FIDO Metadata Service

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Abstract

The FIDO Authenticator Metadata Specification defines so-called "Authenticator Metadata" statements. The metadata statements contains 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 FIDO Alliance specifications index at https://www.fidoalliance.org/specifications/.

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1. Notation§

Type names, attribute names and element names are written as`code`

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

In formulas we use “|” 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.

For definitions of terms, please refer to the FIDO Glossary[FIDOGlossary].

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

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 not 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.

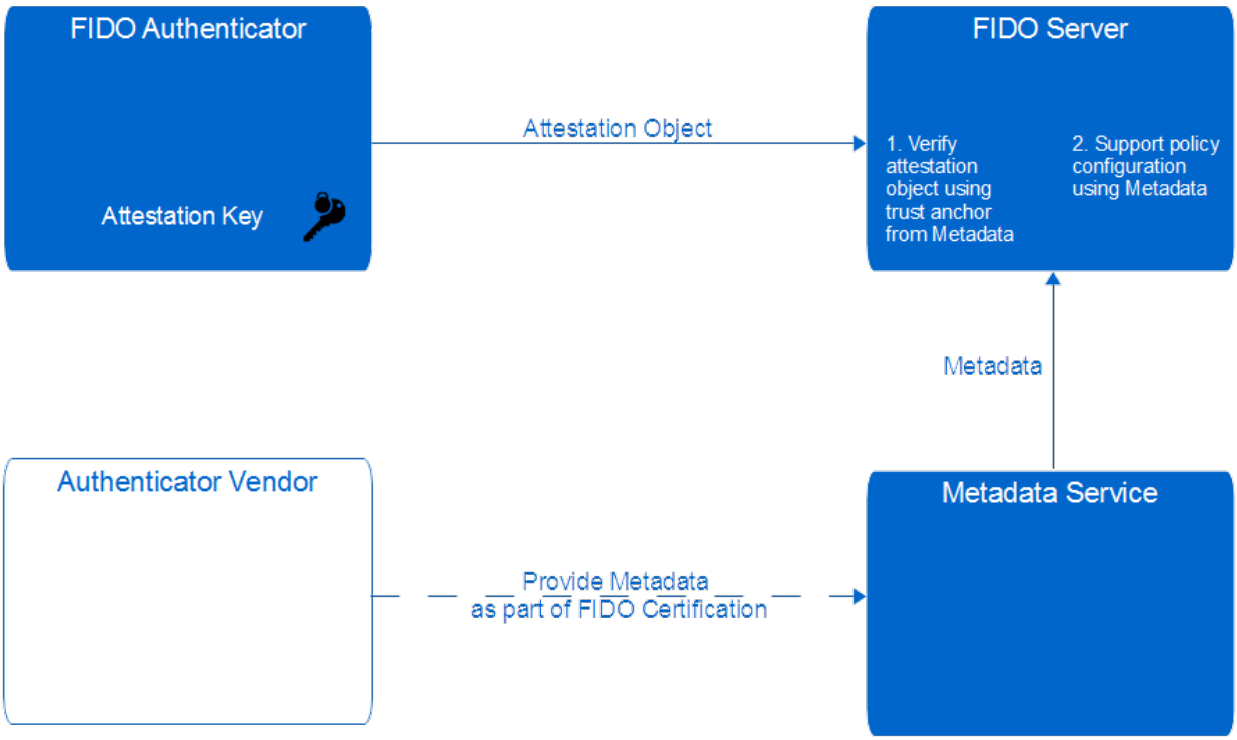

Figure 1 *FIDO Metadata Service Architecture Overview*

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 BLOB file contains a list of metadata statements related to the authenticators known to the FIDO Alliance (FIDO Authenticators).

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

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

Individual metadata statements are included in the entry of the metadata BLOB file, and may be cached by the FIDO Server as required.

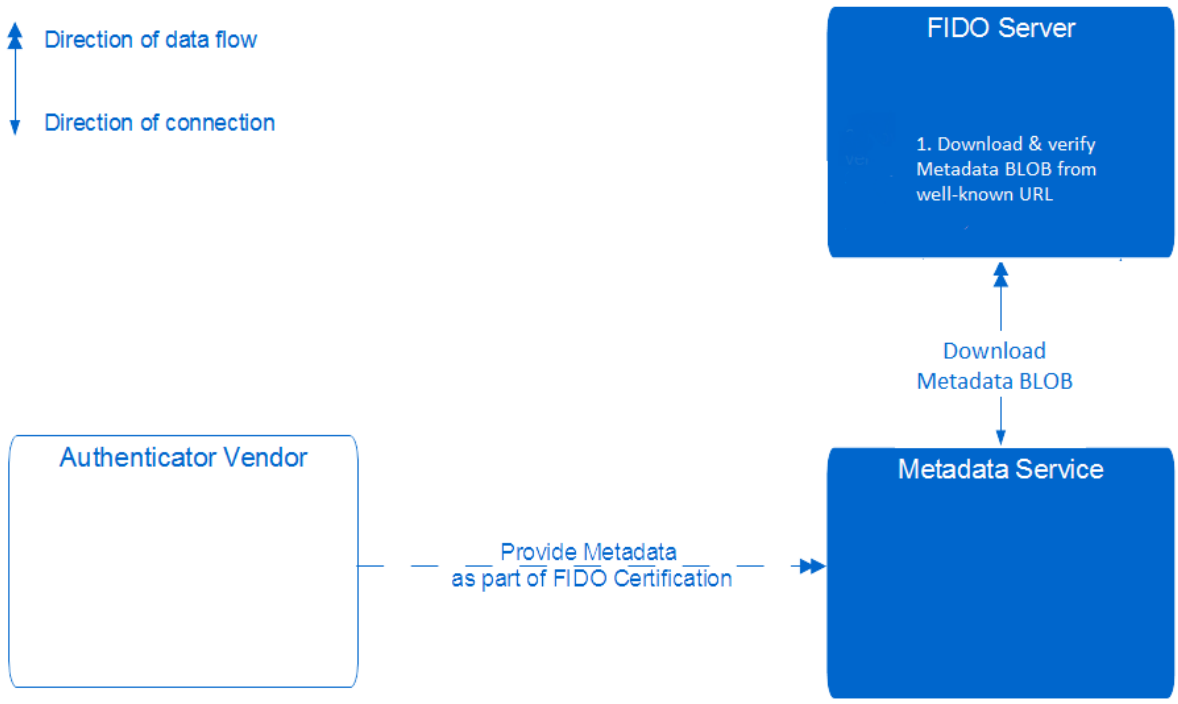

Figure 2 *FIDO Metadata Service Architecture*

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

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

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

3. Metadata Service Details§

This section is normative.

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 BLOB Format§

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

This object contains all metadata for each authenticator including the metadata statements defined in[FIDOMetadataStatement]. The BLOB object contains one signature.

3.1.1. Metadata BLOB Payload Entry dictionary§

Represents the MetadataBLOBPayloadEntry

```
dictionary MetadataBLOBPayloadEntry {
    AAID                        aaid;
    AAGUID                      aaguid;
    DOMString[]                 attestationCertificateKeyIdentifiers;
    required MetadataStatement  metadataStatement;
    BiometricStatusReport[]     biometricStatusReports;
    required StatusReport[]     statusReports;
    required DOMString          timeOfLastStatusChange;
    DOMString                   rogueListURL;
    DOMString                   rogueListHash;
};
```

`aaid`, of type AAID
: The AAID of the authenticator this metadata BLOB 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 FIDO2.

NOTE: FIDO2 authenticators support AAGUID, but they don't support AAID.

`attestationCertificateKeyIdentifiers`, of type 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 keyIdentifier 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 `aaguid` are set. Setting this field implies that the attestation certificate(s) are dedicated to a single authenticator model.

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

`metadataStatement`, of type MetadataStatement
The metadataStatement JSON object as defined in [FIDOMetadataStatement].

`biometricStatusReports`, of type BiometricStatusReport[]
Status of the FIDO Biometric Certification of one or more biometric components of the Authenticator [FIDOBiometricsRequirements].

`statusReports`, of type StatusReport[]
An array of status reports applicable to this authenticator.

`timeOfLastStatusChange`, of type 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 BLOB MUST be used.

