

# Transmission of IPv6 Packets over PLC Networks

draft-hou-6lo-plc-00

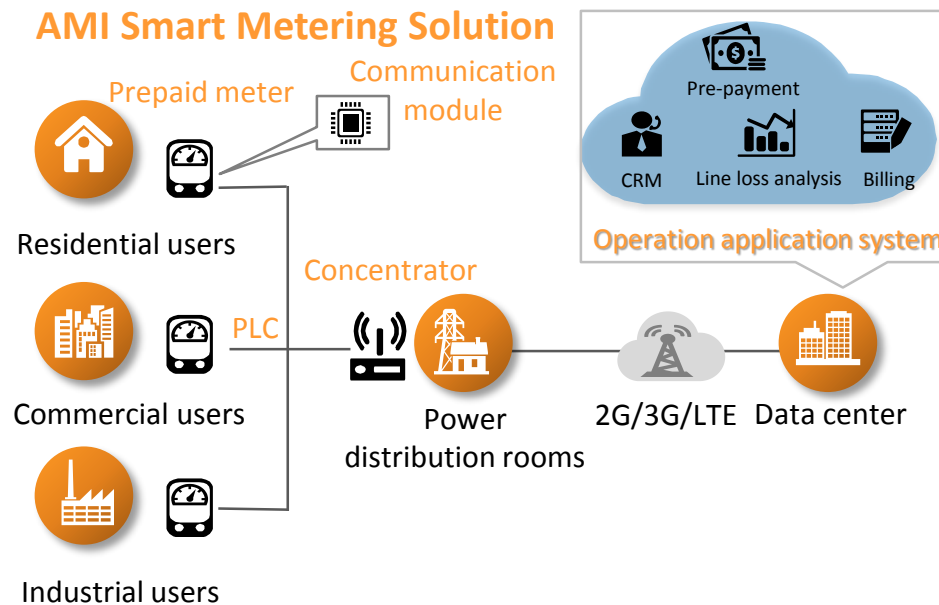
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# Power Line Communication (PLC)

- Power Line Communication (PLC) uses the electric-power lines for indoor and outdoor communications
- Enables convenient **two-way communications**
- Widely applied to support **Advanced Metering Infrastructure (AMI)**



# Protocol Stack for IPv6 over PLC

- Various standards have been developed on the MAC/PHY layers
  - Broadband PLC (2-250 MHz): IEEE 1901, ITU-T G.hn
  - Narrowband PLC (3-500 kHz): IEEE 1901.2, ITU-T G.9902 (G.hnem), ITU-T G.9903 (G3-PLC) and ITU-T G.9904 (PRIME)
  - Upcoming Standard: IEEE 1901.1 (2-12 MHz)

