LonMark® International

Cost Effective IP-Based High-Speed Wireline Communication Technology

Breaking Though Cost Barriers

Shout Out

David Kniepkamp - Presenter

President

Smart Controls LLC

Michael Navid - Contributor

CEO & Founder

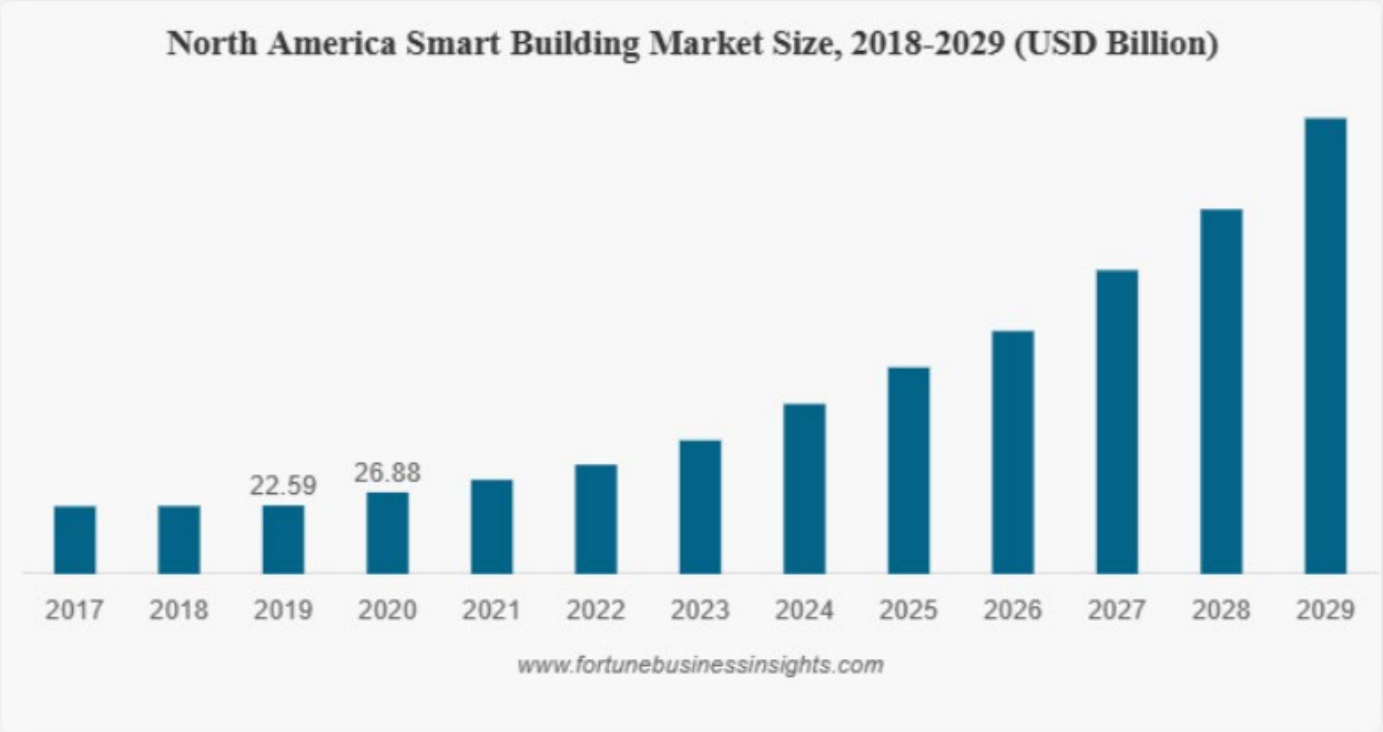
Ecolinqx

MegaChips – Technical Contributions

Jump On It!

- Urbanization Increasing
- Energy Demands
- Healthy Workspace
- Safe Workspace

Onwards & Upwards!



