Observe Notifications as CoAP Multicast Responses

draft-tiloca-core-observe-multicast-notifications-05

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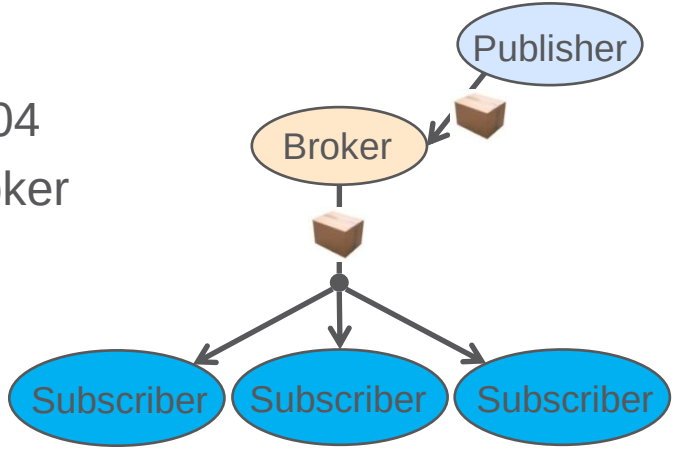
Recap

- Observe notifications as multicast responses
  - Many clients observe the same resource on a server S
  - Improved performance due to multicast delivery
  - Multicast responses are not defined yet --- Token binding, security, …

- Example of relevant use case
  - Pub-Sub scenario, also discussed at IETF 104
  - Many subscribers to a same topic on the Broker
  - Better performance
  - Subscribers can remain clients only



Single notification response over multicast

How

- Define multicast responses, in particular Observe notifications

- Token space managed by the server
  - The Token space belongs to the group (clients)
  - The group entrusts the management to the server
  - All clients in a group observation use the same Token value

- Group OSCORE to protect multicast notifications
  - The server aligns all clients of an observation on a same *external_aad*
  - All notifications for a resource are protected with that *external_aad*

Phantom request and error response

- The server requests the observation on its own, e.g. when:
  1. A first traditional registration request comes from a first client
  2. Some threshold is crossed – clients can be shifted to a group observation

- Consensus on Token & external_aad , by using a phantom observation request
  - Generated inside the server, it does not hit the wire
  - Like if sent by the group, from the multicast IP address of the group
  - Multicast notifications are responses to this phantom request

- The server sends to clients a 5.03 ***error response*** with:
  - Transport-specific information, e.g. the IP multicast address where notifications are sent to
  - The serialization of the phantom observation request
  - The serialization of the latest multicast notification (optional)

Updates from -05

› New payload format for the informative response

```
informative_response_payload = {
   1 => array, ; 'tp_info', i.e. transport-specific information
   2 => bstr,  ; 'ph_req' (transport-independent information)
 ? 3 => bstr   ; 'last_notif' (transport-independent information)
}
```

› The same '*tp_info*' content applies to both '*ph_req*' and '*last_notif*'

› '*ph_req*' - Serialization of the phantom request

› '*last_notif*' - Serialization of latest sent multicast notification

– Now only optional to include

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}
```

```
tp_info = [
    srv_addr  ; Addressing information of the server
  ? req_info  ; Request data extension
]

srv_addr = (
    tp_id : int,  ; Identifier of the used transport protocol
  + elements      ; Number, format and encoding
                  ; based on the value of 'tp_id'
)

req_info = (
  + elements  ; Number, format and encoding based on
              ; the value of 'tp_id' in 'srv_addr'
)
```

