IoT Device Management with LwM2M

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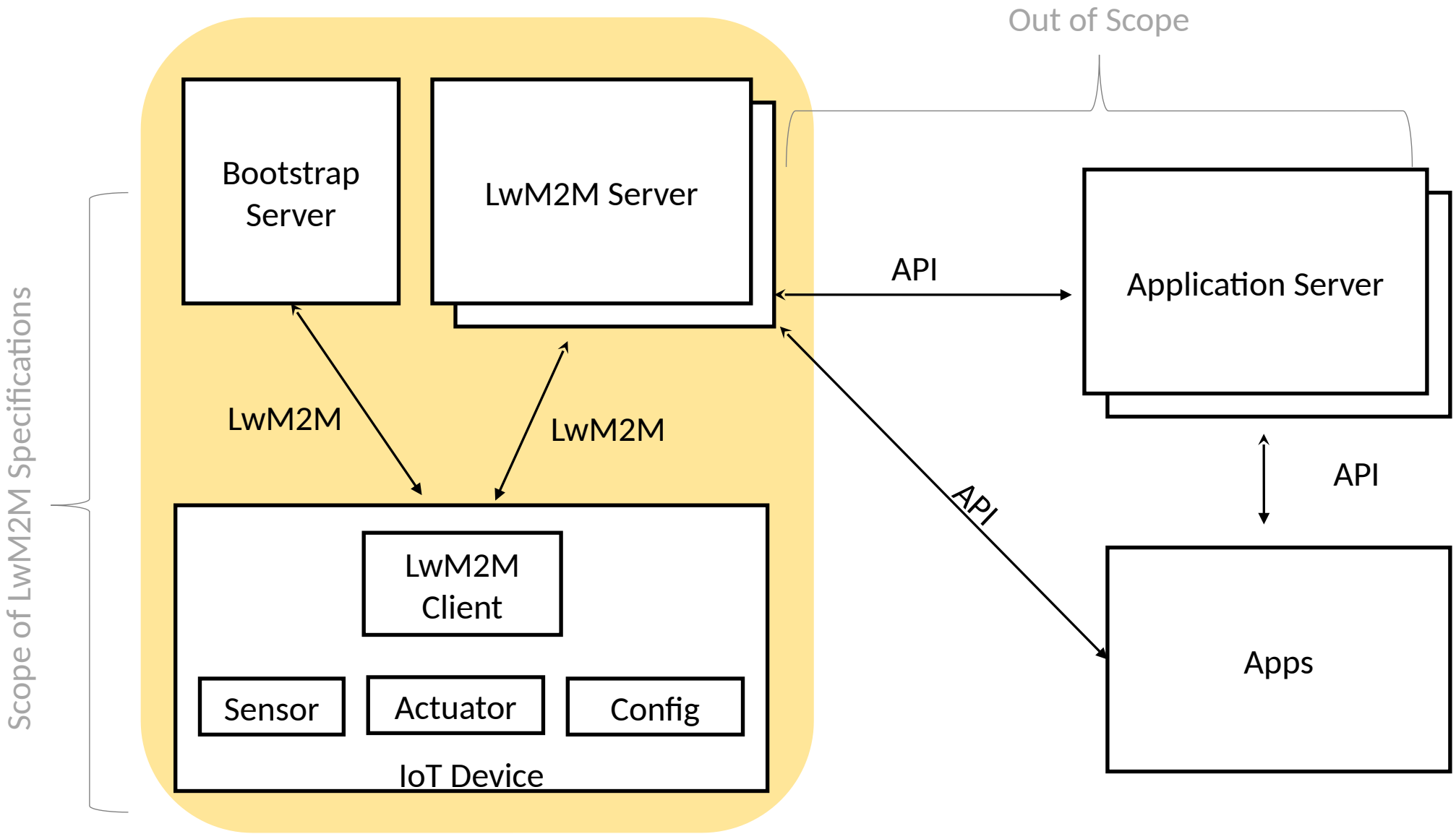
Architecture

