OSCORE-capable Proxies

draft-ietf-core-oscore-capable-proxies-01

Marco Tiloca, RISE
Rikard Höglund, RISE

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Scope: update to RFC 8613

1. **Define the use of OSCORE in a communication leg including a proxy**
   - Between origin client/server and a proxy; or between two proxies in a chain
   - Not only an origin client/server, but also an intermediary can be an “OSCORE endpoint”

2. **Define rules to escalate the protection of CoAP options**
   - If possible, encrypt and integrity-protect an option originally defined as Class U or I for OSCORE

3. **Explicitly admit a nested OSCORE protection – “OSCORE-in-OSCORE”**
   - E.g., first protect end-to-end over C ↔ S, then further protect the result over C ↔ P
   - Typically, at most 2 OSCORE “layers” for the same message
     - 1 end-to-end + 1 between two adjacent hops
   - Possible to seamlessly apply 2 or more OSCORE layers to the same message

- **Focus on OSCORE, but the same applies “as is” to Group OSCORE**

Since IETF 118

- **Received comments from Christian Amsüss [1] and Göran Selander – Thanks!**
- **Submitted version -01 before the cut-off for IETF 119**
- **Summary of latest updates**
  - Updated and added references
  - Various editorial fixes and readability improvements
  - Fixed notation in the examples of Appendix A
  - Onion CoAP [2] mentioned as use case
  - Considered also the CoAP options Proxy-Cri and Proxy-Scheme-Number [3]
  - Revised escalation of CoAP option protection
  - Revised processing of incoming requests

  } Details in the next slides

[1] https://mailarchive.ietf.org/arch/msg/core/9sPP9cAMDO5GFwZ4XeJng_bSnwQ/
[2] https://datatracker.ietf.org/doc/draft-amsuess-t2trg-onion-coap/
[3] https://datatracker.ietf.org/doc/draft-ietf-core-href/

Escalation of CoAP Option Protection

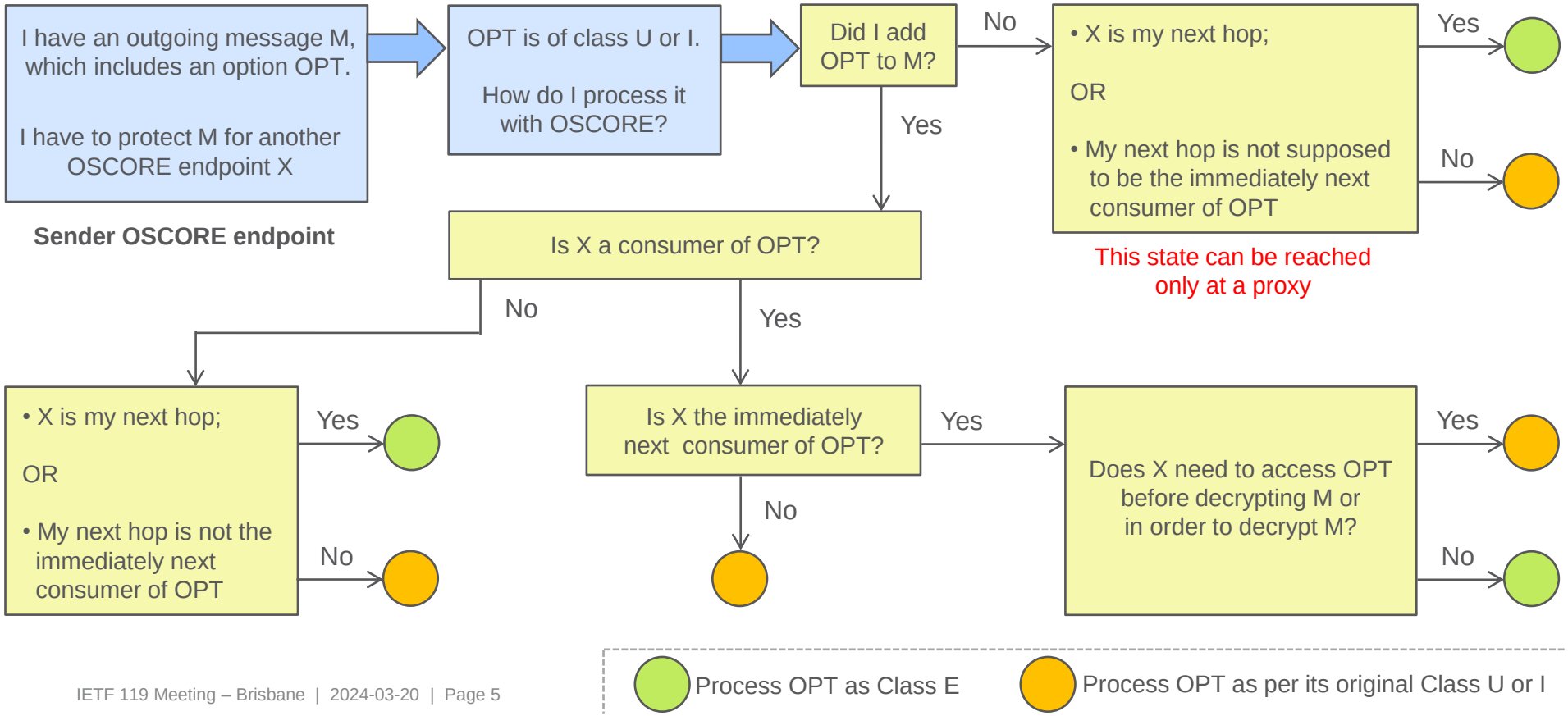
- **Now listed as a point of update to RFC 8613**

