

# LWM2M v1.1

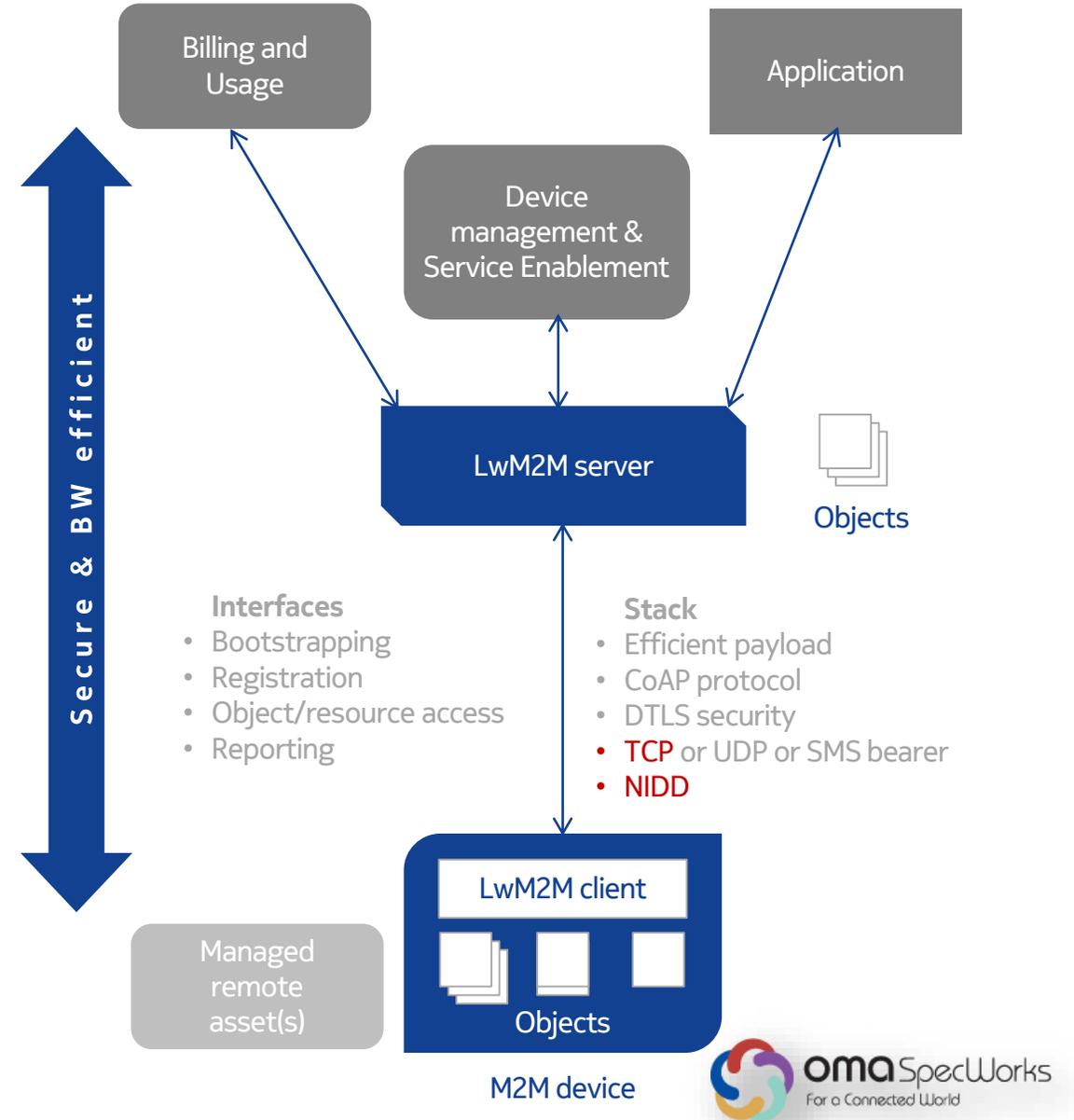
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DM&SE Chair



# Introduction

LwM2M is recommended Device Management and Service Enablement due to benefits such as:

- Increased bandwidth efficiency based on COAP bandwidth optimization
- Transport-agnostic design that supports UDP, **TCP**, SMS
- Developer toolkit for application development
- DTLS-based security based on CoAP (IETF)
- Low power client foot print designed for battery constrained devices
- **End to end security using IETF OSCORE**

