Notification of Revoked Access Tokens in the ACE Framework

draft-ietf-ace-revoked-tokens-notification-01

Marco Tiloca, RISE
Ludwig Seitz, Combitech
Francesca Palombini, Ericsson
Sebastian Echeverria, CMU SEI
Grace Lewis, CMU SEI

IETF 113, ACE WG, March 22nd, 2022

Recap

- **An Access Token may be revoked, before expiration**
  - Client/RS has been compromised, or decommissioned
  - Changed access policies or outcome of their evaluation
  - Changed ACE profile to use

- **Token introspection at the AS is available only for the RS**
  - Validate one Access Token at the time

- **Contribution: new interface at the Authorization Server (AS)**
  - The AS maintains one Token Revocation List (TRL) resource
  - The TRL contains the hashes of revoked, not-yet-expired tokens
  - C/RS can GET or GET-Observe from the TRL
  - C/RS retrieve only their own pertaining portion of the TRL

- **Benefits**
  - Complement token introspection
  - No need for new endpoints at C or RS

Modes of operation

- **Common features**
  - Response limited to the portion of the TRL pertaining the requester
  - TRL filtering based on authenticated identity of the requester (secure association)

- **Full Query - *GET [Observe: 0] coaps://example.as.com/revoke/trl***
  - Get all the pertaining token hashes in the TRL
  - The AS MUST support it

- **Diff Query - *GET [Observe: 0] coaps://example.as.com/revoke/trl?diff=3***
  - Get the N most recent, pertaining updates to the TRL
  - The AS MAY support it

- **Diff Query using the "Cursor" pattern** – Appendix B
  - Enables trasferring of TRL updates in chunks, from a "resumption point"
  - Affects also the content of responses to Full Query and simple Diff Query requests
  - The AS MAY support it

Updates since IETF 112

- **Adopted as WG document** in November 2021

- **Received a review** [1] on version -00 from Marco Rasori – Thanks!

- **New version -01 available by the cut-off**
  - Addressed review comments (one point is still open)
  - More on error handling and on token processing at the RS
  - Section restructuring and editorial improvements

[1] https://mailarchive.ietf.org/arch/msg/ace/XufwPd8bv1aMTzw1Hp5bENaqn_o/

Selected updates in -01 (1/2)

- **Defined explicit actions on tokens for the Client/RS**
  - Expunge a stored token when learning of its revocation or expiration
  - Do not accept a posted revoked token (i.e,. if storing its token hash)

- **More detailed actions on token hashes for the RS**
  - Store the obtained token hash of a revoked token …
    - … until learning that the token has expired
  - This makes the RS able to:
    - Reject a token (re-)posted between its revocation and expiration
    - Reject a token belatedly posted for the first time after its revocation

Selected updates in -01 (2/2)

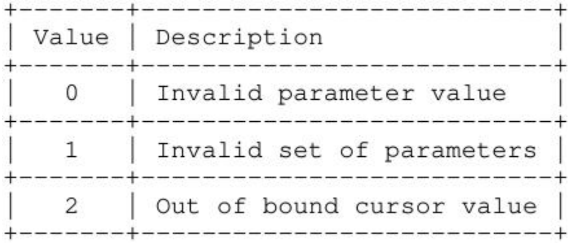
- **Improved error handling at the TRL resource on the AS**

- **Fixed off-by-one errors when using the “Cursor” pattern**
  - Two corner cases when preparing the response to a C/RS

- **Error responses sent in a number of cases**
  - The content-format is application/ace-trl+cbor
  - The payload is a CBOR map

- **Defined parameters for error responses**
  - ‘error’ (int) and ‘error_description’ (tstr, optional)

- **Registration of ‘error’ values**



Value	Description
0	Invalid parameter value
1	Invalid set of parameters
2	Out of bound cursor value

Open points (1/2)

- **The use of the "Cursor" pattern is still in Appendix B**
  - Its mechanics and error handling are stable now
  - It is in fact the Diff Query mode, enhanced with the "Cursor" pattern

- **Planned actions, if no objection**
  - Bring the content from Appendix B to the document body
    - Mostly affect Section 7 (Diff Query mode) but also Section 6 (Full Query mode)
  - Add examples with the Diff Query mode using the "Cursor" pattern

Open points (2/2)

Current definition of responses

- **Error responses**
  - CBOR map as payload

- **2.05 responses (Full Query)**
  - CBOR array as payload (Section 6)

- **2.05 responses (Diff Query)**
  - CBOR array as payload (Section 7)

- **2.05 responses (Diff Query + Cursor)**
  - CBOR map as payload (Appendix B)

Open points (2/2)

Current definition of responses

- **Error responses**
  - CBOR map as payload

- **2.05 responses (Full Query)**
  - CBOR array as payload (Section 6)

- **2.05 responses (Diff Query)**
  - CBOR array as payload (Section 7)

- **2.05 responses (Diff Query + Cursor)**
  - CBOR map as payload (Appendix B)

If (Diff Query + Cursor) is used by the AS, CBOR maps are also used in Full Query and Diff Query responses, to specify additional information, e.g., the cursor value.

