVZWVDY4c1QNCkpLRjVE blntvWpnZHFnNG1TuzlwbXNmREpSMOc2VG9IMGlXOWFWN0xXTEh2WEtsbFREdDBMVEF0allJYWFt cDFRa1Z2Kyt1eUdVeFYNCmRKMEROV1hTbStiMXFSeHBsODRkZGZYMUxwMU8vZDY5dHNvZDB2czVo $R3J10Xh10\bar{G}8rznBMUjFjR2h0VEQ2WjU3Qz1LTVdYZWZKZE8NC1o5NGJiOW9xZDFST25TN3FJVFR6\\SG1tTXFpdmJPM2cwRGRWeWszV1FCaEJ6dEszNV1LTmRPbmM4TzNhY1M2ZkRaRmdLYVhMc0VKcDUN$ CnJkcmxpQnFwODljSmNzL203VHZzMHJrakdmTjRiMGtQb1puM1VKdUlPcm5aMjJ5UDFmbXZVeCtP NWdTcWViVjFtK3pTdVlOVmhxN1QNCldiRGlMVnZsanBsTGxvcDZDTFhQKzJxdHZHTElMLzF2aW1J U2RNQmd6U29GWn11N1RxZCtqenhnc1BhVj1CQ3F1ZS9OallrNnY2bEsNCj1jd21VYy9TVHRmMUhE cE0zŸjU5Mnk3aDNUaHg1b3pLNjlITHBZV3VBd2FxUzVjdjI2cTdjZWI4ZŴZŴWWFSZVAzaUZVOHpq MWtuU3cNC1pYSE1tbkNqWTBPZ2FsbzdVUWZTQ00zcVFRcjJIL1hGUDdzc1h4NDVZbDkxQn11Q2VwNG1vWm9IKzFmRzN4RDR0VDd4OGt3eWo4bncNCmI5ZXYyN1YwQjZkKzdINHpLdnVkQUg1MzdGanF5ek9IZEpuSEV1em1YcS9XanhPYnZOTWJ2N25oeXdzWDJhVnNXdEM4KzQ4YUx1YXANCkU3cDV3S1pp MEEYQVFSVjVudlI0RSt1SmMrYjYxa0FwcUlueEJnbWQvNFY1UVAvbXQxOEhEQzdzUkhmdG1ldTVs bWhWMHJuLOFMWDINCjMyYnFkNEJGbkR4N1ZpMWNXUzJ1ZmYwSWJCNDdxZXh4bVVqoVF1dFlqdXBk M3RZRDZhYldCQk1yaCthcE5iT0tyTkYxK3VnQ2E0cmkNClhHZndNUFB0VmlhdmhVM1lNT0FBbnVV Yi9SMDdMMH1PU2VPYWRFODhBcHNYRkdmZjMweW5obEpnTTUxQ1U2dk45RXpnbnB2SEJGVXkNCmlW cmFlUGl3SjUzREY1WlRabm9tRU5nODVrTlVkMm9KaTJXcHI0T21ta2ZONHg0ekhmaVZGYzhEdjhO enVoTnFPaWRpbEd2QTZER3UNCmVad0830EFBUW42Y21FazYrcnc1VmN2anZxTkRZUE9vSVV3YUtTaHJ4QXVYTGxrSDRhWXVHZk1ZRGMxMFdGNVRhMzFoUEpPZmNVaHINC1UvSmxJTmk2YzZ1bFJZZEJw bzYrK1lmang2MWxHTmZSbTRNRDVySjFgM0ZvR0huakRTOk5hc1lVZ01MeU1zektwYjd0WHBvSGZO czgNCmgzV3AxTHpOZk5rNTRYeEMxd0RHVW1ZelhZZWZoNnovY0t0Vm00RUJ4YT1WUUdEellyM0xy VU1SakhFS2trN3phRktZUUEyaEdRVTENCnorODVORldwWERya3ozdngxMEdxeFE2QnplTmJvQms1 bjhrNG51Y1JoK2sxaFdmeFRGMEQxRX1XVXM1bnYrZGdRcUtheHp1Q2RFMGkNCnNIbDAyT1E4YWgw bVhyMTJMYTNtMGY5d21rOSt3TE5UTVkvODZNUG84eWkzMU9meG1UN1BXb3FHOStEWnVrWW5hNTZt $\label{local_undown} U1pONVdXU3kNCjVxVkExcndVeUpxWEFsbnpraWFpL2dIU0Q3UmtUeWlob2dBQUFBQkpSVTVFcmtK\\ Z2dnPT0iLA0KICAiQXNzZXJ0aW9uU2NoZW1l1jogIlVBR1YxVExWIiwNCiAgIkF1dGhlbnRpY2F0\\ aW9uQWxnb3JpdGht1jogMSwNCiAgIkF0dGVzdGF0aW9uVH1wZXMiOiBbMTYzOTFdLA0KICAiVVBW$ IjogW1sxLDBdXQ0KfQ0K