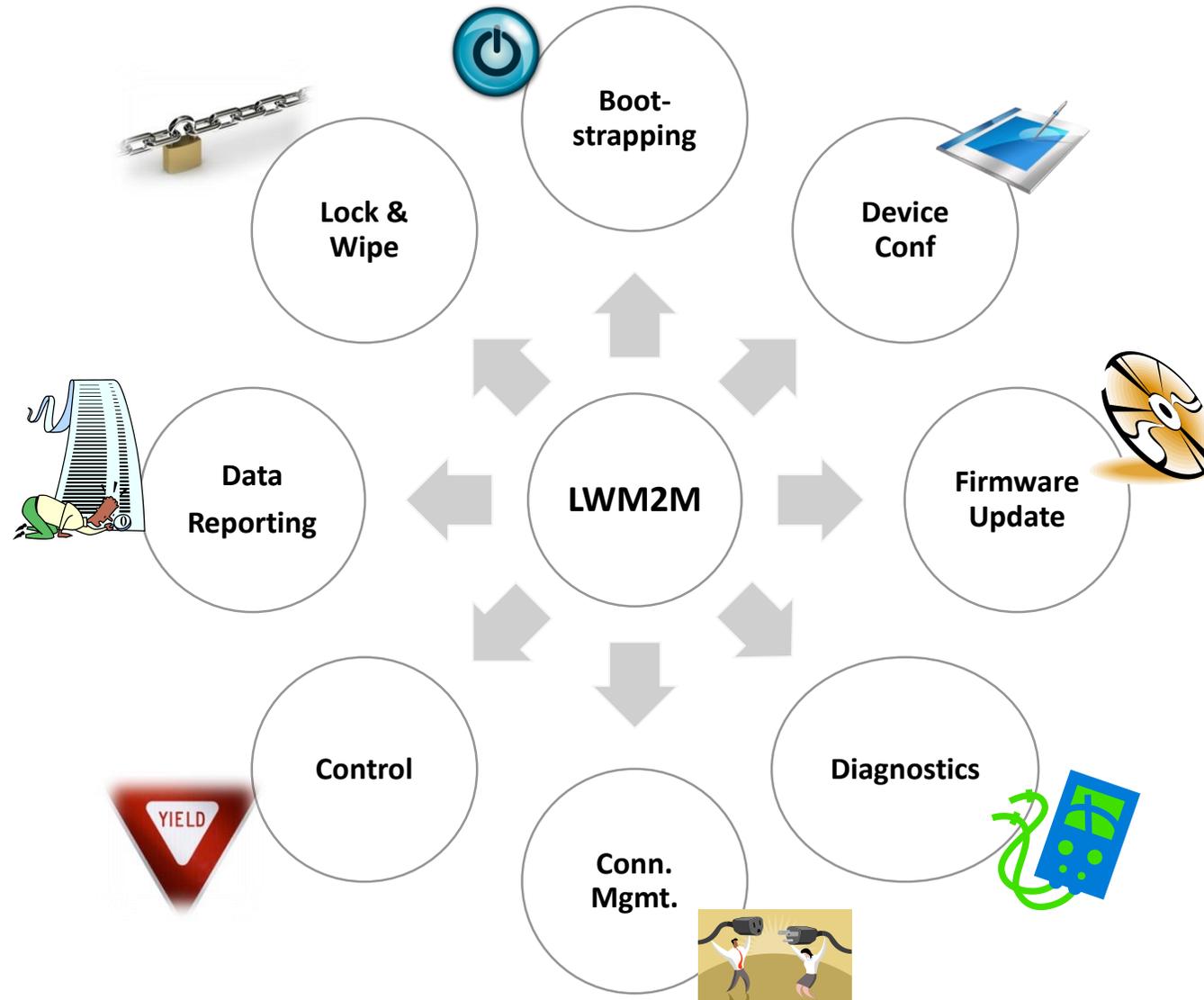


# Strengths of LwM2M

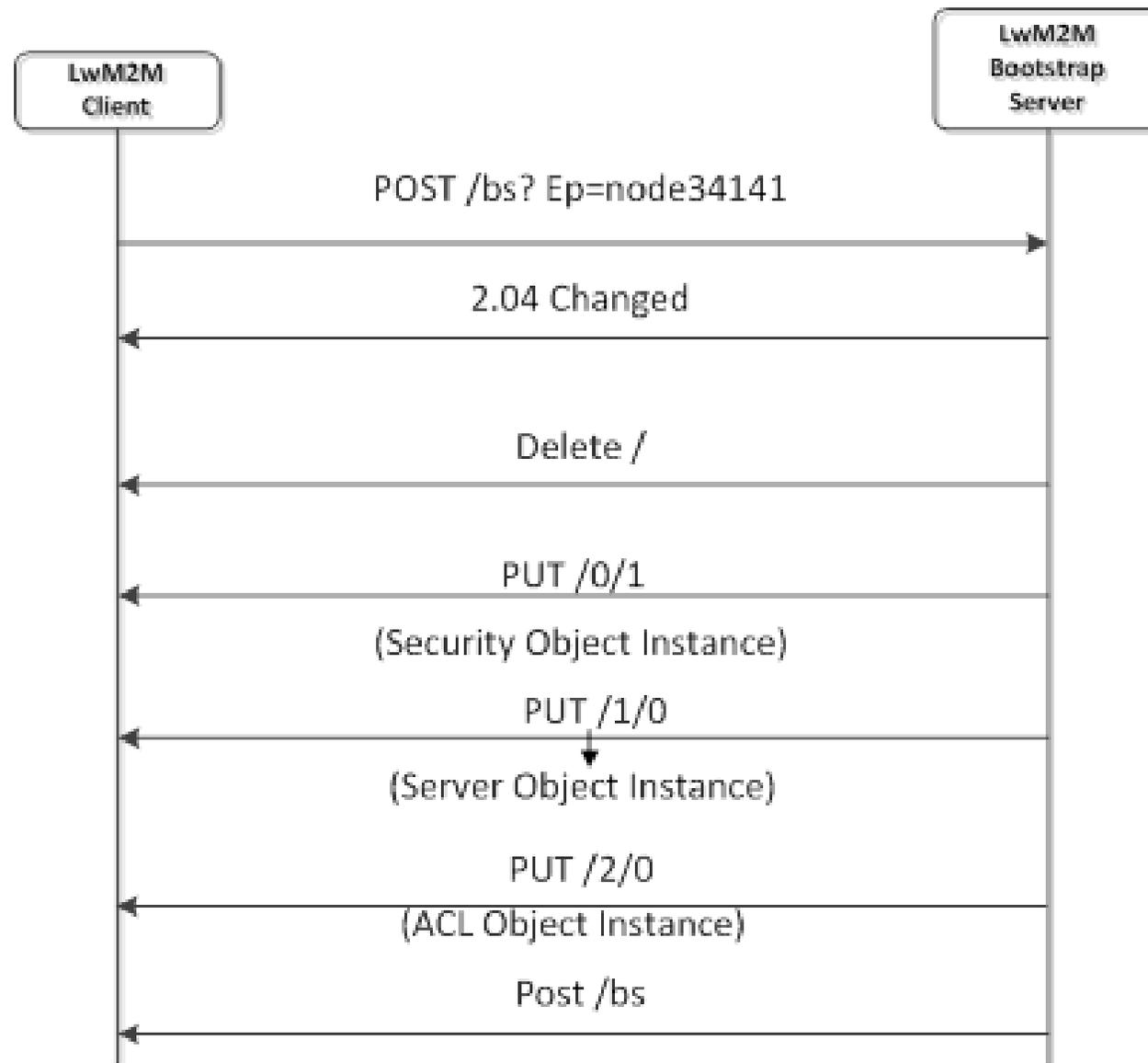
**LwM2M can be used for both data plane (data reporting and devices actuations) and device management.**

- LwM2M is a standard defined by OMA
- Adequate for both fixed and mobile devices
- Adequate for both data plane and device management
- Made for constrained devices (e.g < 20 kB RAM)
- Adequate for low powered battery devices thanks to low client footprint
- Minimizes bandwidth thanks to optimized bandwidth consumption, by definition of COAP (COAP is a simplified HTTP; COAP header = 4bytes)
- Simple, stateless protocol
- Crosses FW and NAT systems thanks to support of COAP/UDP and COAP/TCP
- offers security by design ; COAP over UDP or TCP relies on DTLS or TLS respectively
- **Provides opportunities for e2e security**

