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**Constrained Voucher Artifacts for Bootstrapping Protocols  
draft-ietf-anima-constrained-voucher-00**

Abstract

This document defines a strategy to securely assign a pledge to an owner, using an artifact signed, directly or indirectly, by the pledge's manufacturer. This artifact is known as a "voucher".

This document builds upon the work in [[RFC8366](#)], encoding the resulting artifact in CBOR. Use with two signature technologies are described.

Additionally, this document explains how constrained vouchers may be transported in the [[I-D.ietf-ace-coap-est](#)] protocol.

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## [1.](#) Introduction

Enrollment of new nodes into constrained networks with constrained nodes present unique challenges.

There are bandwidth and code space issues to contend. A solution such as [[I-D.ietf-anima-bootstrapping-keyinfra](#)] may be too large in terms of code space or bandwidth required.

This document defines a constrained version of [[RFC8366](#)]. Rather than serializing the YANG definition in JSON, it is serialized into CBOR ([[RFC7049](#)]).

This document follows a similar, but not identical structure as [[RFC8366](#)]. Some sections are left out entirely. Additional sections have been added concerning:

1. Addition of voucher-request specification as defined in [[I-D.ietf-anima-bootstrapping-keyinfra](#)],
2. Addition to [[I-D.ietf-ace-coap-est](#)] of voucher transport requests over coap.

The CBOR definitions for this constrained voucher format are defined using the mechanism describe in [[I-D.ietf-core-yang-cbor](#)] using the SID mechanism explained in [[I-D.ietf-core-sid](#)]. As the tooling to convert YANG documents into an list of SID keys is still in its infancy, the table of SID values presented here should be considered normative rather than the output of the pyang tool.

Two methods of signing the resulting CBOR object are described in this document:

1. One is CMS [[RFC5652](#)].
2. The other is COSE [[RFC8152](#)] signatures.

## **2. Terminology**

The following terms are defined in [[RFC8366](#)], and are used identically as in that document: artifact, imprint, domain, Join Registrar/Coordinator (JRC), Manufacturer Authorized Signing Authority (MASA), pledge, Trust of First Use (TOFU), and Voucher.

## **3. Requirements Language**

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in [BCP 14](#), [RFC 2119](#) [[RFC2119](#)] and indicate requirement levels for compliant STuPiD implementations.

## **4. Survey of Voucher Types**

[RFC8366] provides for vouchers that assert proximity, that authenticate the registrar and that include different amounts of anti-replay protection.

This document does not make any extensions to the types of vouchers.

Time based vouchers are included in this definition, but given that constrained devices are extremely unlikely to know the correct time, their use is very unlikely. Most users of these constrained vouchers will be online and will use live nonces to provide anti-replay protection.

[RFC8366] defined only the voucher artifact, and not the Voucher Request artifact, which was defined in [[I-D.ietf-anima-bootstrapping-keyinfra](#)].

This document defines both a constrained voucher and a constrained voucher-request. They are presented in the order voucher-request, followed by voucher response as this is the time order that they occur.

## **5. Discovery and URI**

This section describes the BRSKI extensions to EST-coaps [[I-D.ietf-ace-coap-est](#)] to transport the voucher between registrar, proxy and pledge over CoAP.

The extension is targeted to low-resource networks with small packets. Saving header space is important and the EST-coaps URI is shorter than the EST URI.

The presence and location of (path to) the management data are discovered by sending a GET request to `"/.well-known/core"` including a resource type (RT) parameter with the value `"ace.est"` [RFC6690]. Upon success, the return payload will contain the root resource of the EST resources. It is up to the implementation to choose its root resource; throughout this document the example root resource `/est` is used.

The EST-coaps server URIs differ from the EST URI by replacing the scheme `https` by `coaps` and by specifying shorter resource path names:

```
coaps://www.example.com/est/short-name
```

Figure 5 in [section 3.2.2 of \[RFC7030\]](#) enumerates the operations and corresponding paths which are supported by EST. Table 1 provides the mapping from the BRSKI extension URI path to the EST-coaps URI path.