In order to produce the tbsPayload, we first need the base64url-encoded (without padding) JWT Header:

```
EXAMPLE 5: Encoded JWT Header

eyJ0eXAiOiJKV1QiLAogImFsZyI6IkVTMjU2IiwKICJ4NXQjUzI1NiI6IjcyMzE5NjIyMTBkMjkz
M2VjOTkzYTc3YjRhNzIwMzg5OGFiNzRjZGY5NzRmZjAyZDJkZTNmMwVjN2NiOWRlNjgifQ
```

then we have to append a period (".") and the base64url encoding of the ncodedMetadataTOCPayload (taken from the example in section Metadata TOC Format):

```
EXAMPLE 6: tbsPayload
```

 $\begin{array}{l} {\tt eyJ0eXAi0iJKV1QiLAogImFsZyI6IkVTMjU2IiwKICJ4NXQjUzI1NiI6IjcyMzE5NjIyMTBkMjkz} \\ {\tt M2VjOTkzYTc3YjRhNzIwMzg5OGFiNzRjZGY5NzRmZjAyZDJkZTNmMWVjN2NiOWR1NjgifQ.} \\ {\tt eyAibm8iOiAxMjM0LCAibmV4dC11cGRhdGUiOiAiMzEtMDMtMjAxNCIsDQogICJlbnRyaWVzIjogBradGallarryaWVzIIIAGAllarryaWVzIjogBradGallarryaWVzIIIAGAllar$

Ww0KICAgeyAiYWFpZCI6ICIxMjM0IzU2NzgiLCANCiAgICAgImhhc2giOiAiOTBkYThkYTZkZTIZ MjQ4YWJiMzRkYTBkNDg2MWY0YjMwYTc5M2UxOThhOGQ1YmFhN2Y5OGYyNjBkYjcxYwNkNCIsIAOK ICAgICAidXJsIjogImh0dHBzOi8vzmlkb2FsbGlhbmNlLm9yZy9tZxRhZGF0YS8xMjM0JXgyM2Fi Y2QiLCANCiAgICAgICAidNOYXRlcyI6ICJmaWRvQ2VydGlmaWVkIg0KICAgICAidGltzU9mTGFzdFN0 YXRlc0NoYW5nZSI6ICIiLA0KICAgICAiy2VydGlmaWNhdGlvbkRhdGUiOiAiMjAxNC0wMS0wNCIg fswNCiAgIHsgImFhaWQiOiAiOTg3NiM0MzIxIiwgDQogICAgICJoYXNOIjogIjc4NWQxNmRmNjQw ZmQ3YjUwZWQxNzRjYjU2NDVjYzBmMWU3MmI3ZjE5Y2YyMjk1OTA1MmRkMjBiOTU0MWM2NGQiLAOK ICAgICAidXJsIjogImh0dHBzOi8vYXV0aG5yLXzlbmRvcilhLmNvbS9tZXRhZGF0YS85ODc2JXgy MzQZMjEiLA0KICAgICAic3RhdHVzIjogImZpZG9DZXJ0aWZpZWQiDQogICAgICJ0aWllT2ZMYXN0 U3RhdHVzQ2hhbmdlTjogIjIwMTQtMDItMTkiLA0KICAgICAiY2VydGlmaWNhdGlvbkRhdGUiOiAi MjAxNC0wMS0wNyIgfQ0KICBdDQp9DQo

and finally we have to append another period (".") followed by the base64url-encoded signature.

