OSCORE-capable Proxies

draft-tiloca-core-oscore-capable-proxies-06

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Recap

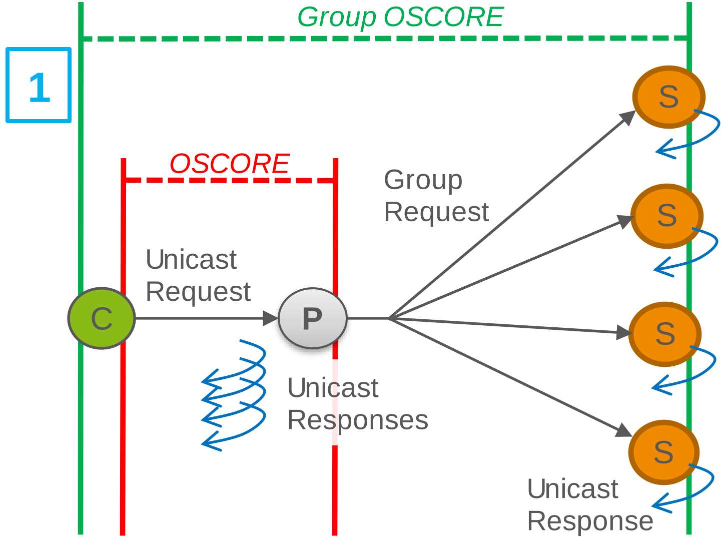
- **A CoAP proxy (P) can be used between client (C) and server (S)**
  - A security association might be required between C and P --- use cases in next slides
- **Good to use OSCORE between C and P**
  - Especially, but not only, if C and S already use OSCORE end-to-end
- **This is not defined and not 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
- **This work started as an Appendix of *draft-tiloca-core-groupcomm-proxy***
  - Agreed at IETF 110 [1] and at the June 2021 CoRE interim [2] to have a separate draft

[1] https://datatracker.ietf.org/doc/minutes-110-core-202103081700/

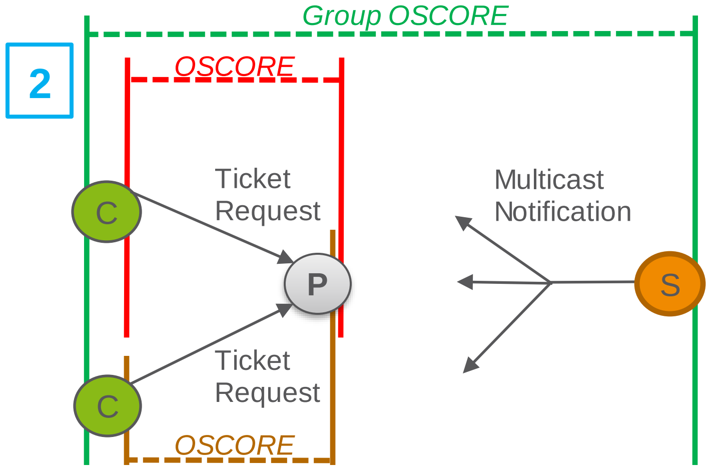
[2] https://datatracker.ietf.org/doc/minutes-interim-2021-core-07-202106091600/

Some use cases

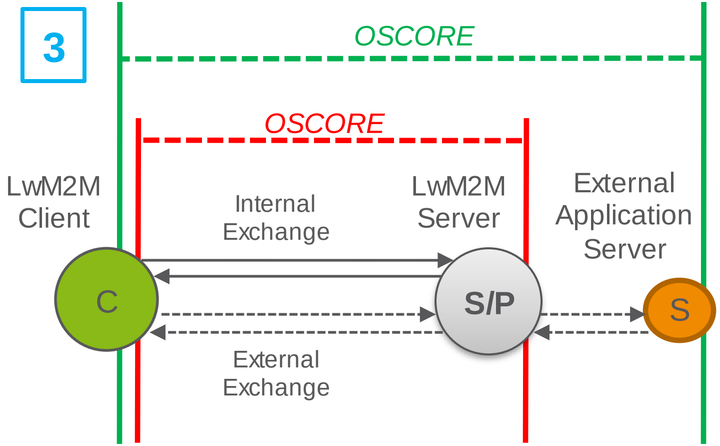
1. **CoAP Group Communication with Proxies**
   - *draft-tiloca-core-groupcomm-proxy*
   - CoAP group communication through a proxy
   - P must identify C through a security association



