



Secure Wired Communication for AI-Driven Smart Infrastructure

February 3, 2026

BROUGHT TO YOU BY:

LONMark International and Nessum Alliance

AHR Expo 2026

AGENDA

- Smart Building Market Overview
 - Market Trend/Requirements

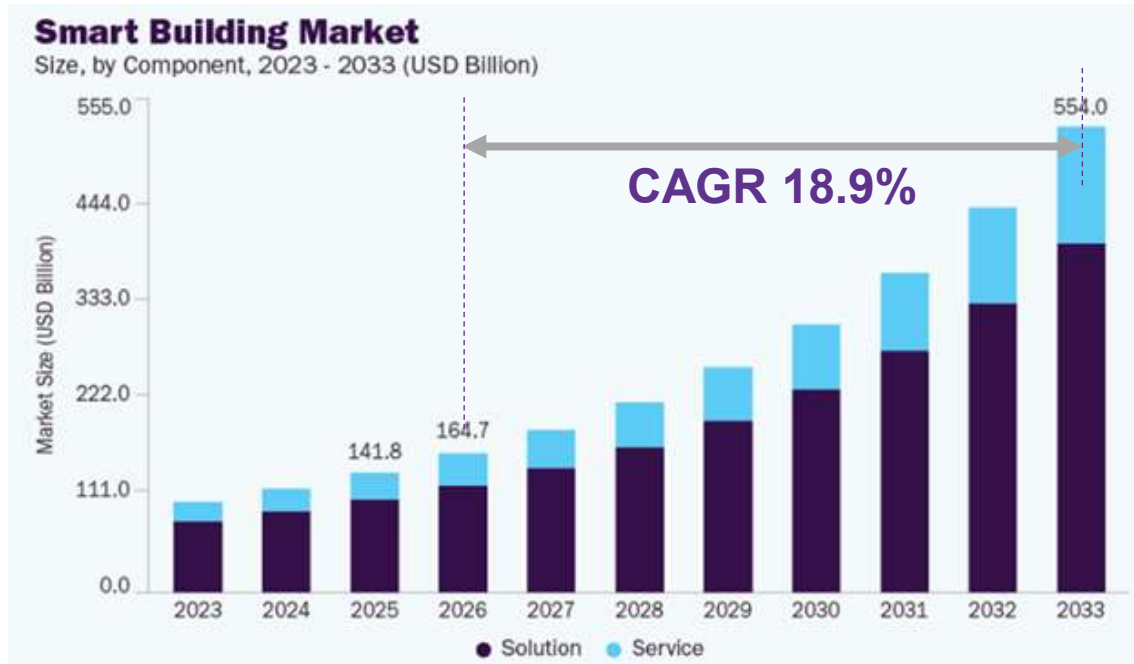
Speaker: Nobu Kodama, Marketing WG Chair - Nessum Alliance
- Introduction to IEEE1901-2020 Nessum
 - Nessum-Wire Specifications
 - Technology Comparison

Speaker: Nobu Kodama, Technical Marketing - Nessum Alliance
- Introduction to Nessum and Building Automation Protocols
 - Lonworks/BACnet over Nessum

Speaker: Ken Tamukai, Technical Advisor - Nessum Alliance
- Introduction to Nessum Alliance
 - Mission and Initiatives
 - Certification / Interoperability

Speaker: Kota Matsuo, Sr. Vice-President - Nessum Alliance

Global Smart Building Market Forecast



SOURCE: <https://www.grandviewresearch.com/industry-analysis/global-smart-buildings-market>

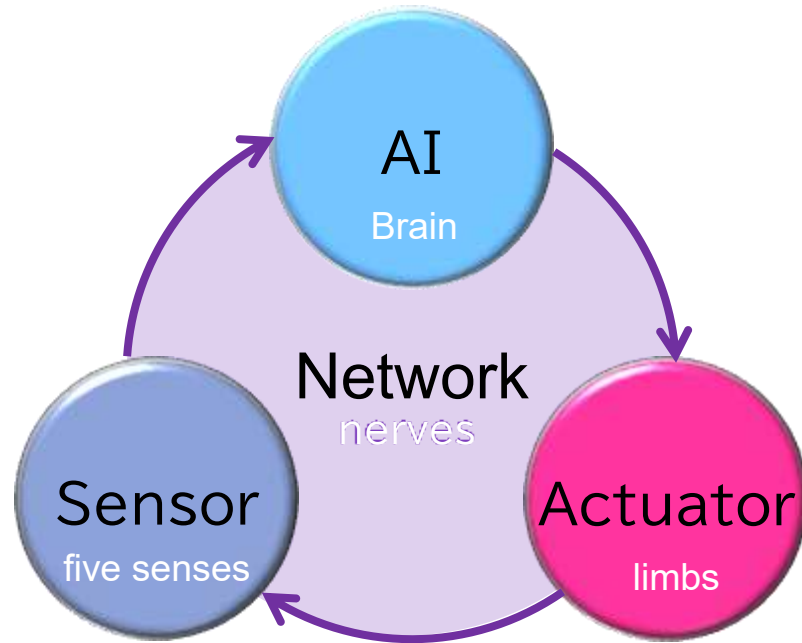
Key Drivers of High Growth

- 1. Decarbonization (GX):**
Strengthening energy-saving regulations to achieve carbon neutrality.
- 2. Redefining workplace value:**
Enhancing worker productivity and well-being.
- 3. Labor Shortage:**
The urgent need for unmanned and automated building management and maintenance.

Against the backdrop of decarbonization (GX) and labor shortages, buildings are dramatically evolving into “autonomous infrastructure.”

Smart Building Components

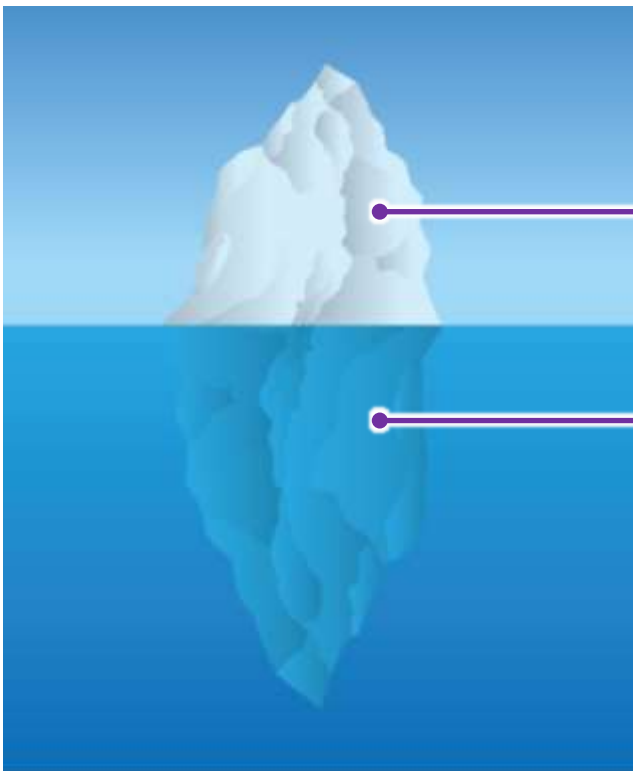
The success or failure of AI, the “brain,” hinges entirely on the quality of the “network,” its nervous system.



Network reconstruction is necessary, but...

Infrastructure reconstruction costs hindering Smart Building adoption

The success or failure of AI implementation hinges on how effectively the underlying “infrastructure reconstruction costs” can be managed.



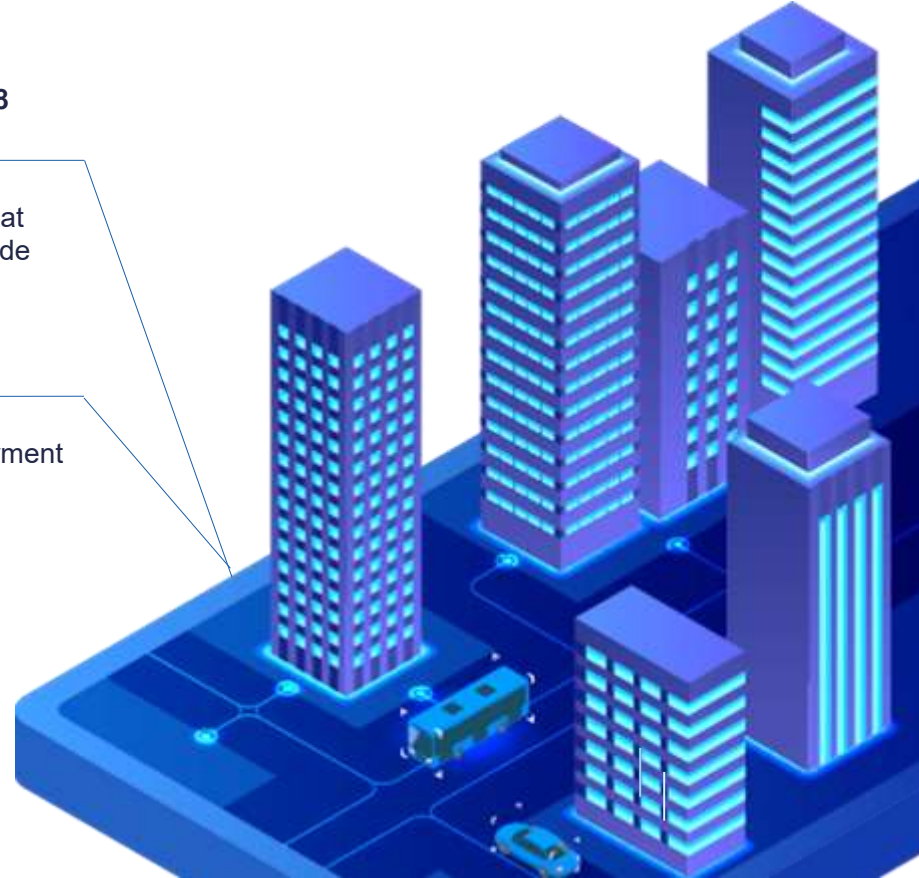
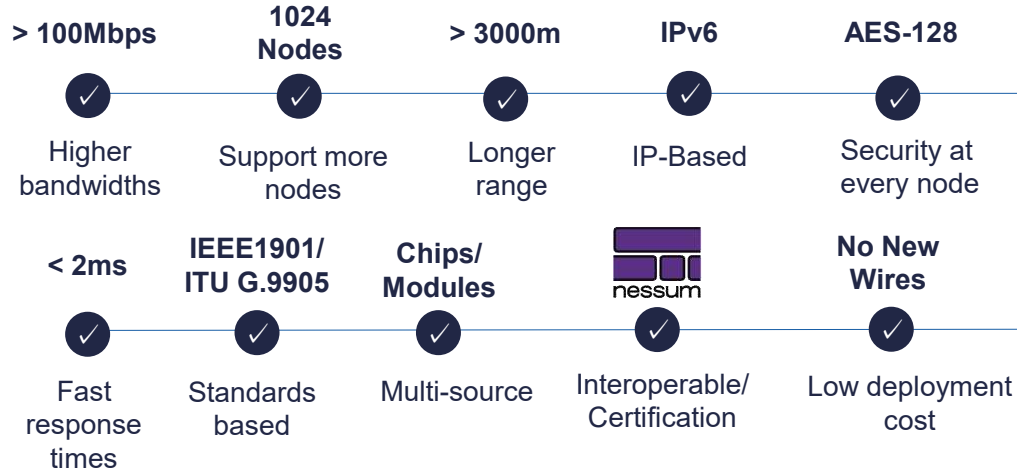
Visible cost: approx. 30%

- AI Applications / Software:
Flashy dashboards, analytics tools, and user apps.

