

# Master Thesis

## Distributing Sensor Telemetry Through Routing Protocols using In-Band Network Telemetry

### Motivation

With the emerge of Integrated Communication and Sensing (ICAS) a resource efficient way to combine radar technology with communication was provided. The radar technology analyzes the signals received by the communication transceiver eliminating the need for specialized radar hardware. The sampled telemetry data needs to be transported through the network. Sending large amount of telemetry data through wireless networks is energy consuming and in many IoT networks the biggest priority is to save power.

This thesis proposes a energy efficient way of transporting telemetry data through wireless networks using In-Band Network Telemetry (INT) in combination with routing protocols like Routing Protocol for Low power and Lossy Networks (RPL). Routing protocols periodically exchange Control Packetss (CPs) in order to explore routes and keep the network operational. This imposes some overhead on the network since this CPs do not carry any application data.

INT is a network monitoring approach designed by the Programming Protocol-independent Packet Processors (P4) consortium. It embeds network telemetry data of network nodes into packets that are sent through the network, provided there is enough space left in the packet. Any node that is forwarding the packet to it's destination can add it's own telemetry data to the packet. This eliminates the need to send dedicated telemetry packets. The telemetry data is extracted at a sink for further processing at the network controller.

The key idea of this thesis is to combine INT with the CPs send by routing protocols. This makes it possible to distribute telemetry data through the network by embedding it in the routing protocols CPs, mitigating the need to send dedicated packets for the telemetry data. In contrast to P4s INT the telemetry data should not be sent to a centralized entity but be distributed through the network. This makes it possible to query the telemetry data from any node in the network. In theory, embedding the telemetry data in the routing protocols CPs should reduce the traffic overhead and energy consumption in the network.

This idea will be implemented and tested on the Magdeburg Internet of Things Lab (MIoT-Lab).

### Objective

The objective of this thesis is to implement and evaluate a INT approach on routing protocols CPs on the MIoT-Lab.

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



**Contact** M.Sc. Jon-Mailles Graeffe  
**E-Mail** jgraeffe@ovgu.de  
**Room** G29-314  
**Tel.** +49 391 67-52673

## Steps to be completed:

1. **Literature Review:** Study INT and commonly used routing protocols for wireless (mesh) networks. Review INT approaches for wireless (mesh) networks.
2. **Design:**
  - a) Design a dynamic packet structure based on Internet Protocol Version 6 (IPv6) to transport the telemetry data.
  - b) Develop and define performance metrics to evaluate the general performance of the approach.
  - c) Develop a dedicated performance metric that evaluates telemetry data freshness against overhead.
3. **Implementation:** Integrate INT in a chosen routing protocol from step 1.
4. **Evaluation:** Study and compare traffic overhead, energy consumption, and trade-off of overhead vs. telemetry freshness.

## References

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**E-Mail** [jgraeffe@ovgu.de](mailto:jgraeffe@ovgu.de)  
**Room** G29-314  
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