

Group OSCORE Profile of the Authentication and Authorization for Constrained Environments Framework

draft-tiloca-ace-group-oscore-profile-02

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Motivation

- › Application scenarios with group communication
 - Group OSCORE provides security also over multicast
 - What about access control for resources at group members ?
- › For very simple use cases
 - Straightforward and plain access control may be just fine
 - Joining the security group is enough to access resources
 - Any group member can do anything at any other group members' resource
- › For more complicated use cases
 - Different clients should have different access rights
 - Creating (many) more groups poorly scales and is hard to manage
 - › Changing access rights means changing group and perform rekeying

Use cases

- › Simple groups of smart locks
 - Some clients should only check the lock status
 - Some clients can both check and change the lock status
 - The smart locks should be servers only, i.e. cannot lock/unlock each other
- › Building automation (BACnet)
 - Light switch (Class C1): issue only low-priority commands
 - Fire panel (Class C2): issue all commands, set/unset high-priority level
 - C1 cannot override C2 commands, until C2 relinquishes high-priority control
 - Goal 1: limit execution of high-priority commands to C2 clients only
 - Goal 2: prevent a compromised C1 client to lock-out normal control
- › Use ACE to enforce fine-grained access control. However ...

Problem

- › Every current profile of ACE
 - Does not cover secure group communication between C and RSs
 - Relies on a single security protocol between C and RS

- › OSCORE profile
 - C and RS must use OSCORE
 - The Token is bound to the OSCORE Security Context
 - Group OSCORE is simply not admitted

- › We cannot use Group OSCORE and ACE-based access control of resources

Contribution

- › New Group OSCORE profile of ACE
 - Group OSCORE as security protocol between C and RS
 - ACE-based access control among group members
 - › The group joining has to happen first
 - The Access Token is bound also to the group context

- › Properties
 - Proof-of-Possession of the client signature key
 - › Use the Client's public key to verify the signature of group messages (*)
 - Proof-of-Group-Membership for the exact Client
 - › Token bound to the group context

(*) In the group mode of Group OSCORE

Updates from -01

- › Clarified event timeline – Requested by Ben at IETF 106
 - Nodes have to join the OSCORE group first
 - › That requires access control at the Group Manager
 - › Out of scope for this document, defined in *ace-key-groupcomm-oscore*
 - This profile focuses on access control among current group members
- › Simplified profile – Thanks Göran!
 - Current document body: Group OSCORE as only security protocol
 - The Client’s public key used in the group acts as actual PoP key
 - Message format and examples adapted accordingly
- › New Appendix – “Dual mode”
 - Essentially the document body of -01, building on the OSCORE profile
 - Both OSCORE and Group OSCORE are used as security protocol
 - A newly established OSCORE context is bound to the group context

Protocol overview

- › The C-to-AS Access Token Request includes also:
 - ‘context_id’: **Group ID** (‘kid_context’) of the OSCORE group
 - ‘salt_input’: Client **Sender ID** (‘kid’) in the OSCORE group
 - ‘req_cnf’: Client’s **public key** in the OSCORE group
 - ‘client_cred_verify’: Client’s **signature**

- › Signature in ‘client_cred_verify’
 - Computed with the signing key in the OSCORE group

- › What does the Client sign?
 - If **(D)TLS** is used between C and AS, sign an exporter value (Section 7.5 of RFC 8446)
 - If **OSCORE** is used between C and AS, sign $PRK = \text{HMAC-Hash}(x1 \mid x2, \text{IKM})$
 - › $x1 = \text{Context ID of the C-AS context}$; $x2 = \text{Sender ID of C in the C-AS context}$
 - › $\text{IKM} = \text{OSCORE Master Secret of the C-AS context}$

```
Header: POST (Code=0.02)
Uri-Host: "as.example.com"
Uri-Path: "token"
Content-Format: "application/ace+cbor"
Payload:
{
  "audience": "tempSensor4711",
  "scope": "read",
  "context_id": h'abcd0000',
  "salt_input": h'00',
  "req_cnf": {
    "COSE_Key": {
      "kty": EC2,
      "crv": P-256,
      "x": h'd7cc072de2205bdc1537a543d53c60a6acb62eccd890c7fa
        27c9e354089bbe13',
      "y": h'f95e1d4b851a2cc80fff87d8e23f22afb725d535e515d020
        731e79a3b4e47120'
    }
  },
  "client_cred_verify": h'...'
  (signature content omitted for brevity),
}
```

Access Token Request

Protocol overview (ctd.)