EXAMPLE 7: JWT

eyJ0eXAiOiJKV1QiLAogImFsZyI6IkVTMjU2IiwKICJ4NXQjUzI1NiI6IjcyMzE5NjIyMTBkMjkz M2VjOTkzYTc3YjRhNzIwMzg5OGFinzRjZGY5NzRmZjAyZDJkZTNmMWVjN2NiOWRlNjgifQ.
eyAibm8iOiAxMjMOLCAibmV4dC11cGRhdGUIOiAiMzEtMDMtMjAxNCIsDQogICJlbnRyaWVzIjog Ww0KICAgeyAiYWFpZCI6ICIxMjM0IzU2NzgiLCANCiAgICAgImhhc2giOiAiOTBkYThkYTZkZTIz MjQ4YWJiMzRkYTBkNDg2MWY0YjMwYTc5M2UxOThhOGQ1YmFhN2Y5OGYYNjBkYjcxYWNkNCIsIAOK ICAgICAidXJsIjogImh0dHBzOi8vZmlkb2FsbGlhbmNlLm9yZy9tZXRhZGF0YS8xMjM0JXgyM2Fi Y2QiLCANCiAgICAgICAidGltzU9mTGFzdFN0 YXRlcONOYW5nZSI6ICIILAOKICAgICAiY2VydGlmaWNkIg0KICAgICAidGltzU9mTGFzdFN0 YXRlcONOYW5nZSI6ICIILAOKICAgICAiY2VydGlmaWNhdGlvbkRhdGUiOiAiMjAxNCOwMS0wNCIg fSwNCiAgIHsgImFhaWQiOiAiOTg3NiMOMzIxIiwgDQogICAgICJOYXNOIjogIjc4NWQxNmRmNjQw ZmQ3YjUwZWQxNzRjYjUZNDVjYzBmMWU3Mm13ZjE5Y2YyMjklOTAlMmRkMjBiOTUOMWM2NGQiLAOK ICAgICAidXJsIjogImh0dHBzOi8vYXV0aG5yLXzlbmRvcilhLmNvbS9tZXRhZGF0YS85ODc2JXgy MzQZMjEiLAOKICAgICAic3RhdHVzIjogImZpZG9DZXJ0aWZpZWQiDQogICAgICJ0aWllT2ZMYXN0 U3RhdHVzQ2hhbmdlIjogIjIwMTQtMDItMTkiLAOKICAgICAiY2VydGlmaWNhdGlvbkRhdGUiOiAi MjAxNCOwMSOwNyIgfQOKICBdDQp9DQo.
AP-q0J3VPzj7L61CE1UzHzJYQnszFQ8d2hJz51sPASgyABK5VXOFnAHzBTQRRkgwGqULy6PtTyUV zKxMOHrvoyZq

NOTE

The line breaks are for display purposes only.

The signature in the example above was computed with the following ECDSA key

EXAMPLE 8: ECDSA Key used for signature computation

x: d4166ba8843d1731813f46f1af32174b5c2f6013831fb16f12c9c0b18af3a9b4
y: 861bc2f803a2241f4939bd0d8ecd34e468e42f7fdccd424edb1c3ce7c4dd04e
d: 3744c426764f331f153e182d24f133190b6393cea480a8eec1c722fce161fe2d

3.1.7 Metadata TOC object processing rules

The FIDO Server must follow these processing rules:

- The FIDO Server must be able to download the latest metadata TOC object from the well-known URL, when appropriate. The nextupdate field of the Metadata TOC specifies a date when the download should occur at latest
- 2. If the x5u attribute is present in the JWT Header, then:
 - 1. The FIDO Server must verify that the URL specified by the x5u attribute has the same web-origin as the URL used to download the metadata TOC from. The FIDO Server should ignore the file if the web-origin differs (in order to prevent loading objects from arbitrary sites).
 - The FIDO Server must download the certificate (chain) from the URL specified by the x5u attribute [JWS].
 The certificate chain must be verified to properly chain to the metadata TOC signing trust anchor according to [RFC5280]. All certificates in the chain must be checked for revocation according to [RFC5280].
 - 3. The FIDO Server should ignore the file if the chain cannot be verified or if one of the chain certificates is revoked.
- 3. If the x5u attribute is missing, the chain should be retrieved from thex5c attribute. If that attribute is missing as well, Metadata TOC signing trust anchor is considered the TOC signing certificate chain.
- 4. Verify the signature of the Metadata TOC object using the TOC signing certificate chain (as determined by the steps above). The FIDO Server should ignore the file if the signature is invalid. It should also ignore the file if its number (no) is less or equal to the number of the last Metadata TOC object cached locally.
- 5. Write the verified object to a local cache as required.
- 6. Iterate through the individual entries (of typeMetadataTOCPayloadEntry). For each entry:
 - 1. Ignore the entry if the AAID, AAGUID or attestationCertificateKeyIdentifiers is not relevant to the relying party (e.g. not acceptable by any policy)
 - 2. Download the metadata statement from the URL specified by the field url. Some authenticator vendors might require authentication in order to provide access to the data. Conforming FIDO Servers should

