Alternative Workflow and OAuth Parameters for the Authentication and Authorization for Constrained Environments (ACE) Framework

draft-ietf-ace-workflow-and-params-02

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Recap

Set of updates to RFC 9200

1. **Define an alternative workflow for uploading the access token**
   - The AS uploads the access token to the RS, on behalf of C
   - Preferable if the C-RS communication leg is constrained, while the AS-RS leg is not
2. **Define additional OAuth parameters to use in ACE**
   - To enable the alternative workflow above
   - To effectively enable the issue of an access token for a group-audience
   - …
3. **Amend two requirements on transport profiles of ACE**
4. **Deprecate the original payload format of error responses**
   - Instead, use the problem-details format from RFC 9290

Updates in v -02

- **Clarifications and editorial improvements**
- **Notation in the examples**
  - The CBOR diagnostic notation uses the construct **e''** (*)
    to import values from the CDDL model in Appendix C
    - e'SOME_NAME' is replaced by the value assigned to SOME_NAME in the CDDL model
    - For example, {e'aud_2' : ["rs1", "rs2"]} stands for {50 : ["rs1", "rs2"]}.

```
/ Access Token Response /

Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
  / expires_in / 2 : 3600,
  / cnf /       8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

```
/ Access Token Response /

Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
    e'token_hash' : h'0153269057e12fe2b74ba07c892560a2d7
                      53877eb62ff44d5a19002530ed97ffe4',
  / expires_in / 2 : 3600,
  / cnf /       8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

```
; OAuth Parameters CBOR Mappings
token_upload = 48
token_hash = 49
aud_2 = 50
rs_cnf_2 = 51
anchor_cnf = 52
rev_aud_param = 53
rev_scope_param = 54

; CBOR Web Token (CWT) Claims
rev_aud_claim = 42
rev_scope_claim = 43

; CWT Confirmation Methods
x5chain = 5

; Custom Problem Detail Keys Registry
ace-error = 2
```


(*) Proposed in https://datatracker.ietf.org/doc/draft-ietf-cbor-edn-e-ref/

Updates in v -02

Alternative workflow

- **Section 2 – Secure communication between AS and RS**
  - Stated as explicit requirement, aligned with RFC 9200
  - The AS protects the uploading of every access token, i.e., also the first one in a token series
- **Section 2 – Remark: usable also by non-ACE Clients (Thanks, Dave Robin!)**
  - If properly configured, the AS just issues access tokens and uploads them to the RS
  - As properly configured, Clients just interact with the RS, without asking for an access token
- **Related parameters**
  - Revised semantics of “token_upload”
  - Defined the new “token_hash”

Updates in v -02

- **“token_upload” – Value type changed to unsigned integer**
  - C indicates its wish for obtaining the access token, or a token hash, or neither
  - The AS indicates the outcome of the token upload to the RS
- **“token_upload” in the Access Token Request (C to AS)**
  - If present: the AS is requested to use the alternative workflow (the final decision remains on the AS)
  - 0: if the token upload to the RS succeeds, C wants neither the access token nor the token hash
  - 1: if the token upload to the RS succeeds, C wants the token hash
  - 2: if the token upload to the RS succeeds, C wants the access token
- **“token_upload” in the Access Token Response (AS to C)**
  - Must be present if and only if the AS used the alternative workflow, irrespective of the outcome
  - 0: the token upload to the RS succeeded
    - The Response includes (access token / token hash / neither), depending on “token_upload” in the Request
  - 1: the token upload to the RS failed
    - The Response includes the access token

Updates in v -02

- **“token_hash” – The value type is byte string**
  - Only intended for the Access Token Response (AS to C)

- **Only used if all the following points hold:**
  - In the Access Token request, C specified “token_upload” = 1
  - The AS actually used the alternative workflow
  - The upload of the access token to the RS was successful

- **Parameter value**
  - The AS computes it from the issued access token, like it does when using the service defined in [1]
  - If the AS provides the service in [1], then the AS must use the same hash algorithm used for that service

- **When using the alternative workflow, why would C want to obtain …**
  - … the token hash? ➔ To be still able to use the service defined in [1]
  - … the access token? ➔ To possibly re-upload the access token to the RS by itself (e.g., see RFC 9203)

[1] https://datatracker.ietf.org/doc/draft-ietf-ace-revoked-token-notification/

Updates in v -02

Alternative workflow – Examples of successful token uploading from the AS

```
/ Access Token Request /

Header: POST (Code=0.02)
Uri-Host: "as.example.com"
Uri-Path: "token"
Content-Format: application/ace+cbor
Payload:
{
  / audience /  5 : "tempSensor4711",
  / scope /     9 : "read",
  e'token_upload' : 0
}

-------------------------------------

/ Access Token Response /

Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
  / expires_in / 2 : 3600,
  / cnf /        8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