- **Section 3.1 – Revised and simplified escalation rules, with inline examples**
  - An outgoing message to protect includes an option OPT
  - OPT is originally defined as Class U or I for OSCORE
  - Should OPT be treated as if being of Class E instead?

- **Same rationale as usual: encrypt and integrity-protect whenever it is possible**
  - Three cases are defined, as “Any CoAP option OPT such that all the following conditions hold”
  - If there is a match, the option is treated as if being of Class E, otherwise as per its original Class
  - Added new state diagram in Appendix B; adapted version also in the next slide

- **Unexpected but good side effect**
  - When no proxies are involved, then Uri-Host and Uri-Port are encrypted
  - Backward compatible with endpoints that do not implement this update

Encryption of Class U/I Options



Processing of incoming requests (1/2)

- **Authorization checks before OSCORE decryption**
  - Already required before proceeding with a forwarding; Christian proposed this addition
  - Check if the Security Context is available and in an allow-list associated with the alleged sender
  - Preserve location anonymity of an origin server, as warranted by a reverse-proxy in front of it

- **Göran: "authorization" is a particular case of something more general**
  - Revised: "authorized operation" → "acceptable operation"
  - Both for a proxy to forward and for any OSCORE endpoint to decrypt an incoming request
  - The endpoint decides based on its local configuration and/or authorization enforcement

- **For reverse-proxies**
  - Considered also the Uri-Host and Uri-Port options as Proxy-related options that influence the process

Processing of incoming requests (2/2)

- **Comply with a special case at a forward-proxy, as noted by Christian**
  - If the request can be forwarded and the target URI authority points to the proxy itself, …
  - then the proxy has to directly consume the request, see Section 5.7.2 of RFC 7252

- **An endpoint SHOULD define the maximum number of OSCORE layers that it is able to apply (remove) when processing an outgoing (incoming) CoAP message**
  - Consistent with the application security requirements, also suggested by Christian
  - Bounded by the maximum active OSCORE Security Contexts at the endpoint
  - Bounded by the number of intermediate OSCORE endpoints explicitly set up
  - At a receiving endpoint, the OSCORE decryption fails if the limit is reached
  - Practical upper bound on the loop-based decryption of incoming messages

- **Updated state diagram in Appendix C; adapted version in the backup slides**
  - We did manage to squeeze in the additions suggested by Christian ☺

Next steps

- **Closer look at:**
  - Processing of the Hop-Limit option (RFC 8768)
  - Addition of an outer option, after producing the corresponding, encrypted inner option (e.g., Observe)
- **Handling multiple responses to the same request, if also protected by a proxy**
  - Same rationale and approach as in *draft-ietf-core-oscore-groupcomm*
- **Extend the security considerations**
- **More examples of message exchanges in Appendix A**
  - E.g., with a reverse-proxy, with a chain of proxies
- **"OSCORE-in-OSCORE" named as "Matryoscore" ?**
- **Comments and reviews are welcome!**

Thank you!