This hash value MUST be present and non-empty whenever `rogueListURL` is present.

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

EXAMPLE 1

```
{
  "no": 1234,
  "nextUpdate": "2014-03-31",
  "entries": [
    {
      "aaid": "1234#5678",
      "metadataStatement": "Metadata Statement object as defined in Metadata Statement spec."
,
      "statusReports": [
        {
          "status": "FIDO_CERTIFIED",
          "effectiveDate": "2014-01-04"
        }
      ],
      "timeOfLastStatusChange": "2014-01-04"
    },
    {
      "attestationCertificateKeyIdentifiers": [
        "7c0903708b87115b0b422def3138c3c864e44573"
      ],
      "metadataStatement": "Metadata Statement object as defined in Metadata Statement spec."
,
      "statusReports": [
        {
          "status": "FIDO_CERTIFIED",
          "effectiveDate": "2014-01-07"
        },
        {
          "status": "UPDATE_AVAILABLE",
          "effectiveDate": "2014-02-19",
          "url": "https://example.com/update1234"
        }
      ],
      "timeOfLastStatusChange": "2014-02-19"
    }
  ]
}
```

3.1.2. BiometricStatusReport dictionary

Contains the current `BiometricStatusReport` of one of the authenticator's biometric component.

```
dictionary BiometricStatusReport {
    required unsigned short certLevel;
    required DOMString      modality;
    DOMString               effectiveDate;
    DOMString               certificationDescriptor;
    DOMString               certificateNumber;
    DOMString               certificationPolicyVersion;
    DOMString               certificationRequirementsVersion;
};
```

`certLevel`, of type unsigned short
: Achieved level of the biometric certification of this biometric component of the authenticator [FIDOBiometrics Requirements].

`modality`, of type DOMString
: A *single* a single USER_VERIFY short form case-sensitive string name constant, representing biometric

modality. See section "User Verification Methods" in [FIDORegistry] (e.g. "fingerprint_internal"). This value MUST NOT be empty and this value MUST correspond to one or more entries in field `userVerificationDetails` in the related Metadata Statement [FIDOMetadataStatement]. This value MUST represent a biometric modality.

> For example use `USER_VERIFY_FINGERPRINT` for the fingerprint based biometric component. In this case the related Metadata Statement must also claim fingerprint as one of the user verification methods.

`effectiveDate`, of type DOMString
ISO-8601 formatted date since when the `certLevel` achieved, if applicable. If no date is given, the status is assumed to be effective while present.

`certificationDescriptor`, of type DOMString
Describes the externally visible aspects of the Biometric Certification evaluation.

> For example it could state that the "biometric component is implemented OnChip - keeping biometric data inside the chip only.".

`certificateNumber`, of type DOMString
The unique identifier for the issued Biometric Certification.

`certificationPolicyVersion`, of type DOMString
The version of the Biometric Certification Policy the implementation is Certified to, e.g. "1.0.0".

`certificationRequirementsVersion`, of type DOMString
The version of the Biometric Requirements [FIDOBiometricsRequirements] the implementation is certified to, e.g. "1.0.0".

3.1.3. StatusReport dictionary

> 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.

> The certification of FIDO Authenticators does NOT cover the security characteristics of multi-device keys.

```
dictionary StatusReport {
    required AuthenticatorStatus status;
    DOMString                    effectiveDate;
    unsigned long                authenticatorVersion;
    DOMString                    batchCertificate;
    DOMString                    certificate;
    DOMString                    url;
    DOMString                    certificationDescriptor;
    DOMString                    certificateNumber;
    DOMString                    certificationPolicyVersion;
    DOMString[]                  certificationProfiles;
    DOMString                    certificationRequirementsVersion;
    DOMString                    sunsetDate;
    unsigned long                fipsRevision;
    unsigned long                fipsPhysicalSecurityLevel;
};
```

`status`, of type 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.

`authenticatorVersion`, of type unsigned long
The authenticatorVersion (firmware version) that this status report relates to. In the case of FIDO_CERTIFIED* status values, the status applies to higher authenticatorVersions until there is a new statusReport.

> For example, if the status would be USER_VERIFICATION_BYPASS, the authenticatorVersion indicates the vulnerable firmware version of the authenticator. Similarly, if the status would be UPDATE_AVAILABLE, the authenticatorVersion indicates the updated firmware version that is available now. If the status would be SELF_ASSERTION_SUBMITTED, the authenticatorVersion indicates the firmware version that the self assertion was based on.

> The firmware version of the authenticator providing the attestation can be found in the attestation certificate in extension id-fido-gen-ce-fw-version (OID 1.3.6.1.4.1.45724.1.1.5).

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

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

`certificate`, of type DOMString
Base64-encoded [RFC4648] (not base64url!) DER [ITU-X690-2008] PKIX certificate value related to the current status, if applicable. This field will typically not be present if field `batchCertificate` is present.

> 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.

> 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`.

`certificationDescriptor`, of type DOMString
Describes the externally visible aspects of the Authenticator Certification evaluation.

> For example it could state that the authenticator is a "SecurityKey based on a CC EAL 5 certified chip hardware".

`certificateNumber`, of type DOMString
The unique identifier for the issued Certification.

`certificationPolicyVersion`, of type DOMString
The version of the Authenticator Certification Policy the implementation is Certified to, e.g. "1.0.0".

`certificationProfiles`, of type DOMString[]
array of strings. Each entry represents a supported certification profile. The supported profiles are defined in the active version of the Authenticator Certification Policy document. At the time of writing this specification, the supported profiles are: "consumer" and "enterprise".

`certificationRequirementsVersion`, of type DOMString
: The Document Version of the Authenticator Security Requirements (DV)[FIDOAuthenticatorSecurityRequirements] the implementation is certified to, e.g. "1.2.0".

`sunsetDate`, of type DOMString
: ISO-8601 formatted date since when the status wil expire, if applicable. If no date is given, the status is assumed to not have a scheduled expiry.

`fipsRevision`, of type unsigned long
: The revision number of the FIPS 140 specification, e.g. "3" in the case of FIPS 140-3. This entry MUST be present if and only if the status entry is one of FIPS140_CERTIFIED_L*.

`fipsPhysicalSecurityLevel`, of type unsigned long
: In the case the status represents a FIPS certification, this field contains the "physical security level" of the FIPS certification. This entry MUST be present if and only if the status entry is one of FIPS140_CERTIFIED_L*. It MUST reflect the physical security level which might deviate from the overall level.

3.1.4. AuthenticatorStatus enum

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

```
enum AuthenticatorStatus {
    "NOT_FIDO_CERTIFIED",
    "FIDO_CERTIFIED",
    "USER_VERIFICATION_BYPASS",
    "ATTESTATION_KEY_COMPROMISE",
    "USER_KEY_REMOTE_COMPROMISE",
    "USER_KEY_PHYSICAL_COMPROMISE",
    "UPDATE_AVAILABLE",
    "RETIRED",
    "REVOKED",
    "SELF_ASSERTION_SUBMITTED",
    "FIDO_CERTIFIED_L1",
    "FIDO_CERTIFIED_L1plus",
    "FIDO_CERTIFIED_L2",
    "FIDO_CERTIFIED_L2plus",
    "FIDO_CERTIFIED_L3",
    "FIDO_CERTIFIED_L3plus",
    "FIPS140_CERTIFIED_L1",
    "FIPS140_CERTIFIED_L2",
    "FIPS140_CERTIFIED_L3",
    "FIPS140_CERTIFIED_L4"
};
```

3.1.4.1. Certification Related Statuses

> The certification of FIDO Authenticators does NOT cover the security characteristics of multi-device keys.

NOT_FIDO_CERTIFIED
: This authenticator is not FIDO certified.

> Applicable StatusReport fields are:
>
> - effectiveDate - When status was achieved
> - authenticatorVersion - The minimum applicable authenticator version.
> - url - To the authenticator page or additional information about the authenticator

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 url.

> Applicable StatusReport fields are:
>
> - effectiveDate - Date of incident being reported
> - authenticatorVersion - New authenticator version that is

FIDO_CERTIFIED

This authenticator has passed FIDO functional certification. This certification scheme is phased out and will be replaced by FIDO_CERTIFIED_L1.

