6loWPAN Introduction

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Contents

6loWPAN

- IPv6 over Low Power Wireless Personal Area Networks (WPAN)
- Low Power → low data rate
- IETF Working-Group
- Internet of Things
- IEEE 802.15.4: OSI Layer 1 and 2 (MAC)
- Problem statement: RFC 4919, 6loWPAN: RFC 4944
- IPv6: MTU at least 1280 bytes
- 6loWPAN: IEEE802.15.4 packet size: 127 bytes

→ Encapsulation and header compression mechanisms

- Address-length: 128 bit IPv6 vs. 64 or 16 bit in PAN

IEEE 802.15.4

- Basis for ZigBee and 6loWPAN (and others)
- Data Rate 250 kbit/s and lower rates: 100 kbit/s, 40 kbit/s, 20 kbit/s
- 868.0–868.6 MHz: Europe, only 1 channel (!)
- 902–928 MHz: North America, up to 10 channels, extended to 30 in 2006
- 2400–2483.5 MHz: worldwide, up to 16 channels
- Two node types: Full-function device (FFD), reduced-function device (RFD), network needs at least one FFD as coordinator

IEEE 802.15.4

- modulation standards depending on frequency and standard version:
  - direct sequence spread spectrum (DSSS)
  - binary or offset quadrature phase shift keying
  - binary / amplitude shift keying
- P2P or star topology, routing on higher layer (for mesh)
- MAC-layer: network beacons, time-slots
- CSMA-CA for medium access control
- support for encrypted communication

Mesh-Networking

- Edge-Router has connection to the IPv6 Internet (or Intranet)
- Not all nodes need direct radio connection to central server
- A router-node can send data to the next node
- . . . mobile ad-hoc network (MANET)
- IETF draft: 6LoWPAN Ad Hoc On-Demand Distance Vector Routing (LOAD)
- IETF draft: Dynamic MANET On-demand for 6LoWPAN (DYMO-low) Routing

Bus Systems in Building Automation

- huge number of nodes: Each light-switch and each light source is potentially a node in the network
- large address space not provided by most fieldbus standards not designed for building automation
- majority of telegrams can be very short: light switch
- but some applications (analog information) require larger data structures
- no requirements for high data rates for most applications

Bus Systems in Building Automation

- huge physical network: buildings can be *large*
- usually solved by hierarchical bus topology (tree)
- distributed: no central master
- no single point of failure
- no bottleneck for communication: direct communication of devices (peer-to-peer)
- should be possible to retrofit: different media and physical layers, radio or power-line
- better use radio-communication: transmission on power-line is bad due to unshielded media

Excursus: Open standards

- Wikipedia has a good treatment of the issue
- access to standard without fees or at least “reasonable and non-discriminatory royalties”
- precondition for low entry barrier
- avoids vendor lock-in
- for long-term solutions (building automation, factory automation): protection of investment: maintenance costs

Protocols in Building Automation

- Most bus-systems for buildings today use unshielded twisted pair wiring
- current standards are open but have high entry barriers (e.g. certification requirements)
- KNX: uses up to 9.6 kbit/s, supports IP-encapsulation and 868 MHz RF
- LON: 78 kbit/s RS-485, RF 400-470MHz, 2.4 GHz
- BacNet: higher-layer protocols for managing several buildings, 9.6 kbit/s up to 76.8 kbit/s, RS-485, supports IP encapsulation

→ 6loWPAN has potential to gain market-share