Build Faster Networks

Introducing the New ISO/IEC 14908-8 Standard for High-Speed Wireline Communications and Control Networks

Renewable Energy  Smart Cities Streetlighting  Commercial & Residential Buildings  Internet of Things
Is Your Network Ready?

- 50 Billion by 2025
  Connected Devices*

- $4+ Trillion
  Revenue Opportunity

- 25+ Million
  Applications

- 5+ Billion
  Connected People

- 50+ Trillion
  GBs of Data

*Statista 2021

[Diagram showing inter-connected ecosystems like Smart Buildings, Smart Factories, Smart Cities, Smart Cars, Smart Homes, Smart Grid, Motor Controls, HVAC, Safety & Security, Building Automation, Energy Management, Power Plant, Solar/Wind Generated Power Plant, Electric Grid, Smart Meter, ISO, Smart Street Lighting, Smart Parking, Smart Transportation, Smart Traffic Control.]

- Connected Devices: 50 Billion by 2025
- Revenue Opportunity: $4+ Trillion
- Applications: 25+ Million
- Connected People: 5+ Billion
- GBs of Data: 50+ Trillion

*Statista 2021
Smart City Communications Requirements

- Higher bandwidths
- Support more nodes
- Longer range
- IP-Based
- Security at every node
- Fast response times
- Standards based
- Multi-source
- Interoperable
- Low deployment cost
Existing Technology Requires Tough Tradeoffs

**SERIAL**
Long range, but slow and size-limited

**WIRELESS**
Easy to deploy, but needs line of sight

**NB POWER LINE**
Lowest deployment cost, but slow and size-limited

**ETHERNET**
Very fast, but cost can be prohibitive
Advantages of HD-PLC

- Megabit Data Rates
- Ranges Up to Several km
- Up to 1024 Nodes
- Crypto-Strong Encryption
- IP-Based Mesh Networking
- Over ANY Wire
HD-PLC Leaps Past Other Technologies

This chart shows how HD-PLC stacks up against other wireline technologies. With multi-hop technology, HD-PLC is able to deliver broadband speeds over the long distances one normally expects to find in only low-speed approaches like RS-485.

Multi-hop enables HD-PLC to achieve longer ranges than RS-485 but at much higher speeds.
### What Is HD-PLC?

Advanced Wireline Communication Technology Delivering Long-Range, Secure, Bi-directional, IP-based, High-Speed Communication over ANY WIRE.

<table>
<thead>
<tr>
<th><strong>Standard</strong></th>
<th>IEEE1901-2020, &amp; ISO/IEC14908-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Band</strong></td>
<td>2 – 125MHz</td>
</tr>
<tr>
<td><strong>Modulation</strong></td>
<td>Flexible Channel Wavelet OFDM</td>
</tr>
<tr>
<td><strong>Transmission PHY Rate</strong></td>
<td>1Gbps</td>
</tr>
<tr>
<td><strong>Access Method</strong></td>
<td>CSMA/CA, Dynamic Virtual Token Passing</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>AES 128-bit Encryption</td>
</tr>
<tr>
<td><strong>Error Correction</strong></td>
<td>Reed-Solomon/LDPC-CC</td>
</tr>
<tr>
<td><strong>Coexistence</strong></td>
<td>ISP (Inter-System Protocol)</td>
</tr>
<tr>
<td><strong>Routing</strong></td>
<td>CMSR (ITU-T G.9905)</td>
</tr>
<tr>
<td><strong>IP Support</strong></td>
<td>IPv6 (IETF)</td>
</tr>
</tbody>
</table>
IEEE1901-2020: Flexible Channel Wavelet OFDM

Single Standard – World of Applications

- 4 Channels at 62.5Mbps
- 4 Channels at 125Mbps
- 4 Channels at 250Mbps
- 2 Channels at 500Mbps
- 1 Channel at 1Gbps

15 User Selectable Frequency Channels
CMSR: A Giant Leap Forward for LON Networks

ITU-T G.9905 Centralized Matric-Based Source Routing Extends Range, Robustness & Scalability

**MULTI-HOP CAPABILITY**
Extends range up to 10x; supports distances up to several km; scalable up to 1024 nodes

**MESH NETWORKING**
Selects best route based on link quality; improves coverage and system robustness

**INDUSTRIAL-GRADE PERFORMANCE**
Ideal for time-varying transmissions; low control overhead; routing load independent of number of nodes
<table>
<thead>
<tr>
<th>Feature</th>
<th>RS485</th>
<th>IEEE 1901-2020 (HD-PLC)</th>
<th>IEEE 802.3 (Ethernet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY Speed (bps)</td>
<td>10M</td>
<td>1G</td>
<td>10M/100M/1G</td>
</tr>
<tr>
<td>Max Range (m)</td>
<td>10</td>
<td>2,000+</td>
<td>100</td>
</tr>
<tr>
<td>No. of Nodes</td>
<td>64</td>
<td>1024</td>
<td>100</td>
</tr>
<tr>
<td>IP-Based</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High Security</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Plug-and-Play</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Free Topology</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Ether and Serial Bridging</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Repeater Functionality</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Wiring</td>
<td>Twisted pair</td>
<td>Any wire</td>
<td>CAT5</td>
</tr>
</tbody>
</table>

HD-PLC: Purpose-Built for Industrial IoT

Robustness of RS-485 with the Performance of Ethernet
Integrating Islands of Automation
Simple Bridging Enables System Convergence

Internet Router

Ethernet

HD-PLC Bridge

Any Wire

Power Line

Twisted Pair

COAX

HD-PLC Bridge

RS-485

Twisted Pair

HD-PLC Bridge

RS-485

Power Line

Coaxial Cable

Security Camera / Video Entry Systems

Controllers / Sensors / Actuators

HD-PLC Bridge

Ethernet Extender

Ethernet ↔ RS-485

RS-485 ↔ RS-485

Power-over- COAX (PoC)

Power-over Ethernet (PoE)

Wireless Bridge
Key Takeaways

- HD-PLC is the most advanced high-speed wireline communication standard for Smart Cities
- Based on IEEE1901-2020 PHY/MAC, and ITU G.9905 routing standards
- Adopted by ISO/IEC 14908-8 Standard for High-Speed Wireline Communications and Control Networks
- Provides higher data rates, more security, and wider coverage than RS-485
- Provides longer range, IETF IPv6, higher # of nodes, and lower cost than Ethernet
- Works on any wires (power lines, twisted-pair, CAT5, RG58, COAX…)
- Protocol independent: can support LON, BACnet, KNX, MODBUS…
- Free topology provides flexibility and freedom in your network designs
- Interoperability and certification provided by HD-PLC Alliance and Lonmark International
- Multi-source solution (chip/module/box) to ensure availability and support
The New High-Speed Network

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