> Applicable StatusReport fields are:
>
> - effectiveDate - When certification was issued
> - authenticatorVersion - The minimum version of the certified solution
> - certificationDescriptor - Authenticator Description. I.e. "Munikey 7c Black Edition"
> - certificateNumber - FIDO Alliance Certificate Number
> - certificationPolicyVersion - Authenticator Certification Policy
> - certificationProfiles - list of supported certification profiles
> - certificationRequirementsVersion - Security Requirements Version
> - url - URL to the certificate, or the news article about achievement of the certification.
>
> These fields are applicable to any of the FIDO_CERTIFIED_*.

FIDO_CERTIFIED_L1

The authenticator has passed FIDO Authenticator certification at level 1. This level is the more strict successor of FIDO_CERTIFIED.

FIDO_CERTIFIED_L1plus

The authenticator has passed FIDO Authenticator certification at level 1+. This level is the more than level 1.

FIDO_CERTIFIED_L2

The authenticator has passed FIDO Authenticator certification at level 2. This level is more strict than level 1+.

FIDO_CERTIFIED_L2plus

The authenticator has passed FIDO Authenticator certification at level 2+. This level is more strict than level 2.

FIDO_CERTIFIED_L3

The authenticator has passed FIDO Authenticator certification at level 3. This level is more strict than level 2+.

FIDO_CERTIFIED_L3plus

The authenticator has passed FIDO Authenticator certification at level 3+. This level is more strict than level 3.

FIPS140_CERTIFIED_L1

The authenticator has passed FIPS 140 certification at overall level 1.

> Applicable StatusReport fields are:
>
> - certificateNumber - certificate number as given in the FIPS certificate
> - url - URL to the FIPS certificate (e.g. https://csrc.nist.gov/projects/cryptographic-module-validation-program/certificate/[nn])
> - sunsetDate - the sunset data as given in the FIPS certificate
> - fipsPhysicalSecurityLevel - the level of the physical security according to the FIPS certificate
>
> These fields are applicable to any of the FIPS140_CERTIFIED_*.

FIPS140_CERTIFIED_L2
The authenticator has passed FIPS 140 certification at overall level 2.

FIPS140_CERTIFIED_L3
The authenticator has passed FIPS 140 certification at overall level 3.

FIPS140_CERTIFIED_L4
The authenticator has passed FIPS 140 certification at overall level 4.

RETIRED
The authenticator vendor has decided to retire the product, that this authenticator should not be accepted any longer. For example if a prototype version of the authenticator was added to FIDO MDS and has now been superseded by the final product, the entry for the prototype might be set to "retired".

> Applicable StatusReport fields are:

- effectiveDate - Date of retirement
- url - URL to the news/corporate article explaining the reason for retirement

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. Relying parties SHOULD reject any future registration of this authenticator model.

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - New authenticator version that is
- url - URL to the news/corporate article explaining the reason for revocation

3.1.4.2. Security Notification Statuses

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.

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - Minimum affected authenticator version
- batchCertificate - Base64 DER-encoded PKIX certificate identifying the compromised batch attestation certificate related to the affected authenticators.
- certificate - Base64 DER-encoded PKIX certificate. Might not be present if batchCertificate is present. identifying the attestation root certificate related to the affected authenticators.
- url - URL to the news/corporate article explaining the incident

ATTESTATION_KEY_COMPROMISE

Indicates that an attestation key for this authenticator is known to be compromised. The relying party SHOULD check the certificate field and use it to identify the compromised authenticator batch. If neither the batchCertificate nor the certificate field are set, the relying party should reject all new registrations of the compromised authenticator. The Authenticator manufacturer should set the date to the date when compromise has occurred.

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - Minimum affected authenticator version
- batchCertificate - Base64 DER-encoded PKIX certificate identifying the compromised batch attestation certificate related to the affected authenticators.
- certificate - Base64 DER-encoded PKIX certificate. Might not be present if batchCertificate is present. identifying the attestation root certificate related to the affected authenticators.
- url - URL to the news/corporate article explaining the incident

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.

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - Minimum affected authenticator version
- batchCertificate - Base64 DER-encoded PKIX certificate identifying the compromised batch attestation certificate related to the affected authenticators.
- certificate - Base64 DER-encoded PKIX certificate. Might not be present if batchCertificate is present. identifying the attestation root certificate related to the affected authenticators.
- url - URL to the news/corporate article explaining the incident

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.

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - Minimum affected authenticator version
- batchCertificate - Base64 DER-encoded PKIX certificate identifying the compromised batch attestation certificate related to the affected authenticators.
- certificate - Base64 DER-encoded PKIX certificate. Might not be present if batchCertificate is present. identifying the attestation root certificate related to the affected authenticators.
- url - URL to the news/corporate article explaining the incident

3.1.4.3. Info Statuses

UPDATE_AVAILABLE

A software or firmware update is available for the device. The Authenticator manufacturer should set the url to the URL where users can obtain an update and the date the update was published. When this status code

is used, then the field authenticatorVersion in the authenticator 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. The Relying party MUST reject the Metadata Statement if the authenticatorVersion has not increased

> Applicable StatusReport fields are:

- effectiveDate - Date of incident being reported
- authenticatorVersion - New authenticator version that is available. MUST match authenticatorVersion in the metadata statement.
- url - URL to the page with the update info

> Relying parties might want to inform users about available firmware updates.

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

3.1.5. RogueListEntry dictionary

> 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.

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

sk, of type 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 DOMString
ISO-8601 formatted date since when this entry is effective.

```
EXAMPLE: ROGUELISTENTRY[] EXAMPLE
[
    { "sk": "MO-oaqbeJSSayzXaDUhh9LMKeT4Zio1bqn6W8kDaUfM",
      "date": "2016-06-07"},
    { "sk": "k96Npt4jJIq7NNoNSGH0swp5PhU6jVuyf5jyYNtxrNQ",
      "date": "2016-06-09"},
]
```

3.1.6. Metadata BLOB Payload dictionary

Represents the MetadataBLOBPayload

```
dictionary MetadataBLOBPayload {
    DOMString                           legalHeader;
    required Number                     no;
    required DOMString                  nextUpdate;
    required MetadataBLOBPayloadEntry[] entries;
};
```

`legalHeader`, of type DOMString
: The legalHeader, which MUST be in each BLOB, is an indication of the acceptance of the relevant legal agreement for using the MDS. The FIDO Alliance's Blob will contain this legal header: "legalHeader": "Retrieval and use of this BLOB indicates acceptance of the appropriate agreement located at https://fidoalliance.org/metadata/metadata-legal-terms/"

`no`, of type Number
: The serial number of this Metadata BLOB Payload. This serial number MUST be incremented whenever the contents of the BLOB changes. Serial numbers MUST be consecutive and strictly monotonic, i.e. the successor BLOB will have a `no` value exactly incremented by one.

`nextUpdate`, of type DOMString
: ISO-8601 formatted date when the next update will be provided at latest.

> NOTE: The FIDO operational approach to publishing the FIDO Metadata has changed. Guidance on the download frequency and download approach is given in section Metadata BLOB Processing Rules. The use of the "nextUpdate" field is discouraged and the field will be removed in the future. FIDO servers should ensure this field is not required by their code.

`entries`, of type MetadataBLOBPayloadEntry[]
: List of zero or more MetadataBLOBPayloadEntry objects.

> NOTE: The "issued at" claim (`iat`) is included in the JWT header according to [RFC7519].

3.1.7. Metadata BLOB

The metadata BLOB 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 Metadata BLOB Payload (see example at the beginning of section Metadata BLOB Format>),
- and the base64url-encoded, also without padding, JWS Signature [JWS] computed over the to-be-signed payload using the Metadata BLOB signing key, i.e. `tbsPayload = EncodedJWTHeader | "." | EncodedMetadataBLOBPayload`

All three elements of the BLOB are concatenated by a period (".") : `MetadataBLOB = EncodedJWTHeader | "." | EncodedMetadataBLOBPayload | "." | 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 BLOB Payload Entry Dictionary).

The JWT Header SHALL include the "iat" ("issued at") claim as specified in [RFC7519].

3.1.7.1. Examples

This section is not normative.