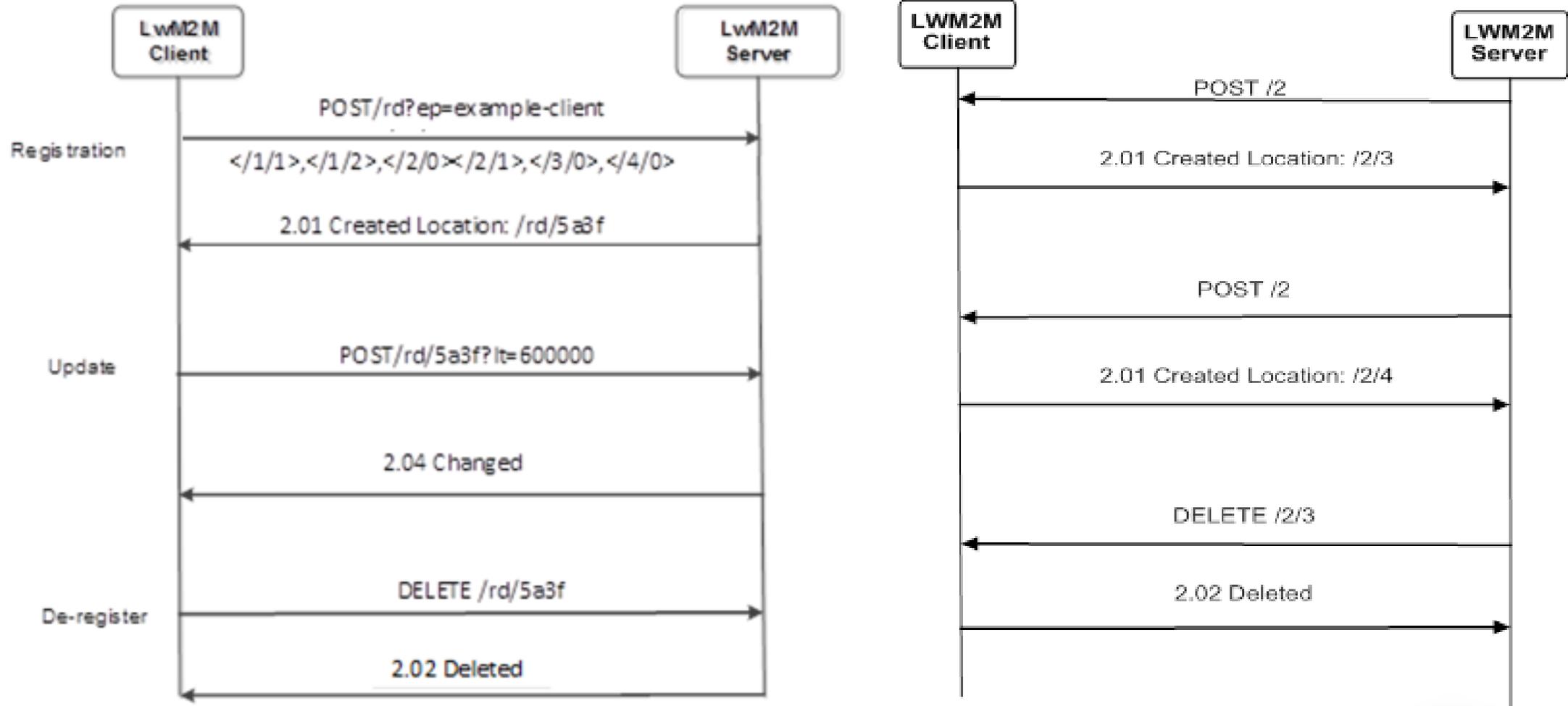
# LwM2M: Core functionalities



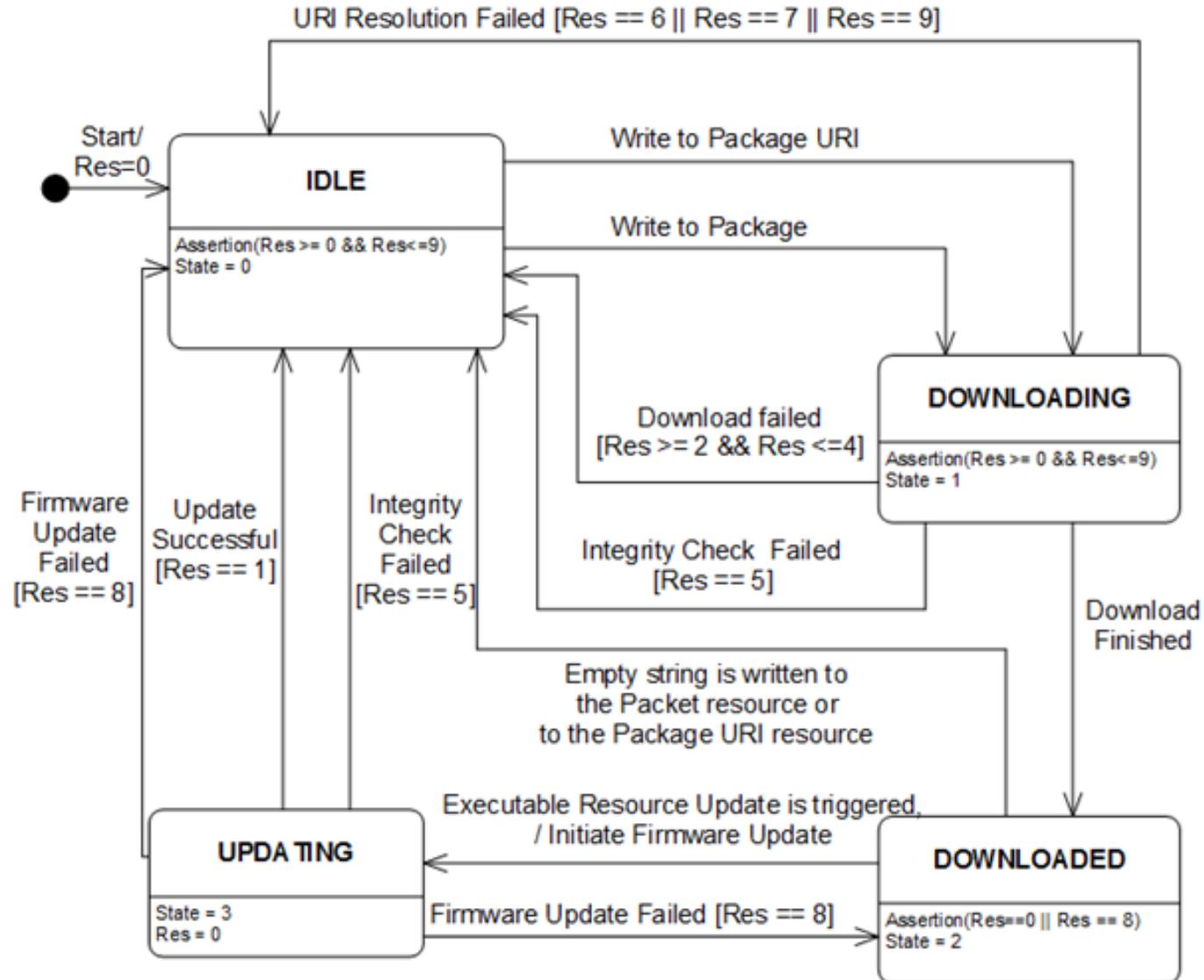
# Bootstrap



# Device Configuration

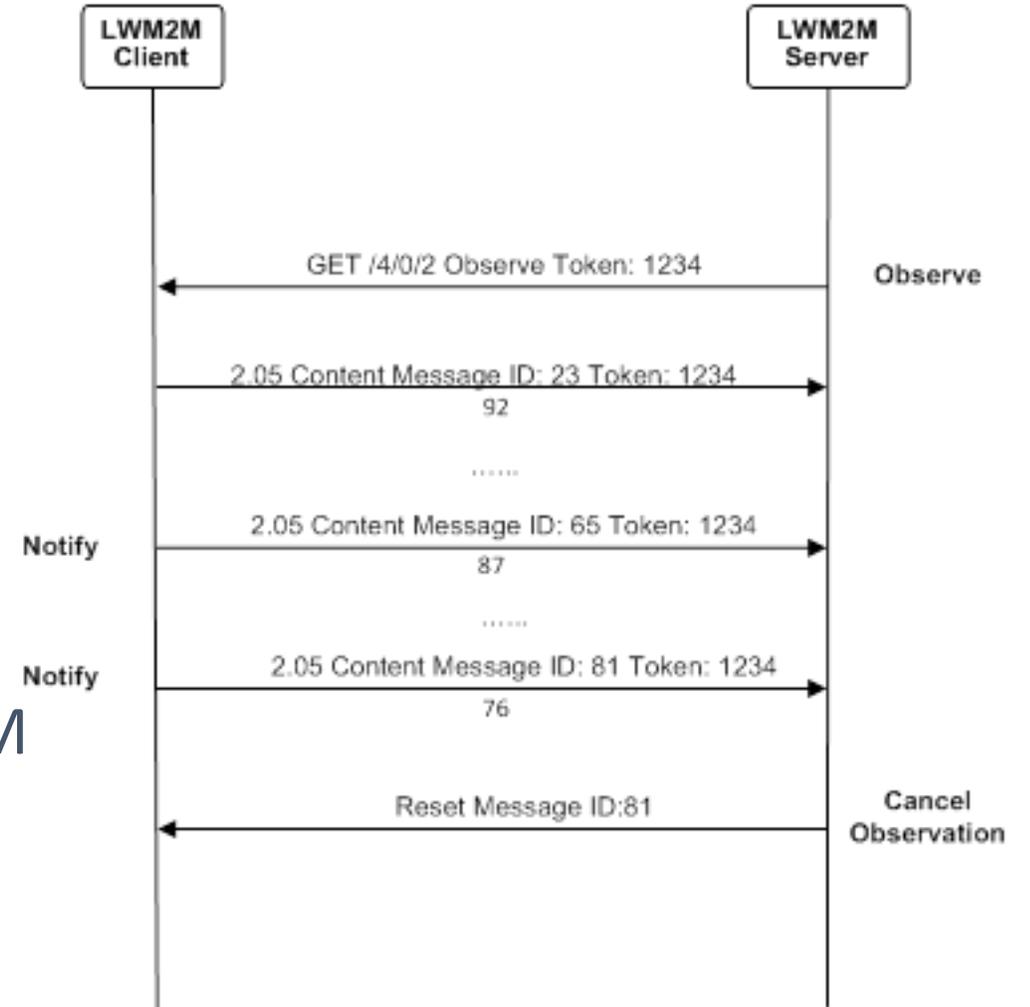


# Firmware Update



# Diagnostics

- Power sources and its values of the LwM2M Device
- Battery level of the LwM2M Device
- Memory status of the LwM2M Device
- Supported binding modes of the LwM2M Device
- Version of hardware/software of the LwM2M Device