```
tp_info = [
    tp_id    : 1,              ; UDP as transport protocol
    srv_host : #6.260(bstr),   ; Src. address of multicast notifications
    srv_port : uint,           ; Src. port of multicast notifications
    token    : bstr,           ; Token of the phantom request and
                               ; associated multicast notifications
    cli_addr : #6.260(bstr),   ; Dst. address of multicast notifications
  ? cli_port : uint            ; Dst. port of multicast notifications
]
```

Concrete encoding for this document, where 'tp_id' = 1 (UDP)

› Defined new IANA registry, for 'tp_id' values, and formats of 'srv_addr' and 'req_info'

› Format reused for the Response-Forwarding option in *draft-tiloca-core-groupcomm-proxy*

Updates from -05

- There is no client-server negotiation of multicast notification service
  - The proposed mechanisms is used in situations where:
    - Individual notifications are not feasible; or
    - Individual notifications are not preferred beyond a certain number of observers
  - Future applications can define negotiation mechanisms if need be

- Signaling of multicast notification service
  - A web link can include the target attribute “grp_obs”, as a simple hint

- Revised processing in the presence of forward proxies
  - Improved mechanics without and with Group OSCORE (Section 9 and Section 10)
  - Updated examples in Appendix E and Appendix F

Updates from -05

- Appendix C – OSCORE group self-managed by the server