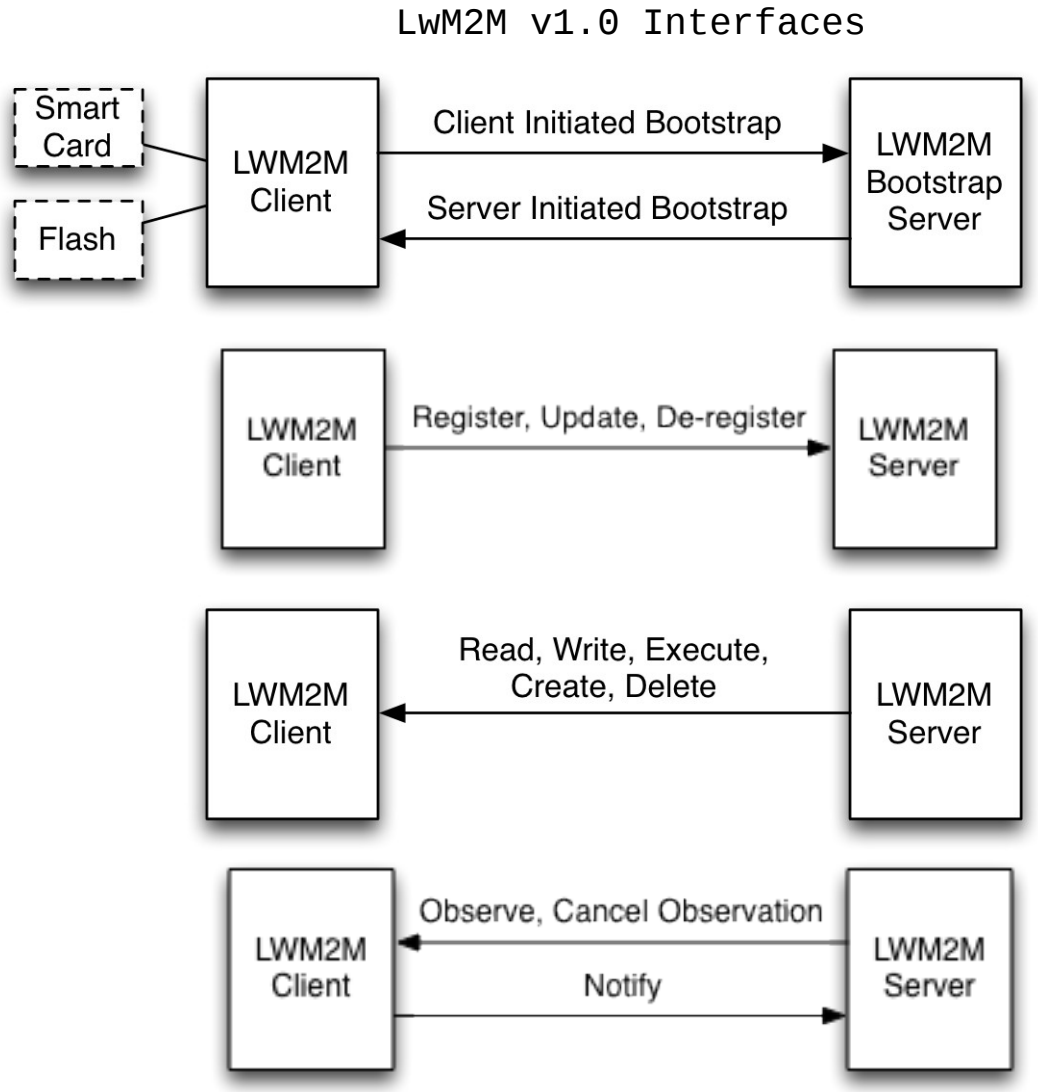


Also out of scope: Provisioning of credentials for network access (because those tend to be radio technology specific)