- Capabilities of the LwM2M Device

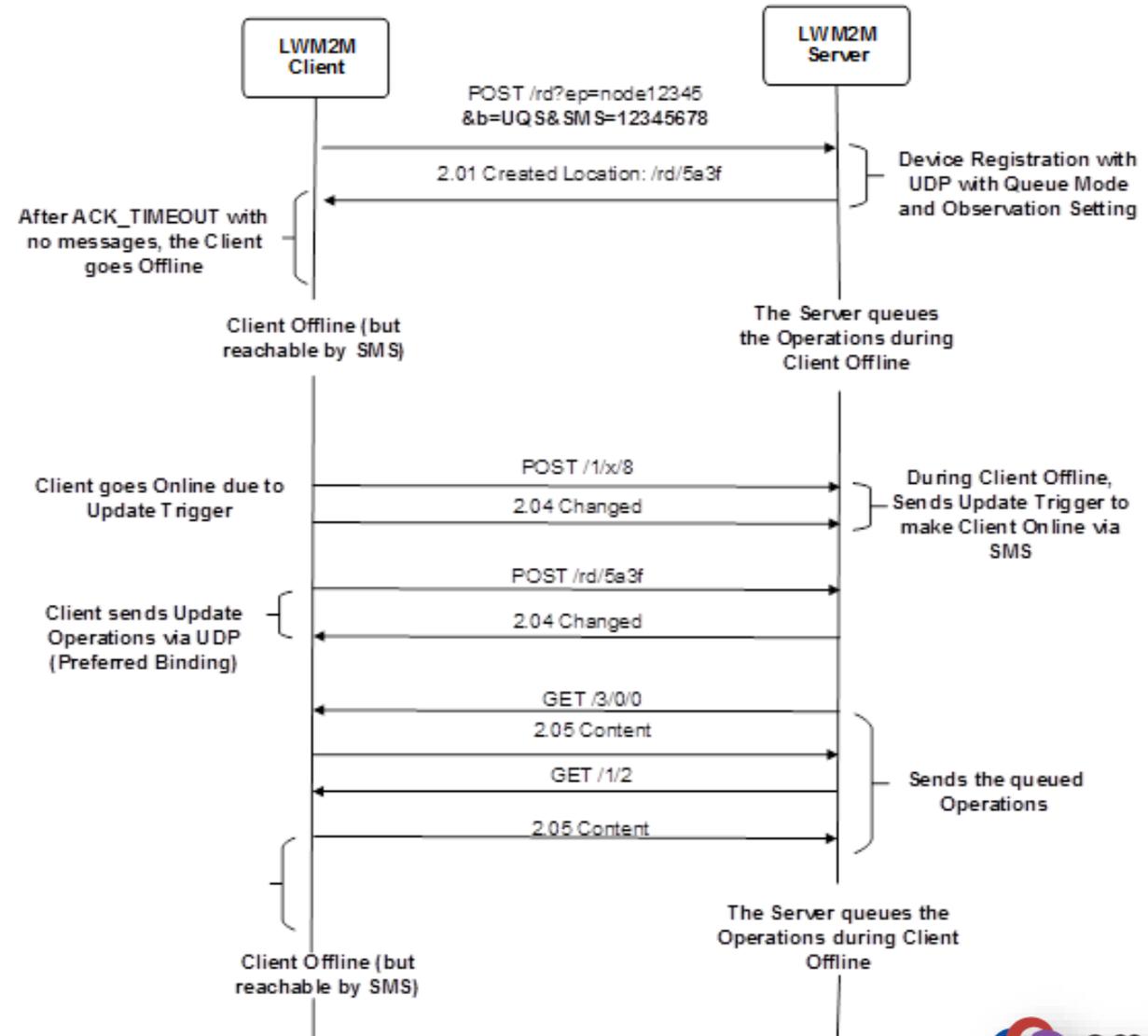


# Connection Management

- Mapping of necessary Cellular and Wi-Fi technologies
- Managing basic parameters needed for those technologies functioning like APN, WEP keys etc.,
- Adding relevant parameters for bearer selection for cellular connectivity
- Security is covered by DTLS and relevant section provide multiple details