EXAMPLE: ENCODED METADATA BLOB

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ewoJImxlZ2FsSGVhZGVyIjogIlJldHJpZXZhbCBhbmQgdXNlIG9mIHRoaXMgQkxPQiBpbmRpY2F0ZXMg
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```

```
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ME5GdjdhaTluN1FaUE13YmR5czJlclUyWE1xVWR5OCtaY2FObUdpbUU4eVhOM1JVZDNhMThuRjBmVWxv
dlorMENUeldwZDJWaitlT20xYkV5eTZEeDRpNXBVTUdXdmVvNTA2cTIyN2R0dVdCSXVmZnI2b1dwVjBG
UE5MaG93MTc1MU5tMjFMdlBIM3JWdFdqZno2NkxmcWw4dFg3RlJsOVlGU1hzbVNzZWI5Y2VPR2JZazdN
TlVjR1BnOFpzYk1lOXJmUVVhYVYvSk1YOXNxZHpEQ1N2cDBrWkhtVFpnOXg3YkxIY01uVGhiMTZlSitt
VmZRcTh5YVVaUU5HNjRpWForMC9rcTZ1T1pGTzBRdGF0ZFdLZlhuUlE5OUJqOTFSNU9JRm5rNTRqTjBt
a1VpcWxPM1hEVytNbCs5OG1LQjZ0VzdyV3BaY1BjKzB6ZzR0THJZbFVjODZFNmVHRGpJTXViVnBjdXNl
YXJmZ0lZR1JrNmJyaFpWci9KY0h6b29MNzU1MGplZExFeG9wV2NBcGkyWlVxaHU3Skx2clZzUVU4MXpr
ek9QZWVtTVJZdlZ1UXNYN1BiaURRWTVKdlpvbmZ0SysxVlk4SDl1dHg1MzBoMG9iK2ptUllxajZvdWFZ
dkVlblcvV2xZanA4Y3diTW02ODJ0UHdxVzFSNHRqLzJTSDEzSVJKWWw0bW9adlhwaVNxRHI3ZFh0UUh4
YS9QSzMvK0JXc0sxZFRnSHU2Vjh0UUozYndGa3dwRnJVT1E1MHMxcjNsZXZtOHpaY3ExNytCQmF3N0s4
bEVLNXF6a1llYXJrOUE4cDdQM0d6RErbrmQzRFFvdys2VUM4U1ZOODJpdXYzOGltN050YVh0VjFDVnE2
Umd3NHBrc21iZGkzYnUyRGU3WWZhQkJ4Y3FmdnFQclVqRlFOVFEyMmxmZFVWVlQ2OHJUSktGNURuU21V
amdkcWc0bVNTOXBtc2ZESlIzRzZUb0gwaVc5YVY3TFdMSFlYS2xsVER0MExUQXRrWUlhYW1wMVFqVnYr
K3V5R1V4VmRKMEROVlhTbStiMXFSeHBsODRkZGZYMUxwMU8vZDY5dHNvZDB2czVoR3JlOXh1OG8rZnBM
UjFjR2hOVEQ2WjU3QzlLTVdYZWZKZE9aOTRiYjlvcWQxUk9uUzdxSVRUekhpbU1xaXZiTzNnMERkVnlr
M1dRQmhCenRLMzVZS05kT25jOE8zYWNTNmZEWkZnS2FYTHNFSnA1cmRybGlCcXA4OWNKY3MvbTdUdnMw
cmtqR2ZONGIwa1BvWm4zVUp1SU9ybloyMnlQMWZtdlV4K081Z1NxZWJWMW0relN1WU5WaHE3VFdiRGlM
VnZsanBsTGxvcDZDTFhQKzJxdHZHTElMLzF2aW1JU2RNQmd6U29GWnl1NlRxZCtqenhnc1BhVjlCQ3Fl
ZS9OallrNnY2bEs5Y3dpVWMvU1R0ZjFIRHBNM2I1OTJ5N2gzVGh4NW96SzY5SExwWVd1QXdhcVM1Y3Yy
NnE3Y2ViOGVmVllhUmVQM2lGVTh6ajFrblN3WlhITW1uQ2pZME9nYWxvN1VRZlNDTTNxUVFyMkgvWEZQ
N3NzWHg0NVlsOTFCeWVDZXA0bW9ab0grMWZHM3hENHRUN3g4a3d5ajhud2I5ZXYyNlYwQjZkKzdINHpL
dnVkQUg1MzdGanF5ek9IZEpuSEV1em1YcS9XanhPYnZOTWJ2N25oeXdzWDJhVnNXdEM4KzQ4YUxlYXBF
N3A1d0taaTBBMkFRUlY1bnZSNEUrdUpjK2I2MWtBcHFJbnhCZ21kLzRWNVFQL210MThIREM3c1JIZnRt
ZXU1bG1oVjBybi9BTFgyMzJicWQ0QkZuRHg3VmkxY1dTMnVmZjBJYkI0N3FleHhtVWo5UXV0WWp1cGQz
dFlENmFiV0JCTXJoK2FwTmJPS3JORjErdWdDYTRyaVhHZndNUFB0VmlhdmhVM1lNT0FBbnVVYi9SMDdM
MHlPU2VPYWRFODhBcHNYRkdmZjMweW5obEpnTTUxQ1U2dk45RXpnbnB2SEJGVXlpVnJhZVBpd0o1M0RG
NVpUWm5vbUVOZzg1a05VZDJvSmkyV3ByNE9tbWtmTjR4NHpIZmlWRmM4RHY4Tnp1aE5xT2lkaWxHdkE2
REd1ZVp3Tzc4QUFRbjZjaUVrNitydzVWY3ZqdnFORFlQT29JVXdhS1NocnhBdVhMbGtINGFZdUdmTVlE
YzEwV0Y1VGEzMWhQSk9mY1VoclUvSmxJTmk2YzZlbFJZZEJwbzYrK1lmang2MWxHTmZSbTRNRDVySjFq
M0ZvR0huakRTQk5hcllVZ01MeU1zektwYjd0WHBvSGZQczhoM1dwMUx6TmZOazU0WHhDMXdER1VtWXpY
WWVmaDZ6L2NLdFZtNEVCeGE5VlFHRHpZcjNMclVNUmpIRUtrazd6YUZLWVFBMmhHUVUxeis4NU5GV3BY
RHJrejN2eDEwR3F4UTZCemVOYm9CazVuOGs0bmViUmgrazFoV2Z4VEYwRDFFeVdVczVuditkZ1FxS2F4
enVDZEUwaXNIbDAyTlE4YWgwbVhyMTJMYTNtMGY5d2lrOSt3TE5UTVkvODZNUG84eWkzMU9meG1UNlBX
b3FHOStEWnVrWW5hNTZtU1p0NVdXU3k1cVZBMXJ3VXlKcVhBbG56a2lhaS9nSFNEN1JrVHlpaG9nQUFB
QUJKUlU1RXJrSmdnZz09IiwKCQkJCSJzdXBwb3J0ZWRFeHRlbnNpb25zIjogW3sKCQkJCQkJImlkIjog
ImhtYWMtc2VjcmV0IiwKCQkJCQkJImZhaWxfaWZfdW5rbm93biI6IGZhbHNlCgkJCQkJfSwKCQkJCQl7
CgkJCQkJCSJpZCI6ICJjcmVkUHJvdGVjdCIsCgkJCQkJCSJmYWlsX2lmX3Vua25vd24iOiBmYWxzZQoJ
CQkJCX0KCQkJCV0sCgkJCQkiYXV0aGVudGljYXRvckldEluZm8iOiB7CgkJCQkJInZlcnNpb25zIjog
WyJVMkZfVjIiLCAiRklET18yXzAiXSwKCQkJCQkiZXh0ZW5zaW9ucyI6IFsiY3JlZFByb3RlY3QiLCAi
aG1hYy1zZWNyZXQiXSwKCQkJCQkiYWFndWlkIjogIjAxMzJkMTEwYmY0ZTQyMDhhNDAzYWI0ZjVmMTJl
ZmU1IiwKCQkJCQkib3B0aW9ucyI6IHsKCQkJCQkJInBsYXQiOiAiZmFsc2UiLAoJCQkJCQkicmsiOiAi
dHJ1ZSIsCgkJCQkJCSJjbGllbnRQaW4iOiAidHJ1ZSIsCgkJCQkJCSJ1cCI6ICJ0cnVlIiwKCQkJCQkJ
InV2IjogInRydWUiLAoJCQkJCQkidXZUb2tlbiI6ICJmYWxzZSIsCgkJCQkJCSJjb25maWciOiAiZmFs