2. **CoAP Observe Notifications over Multicast**
   - *draft-ietf-core-observe-multicast-notifications*
   - If Group OSCORE is used for e2e security …
   - … C provides P with a Ticket Request obtained from S
   - That provisioning should be protected over C ↔ P

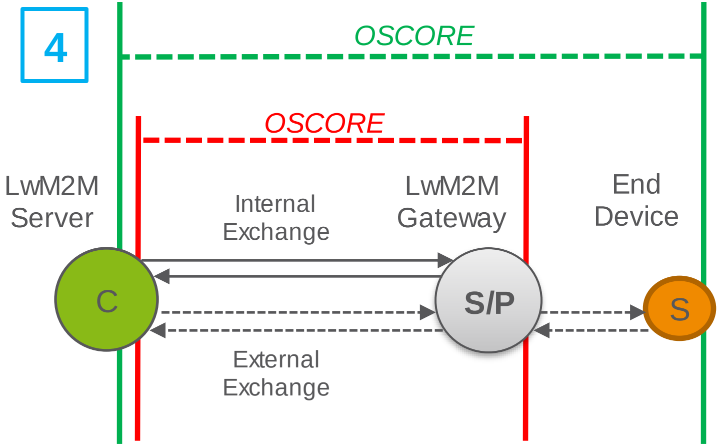


Some use cases



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 (from David Navarro)

- 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

Contribution

- **Twofold 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. **Explicitly admit 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
    - But possible to seamlessly apply 2 or more OSCORE layers to the same message
        - Building block for “OSCORE-protected Onion Forwarding”, see Appendix B

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

Recent updates

- **Previous presentation: version -04 at the 2022-09-28 CoRE interim meeting**

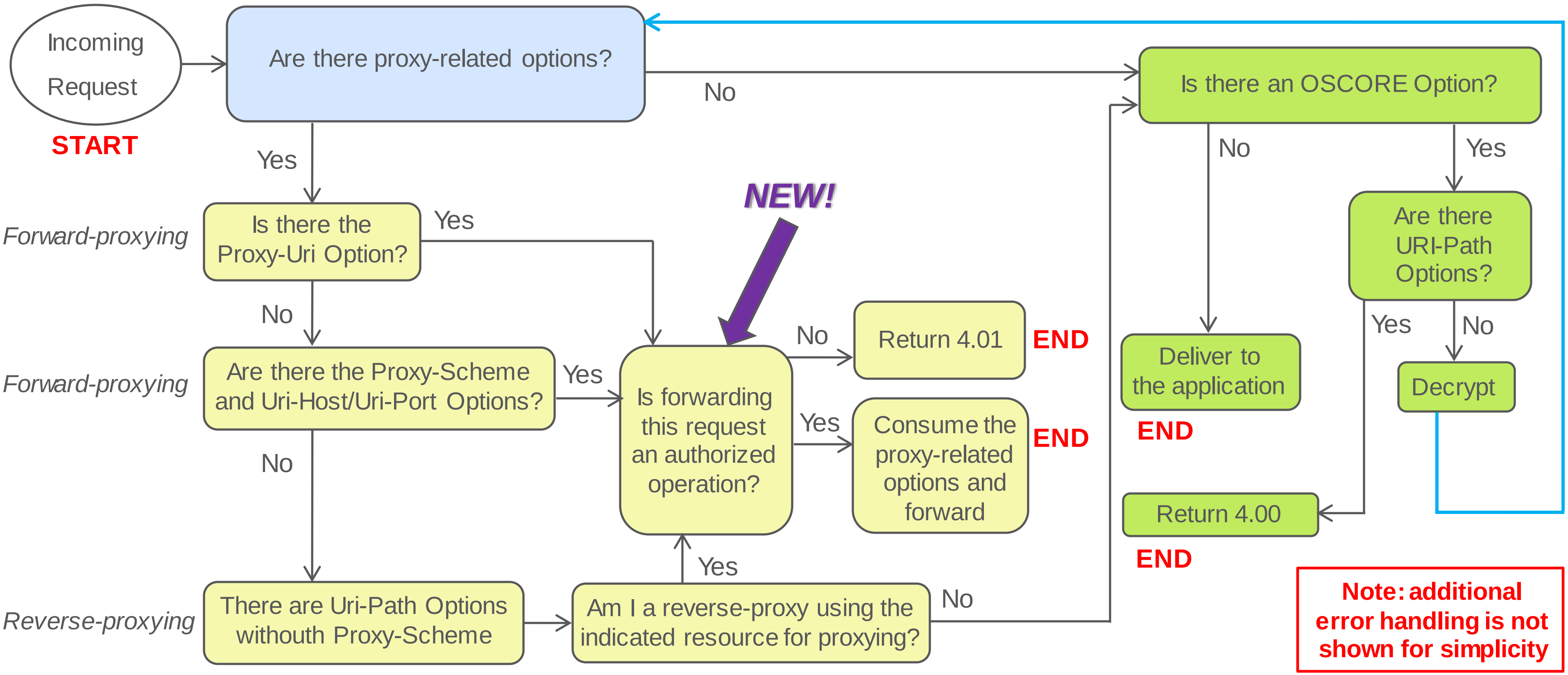
- **Then two close submissions of -05 and -06 around IETF 116**