```
/ Access Token Request /

Header: POST (Code=0.02)
Uri-Host: "as.example.com"
Uri-Path: "token"
Content-Format: application/ace+cbor
Payload:
{
  / audience /  5 : "tempSensor4711",
  / scope /     9 : "read",
  e'token_upload' : 1
}

-------------------------------------

/ Access Token Response /

Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
  e'token_hash' : h'0153269057e12fe2b74ba07c892560a2d7
                    53877eb62ff44d5a19002530ed97ffe4',
  / expires_in / 2 : 3600,
  / cnf /        8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

As it was requested in

```
/ Access Token Request /

Header: POST (Code=0.02)
Uri-Host: "as.example.com"
Uri-Path: "token"
Content-Format: application/ace+cbor
Payload:
{
  / audience /  5 : "tempSensor4711",
  / scope /     9 : "read",
  e'token_upload' : 2
}

-------------------------------------

/ Access Token Response /

Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
  / access_token / 1 : h'd08343a1'/...
   (remainder of CWT omitted for brevity;
    CWT contains the symmetric PoP key in the "cnf" claim)/,
  / expires_in /   2 : 3600,
  / cnf /          8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

As it was requested in

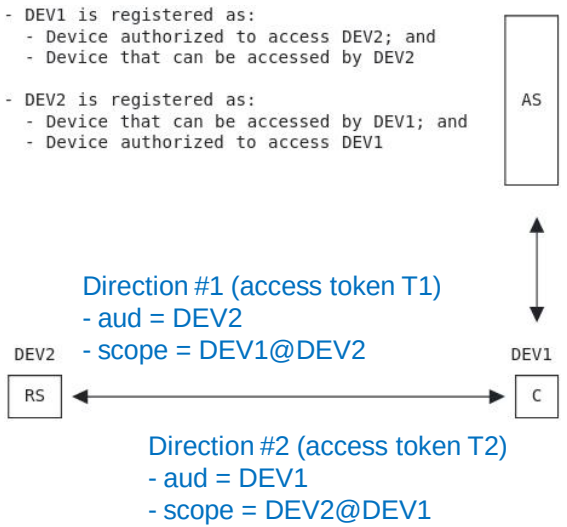
Updates in v -02

- **Bidirectional access control – The original way**
  1. DEV1 (C) to DEV2 (RS), with an access token T1 requested by DEV1
  2. DEV2 (C) to DEV1 (RS), with another access token T2 requested by DEV2

- **For the Direction #1, T1 specifies:**
  - "aud" – An identifier of DEV2
  - "scope" – The access rights of DEV1 for accessing DEV2

- **For the Direction #2, T2 specifies:**
  - "aud" – An identifier of DEV1
  - "scope" – The access rights of DEV2 for accessing DEV1

- **New proposal: enforce both directions, but with a single access token**
  - See also the Github issue #1



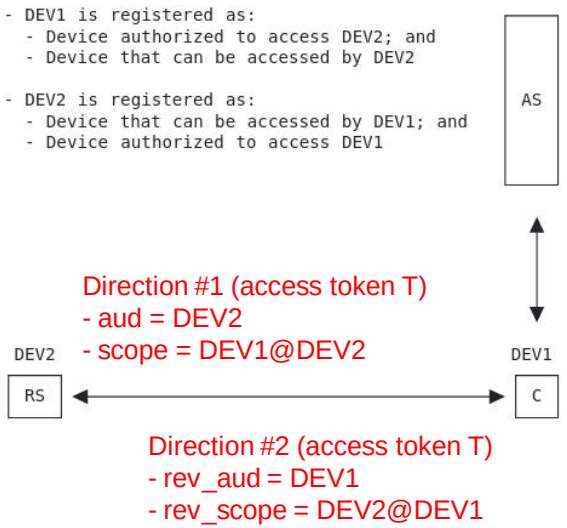
Updates in v -02

- **Bidirectional access control – The new way**
  1. DEV1 (C) to DEV2 (RS), with an access token T requested by DEV1
  2. DEV2 (RS) to DEV1 (C), with the same access token T

- **Who has which roles?**
  - DEV1 is the only ACE Client, as the only one requesting an access token
  - DEV2 is the only ACE RS, as the only one processing an access token