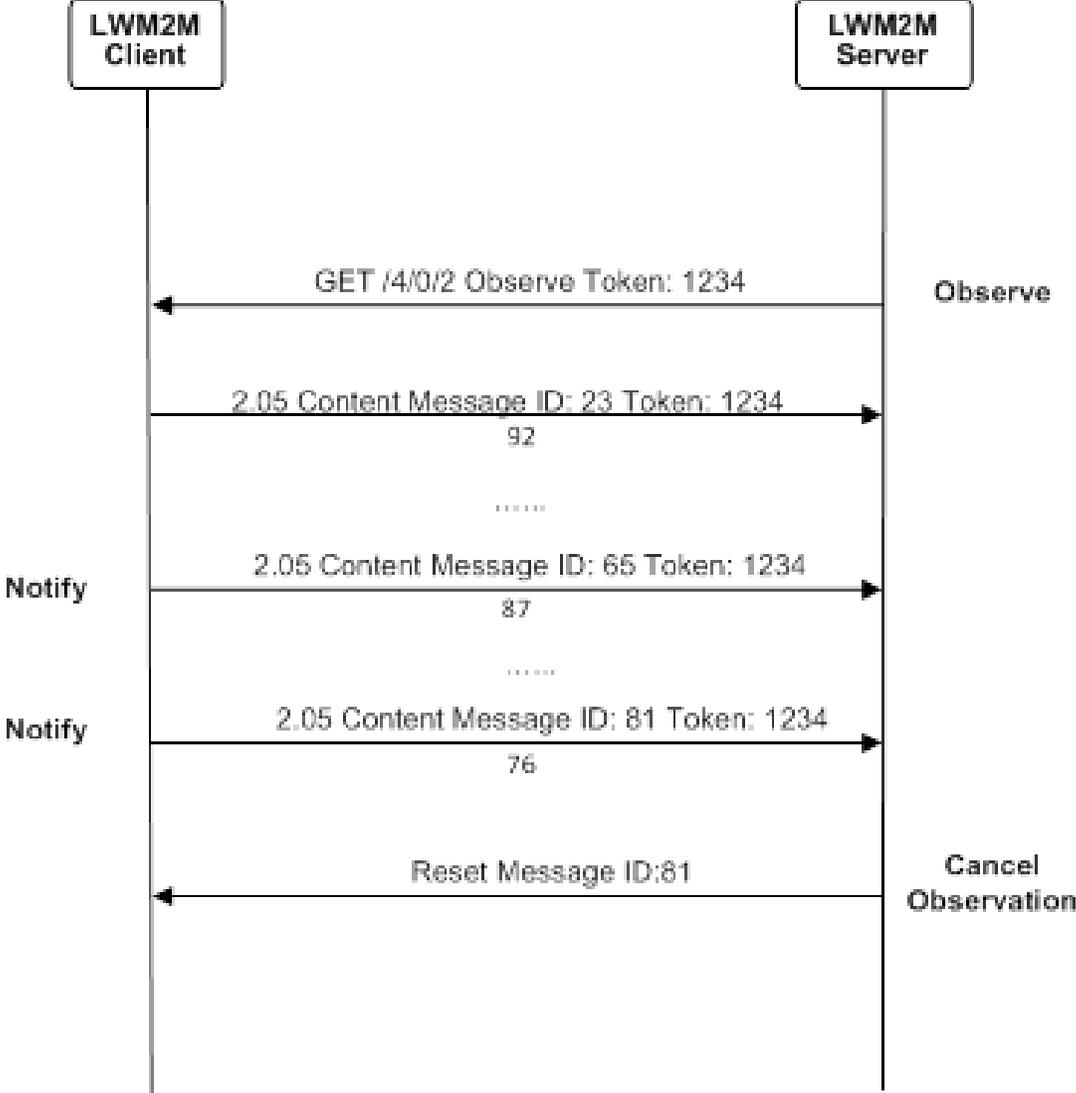
# Control

- Ability to setup access control on Objects for various LwM2M server
- Wake up the LwM2M Device using SMS
- Reboot the LwM2M Device
- Disable the LwM2M Device for a specified time
- Ask the LwM2M Device to perform registration

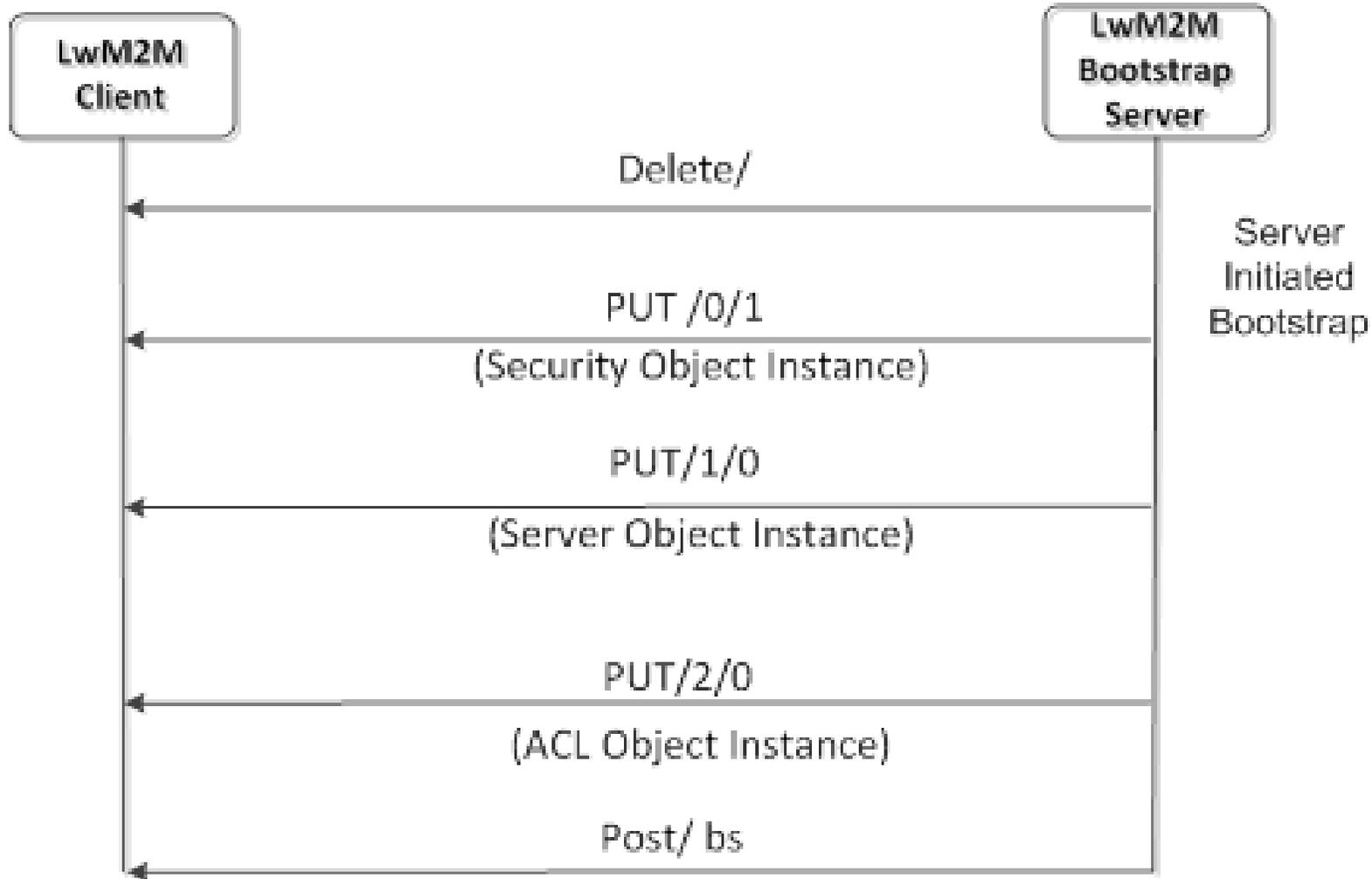


Example of Device Management & Service Enablement interface exchanges for Queue Mode with SMS Registration Update Trigger