- › The AS-to-C Access Token Response includes also:

- ‘profile’ : “coap_group_oscore”

- › The Access Token includes also:

- ‘cnf’: Client’s **Public Key** in the Group
- ‘salt_input’ : **Sender ID** of C in the group
- ‘contextId_input’ : **Group ID** of the group

- › Token POST and response

- RS checks the public key of C with the Group Manager
- RS stores
 - › **Access Token**;
 - › **Group ID**; **Sender ID of C in the group**; **C Public Key**
- Another group member cannot impersonate C

```
Header: Created (Code=2.01)
Content-Type: "application/ace+cbor"
Payload:
{
  "access_token" : h'a5037674656d7053656e73 ...'
  (remainder of CWT omitted for brevity),
  "profile" : "coap_group_oscore",
  "expires_in" : 3600,
}
```

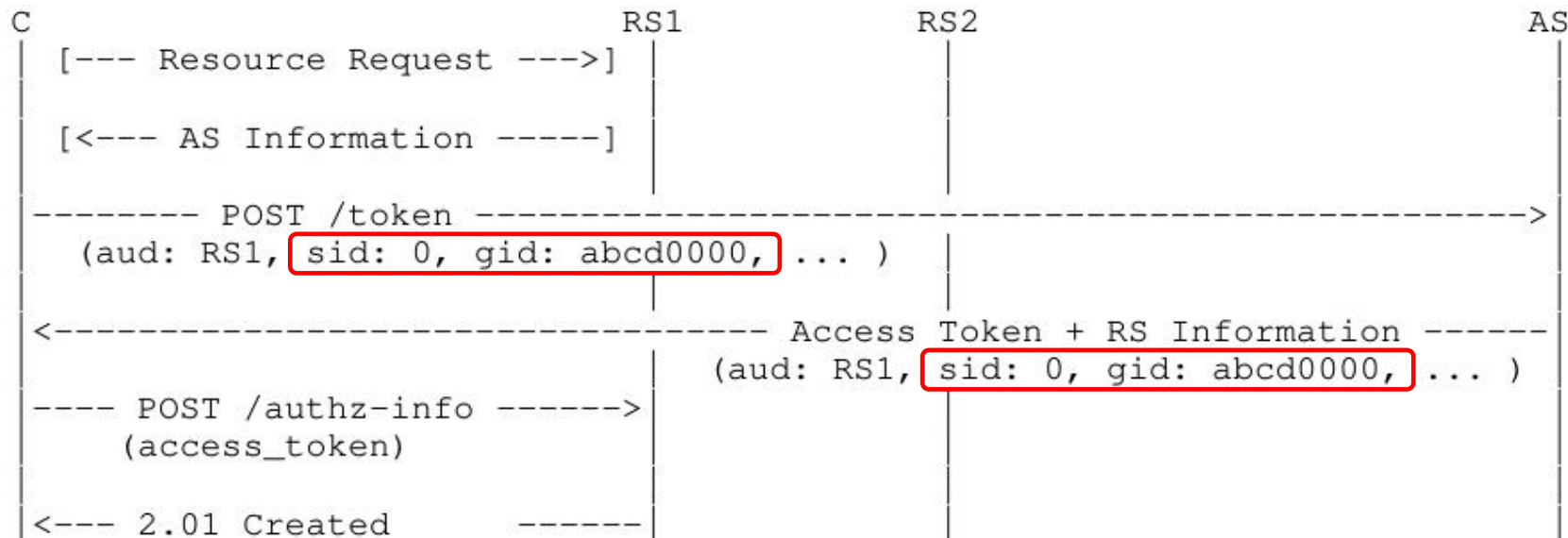
Access Token Response

```
{
  "aud" : "tempSensorInLivingRoom",
  "iat" : "1360189224",
  "exp" : "1360289224",
  "scope" : "temperature q firmware p",
  "cnf" : {
    "COSE_Key" : {
      "kty" : EC2,
      "crv" : P-256,
      "x" : h'd7cc072de2205bdc1537a543d53c60a6acb62eccd890c7fa
        27c9e354089bbe13',
      "y" : h'f95eld4b851a2cc80fff87d8e23f22afb725d535e515d020
        731e79a3b4e47120'
    },
    "salt_input" : h'00',
    "contextId_input" : h'abcd0000'
  }
}
```