  - DEV1 and DEV2 are CoAP Client and CoAP Server (like for the old way)

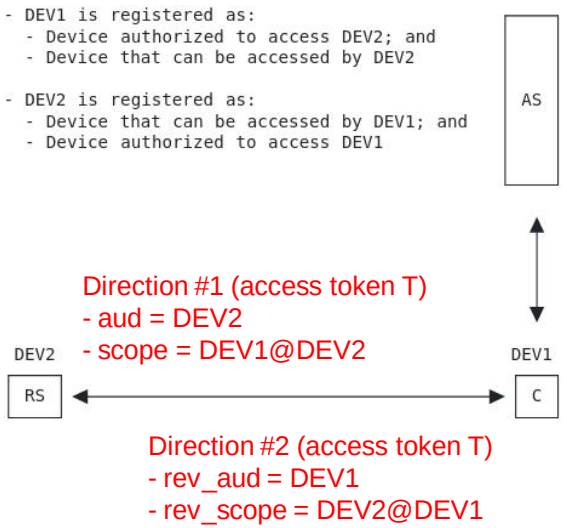
- **For the primary Direction #1, T specifies:**
  - "aud" – An identifier of DEV2
  - "scope" – The access rights of DEV1 for accessing DEV2

- **For the secondary Direction #2, T specifies:**
  - "rev_aud" – An identifier of DEV1
  - "rev_scope" – The access rights of DEV2 for accessing DEV1



Updates in v -02

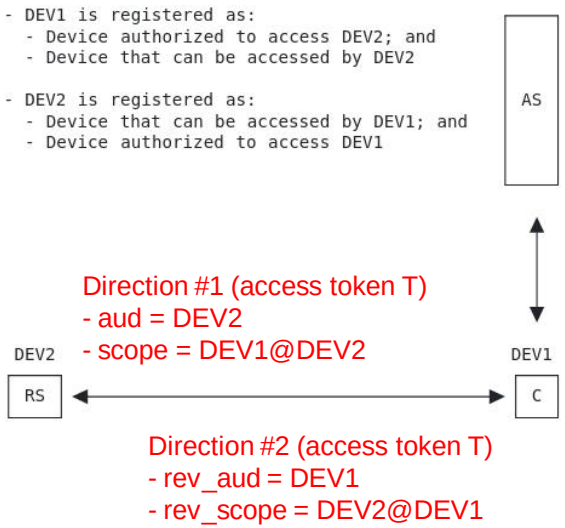
- **Defined two new parameters for the Access Token Request/Response**
  - "rev_aud": identifier of the Client C requesting the access token
  - "rev_scope": access rights that C wishes to grant to the audience of the access token, for accessing resources at C
  - While used for the secondary Direction #2, they have the same encoding and purpose of "aud" and "scope" for Direction #1
  - Corresponding claims for the access token are also defined



- **Practical use (in short)**
  - The primary Direction #1 works as usual, based on "aud" and "scope"
  - The Access Token Request can include "rev_aud" and "rev_scope", i.e.:
    - C asks that the access token also enables the secondary Direction #2
  - The AS determines the granted reverse scope like it does for an Access Token Request where the values of "rev_aud" and "rev_scope" are instead specified as values of "aud" and "scope"

Updates in v -02

- **Secure communication**
  - The same secure communication association is used for both directions
  - The association is still established per the used transport profile of ACE
- **Dynamic update of access rights**
  - Still possible according to the used transport profile of ACE
  - Only the access token requester (DEV1) can trigger it
- **Alternative ACE workflow**
  - Entirely orthogonal to the bidirectional access control
  - Also in this case, the AS can seamlessly upload the access token to DEV2 on behalf of DEV1



Next steps

- **Address a comment from IANA on Section 8.2 “OAuth Parameters CBOR Mappings Registry”*:***
  - *Please add an entry for the OAuth Parameters CBOR Mappings field called "Original Specification."*
- **OAuth parameter “anchor_cnf”**
  - Guidelines for its use with group-audiences (see also the Github issue #2)
- **Alternative ACE workflow**