Proposal from the review of -00: just have a CBOR map in all responses.

There is a more efficient compromise …

Open points (2/2)

Current definition of responses

- **Error responses**
  - CBOR map as payload
- **2.05 responses (Full Query)**
  - CBOR array as payload (Section 6)
- **2.05 responses (Diff Query)**
  - CBOR array as payload (Section 7)
- **2.05 responses (Diff Query + Cursor)**
  - CBOR map as payload (Appendix B)

New definition of responses

- **Error responses**
  - CBOR map as payload
- **2.05 responses (any mode)**
  - The payload is a CBOR map if the AS supports the Diff Query mode and the “Cursor” pattern
  - The payload is a CBOR array otherwise
  - Clients/RSs are ok to receive either

Ok with this change? Alternatives?

Summary and next steps

- **Notification of revoked Access Token**
  - GET or GET-Observe at the AS; for both Client and RS
  - (i) Full Query; (ii) Diff Query; (iii) Diff Query with “Cursor” pattern

- **Ongoing implementation from CNR**
  - https://bitbucket.org/marco-rasori-iit/ace-java/src/ucs/
  - Building on the RISE implementation of ACE for the Californium library

- **Main planned next steps**
  - Integrate the “Cursor” pattern in the document body, as extension of the Diff Query mode
  - Define the response format as depending on the AS supporting the “Cursor” pattern

- **More comments are welcome!**

Thank you!

Comments/questions?

