LwM2M over MQTT

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**Quick Overview**

- **CoAP - Constrained Application Protocol**
  - REST based (GET/POST/PUT/DELETE), Device is viewed as a server
  - Eclipse Reference Implementation: Californium

- **MQTT – Message Queue Telemetry Transport**
  - Publish/Subscribe paradigm with quality of services
  - Centralized Server (broker)
  - Eclipse Reference implementation: Paho

- **LwM2M - Lightweight Machine to Machine**
  - Provisioning & Device Management
  - Standard for Core Objects (Device, Firmware Update)
  - Eclipse IOT Reference implementation: Leshan
Why This Specification?

- LwM2M is becoming the standard protocol for device management
- LwM2M specification is tightly coupled with CoAP/UDP/DTLS:
  
  [...] The LWM2M Enabler uses the Constrained Application Protocol (CoAP) with UDP and SMS bindings. Datagram Transport Layer Security (DTLS) provides security for UDP transport layer. [...]

- Still an industrial issue to access a device behind NAT (home topology)
  - DTLS (re-)negotiation latency
  - Keep NAT alive (1 minute ?)
Why This Specification?

- When MQTT is already a project requirement
- MQTT widely used for domain data transfer
  - Device <-> Cloud
  - Optional Peripherals (smartphones, ...)
- A large offering of scalable MQTT Servers for production
- Regular TCP/TLS connection
TOPOLOGY (ECLIPSE PROJECTS)

Fleet Management
Dashboards, ...

LWM2M Server

MQTT Server

Devices Field
LwM2M (extended) Protocol Stack

- LwM2M
- CoAP
- DTLS
- UDP
- SMS on-device
- SMS on-Smartcard

LwM2M
CoAP (message format)
MQTT
TCP/TLS

OMA-TS-LightweightM2M-V1_0-20170208-A
KEY POINT - SINGLE LINK TO THE CLOUD

• For all kind of data transfer
  o Data & Device management

• Security
  o Not Yet Another Link to Secure
  o No additional protocol for large data transfer (firmware upgrade)

• Device Code Footprint
  o Embed only one vertical stack
KEY POINT - DEDICATED TOPICS FOR LwM2M

• 2 general purpose topics: “transport topics”
  o “deviceToServer” for ascending messages
  o “serverToDevice” for descending messages
• Prefixed per device
• Payload = CoAP messages
Key Point - Remove CoAP Reliability Stuff

- Connection is maintained at TCP layer
- No Confirmable (CON) and Acknowledgment (ACK) messages
- No duplication
  - QoS set to 0
  - Retain mode set to false
  - CleanSession flag set to 1
- Only CoAP compact message format is kept
**Key Point - Large Binary Transfer**

- Firmware Upgrade / Application Upgrade
- Use of LwM2M Package URI resources (no Package)
- A new URI scheme for fetching a resource
  - `mq2m://[owner]/[path]?size=xxx`
  - `mq2m://server/firmware-1.1.0?size=12345678`
- Device controls the download rhythm/rate/schedule
- Block oriented
  - Using Block-wise Transfer Block Options semantic
CURRENT SPECIFICATION HOSTING

- ESR - Publicly available for comments and implementation
SPECIFICATION NEXT STEPS

• Ownership
  o Move to appropriate organization OMA
  o Anyone interested can help us on the process?

• Content
  o Final update against Feb 2017 LwM2M 1.0 release
  o Self-contained specification
    • No CoAP IETF dependency
    • CoAP message format may be derived
  o Proposal for LwM2M specification split
    • LwM2M semantics & core normative objects
    • LwM2M bindings (UDP / SMS / TCP / MQTT...)

Mar-17
MICROEJ REFERENCE IMPLEMENTATION (1)

• Leshan client port on MicroEJ (ARM Cortex-M)
MICROEJ REFERENCE IMPLEMENTATION (2)

• MicroEJ Leshan Server runs LwM2M over MQTT
  - http://leshan.microej.com:8080/#/clients

• MicroEJ Leshan Client App available on MicroEJ Store
  - https://communitystore.microej.com
Reference Implementation Next Steps

• Introduced to Eclipse IOT WG call
• Can be delivered as a Leshan sub-project
• Suggest core modifications to main stream to allow to plug this new backend
FREQUENTLY ASKED QUESTIONS

• Why not LwM2M over CoAP over TCP?
  o Reduced CoAP scope to only cover the LwM2M case
  o Would break the assumption to keep a single secured link for everything

• Why over MQTT?
  o Assumption that MQTT is a requirement

• What about IETF “draft-koster-core-coap-pubsub-05”?
  o This is a proposal for a pub/sub paradigm on top of CoAP
THANK YOU FOR YOUR ATTENTION!