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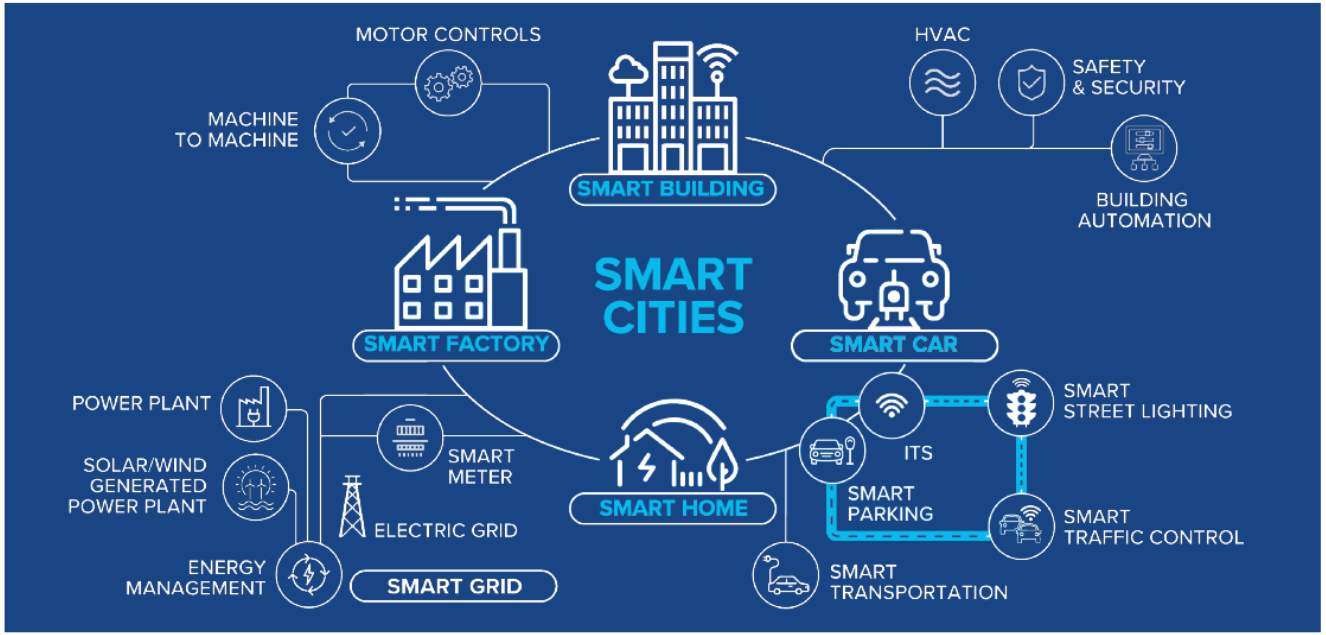
Opportunity Knocks!



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

*Statista 2021

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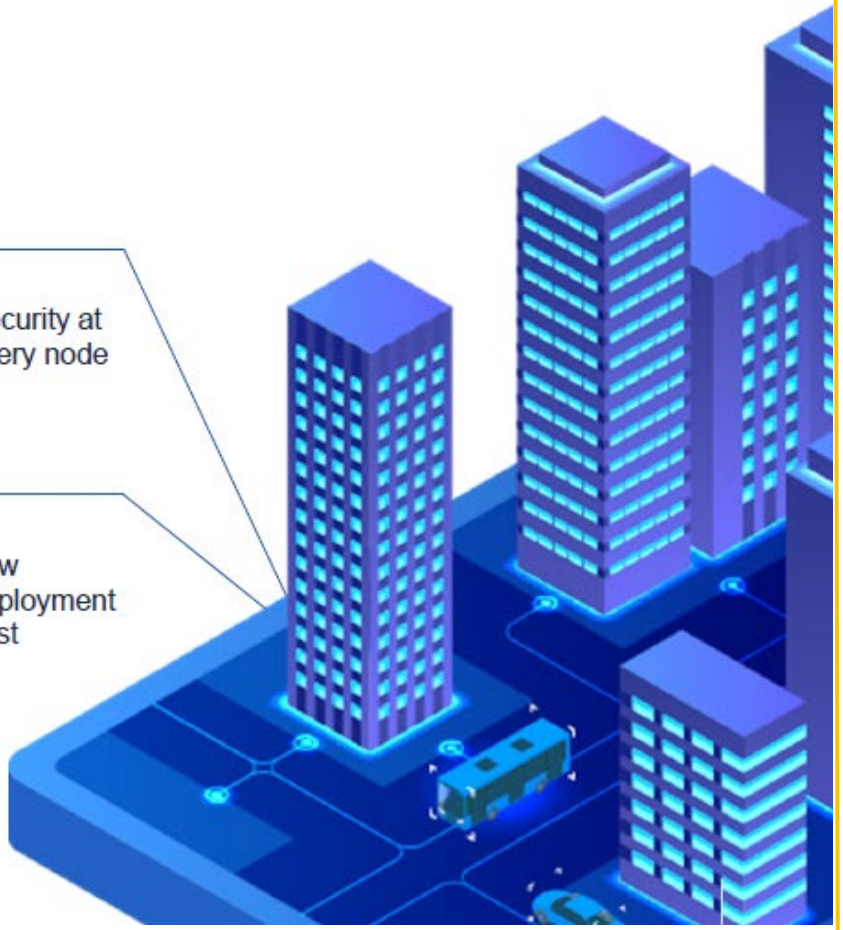
Get Your Game On!

