IPv6 over Constrained Node Networks(6lo) Applicability & Use cases

draft-ietf-6lo-use-cases-03

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History and status

-Discussed from IETF 89 (Mar. 2014)

-Initial Document: draft-hong-6lo-use-cases-00 (Oct.17.2015)

- Presented at IETF-94 6lo WG meeting

-WG document : draft-ietf-6lo-use-cases-00 (Nov.2.2016)

-1st revision : draft-ietf-6lo-use-cases-01 (Mar.12.2017)

-2nd revision : draft-ietf-6lo-use-cases-02 (Jul.3.2017)

-3rd revision : draft-ietf-6lo-use-cases-03 (Oct.30.2017)

Goal of this document:

Help 6lo/6lowpan stack adaptation by a L2-constrained technology and help a newcomer understand how 6lowpan stack can be applicable in practice. U seful for new adopters of IOT@IETF.

Update based on IETF98 comments

Shortened, cleaned up and focused on Applicability

- Specified 6lo link layer technologies in a nutshell
  - Added a comparison table on 6lo technology usage
  - LTE-MTC is used as an example of potential 6lowpan L2-candidate
- Two 6lo deployment scenarios from external SDO
  - Wi-SUN
  - jupiterMesh
- A section of guidelines for 6lo/6lowpan adaptation is added
- Moved 6lo use case examples to Appendix (for now)
- Additional editorial comments
- Author added
  - Samita Chakrabarti helped with document re-organization

Update based on IETF99 comments

- Add another Design Space Dimensions
  - Wired vs. Wireless
  - Comment from Kerry

- Resolve comments from Jianqiang HOU
  - Modify Abstract and section 3.9 to reflect PLC
  - Fix editorial comments

- Update affiliation of Rashid Sangi

- Fix editorial typos

6lo Link layer technologies

- ITU-T G.9959 (Z-wave) : RFC 7428
- Bluetooth Low Energy : RFC 7668
- DECT-ULE : RFC 8105
- Master-Slave/Token-Passing : RFC 8163
- NFC : draft-ietf-6lo-nfc-08
- PLC : IEEE 1901.2, draft-hou-6lo-plc-02
- IEEE 802.15.4e : RFC 7554
- (Potential candidate) LTE MTC : 3GPP TS 36.306 V13.0.0

Comparison across 6lo Link layer tech.

	Z-Wave	BLE	DECT-ULE	MS/TP	NFC	PLC	TSCH
Usage	Home Automation	Interaction with Smart phone	Meter Reading	District Heat-ing	Health care Services	Smart Grid	Industrial Automation
Technology & Subnet	L2-mesh or L3-mesh	Star No mesh	Star No mesh	Bus MS/TP	P2P L2-mesh	Star, Tree, Mesh	Mesh
Mobility Re-qmt	No	Low	No	No	Moderate	No	No
Security Reqmt	High, Privacy re-quired	Partially	High, Privacy re-quired	High, Authen. required	High	High, Encrypt. required	High, Privacy re-quired
Buffering Reqmt	Low	Low	Low	Low	Low	Low	Low
Latency, QoS Reqmt	High	Low	Low	High	High	Low	High
Date Rate	Infrequent	Infrequent	Infrequent	Frequent	Small	Infrequent	Infrequent
RFC # or Draft	RFC 7428	RFC 7668	RFC 8105	RFC 8163	draft-6lo-nfc	draft-hou-6lo-plc	RFC 7554|

Guidelines for adopting IPv6 stack (6lo/6LoWPAN)

- It targets candidates for new constrained L2 technologies that consider running modified 6LoWPAN stack
- The modification of 6LoWPAN stack should be based on the following:
  - Addressing Model
  - MTU Considerations
  - Mesh or L3-Routing
  - Address Assignment
  - Header Compression
  - Security and Encryption
  - Additional processing

6lo Deployment Scenarios : Wi-SUN

- Wi-SUN technology
  - Based on the IEEE 802.15.4g standard
  - Wi-SUN networks support star and mesh topologies, as well as hybrid star/ mesh deployments
  - Wi-SUN networks are deployed on both powered and battery-operated dev ices
- Wi-SUN Field Area Network (FAN) technology
  - Cover primarily outdoor networks, and its specification is oriented towards meeting the more rigorous challenges of these environments
  - Adaptation layer based on 6lo and IPv6 network layer are described
- Wi-SUN usage of 6lo stacks
  - Advanced Metering Infrastructure (AMI)
  - Distribution Automation (DA)

[*. On behalf of Wi-SUN Alliance, Paul Duffy helped to prepare text]

6lo Deployment Scenarios : jupiterMesh

- jupiterMesh specification is based on
  - PHY layer : IEEE 802.15.4 SUN specification [IEEE 802.15.4-2015]
  - MAC layer : IEEE 802.15.4 TSCH specification
  - Network layer : DHCPv6 [RFC3315], 6lo/6LoPWAN header compression [RFC6282], RPL [RFC6550]
- jupiterMesh in Smart Grid using 6lo in network layer
  - Multi-hop wireless mesh network specification designed mainly for deployment in large geographical areas
  - Each subnet in jupiterMesh is able to cover an entire neighborhood with thousands of nodes consisting of IPv6-enabled routers and end-points

[*. On behalf of jupiterMesh WG, Michel Veillette and Das Subir provided related text]

Design space dimensions for 6lo use cases

- Deployment/Bootstrapping
- Topology
- L2-Mesh or L3-Mesh
- Multi-link subnet
- Data rate
- Buffering requirements
- Security Requirements
- Mobility across 6lo networks and subnets
- Time synchronization requirements
- Reliability and QoS
- Traffic patterns
- Security Bootstrapping
- Power use strategy
- Update firmware requirements
- Wired vs. Wireless

Design space dimensions - Wired vs. Wireless

- Wired vs. Wireless: Plenty of 6lo link layer technologies are wireless except MS/TP and PLC. The selection of wired or wireless link layer technology is mainly dependent on the requirement of 6lo use cases and the characteristics of wired/wireless technologies. For example, some 6lo use cases may require easy and quick deployment and some 6lo use cases may require continuous source of power.

6lo use cases (1/2)

- Use case of ITU-T G.9959: Smart Home
  - Example: Use of ITU-T G.9959 for Home Automation

- Use case of Bluetooth LE: Smartphone-Based Interaction with Constrained Devices
  - Example: Use of Bluetooth LE-based Body Area Network for fitness

- Use case of DECT-ULE: Smart Home
  - Example: use of DECT-ULE for Smart Metering

- Use case of MS/TP: Management of District Heating
  - Example: use of MS/TP for management of district heating

6lo use cases (2/2)

- Use case of NFC: Alternative Secure Transfer
  - Example: Use of NFC for Secure Transfer in Healthcare Services with
  - Tele-Assistance

- Use case of PLC: Smart Grid
  - Example: Use of PLC for Advanced Metering Infrastructure
  - Example: Use of PLC (IEEE1901.1) for WASA in Smart Grid

- Use case of IEEE 802.15.4e: Industrial Automation
  - Use of IEEE 802.15.4e for P2P communication in closed-loop applic ation

Thanks!!

Questions & Comments