- support the HTTP Basic, and HTTP Digest authentication schemes, as defined in [RFC2617].
- 3. Check whether the status report of the authenticator model has changed compared to the cached entry by looking at the fields timeofLastStatusChange and statusReport. Update the status of the cached entry. It is up to the relying party to specify behavior for authenticators with status reports that indicate a lack of certification, or known security issues. However, the status REVOKED indicates significant security issues related to such authenticators.

Authenticators with an unacceptable status should be marked accordingly. This information is required for building registration and authentication policies included in the registration request and the authentication request [UAFProtocol].

- 4. Compute the hash value of the (base64url encoding without padding of the UTF-8 encoded) metadata statement downloaded from the URL and verify the hash value to the hash specified in the field hash of the metadata TOC object. Ignore the downloaded metadata statement if the hash value doesn't match.
- 5. Update the cached metadata statement according to the dowloaded one.

4. Considerations

This section is non-normative.

This section describes the key considerations for designing this metadata service.

Need for Authenticator Metadata When defining policies for acceptable authenticators, it is often better to describe the required authenticator characteristics in a generic way than to list individual authenticator AAIDs. The metadata statements provide such information. Authenticator metadata also provides the trust anchor required to verify attestation objects.

The metadata service provides a standardized method to access such metadata statements.

Integrity and Authenticity Metadata statements include information relevant for the security. Some business verticals might even have the need to document authenticator policies and trust anchors used for verifying attestation objects for auditing purposes.

It is important to have a strong method to verify and proof integrity and authenticity and the freshness of metadata statements. We are using a single digital signature to protect the integrity and authenticity of the Metadata TOC object and we protect the integrity and authenticity of the individual metadata statements by including their cryptographic hash values into the Metadata TOC object. This allows for flexible distribution of the metadata statements and the Metadata TOC object using standard content distribution networks.

Organizational Impact Authenticator vendors can delegate the publication of metadata statements to the metadata service in its entirety. Even if authenticator vendors choose to publish metadata statements themselves, the effort is very limited as the metadata statement can be published like a normal document on a website. The FIDO Alliance has control over the FIDO certification process and receives the metadata as part of that process anyway. With this metadata service, the list of known authenticators needs to be updated, signed and published regularly. A single signature needs to be generated in order to protect the integrity and authenticity of the metadata TOC object.

Performance Impact Metadata TOC objects and metadata statements can be cached by the FIDO Server.

The update policy can be specified by the relying party.

The metadata TOC object includes a date for the next scheduled update. As a result there is *no additional impact* to the FIDO Server during FIDO Authentication or FIDO Registration operations.

Updating the Metadata TOC object and metadata statements can be performed asynchronously. This reduces the availability requirements for the metadata service and the load for the FIDO Server.

The metadata TOC object itself is relatively small as it does not contain the individual metadata statements. So downloading the metadata TOC object does not generate excessive data traffic.

Individual metadata statements are expected to change less frequently than the metadata TOC object. Only the modified metadata statements need be downloaded by the FIDO Server.

Non-public Metadata Statements Some authenticator vendors might want to provide access to metadata statements only to their subscribed customers.

They can publish the metadata statements on access protected URLs. The access URL and the cryptographic hash of the metadata statement is included in the metadata TOC object.

High Security Environments Some high security environments might only trust internal policy authorities. FIDO Servers in such environments could be restricted to use metadata TOC objects from a proprietary trusted source only. The metadata service is the baseline for most relying parties.

