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Wireless sensor networks: driving forces

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Agenda

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2. WSN software platforms
3. Application areas of WSN technologies
4. Driving forces for adoption of WSN by the industry
5. Problems and blocking factors
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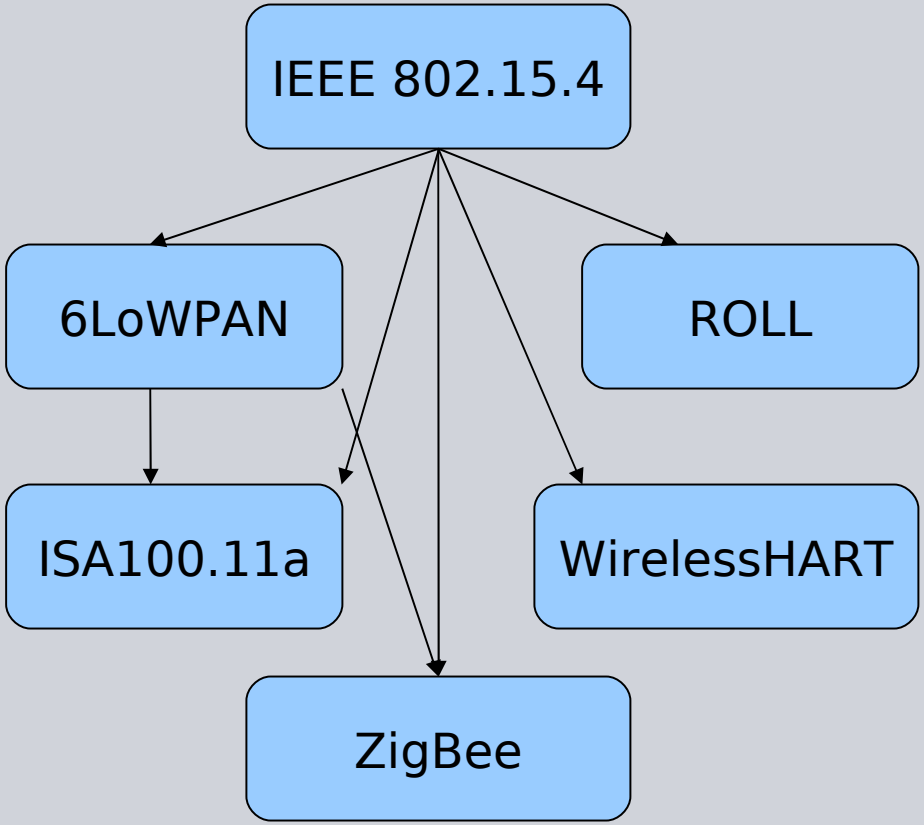
WSN technologies overview

IEEE 802.15.4 based:

- ZigBee
  - ZigBee
  - RF4CE
  - Smart Energy
- IETF
  - 6LoWPAN
  - ROLL
- WirelessHART
- ISA100.11a

Others:

- Bluetooth Low Power
- EnOcean
- Z-Wave, KNX RF, ...



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WSN software platforms

- **TinyOS**

Open Source, component based, written on nesC C-dialect, targeted to sensor platforms (limited resources), used as a basis for some WSN protocol stacks (ex. Meshnetics).

- **Contiki OS**

Open Source, implemented in C language, supports multiple sensor hardware platforms and WSN stacks (ex. was a basis for 6LoWPAN development and FreakZ ZigBee stack).

- **Linux**

Open Source, supports server, desktop and embedded platforms (but not sensors), WSN support is limited but evolving (Linux-ZigBee stack).

- **Custom stacks**

Usually target to particular WSN hardware platforms, vendor-dependent and may be supplied in binary form.

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WSN application areas

- **Home automation**

Traditional area of WSN application and the most mature one (ex. Alertme.com, etc.). Many families of protocols are targeted to this area (KNX, Z-Wave, EnOcean, ZigBee).

- **Energy**

Become perspective due to US recovery package and marketing efforts of ZigBee Alliance. The main WSN application is Advanced Metering technologies.

- **Industry**

Very perspective, but has significant new technology adoption barriers due to application requirements (real time, reliability). Two recent major standardization efforts are targeted to this area (WirelessHART and ISA100.11a).

- **Healthcare**

Perspective, but not really covered with common standards base and driven by custom solutions.

- **Environmental**

Same as with healthcare, due to multiple different applications, no common standards exist.

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WSN adoption driving forces

- **Market forces**

"Obvious" application scenarios for wireless technologies, for example for home automation drive new products development, sometimes using custom technologies (ex. EnOcean).

- **Government financing**

Significant investments into particular industry lead to creation of new products and related standardization activities (ex. US DoE Smart Grid efforts).

- **Research advances**

Significant achievements in academic research lead to possibility for new business development (ex. Contiki OS and IP for Smart Objects).

- **Problems and blocking factors**

Technology maturity, standardization problems, industry-specific requirements (reliability).

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WSN regional aspects

- **United States**

Development of WSN standards in US is mainly driven by economic recovery packages, for example regional standards for Smart Grid promote usage of Internet standards.

- **Europe**

Major influence on WSN technologies development in Europe is provided by university research (example would be IPv6 encapsulation scheme for IEEE 802.15.4, which evolved to 6LoWPAN standard).

- **Russia**

Standardization efforts are limited, and foreign standards are often adopted de-facto. This leads to high diversification of existing solution base and (sometimes) incompatibilities.

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Conclusions

- Significant recent industrial standardization efforts in the area of Wireless Sensor Network technologies indicate perspectives of this technology direction.
- Wireless Sensor Network technologies base is very broad, both from standards and application platforms perspectives, however standards are shifting towards usage of IETF RFCs.
- Adoption of WSN technologies is facilitated by marketing efforts of industrial alliances and direct financial stimulation by the governments in certain economic sectors.
- Cooperation in this area may be especially interesting for RU-EU projects due to novelty of technology and significant coverage of NECS application domains.