# Data Reporting



# Lock & Wipe



# LwM2M Security

## Types of credential procedures supported

- Certificates
- Pre-shared key
- Public Raw Key
- PKI deployments

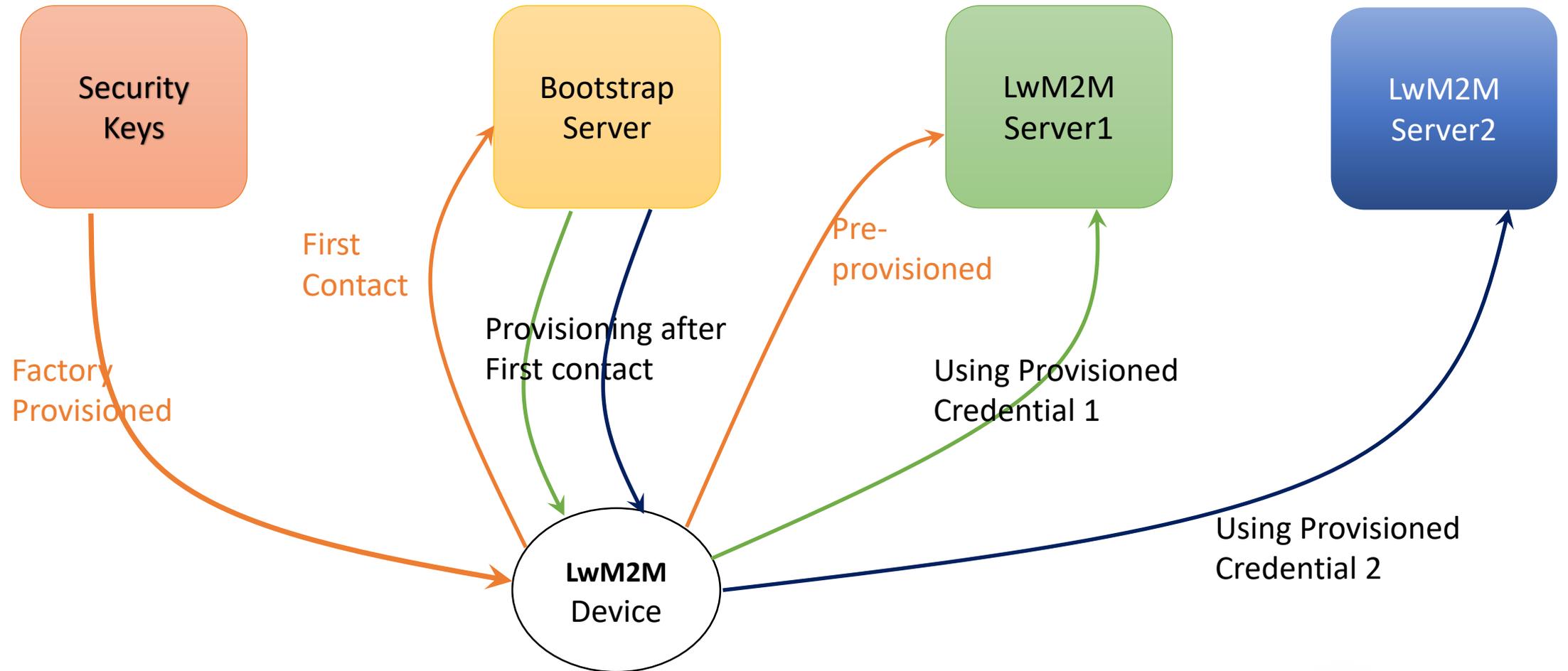
## Security paths

- DTLS
- SMS
- DTLS over SMS
- OSCORE

## LwM2M Security abilities

- Initial keys can be replaced during bootstrap procedure
- Multiple servers could be added with different credentials
- Provide security in every path

# LwM2M security – contd.



# LwM2M v1.0 features

- Simple resource model with the core set of objects and resources defined in this specification. The full list of registered objects can be found at [OMNA].
- Operations for creation, update, deletion, and retrieval of resources.
- Asynchronous notifications of resource changes.
- Support for several serialization formats, namely TLV, JSON, Plain Text and binary data formats and the core set of LightweightM2M Objects.
- UDP and SMS transport support.
- Communication security based on the DTLS protocol supporting different types of credentials.

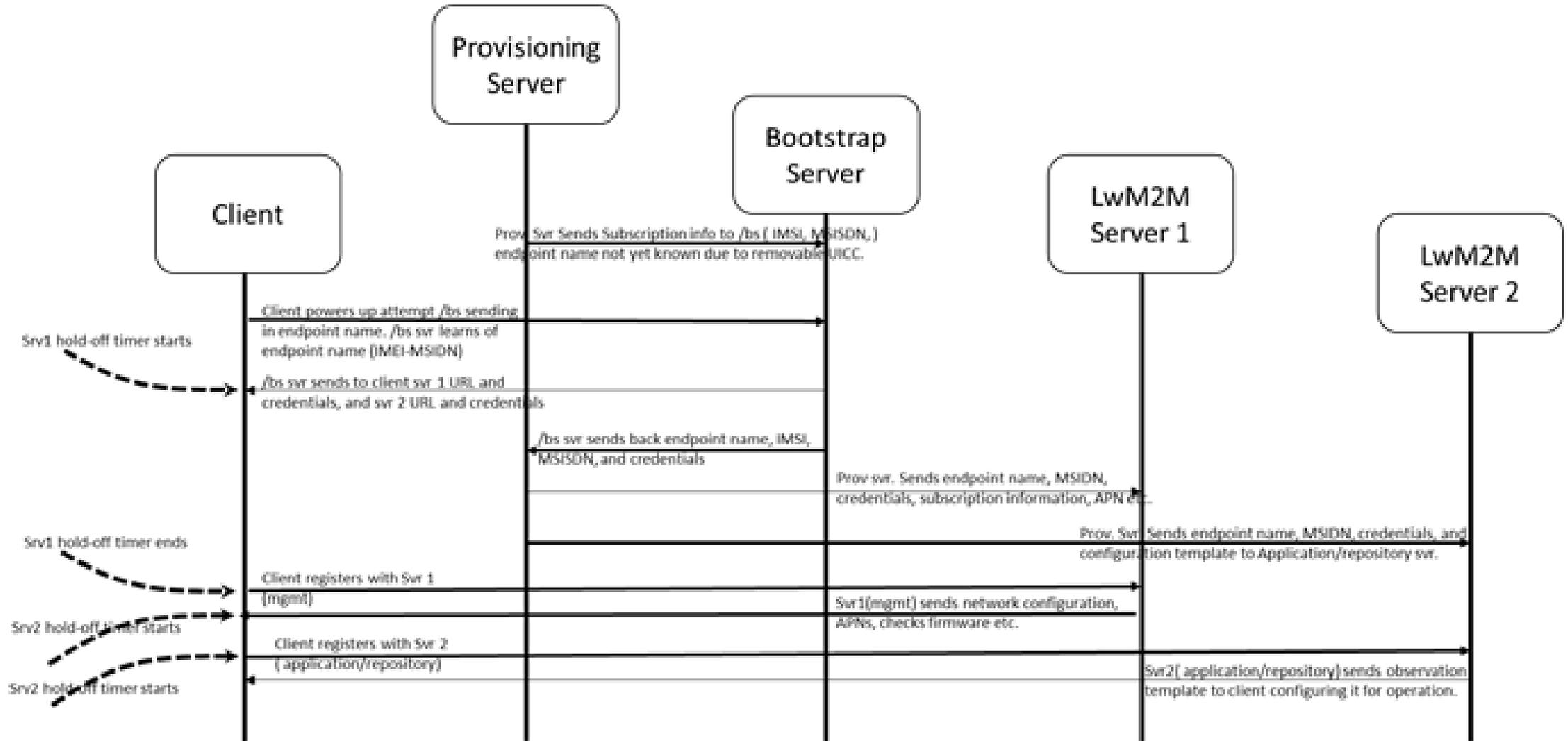
# LwM2M v1.0 features contd..