Comments/questions?

https://github.com/core-wg/oscore-capable-proxies

Backup

Motivation

- **A CoAP proxy (P) can be used between client (C) and server (S)**
  - A security association might be required between C and P

- **Good to use OSCORE between C and P**
  - Especially, but not only, if C and S already use OSCORE end-to-end

- **This is not defined and not admitted in OSCORE (RFC 8613)**
  - C and S are the only considered “OSCORE endpoints”
  - It is forbidden to double-protect a message, i.e., both over C ↔ S and over C ↔ P

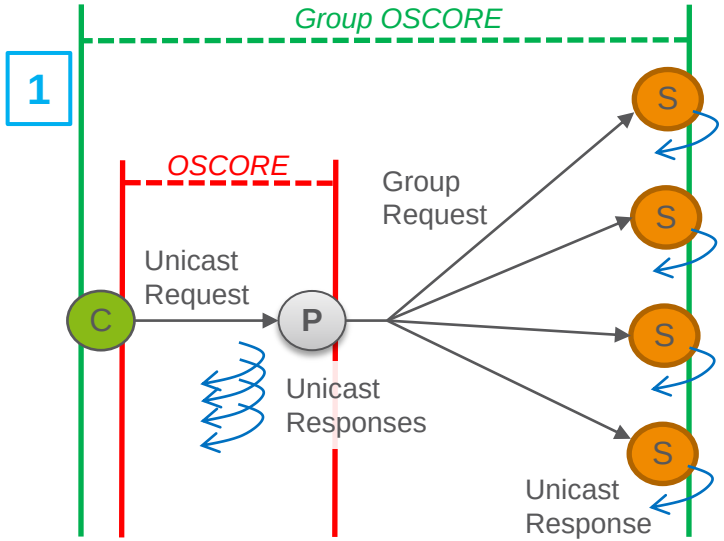
Use cases

- **Section 2.1, CoAP group communication through a proxy [4]**
  - The proxy identifies the client before forwarding
- **Section 2.2, Observe multicast notifications with Group OSCORE [5]**
  - The client securely provides the Ticket Request to the proxy
- **Sections 2.3 and 2.4, OMA Lightweight Machine-to-Machine (LwM2M)**
  - The LwM2M Client uses the LwM2M Server as a proxy towards External Application Servers
  - The LwM2M Server uses the LwM2M Gateway as a reverse-proxy towards External End Devices
- **Further use cases are listed in Section 2.5**
  - Transport indication through trusted proxies – *draft-ietf-core-transport-indication*
  - CoAP performance measurements involving on-path probes – *draft-ietf-core-coap-pm*
  - EST over OSCORE through a CoAP-to-HTTP proxy – *draft-ietf-ace-coap-est-oscore*
  - OSCORE-protected “onion forwarding”, a la TOR – *draft-amsuess-t2trg-onion-coap*
  - Proxies as entry point to a firewalled network

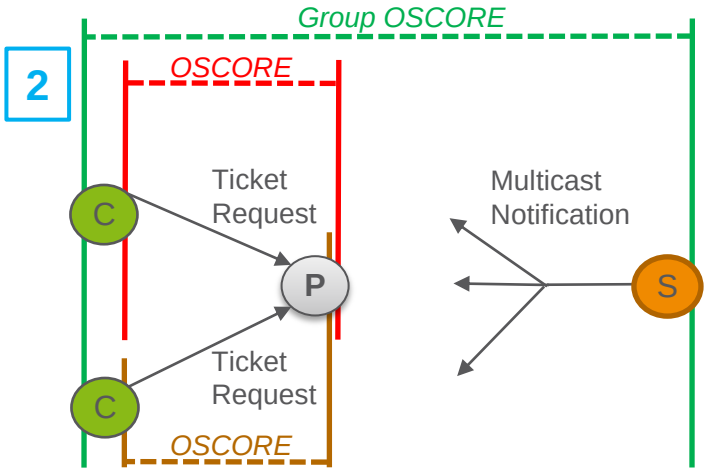
[4] https://datatracker.ietf.org/doc/draft-ietf-core-groupcomm-proxy/
[5] https://datatracker.ietf.org/doc/draft-ietf-core-observe-multicast-notifications/