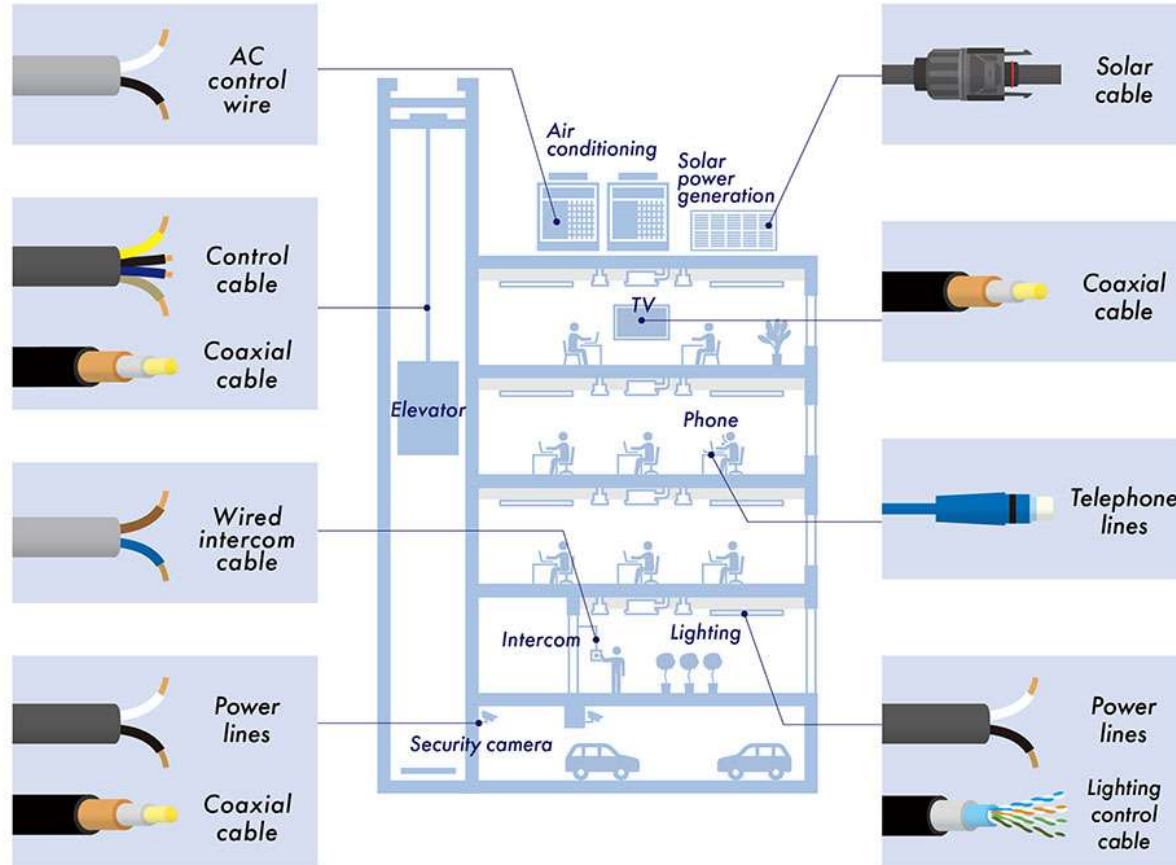
Hidden massive costs: approx. 70%

- Physical infrastructure:
LAN cabling, power wiring, hub expansion.
- Existing equipment retrofits:
Replacement of old controllers, analog-to-digital signal conversion.
- Security design:
Segmentation to prevent external attacks, advanced configuration.

Smart Building Network Requirements



Simple Bridging Enables System Convergence



Takeaways

- ✓ Nessum-Wire is the most advanced wireline communication standard today
- ✓ 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 Nessum Alliance
- ✓ Multi-source solution (chip/module/box) to ensure availability and support

Next-Generation Building Automation Innovation Technology Nessum (IEEE 1901)

Nessum Alliance

About Nessum WIRE



Technology to carry information on any cable



Flat Cable



Twisted Pair Wire



coaxial cable



Power Line

Value Provided

**Renovate communications
without changing wiring**

**Make your building smarter with
Secure, high-speed IP communication**

Nessum's Features

Large Scale Network



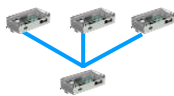
Master

Up to 1024

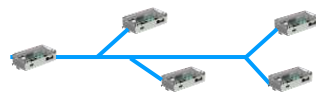


Terminals

Free Topology



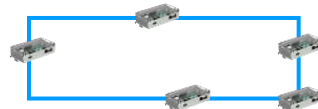
Star



Bus (Multi-drop)



Daisy chain

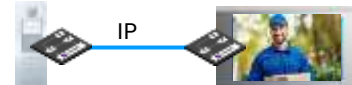


Ring

IP Communication



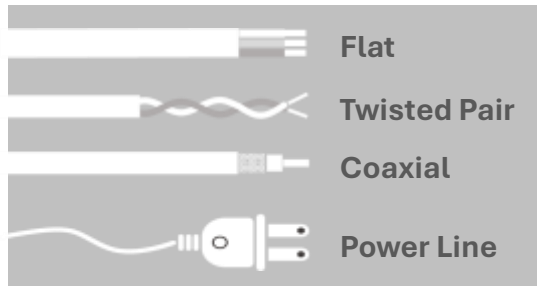
Analog



Embedded Nessum LSI

With Existing Wires

Any Wire



Flat

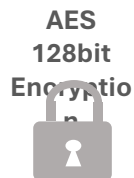
Twisted Pair

Coaxial

Power Line

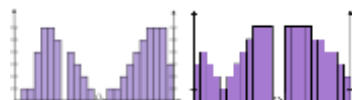
Mbps class communication

Higer Security



AES
128bit
Encryption

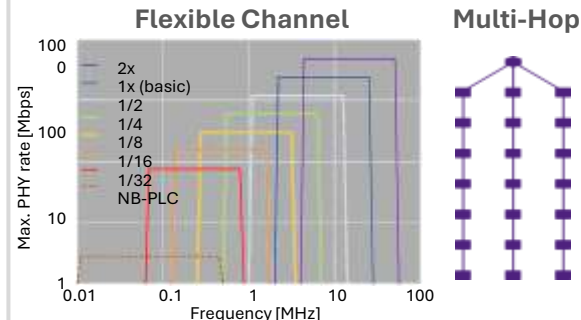
Max. 7432
Modulation Patterns



+

IEEE 802.1x Authentication
(IEEE 1901b)

Long Distance



Changes in the surrounding environment - topics related to Nessum

From the second half of 2024, DAIKIN launched the latest model equipped with Nessum

Nov. 2024: Released products w/ Nessum

【November 2024】

Released Nessum-equipped air conditioner VRV7 in Japan

●VRV7シリーズの冷媒転換を基点としたDM-NETの適用

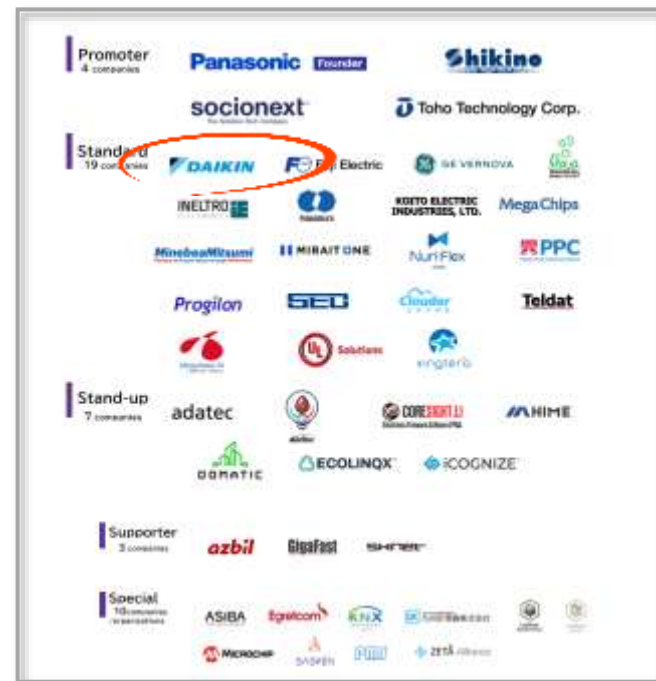
DM-NETでは、通信の高速化、データ通信の大容量化を実現するため、通信方式を大きく刷新しました。DⅡ-NETとの互換性は持たず、同一系統の室外と室内ユニットを同時に更新が必要になります。2025年より冷媒R410AからR32へ転換されるVRV7の発売タイミングよりDM-NETの適用を順次拡大していきます。

(Excerpt from Daikin's website)

【January 2025】

Launched air conditioners equipped with Nessum communication in North America.

Jul. 2025: Joined the Alliance



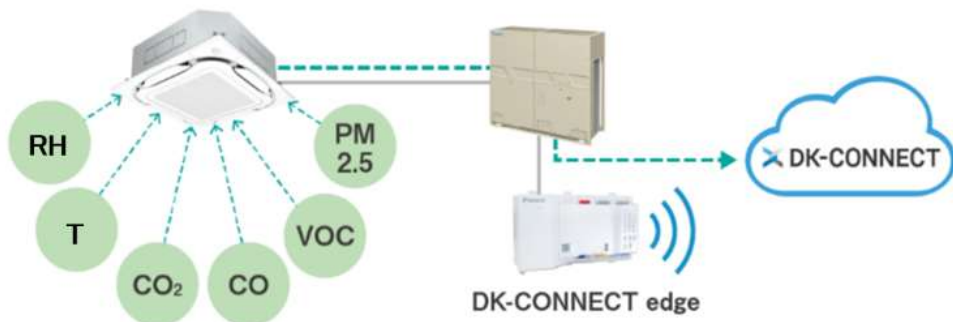
The Reason why DAIKIN adopts Nessum

Improving comfort, security, energy savings, and ease of deployment

Frequent data collection and detailed control require
"secure, high-speed stable communication"

With accelerated communication speeds, Nessum enables seamless integration with external sensors, achieving a perfect balance between comfort and energy efficiency.

By utilizing existing wiring for IP communication, it allows for easy remote configuration of device identification labels, streamlining installation processes.



The need for secure, high-speed, and stable communication

The same needs are increasing in fields other than HVAC

The European Cyber Resilience Act (CRA) came into force in December 2024

"High security" and "IP support" of equipment are urgently needed

Commercial AC

Instrumentation

Apartment
Intercom

High-security and IP-compatible communication tech that can be introduced with simple construction is desired.

