QoS-enabled Industrial Wireless Sensor Networks Testbed
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Motivation
- Future industrial networked control systems (NCS) will be wirelessly interconnected
- Control loops pose strict QoS requirements on wireless communications
- Wireless Sensor Networks (WSN) can support NCS traffic and allow centralized RRM through scheduling (TSCH)
- Goal: Low-latency implementation of QoS provisioning in IWSN
- Problem: Current WSN devices are not designed for low-latency
- Approach:
  1. Definition of a Network Architecture and QoS framework
  2. Implementation of QoS-aware low-latency algorithms and protocols

Network Architecture
- Centralized, cellular architecture
- Network elements:
  - Application (App.)
  - Network Manager (NM): entity that manages the Network Resources of the entire WSN
  - Gateway (GW): interface btw the WSN devices, the NM and applications
  - Sensor (S): WSN device representing the endpoint of the application
  - Control links btw NM and WSN devices through the GW
  - Data links btw App and WSN devices through the GW

QoS Provisioning Framework - Wireless DetServ
- WDetServ collects application QoS requirements (latency, reliability, QoC, …), Link Quality Information and allocates Radio Resources to the WSN devices
- RRM models the MAC Radio Resources to provide QoS
- RRM allocates RR for both Control and Data messages
- RRM allocates resources to retrieve Link Quality Information
- Simulation results of centralized dynamic scheduling in WSN s.t. latency and reliability constrains (Fig. 5)

Conclusion & Current Work
- Wireless DetServ QoS cross-layer Framework can provide QoS (latency, reliability, QoC, …) in WSN and support industrial NCSs
- Cross-layer protocols for dynamic RRM in IWSN will be implemented
- Latency is the major issue for HW implementation (radio, processing, ext. interface)
- Multi-radio, multi-processor, high-speed interface solutions will be implemented
- Standard NCS application will be defined for benchmarking purposes

Relevant references