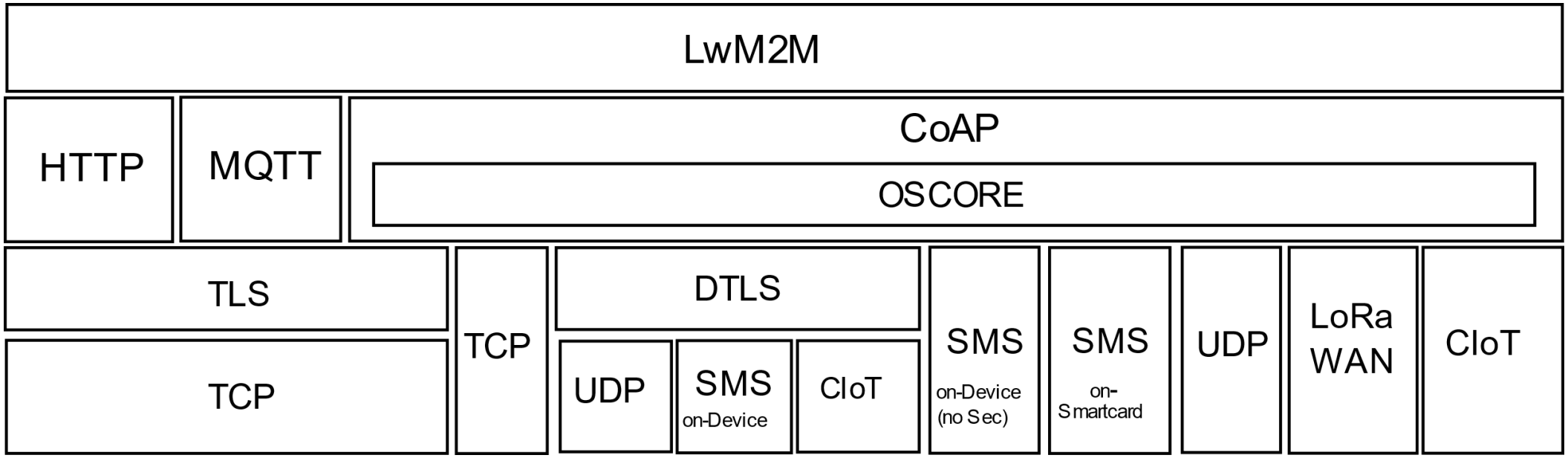
Interfaces

RESTful APIs hiding details of underlying transports

- Bootstrap interface
  - Configure credentials, servers, ACLs, …
- Registration interface
  - Informs server about “existence” and supported functionality (e.g., objects, transport bindings)
- Device management & service enablement interface
  - Ability to access object instances and resources
- Information reporting interface
  - Publish/subscribe interaction for observing changes in resources.



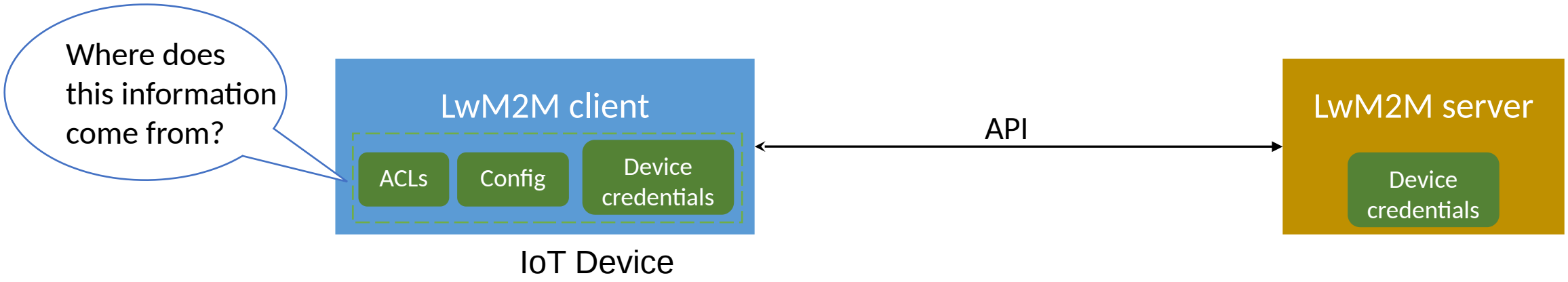
Re-Use of IETF Protocols



+ many CoAP extensions (Observe, CoAP over TCP, CoreLink Format, Dynlink, …), CBOR/COSE, SenML, PKCS#15, EST over CoAP, Asymmetric Key Package, …

Bootstrapping

- A LwM2M client needs credentials to securely communicate with the LwM2M server. Configuration and access rights might also change over time.



- Information comes from bootstrap server.

Bootstrapping

Server-generated Credentials

Used for symmetric keys and raw public keys.

Can also be used for certificates

Bootstrap server generates the keying material and sends it to the client.

Communication is protected using DTLS/TLS.

Client-generated Credentials

Available with “Enrollment over Secure Transport (EST)”

