Using The Delegated CoAP Authentication and Authorization Framework (DCAF) With CBOR Encoded Message Syntax

draft-bergmann-ace-dcaf-cose

Olaf Bergmann, Stefanie Gerdes
{gerdes | bergmann}@tzi.org

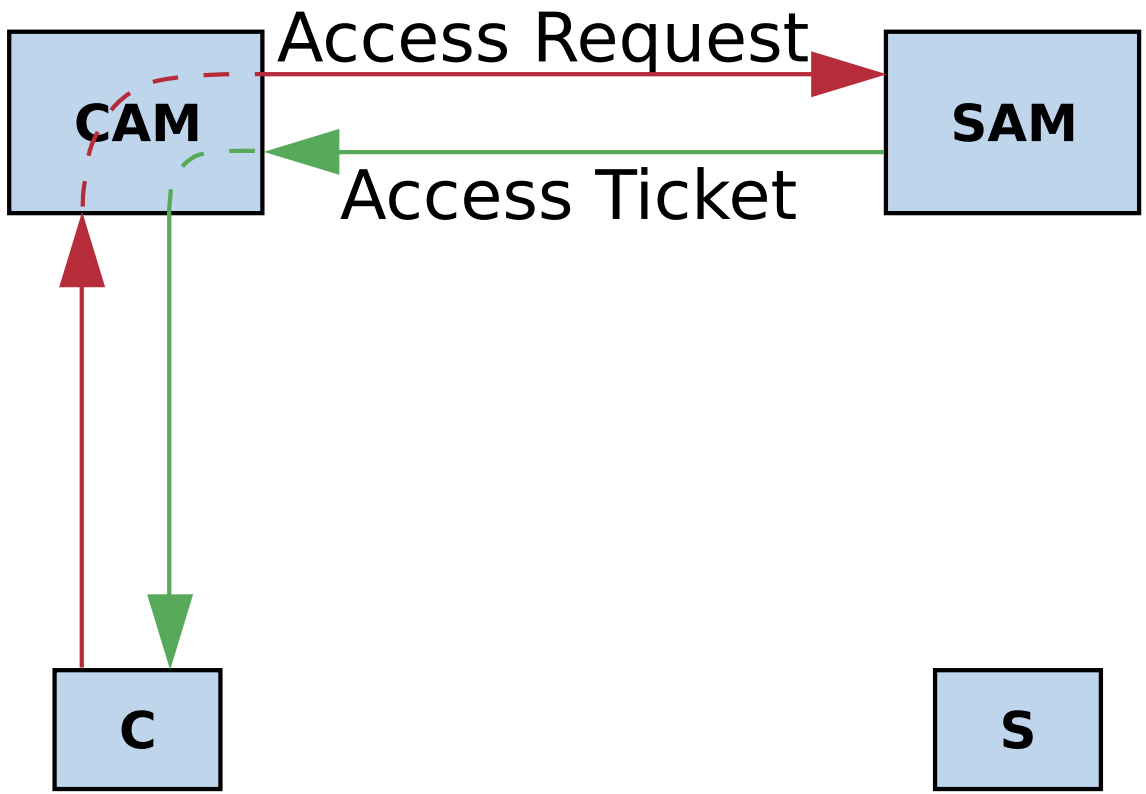
Presented by **Carsten Bormann**
cabo@tzi.org