Access Token

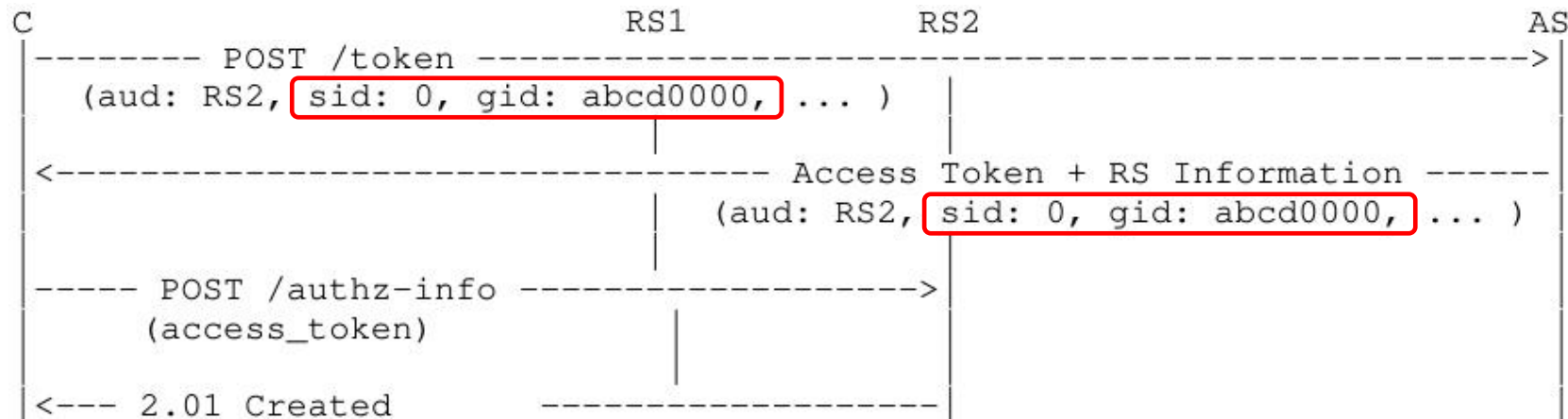
C – RS1 pairing

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



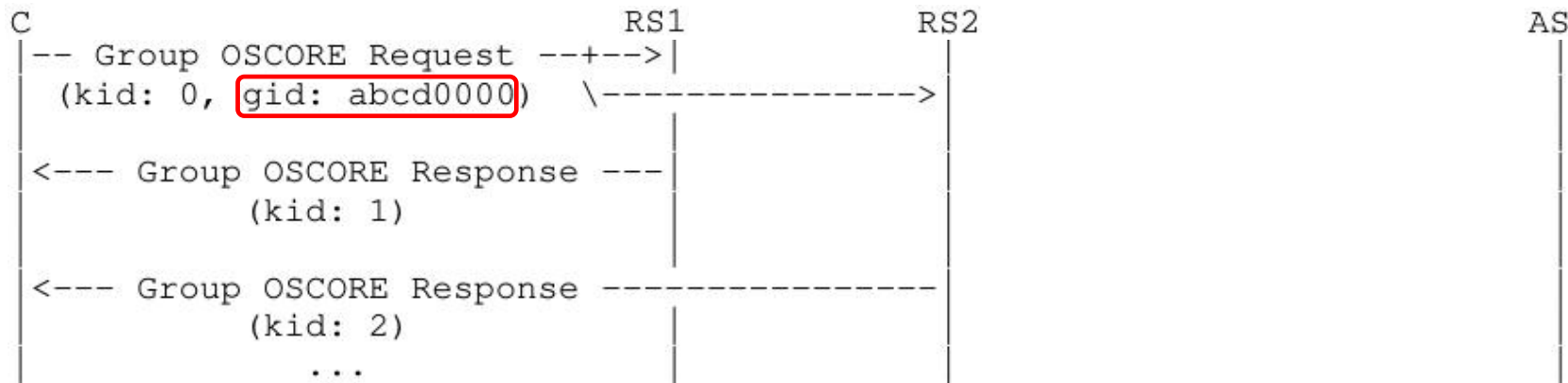
C – RS2 pairing

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



C – {RS1,RS2}

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



- › C can access RS1 and RS2 resources, as per the posted Access Token
- › Proof-of-possession achieved when receiving a Group OSCORE message
 - Signature verification, using the Client's public key from the Access Token

Summary

- › New ACE profile for secure group communication
 - Group OSCORE as security protocol
 - ACE-based access control among group members
 - The Access Token is bound also to the group context
 - Appendix: “Dual mode” for OSCORE + Group OSCORE

- › Next steps
 - Align with latest Group OSCORE (PoP through signature/pairwise mode)
 - Guidelines on later running the OSCORE profile with the same RS

- › Need for document reviews

Thank you!

Comments/questions?

<https://gitlab.com/crimson84/draft-tiloca-ace-group-oscore-profile>

Backup

“Dual mode”

Overview – Δs from OSCORE profile

- › The C-to-AS Access Token Request includes also:
 - ‘context_id’: **Group ID** (‘kid_context’) of the OSCORE group
 - ‘salt_input’: Client **Sender ID** (‘kid’) in the OSCORE group
 - ‘client_cred’: Client’s **public key** in the OSCORE group
 - ‘client_cred_verify’: Client’s **signature**

- › Signature in ‘client_cred_verify’
 - Computed with the signing key in the OSCORE group

- › What does the Client sign?

- If **(D)TLS** is used between C and AS, sign an exporter value (Section 7.5 of RFC 8446)
- If **OSCORE** is used between C and AS, sign PRK = HMAC-Hash(x1 | x2, IKM)
 - › x1 = Context ID of the C-AS context ; x2 = Sender ID of C in the C-AS context
