Technische Universität München

Chair for Network Architectures and Services
Prof. Dr.-Ing. Georg Carle

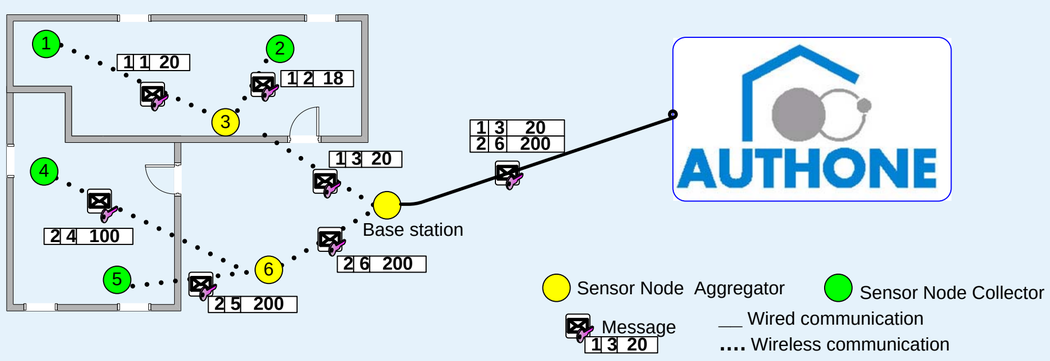
Corinna Schmitt, Lothar Braun
Contact: schmitt@net.in.tum.de · http://www.net.in.tum.de

Wireless Sensor Networks

Motivation

- Call for new approaches for data acquisition in real-time
- Challenging requirements
- Efficient collection of environmental data by Wireless Sensor Networks
- Efficient transmission due to hardware limitations

- Integration of standard protocol (IPFIX) for efficient data transmission
- Reduce of data amount by data aggregation and compression
- Ensure interoperability between devices of different vendors



IRIS Motes

- Crossbow Technology Inc.

- Sensors:
  - Light
  - Temperature
  - Humidity
  - Barometric pressure

- Limited Ressources:
  - 8K bytes RAM
  - 4K bytes EEPROM
  - 128K bytes Program Flash Memory
  - 250 kbps Transmit (TX) data rate
  - 300m Outdoor / 30m Indoor Range
  - 2 AA batteries power supply

- Many requirements exist concerning hardware and application scenarios

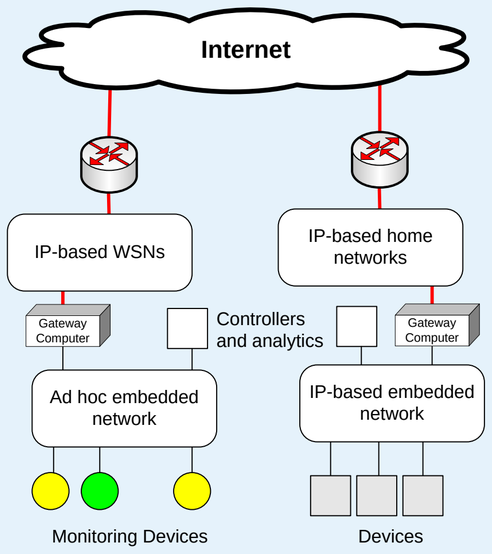
- ZigBee

IP communication for WSN

- 6LoWPAN
- Connection between wireless and wired infrastructure
- Software is built on TCP/IP or UDP/IP data transports, regardless to the underlaying physical layer

- Supports:
  - authentication and security basics
  - two address types: 16-Bit and 64-Bit
  - Fragmentation mechanisms
  - Header compression

- Individual data payload size up to 110 Bytes

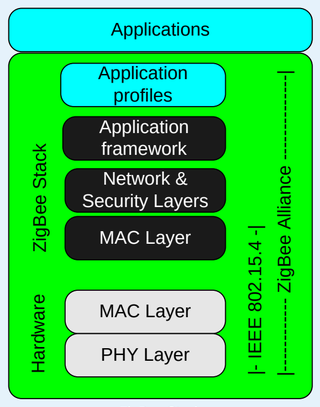


ZigBee vs 6LoWPAN

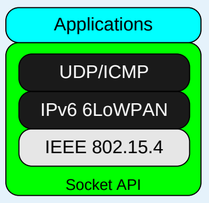
- 2002 – ZigBee based on 802.15.4
- 2007 – 6LoWPAN

	ZigBee	6LoWPAN
Code Size with mesh	32K – 64K+	22K
Code Size w/o mesh	Not possible	12K
RAM requirements	8K	4K
Header Overhead	8-16 bytes	2-11 bytes
Network Size	~ 65K	2^{64}
RF Radio Suppport	802.15.4	802.15.4 ++
Transport Layer	None	UDP/TCP
Mesh Network Support	ZigBee	Many
Internet Connectivity	ZigBee Gateway	Bridge/Router

Stack Comparision [Mulligan 2008]



ZigBee Stack



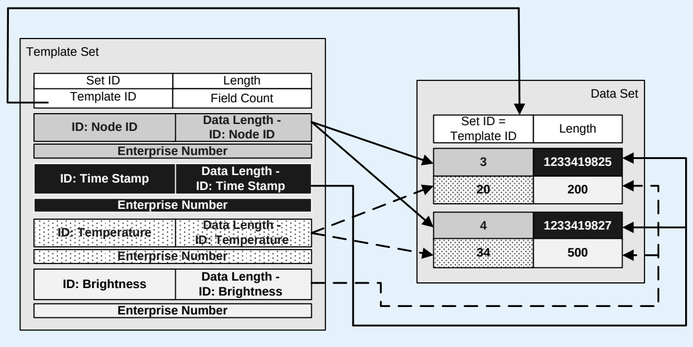
NanoStack 6LoWPAN

tinyIPFIX

- IP Flow Information Export (IPFIX) protocol – RFC 5101
- PUSH-protocol: exporter periodically transmits data to one or more collectors
- Template based design → Meta Information is sent only once
- Only pointers need to be moved over the data record
  → low processing needs

- Modifications for Wireless Sensor Networks
  - Specify Type IDs
  - Specify Enterprise IDs (EID)
  - Specify IPFIX templates

- Aims:
  - Minimizing data amount in the network
  - Transmit as much as possible in one packet
  - Saving energy



Summary and Outlook

- tinyIPFIX defines an efficient data format for transmitting sensor measurement data using low bandwidth.
- tinyIPFIX needs little processing power.
- 6LoWPAN integrates Wireless Sensor Networks in existing home networks by using IP on the network layer below tinyIPFIX.

- Running work:
  - Integration of more sensors
  - Data aggregation
  - Data compression