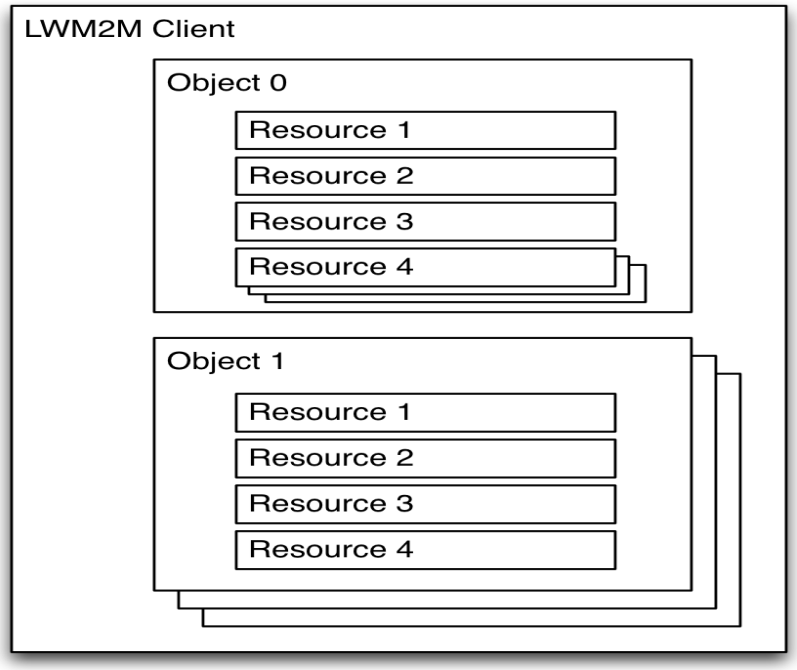
Private key remains on the IoT device and Certificate Signing Request is protected using DTLS/TLS.

Added security benefit

LwM2M Data Model

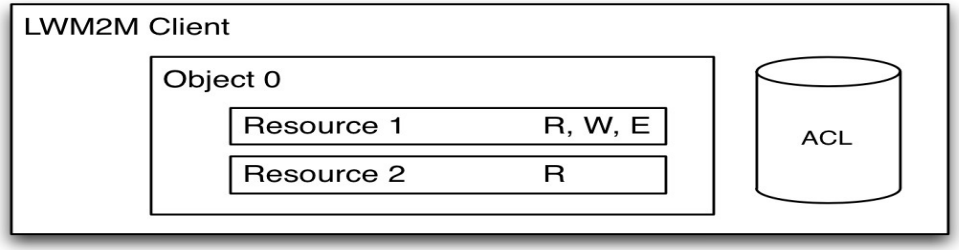
Resource access via /{Object ID}/{Object Instance}/{Resource ID}/{Resource Instance}

Object Name	ID	Description
LwM2M Security	0	Keying material of a LwM2M Client to access a LwM2M Server.
LwM2M Server	1	Data related to a LwM2M server.
Access Control	2	Information used to check whether a LwM2M Server has access to object.
Device	3	Device related information, including device reboot and factory reset function.
Connectivity Monitoring	4	Parameters related to network connectivity.
Firmware Update	5	Capability to update firmware
Location	6	Device location information
Connectivity Statistics	7	Information like transmit and receive counters



+ hundreds of additional objects in the OMA registry

(most of it relates to sensor data and actuator configuration)



Interoperability and Open Source

- Interoperability:
  - 9 testfests took place so far. Next testfest will be in 2 weeks (online).
  - 40+ implementations at the testfests
  - Successfully used in deployments with as little as 64 KB flash and 16 KB RAM.

- Specification development:
  - Spec is in development for 7+ years.
  - More than 500 issues raised by developers on our public Github issue tracker

Interoperability and Open Source, cont.

- A selected list of open source implementations (servers and clients) can be found here:
  - https://github.com/OpenMobileAlliance/OMA_LwM2M_for_Developers/wiki/LwM2M-Open-Source-Code

- Github repository for questions and comments:
  - https://github.com/OpenMobileAlliance/OMA_LwM2M_for_Developers/issues

Specs?

"Lightweight Machine to Machine (LwM2M) Technical Specifications, Version 1.0.2",

February 2018. URL: http://www.openmobilealliance.org/release/LightweightM2M/V1_0_2-20180209-A/

"Lightweight Machine to Machine (LwM2M) Technical Specifications, Version 1.1.1", June 2019.
URL: http://www.openmobilealliance.org/release/LightweightM2M/V1_1_1-20190617-A/

"Lightweight Machine to Machine (LwM2M) Technical Specifications, Version 1.2", November 2002. URL:
http://www.openmobilealliance.org/release/LightweightM2M/V1_2-20201110-A/

"Lightweight Machine to Machine (LwM2M) Technical Specifications, All Versions",
URL: http://www.openmobilealliance.org/release/LightweightM2M/

"OMA LightweightM2M (LwM2M) Object and Resource Registry“
URL: http://www.openmobilealliance.org/wp/OMNA/LwM2M/LwM2MRegistry.html