- Queue Mode offers functionality for a LwM2M Client to inform the LwM2M Server that it may be disconnected for an extended period of time and also when it becomes reachable again.
- Support for use of multiple LwM2M Servers.
- Provisioning of security credentials and access control lists by a dedicated LwM2M bootstrap-server.

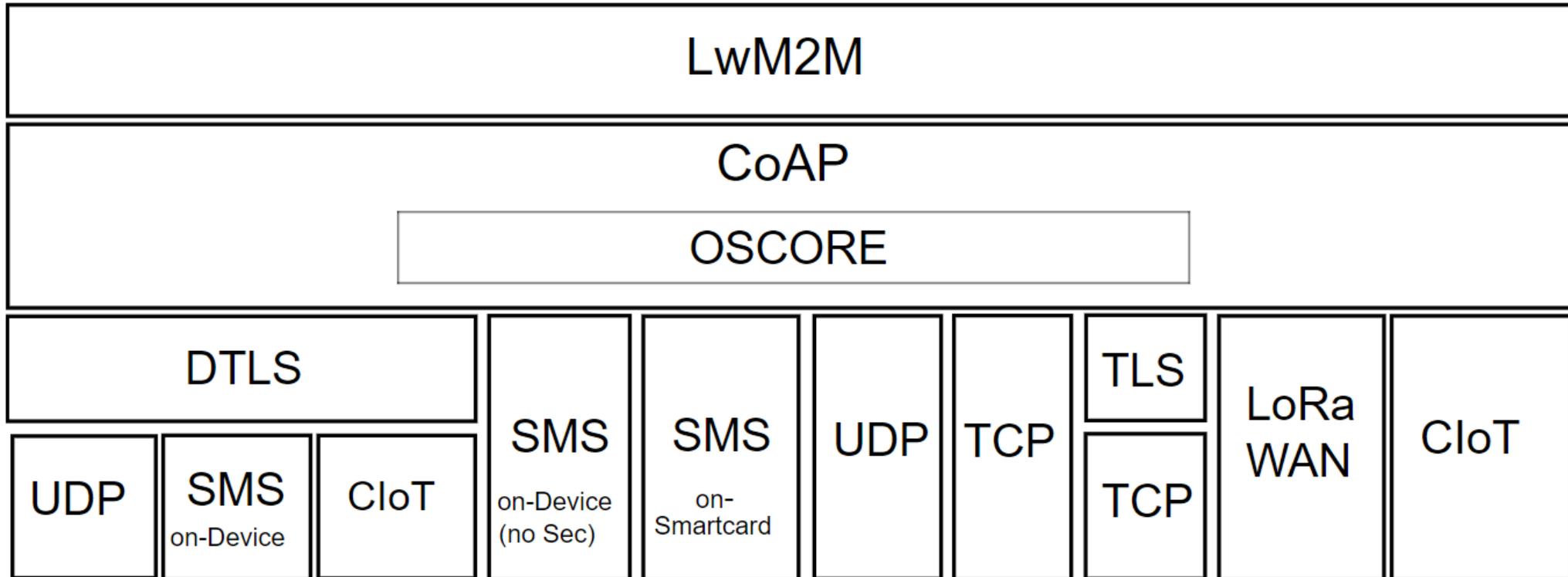
# LwM2M v1.1 features

- Improved support for Public Key Infrastructure (PKI) deployments.
- Introduction of enhanced registration sequence mechanisms by the LwM2M Client to LwM2M Server(s).
- Support for LwM2M over TCP/TLS to better support firewall and NAT traversal.
- Support for application layer security for LwM2M based on OSCORE
- Better support of LwM2M over Low Power WANs, including 3GPP Clot & LoRaWAN.
- Extended LwM2M commands to enable Resource Instance level access.
- Performance improvement for retrieving and updating Resources of multiple objects.
- Support for JSON using SenML with CBOR serialization for compressed payload with highly efficient transmission.