c2UiCgkJCQkJfSwKCQkJCQkibWF4TXNnU2l6ZSI6IDEyMDAsCgkJCQkJInBpblV2QXV0aFByb3RvY29s
cyI6IFsxXSwKCQkJCQkibWF4Q3JlZGVudGlhbENvdW50SW5MaXN0IjogMTYsCgkJCQkJIm1heENyZWRl
bnRpYWxZExlbmd0aCI6IDEyOCwKCQkJCQkidHJhbnNwb3J0cyI6IFsidXNiIiwgIm5mYyJdLAoJCQkJ
CSJhbGdvcml0aG1zIjogW3sKCQkJCQkJCSJ0eXBlIjogInB1YmxpYy1rZXkiLAoJCQkJCQkJImFsZyI6
IC03CgkJCQkJCX0sCgkJCQkJCXsKCQkJCQkJCSJ0eXBlIjogInB1YmxpYy1rZXkiLAoJCQkJCQkJImFs
ZyI6IC0yNTcKCQkJCQkJfQoJCQkJCV0sCgkJCQkJInRpY2F0b3JDb25maWdMZW5ndGgi
OiAxMDI0LAoJCQkJSkZWZhdWx0Q3JlZFByb3RlY3QiOiAyLAoJCQkJSmaXJtd2FyZVZlcnNpb24i
OiA1CgkJCQl9CgkJCX0sCgkJCSJzdGF0dXNSZXBvcnRzIjogW3sKCQkJCQkic3RhdHVzIjogIkZJRE9f
Q0VSVElGSUVEIiwKCQkJCQkiZWZmZWN0aXZlRGF0ZSI6ICIyMDE5LTAxLTA0IgoJCQkJfSwKCQkJCXsK
CQkJCQkic3RhdHVzIjogIkZJRE9fQ0VSVElGSUVEX0wxIiwKCQkJCQkiZWZmZWN0aXZlRGF0ZSI6ICIy
MDIwLTExLTE5IiwKCQkJCQkiY2VydGlmaWNhdGlvbkRlc2NyaXB0b3IiOiAiRklETyBBbGxpYW5jZSBT
YW1wbGUgRklETzIgQXV0aGVudGljYXRvciIsCgkJCQkJImNlcnRpZmljYXRlTnVtVmVyIjogIkZJRE8y
MTAxMDI1MTUxMiIsMDAxIiwKCQkJCQkiY2VydGlmaWNhdGlvbkRlc2NyaXB0b3IiOiAiRklETyAyLjEi
```

```
MTAwMDIwMTUxMjIxMDAxIIwKCQkJCQkIY2VydGlmaWNhdGVbtBvbGtjeVZtcHNpb24iOiAiMS4wLjE1
LAoJCQkJCSJjZXJ0aWZpY2F0aW9uUmVxdWlyZW1lbnRzVmVyc2lvbiI6ICIxLjAuMSIKCQkJCX0KCQkJ
XSwKCQkJInRpbWVPZkxhc3RTdGF0dXNDaGFuZ2UiOiAiMjAxOS0wMS0wNCIKCQl9CgldCn0
```

```
EXAMPLE: JWT HEADER
{
  "alg": "ES256",
  "typ": "JWT",
  "iat": 1743490805,
  "x5c": [
    "MIICZTCCAgugAwIBAgIBATAKBggqhkjOPQQDAjCBozEnMCUGA1UEAwweRVhBTVBM
    RSBNRFMzIFRFU1QgSU5URVJNRURJQVRFMSIwIAYJKoZIhvcNAQkBFhNleGFtcGxl
    QGV4YW1wbGUuY29tMRQwEgYDVQQKDAtFeGFtcGxlIE9SRzEQMA4GA1UECwwHRXhh
    bXBsZTELMAkGA1UEBhMCVVMxCzAJBgNVBAgMAk1ZMRIwEAYDVQQHDAlXYWtlZmll
    bGQwHhcNMjEwNDE5MTEzNTA3WhcNMzEwNDE3MTEzNTA3WjCBpTEpMCcGA1UEAwwg
    RVhBTVBMRSBNRFMzIFNJR05JTkcgQ0VSVElGSUNBVEUxIjAgBgkqhkiG9w0BCQEW
    E2V4YW1wbGVAZXhhbXBsZS5jb20xFDASBgNVBAoMC0V4YW1wbGUgT1JHMRAwDgYD
    VQQLDAdFeGFtcGxlMQswCQYDVQQGEwJVUzELMAkGA1UECAwCTVkxEjAQBgNVBAcM
    CVdha2VmaWVsZDBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABNQJs6wTqixc+S+V
    DAajFlPNat10KEWJE5jcWOvm6qpO9SDAAMZvb4HHrvs+P5YRpHrSlUPdvK+uEQbd
    Wg31P9ujLDAqMAkGA1UdEwQCMAAwHQYDVR0OBBYEFLqsapcXV4ZoVHAnRpPZwQe7
    Yy20MAoGCCqGSM49BAMCA0gAMEUCIQC67za8EIuyRiKgNDXIP1s1aLr3jzH9WVXf
    Hx4bJ+zCsgIgG/tVButOJUU+vvoHIo/otAUAcH5bNHP3uIziDS+PTUc=",
    "MIIEHzCCAgegAwIBAgIBAjANBgkqhkiG9w0BAQsFADCBmzEfMB0GA1UEAwwWRVhB
    TVBMRSBNRFMzIFRFU1QgUk9PVDEiMCAGCSqGSIb3DQEJARYTZXhhbXBsZUBleGFt
    cGxlLmNvbTEUMBIGA1UECgwLRXhhbXBsZSBPUkcxEDAOBgNVBAsMB0V4YW1wbGUx
    CzAJBgNVBAYTAlVTMQswCQYDVQQIDAJNWTESMBAGA1UEBwwJV2FrZWZpZWxkMB4X
    DTIxMDQxOTExMzUwN1oXDTQ4MDkwNDExMzUwN1owgaMxJzAlBgNVBAMMHkVYQU1Q
    TEUgTURTMyBURVNUIElOVEVSTUVESUFURTEiMCAGCSqGSIb3DQEJARYTZXhhbXBs
    ZUBleGFtcGxlLmNvbTEUMBIGA1UECgwLRXhhbXBsZSBPUkcxEDAOBgNVBAsMB0V4
    YW1wbGUxCzAJBgNVBAYTAlVTMQswCQYDVQQIDAJNWTESMBAGA1UEBwwJV2FrZWZp
    ZWxkMFkwEwYHKoZIzj0CAQYIKoZIzj0DAQcDQgAENGumBbYnFQnTjP1RSfc70hsh
    gbiI1ZtpwQ5n6xRLA/Wq0PSCfLl5qQ+r7dlcK1d3r3vLa+vm6G6vKHGCPEeUzqMv
    MC0wDAYDVR0TBAUwAwEB/zAdBgNVHQ4EFgQUNk6F4RJnGGVFe+0/cbZwfrZd7ZUw
    DQYJKoZIhvcNAQELBQADggIBACnp1fm0FKlWmUtTplLuYg7mps4xP/COu8dnb38u
    1nMDVuOT4+CZaiM9AGz313GD22hjLGrmPuYn86wGOKI3HOrEpsGdMmfy7tTmKX/e
    M/eS3FEDXZnE82Pn5oFIyBT/f8sGuXyOsFZqWBvVdBIIDldCpD4mxMQZZOZtTrlv
    3WvBQMC/dsicOxe3QKXvWHi6Qb/Rhuaip3rPmwMf+4JpnJO+JMPqAaU1cAH8HVsf
    rLAMoKs148j2+cvbpaWmsT5rIoH/ezVrPaG/MOiIgq79w/efuvSi5AX8J+kDoLSE
    f3d5wOgkJYAqUqcRxXTEEtKIzDM6hzaBQFiAWvTn9IlVWgntQamSXvH+txaTF9iE
    lHxUf5INYFVciCpztSrydeHv/OCNRf7/LVricMSlo8Rh+O3yP9V+2uNf3X8sQJNt
    ufrQNaqq18wiXliTLufSn02/g+mkhIUiNKfTOJpvCjKeCnCFcxQU2/XT3Kh3G8gD
    JwsO6EVRjMUJt4AYKze/hEUCwF55IF2m3jHIoCu8jVfj24CeEX5dnfvSr+SVvN5Q
    B0uZ05M4rmyZXyqBm0zK3fR+iE0/ZpInuwLC7X+W82zXlnMkplI3Q+Jxd7jfQ15S
    YNE2K6rvRIT01w0P9ZqyDF7knGKpRlp7Oqxd37bD/VUbWpQ7gIAfsJNH5KBLowHJ
    FFjW"
  ]
}
```