- Higher bandwidths
- Support more nodes
- Longer range
- IP-Based
- Security at every node

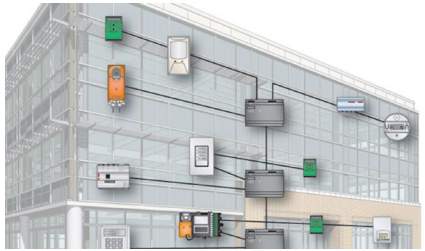
- Fast response times
- Standards based
- Multi-source
- Interoperable
- Low deployment cost



Hybrid Control

WIRELESS

SERIAL



Narrow-Band
POWER LINE

EHTERNET

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Wireless Solutions

- Zigbee
- Z-Wave
- EnOcean

Convenience

Quickly Install
Plug-and Play Autodiscover
Mesh Networking

Performance

Data Rates – 250kbps (ideal)
Line-of-Site
Range Limitations
Interference

Wired Solutions

- BACNET
- MODBUS
- LONWORKS

Convenience

Serial – Long Distance
Ethernet – Fast Data Rates
NB Power Line – Easy Install

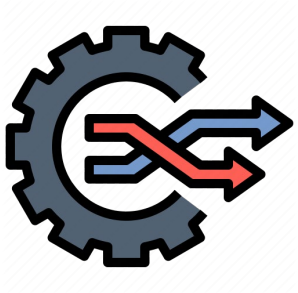
Performance

Serial – Slower Data Rates
Ethernet - Costly
NB Power Line – Sized Limited

Challenges

- Islands of Automation Created by Multitude of Communication Protocols and Media
- Reduce the Cost and Complexity of Deployment

Tasks to Overcome



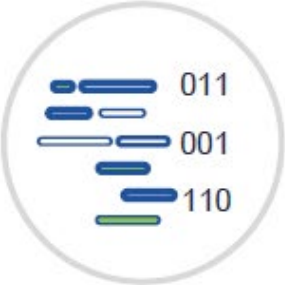
- Integration of Control Networks

- Convergence of OT with IT

- Distribution of Intelligence Across Endpoints

- Standardized and Interoperable Communication Network

Advantage 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

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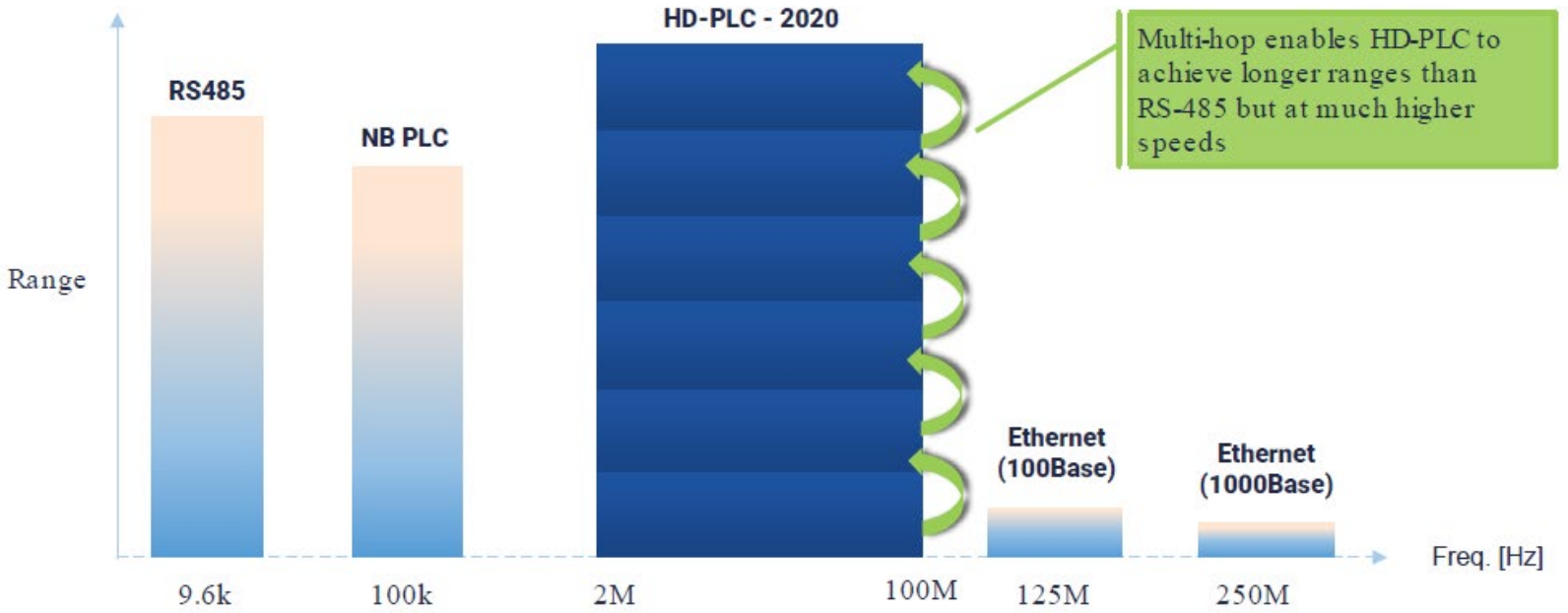
HD-PLC Provides Solutions