  - Handling of an uploaded access token on the RS side
  - Ensure applicability to any ACE profile (*)
  - Ensure the possible dynamic update of access rights (*)
  - Detailed use in different transport profiles of ACE
- **Bidirectional access control with a single access token (see also the Github issue #1)**
  - Setup with two different Authorization Servers
  - More practical considerations on applicability, limitations, and group-audiences
- **Comments are welcome!**

(*) Appendix B provides a roadmap for addressing this point

Thank you!

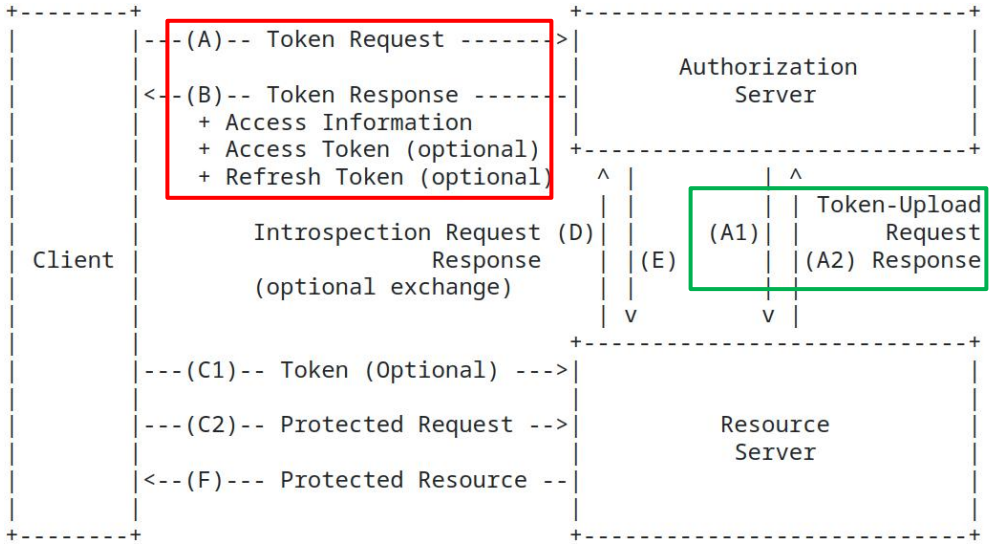
Comments/questions?

https://github.com/ace-wg/ace-workflow-and-params

Backup

Alternative workflow

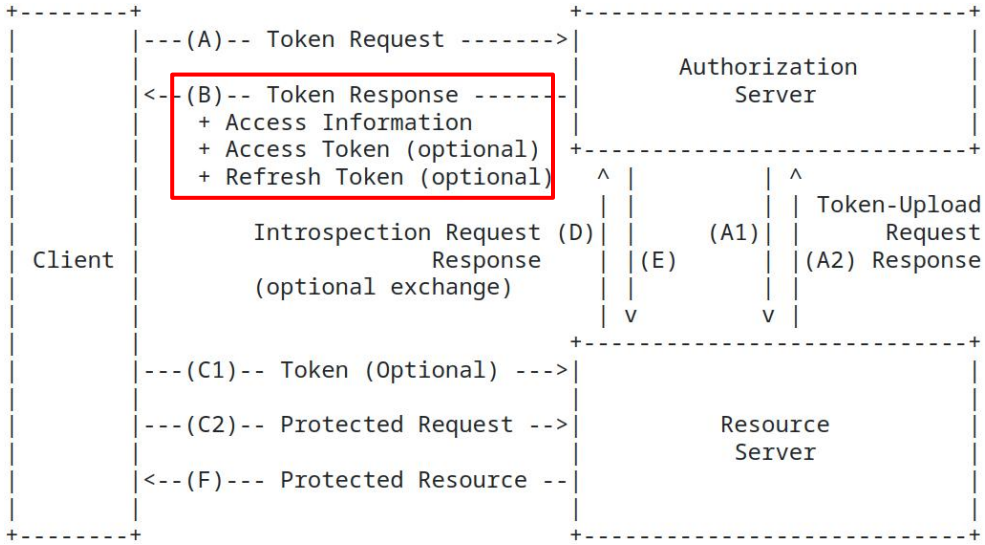
- **(A) C-to-AS Token Request as usual**
  - C explicitly opts-in for the new workflow, by including the new parameter “token_upload”
  - The final choice about using it is on the AS
- **(A1) The AS uploads the access token to RS, on behalf of C**
  - No intention to replace the original workflow
  - The AS can dynamically choose the workflow to use, e.g., based on the specific RS
- **(A2) The AS receives a response from RS**
- **(B) AS-to-C Token Response**
  - New parameter “token_upload”, with value 0 (successful upload) or 1 (failed upload)
  - **0** → The Response includes: the access token; or a token hash; or neither. Then, C skips step C1.
  - **1** → The Response includes the access token. Then, C performs step C1.



Examples with alternative workflow

```
Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
  e'token_upload' : 0,
  / expires_in / 2 : 3600,
  / cnf /        8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

Example 1: the AS successfully uploaded the access token




```
Header: Created (Code=2.01)
Content-Format: application/ace+cbor
Max-Age: 3560
Payload:
{
    e'token_upload' : 1,
  / access_token / 1 : h'd08343a1'/...
   (remainder of CWT omitted for brevity;
   CWT contains the symmetric PoP key in the "cnf" claim)/,
  / expires_in /   2 : 3600,
  / cnf /          8 : {
    / COSE_Key / 1 : {
      / kty / 1 : 4 / Symmetric /,
      / kid / 2 : h'3d027833fc6267ce',
      / k /  -1 : h'73657373696f6e6b6579'
    }
  }
}
```

Example 2: the AS attempted to upload the access token but failed