  - The client's observation request works as a joining request
  - The informative response includes also group keying material
  - This mirrors the case where the client joins an OSCORE group only as silent server
  - Not suitable when backward security and forward security are required

- Appendix D – Phantom request as deterministic request
  - Each client builds the same phantom request, see *draft-amsuess-core-cachable-oscore*
  - No need to include the phantom request in the '*ph_req*' of informative responses

Summary

- Latest additions
  - New flexible and extensible encoding of the informative response
  - No negotiation with clients; just signaling of support for group observations
  - Revised processing with proxies; updated examples in Appendix E and F
  - New Appendix C: OSCORE group self-managed by the server
  - New Appendix D: phantom request as deterministic request
- Next steps
  - Case with reverse proxy – Mechanics and example
  - Case with deterministic request and proxy – Mechanics and example
- Ready for WG adoption ?

Thank you!

Comments/questions?

https://gitlab.com/crimson84/draft-tiloca-core-observe-responses-multicast

Backup

Server side

1. Build a GET phantom request; Observe option set to 0

2. Choose a value T, from the Token space for messages …
   - … coming from the multicast IP address and addressed to target resource

3. Process the phantom request
   - As coming from the group and its IP multicast address
   - As addressed to the target resource

4. Hereafter, use T as token value for the group observation

5. Store the phantom request, store (not send) reply for last_notif

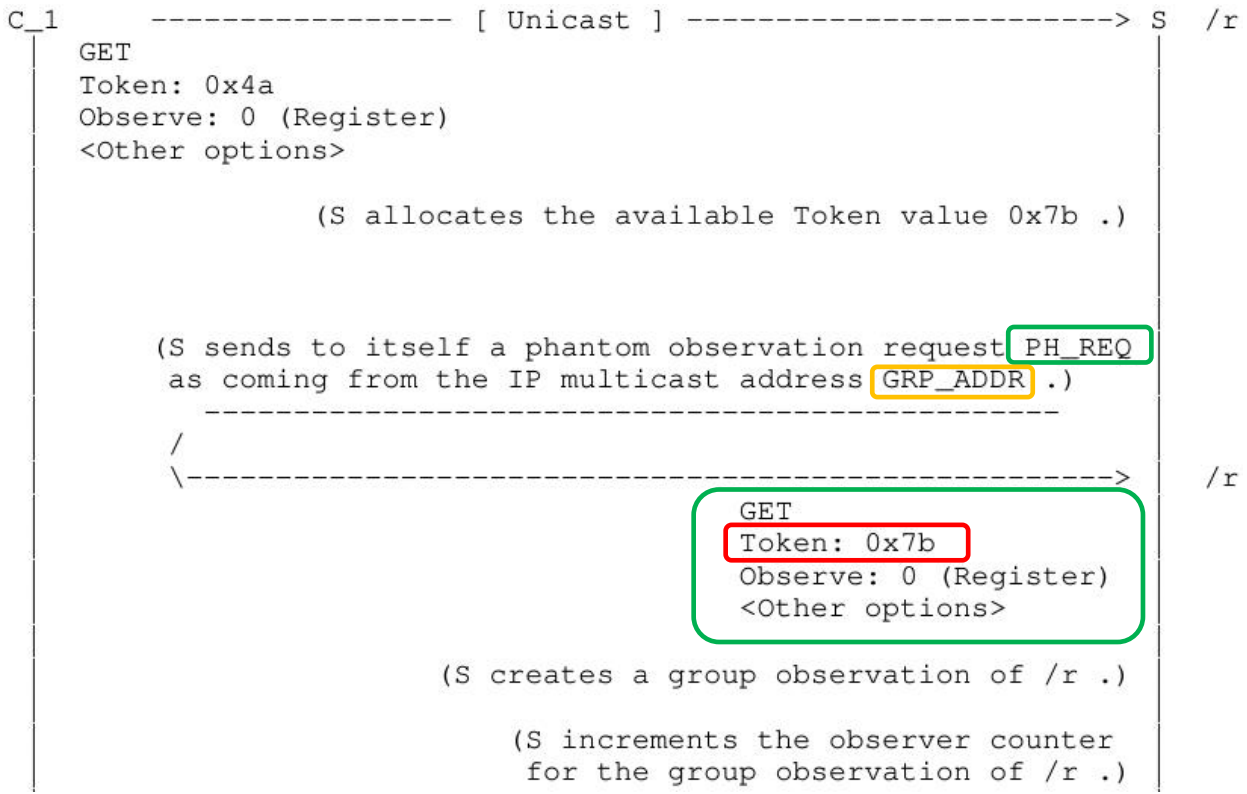
Interaction with clients

- The server sends to new/shifted clients an ***error response*** with
  - '*tp_info*': transport-specific information
    - '*srv_addr*' and '*srv_port*': destination address/port of the phantom request
    - '*token*': the selected Token value T, used for '*ph_req*' and '*last_notif*'
    - '*cli_addr*' and '*cli_port*': source address/port of the phantom request
  - '*ph_req*': serialization of the phantom request
  - '*last_notif*': serialization of the latest sent notification for the target resource

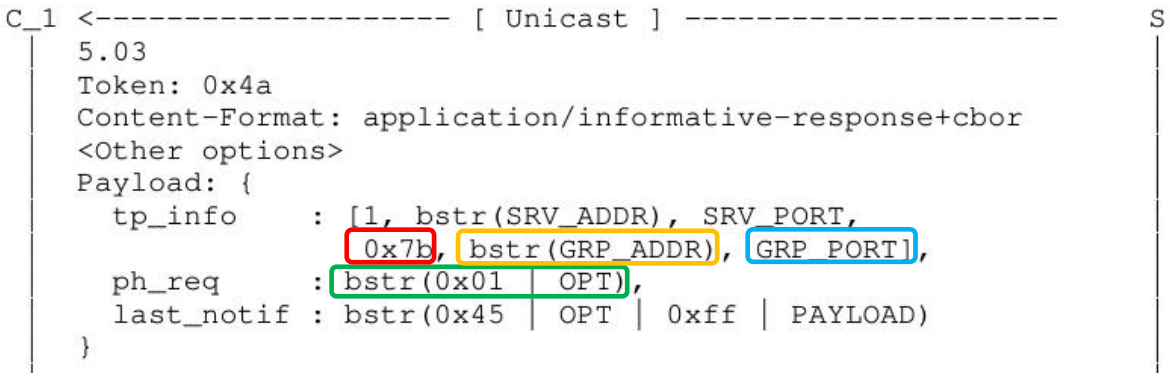
- When the value of the target resource changes:
  - The server sends an Observe notification to the IP multicast address '*cli_addr*'
  - The notification has the Token value T of the phantom request

- When getting the error response, a client:
  - Configures an observation for an endpoint associated to the multicast IP address
  - Accepts observe notifications with Token value T, sent to that multicast IP address

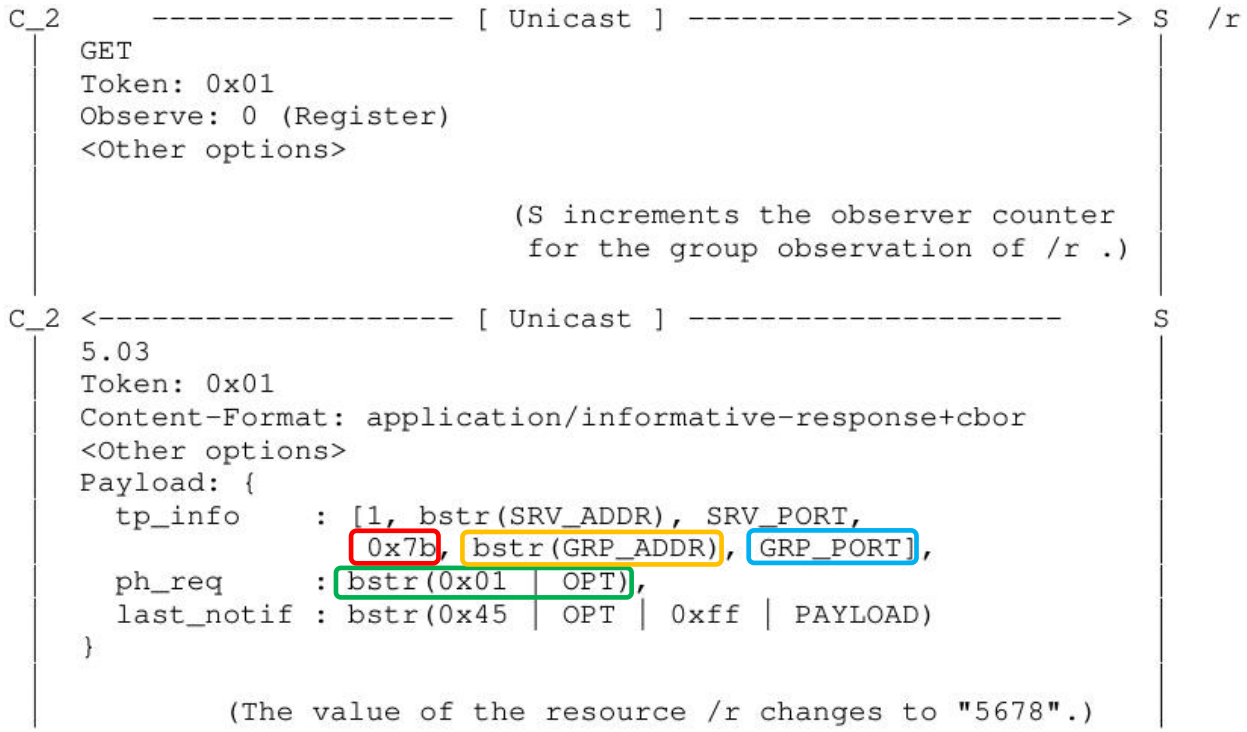
C1 registration



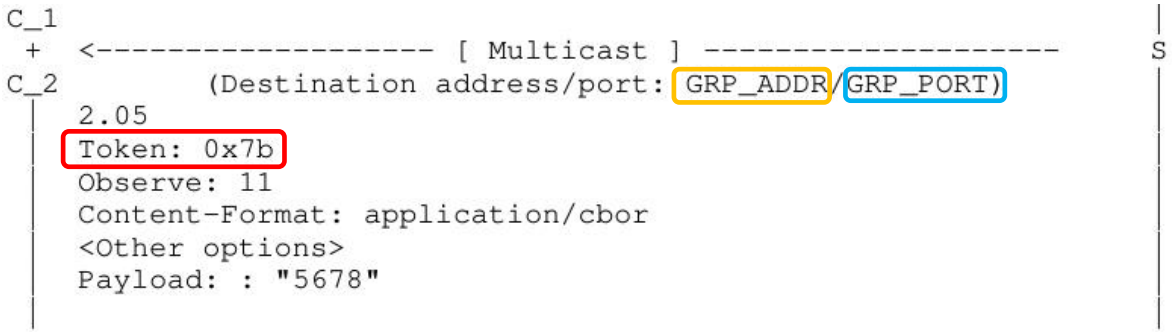
C1 registration



C2 registration



Multicast notification



- Same Token value of the Phantom Request
- Enforce binding between
  - Every multicast notification for the target resource