IETF-94, ACE Meeting, 2015-11-02

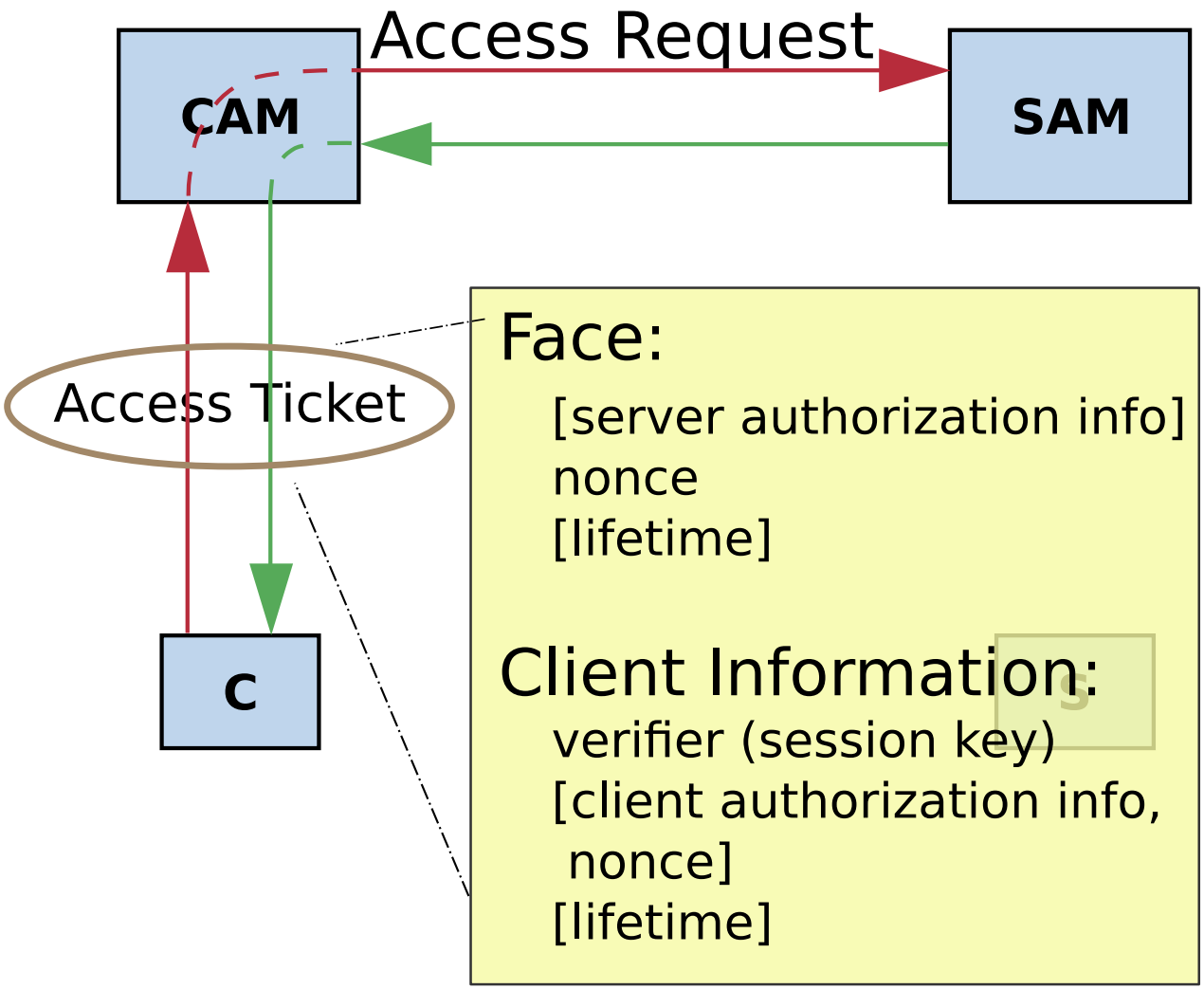
Motivation

- `draft-gerdes-ace-dcaf-authorize`
  - Secure exchange of authorization information.
  - Establish DTLS channel between constrained nodes.
  - Support of class-1 devices (RFC 7228).
  - Support cross-domain, multi-owner scenarios.
- `draft-bergmann-ace-dcaf-cose`
  - Re-use light-weight DCAF messaging
  - Support for application-level security using COSE objects
  - Enable *piggybacked protected content* use-case

Observation: DCAF Messages are not tied to DTLS



Nor is the Ticket Data



DCAF-Messages can be protected with COSE

Example: Access Request

```
POST /client-authorize
Content-Format: application/cose+cbor
[ h'a1031862',      # protected { content_type: application/dcaf+cbor }
  { alg: AES-CCM-16-64-128          # unprotected
    nonce: h'd6150b90e6f0eb5be42164062c', # nonce
  },
  h'{encrypted payload w/ tag}',    # encrypted DCAF payload
  # recipients:
  [ [ h'',                          # protected (absent for AE algorithm)
      { alg: A128KW,                # unprotected
        kid: h'383261622e6161733432' # context identifier: "82ab.aas42"
      },
      h'52ff9ed52d...'              # encrypted session key
  ] ]
]
```

DCAF-Messages can be protected with COSE

Example: Access Request

```
POST /client-authorize
Content-Format: application/cose+cbor
[ h'a1031862',      # protected { content_type: application/dcaf+cbor }
  { alg: AES-CCM-16-64-128          # unprotected
    nonce: h'd6150b90e6f0eb5be42164062c', # nonce
  },
  h'{encrypted payload w/ tag}',    # encrypted DCAF payload
  # recipients:
  [ [ h'',                          # protected (absent for AE algorithm)
      { alg: A128KW,                # unprotected
        kid: h'383261622e6161733432' # context identifier: "82ab.aas42"
      },
      h'52ff9ed52d...'              # encrypted session key
  ] ]
]
```

Key Derivation

Security Association

transfer Ticket Face during setup

use session key from Verifier (direct or derived)

derive session key from Ticket Face and $K_{S,SAM}$

Convey Ticket Face from C to S

```
POST /authorize
Content-Format: application/cose+cbor
[ h'a1031862',     # protected { content_type: application/dcaf+cbor }
  { alg: HMAC 256/256 },        # unprotected
  h'{ SAI: [ "/s/tempC" ... }', # DCAF payload wrapped in CBOR binary
  h'....',              # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]          # recipients
]
```