Nessum WIRE Standout Differentiators

- Establishing a **secure** (data encryption, IEEE 802.1X compliant) **network** environment
- **Improving maintainability** and **reducing operational load** by switching to IP easily
- **Improving equipment and system performance** by increasing communication speed (from a few Mbps to tens of Mbps)
- **Reducing installation costs** and **shortening of construction period** by utilizing existing wiring

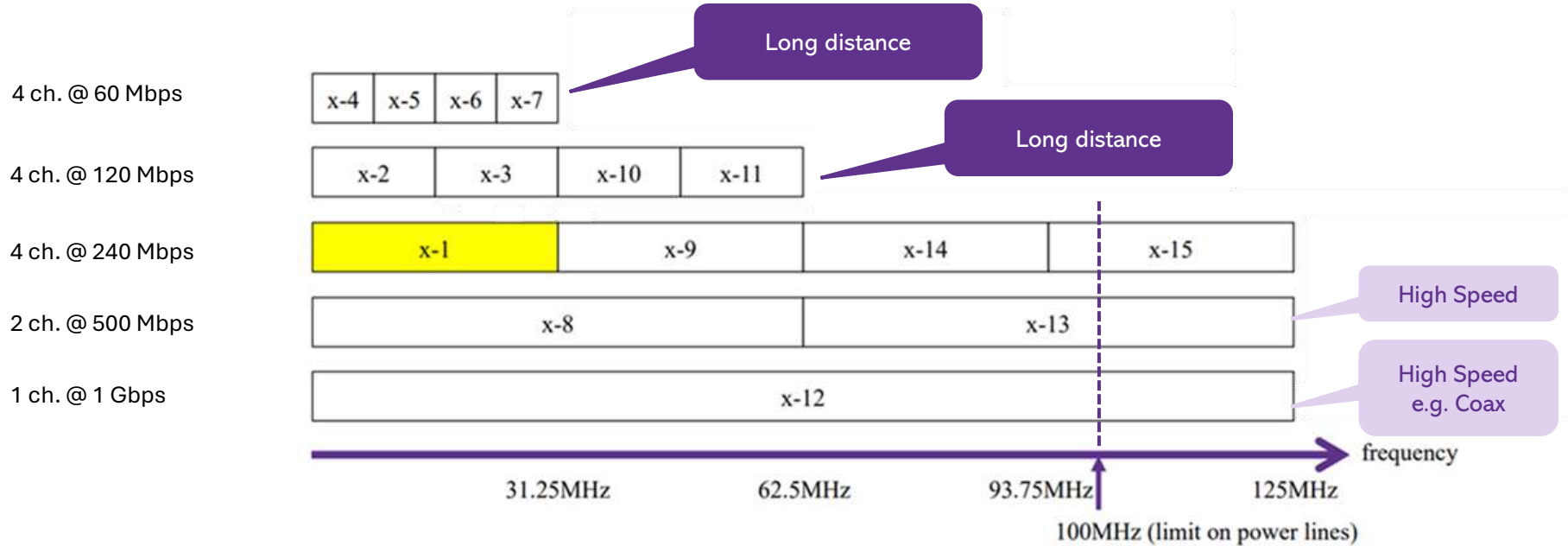
Nessum WIRE vs. 10BASE-T1L vs. 100BASE-T

	Nessum WIRE	10BASE-T1L	(ref) 100BASE-T
Standard	IEEE 1901	IEEE 802.3cg	IEEE 802.3ab
Comm. Speed	Several to tens of Mbps(*)	10 Mbps	100 Mbps
Comm. Distance	Several km ^(*) (Max. x10 extension with multi-hop)	1,000 m	100 m
Connection	Point-to-Multipoint (Free Topology / 1,024 nodes)	Point-to-Point (Star / Daisy chain with dual port devices)	Point-to-Point (Star)
Cable	Any type of cable (No new wiring)	SPE cable (Existing cables may be reusable)	> Cat5 cable

* Depends on the type of cable and communication environment

High Speed / Long Distance Technology

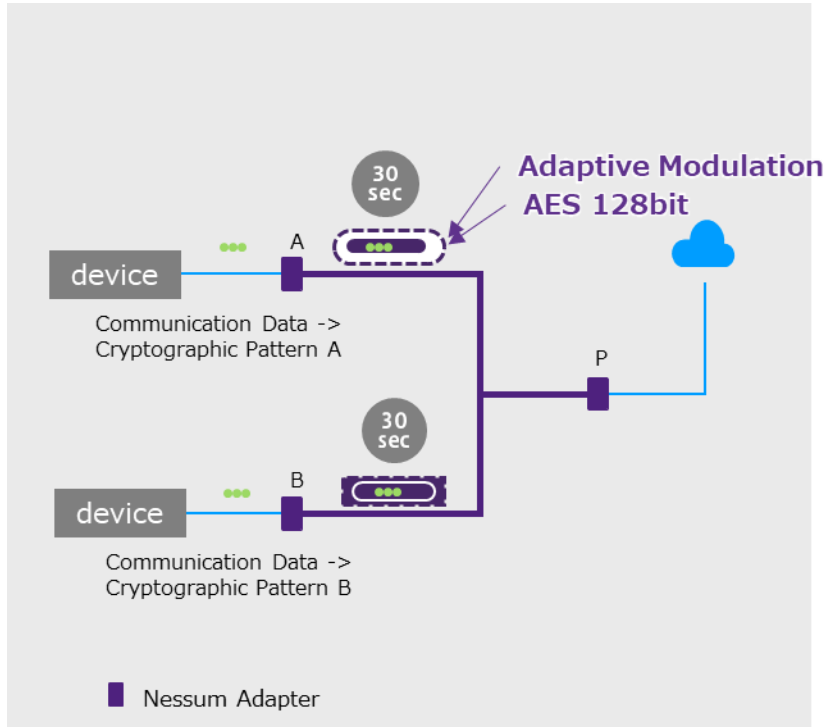
Nessum supports Flexible Channel mode



x-1 Basic channel (2M to 28MHz)

Stronger Nessum Security Technology

Two main types of encryption methods for more secure communication

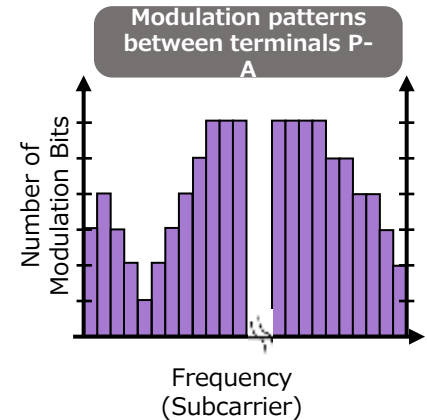
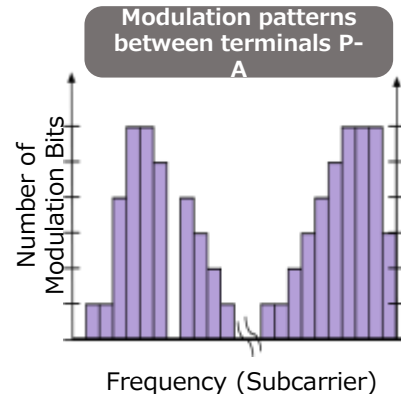


•AES 128bit

A cryptographic method that is widely used today. There are 2^{128} patterns, so it is said that there is no practical method of attack at this time.

•Adaptive Modulation

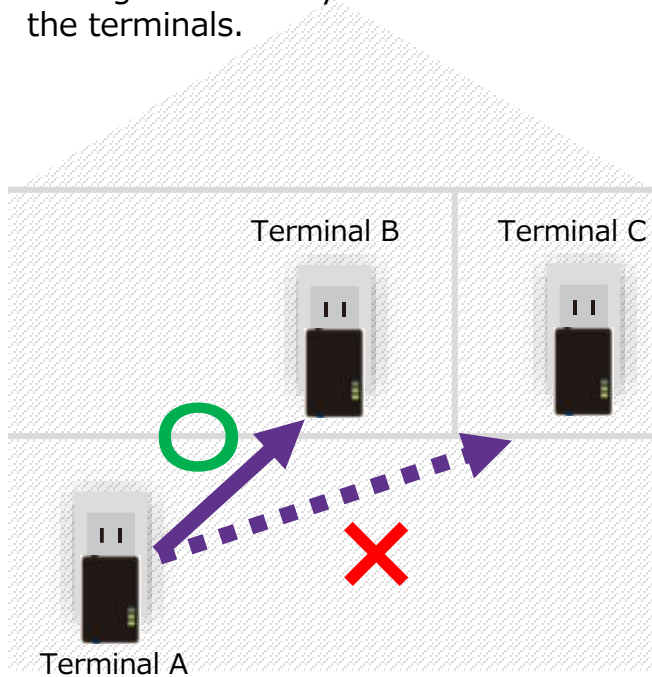
A modulation pattern that changes between terminals to match the frequency characteristics of different transmission lines between terminals. There are up to 7^{432} patterns, and they are updated every 30 seconds, so it is extremely difficult to eavesdrop.



Multi-hop enables long-distance communication of several km

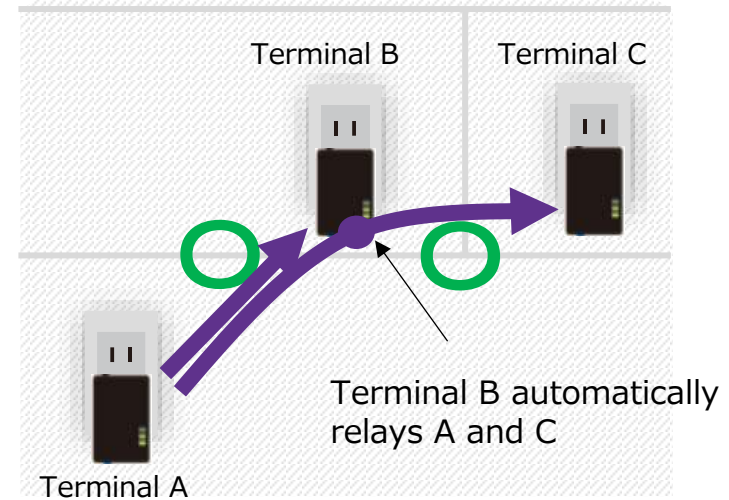
No multi-hop

Communication is possible only when the signal is directly visible between the terminals.



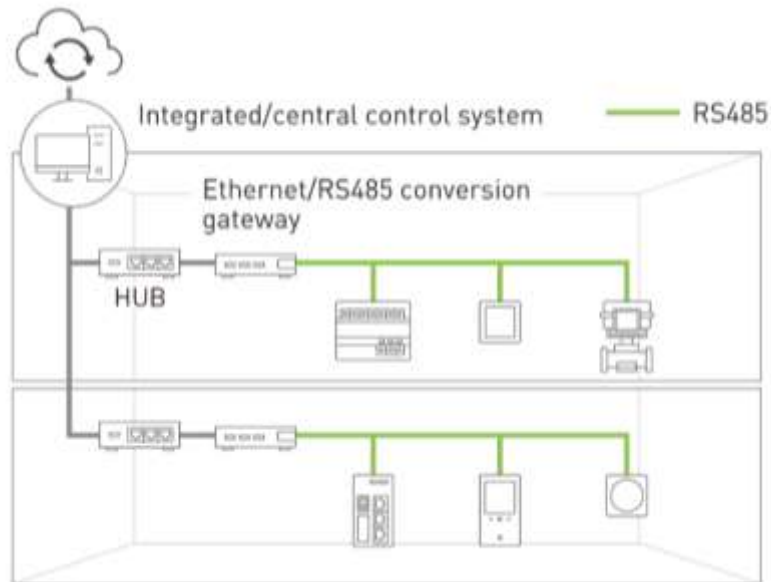
With multi-hop

The automatic relay function allows communication between terminals that cannot communicate directly. The communication distance can be extended by increasing the number of relays.