Extended Authenticator Information Some relying parties might want additional information about authenticators

before accepting them. The policy configuration is under control of the relying party, so it is possible to only accept authenticators for which additional data is available and meets the requirements.

A. References

A.1 Normative references

[FIDOMetadataStatement]

B. Hill, D. Baghdasaryan, J. Kemp, FIDO Metadata Statements v1.0. FIDO Alliance Implementation Draft.

HTML: https://fidoalliance.org/specs/fido-u2f-v1.2-ps-20170411/fido-metadata-statements.html PDF: https://fidoalliance.org/specs/fido-u2f-v1.2-ps-20170411/fido-metadata-statements.pdf

[JWS]

M. Jones; J. Bradley; N. Sakimura. <u>JSON Web Signature (JWS)</u>. May 2015. RFC. URL: https://tools.ietf.org/html/rfc7515

[JWT]

M. Jones; J. Bradley; N. Sakimura. *JSON Web Token (JWT)*. May 2015. RFC. URL: https://tools.ietf.org/html/rfc7519

[RFC4648]

S. Josefsson, *The Base16, Base32, and Base64 Data Encodings (RFC 4648)*, IETF, October 2006, URL: http://www.ietf.org/rfc4648.txt

[RFC5280]

D. Cooper, S. Santesson, s. Farrell, S.Boeyen, R. Housley, W. Polk; *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*, IETF, May 2008, URL: http://www.ietf.org/rfc/rfc5280.txt

[WebIDL-ED]

Cameron McCormack, Web IDL, W3C. Editor's Draft 13 November 2014. URL: http://heycam.github.io/webidl/

A.2 Informative references

[FIDOEcdaaAlgorithm]

R. Lindemann, J. Camenisch, M. Drijvers, A. Edgington, A. Lehmann, R. Urian, FIDO ECDAA Algorithm. FIDO Alliance Implementation Draft. URLs:

HTML: <u>fido-ecdaa-v1.1-id-20170202.html</u> PDF: <u>fido-ecdaa-v1.1-id-20170202.pdf</u>.

[FIDOGlossary]

R. Lindemann, D. Baghdasaryan, B. Hill, J. Hodges, *FIDO Technical Glossary*. FIDO Alliance Implementation Draft. URLs:

HTML: https://fidoalliance.org/specs/fido-u2f-v1.2-ps-20170411/fido-glossary-v1.2-ps-20170411.html PDF: https://fidoalliance.org/specs/fido-u2f-v1.2-ps-20170411/fido-glossary-v1.2-ps-20170411.pdf

[FIDOKeyAttestation]

FIDO 2.0: Key attestation format. URL: https://fidoalliance.org/specs/fido-v2.0-ps-20150904/fido-key-attestation-v2.0-ps-20150904.html

[ITU-X690-2008]

X.690: Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER), (T-REC-X.690-200811). International Telecommunications Union, November 2008 URL: http://www.itu.int/rec/T-REC-X.690-200811-1/

[RFC2119]

S. Bradner. Key words for use in RFCs to Indicate Requirement Levels March 1997. Best Current Practice. URL: https://tools.ietf.org/html/rfc2119

[RFC2617]

J. Franks; P. Hallam-Baker; J. Hostetler; S. Lawrence; P. Leach; A. Luotonen; L. Stewart <u>HTTP Authentication: Basic and Digest Access Authentication</u>. June 1999. Draft Standard. URL: https://tools.ietf.org/html/rfc2617

[RFC3986]

T. Berners-Lee; R. Fielding; L. Masinter. *Uniform Resource Identifier (URI): Generic Syntax* January 2005. Internet Standard. URL: https://tools.ietf.org/html/rfc3986

[UAFProtocol]

R. Lindemann, D. Baghdasaryan, E. Tiffany, D. Balfanz, B. Hill, J. Hodges, *FIDO UAF Protocol Specification v1.0.* FIDO Alliance Proposed Standard. URLs:

HTML: fido-uaf-protocol-v1.1-id-20170202.html

PDF: fido-uaf-protocol-v1.1-id-20170202.pdf

[WebIDL]

Cameron McCormack; Boris Zbarsky; Tobie Langel. <u>Web IDL</u>. 15 December 2016. W3C Editor's Draft. URL: <u>https://heycam.github.io/webidl/</u>