 - › IKM = OSCORE Master Secret of the C-AS context

```
Header: POST (Code=0.02)
Uri-Host: "as.example.com"
Uri-Path: "token"
Content-Format: "application/ace+cbor"
Payload:
```

```
{
  "audience" : "tempSensor4711",
  "scope" : "read",
  "context_id" : h'abcd0000',
  "salt_input" : h'00',
  "client_cred" : {
    "COSE_Key" : {
      "kty" : EC2,
      "crv" : P-256,
      "x" : h'd7cc072de2205bdc1537a543d53c60a6acb62eccd890c7fa
        27c9e354089bbe13',
      "y" : h'f95e1d4b851a2cc80fff87d8e23f22afb725d535e515d020
        731e79a3b4e47120'
    }
  },
  "client_cred_verify" : h'...'
  (signature content omitted for brevity),
}
```

Access Token Request

Overview – Δs from OSCORE profile

- › The AS-to-C Access Token Response includes also:
 - Same OSCORE Sec Ctx Object in the Access Token
- › The Access Token includes also:
 - ‘salt_input’: Client **Sender ID** in the OSCORE group
 - ‘contextId_input’ : **Group ID** of the OSCORE group
 - ‘client_cred’: Client’s **public key** in the OSCORE Group
- › Token POST and response
 - Exchange of nonces N1 and N2 as in the OSCORE profile
 - RS checks the public key of C with the Group Manager
 - RS stores {**Access Token; Sender ID; Group ID; C Public Key**}
 - Another group member cannot impersonate C

```
Header: Created (Code=2.01)
Content-Type: "application/ace+cbor"
Payload:
{
  "access_token" : h'a5037674656d7053656e73 ...'
  (remainder of CWT omitted for brevity),
  "profile" : "coap_group_oscore",
  "expires_in" : 3600,
  "cnf" : {
    "osc" : {
      "alg" : "AES-CCM-16-64-128",
      "clientId" : h'a8',
      "serverId" : h'42',
      "ms" : h'f9af838368e353e78888e1426bd94e6f',
      "salt" : h'1122',
      "contextId" : h'99'
    }
  }
}
```