https://github.com/ace-wg/ace-revoked-token-notification

Backup

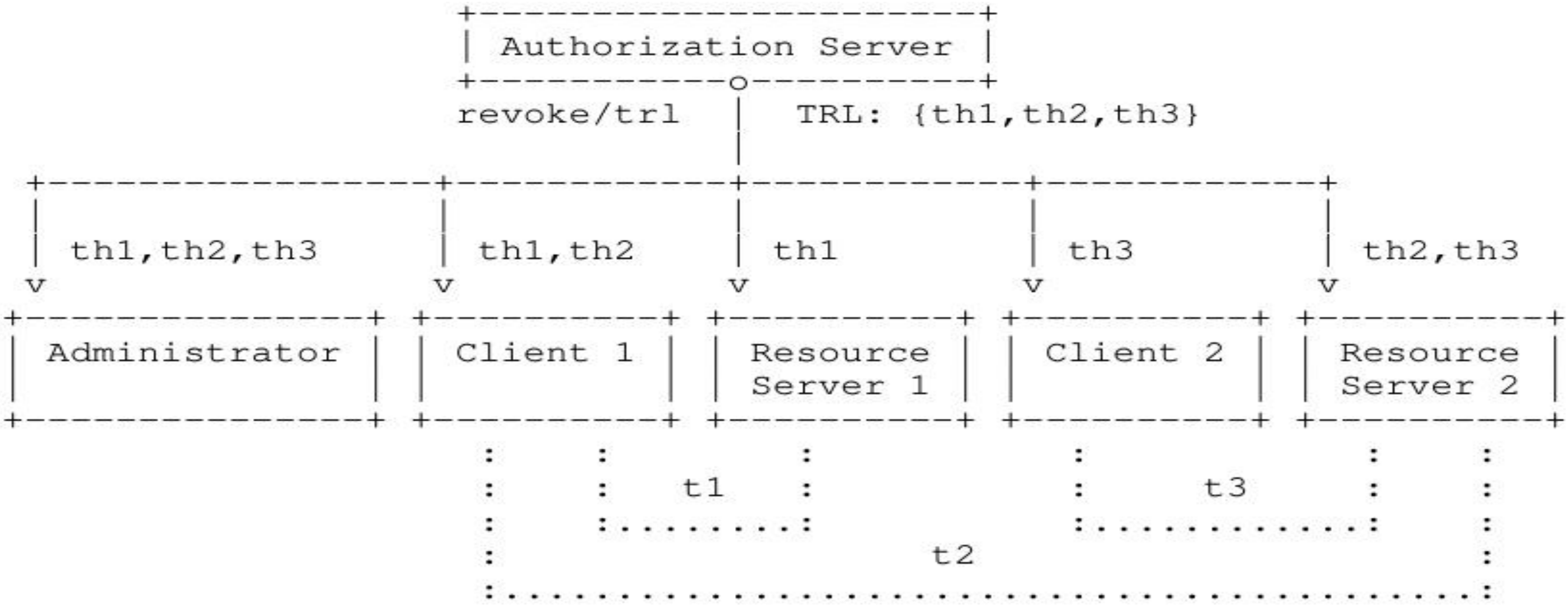
How it works

- **Token hashes computed as per RFC 6920 (binary format)**
  - Hash input: what is in 'access_token' of the AS response from */token*

- **TRL resource at the AS**
  - CBOR array of Token hashes
  - Add token hashes when Tokens are revoked
  - Remove token hashes when revoked Tokens expire

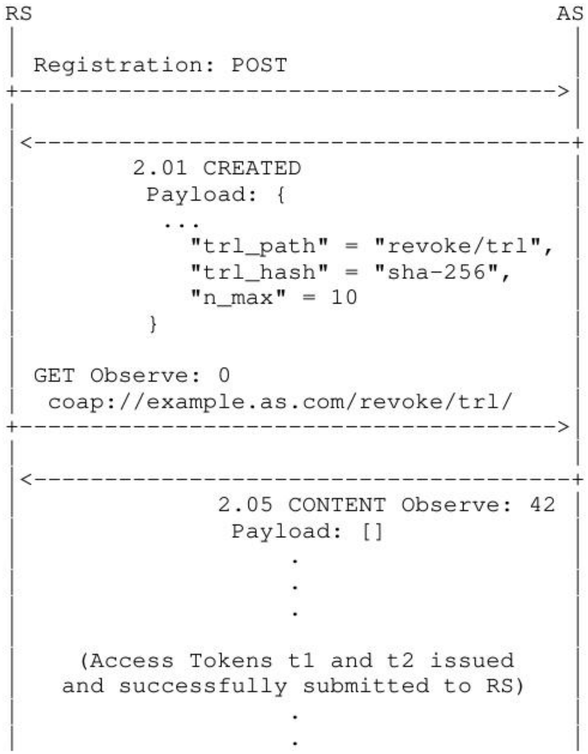
- **Interaction**
  - C and RS get the URL to the TRL endpoint upon registration
  - C and RS obtain only hashes of their own pertaining Tokens
  - A registered Administrator gets all Token hashes in the TRL

Protocol overview



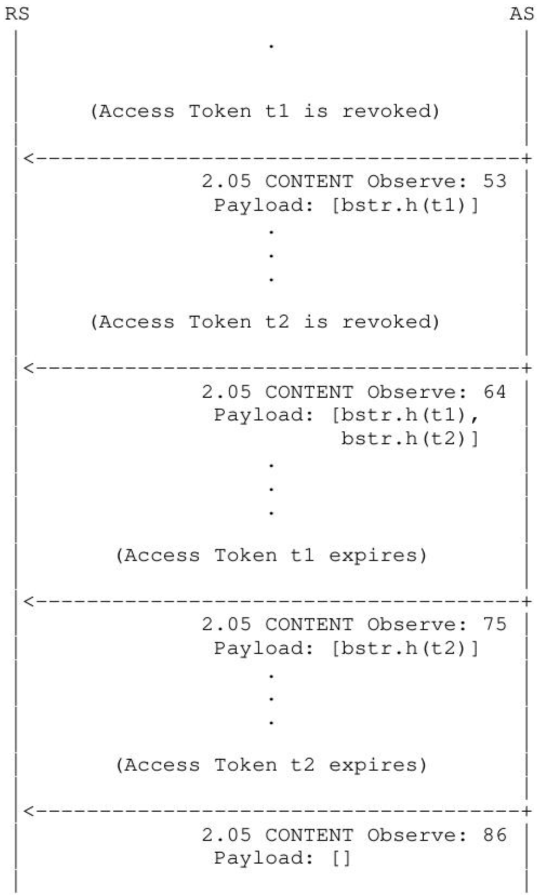
```
                    +----------------------+
                    | Authorization Server |
                    +-----------o----------+
                    revoke/trl  |  TRL: {th1,th2,th3}
                                |
 +-----------------+------------+------------+------------+
 |                 |            |            |            |
 | th1,th2,th3     | th1,th2    | th1        | th3        | th2,th3
 v                 v            v            v            v
+---------------+ +----------+ +----------+ +----------+ +----------+
| Administrator | | Client 1 | | Resource | | Client 2 | | Resource |
|               | |          | | Server 1 | |          | | Server 2 |
+---------------+ +----------+ +----------+ +----------+ +----------+
                     :    :        :           :            :    :
                     :    :   t1   :           :     t3     :    :
                     :    :........:           :............:    :
                     :                   t2                      :
                     :...........................................:
```