BRSKI	EST-coaps
<code>/requestvoucher</code>	<code>/rv</code>
<code>/voucher-status</code>	<code>/vs</code>
<code>/enrollstatus</code>	<code>/es</code>
<code>/requestauditlog</code>	<code>/ra</code>

Table 1: BRSKI path to EST-coaps path

`/requestvoucher` and `/enrollstatus` are needed between pledge and Registrar.

When discovering the root path for the EST resources, the server MAY return the full resource paths and the used content types. This is useful when multiple content types are specified for EST-coaps server. The example below shows the discovery of the presence and the location of voucher resources.

```
REQ: GET /.well-known/core?rt=ace.est
```

```
RES: 2.05 Content
</est>; rt="ace.est"
</est/rv>; ct=50 TBD2 TBD3 16
</est/vs>; ct=50
</est/es>; ct=50
</est/ra>; ct=TBD2 TBD3 16
```

The first line MUST be returned in response to the GET, The following four lines MAY be returned to show the supported Content-Formats. The return of the content-types allows the client to choose the most appropriate one from multiple content types.

ct=50 stands for the Content-Format "application/json", ct=16 stands for the Content-Format "application/cose; cose-type="cose-encrypt0", ct=TBD2 stands for Content-Format "application/voucher-cms+cbor, ct=TBD3 stands for Content-Format "application/voucher-cose+cbor; cose-type="cose-sign1. The latter two are defined in this document.

## **6. Artifacts**

This section describes the abstract (tree) definition as explained in [[I-D.ietf-netmod-yang-tree-diagrams](#)] first. This provides a high-level view of the contents of each artifact.

Then the assigned SID values are presented. These have been assigned using the rules in [[I-D.ietf-core-yang-cbor](#)], with an allocation that was made via the <http://comi.space> service.

((EDNOTE: it is unclear if there is further IANA work))

### **6.1. Voucher Request artifact**

#### **6.1.1. Tree Diagram**

module: ietf-cwt-voucher-request

```

grouping voucher-request-cwt-grouping
+---- voucher
  +---- created-on
  |      yang:date-and-time
  +---- expires-on?
  |      yang:date-and-time
  +---- assertion
  |      enumeration
  +---- serial-number
  |
  +---- idevid-issuer?
  |
  +---- pinned-domain-cert
  |
  +---- domain-cert-revocation-checks?
  |
  +---- nonce?
  |
  +---- last-renewal-date?
  |      yang:date-and-time
  +---- proximity-registrar-subject-public-key-info?
  |

```

### 6.1.2. SID values

```

      SID Assigned to
-----
1001150 module ietf-cwt-voucher-request
1001151 module ietf-restconf
1001152 module ietf-voucher
1001153 module ietf-yang-types
1001154 data .../ietf-cwt-voucher-request:voucher
1001155 data .../assertion
1001156 data .../created-on
1001157 data .../domain-cert-revocation-checks
1001158 data .../expires-on
1001159 data .../idevid-issuer
1001160 data .../last-renewal-date
1001161 data .../nonce
1001162 data .../pinned-domain-cert
1001163 data .../proximity-registrar-subject-public-key-info
1001164 data .../serial-number

```

### 6.1.3. YANG Module

In the cwt-voucher-request YANG module, the voucher is "used" and not "augmented" such that one continuous set of SID values is generated for the cwt-voucher-request module name, all voucher attributes, and the cwt-voucher-request attribute.

```

<CODE BEGINS> file "ietf-cwt-voucher-request@2018-02-07.yang"
/* -*- c -*- */
module ietf-cwt-voucher-request {
  yang-version 1.1;

  namespace
    "urn:ietf:params:xml:ns:yang:ietf-cwt-voucher-request";
  prefix "vcwt";

  import ietf-voucher {
    prefix "v";
  }

  organization
    "IETF 6tisch Working Group";

  contact
    "WG Web:   <http://tools.ietf.org/wg/6tisch/>
    WG List:  <mailto:6tisch@ietf.org>
    Author:   Michael Richardson