Access Token Response

```
{
  "aud" : "tempSensorInLivingRoom",
  "iat" : "1360189224",
  "exp" : "1360289224",
  "scope" : "temperature_g firmware_p",
  "cnf" : {
    "osc" : {
      "alg" : "AES-CCM-16-64-128",
      "clientId" : h'00',
      "serverId" : h'01',
      "ms" : h'f9af838368e353e78888e1426bd94e6f',
      "salt" : h'1122',
      "contextId" : h'99'
    }
  },
  "salt_input" : h'00',
  "contextId_input" : h'abcd0000',
  "client_cred" : {
    "COSE_Key" : {
      "kty" : EC2,
      "crv" : P-256,
      "x" : h'd7cc072de2205bdc1537a543d53c60a6acb62eccd890c7fa
        27c9e354089bbe13',
      "y" : h'f95e1d4b851a2cc80fff87d8e23f22afb725d535e515d020
        731e79a3b4e47120'
    }
  }
}
```

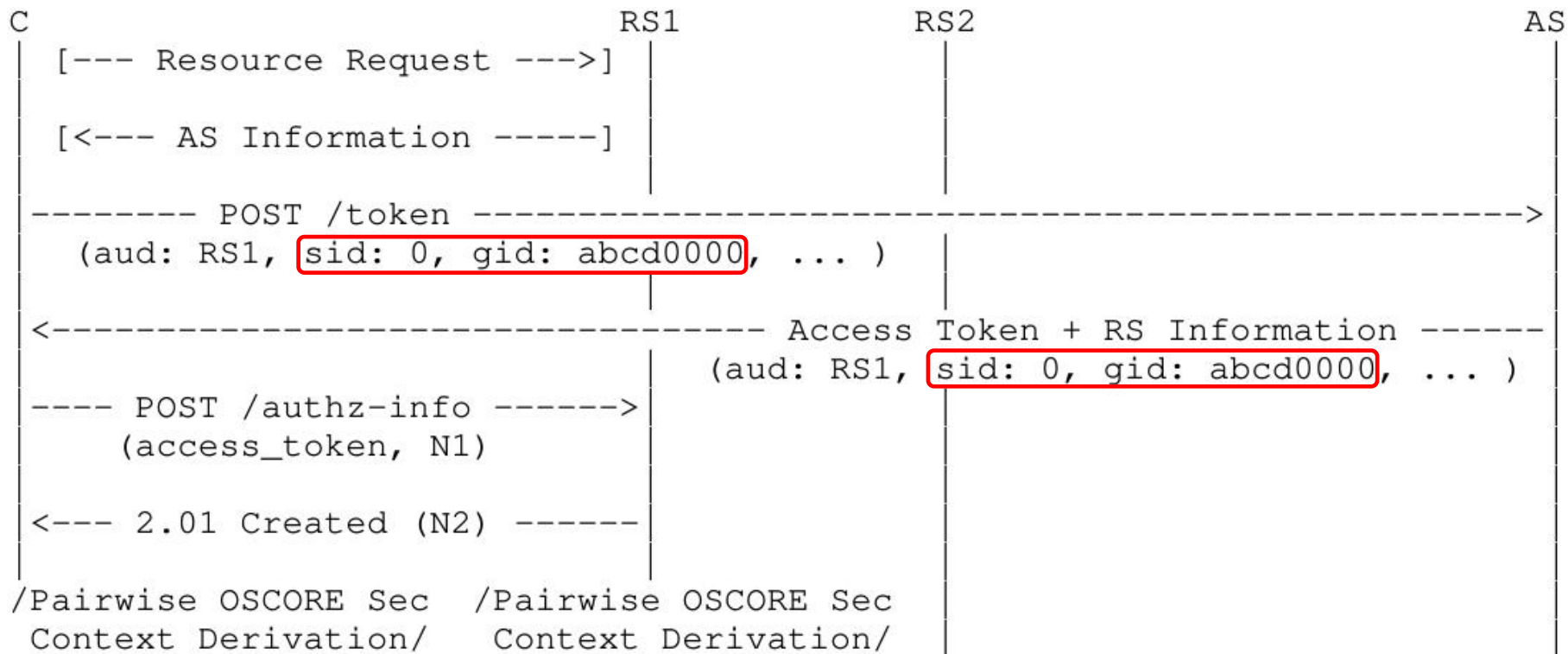
Access Token

Overview – Δ s from OSCORE profile

- › Derivation of the pairwise OSCORE Security Context **ctx**
 - Extended parameters, through more concatenations
 - Use also information related to the OSCORE Group
- › **Context ID** = $\text{GID} \mid \text{N1} \mid \text{N2} \mid \text{CID}$
 - The **Group ID of the OSCORE group** is also in the Access Token, as ‘contextId_input’
 - The **context identifier** indicated in the Access Token, in the ‘contextId’ field of ‘osc’
- › **Salt** = $\text{SaltInput} \mid \text{MSalt} \mid \text{N1} \mid \text{N2} \mid \text{GMSalt}$
 - The **Sender ID of C in the OSCORE group** is also in the Access Token, as ‘salt’
 - The **Salt** indicated in the Access Token, in the ‘salt’ field of ‘osc’
 - The **Master Salt in the OSCORE group** is known to C and RS as group members
- › **Master Secret** = $\text{MSec} \mid \text{GMsec}$
 - The **OSCORE Master Secret** in the Access Token, in the ‘ms’ field of ‘osc’
 - The **Master Secret of the OSCORE group** is known to C and RS as group members