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

```
EXAMPLE: ENCODED JWT HEADER
ew0KICAiYWxnIjogIkVTMjU2IiwNCiAgInR5cCI6ICJKV1QiLA0KICAiaWF0IjogMTc0MzQ5MDgwNSwN
CiAgIng1YyI6IFsNCiAgICAiTUlJQ1pUQ0NBZ3VnQXdJQkFnSUJBVEFLQmdncWhrak9QUVFEQWpDQm96
RW5NQ1VHQTFVRUF3d2VSVmhCVFZCTQ0KICAgIFJTQk5SRk16SUZSRlUxUWdTVTVVUlZKTlJVUkpRVlJG
TVNJd0lBWUpLb1pJaHZjTkFRa0JGaE5sZUdGdGNHeGwNCiAgICBRR1Y0WVcxd2JHVXVZMjl0TVJRd0Vn
WURWUVFLREF0RmVHRnRjR3hsSUU5U1J6RVFNQTRHQTFVRUN3d0hSWGhoDQogICAgYlhCc1pURUxNQWtH
QTFVRUJoTUNWVk14Q3pBSkJnTlZCQWdNQWsxWk1SSXdFQVlEVlFRSERBbFhZV3RsWm1sbA0KICAgIGJH
UXdIaGNOTWpFd05ERTVNVEV6TlRBM1doY05NekV3TkRFM01URXpOVEEzV2pDQnBURXBNQ2NHQTFVRUF3
d2cNCiAgICBSVmhCVFZCTVJTQk5SRk16SUZOSlIwNUpUa2NnUTBWU1ZFbEdTVU5CVkVVeElqQWdCZ2tx
aGtpRzl3MEJDUUVXDQogICAgRTJWNFlXMXdiR1ZBWlhoaGJYQnNaUzVqYjIweEZEQVNCZ05WQkFvTUMw
VjRZVzF3YkdVZ1QxSkhNUkF3RGdZRA0KICAgIFZRUUxEQWRGZUdGdGNHeGxNUXN3Q1FZRFZRUUdFd0pW
VXpFTE1Ba0dBMVVFQ0F3Q1RWa3hFakFRQmdOVkJBY00NCiAgICBDVmRoYTJWbWFXVnNaREJaTUJNR0J5
cUdTTTQ5QWdFR0NDcUdTTTQ5QXdFSEEwSUFCTlFKczZ3VHFpeGMrUytWDQogICAgREFhakZsUE5hdDEw
S0VXSkU1amNXT3ZtNnFwTzlTREFBTVp2YjRISHJ2cytQNVlScEhyU2xVUGR2Syt1RVFiZA0KICAgIFdn
MzFQOXVqTERBcU1Ba0dBMVVkRXdRQ01BQXdIUVlEVlIwT0JCWUVGTHFzYXBjWFY0Wm9WSEFuUnBQWndR
ZTcNCiAgICBZeTIwTUFvR0NDcUdTTTQ5QkFNQ0EwZ0FNRVVDSVFDNjd6YThFSXV5UmlLZ05EWElQMXMx
YUxyM2p6SDlXVlhmDQogICAgSHg0YkorekNzZ0lnRy90VkJ1dE9KVVUrdnZvSElvL290QVVBY0g1Yk5I
UDN1SXppRFMrUFRVYz0iLA0KICAgICJNSUlFSHpDQ0FnZWdBd0lCQWdJQkFqQU5CZ2txaGtpRzl3MEJB
UXNGQURDQm16RWZNQjBHQTFVRUF3d1dSVmhCDQogICAgVFZCTVJTQk5SRk16SUZSRlUxUWdVazlQVkRF
aU1DQUdDU3FHU0liM0RRRUpBUllUWlhoaGJYQnNaVUJsZUdGdA0KICAgIGNHeGxMbU52YlRFVU1CSUdB
MVVFQ2d3TFJYaGhiWEJzWlNCUFVrY3hFREFPQmdOVkJBc01CMFY0WVcxd2JHVXgNCiAgICBDekFKQmdO
VkJBWVRBbFZUTVFzd0NRWURWUVFJREFKTldURVNNQkFHQTFVRUJ3d0pWMkZyWldacFpXeGtNQjRYDQog
ICAgRFRJeE1EUXhPVEV4TXpVd04xb1hEVFE0TURrd05ERXhNelV3TjFvd2dhTXhKekFsQmdOVkJBTU1I
a1ZZUVUxUQ0KICAgIFRFVWdUVVJUTXlCVVJWTlVJRWxPVkVWU1RVVkVTVUZVUlRFaU1DQUdDU3FHU0li
M0RRRUpBUllUWlhoaGJYQnNCiAgICBaVUJsZUdGdGNHeGxMbU52YlRFVU1CSUdBMVVFQ2d3TFJYaGhi
WEJzWlNCUFVrY3hFREFPQmdOVkJBc01CMFY0DQogICAgWVcxd2JHVXhDekFKQmdOVkJBWVRBbFZUTVFz
d0NRWURWUVFJREFKTldURVNNQkFHQTFVRUJ3d0pWMkZyWldacA0KICAgIFpXeGtNRmt3RXdZSEtvWkl6
ajBDQVFZSUtvWkl6ajBEQVFjRFFnQUVOR3VtQmJZbkZRblRqUDFSU2ZjNzBoc2gNCiAgICBnYmlJMVp0
cHdRNW42eFJMQS9XcTBQU0NmTGw1cVErcjdkbGNLMWQzcjN2TGErdm02RzZ2S0hHQ1BFZVV6cU12DQog
ICAgTUMwd0RBWURWUjBUQkFVd0F3RUIvekFkQmdOVkhRNEVGZ1FVTms2RjRSSm5HR1ZGZSswL2NiWndm
clpkN1pVdw0KICAgIERRWUpLb1pJaHZjTkFRUxCUUFEZ2dJQkFDbnAxZm0wRktsV21VdFRwbEx1WWc3
bXBzNHhQL0NPdThkbmIzOHUNCiAgICAxbk1EVnVPVDQrQ1phaU05QUd6MzEzR0QyMmhqTEdybVB1WW44
NndHT0tJM0hPckVwc0dkTW1meTd0VG1LWC9lDQogICAgTS9lUzNGRURYWm5FODJQbjVvRkl5QlQvZjhz
R3VYeU9zRlpxV0J2VmRCSUlEbGRDcEQ0bXhNUVpaT1p0VHJsdg0KICAgIDNXdkJRTUMvZHNpY094ZTNR
S1h2V0hpNlFiL1JodWFpcDNyUG13TWYrNEpwbkpPK0pNUHFBYVUxY0FIOEhWc2YNCiAgICBByTEFNb0tz
MTQ4ajIrY3ZicGFXbXNUNXJJb0gvZXpWclBhRy9NT2lJZ3E3OXcvZWZ1dlNpNUFYOEora0RvTFNFDQog
ICAgZjNkNXdPZ2tKWUFxVXFjUnhYVEVFdEtJekRNNmh6YUJRRmlBV3ZUbjlJbFZXZ250UWFtU1h2SCt0
eGFURjlpRQ0KICAgIGxIeFVmNUlOWUZWY2lDcHp0U3J5ZGVIdi9PQ05SZjcvTFZyaWNNU2xvOFJoK08z
eVA5VisydU5mM1g4c1FKTnQNCiAgICB1ZnJRTmFxcTE4d2lYbGlUTHVmU24wMi9nK21raElVaU5LZlRP
SnB2Q2pLZUNuQ0ZjeFFVMi9YVDNLaDNHOGdEDQogICAgSndzTzZFVlJqTVVKdDRBWUt6ZS9oRVVDd0Y1
NUlGMm0zakhJb0N1OGpWZmoyNENlRVg1ZG5mdlNyK1NWdk41UQ0KICAgIEIwdVowNU00cm15Wlh5cUJt
MHpLM2ZSK2lFMC9acEludXdMQzdYK1c4MnpYbG5Na3BsSTNRK0p4ZDdqZlExNVMNCiAgICBZTkUySzZy
dlJJVDAxdzBQOVpxeURGN2tuR0twUmxwN09xeGQzN2JEL1ZVYldwUTdnSUFmc0pOSDVLQkxvd0hKDQog
ICAgRkZqVyINCiAgXQ0KfQ
```