Use cases

1. **CoAP Group Communication with Proxies**
   - *draft-ietf-core-groupcomm-proxy*
   - CoAP group communication through a proxy
   - P must identify C through a security association



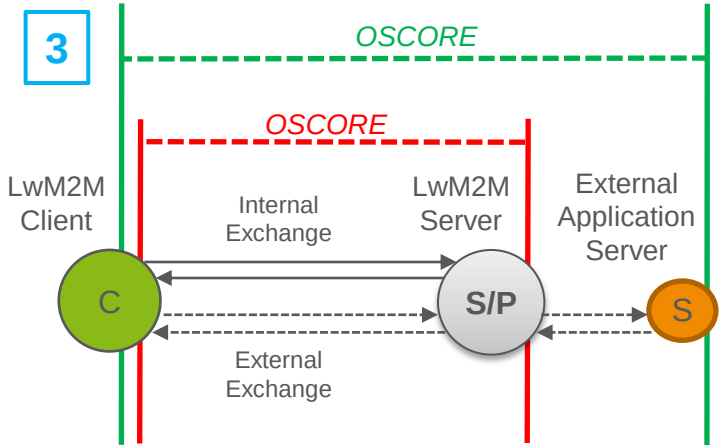
2. **CoAP Observe Notifications over Multicast**
   - *draft-ietf-core-observe-multicast-notifications*
   - If Group OSCORE is used for end-to-end security …
   - … C provides P with a Ticket Request obtained from S
   - That provisioning should be protected over C ↔ P



Use cases

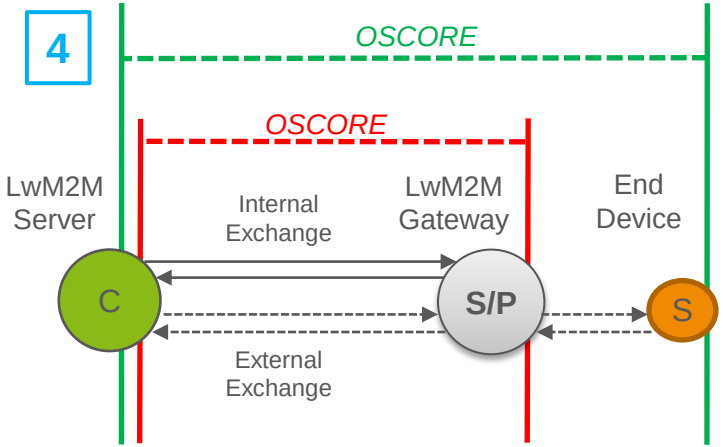
3. LwM2M Client and external Application Server

- From the *L2wM2M Transport Binding* specification:
  - OSCORE can be used between a LwM2M endpoint and a non-LwM2M endpoint, via the LwM2M Server
- The LwM2M Client may use OSCORE to interact:
  - With the LwM2M Server (LS), as usual; and
  - With an external Application Server, via LS acting as proxy



4. Use of the LwM2M Gateway

- It provides the LwM2M Server with access to:
  a) Resources at the LwM2M Gateway
  b) Resources at external End Devices, through the LwM2M Gateway, via dedicated URI paths
- In case (b), the LwM2M Gateway acts, at its core, as a reverse-proxy



