OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG | INF

Communication and Networked Systems

Bachelor/Master Thesis
Peer Discovery for CoAP

Motivation

A wide range of solutions exist for connecting devices in the Internet of Things (IoT). For example, ZigBee & Z-Wave exist for the world of home automation and smart buildings, and LoRaWAN & 6LoWPAN with protocols like the Constrained Application Protocol (CoAP) [1] exist for distributed sensor networks in industrial or agricultural applications. While other technologies usually introduce entirely new network stacks and require specialized hardware transcievers or at least the drivers for it, CoAP works on well-known and widely adopted Internet Protocol (IP)-based infrastructure and already deployed hardware. This makes it the perfect cost-efficient and ready-to-use candidate for most IoT use cases, in theory also for home automation, smart homes, smart cities and alike.

However, while ZigBee, Z-Wave and LoRaWAN have mechanisms built into their protocol chain to discover and identify new peers over the network, CoAP lacks a uniform way to identify new peers (not to be confused with resource discovery, which is standardized for CoAP already). This usually leads to lots of manually configured IP addresses, which is a tedious and error-prone process, and is not a good user experience (UX) at all, especially for laymen. Solutions such as RELOAD [2] for CoAP or libp2p [3] for IP exist but are most likely not suitable for very constrained devices as found in the IoT, or at the very least might be too complex for simple use cases.

Goal

The goal of this thesis is to develop, implement and evaluate an approach to discover new peers that speak CoAP in the context of IoT.

Tasks

- research current peer discovery technologies that are used for IoT- and non-IoT applications (e.g. ZigBee, Bluetooth, RELOAD, libp2p)
- design and implement approach(es) to discover new peers speaking CoAP
  - beaconing or request-based
  - implementation of libraries for embedded (C, e.g. RIOT OS) and/or server (high-level language, e.g. Python, Java et cetera) applications
  - compatibility with existing resource discovery mechanisms
- evaluate the approach(es) on the Magdeburg Internet of Things Laboratory (MIoT-Lab) [4]
  - setup realistic scenarios to test your approaches
  - compare your solution(s) with existing ones

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  - run experiments on tens or hundreds of embedded nodes to stress test your implementation(s)
- write a thesis about it

References

[1] Z. Shelby, K. Hartke, and C. Bormann, *The Constrained Application Protocol (CoAP)*, RFC 7252, Jun. 2014. DOI: 10.17487/RFC7252. [Online]. Available: https://www.rfc-editor.org/info/rfc7252.

[2] C. F. Jennings, B. Lowekamp, E. Rescorla, S. Baset, and H. Schulzrinne, *REsource LOcation And Discovery (RELOAD) Base Protocol*, RFC 6940, Jan. 2014. DOI: 10.17487/RFC6940. [Online]. Available: https://www.rfc-editor.org/info/rfc6940.

[3] *libp2p - A modular network stack | libp2p*, Mar. 2026. [Online]. Available: https://docs.libp2p.io/.

[4] *Communication and Networked Systems (ComSys) - MIOT-Lab*, Mar. 2025. [Online]. Available: https://comsys.ovgu.de/MIOT_Lab.html.