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

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

ISSUE 1 Update this example

```
EXAMPLE: JWT
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The line breaks are for display purposes only.

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

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EXAMPLE: ECDSA KEY USED FOR SIGNATURE COMPUTATION
-----BEGIN CERTIFICATE-----
MIICZTCCAgugAwIBAgIBATAKBggqhkjOPQQDAjCBozEnMCUGA1UEAwweRVhBTVBM
RSBNRFMzIFRFU1QgSU5URVJNRURJQVRFMSIwIAYJKoZIhvcNAQkBFhNleGFtcGxl
QGV4YW1wbGUuY29tMRQwEgYDVQQKDAtFeGFtcGxlIE9SRzEQMA4GA1UECwwHRXhh
bXBsZTELMAkGA1UEBhMCVVMxCzAJBgNVBAgMAk1ZMRIwEAYDVQQHDAlXYWtlZmll
bGQwHhcNMjEwNDE5MTEzNTA3WhcNMzEwNDE3MTEzNTA3WjCBpTEpMCcGA1UEAwwg
RVhBTVBMRSBNRFMzIFNJR05JTkcgQ0VSVElGSUNBVEUxIjAgBgkqhkiG9w0BCQEW
E2V4YW1wbGVAZXhhbXBsZS5jb20xFDASBgNVBAoMC0V4YW1wbGUgT1JHMRAwDgYD
VQQLDAdFeGFtcGxlMQswCQYDVQQGEwJVUzELMAkGA1UECAwCTVkxEjAQBgNVBAcM
CVdha2VmaWVsZDBZMBMGByqGSM49AgEGCCqGSM49AwEHA0IABNQJs6wTqixc+S+V
DAajFlPNat10KEWJE5jcWOvm6qpO9SDAAMZvb4HHrvs+P5YRpHrSlUPdvK+uEQbd
Wg31P9ujLDAqMAkGA1UdEwQCMAAwHQYDVR0OBBYEFLqsapcXV4ZoVHAnRpPZwQe7
Yy20MAoGCCqGSM49BAMCA0gAMEUCIQC67za8EIuyRiKgNDXIP1s1aLr3jzH9WVXf
Hx4bJ+zCsgIgG/tVButOJUU+vvoHIo/otAUAcH5bNHP3uIziDS+PTUc=
-----END CERTIFICATE-----

-----BEGIN EC PRIVATE KEY-----
MHcCAQEEIFNpFhJvod3jKvbrLLzKTWKFxzaZ4l7kMchx3NyytQYUoAoGCCqGSM49
AwEHoUQDQgAE1AmzrBOqLFz5L5UMBqMWU81q3XQoRYkTmNxY6+bqqk71IMAAxm9v
gceu+z4/lhGketKVQ928r64RBt1aDfU/2w==
-----END EC PRIVATE KEY-----
```

The root certificate to validate certificate path in the X5C is:

```
EXAMPLE: CERTIFICATE PATH ROOT CERTIFICATE
-----BEGIN CERTIFICATE-----
MIIGGTCCBAGgAwIBAgIUdT9qLX0sVMRe8l0sLmHd3mZovQ0wDQYJKoZIhvcNAQEL
BQAwgZsxHzAdBgNVBAMMFkVYQU1QTEUgTURTMyBURVNUIFJPT1QxIjAgBgkqhkiG
9w0BCQEWE2V4YW1wbGVAZXhhbXBsZS5jb20xFDASBgNVBAoMC0V4YW1wbGUgT1JH
MRAwDgYDVQQLDAdFeGFtcGxlMQswCQYDVQQGEwJVUzELMAkGA1UECAwCTVkxEjAQ
BgNVBAcMCVdha2VmaWVsZDAeFw0yMTA0MTkxMTM1MDdaFw00ODA5MDQxMTM1MDda
MIGbMR8wHQYDVQQDDBZFWEFNUExFIE1EUzMgVEVTVCBST09UMSIwIAYJKoZIhvcN
AQkBFhNleGFtcGxlQGV4YW1wbGUuY29tMRQwEgYDVQQKDAtFeGFtcGxlIE9SRzEQ
MA4GA1UECwwHRXhhbXBsZTELMAkGA1UEBhMCVVMxCzAJBgNVBAgMAk1ZMRIwEAYD
VQQHDAlXYWtlZmllbGQwggIiMA0GCSqGSIb3DQEBAQUAA4ICDwAwggIKAoICAQDD
jF5wyEWuhwDHsZosGdGFTCcI677rW881vV+UfW38J+K2ioFFNeGVsxbcebK6AVOi
CDPFj0974IpeD9SFOhwAHoDu/LCfXdQWp8ZgQ91ULYWoW8o7NNSp01nbN9zmaO6/
xKNCa0bzjmXoGqglqnP1AtRcWYvXOSKZy1rcPeDv4Dhcpdp6W72fBw0eWIqOhsrI
tuY2/N8ItBPiG03EX72nACq4nZJ/nAIcUbER8STSFPPzvE97TvShsi1FD8aO6l1W
kR/QkreAGjMI++GbB2Qc1nN9Y/VEDbMDhQtxXQRdpFwubTjejkN9hKOtF3B71Yrw
Irng3V9RoPMFdapWMzSlI+WWHog0oTj1PqwJDDg7+z1I6vSDeVWAMKr9mq1w1OGN
zgBopIjd9lRWkRtt2kQSPX9XxqS4E1gDDr8MKbpM3JuubQtNCg9D7Ljvbz6vwvUr
bPHH+oREvucsp0PZ5PpizloepGIcLFxDQqCulGY2n7Ahl0JOFXJqOFCaK3TWHwBv
ZsaY5DgBuUvdUrwtgZNg2eg2omWXEepiVFQn3Fvj43Wh2npPMgIe5P0rwncXvROx
aczd4rtajKS1ucoB9b9iKqM2+M1y/FDIgVf1fWEHwK7YdzxMlgOeLdeV/kqRU5PE
UlLU9a2EwdOErrPbPKZmIfbs/L4B3k4zejMDH3Y+ZwIDAQABo1MwUTAdBgNVHQ4E
FgQU8sWwq1TrurK7xMTwO1dKfeJBbCMwHwYDVR0jBBgwFoAU8sWwq1TrurK7xMTw
O1dKfeJBbCMwDwYDVR0TAQH/BAUwAwEB/zANBgkqhkiG9w0BAQsFAAOCAgEAFw6M
1PiIfCPIBQ5EBUPNmRvRFuDpolOmDofnf/+mv63LqwQZAdo/W8tzZ9kOFhq24SiL
w0H7fsdG/jeREXiIZMNoW/rA6Uac8sU+FYF7Q+qp6CQLlSQbDcpVMifTQjcBk2xh
+aLK9SrrXBqnTAhwS+offGtAW8DpoLuH4tAcQmIjlgMlN65jnELCuqNR/wpA+zch
8LZW8saQ2cwRCwdr8mAzZoLbsDSVCHxQF3/kQjPT7Nao1q2iWcY3OYcRmKrieHDP
67yeLUbVmetfZis2d6ZlkqHLB4ZW1xX4otsEFkuTJA3HWDRsNyhTwx1YoCLsYut5
Zp0myqPNBq28w6qGMyyoJN0Z4RzMEO3R6i/MQNfhK55/8O2HciM6xb5t/aBSuHPK
lBDrFWhpRnKYkaNtlUo35qV5IbKGKau3SdZdSRciaXUd/p81YmoF01UlhhMz/Rqr
1k2gyA0a9tF8+awCeanYt5izl8YO0FlrOU1SQ5UQw4szqqZqbrf4e8fRuU2TXNx4
zk+ImE7WRB44f6mSD746ZCBRogZ/SA5jUBu+OPe4/sEtERWRcQD+fXgce9ZEN0+p
eyJIKAsl5Rm2Bmgyg5IoyWwSG5W+WekGyEokpslou2Yc6EjUj5ndZWz5EiHAiQ74
hNfDoCZIxVVLU3Qbp8a0S1bmsoT2JOsspIbtZUg=
-----END CERTIFICATE-----
```