- **The proxy has to check whether forwarding a decrypted request is ok**
  - For example, leveraging the OSCORE Security Context used for decryption
  - Input from Christian during the CoRE interim meeting on 2022-09-28 – Thanks!

- **Clarified corner case where the proxy does <u>not</u> forward a valid request**
  - For example, if including the Listen-To-Multicast-Notifications Option [1]

[1] https://datatracker.ietf.org/doc/draft-ietf-core-observe-multicast-notifications/

Processing an incoming request



Incoming Request

START

Are there proxy-related options?

No

Yes

Forward-proxying

Is there the Proxy-Uri Option?

Yes

No

Forward-proxying

Are there the Proxy-Scheme and Uri-Host/Uri-Port Options?

Yes

No

Reverse-proxying

There are Uri-Path Options withouth Proxy-Scheme

NEW!

Is forwarding this request an authorized operation?

No

Return 4.01

END

Yes

Consume the proxy-related options and forward

END

Yes

Am I a reverse-proxy using the indicated resource for proxying?

No

Is there an OSCORE Option?

No

Yes

Deliver to the application

END

Are there URI-Path Options?

Yes

No

Decrypt

Return 4.00

END

Note: additional error handling is not shown for simplicity

● Determine if proxying or not

● Proxying

● Consume; OR decrypt and repeat

Recent updates

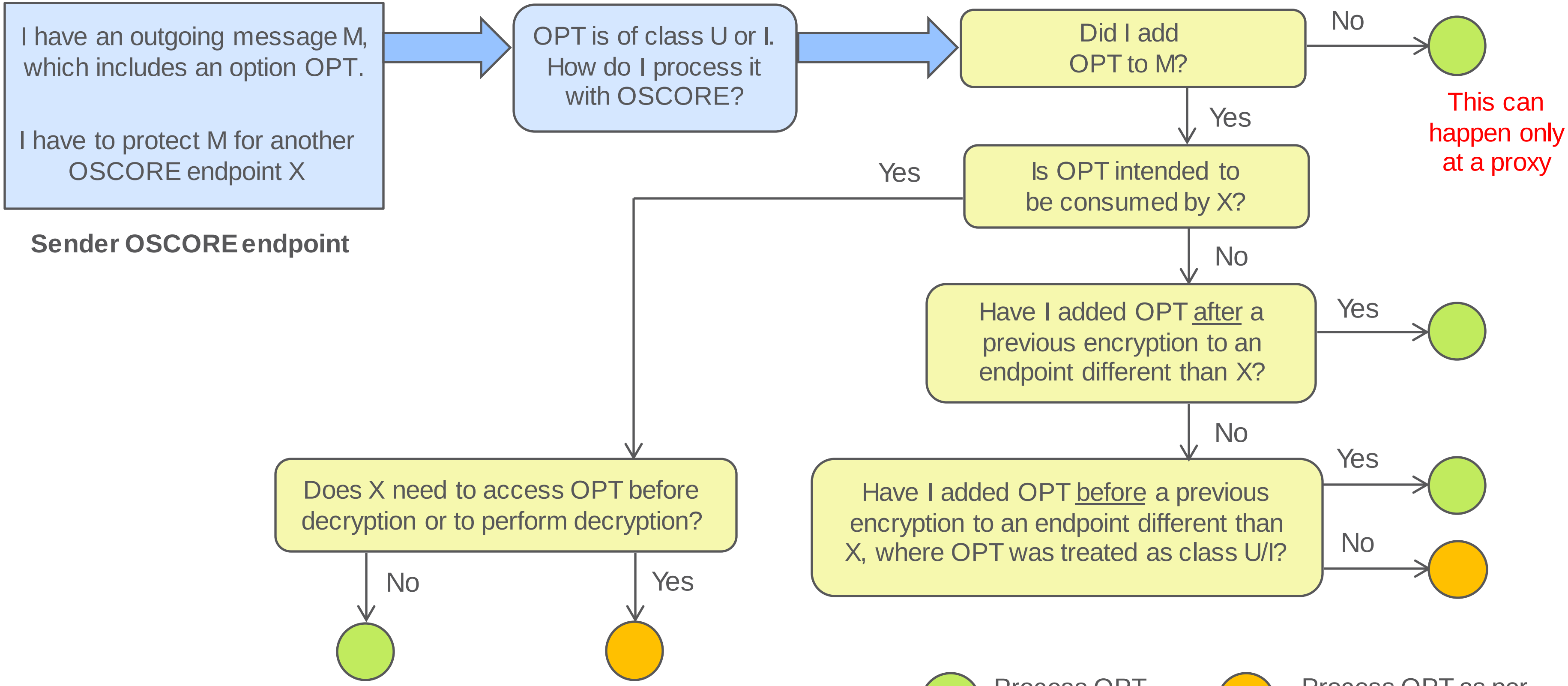
- **OSCORE protection of CoAP options**
  - If a CoAP option is originally defined as class U or I for OSCORE …
  - … when should it be protected as if it was of class E?

- **Improved general rules**
  - Now better covering corner cases and class I options
  - A good sanity check was the Request-Hash option [2]
    - Processed as class I in responses
    - Expected to be elided from responses, but still possible to send it on the wire

- **Current rule formulation – Section 3.1**
  - Three main cases, all formulated as “Any CoAP option such that …”
  - Multiple examples provided for each case
  - The rationale is always to encrypt as many options as possible

[2] https://datatracker.ietf.org/doc/draft-amsuess-core-cachable-oscore/

Encryption of Class U/I Options



I have an outgoing message M, which includes an option OPT.

I have to protect M for another OSCORE endpoint X

Sender OSCORE endpoint

OPT is of class U or I. How do I process it with OSCORE?

Did I add OPT to M?

This can happen only at a proxy

Is OPT intended to be consumed by X?

Have I added OPT after a previous encryption to an endpoint different than X?

Have I added OPT before a previous encryption to an endpoint different than X, where OPT was treated as class U/I?

Does X need to access OPT before decryption or to perform decryption?