  - The (group) observation that each client takes part in

Security with Group OSCORE

- The phantom request is protected with Group OSCORE
  - ***x*** : the Sender ID ('kid') of the Server in the OSCORE group
  - ***y*** : the current SN value ('piv') used by the Server in the OSCORE group
  - Note: the Server consumes the value ***y*** and does not reuse it as SN in the group

- To secure/verify all multicast notifications, the OSCORE *external_aad* is built with:
  - 'req_kid' = ***x***
  - 'req_piv' = ***y***

- The phantom request is still included in the informative response
  - Each client retrieves ***x*** and ***y*** from the OSCORE option

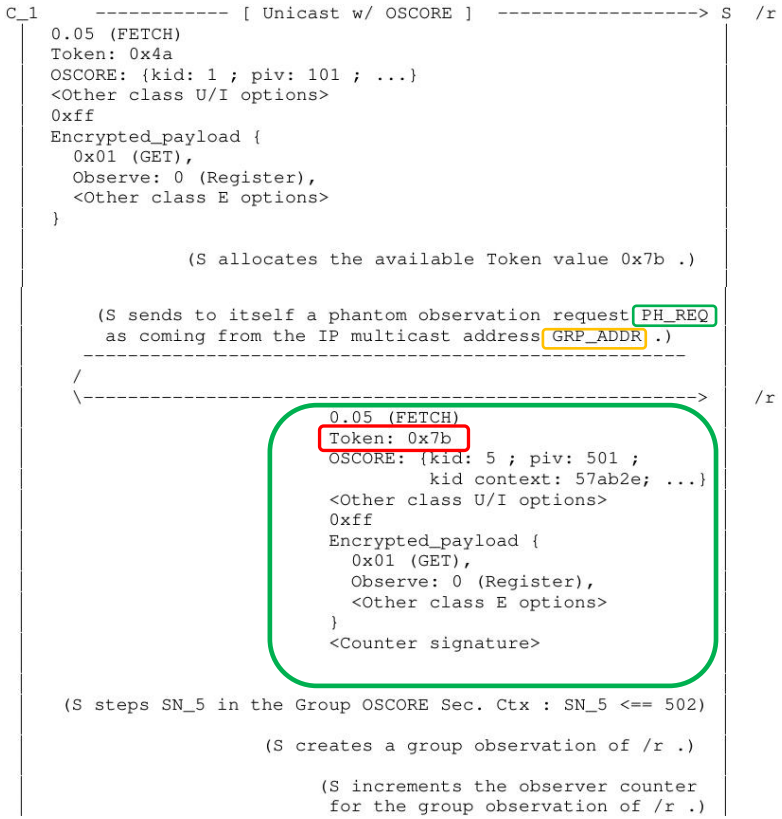
Security with Group OSCORE

- In the error response, the server can ***optionally*** specify also:
  - '*join-uri*' : link to the Group Manager to join the OSCORE group
  - '*sec-gp*' : name of the OSCORE group
  - '*as-uri*' : link to the ACE Authorization Server associated to the Group Manager
  - '*cs-alg*' : countersignature algorithm
  - '*cs-alg-crv*' : countersignature curve of the algorithm
  - '*cs-key-kty*' : countersignature key type
  - '*cs-key-crv*' : countersignature curve of the key
  - '*cs-kenc*' : countersignature key encoding
  - '*alg*' : AEAD algorithm
  - '*hkdf*' : HKDF algorithm

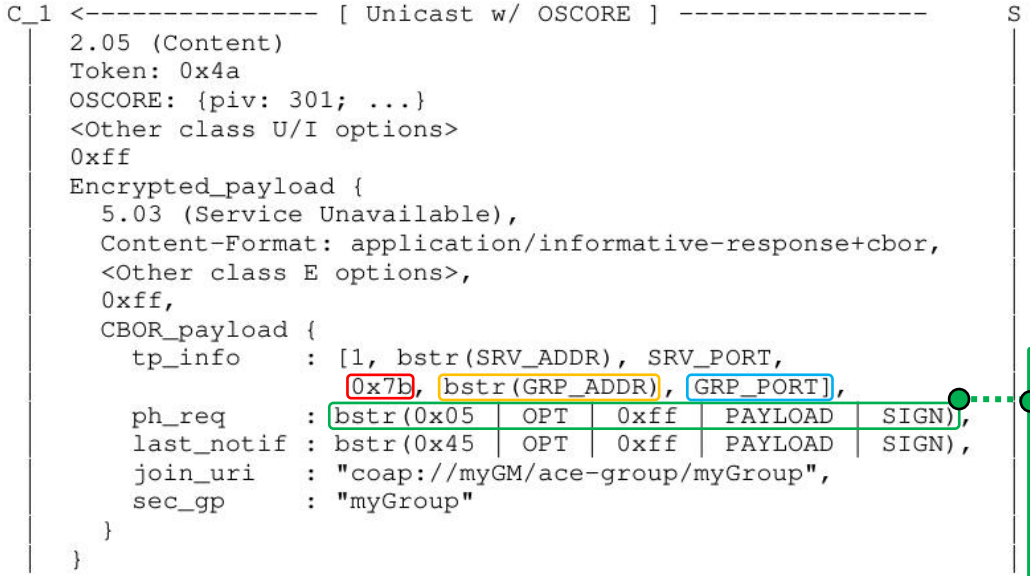
MUST

MAY

C1 registration w/ security



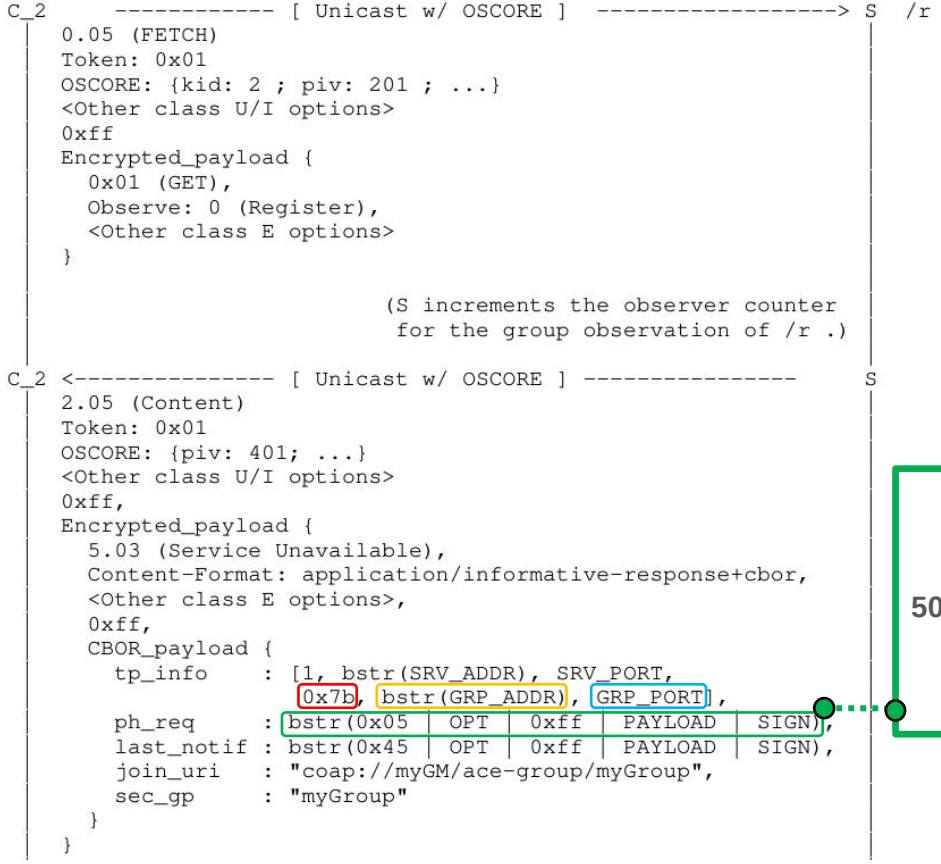
C1 registration w/ security



5: Sender ID ('kid') of S in the OSCORE group