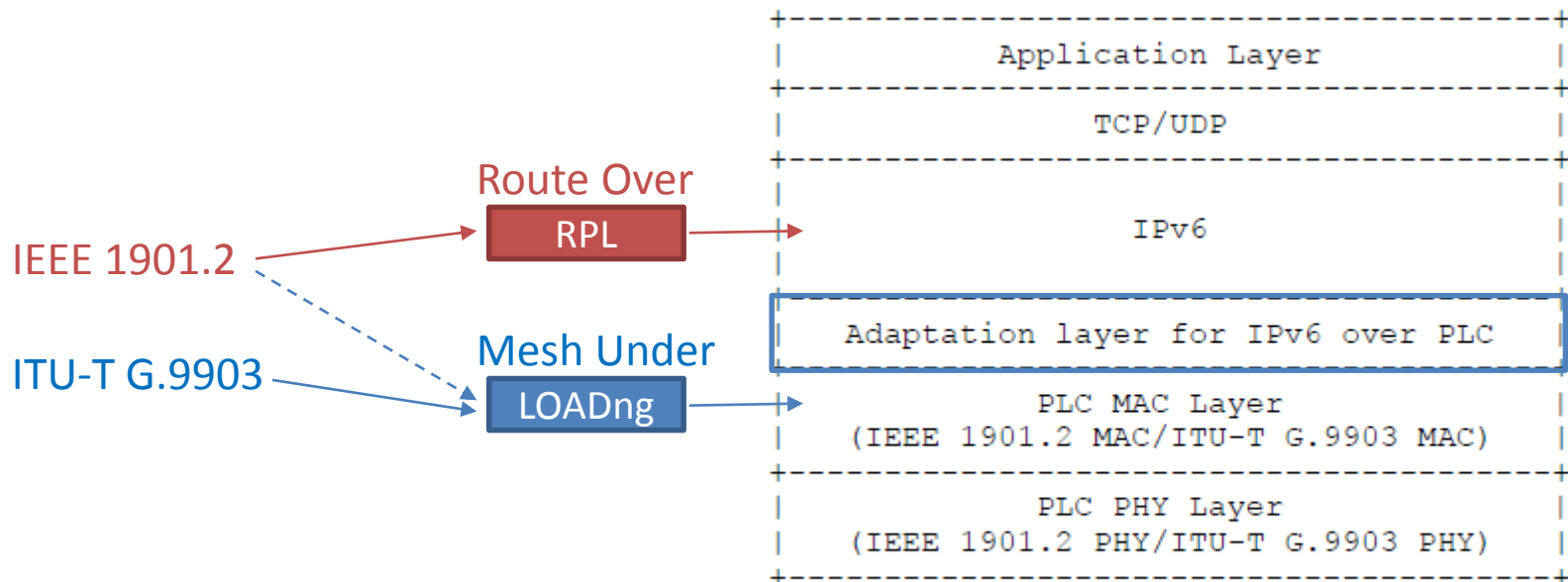
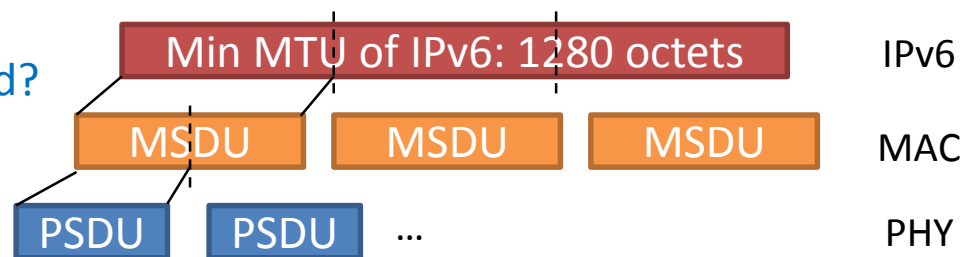


Figure 1: PLC Protocol Stack

# Fragmentation and Reassembly (FAR)

- IEEE 1901.2:
  - MTU = 1576 octets > 1280 octets (support complete IPv6 packets)
  - ⇒ FAR in RFC 4944 **MUST NOT** be used
- ITU-T G.9903:
  - MTU = 400 octets (insufficient for supporting complete IPv6 packets)
  - ⇒ FAR in RFC 4944 **MUST** be provided
- Consideration
  - Segmentation and reassembly at MAC layer are enabled
    - Segment Control Field is defined in the MAC frame header
  - ⇒ Redundant fragmentations in ITU-T G.9903 (6lo adaptation layer & MAC sublayer)
  - ⇒ Optimization is needed?

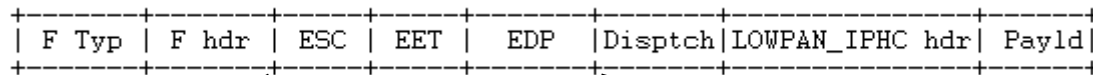


# Header Compression

- Header compression as defined in RFC6282 which specifies the compression format for IPv6 datagrams on top of IEEE 802.15.4, is REQUIRED in this document as the basis for IPv6 header compression in IEEE 1901.2 and ITU-T G.9903.
- All headers **MUST** be compressed according to RFC6282.

