The lightweight GRASP

(draft-zhu-anima-lightweight-grasp-02)

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Lightweight GRASP (Recap)

- With the rapid development, IoT is urgent for self-management capabilities enabled by GRASP (but is heavy and resource-consuming due to its TCP-based feature).
- The UDP-based lightweight GRASP (LW-GRASP) has been proposed by draft-00 and draft-01:
  - Shortens the fixed fields
  - Introduces a built-in reliability mechanism based on Nonce
  - Shares the same option definitions as GRASP
- In the IETF 121, we were advised that it would be helpful to design the CoAP-based LW-GRASP.

Lightweight GRASP over CoAP (Background)

- CoAP is a lightweight, RESTful protocol designed for resource-constrained devices and is widely adopted and supported by IoT.
- Since the mature CoAP ecosystem in IoT, the LW-GRASP development over CoAP can be easier and preferred than UDP-based (e.g., the IoT nodes attached to the campus or entrepreneur networks, where CoAP has already been installed and used).
- The reliability mechanism of CoAP is proven to be stable, which may be reused by LW-GRASP instead of its self-defined reliability mechanism.

Lightweight GRASP over CoAP (Background)

- The UDP-based and CoAP-based LW-GRASP are both optional for nodes, up to their implemented protocol or preference.

- The CoAP-based LW-GRASP would take advantage of the CoAP's mature ecosystem and significantly benefit its adoption by constrained nodes that preferred CoAP.

Lightweight GRASP over CoAP (Overview)

- This draft designs the CoAP-based LW-GRASP:
  - The Well-known URI “grasp-coap” is defined (to be assigned by IANA) to identify the LW-GRASP service over CoAP
  - Utilizes CoAP messages as carriers for LW-GRASP message distribution
  - Gives examples of the LW-GRASP interaction procedures over CoAP (Discovery, Flood, Negotiation)
- A prototype of this draft is under development.

Lightweight GRASP over CoAP (Details)

- The draft defines the well-known URI “grasp-coap” (to be assigned by IANA) to access the LW-GRASP service over CoAP.
- The request/response mechanism of CoAP conflicts with the interaction procedures of LW-GRASP.
- Utilizes Non-confirmable CoAP messages as carriers for LW-GRASP message distribution (Confirmable-CoAP-messages-based version will be considered in the future).
- LW-GRASP messages are encapsulated as CoAP payloads with the content-format identifier application/cbor.

Lightweight GRASP over CoAP (Details)

- LW-GRASP messages are encapsulated as CoAP payloads with the content-format identifier application/cbor.
- Upon receipt of the request with the /.well-known/grasp-coap URI, the CoAP instance parses out the payload and forwards it to the LW-GRASP instance, bypassing associated resource processing.
- The LW-GRASP instance handles messages from CoAP according to its specification and transmits subsequent messages via CoAP responses or new requests.

Lightweight GRASP over CoAP (Discovery)

```
LW-GRASP discovery initiator:
 (NON-confirmable) FETCH coap://FF02::13/.well-known/grasp-coap
 Content-format: application/cbor
 Accept: application/cbor
 No-Response
 Payload: LW-GRASP M_DISCOVERY

 (Non-confirmable) FETCH coap://224.0.1.187/.well-known/grasp-coap
 Content-format: application/cbor
 Accept: application/cbor
 No-Response
 Payload: LW-GRASP M_DISCOVERY

LW-GRASP discovery responder:
 (Non-confirmable) POST coap://2001:db8::1/.well-known/grasp-coap
 Content-format: application/cbor
 Accept: application/cbor
 Payload: LW-GRASP M_RESPONSE

LW-GRASP discovery initiator:
 (Non-confirmable) 2.04(Changed)
 Content-format: application/cbor
 Payload: LW-GRASP M_ACK
```

- LW-GRASP discovery message over CoAP uses the non-confirmable CoAP multicast Fetch request with the No-Response option.
- The discovery response over CoAP uses the non-confirmable CoAP unicast POST request.

Lightweight GRASP over CoAP (Flood)

- The LW-GRASP flooding over CoAP uses the non-confirmable CoAP multicast POST request with the No-Response option.
- Both the LW-GRASP discovery and flooding over CoAP also maintain the relaying instance.

```
LW-GRASP flooding initiator:
 (Non-confirmable) POST coap://FF02::13/.well-known/grasp-coap
 Content-format: application/cbor
 No-Response
 Payload: LW-GRASP M_FLOOD
```

Lightweight GRASP over CoAP (Negotiation)

```
LW-GRASP negotiation initiator:
 (Non-confirmable) POST coap://2001:db8::1/.well-known/grasp
 Content-format: application/cbor
 Accept: application/cbor
 Payload: LW-GRASP M_REQ_NEG
 with lw-objective[objective-num=0,expected-value="A"]

LW-GRASP negotiation responder:
 (Non-confirmable) 2.04(Changed)
 Content-format: application/cbor
 Payload: LW-GRASP M_WAIT with O_ACK

LW-GRASP negotiation responder:
 (Non-confirmable) POST coap://2001:db8::2/.well-known/grasp
 Content-format: application/cbor
 Accept: application/cbor
 Payload: LW-GRASP M_NEGOTIATE with O_ACK
 and lw-objective[objective-num=0,expected-value="B"]

LW-GRASP negotiation initiator:
 (Non-confirmable) 2.04(Changed)
 Content-format: application/cbor
 Payload: LW_GRASP M_END with O_ACCEPT and O_ACK

LW-GRASP negotiation responder:
 (Non-confirmable) POST coap://2001:db8::2/.well-known/grasp
 Content-format: application/cbor
 No-Response
 Payload: LW-GRASP M_ACK
```

- The negotiation-related messages over CoAP use the non-confirmable CoAP POST request or their corresponding response.

Lightweight GRASP

- This draft defines 2 lightweight versions of LW-GRASP: UDP-based and CoAP-based, which covers (almost) all IoT scenarios.
- The prototypes are ongoing and will be open-sourced in the future.

- Any Comment or Question?
- Could ANIMA adopt this draft?

THANKS!