🟢 Process OPT as class E

🟠 Process OPT as per its original class U or I

Recent updates

- **New Section 5 – Guidelines on establishing OSCORE Security Contexts**
  - Generally agnostic of the used establishment method

- **For OSCORE**
  - Guidelines for the client using EDHOC [3], first with the proxy, then with the origin server
  - Reference to the possible, optimized EDHOC workflow [4]

- **For Group OSCORE**
  - Expected between origin client and servers; they rely on the Group Manager
  - If a proxy uses Group OSCORE, it must not be in the same group of the origin endpoints

[3] https://datatracker.ietf.org/doc/draft-ietf-lake-edhoc/
[4] https://datatracker.ietf.org/doc/draft-ietf-core-oscore-edhoc/

Recent updates

- **Revised notation in the examples of message exchange – Appendix A**
  - Easier to see what is encrypted
  - Easier to see which OSCORE Security Context is used

- **New example with EDHOC [3] and the EDHOC + OSCORE request [4]**
  - See Appendix A.5 – The improvement is bigger than intuitively expected
  - Use EDHOC between C and P as well as between C and S (through P)
  - How many messages to: i) complete EDHOC with P and with S; and ii) exchange data with S?
  - Without optimization (Appendix A.4): 16 messages
  - With optimization (Appendix A.5): 10 messages

[3] https://datatracker.ietf.org/doc/draft-ietf-lake-edhoc/
[4] https://datatracker.ietf.org/doc/draft-ietf-core-oscore-edhoc/

Open point #1

- **Appendix B “OSCORE-protected Onion Forwarding”**
  - The origin client protects its request first for the origin server, …
  - … then for the last proxy, then for the second from last proxy, … , then for the first proxy
  - That can become something similar to TOR, but using OSCORE

- **At a high level, the use case is described earlier in the draft**
  - The text in Appendix B is currently a collection of notes and directions
  - The foundation looks promising, but it is unlikely to be ready and used any time soon

- **Proposal**
  - Remove Appendix B from the current Internet Draft
  - Reuse its content for a separate, Experimental Internet Draft building on the current one

Thoughts?

Open point #2

- **Revising the rules on protecting CoAP options put light on RFC 8798**
  - For the Hop-Limit option, no OSCORE processing and class is defined

- **From RFC 8613, Section 4.1**
  - *Options that are unknown or for which OSCORE processing is not defined SHALL be processed as Class E (and no special processing).*

- **That is, Hop-Limit has to be treated as a class E option**
  - If the origin client adds the option, encrypting it is not desirable (even w/o OSCORE with proxy)
  - You would have an inner option and outer option, with the inner one not useful

- **Proposal**
  - In this Internet Draft, define that the Hop-Limit Option is of class U (i.e., update RFC 8798)
  - Per the protection rules: the option is unprotected end-to-end, but protected for the next proxy

Thoughts?

Summary and next steps

- **Proposed update to RFC 8613**
  - Define the use of OSCORE in a communication leg including a proxy
  - Explicitly admit nested OSCORE protection – “OSCORE-in-OSCORE”

- **Next step: submit version -07 before the IETF 117 cut-off**
  - More, newly identified use cases: *-core-coap-pm* and *-ace-coap-est-oscore*
  - High-level use of SCHC header compression (see RFC 8824 & *draft-tiloca-schc-8824-update*)
  - New appendix with ASCII-art figure for the processing of incoming requests
  - Address the two raised open points (see slides 13 and 14)
  - Minor editorial fixes

- **Version -07 should be ready for considering a WG Adoption Call**

- **The core mechanics are already stable – Comments are welcome!**

Thank you!