```

```
<mailto:mcr+ietf@sandelman.ca>;
```

```
description
```

```
"This module defines the format for a voucher, which is produced by a pledge's manufacturer or delegate (MASA) to securely assign one or more pledges to an 'owner', so that the pledges may establish a secure connection to the owner's network infrastructure.
```

```
This version provides a very restricted subset appropriate for very constrained devices.
```

```
In particular, it assumes that nonce-ful operation is always required, that expiration dates are rather weak, as no clocks can be assumed, and that the Registrar is identified by a pinned Raw Public Key.
```

```
The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'MAY', and 'OPTIONAL' in the module text are to be interpreted as described in RFC 2119.";
```

```
revision "2018-02-07" {
```

```
  description
```

```
    "Initial version";
```

```
  reference
```

```
    "RFC XXXX: Voucher Profile for Constrained Devices";
```

```
}
```

```
// Grouping defined for future usage
```

```
grouping voucher-request-cwt-grouping {
```

```
  description
```

```
    "Grouping to allow reuse/extensions in future work.";
```

```
uses v:voucher-artifact-grouping {
```

```
  augment "voucher" {
```

```
    description "Base the CWT voucher-request upon the regular one";
```

```
    leaf proximity-registrar-subject-public-key-info {
```

```
      type binary;
```

```
      description
```

```
        "The proximity-registrar-subject-public-key-info replaces the proximit-registrar-cert in constrained uses of the voucher-request.
```

```
The proximity-registrar-subject-public-key-info is the Raw Public Key of the Registrar. This field is encoded as specified in RFC7250, section 3.
```

```
The ECDSA algorithm MUST be supported.
```

```
The EdDSA algorithm as specified in draft-ietf-tls-rfc4492bis-17 SHOULD be supported.
```

```
Support for the DSA algorithm is not recommended.
```

```
Support for the RSA algorithm is a MAY.";
```



```
      SID Assigned to
-----
1001100 module ietf-cwt-voucher
1001101 module ietf-restconf
1001102 module ietf-voucher
1001103 module ietf-yang-types
1001104 data ../ietf-cwt-voucher:voucher
1001105 data ../assertion
1001106 data ../created-on
1001107 data ../domain-cert-revocation-checks
1001108 data ../expires-on
1001109 data ../idevid-issuer
1001110 data ../last-renewal-date
1001111 data ../nonce
1001112 data ../pinned-domain-cert
1001113 data ../pinned-domain-subject-public-key-info
1001114 data ../serial-number
```

### **6.2.3. YANG Module**

In the cwt-voucher YANG module, the voucher is "used" and not "augmented" such that one continuous set of SID values is generated for the cwt-voucher module name, all voucher attributes, and the cwt-voucher attribute.

```
<CODE BEGINS> file "ietf-cwt-voucher@2018-02-07.yang"
/* -*- c -*- */
module ietf-cwt-voucher {
  yang-version 1.1;

  namespace
    "urn:ietf:params:xml:ns:yang:ietf-cwt-voucher";
  prefix "vcwt";

  import ietf-voucher {
    prefix "v";
  }

  organization
    "IETF 6tisch Working Group";

  contact
    "WG Web: <http://tools.ietf.org/wg/6tisch/>
    WG List: <mailto:6tisch@ietf.org>
    Author: Michael Richardson
           <mailto:mcr+ietf@sandelman.ca>;

  description
```

"This module defines the format for a voucher, which is produced by a pledge's manufacturer or delegate (MASA) to securely assign one or more pledges to an 'owner', so that the pledges may establish a secure connection to the owner's network infrastructure.

This version provides a very restricted subset appropriate for very constrained devices. In particular, it assumes that nonce-ful operation is always required, that expiration dates are rather weak, as no clocks can be assumed, and that the Registrar is identified by a pinned Raw Public Key.

The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'MAY', and 'OPTIONAL' in the module text are to be interpreted as described in [RFC 2119](#)."

```
revision "2018-02-07" {
  description
    "Initial version";
  reference
    "RFC XXXX: Voucher Profile for Constrained Devices";
}

// Grouping defined for future usage
grouping voucher-cwt-grouping {
  description
    "Grouping to allow reuse/extensions in future work.";

  uses v:voucher-artifact-grouping {
    augment "voucher" {
      description "Base the CWT voucher upon the regular one";
      leaf pinned-domain-subject-public-key-info {
        type binary;
        description
          "The pinned-domain-subject replaces the
          pinned-domain-certificate in constrained uses of
          the voucher. The pinned-domain-public-key-info is the
          Raw Public Key of the Registrar. This field is encoded
          as specified in RFC7250, section 3.
          The ECDSA algorithm MUST be supported.
          The EdDSA algorithm as specified in
          draft-ietf-tls-rfc4492bis-17 SHOULD be supported.
          Support for the DSA algorithm is not recommended.
          Support for the RSA algorithm is a MAY.";
      }
    }
  }
}
```

```
}
<CODE ENDS>
```

#### **6.2.4. Example voucher artifacts**

Below a the CBOR serialization of the the cwt-voucher and cwt-voucher-request are shown in diagnostic CBOR notation.