Convey Ticket Face from C to S

```
POST /authorize
Content-Format: application/cose+cbor
[ h'a1031862',     # protected { content_type: application/dcaf+cbor }
  { alg: HMAC 256/256 },        # unprotected
  h'{ SAI: [ "/s/tempC" ... }', # DCAF payload wrapped in CBOR binary
  h'....',              # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]          # recipients
]
```

Creation of Security Context

```
POST /authorize
Content-Format: application/cose+cbor
[ h'a1031862',     # protected { content_type: application/dcaf+cbor }
  { alg: HMAC 256/256 },         # unprotected
  h'{ SAI: [ "/s/tempC" ... }', # DCAF payload wrapped in CBOR binary
  h'....',              # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]           # recipients
]


2.01 Created
Content-Format: application/cose+cbor
Location-Path: 238dsa29
Authorization: [ h'a1031862',    # protected
  { alg: HMAC 256/256 },         # unprotected
  h'',                           # empty payload
  h'....',                       # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]           # recipients
]
```

Creation of Security Context

```
POST /authorize
Content-Format: application/cose+cbor
[ h'a1031862',     # protected { content_type: application/dcaf+cbor }
  { alg: HMAC 256/256 },         # unprotected
  h'{ SAI: [ "/s/tempC" ... }', # DCAF payload wrapped in CBOR binary
  h'....',              # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]           # recipients
]

2.01 Created
Content-Format: application/cose+cbor
Location-Path: 238dsa29
Authorization: [ h'a1031862',    # protected
  { alg: HMAC 256/256 },         # unprotected
  h'',                           # empty payload
  h'....',                       # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]           # recipients
]
```

used as security context identifier

new option

derived from Ticket Face and $K_{S,SAM}$

Usage of Security Context

without payload

```
GET /r
Authorization: [ h'',                  # protected (empty)
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  nil,                                 # payload (empty)
  h'....',                             # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
```

Usage of Security Context

without payload

```
GET /r
Authorization: [ h'',                  # protected (empty)
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  nil,                                 # payload (empty)
  h'....',                             # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
```

as returned in Location-Path

Usage of Security Context

with payload

```
GET /r
Authorization: [ h'',                  # protected (empty)
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  nil,                                 # payload (empty)
  h'....',                             # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
PUT /r
Content-Format: application/cose+cbor
[ h'a10300',                           # protected { content_type: text/plain }
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  h'48656c6c6f20576f726c6421',  # payload: "Hello World!\n"
  h'....',                  # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
```

as returned in Location-Path

Usage of Security Context

with payload

```
GET /r
Authorization: [ h'',                  # protected (empty)
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  nil,                                 # payload (empty)
  h'....',                             # tag: HMAC(options+protected, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
PUT /r
Content-Format: application/cose+cbor
[ h'a10300',                           # protected { content_type: text/plain }
  { alg: HMAC 256/256,                 # unprotected
    kid: h'3233386473613239'           # context identifier: "238dsa29"
  },
  h'48656c6c6f20576f726c6421',  # payload: "Hello World!\n"
  h'....',                  # tag: HMAC(options+protected+payload, secret)
  [ [ h'', {}, h'' ] ]                 # recipients
]
```

as returned in Location-Path

Open Issues

- protection of changeable CoAP options (-> CoRE WG)
- describe how to apply key derivation methods from `draft-ietf-cose-msg`

Summary

- DCAF-COSE supports application-level security using COSE objects
- use plain COSE as described in `draft-ietf-cose-msg`
- two new CoAP options:
  - `Authorization`: convery authorization information
  - `Authorization-Format`: allow for future extensions

DCAF-COSE vs. OSCOAP

	DCAF-COSE	OSCOAP
Changes to COSE	use COSE as is (-06) no changes required	invent "Secure Message format" (COSE-profile in Appendix A) invent "COSE Optimizations" that are not COSE-compatible (new message types, remove unprotected header, alg ...)
Security Context	use parameter kid (identifies auth info and session key)	invent new parameter cid (identifies cipher suite, keys, alg-specific parameters, different for client and server: "typically identifies the sending party")
Replay protection	use parameter nonce (-> local time)	invent new parameter seq (-> sequence number, no freshness information)
Re-key	Server sends SAM Information Message	"out of scope" (Section 7.1)
Signaling	use existing payload types two new options (not critical due to usual content-format handling)	implicit, new payload type new critical option
Handling of unknown options	COSE extension parameter to signal required options	not supported
RFC 7252, 7641 options block-wise	needs more work in CoRE WG	