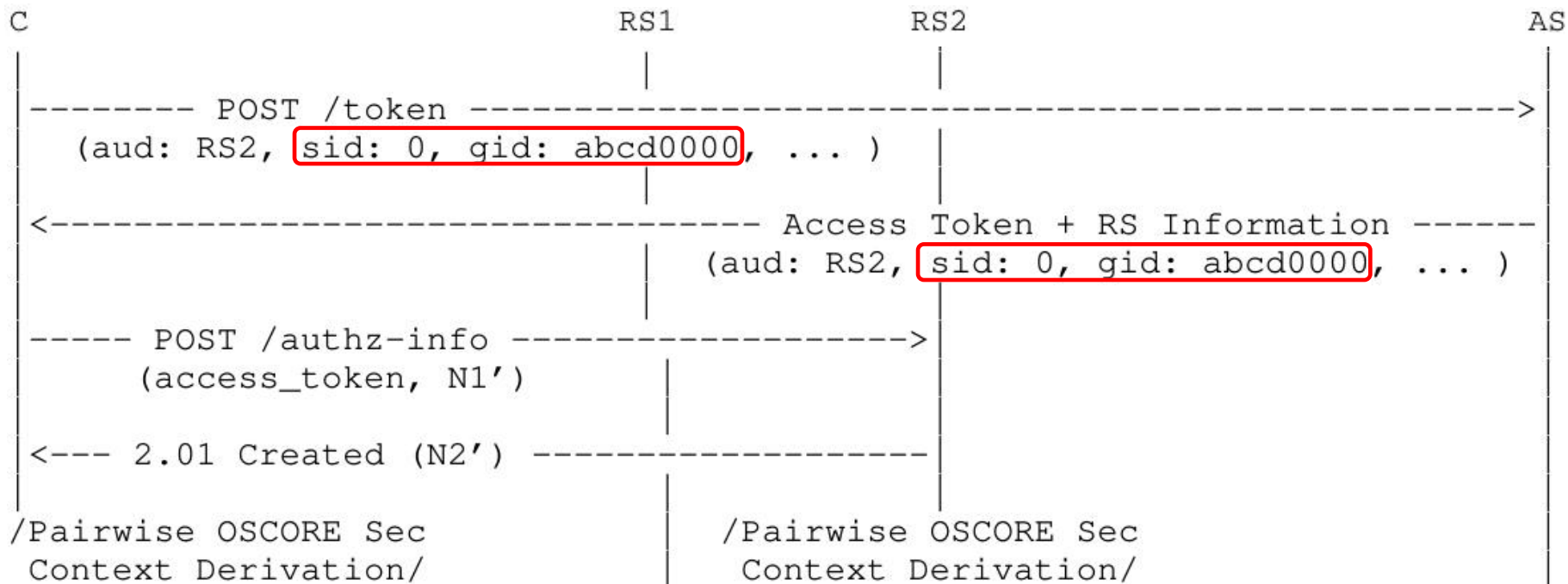
C – RS1 pairing

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



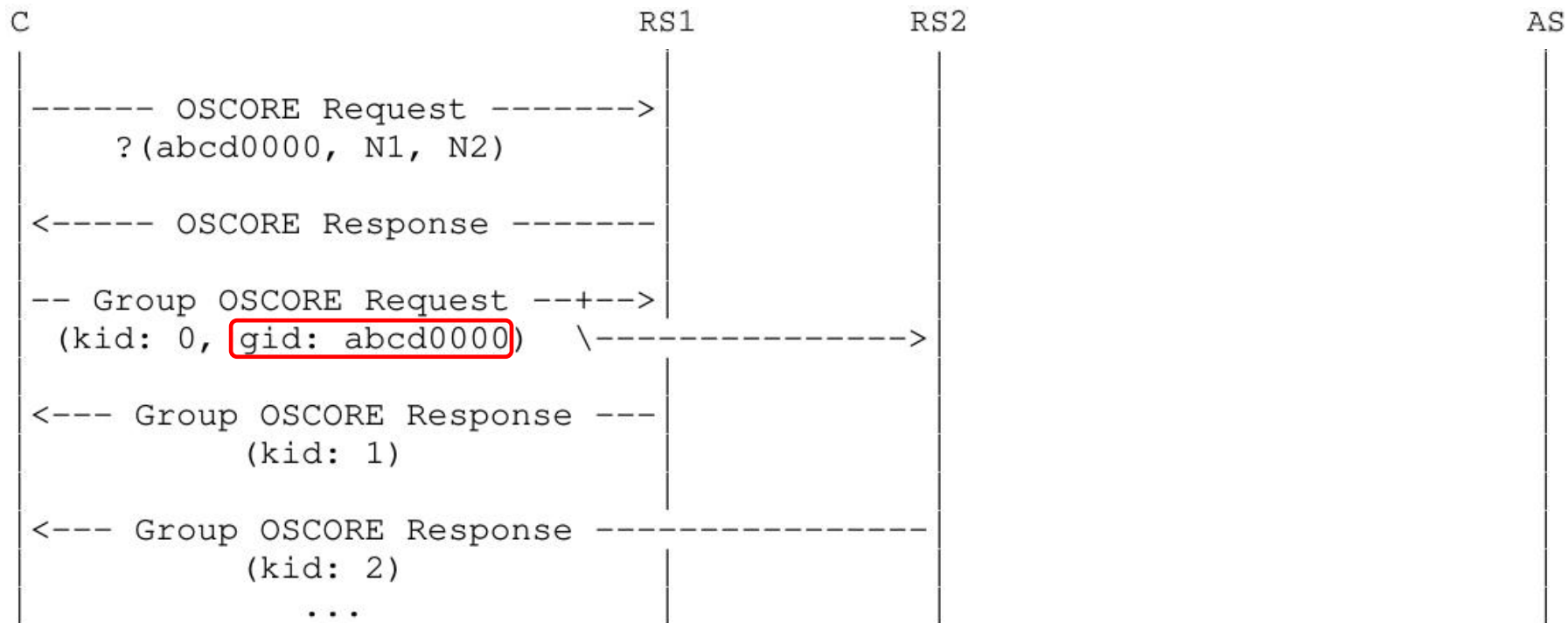
C – RS2 pairing

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



C – {RS1,RS2}

0: Sender ID ('kid') of C in the OSCORE group
abcd0000: Group ID ('kid_context') of the OSCORE group



C can access RS1 and RS2 resources, as per the posted Access Token, using OSCORE or Group OSCORE