3.2. Metadata BLOB object processing rules§

The FIDO Server MUST follow these processing rules:

1. Download (see here for considerations) and cache the root signing trust anchor from the respective MDS root location "mds.fidoalliance.org". More information can be found at https://fidoalliance.org/metadata/

   > The FIDO server should pass the serial number of the latest cached Metadata Service BLOB to the service (`GET /?localCopySerial=77`). In that case, the MDS will return HTTP code 304 (Not Modified) if no newer MDS blob is available. Alternatively, the serial number of the local copy could be provided through the "If-None-Match" header field. The server will always return the serial number in the ETag header field. If both, the "localCopySerial" parameter and the "If-None-Match" header are provided, the server will only process the "localCopySerial" parameter.

2. To validate the digital certificates used in the digital signature, the certificate revocation information MUST be available in the form of CRLs at the respective MDS CRL location e.g. More information can be found at https://fidoalliance.org/metadata/
3. The FIDO Server MUST be able to download the latest metadata BLOB object from the well-known URL when appropriate, e.g. https://mds.fidoalliance.org/. The serial number of the latest local copy SHOULD be provided in order to avoid unnecessary data transfers.
4. 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 BLOB from. The FIDO Server SHOULD ignore the file if the web-origin differs (in order to prevent loading objects from arbitrary sites).
   2. 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 BLOB 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.

      > The requirements for verifying certificate revocation, are only applicable to the MDS BLOB payload certificates. It is up to the server vendors whether to enforce CRL check for the certificates in the individual metadata statements.

5. If the `x5u` attribute is missing, the chain should be retrieved from the `x5c` attribute. If that attribute is missing as well, Metadata BLOB signing trust anchor is considered the BLOB signing certificate chain.
6. Verify the signature of the Metadata BLOB object using the BLOB 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 BLOB object cached locally.
7. Write the verified object to a local cache as required. Remember the "iat" ("issued at") time as needed.
8. Iterate through the individual entries (of type `MetadataBLOBPayloadEntry`). 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)

      > Note: To remain compatible with future versions the FIDO Server SHOULD ignore unrecognized fields when processing any element of an entry. The addition, subtraction or change in interpretation of any fields in an entry of this specification which substantively changes the processing logic of a consumer will only occur alongside an update to the major version number of the specification.

   2. 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].

3. Update the cached metadata statement.

> It is possible that an MDS entry representing an authenticator disappears in a future update of the BLOB. This should not affect the processing of any other MDS entries.

4. Considerations§

This section is not 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 BLOB object and all metadata statements.

Organizational Impact

The FIDO Alliance has control over the FIDO certification process and authentication vendors provide the metadata as part of that process. With this metadata service, the list of known authenticators and their metadata statements need 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 BLOB object and all embedded metadata statements.

Performance Impact

Metadata BLOB objects and metadata statements can be cached by the FIDO Server.

The update policy can be specified by the relying party.

The metadata BLOB 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.

High Security Environments

Some high security environments might only trust internal policy authorities. FIDO Servers in such environments could be restricted to use metadata BLOB 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.

Implementer Guidance

For typical applications, we recommend checking for updated Metadata Statements once a day. This ensures up-to-date information about available security keys and passkey providers and their respective characteristics and certification status.

In order to minimize bandwidths needs and system load, we also recommend providing the serial number of the most recent local copy that is available, see section Metadata BLOB object processing rules for more details. This avoids downloading the data again if there is no change.

Note that the nextUpdate field will be removed in the future.

Index§

Terms defined by this specification§

Terms defined by reference§

[ECMASCRIPT] defines the following terms:

- Number

[WebIDL] defines the following terms:

- DOMString
- unsigned long
- unsigned short

References§

Normative References§

[ECMASCRIPT]
ECMAScript Language Specification. URL: https://tc39.es/ecma262/multipage/

[FIDOAuthenticatorSecurityRequirements]
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[RFC5280]
D. Cooper; et al. *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*. May 2008. URL: https://tools.ietf.org/html/rfc5280

[RFC7519]
M. Jones; J. Bradley; N. Sakimura. *JSON Web Token (JWT)*. May 2015. Proposed Standard. URL: https://www.rfc-editor.org/rfc/rfc7519

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R. Lindemann; et al. *FIDO ECDAA Algorithm*. 23 May 2022. Proposed Standard. URL: https://fidoalliance.org/specs/fido-v2.0-id-20180227/fido-ecdaa-algorithm-v2.0-id-20180227.html

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https://fidoalliance.org/specs/common-specs/fido-glossary-v2.1-ps-20220523.html

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R. Lindemann; et al. *FIDO Registry of Predefined Values*. 05 January 2026. Proposed Standard. URL: https://fidoalliance.org/specs/common-specs/fido-registry-v2.3-ps-20260105.html

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IDL Index§

```
dictionary MetadataBLOBPayloadEntry {
    AAID                        aaid;
    AAGUID                      aaguid;
    DOMString[]                 attestationCertificateKeyIdentifiers;
    required MetadataStatement  metadataStatement;
    BiometricStatusReport[]     biometricStatusReports;
    required StatusReport[]     statusReports;
    required DOMString          timeOfLastStatusChange;
    DOMString                   rogueListURL;
    DOMString                   rogueListHash;
};

dictionary BiometricStatusReport {
    required unsigned short certLevel;
    required DOMString      modality;
    DOMString               effectiveDate;
    DOMString               certificationDescriptor;
    DOMString               certificateNumber;
    DOMString               certificationPolicyVersion;
    DOMString               certificationRequirementsVersion;
};

dictionary StatusReport {
    required AuthenticatorStatus status;
    DOMString                    effectiveDate;
    unsigned long                authenticatorVersion;
    DOMString                    batchCertificate;
    DOMString                    certificate;
    DOMString                    url;
    DOMString                    certificationDescriptor;
    DOMString                    certificateNumber;
    DOMString                    certificationPolicyVersion;
    DOMString[]                  certificationProfiles;
    DOMString                    certificationRequirementsVersion;
    DOMString                    sunsetDate;
    unsigned long                fipsRevision;
    unsigned long                fipsPhysicalSecurityLevel;
```

```
};

enum AuthenticatorStatus {
    "NOT_FIDO_CERTIFIED",
    "FIDO_CERTIFIED",
    "USER_VERIFICATION_BYPASS",
    "ATTESTATION_KEY_COMPROMISE",
    "USER_KEY_REMOTE_COMPROMISE",
    "USER_KEY_PHYSICAL_COMPROMISE",
    "UPDATE_AVAILABLE",
    "RETIRED",
    "REVOKED",
    "SELF_ASSERTION_SUBMITTED",
    "FIDO_CERTIFIED_L1",
    "FIDO_CERTIFIED_L1plus",
    "FIDO_CERTIFIED_L2",
    "FIDO_CERTIFIED_L2plus",
    "FIDO_CERTIFIED_L3",
    "FIDO_CERTIFIED_L3plus",
    "FIPS140_CERTIFIED_L1",
    "FIPS140_CERTIFIED_L2",
    "FIPS140_CERTIFIED_L3",
    "FIPS140_CERTIFIED_L4"
};

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

dictionary MetadataBLOBPayload {
    DOMString                           legalHeader;
    required Number                     no;
    required DOMString                  nextUpdate;
    required MetadataBLOBPayloadEntry[] entries;
};
```

Issues Index§

ISSUE 1 Update this example ↵