Ex.1: IP conversion of existing wire network – Ethernet

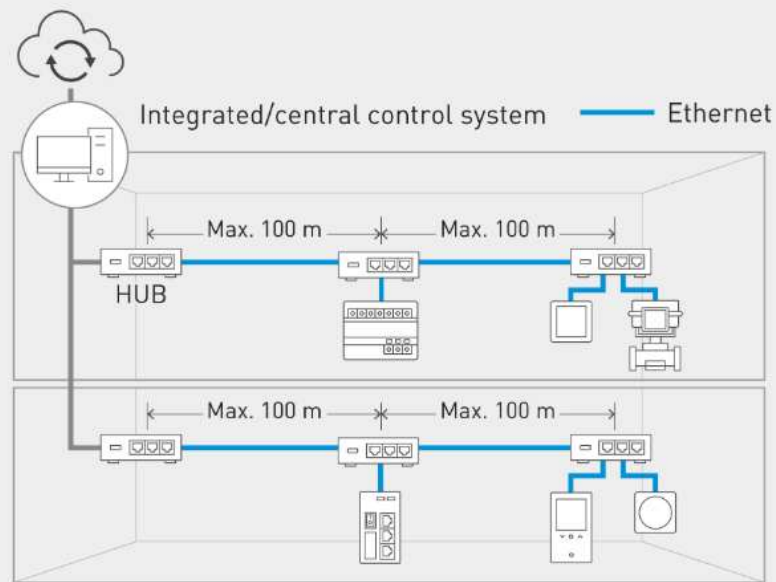
Before Existing 2-wire cable system [non-IP]



For 10BASE-T1L

Since it does not support **bus-type connections**, hubs are required at the junctions, and the cable is an SPE cable, but it is wired like Ethernet

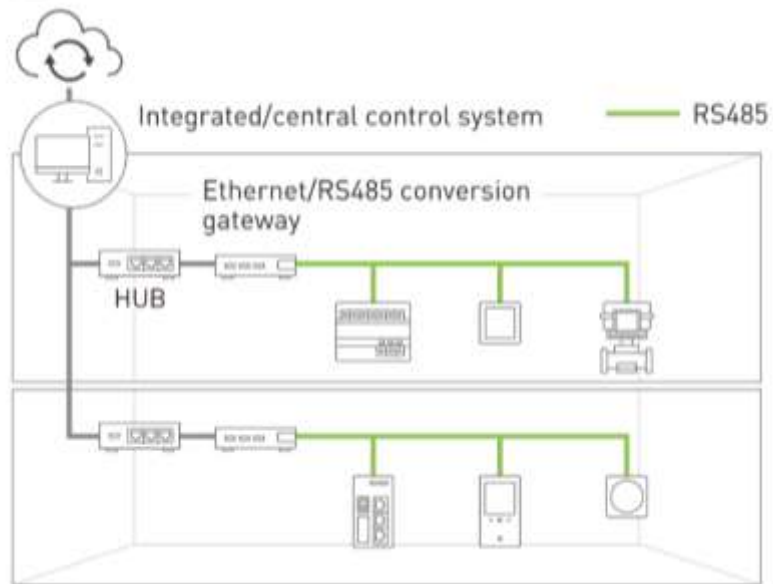
After IP with Ethernet



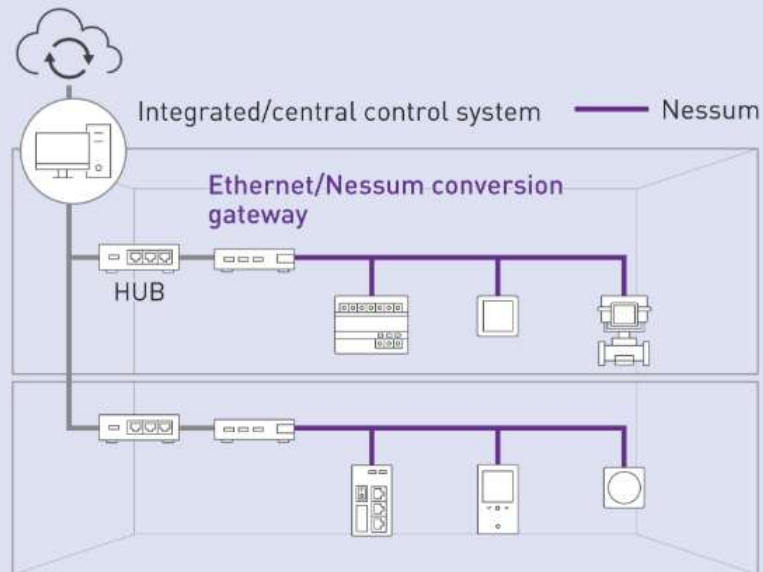
- Replacing 2-wire cables with Ethernet cables
- Switching hub required every 100 meters
- Length of wiring is longer due to constraints of star wiring

Ex.1: IP conversion of existing wire network – Nessum

Before Existing 2-wire cable system [non-IP]



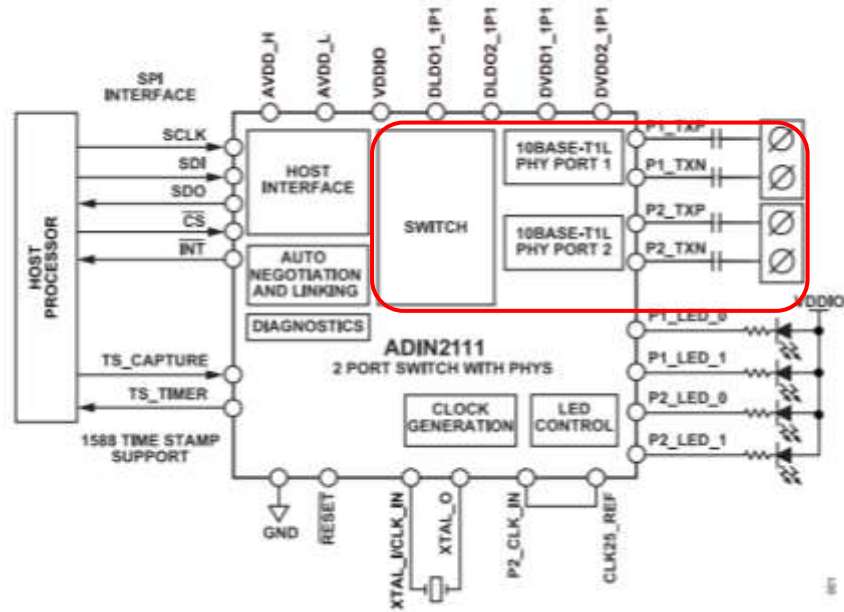
After IP with Nessum



- Reuse the 2-wire cable as it is (no need to re-install wires)
- Multi-hop tech allows comm. over long distances w/o worrying
- Just connect the terminal w/o worrying about the wiring topology.

Ex.1: IP conversion of existing wire network – 10BASE-T1L

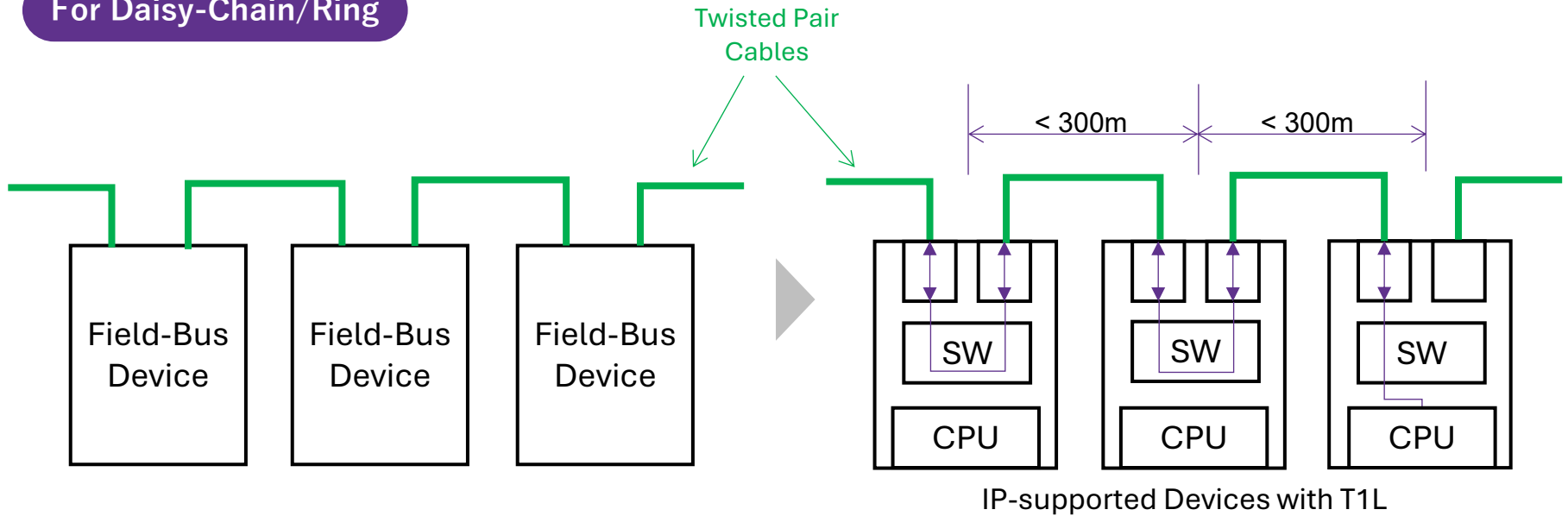
Manufacture IP devices with T1L using the dedicated chip



2-Port Ethernet Switch with Integrated 10BASE-T1L PHYs

Ex.2: IP conversion of existing wire network – 10BASE-T1L

For Daisy-Chain/Ring

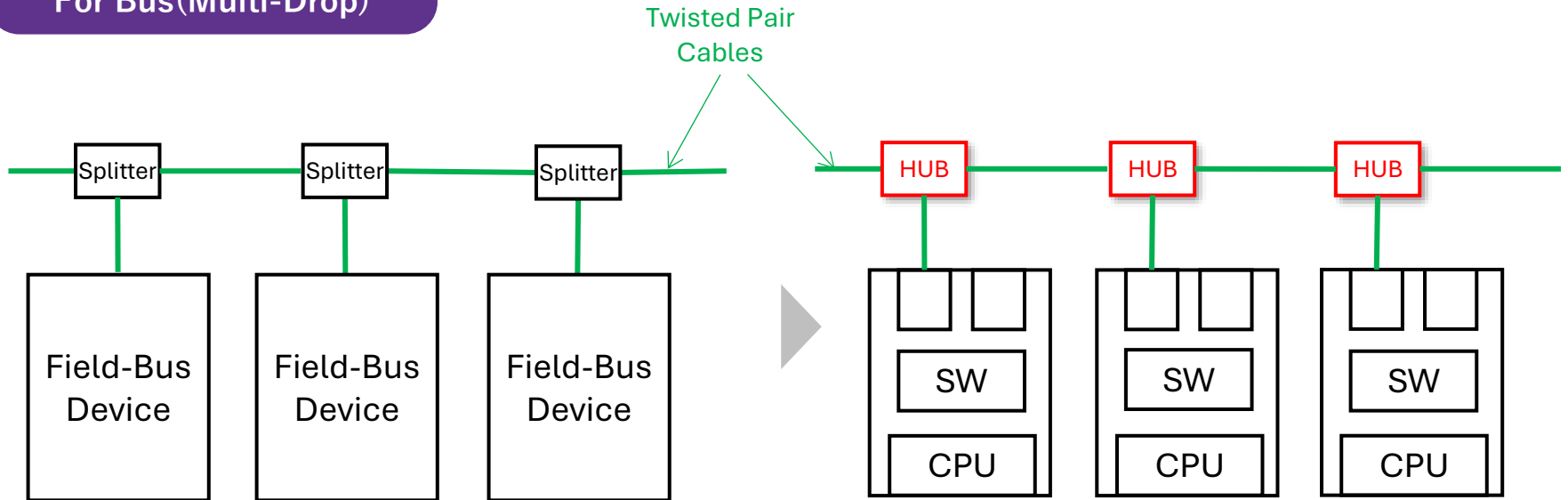


Existing cables can be used as-is
(However, there are restrictions on the distance between devices)

Supports daisy-chain (+ring) topology

Ex.2: IP conversion of existing wire network – 10BASE-T1L

For Bus(Multi-Drop)



IP-supported Devices with T1L

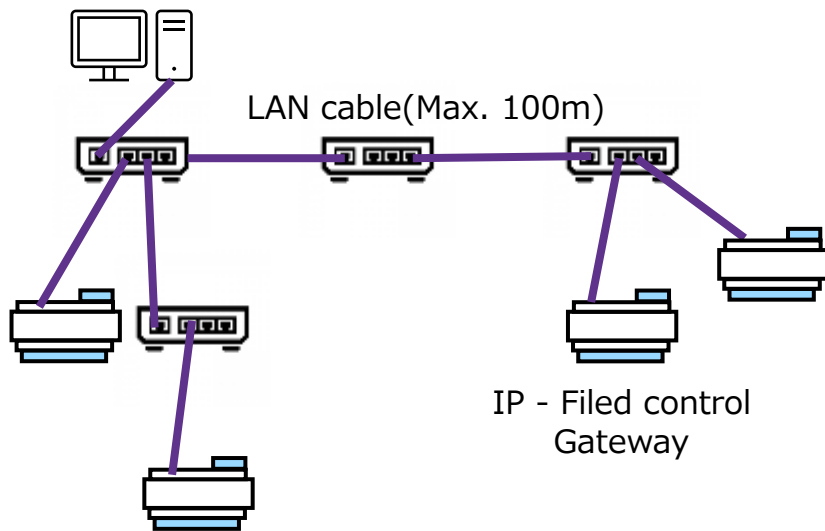
Existing cables can be used as-is,
but splitters must be replaced with HUBs