##### **6.2.4.1. CBOR serialization of cwt-voucher**

```
{
  1001051: {
    +2 : "2016-10-07T19:31:42Z", / SID = 1001053, created-on /
    +4 : "2016-10-21T19:31:42Z", / SID = 1001055, expires-on /
    +1 : "verified", / SID = 1001052, assertion /
    +11: "JADA123456789", / SID = 1001062, serial-number /
    +5 : h'01020D0F', / SID = 1001056, idevid-issuer /
    +8 : h'01020D0F', / SID = 1001059, pinned-domain-cert /
    +3 : true, / SID = 1001054, domain-cert-revocation-
checks /
    +6 : "2017-10-07T19:31:42Z", / SID = 1001057, last-renewal-date /
    +9 : h'01020D0F' / SID = 1001060, pinned-domain-subject-
public-key-info /
  }
}
```

##### **6.2.4.2. CBOR serialization of cwt-voucher-request**

```
{
  1001101: {
    +2 : "2016-10-07T19:31:42Z", / SID = 1001103, created-on /
    +4 : "2016-10-21T19:31:42Z", / SID = 1001105, expires-on /
    +1 : "verified", / SID = 1001102, assertion /
    +11: "JADA123456789", / SID = 1001112, serial-number /
    +5 : h'01020D0F', / SID = 1001106, idevid-issuer /
    +8 : h'01020D0F', / SID = 1001109, pinned-domain-cert /
    +3 : true, / SID = 1001104, domain-cert-revocation-
checks /
    +6 : "2017-10-07T19:31:42Z", / SID = 1001107, last-renewal-date /
    +10: h'01020D0F' / SID = 1001111, proximity-registrar-subject-
public-key-info /
  }
}
```

#### **6.3. Signing of voucher and voucher-request artifacts**

The IETF evolution of PKCS#7 is CMS [[RFC5652](#)]. The CMS signed voucher is much like the equivalent voucher defined in [[RFC8366](#)].

A different eContentType of TBD1 is used to indicate that the contents are in a different format than in [[RFC8366](#)].



The ContentInfo structure contains a payload consisting of the CBOR encoded voucher. The [[I-D.ietf-core-yang-cbor](#)] use of delta encoding creates a canonical ordering for the keys on the wire. This canonical ordering is not important as there is no expectation that the content will be reproduced during the validation process.

Normally the recipient is the pledge and the signer is the MASA.

[I-D.ietf-anima-bootstrapping-keyinfra] supports both signed and unsigned voucher requests from the pledge to the JRC. In this specification, voucher-request artifact is not signed from the pledge to the registrar. From the JRC to the MASA, the voucher-request artifact MUST be signed by the domain owner key which is requesting ownership.

### **6.3.1. CMS signing**

The considerations of [[RFC5652](#)] [section 5.1](#), concerning validating CMS objects which are really PKCS7 objects (cmsVersion=1) applies.

The CMS structure SHOULD also contain all the certificates leading up to and including the signer's trust anchor certificate known to the recipient. The inclusion of the trust anchor is unusual in many applications, but without it third parties can not accurately audit the transaction.

The CMS structure MAY also contain revocation objects for any intermediate certificate authorities (CAs) between the voucher-issuer and the trust anchor known to the recipient. However, the use of CRLs and other validity mechanisms is discouraged, as the pledge is unlikely to be able to perform online checks, and is unlikely to have a trusted clock source. As described below, the use of short-lived vouchers and/or pledge provided nonce provides a freshness guarantee.