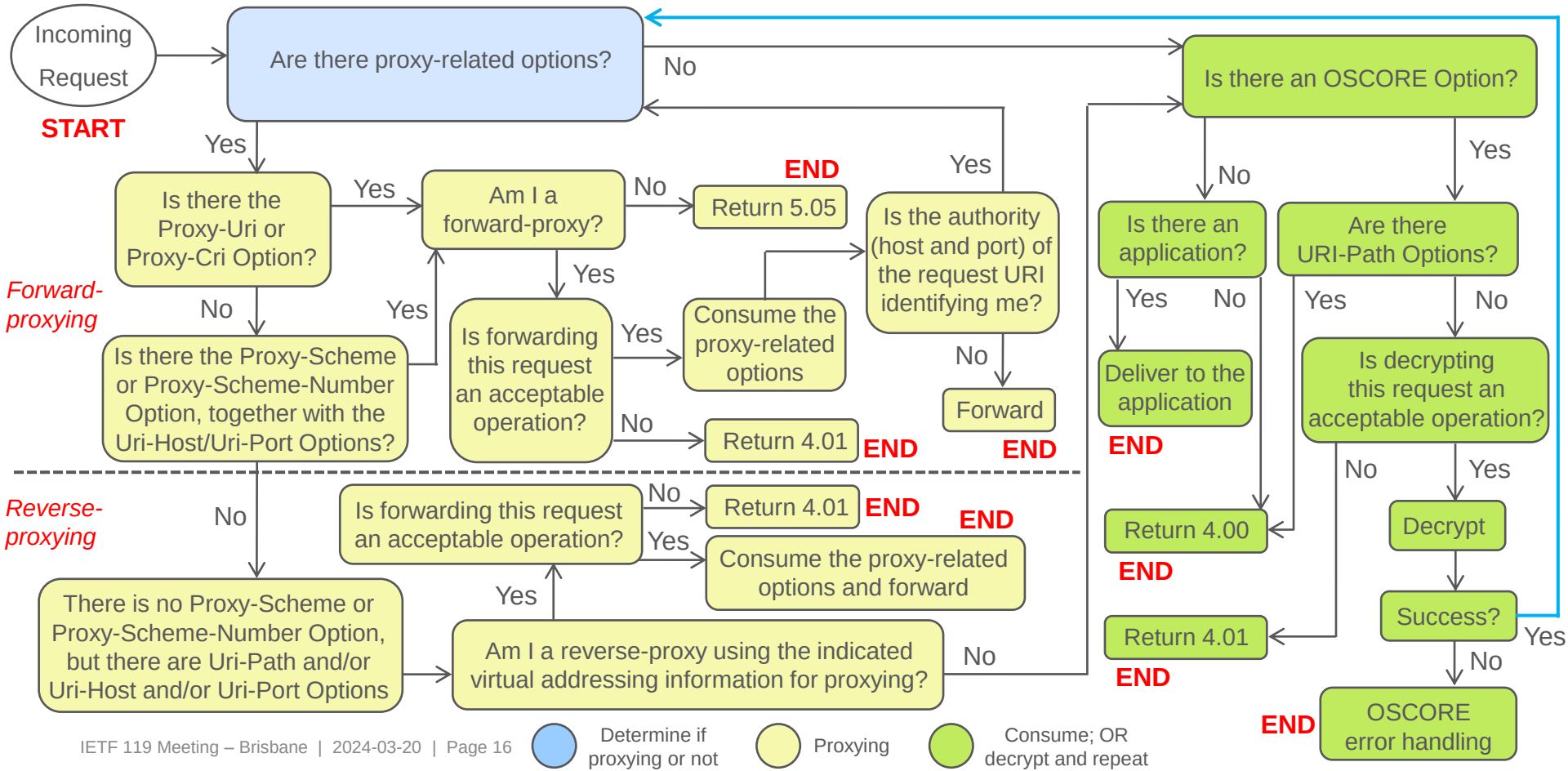
Use case 3 – LwM2M

- **OMA LwM2M Client and External Application Server**
  - *Lightweight Machine to Machine Technical Specification – Transport Binding*

> *OSCORE MAY also be used between LwM2M endpoint and non-LwM2M endpoint, e.g., between an Application Server and a LwM2M Client via a LwM2M server. Both the LwM2M endpoint and non-LwM2M endpoint MUST implement OSCORE and be provisioned with an OSCORE Security Context.*

  - The LwM2M Client may register to and communicate with the LwM2M Server using OSCORE
  - The LwM2M Client may communicate with an External Application Server, also using OSCORE
  - The LwM2M Server would act as CoAP proxy, forwarding traffic outside the LwM2M domain

Processing an incoming request



Determine if proxying or not

Proxying

Consume; OR decrypt and repeat