Comments/questions?

https://gitlab.com/crimson84/draft-tiloca-core-oscore-to-proxies

Backup

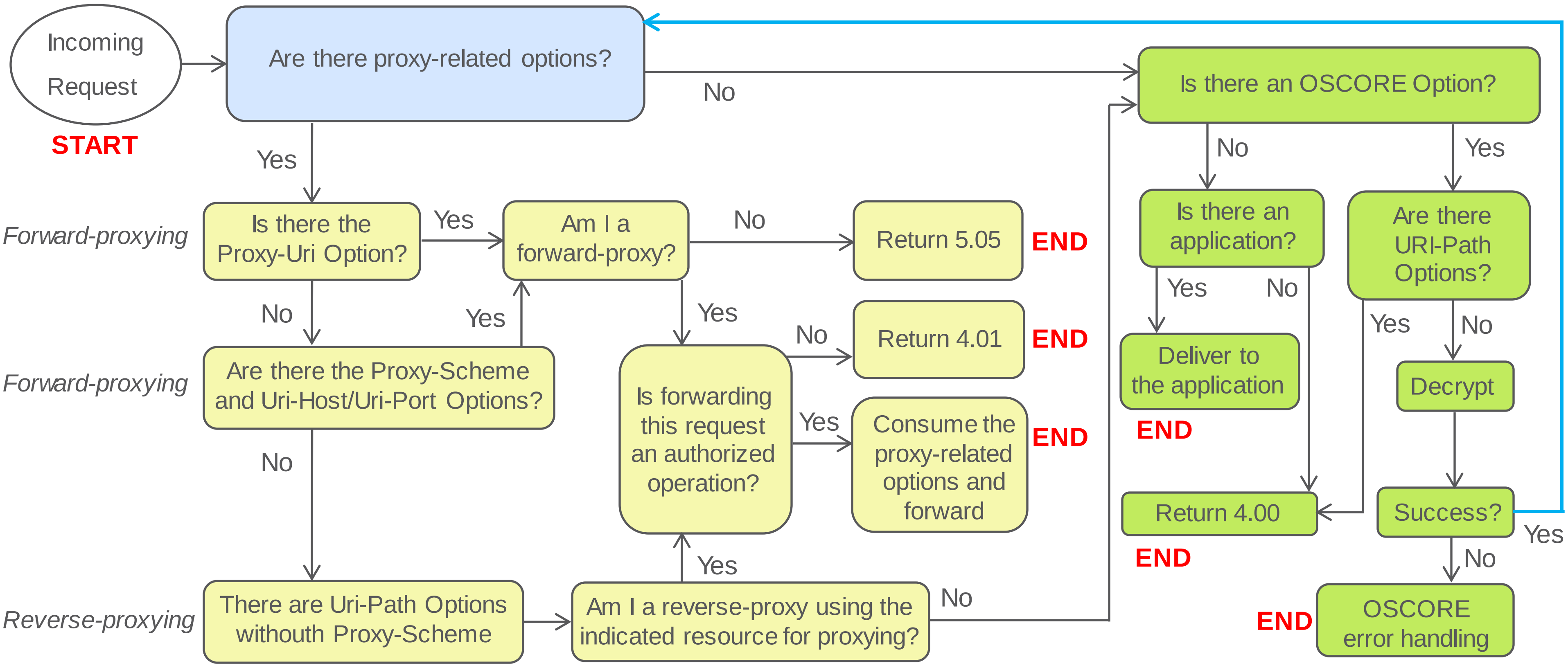
Some use cases – LwM2M

- **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



Incoming Request

START

Are there proxy-related options?

No

Yes

Forward-proxying

Is there the Proxy-Uri Option?

Yes

Am I a forward-proxy?

No

Return 5.05

END

No

Yes

Yes

Forward-proxying

Are there the Proxy-Scheme and Uri-Host/Uri-Port Options?

No

Return 4.01

END

Is forwarding this request an authorized operation?

Yes

Consume the proxy-related options and forward

END

No

Reverse-proxying

There are Uri-Path Options withouth Proxy-Scheme

Am I a reverse-proxy using the indicated resource for proxying?

Yes

No

Is there an OSCORE Option?

No

Yes

Is there an application?

Yes

No

Deliver to the application

END

Are there URI-Path Options?

Yes

No

Decrypt

Return 4.00

END

Success?

Yes

No

OSCORE error handling

END

🟦 Determine if proxying or not

🟨 Proxying

🟩 Consume; OR decrypt and repeat