Introduction to ZCL and ZCL-over-IP

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ZigBee Cluster Library (ZCL)

- Application layer protocol for device-to-device interaction

- Uses ZigBee PRO stack for transport

- Not RESTful
  - Numerous different general commands
  - Specific commands per cluster

- Binary hand-crafted payloads
  - Defined in tables in [ZCL documentation](#)

What is a cluster?

- Collection of attributes and commands
  - Closest analogy is an "object"
  - Lacks properties normally associated with objects, e.g. inheritance and polymorphism
- Client and server counterparts
  - Not truly client and server in the traditional sense
- Attributes are a flat structure indexed by ID
- Specific commands are a mixture of actions and complex attribute manipulation

Example

- On/off cluster

- Send "On" command from Light Switch client to Light server

- Server on/off cluster is on Endpoint 64 on the Light

Light Switch   Light

Cluster binding

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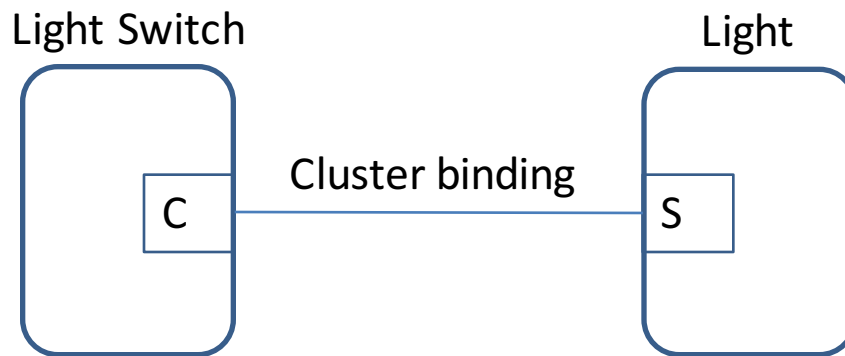
ZCL-over-IP

- Fourteen years of effort has gone into the ZCL from industry experts
- Take ZCL and rework it to be more suitable for IP-based transport
- Decision is to map as closely to the existing ZCL
- What we decided not to do:
  - Transport ZCL as-is over UDP
  - Abstract a model and try and rework it RESTfully
- Use CoAP/UDP for transfer/transport and CBOR for payload

ZCL Service Discovery

- Light device advertises its on/off server cluster in its Simple Descriptor
- A counterpart Simple Descriptor is normally discovered using Match_Desc_req query to Endpoint 0 (device endpoint, or ZDO)
    - May be unicast or multicast
- End Device Bind procedure can be used to pair two devices
- Binding table records which device services which cluster

ZCL-over-IP Service Discovery

- Not been decided yet

- Discussion about using CoRE resource directory and CoRE link format

- Details still to be worked out

ZCL transaction

- Command will be sent from Client to Server

- APS frame will look like:

FCTL 0x02	Dst EP 64	Dst Clst 6	Dst Prfl 0xffff	Src EP 65	Seq 0	FCTL 0x48	Seq 0	Cmd 1

APS header   ZCL header (no payload)

- APS frame unicast from Light Switch to Light using ZigBee PRO network

ZCL-over-IP transaction

- Command will be sent from Client to Server:
  - URI: /zcl/e/64/s6/c/1
    - zcl: To discriminate ZCL command
    - e: Endpoint command
    - 64: Endpoint 64
    - s6: Server cluster ID 6 ("On/Off")
    - c: Command
    - 1: Command ID 1
  - Method: POST
  - Payload: Empty
  - UDP to dest. Port TBC
- UDP datagram unicast from Light Switch to Light using IP network (Thread, Wi-Fi, etc.)