### **6.3.2. COSE signing**

The COSE-Sign1 structure discussed in [section 4.2 of \[RFC8152\]](#). The CBOR object that carries the body, the signature, and the information about the body and signature is called the COSE\_Sign1 structure. It is used when only one signature is used on the body. The signature algorithm is ECSDA with three curves P-256, P-384, and P-512.

Support for EdDSA is encouraged

## **7. Design Considerations**

The design considerations for the CBOR encoding of vouchers is much the same as for [\[RFC8366\]](#).

One key difference is that the names of the leaves in the YANG does not have a material effect on the size of the resulting CBOR, as the SID translation process assigns integers to the names.

## **8. Security Considerations**

### **8.1. Clock Sensitivity**

TBD.

### **8.2. Protect Voucher PKI in HSM**

TBD.

### **8.3. Test Domain Certificate Validity when Signing**

TBD.

## **9. IANA Considerations**

### **9.1. The IETF XML Registry**

This document registers two URIs in the IETF XML registry [\[RFC3688\]](#). Following the format in [\[RFC3688\]](#), the following registration is requested:

URI: urn:ietf:params:xml:ns:yang:ietf-cwt-voucher  
Registrant Contact: The ANIMA WG of the IETF.  
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-cwt-voucher-request  
Registrant Contact: The ANIMA WG of the IETF.  
XML: N/A, the requested URI is an XML namespace.

### **9.2. The YANG Module Names Registry**

This document registers two YANG modules in the YANG Module Names registry [\[RFC6020\]](#). Following the format defined in [\[RFC6020\]](#), the following registration is requested:

```

name:          ietf-cwt-voucher
namespace:     urn:ietf:params:xml:ns:yang:ietf-cwt-voucher
prefix:        vch
reference:     RFC XXXX

name:          ietf-cwt-voucher-request
namespace:     urn:ietf:params:xml:ns:yang:ietf-cwt-voucher-request
prefix:        vch
reference:     RFC XXXX
    
```

**9.3. The SMI Security for S/MIME CMS Content Type Registry**

This document registers an OID in the "SMI Security for S/MIME CMS Content Type" registry (1.2.840.113549.1.9.16.1), with the value:

Decimal	Description	References
TBD1	id-ct-animaCBORVoucher	[ThisRFC]

EDNOTE: should a separate value be used for Voucher Requests?

**9.4. The SID registry**

The SID range 1001100 was allocated by comi.space to the IETF-CWT-VOUCHER yang module.

The SID range 1001150 was allocated by comi.space to the IETF-CWT-VOUCHER-REQUEST yang module.

EDNOTE: it is unclear if there is further IANA work required.

**9.5. Media-Type Registry**

This section registers the 'application/voucher-cms+cbor' media type and the 'application/voucher-cose+cbor' in the "Media Types" registry. These media types are used to indicate that the content is a CBOR voucher either signed with a cms structure or a COSE\_Sign1 structure [RFC8152].

**9.5.1. application/voucher-cms+cbor**

Type name: application  
Subtype name: voucher-cms+cbor  
Required parameters: none  
Optional parameters: none  
Encoding considerations: CMS-signed CBOR vouchers are CBOR encoded.  
Security considerations: See Security Considerations, Section  
Interoperability considerations: The format is designed to be broadly interoperable.  
Published specification: THIS RFC.  
Applications that use this media type: ANIMA, 6tisch, and other zero-touch imprinting systems  
Additional information:  
  Magic number(s): None  
  File extension(s): .cbor  
  Macintosh file type code(s): none  
Person & email address to contact for further information: IETF ANIMA WG  
Intended usage: LIMITED  
Restrictions on usage: NONE  
Author: ANIMA WG  
Change controller: IETF  
Provisional registration? (standards tree only): NO

#### [9.5.2.](#) application/voucher-cose+cbor

Type name: application  
Subtype name: voucher-cose+cbor  
Required parameters: none  
Optional parameters: cose-type  
Encoding considerations: COSE\_Sign1 CBOR vouchers are COSE objects signed with one signer.  
Security considerations: See Security Considerations, Section  
Interoperability considerations: The format is designed to be broadly interoperable.  
Published specification: THIS RFC.  
Applications that use this media type: ANIMA, 6tisch, and other zero-touch imprinting systems  
Additional information:  
  Magic number(s): None  
  File extension(s): .cbor  
  Macintosh file type code(s): none  
Person & email address to contact for further information: IETF ANIMA WG  
Intended usage: LIMITED  
Restrictions on usage: NONE  
Author: ANIMA WG  
Change controller: IETF  
Provisional registration? (standards tree only): NO

#### **9.6. CoAP Content-Format Registry**

Additions to the sub-registry "CoAP Content-Formats", within the "CoRE Parameters" registry are needed for the below media types. These can be registered either in the Expert Review range (0-255) or IETF Review range (256-9999).