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.

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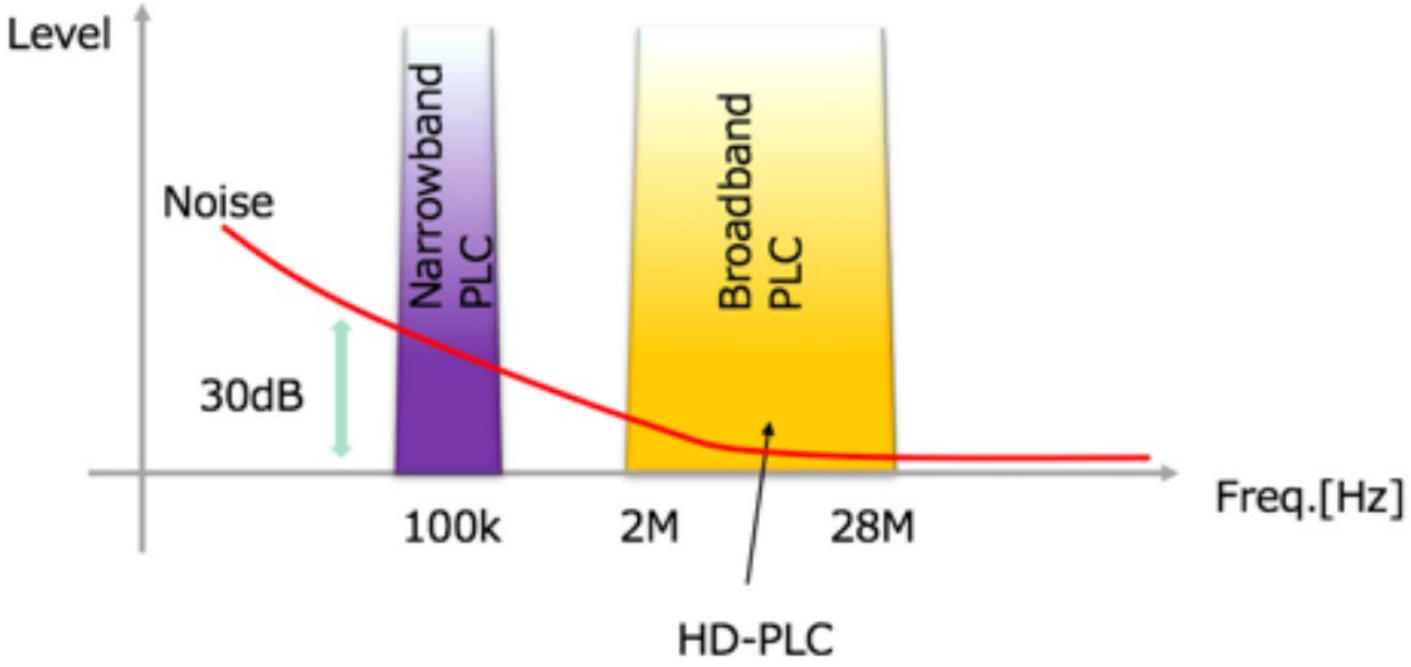
Avoiding Noise



What is HD-PLC?