501: Sequence Number of S in the OSCORE group <u>when S created the group observation</u>

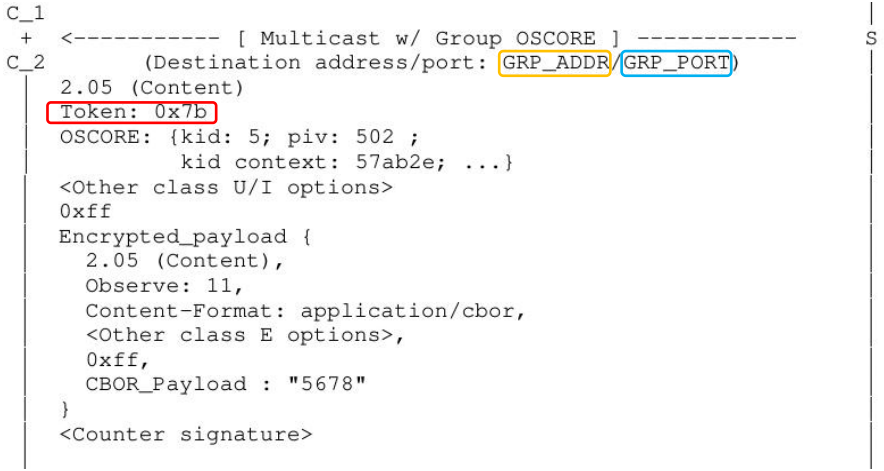
C2 registration w/ security



5: Sender ID ('kid') of S in the OSCORE group

501: Sequence Number of S in the OSCORE group when S created the group observation

Multicast notification w/ security



- When encrypting and signing the multicast notification:
  - The OSCORE *external_aad* has 'req_kid' = **5** and 'req_iv' = **501**
  - Same for all following notifications for the same resource
- Enforce secure binding between
  - Every multicast notification for the target resource
  - The (group) observation that each client takes part in

Support for intermediary proxies

- How it works
  - The proxy (next to the server) directly listens to the IP multicast address
  - The original Token of the phantom request has to match at the proxy
  - The proxy forwards multicast notifications back to each client
    - The proxy uses the Token values offered by the clients

- Without end-to-end security (Section 9)
  - The proxy can retrieve the phantom request from the informative response
  - No need to forward the informative response back to the clients

- With end-to-end security (Section 10)
  - The informative response is also protected with OSCORE or Group OSCORE
  - The proxy **cannot** retrieve the phantom request from the informative response
  - Each client has to explicitly provide the phantom request to the proxy