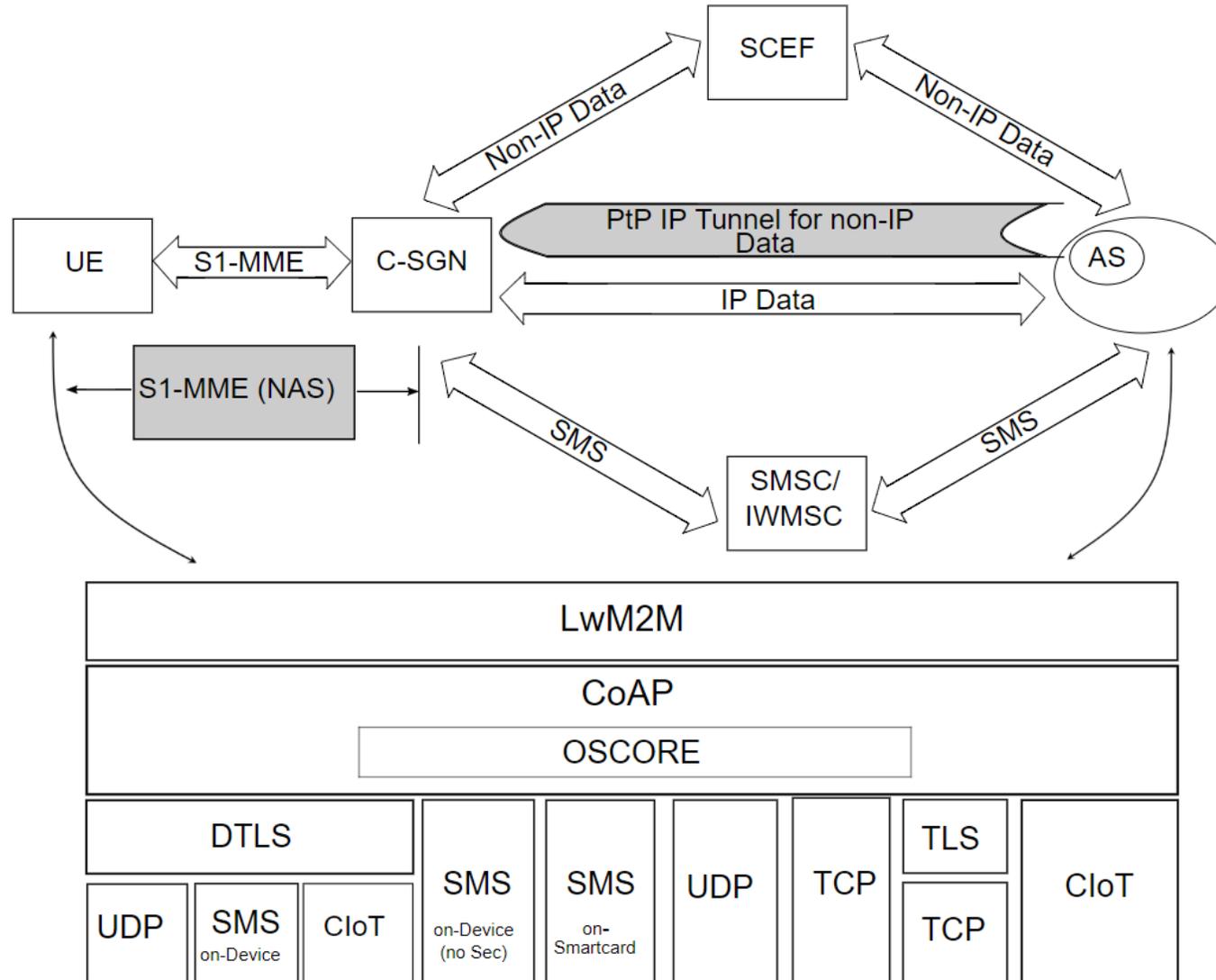
# Enhanced Registration Sequence



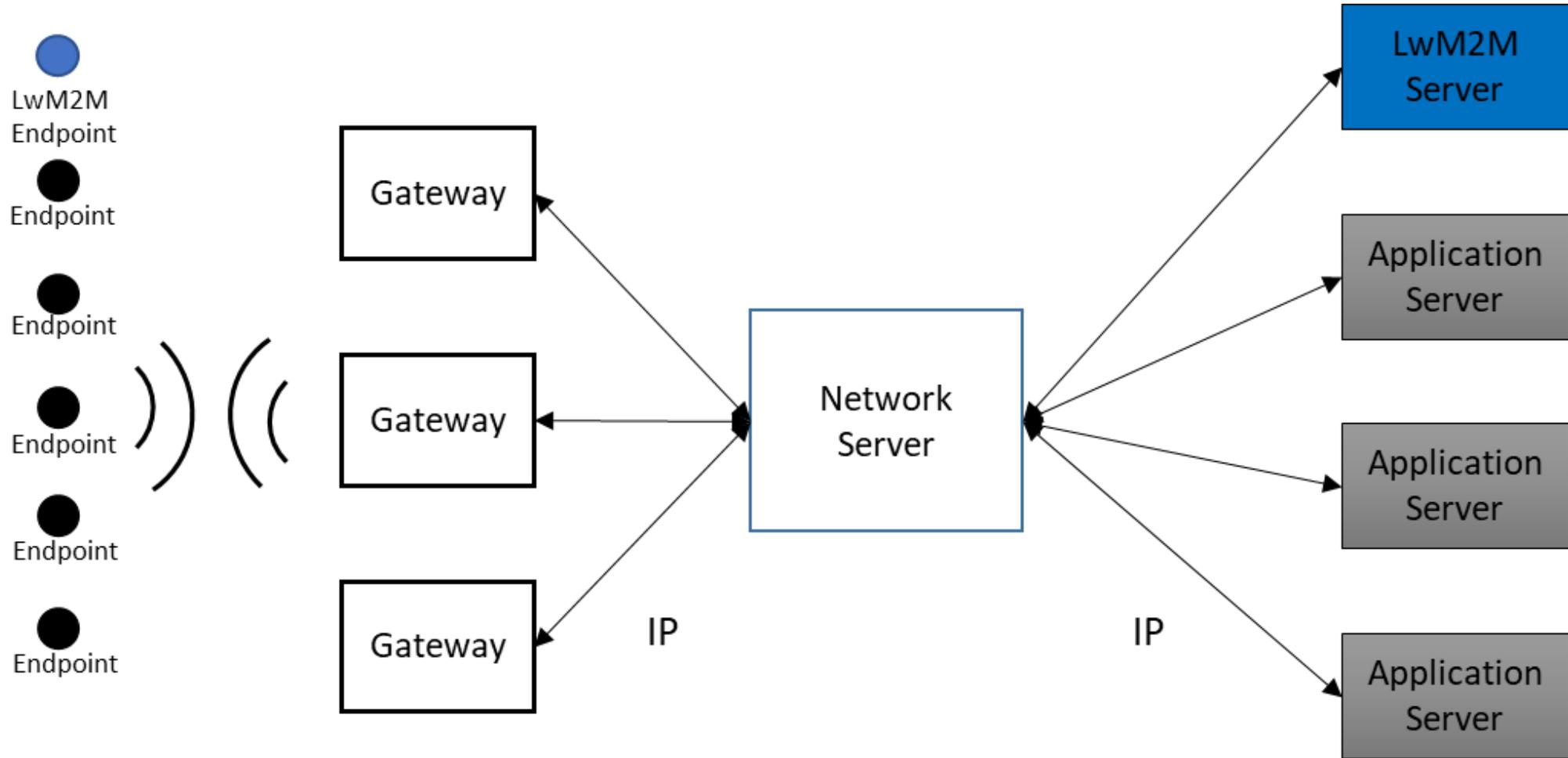
# Security & additions to v1.1



# Support of LPWAN – 3GPP CIoT



# Support of LPWAN – LoRAWAN



# Objects from OMASpecWorks

- LwM2M Security
- LwM2M Server
- LwM2M Access Control
- Device
- Connectivity Monitoring
- Firmware Update
- Location
- Connectivity Statistics
- Cellular Connectivity
- APN Connection Profile
- WLAN Connectivity
- Bearer Selection
- **Communication Characteristics**
- **Non-Access Stratum (NAS) Configuration**
- **LwM2M OSCORE**
- Lock and Wipe
- DevCapMgmt
- Portfolio
- LwM2M Software Management
- LwM2M Software Component
- BinaryAppDataContainer
- Event Log

# Objects registered OMASpecWorks

- Power Control
- Light Control
- Accelerometer
- Magnetometer
- Barometer
- Altitude
- Load
- Pressure
- Loudness
- Gyrometer
- Addressable Text Display
- Multiple Axis Joystick
- Multi-state selector
- Dimmer
- powerupLog
- radioLinkFailureEvent
- cellBlacklistEvent
- NeighborCellMeasurements
- ServingCellMeasurement
- PagingDRX
- txPowerBackOffEvent
- SipRegistrationEvent
- sipSubscriptionEvent
- VolteCallEvent
- volteCallStateChangeEvent

**Refer OMNA for full list -**

**<http://www.openmobilealliance.org/wp/OMNA/LwM2M/LwM2MRegistry.html>**

# Comparing Equivalent Standards in mobile space

Areas	OMA-DM 1.x	LwM2M v1.1
Device Management	Established and stable	Growing
Firmware Updates	Partial Standardized	Partial Standardized and expanding
Scalability	Targeting bigger devices	Wide Range feasible
Use in Constrained Devices	No	yes
IoT enablement	Bigger devices feasible but data model needs evolution	Data Model evolved for IoT enablement and is expanding
Active Standardization members	None	Stable with additional standards working on top
Service Enablement	Limited to Telecom Features	Expanding into other IoT/verticals
Service level standardization	- NA -	IRTF T2TRG actively collaborating to expand semantic interoperability on top of LwM2M (OCF, W3C WoT, Fairhair Alliance)
Supporting Standardization Groups	GSMA, 3GPP	GSMA, IPSO (assimilated into OMA), IETF, IRTF, OpenAIS, oneM2M and expanding..

# Status with Industry & market

- ARM
- Friendly Technologies
- Gemalto
- Netcomm Wireless
- Qualcomm
- Sequans
- Sierra Wireless
- Ublox
- AVSystems
- CISCO
- Microsoft Azure
- Ericsson
- Huawei
- IoTerop
- Nokia
- Software AG
- Smith Micro
- Zatar
- AT&T
- KDDI
- Itron
- Orange
- Softbank
- TMobile
- Verizon
- Vodafone

Note : A large number of small and medium companies across the globe is working on LwM2M implementations