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

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

HD-PLC LONMARK® INTERNATIONAL IEEE IEC ISO

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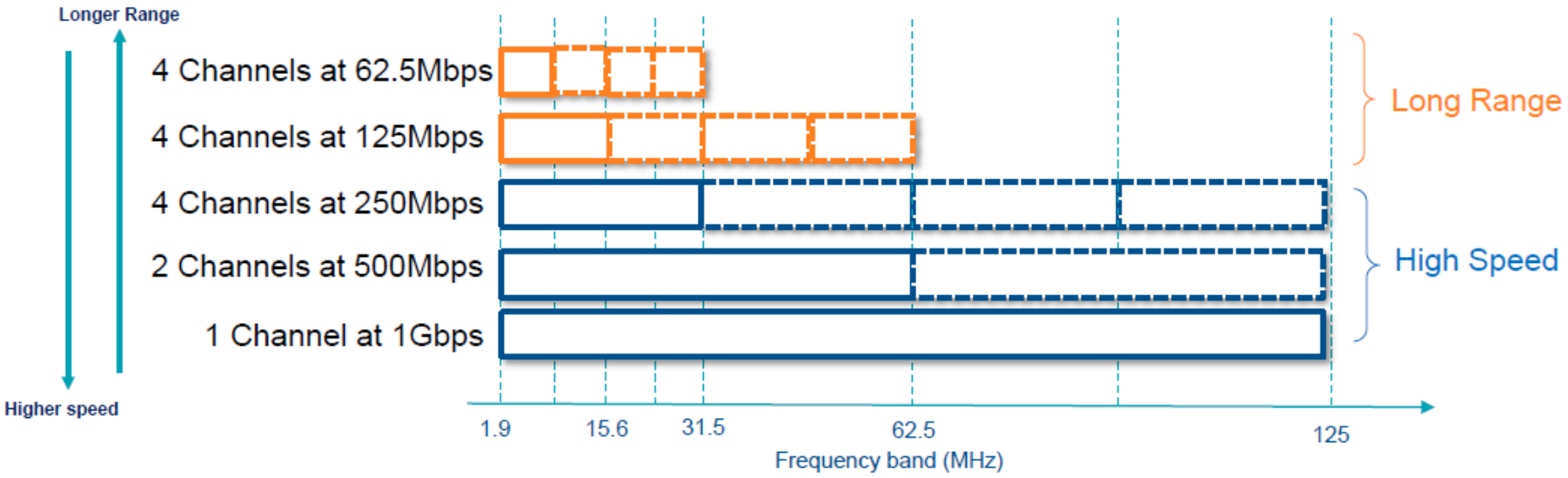
IEEE1901-2020: Flexible Channel Wavelet OFDM

Single Standard – World of Applications



15 User Selectable Frequency Channels

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CMSR: A Giant Leap Forward for Control Networks

ITU-T G.9905 Centralized Metric-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

