Discovery of OSCORE Groups with the CoRE Resource Directory

draft-tiloca-core-oscore-discovery-08

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Recap

- A newly deployed device:
  - May not know the OSCORE groups and their Group Manager (GM)
  - May have to wait GMs to be deployed or OSCORE groups to be created
- Use web links for discovery – Typically through the Resource Directory (RD)
  - Discover an OSCORE group and retrieve information to join it
  - Practically, discover the links to join the OSCORE group at its GM
  - CoAP Observe supports early discovery and changes of group information
- Use resource lookup, to retrieve:
  - The name of the OSCORE group
  - A link to the resource at the GM for joining the group
- Full support for both Link-Format and CoRAL RD

Updates from -08

- Added target attributes related the pairwise mode of Group OSCORE
  - *ecdh_alg* , *ecdh_alg_crv* , *ecdh_key_kty* , *ecdh_key_crv*
  - To refer to for the derivation of pairwise symmetric keys
  - Same advantages as for the attributes on the signature algorithm
- Usage of the right content-format, for links to join OSCORE groups
  - “application/ace-groupcomm+cbor”
  - See Section 8.2 of draft-ietf-ace-key-groupcomm
- Group discovery intended not only to joining nodes
  - Relevant case: signature verifiers, e.g. intermediary gateways
  - They don’t join the OSCORE group, but retrieve public keys from the Group Manager

Updates from -08

- Revised all examples in Link Format and CoRAL

- Proof-of-concept implementation using Link Format [1]
  - The full set of operations from the draft is covered
    - Register an application group
    - Register Group Manager, security group and associated Authorization Server
    - Discover the security group, with descriptive target attributes
    - Discover the associated Authorization Server
    - Discover the application group, with the multicast IP address
  - Successfully tested with Christian's RD at coap://rd.coap.amsuess.com

[1] https://bitbucket.org/marco-tiloca-sics/ace-java/src/master/src/test/java/se/sics/ace/interopGroupOSCORE/CoAPEndpointToResourceDirectory.java

Open points

Mostly on security considerations

1. Denial (common issue)
   – The RD hides the presence of groups
2. Interaction leaking (common issue)
   – An endpoint advertises groups and learn addresses of joining nodes as they come
   – Possibly acting also as MITM between joining nodes and real Group Manager
3. Downgrade attack
   – Data from the RD are a hint here
   – Possible to mitigate, by directly checking also with the Group Manager

… and more, consistent with the latest version -27 of the RD

Next steps

- Update also based on the latest *draft-ietf-core-resource-directory-27*
  - Revised used of the ‘anchor’ attribute
  - Security considerations, covering also the specific open points

- Integrate implementation in the ACE Group Manager and joining node

- Need for more reviews

Thank you!

Comments/questions?

