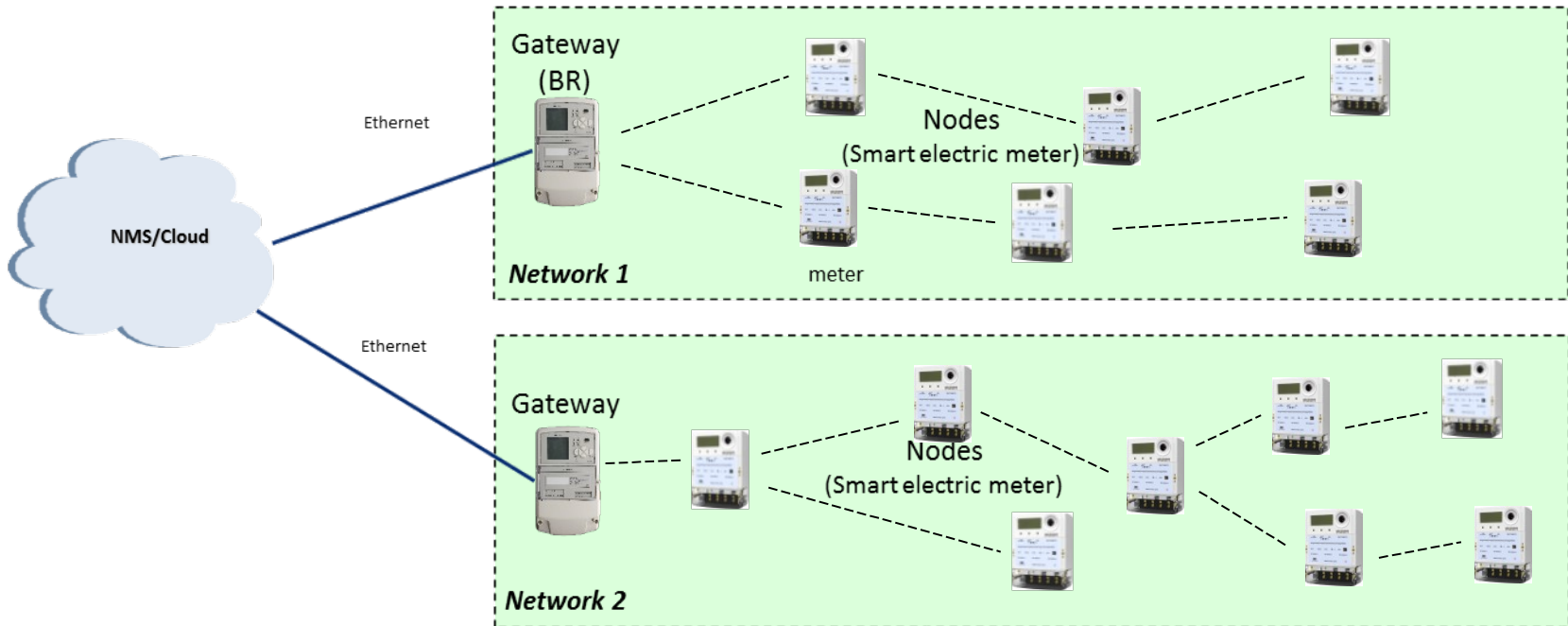


ANI Applied in IoT Network Management

(draft-rfmesh-anima-iot-management-00)

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An Example of Target Scenarios



- Low-power wireless field area network dedicated for industrial usage.
- IPv6 addressing, which is beneficial for auto-configuration.
- L3 routing is enabled (mostly RPL).
- Nodes are extremely resource constrained. (E.g., one typical hardware model only has 128Kbytes RAM and 512Kbytes ROM.)
- Gateway is much more resource rich, which acts as a management server to the nodes.
- Normally nodes don't need to directly communicate with the NMS beyond the gateway.

Example Management Content

- **Status Inquiry/Report**

- NODE_DATA_BRCT (BR<->Node, unicast)
- NETWORK_HEARTBEAT (BR->Node, broadcast)
- NODE_STATISTICS_GET (BR<->Node, unicast)
- NODE_LEFT_NETWORK (Node->BR, unicast)
- NODE_RSSI (BR<->Node, unicast)
- NODE_LOG (BR<->Node, unicast)
- NODE_PATH (BR<->Node, unicast)
- NODE_TABLES (Node->BR, unicast)

- **Operational Commands**

- NODE_REMOVE (BR<->Node, unicast)
- NETWORK_DISMISS (BR->Node, broadcast)
- NODE_STATISTICS_CLEAR (BR<->Node, unicast)
- NODE_RESET (BR->Node, unicast)

- **Configuration**

- NETWORK_CFG (BR->Node, broadcast)



Existing solutions for IoT management

- CoAP Management interface (CoMI)
 - [draft-ietf-core-comi-01](#) ; [draft-ietf-core-yang-cbor-04](#)
 - an “IoT version Netconf/RESTconf*YANG”
- Lightweight Machine-to-Machine
 - specification of OMA (Open Mobile Alliance)
 - protocol also based on CoAP; but
 - data model is not YANG, rather, OMA Objects
 - individual objects, not organized as trees like YANG
 - supports some sophisticated functions such as Access Control, Multiple Instances and Resource Link etc.

ANI in use – GRASP as the Management Protocol

- Why GRASP
 - enough to support the management functions
 - Minimal requirement: M_Request(Sync)+M_Sync+M_Flood
 - lightweight
 - code space is really small (3k for minimal requirement)
 - CBOR encoding reduces payload size
 - Extensible
 - GRASP Options allow easy further definitions
 - CBOR supports Key/Value pairs in MAP structure, which makes compatibility between different versions
 - re-useable for other functions

The bottom line: CoMI and LWM2M occupy too much code space, e.g. ROM in the nodes.

(CoMI around 150K; LWM2M around 50K)

Potential future work – GRASP profile/extension for IoT

- GRASP over UDP
 - current GRASP mostly runs on TCP, which is not acceptable by the target scenarios
- Reliable management signaling transport
 - Minimal requirement: acknowledgement of receiving some important messages
- Fragmentation handling
- Possible compression
 - e.g. using numbers for “Objective Name”
 - make some message/option fields optional (e.g. TTL, loopcount etc.)

ANI in use – ACP

- A separate management plane used for
 - when IP is not employed, an autonomic IPv6-based management plane provides more friendly interface to the management system.
 - when IP and routing are employed, ACP might be needed to configure some fundamental functions, such as the routing configuration, the MAC layer security (e.g. dynamically and securely refresh the keys) etc.
- However, current ACP is way too heavy for IoT nodes and networks. A simplified profile of ACP might be needed.
- Hop-by-hop design might be challenging, since the wireless interface might be changing all the time

(Note: this topic needs further study)

Next Step

- Collect more IoT management scenarios to consolidate the requirements
- Design the GRASP/ACP profile and extension
- A potential future work in Anima? Any interest?

Comments?

Thank you!

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