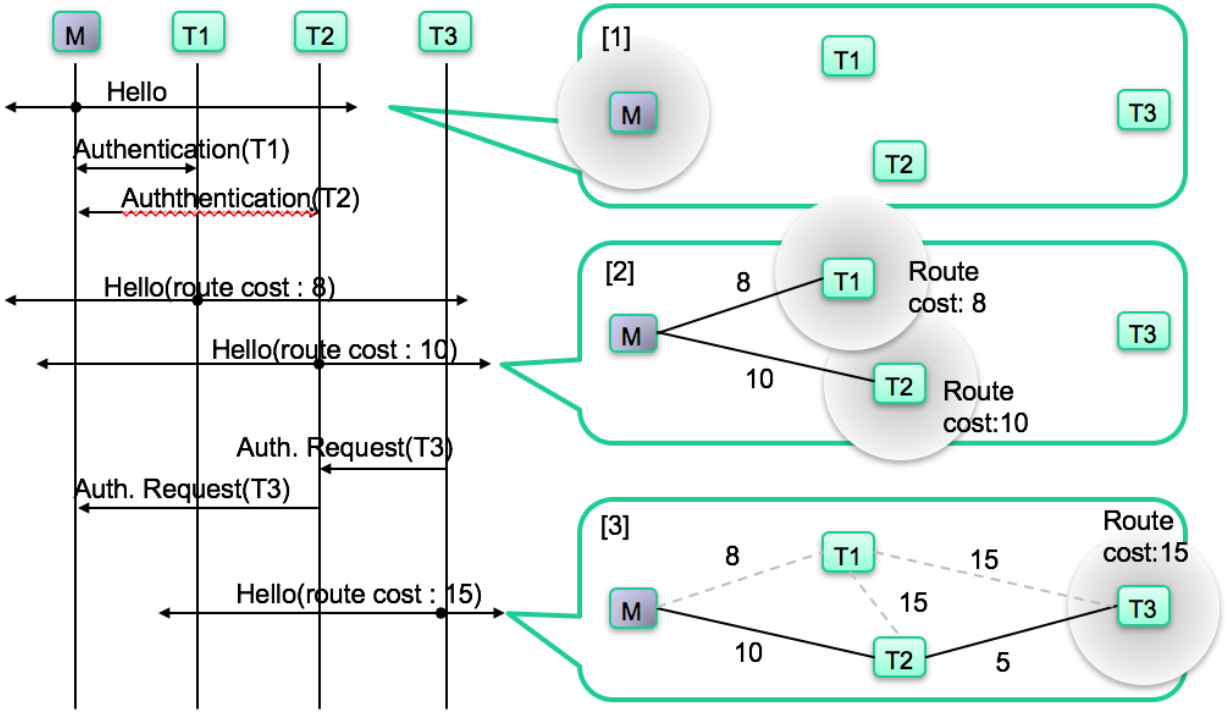
MESH NETWORKING

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

HD-PLC Multihop Route Construction



HD-PLC: High Performance Cost Effective

	HD-PLC	RS-485	ETHERNET
PHY Speed (bps)	500M	100k	10M/100M/1G
Max Range (m)	2,000+	1000+	100
No. of Nodes	1024	64	100
Free Topology	✓	✓	X
IP-Based	✓	X	✓
High Security	✓	X	✓
Ether and Serial Bridging	✓	X	X
Repeating	✓	X	X
Wire Type	Any wire	Twisted pair	CAT5

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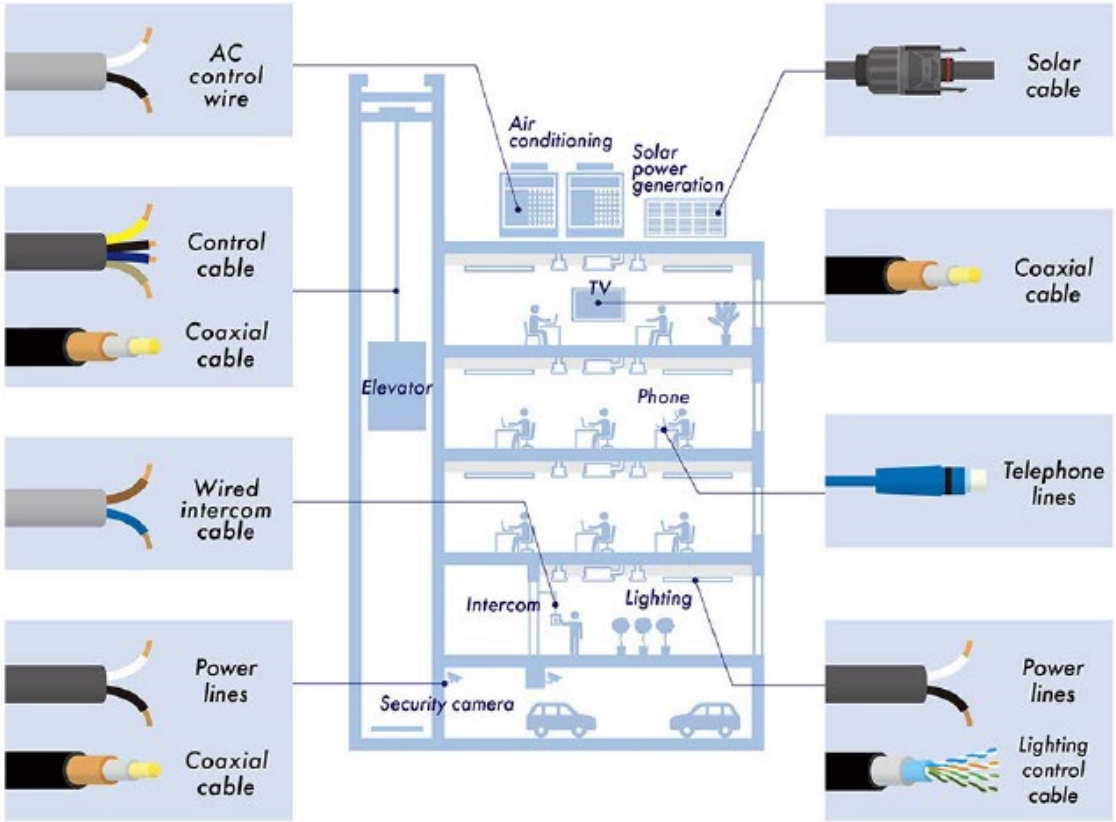
Integrating Islands of Automation