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

Backup

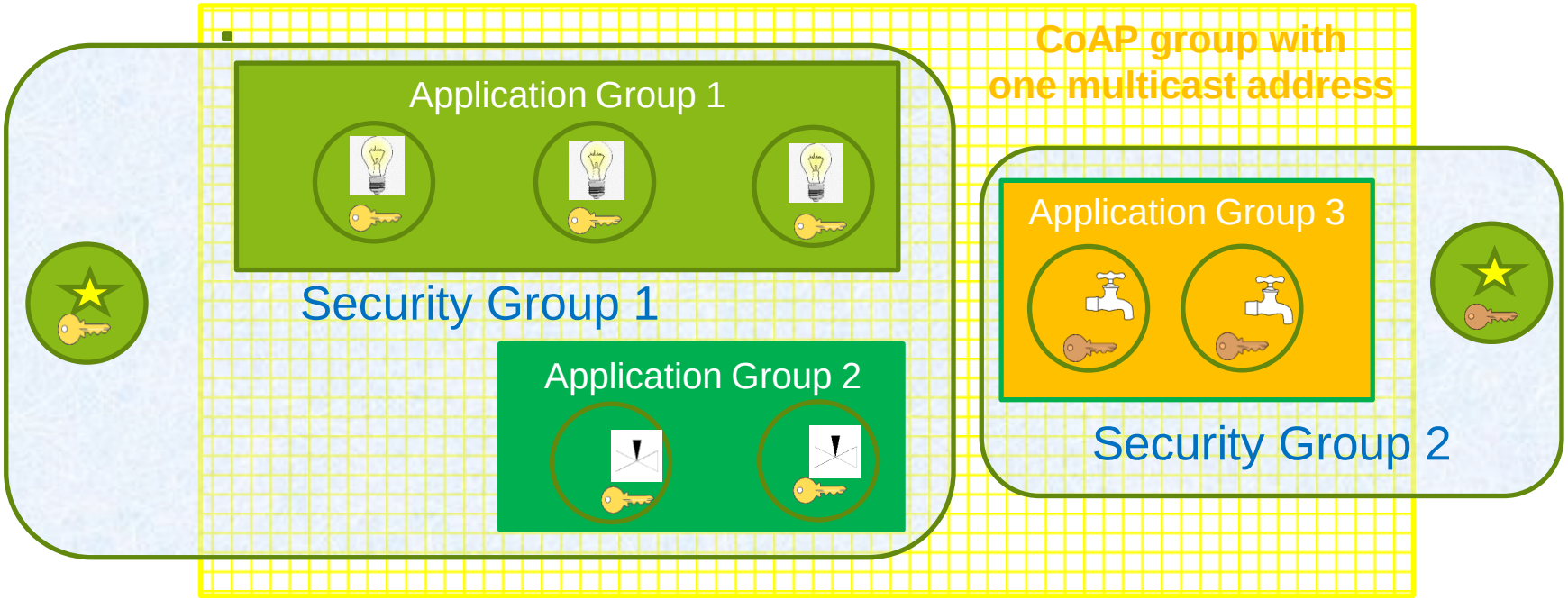
Application/CoAP/Security Groups

- Application group
  - Defined in {RD} and reused as is
  - Set of CoAP endpoints sharing a pool of resources
  - Registered and looked up just as per Appendix A of {RD}

- CoAP Group
  - Defined in *draft-ietf-core-groupcomm-bis*
  - Set of CoAP endpoints listening to the same IP multicast address
  - The IP multicast address is the ‘base’ address of the link to the application group

- (OSCORE) Security Group
  - Set of CoAP endpoints sharing common security material (e.g. OSCORE Ctx)
  - A GM registers the group-membership resources for accessing its groups

Application vs. Security Groups



Client of application group

Different key sets

Resources for given function

Registration

- The GM registers itself with the RD
  - MUST include all its join resources, with their link attributes
  - rt="core.osc.gm" , if="ace.group"

```
Request: GM -> RD

Req: POST coap://rd.example.com/rd?ep=gm1
Content-Format: 40
Payload:
</ace-group/feedca570000>;ct=65000;rt="core.osc.gm";if="ace.group";
                          sec-gp="feedca570000";app-gp="group1";
                          cs_alg="-8";cs_alg_crv="6";
                          cs_kenc="1";ecdh_alg="-27";
                          ecdh_alg_crv="4",
<coap://as.example.com/token>;
      rel="authorization-server";
      anchor="coap://[2001:db8::ab]/ace-group/feedca570000"

Response: RD -> GM
Res: 2.01 Created
Location-Path: /rd/4521
```

Discovery (1/2)

- The device performs a resource lookup at the RD
  - Known information: name of the Application Group, i.e. “group1”
  - Need to know: name of the OSCORE Group; Join resource @ GM; Multicast IP address
  - ‘*app-gp*’ → Name of the Application Group, acting as tie parameter in the RD

```
Request: Joining node -> RD

Req: GET coap://rd.example.com/rd-lookup/res
  ?rt=core.osc.gm&app-gp=group1

Response: RD -> Joining node

Res: 2.05 Content
Payload:
<coap://[2001:db8::ab]/ace-group/feedca570000>;ct=65000;
    rt="core.osc.gm";if="ace.group";sec-gp="feedca570000";
    app-gp="group1";cs_alg="-8";cs_alg_crv="6";
    cs_kenc="1";ecdh_alg="-27";ecdh_alg_crv="4";
    anchor="coap://[2001:db8::ab]"
```

Discovery (2/2)

› The device performs an endpoint lookup at the RD
  – Still need to know the Multicast IP address
  – ‘ep’ // Name of the Application Group, value from ‘*app-gp*’
  – ‘base’ // Multicast IP address used in the Application Group

```
Request: Joining node -> RD

Req: GET coap://rd.example.com/rd-lookup/ep
  ?et=core.rd-group&ep=group1

Response: RD -> Joining node

Res: 2.05 Content
Payload:
</rd/501>;ep="group1";et="core.rd-group";
          base="coap://[ff35:30:2001:db8::23]";rt="core.rd-ep"
```

Alg/key related parameters

- New optional parameters for a registered group-membership resource
  - (*)(**) *cs_alg* : countersignature algorithm, e.g. “EdDSA”
  - (*) *cs_alg_crv* : countersignature curve (if applicable), e.g. “Ed25519”
  - (*) *cs_key_kty* : countersignature key type, e.g. “OKP”
  - (*) *cs_key_crv* : countersignature curve (if applicable), e.g. “Ed25519”
  - (*) *cs_kenc* : encoding of public keys, e.g. “COSE_Key”
  - (*)(**) *ecdh_alg* : ECDH algorithm to derive pairwise keys, e.g. “ECDH-SS + HKDF-256”
  - (*) *ecdh_alg_crv* : ECDH curve, e.g. “X25519”
  - (*) *ecdh_key_kty* : ECDH key type, e.g. “OKP”
  - (*) *ecdh_key_crv* : ECDH curve, e.g. “X25519”
  - (**) *alg* : AEAD algorithm, e.g. “AES-CCM-16-64-128”
  - (**) *hkdf* : HKDF algorithm, e.g. “HKDF SHA-256”

- Benefits for a joining node, when discovering the OSCORE group
  - (*) No need to ask the GM or to have a trial-and-error when joining the group
  - (**) Decide whether to join the group or not, based on the supported algorithms