Basically, not support Bus(Multi-Drop) topology

Ex.2 IP Network installation for new facility construction

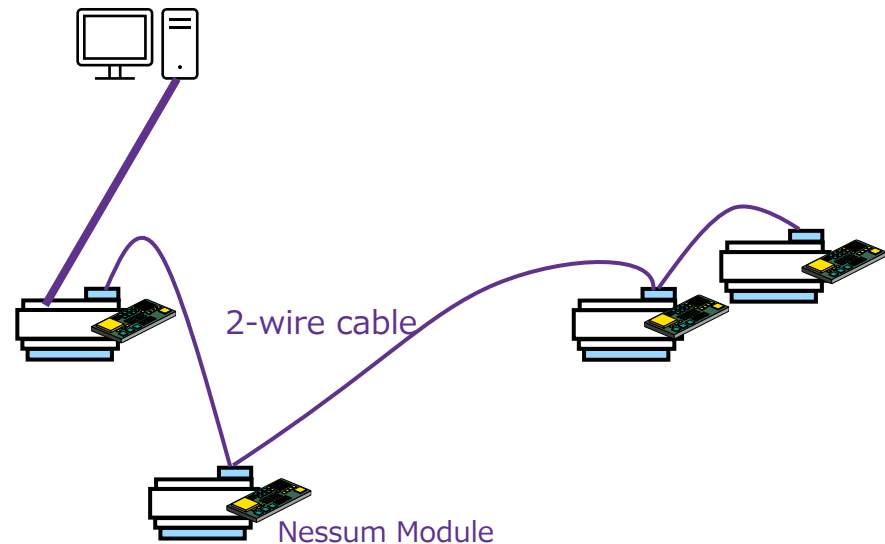
For Ethernet

Laying LAN cables requires cable costs, HUBs and wiring man-hours.



For Nessum

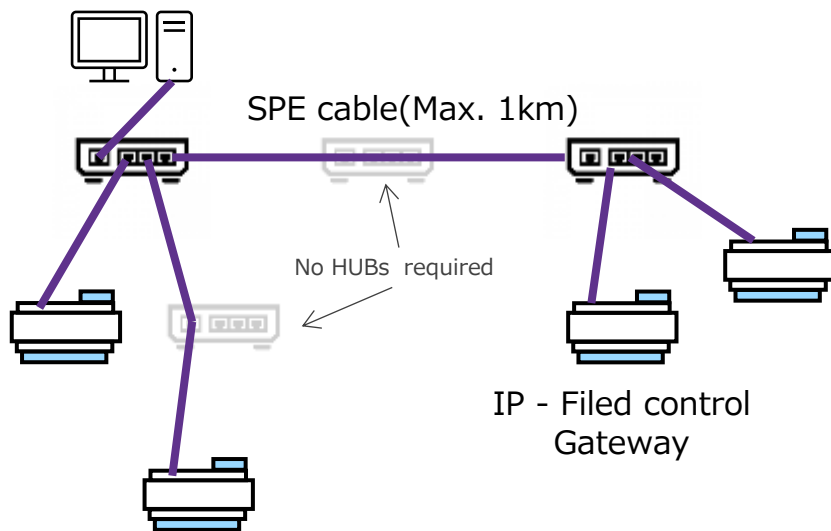
By adopting Nessum-embedded equipment, you can easily build new networks with free topology connections and long-distance communications. The wiring length can be kept short during installation, leading to cost savings.



Ex.3 IP Network installation for new facility construction

For T1L

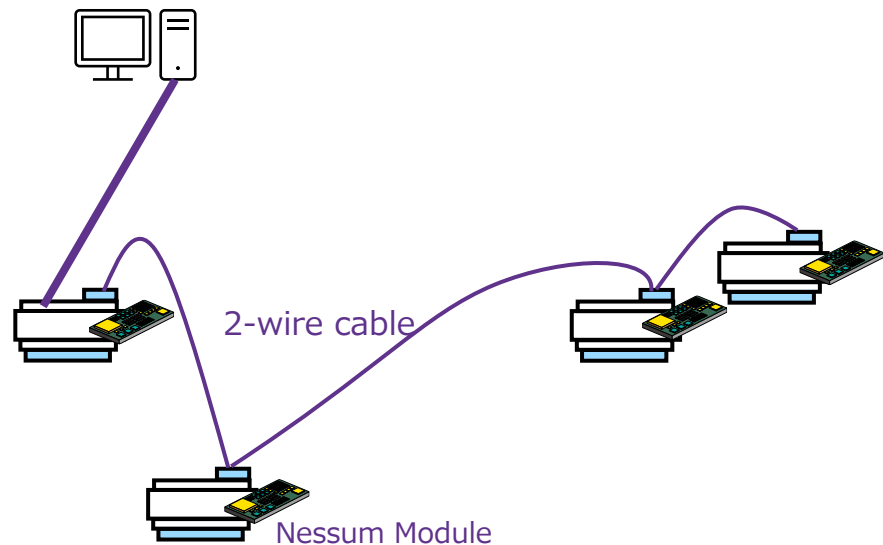
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For Nessum

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Cable	Any type of cable (No new wiring)	SPE cable (Existing cables may be reusable)	> Cat5 cable

* Depends on the type of cable and communication environment

Takeaways

✓ **Nessum** is technology to carry information **on any cable**

✓ **Nessum** has **6** main key feature

Large Scale Network

Free Topology

IP Communication

Any Wire

Higer Security

Long Distance

✓ **Nessum** already has been adopted by **DAIKIN** for their products

✓ **Nessum** is the only communication technology that supports both **free-topology** connections and **any types of cables**



Introduction to Nessum and Building Automation Protocols

Ken Tamukai

Why Building Automation Needs a New Physical / Link Layer ?

- Legacy field buses are bandwidth-limited
- Installation complexity (polarity, termination)
- Coexistence of non-IP and IP networks during transition
- Reuse of existing wiring is strongly desired

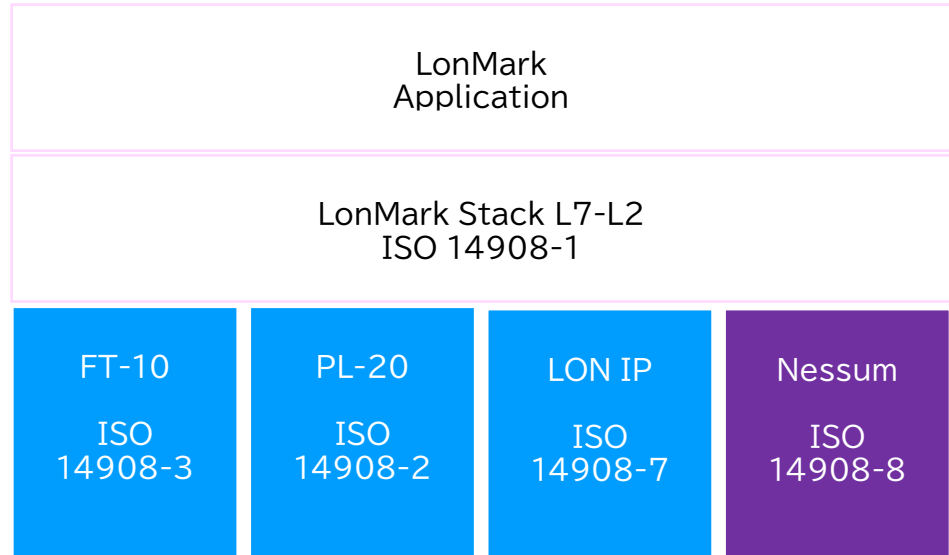
Agenda



LonMark Link Layer



LONMARK[®]
INTERNATIONAL



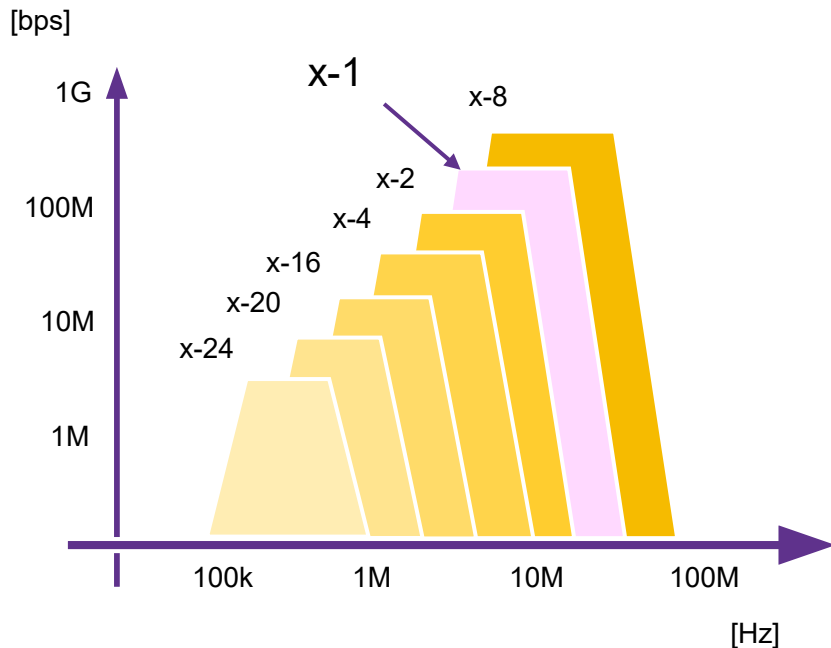
Nessum approved as one of link layer in 2020.

LonMark Link Layer Comparison

	FT-10	PL-20	Nessum(x-1) *with multi-hop
Topology	Free	Free	Free
Polarity	No	No	No
Termination	Required	No	No
Distance between two nodes	300m	~3,000m	500~1,000m
Total cable length	500m	~3,000m	~2,000m
Data rate	78kbps	5.4kbps	~10,000kbps

Nessum delivers higher bandwidth over existing wiring.

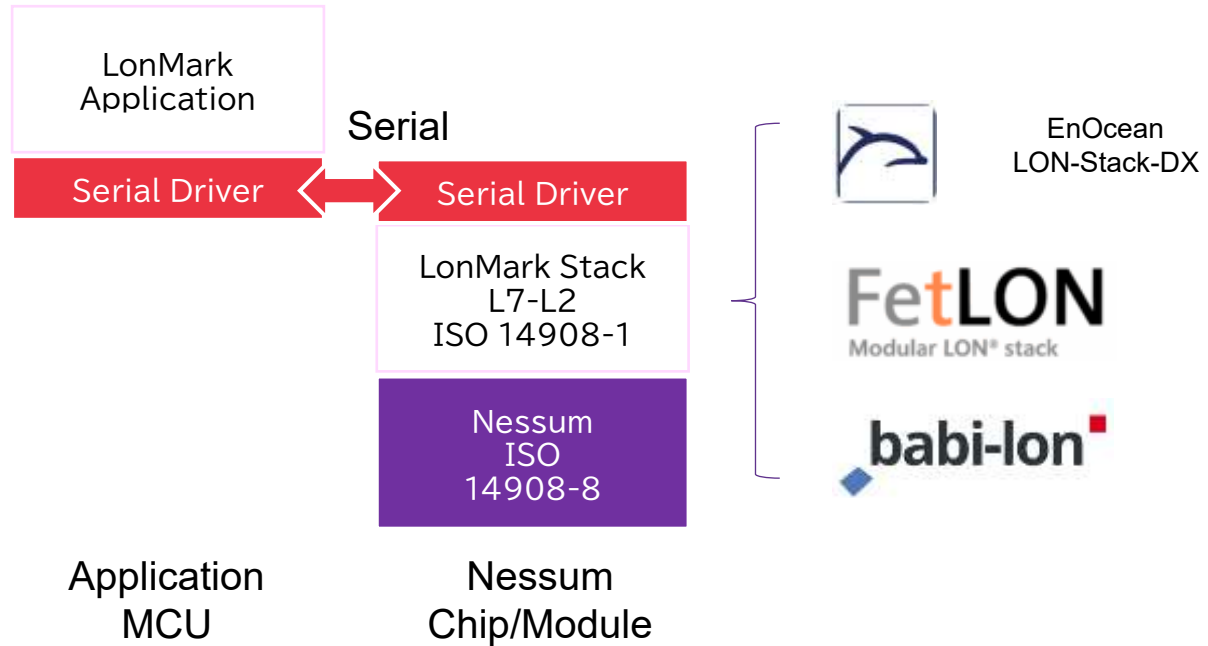
Nessum tips (Trade-off between Bandwidth and Distance)



Channels can be selected depending on required data rate and communication distance.