Addition1:

Type name: application  
Subtype name: voucher-cms+cbor  
ID: TBD2  
Required parameters: None  
Optional parameters: None  
Encoding considerations: CBOR  
Security considerations: As defined in this specification  
Published specification: this document  
Applications that use this media type: ANIMA bootstrap (BRSKI)

Addition2:

Type name: application  
Subtype name: voucher-cose+cbor  
ID: TBD3  
Required parameters: cose-type="COSE-Sign1"  
Optional parameters: none  
Encoding considerations: CBOR  
Security considerations: As defined in this specification  
Published specification: this document  
Applications that use this media type: ANIMA bootstrap (BRSKI)

## **10. Acknowledgements**

We are very grateful to Jim Schaad for explaining COSE and CMS choices.

## **11. Changelog**

-03

Cms and cose mediatypes are introduced

## **12. References**

### **12.1. Normative References**

- [I-D.ietf-ace-cbor-web-token]  
Jones, M., Wahlstroem, E., Erdtman, S., and H. Tschofenig, "CBOR Web Token (CWT)", [draft-ietf-ace-cbor-web-token-15](#) (work in progress), March 2018.
- [I-D.ietf-ace-coap-est]  
Stok, P., Kampanakis, P., Kumar, S., Richardson, M., Furuhed, M., and S. Raza, "EST over secure CoAP (EST-coaps)", [draft-ietf-ace-coap-est-00](#) (work in progress), February 2018.
- [I-D.ietf-anima-bootstrapping-keyinfra]  
Pritikin, M., Richardson, M., Behringer, M., Bjarnason, S., and K. Watsen, "Bootstrapping Remote Secure Key Infrastructures (BRSKI)", [draft-ietf-anima-bootstrapping-keyinfra-15](#) (work in progress), April 2018.
- [I-D.ietf-core-object-security]  
Selander, G., Mattsson, J., Palombini, F., and L. Seitz, "Object Security for Constrained RESTful Environments (OSCORE)", [draft-ietf-core-object-security-12](#) (work in progress), March 2018.

- [I-D.ietf-core-sid]  
Veillette, M. and A. Pelov, "YANG Schema Item Identifier (SID)", [draft-ietf-core-sid-03](#) (work in progress), December 2017.
- [I-D.ietf-core-yang-cbor]  
Veillette, M., Pelov, A., Somaraju, A., Turner, R., and A. Minaburo, "CBOR Encoding of Data Modeled with YANG", [draft-ietf-core-yang-cbor-06](#) (work in progress), February 2018.
- [ieee802-1AR]  
IEEE Standard, ., "IEEE 802.1AR Secure Device Identifier", 2009, <<http://standards.ieee.org/findstds/standard/802.1AR-2009.html>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC5652] Housley, R., "Cryptographic Message Syntax (CMS)", STD 70, [RFC 5652](#), DOI 10.17487/RFC5652, September 2009, <<https://www.rfc-editor.org/info/rfc5652>>.
- [RFC7049] Bormann, C. and P. Hoffman, "Concise Binary Object Representation (CBOR)", [RFC 7049](#), DOI 10.17487/RFC7049, October 2013, <<https://www.rfc-editor.org/info/rfc7049>>.
- [RFC7250] Wouters, P., Ed., Tschofenig, H., Ed., Gilmore, J., Weiler, S., and T. Kivinen, "Using Raw Public Keys in Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [RFC 7250](#), DOI 10.17487/RFC7250, June 2014, <<https://www.rfc-editor.org/info/rfc7250>>.
- [RFC8152] Schaad, J., "CBOR Object Signing and Encryption (COSE)", [RFC 8152](#), DOI 10.17487/RFC8152, July 2017, <<https://www.rfc-editor.org/info/rfc8152>>.
- [RFC8366] Watsen, K., Richardson, M., Pritikin, M., and T. Eckert, "A Voucher Artifact for Bootstrapping Protocols", [RFC 8366](#), DOI 10.17487/RFC8366, May 2018, <<https://www.rfc-editor.org/info/rfc8366>>.