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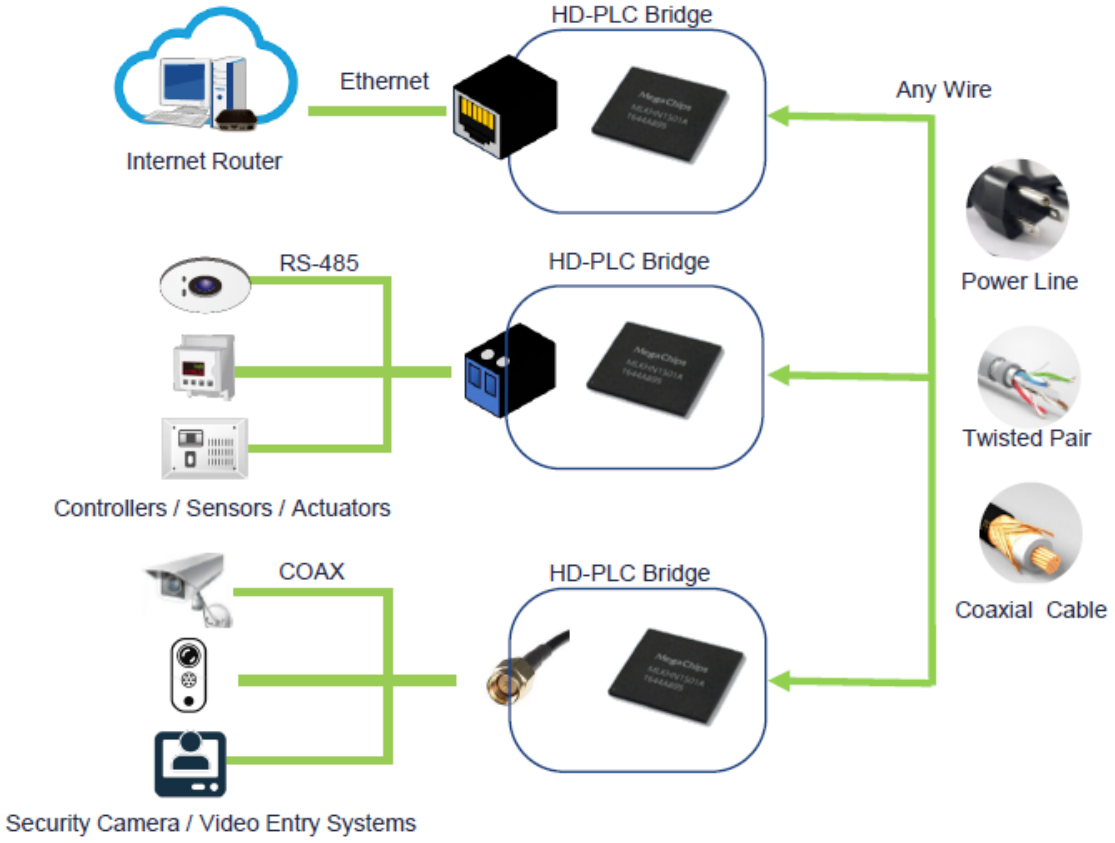
Simple Bridging Enables System Convergence



1. Ethernet Extender
2. Ethernet ⇔ RS-485
3. RS-485 ⇔ RS-485
4. Power-over- COAX (PoC)
5. Power-over Ethernet (PoE)
6. Wireless Bridge

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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

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Thank You!

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