Nessum	Distance between two nodes [m]	Total cable length [m]	Data rate [bps] *with multi-hop
x-8	350~700	~1,400	~20M
x-1	500~1,000	~2,000	~10M
x-2	700~1,400	~2,800	~5M
x-4	1,000~2,000	~4,000	~2.5M
x-16	1,400~2,800	~5,600	~1.25M
x-20	2,000~4,000	~8,000	~0.67M
x-24	2,800~5,600	~11,200	~0.33M

LonMark Nessum Implementation

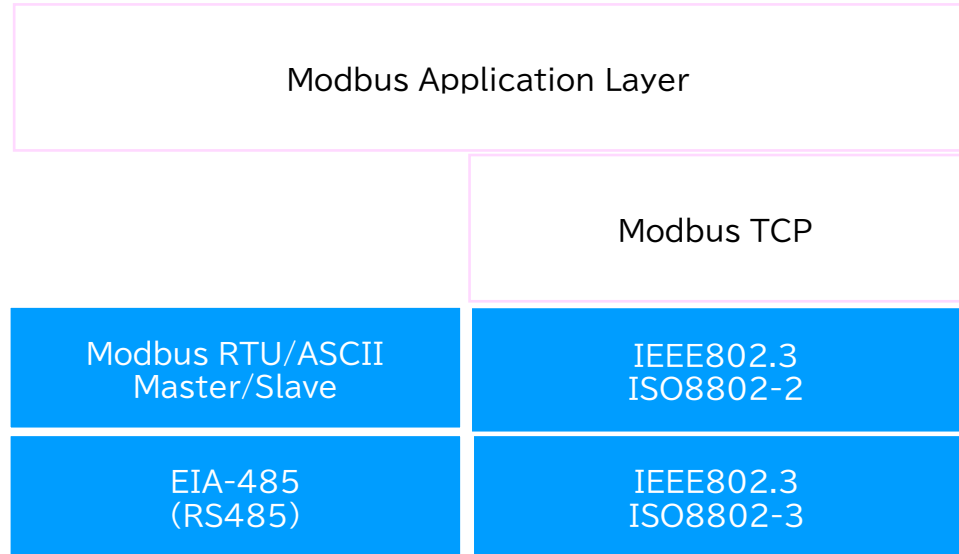


Lon-Nessum is available with combination software stack.
By using Nessum resources, it becomes possible to use low cost MCU.

Agenda

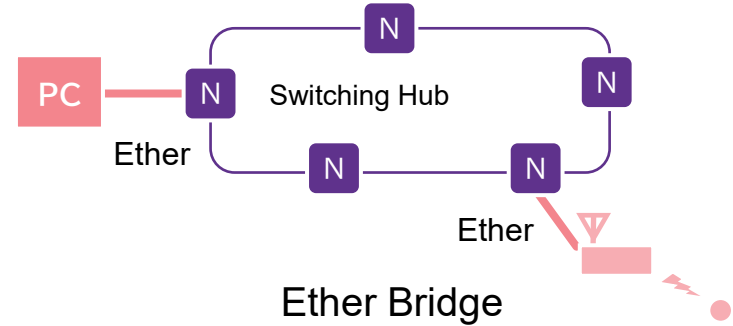
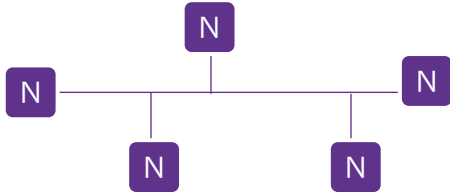


Modbus Link Layer



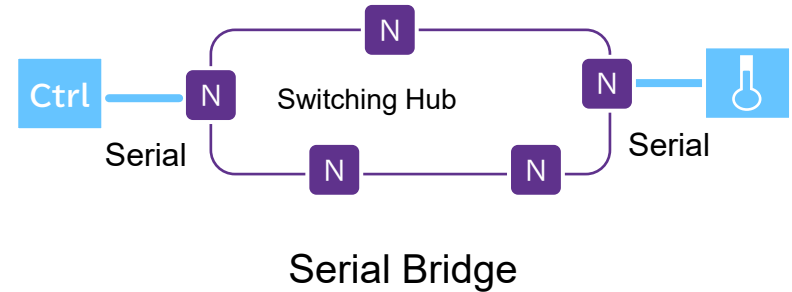
Nessus is not defined as a Modbus standard link layer, but can be transparently introduced at the physical layer.

Nessus tips (Bridge functionality)

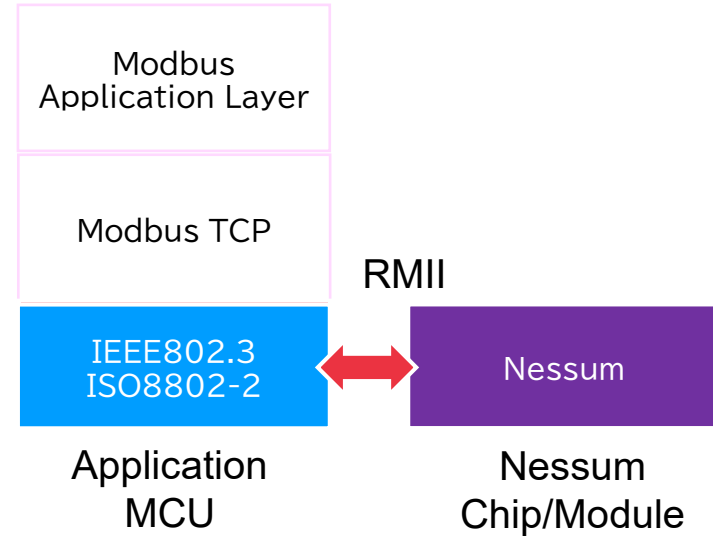
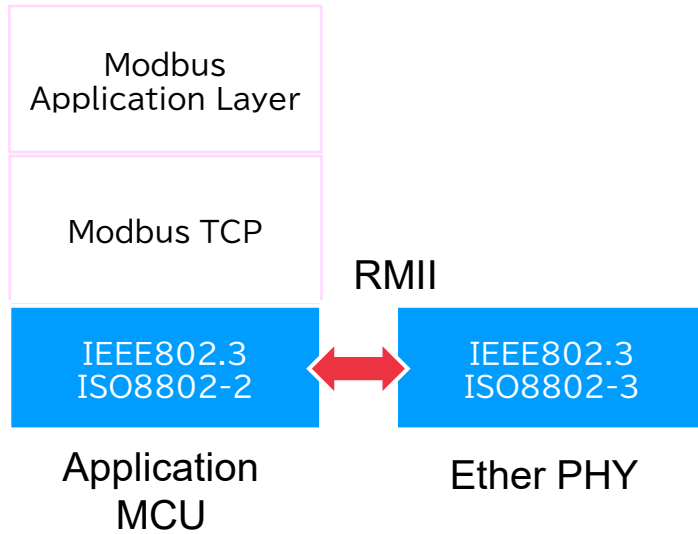


Nessus network acts as an L2 switch.

It also bridges serial communications at the same time.

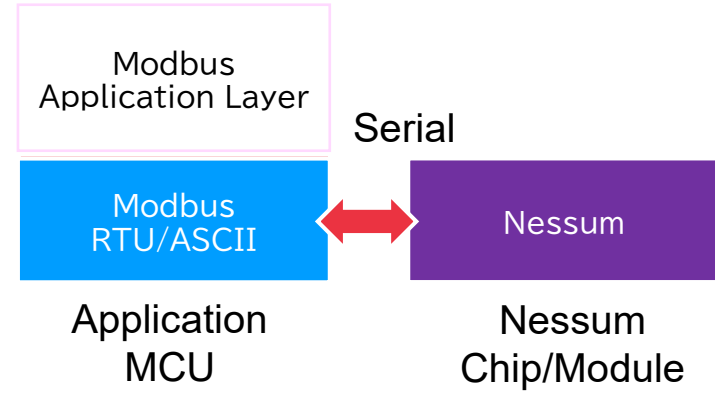
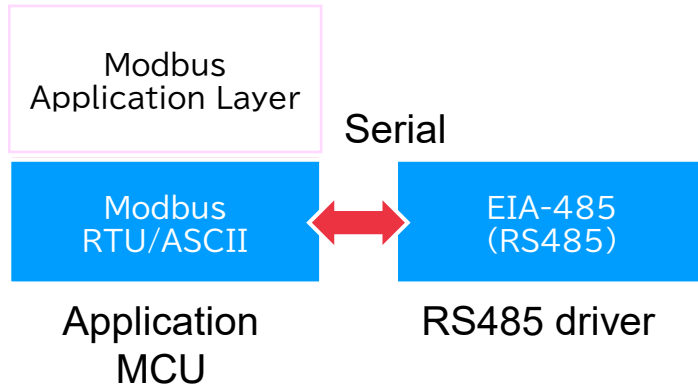


Modbus TCP/IP with Nessim implementation



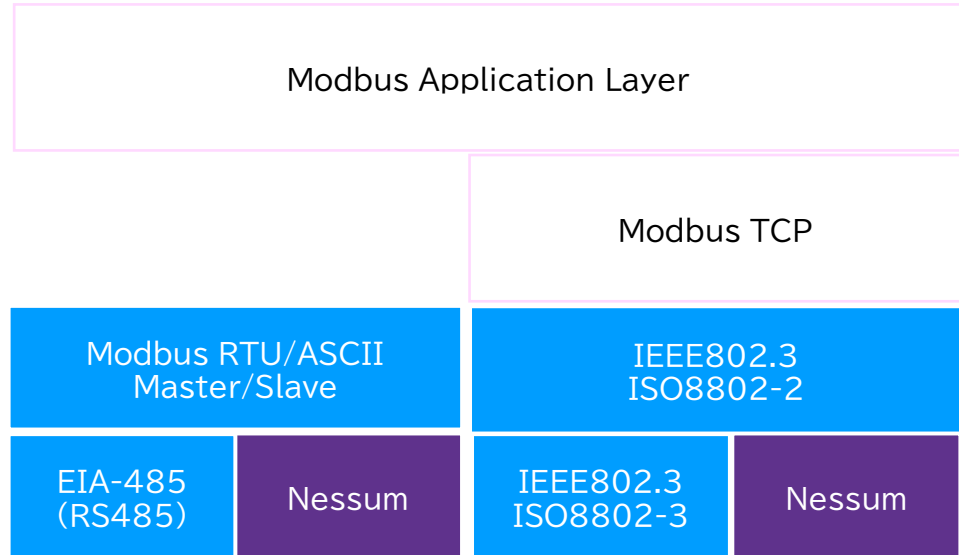
Nessim is enabled by replacing Ether PHY

Modbus RTU with Nessim implementation



Nessim is enabled by replacing RS485 driver

Modbus Link Layer



Nessum is enabled by replacing RS485 driver or Ether PHY.

Seamless coexistence of non-IP and IP networks.

