6LoWPAN

Internet of Things

Overview

- *6LoWPAN* is an acronym of **IPv6 over Low power Wireless Personal Area Networks**.
- A simple **low throughput** wireless network comprising typically **low cost and low power** devices.
- Common **topologies** include – star, mesh, and combinations of star and mesh.
- The Phy and MAC layers *conform* to IEEE 802.15.4-2003 standard.

6LoWPAN Characteristics

- Small packet size (127Byte).
- 16-bit short or IEEE 64-bit extended media access control addresses.
- Low bandwidth. (250kbps).
- Low power, typically battery operated .
- Relatively low cost.

Protocol and Architecture

- High number of proprietary or semi-closed solutions:Zigbee, Z-Wave, Xmesh, SmartMesh/TSMP, … at many layers (physical, MAC, L3) and most chip vendor claim to be compatible with their own standard.
- Many non-interoperable “solutions” addressing specific problems.
  - Different **Architectures**,
  - Different **Protocols**

Which protocol and architecture ?

- The architecture and protocol MUST have a specific properties.
- Based on open standards: for interoperability, cost reduction and innovation …
- Flexibility in many dimensions:
  - Support a wide range of media
  - Support a wide range of devices
- Always favor global than local optimum.
- Highly secure
- Plug & Play
- Scalable

IP: The perfect fit !

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- Open standard: The Internet Engineering Task Force.
- **Flexibility** in many dimensions:
  - Serial, SDH, FR, ATM, Ethernet, Wireless, Optical …
  - From cell phone to high speed routers
- **Always favor global than local optimum**: "IP if good enough for everything: from email to video to realtime protocols"
- A very secure and well proven
- **Biliions of connected devices**

IP to the Sensors

- New services and applications
  - M2M, remote management.
- New Markets
  - Process Control for factories.
  - Control and Automation for home, building, cities.
- Larger Core Market
  - Open standards to the sensor
    - Lower cost
    - More connected devices and new applications
    - A wider Internet
- Shaping the future
  - Internet of things.

Why IPv6?

- **Advantage**
  - More suitable for higher density Statelessness mandated.
  - No NAT necessary.
  - Possibility of adding innovative techniques such as location aware addressing.
- **Defect**
  - Larger address width(128bit).
  - Complying to IPv6 node requirements.

Key Factors for IPv6 over 802.15.4

- Header
  - Standard IPv6 header is 40 bytes [RFC 2460]
  - Entire 802.15.4 MTU is 127 bytes [IEEE]
  - Often data payload is small
- Fragmentation
  - Interoperability means that applications need not know the constraints of physical links that might carry their packets
  - IP packets may be large, compared to 802.15.4 max frame size
  - IPv6 requires all links support 1280 byte packets [RFC 2460]
- Allow link-layer mesh routing under IP topology
  - 802.15.4 subnets may utilize multiple radio hops per IP hop
  - Similar to LAN switching within IP routing domain in Ethernet
- Allow IP routing over a mesh of 802.15.4 nodes
  - Options and capabilities already well-defines
  - Various protocols to establish routing tables
- Energy calculations and 6LoWPAN impact

Conclusion

- 6LoWPAN turns IEEE 802.15.4 into the next IP-enabled link
- Provides open-systems based interoperability among low-power devices over IEEE 802.15.4
- Provides interoperability between low-power devices and existing IP devices, using standard routing techniques
- Paves the way for further standardization of communication functions among low-power IEEE 802.15.4 devices
- Great ability to work within the resource constraints of low-power, low-memory, low-bandwidth devices like WSN