## **12.2. Informative References**

- [duckling] Stajano, F. and R. Anderson, "The resurrecting duckling: security issues for ad-hoc wireless networks", 1999, <<https://www.cl.cam.ac.uk/~fms27/papers/1999-StajanoAnd-duckling.pdf>>.
- [I-D.ietf-netmod-yang-tree-diagrams] Bjorklund, M. and L. Berger, "YANG Tree Diagrams", [draft-ietf-netmod-yang-tree-diagrams-06](#) (work in progress), February 2018.
- [pledge] Dictionary.com, ., "Dictionary.com Unabridged", 2015, <<http://dictionary.reference.com/browse/pledge>>.
- [RFC6690] Shelby, Z., "Constrained RESTful Environments (CoRE) Link Format", [RFC 6690](#), DOI 10.17487/RFC6690, August 2012, <<https://www.rfc-editor.org/info/rfc6690>>.
- [RFC7030] Pritikin, M., Ed., Yee, P., Ed., and D. Harkins, Ed., "Enrollment over Secure Transport", [RFC 7030](#), DOI 10.17487/RFC7030, October 2013, <<https://www.rfc-editor.org/info/rfc7030>>.

## **Appendix A. EST messages to EST-coaps**

This section extends the examples from [Appendix A](#) of [\[I-D.ietf-ace-coap-est\]](#). The CoAP headers are only worked out for the enrollstatus example.

### **A.1. enrollstatus**

A coaps enrollstatus message can be :

```
GET coaps://[192.0.2.1:8085]/est/es
```

The corresponding coap header fields are shown below.

```

Ver = 1
T = 0 (CON)
Code = 0x01 (0.01 is GET)
Options
Option1 (Uri-Host)
  Option Delta = 0x3 (option nr = 3)
  Option Length = 0x9
  Option Value = 192.0.2.1
Option2 (Uri-Port)
  Option Delta = 0x4 (option nr = 4+3=7)
  Option Length = 0x4
  Option Value = 8085
Option3 (Uri-Path)
  Option Delta = 0x4 (option nr = 7+4= 11)
  Option Length = 0x7
  Option Value = /est/es
Payload = [Empty]

```

A 2.05 Content response with an unsigned JSON voucher (ct=50) will then be:

```

2.05 Content (Content-Format: application/json)
  {payload}

```

With CoAP fields and payload:

```

Ver=1
T=2 (ACK)
Code = 0x45 (2.05 Content)
Options
  Option1 (Content-Format)
    Option Delta = 0xC (option nr 12)
    Option Length = 0x2
    Option Value = 0x32 (application/json)

  Payload =
    [EDNOTE: put here voucher payload ]

```

## A.2. voucher\_status

A coaps voucher\_status message can be :

```

GET coaps://[2001:db8::2:1]:61616]/est/vs

```

A 2.05 Content response with a non signed JSON voucher (ct=50) will then be:

2.05 Content (Content-Format: application/json)  
Payload =  
[EDNOTE: put here voucher payload ]

### **A.3. requestvoucher**

A coaps requestvoucher message can be :

GET coaps://[2001:db8::2:1]:61616]/est/rv

A 2.05 Content response returning CBOR voucher signed with a cms structure(ct=TBD2) will then be:

2.05 Content (Content-Format: application/voucher-cms+cbor)  
Payload =  
[EDNOTE: put here CMS signed voucher payload ]

### **A.4. requestauditing**

A coaps requestauditing message can be :

GET coaps://[2001:db8::2:1]:61616]/est/ra

A 2.05 Content response returning a COSE\_Sign1 object (ct=TBD3) will then be:

2.05 Content (Content-Format: application/voucher-cose+cbor)  
Payload =  
[EDNOTE: put here COSE\_Sign1 voucher payload ]

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