Modbus Link Layer Comparison

	RS-485		10Base-T1L	Nessus(x-1) *with multi-hop
Topology	Bus*	Daisy chain	Peer-to-Peer*	Free
Polarity	Required	Required	No	No
Termination	Required*	Required	Required*	No
Node-to-Node Distance	2,000m	1,200m	1,000m	500~1,000m
Total cable length	2,000m	1,200m	1,000m	~2,000m
Data rate	10kbps	100kbps	10,000kbps	~10,000kbps
Connectivity Resilience	Low		Medium	High

Nessus simplifies network deployment by combining Free Topology with Autonomous Connectivity Resilience.

Nessum tips (Media Independent)

Non twisted pair



Redundant Pair Wiring



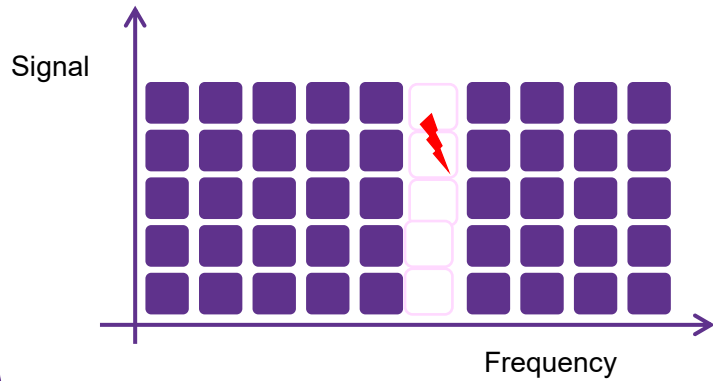
Power line



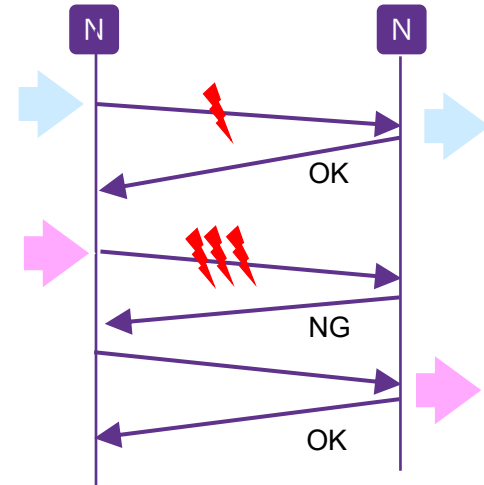
AC 24V / DC 30V
LV / MV

Nessum tips (Noise Immunity)

Multi carrier

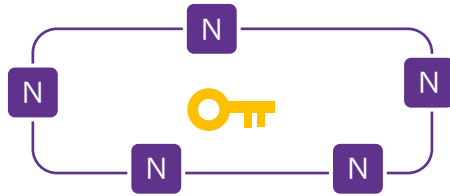


Error Correction + Retransmission



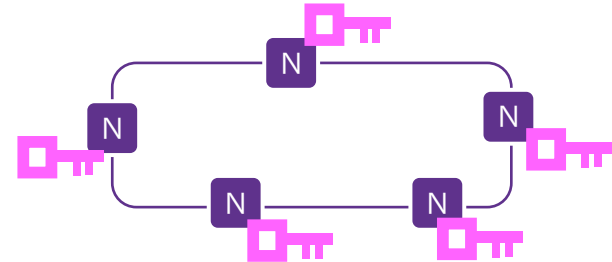
Nessus tips (Security)

Communication

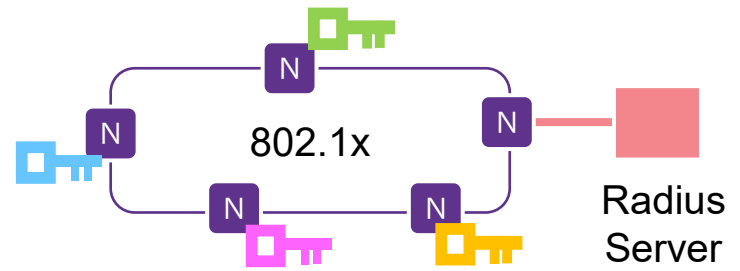


- AES-128
- Dynamic Update

Authentication



Common key

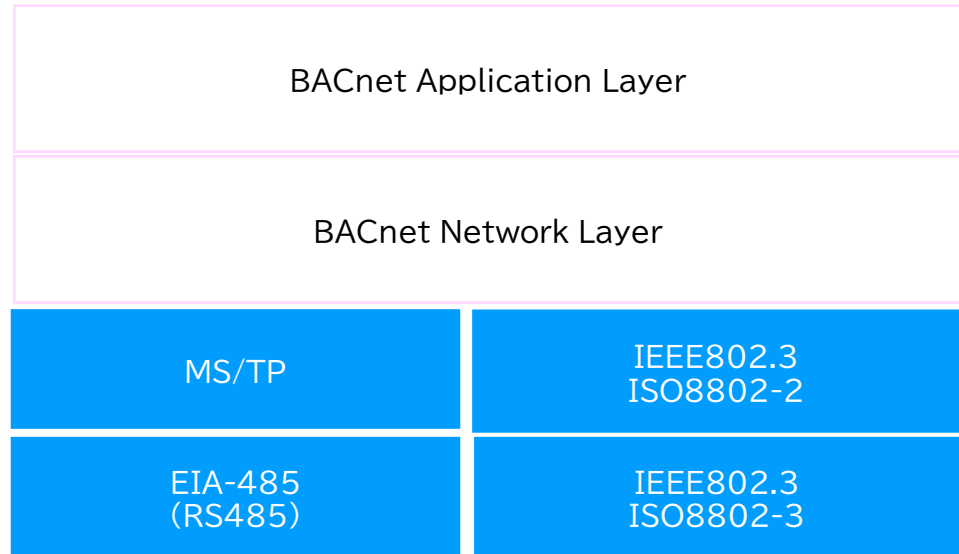


Private key

Agenda

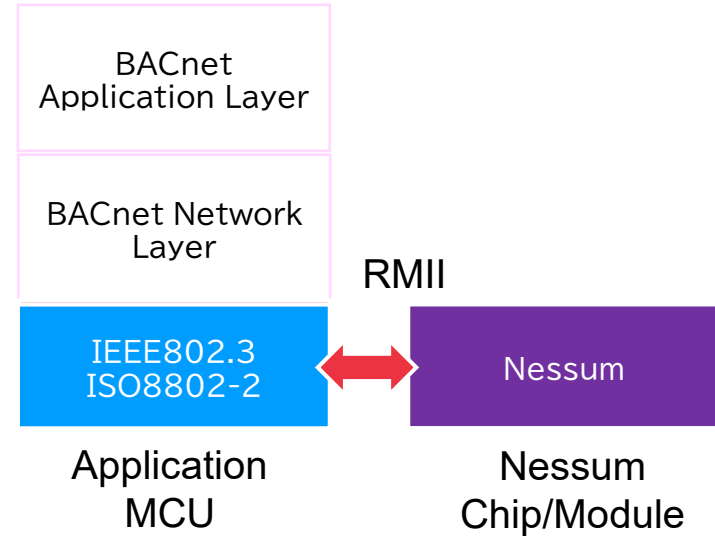
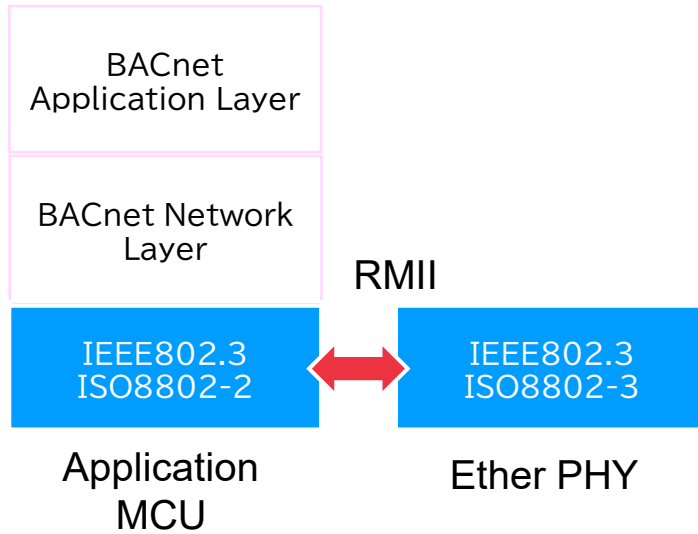


BACnet Link Layer



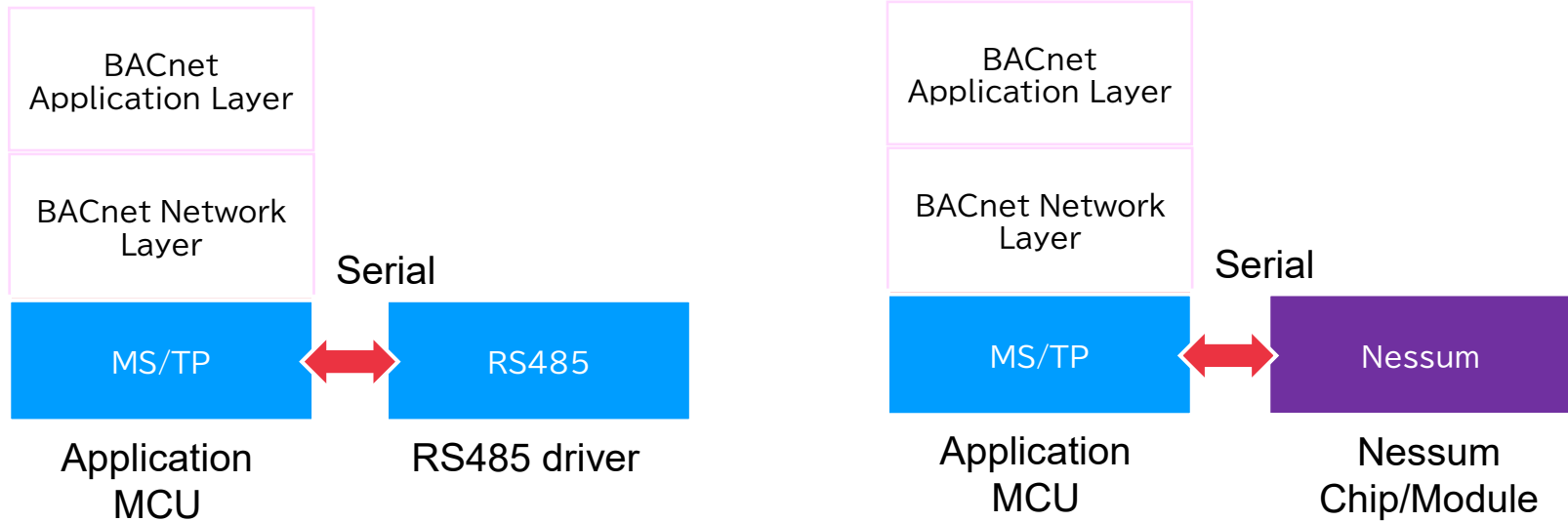
Nessum is not defined as a BACnet standard link layer, but can be transparently introduced at the physical layer.

BACnet/IP with Nessim implementation



Nessim is enabled by replacing Ether PHY

BACnet MS/TP with Nessum implementation



Nessum is enabled by replacing RS485 driver.
BACnet MS/TP requires strict token-passing timing.