# Extension at 6lo Adaptation Layer

- **ITU-T G.9903:** Apart from the 6Lo headers specified in RFC 4944, an additional **command frame header** is defined for the mesh routing procedure
  - Order:
    - in the last position if more than one header is present in the 6LoWPAN frame
    - MUST appear before the LoWPAN\_IPHC dispatch type
  - Command ID:
    - LOADng message (0x01), LoWPAN bootstrapping protocol message (0x02), Reserved by ITU-T (0x03 – 0x0F), CSMR protocol messages (0x10 – 0x1F)



- **ESC + Command ID + Command Frame Header**

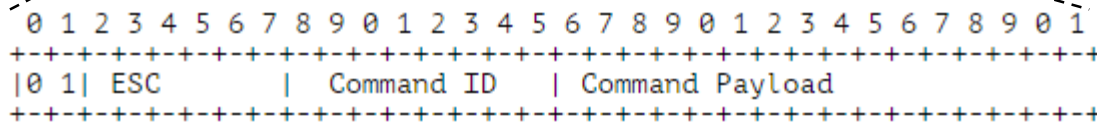


Figure 3: G.9903 Frame Format with ESC Dispatch Type

# Connectivity and Topology

- IPv6 over PLC networks: connectivity, topology, using scenario...
  - Star (AMI)
  - Tree (AMI, street lighting...)
  - Mesh (developing, peer-to-peer)
  - Internet connected, Isolated...

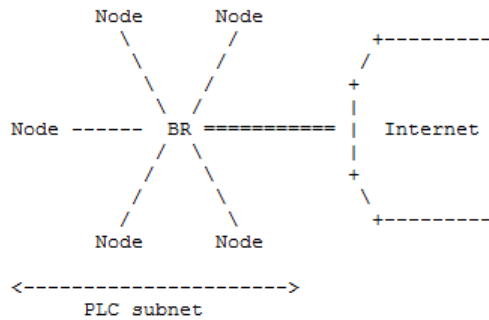


Figure 7: PLC Star Network connected to the Internet

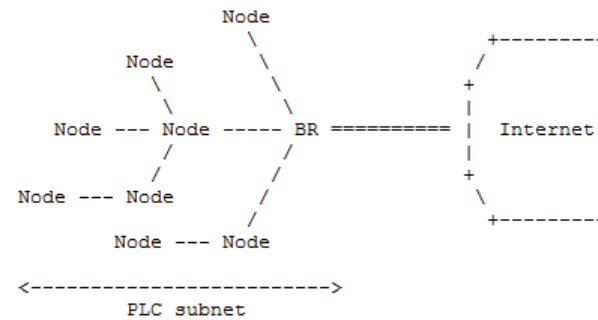


Figure 8: PLC Tree Network connected to the Internet

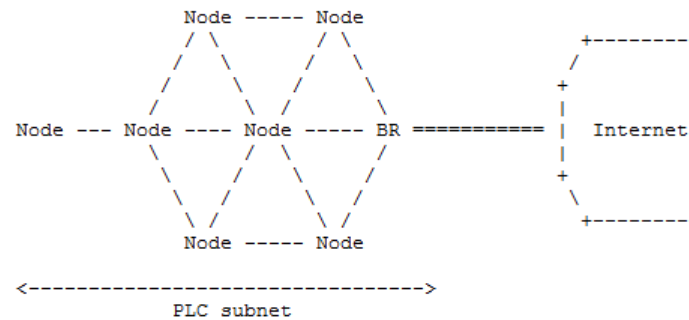


Figure 9: PLC Mesh Network connected to the Internet

# Future Work

- Discussion
  - Include more PLC standards in future?
    - Current: IEEE 1901.2, ITU-T G.9903 (G3-PLC)
    - More PLC standards: ITU-T G.9904 (PRIME), ITU-T G.9902 (G.hnem), IEEE 1901.1
- Next steps
  - Add subsection “Neighbor Discovery”
  - Update 4.1.3 & 4.2.6 as per Samita’s comments (Many thanks!)
    - 64-bit & 16-bit addresses, Command frame header
  - Update if any based on the ongoing discussion with Daniel Popa (draft-popa-6lo-6loplc-ipv6-over-ieee19012-networks-00)
- More review and comments are appreciated