Example with Full Query



```
RS                                      AS
|                                        |
| Registration: POST                     |
+--------------------------------------->|
|                                        |
|<---------------------------------------+
|        2.01 CREATED                    |
|         Payload: {                     |
|          ...                           |
|            "trl_path" = "revoke/trl",  |
|            "trl_hash" = "sha-256",     |
|            "n_max" = 10                |
|         }                              |
|                                        |
| GET Observe: 0                         |
|  coap://example.as.com/revoke/trl/     |
+--------------------------------------->|
|                                        |
|<---------------------------------------+
|              2.05 CONTENT Observe: 42  |
|               Payload: []              |
|                    .                   |
|                    .                   |
|                    .                   |
|                                        |
|     (Access Tokens t1 and t2 issued    |
|    and successfully submitted to RS)   |
|                    .                   |
|                    .                   |
```

Example with Full Query (ctd.)



```
RS                                        AS
|                    .                     |
|                                          |
|     (Access Token t1 is revoked)         |
|                                          |
|<-----------------------------------------+
|              2.05 CONTENT Observe: 53    |
|               Payload: [bstr.h(t1)]      |
|                    .                     |
|                    .                     |
|                    .                     |
|                                          |
|     (Access Token t2 is revoked)         |
|                                          |
|<-----------------------------------------+
|              2.05 CONTENT Observe: 64    |
|               Payload: [bstr.h(t1),      |
|                         bstr.h(t2)]      |
|                    .                     |
|                    .                     |
|                    .                     |
|                                          |
|       (Access Token t1 expires)          |
|                                          |
|<-----------------------------------------+
|              2.05 CONTENT Observe: 75    |
|               Payload: [bstr.h(t2)]      |
|                    .                     |
|                    .                     |
|                    .                     |
|                                          |
|       (Access Token t2 expires)          |
|                                          |
|<-----------------------------------------+
|              2.05 CONTENT Observe: 86    |
|               Payload: []                |
|                                          |
```

Query modes

- **Common features**
  - Limited to the portion of the TRL pertaining the requester
  - TRL filtering based on authenticated identity of the requester (e.g., secure communication session)

- **Full Query (Section 6) – *GET [Observe: 0] coaps://example.as.com/revoke/trl***
  - Request for all pertaining token hashes in the TRL
  - Return a CBOR array, with the Token hashes as elements

- **Diff Query (Section 7) – *GET [Observe: 0] coaps://example.as.com/revoke/trl?diff=3***
  - Request for the latest N updates to the pertaining portion of the TRL list
  - Build N entries as CBOR arrays. Each entry refers to an update and has:
    - An element "deleted", with a CBOR array of Token hashes.
    - An element "added", with a CBOR array of Token hashes.
  - Return a CBOR array with the N arrays as element, in reverse chronological order
  - Example of usage of the Series Transfer Pattern (STP)

- **Diff Query using the "Cursor" pattern (Appendix B)**
  - Still Diff Query mode, but also enabling transfers in chunks from a "resumption point"
  - This results in extended responses also when the Full Query mode is used

Diff Query using the “Cursor” pattern

- **Rather than the N most recent TRL updates …**
  - Get N updates from “where we previous query stopped”
  - Revert to Full Query if not possible, e.g., information loss/removal at the AS

- **Use the Series Transfer Pattern (STP) and its “Cursor” pattern**
  - Both (a) Full Query and (b) Diff Query responses specify also a cursor value
  - In (a), it is a pointer to the most recent, pertaining TRL update
  - In (b) it is a pointer to the most recent TRL update included in the response

- **What becomes possible due to the “Cursor” pattern**
  - A follow-up request may resume fetching TRL updates from after the cursor
  - Adjacent batches of TRL updates are possible to be sent, thus limiting excessive latencies

- **Handled corner cases**
  - No TRL updates have occurred yet, either at all or after the cursor
  - Requested updates have been deleted as too old