Master Thesis
SUIT Based OTA Updates for RIOT

Updating embedded systems reliably and securely is challenging due their constrained nature. But especially for embedded systems connected to the Internet, a robust update mechanism is of utmost importance to roll out security fixes swiftly. Hence, Over the Air (OTA) is largely considered to be a key component for successful IoT deployments. The goal of the proposed thesis is to design and implement an efficient, scalable, and reliable OTA update solution based on SUIT for RIOT.

Goals of the Thesis

SUIT [1] specifies an firmware update architecture and an experimental implementation of the current draft is already implemented for the IoT Operating System RIOT [2]. By design, SUIT is agnostic to the transport of the firmware image. Hence, SUIT can serve as one building block of an OTA update mechanism, but needs to be complemented with a network protocol to distribute and trigger firmware updates. The goal of this thesis is to provide the missing pieces and design and implement a functional OTA update mechanism. This OTA update mechanism should be evaluated in the context of Wireless Multi-Hop Networks using an IEEE 802.15.4 6LoWPAN network stack.
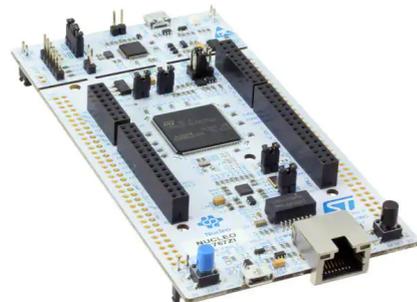
The target hardware for the evaluation of the OTA updates: A Nucleo-F767ZI

Project type	Master Thesis
Duration	1 Term
Language(s)	English, German
Field	Computer Science

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Task

- Select a suitable application layer protocol for distribution of the firmware image
  - For increased efficiency in terms of firmware size, this protocol should be general purpose to allow using it for all communication
  - A comparison of at least three mayor protocols should be conducted to justify the choice
- Implement missing features on the Nucleo-F767ZI needed by RIOT's SUIT implementation
  - Support for the `riotboot` bootloader is needed to allow booting into the newly written firmware
  - The `periph_flashpage` feature is needed to write the firmware update into the flash memory
- A network protocol for OTA updates that allows
  - Basic update related device management like assessment of the currently running nodes and their firmware state
  - Efficient distribution of the firmware image
  - Scheduling of firmware distribution and updating
- The provided implementation should be evaluated, including at least
  - Does the implementation meet the goals of the thesis?
  - The resource requirements of the implemented software
  - The communication overhead for both device management and firmware updates (evaluated individually)
  - Measure the time the distribution of the firmware update takes experimentally, using the MIoT Testbed

References

[1] B. Moran and H. Tschofenig and D. Brown and M. Meriac. A Firmware Update Architecture for Internet of Things. Internet-Draft. `https://tools.ietf.org/html/draft-ietf-suit-architecture-12`. 2020.

[2] Emmanuel Baccelli and Oliver Hahm and Mesut Güneş and Matthias Wählisch and Thomas Schmidt. RIOT OS: Towards an OS for the Internet of Things. 32nd IEEE International Conference on Computer Communications (INFOCOM). 2013.