BACnet MS/TP with Nessum Test Report (BTL)



TestProcedureReport_MegaChips_Nessum_MSTP_Testing

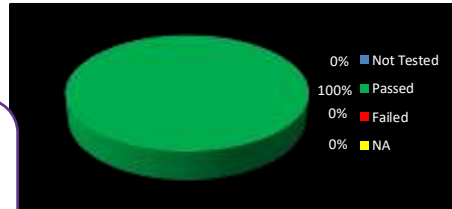
Report Information

Project Name:	Nessum Converters
Client	MegaChips, Japan
In-charge	Ameet Kothari/Swapnil Zaveri/Pooja Ugale
Module	Dolphin and GEN4BPL Converters

Test Summary

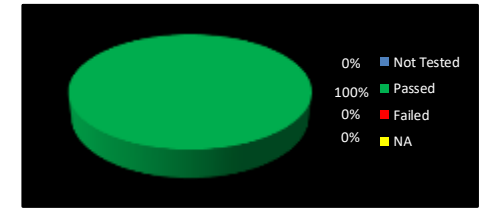
MSTP TestCases

Not Tested	0
Passed	32
Failed	0
NA	0
Total Tests	32



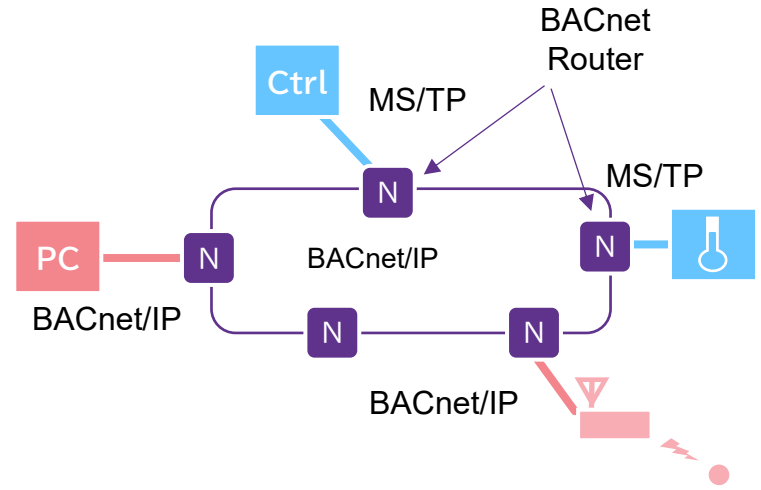
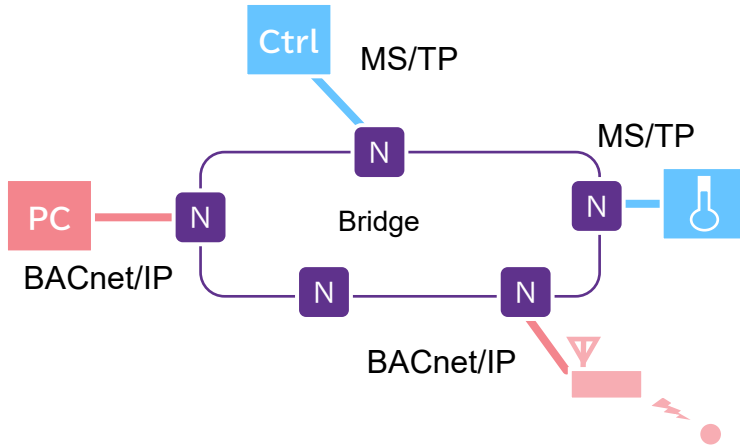
Test Multiple MSTP Cases

Not Tested	0
Passed	8
Failed	0
NA	0
Total Tests	8



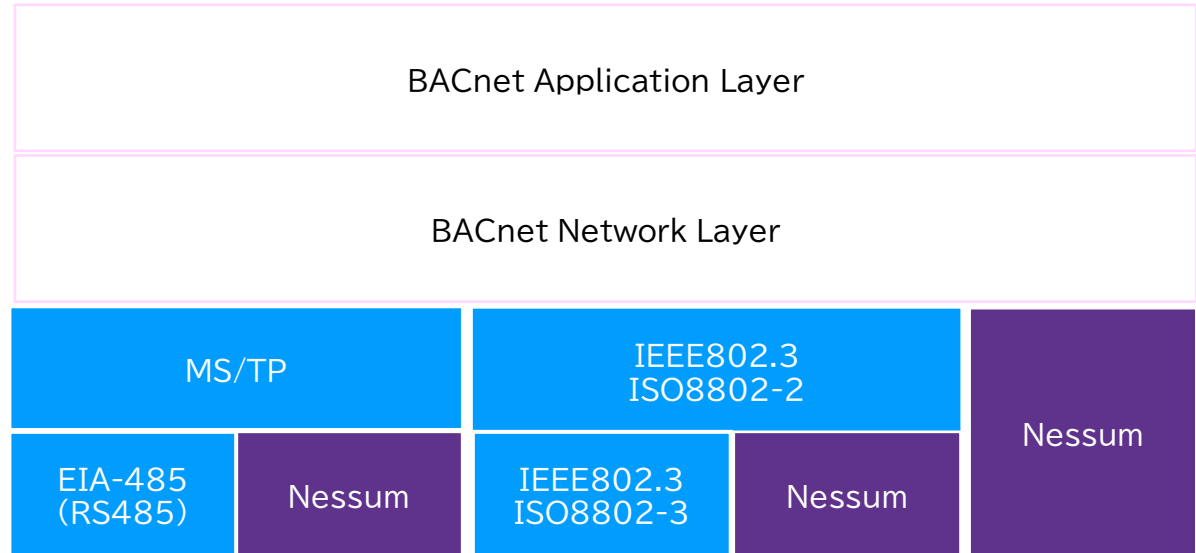
Pass all test items

Nessum tips (BACnet Router function)



Nessum's BACnet/IP MS/TP router function unifies BACnet/IP and BACnet MS/TP

BACnet Link Layer



Nessum is enabled by replacing RS485 driver or Ether PHY.




We plan to propose Nessum as a Link Layer option for enhanced interoperability.

BACnet Link Layer Comparison

	RS-485		10Base-T1L	Nessus(x-1) *with multi-hop
Topology	Bus*	Daisy chain	Peer-to-Peer*	Free
Polarity	Required	Required	No	No
Termination	Required*	Required	Required*	No
Node-to-Node Distance	2,000m	1,200m	1,000m	500~1,000m
Total cable length	2,000m	1,200m	1,000m	~2,000m
Data rate	10kbps	100kbps	10,000kbps	~10,000kbps
Connectivity Resilience	Low		Medium	High

Nessus simplifies network deployment by combining Free Topology with Autonomous Connectivity Resilience.

Conclusion

Protocol	Bridging Capability	Standardization Status
 LONMARK [®] INTERNATIONAL	-	Yes
 Modbus	Yes	-
 ASHRAE BACnet [™]	Yes	Planned
 KNX	Under Research	Under Research

Nessum brings Ethernet-class performance and simplify installation without changing existing wiring.



Introduction to

Nessum Alliance

Kota Matsuo
Vice President

Nessum Alliance Overview

Name	Nessum Alliance (former name HD-PLC Alliance)
Founder and Establish	Founded by Panasonic in 2007
Number of members	43 (38 companies, 5 organizations)
Location	Fukuoka, Japan
WEB site	https://nessum.org



2007 HD-PLC Alliance was established in Japan

2011 IEEE 1901 wavelet OFDM certification program

2011 ITU-T G.9972, Coexistence mechanism for different BPL system

2013 Japanese Standard for Smart Meter JJ300.20&21 (echonet light)

2013 China National Standard for IGRS PLC GB/T 29265.305-2012

2015 ITU-T G.9905 MultiHops CMSR for BPL

2017 LON ver HD-PLC approved as ISO/IEC 14908 (ANSI/CTA 709.8)

2018 IEEE 1901-2020 released

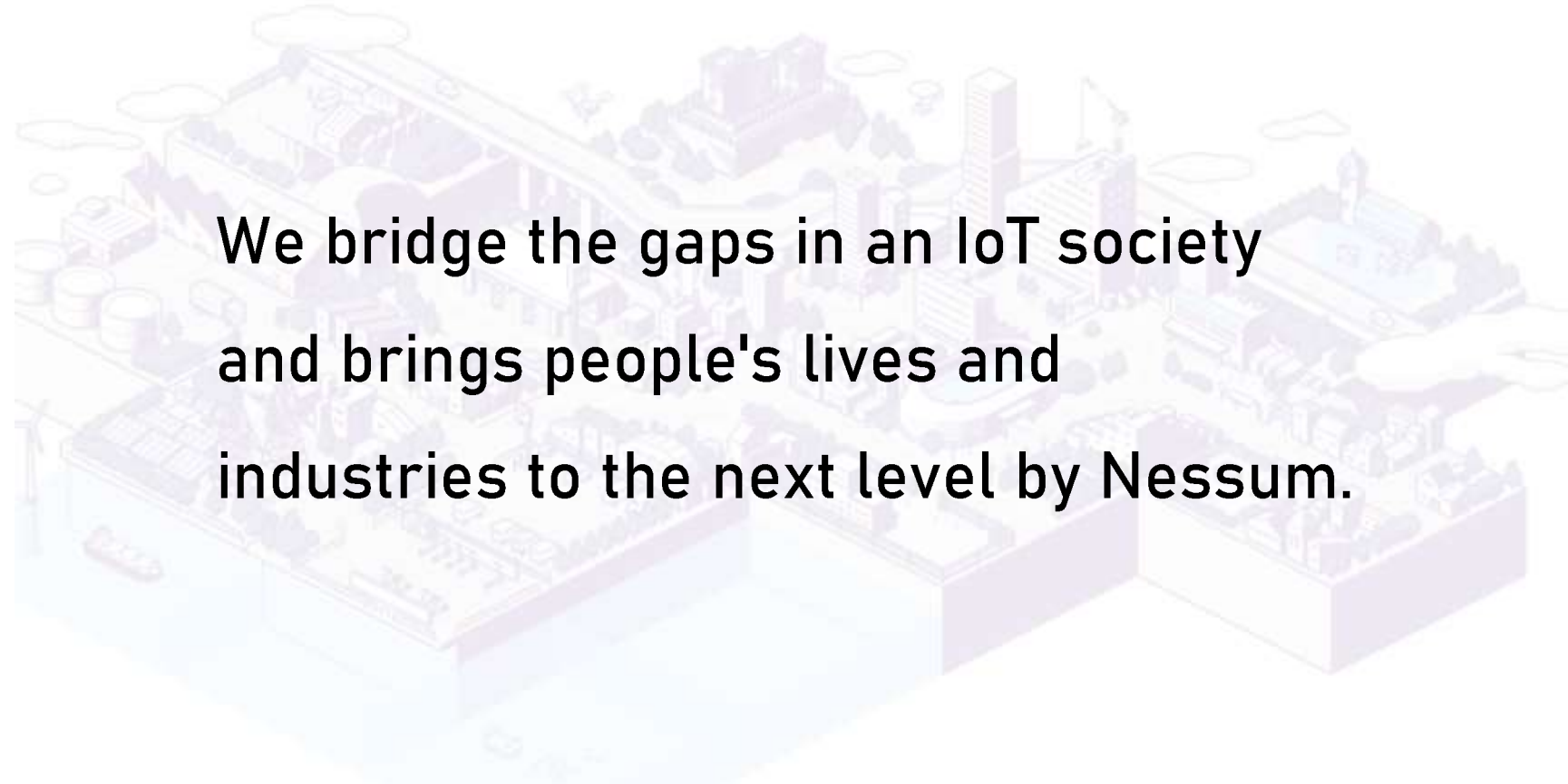
2019 IEEE 1901a published

2022 IEEE 1901b published

2023 Renamed to Nessum Alliance

2024 IEEE 1901c was published

Mission

An isometric illustration of a city and industrial landscape. The scene includes various buildings, a factory with smokestacks, a hand pointing towards a building, and a large blue rectangular block in the foreground. The background features a city skyline with tall buildings and a hand pointing towards a building. The overall style is clean and modern, with a color palette of purples, blues, and greys.

**We bridge the gaps in an IoT society
and brings people's lives and
industries to the next level by Nessum.**

Members Roster : A global alliance with 40 members and partner

Promoter

The Solution SoC Company
Shikino High-Tech CORP.

Standard

株式会社ヘルヴェチア

Kawamura

KOITO ELECTRIC INDUSTRIES, LTD.

Pursuing to Create Value through Difference
Power Plus Communications
云間宇宙

Start-up

Supporter

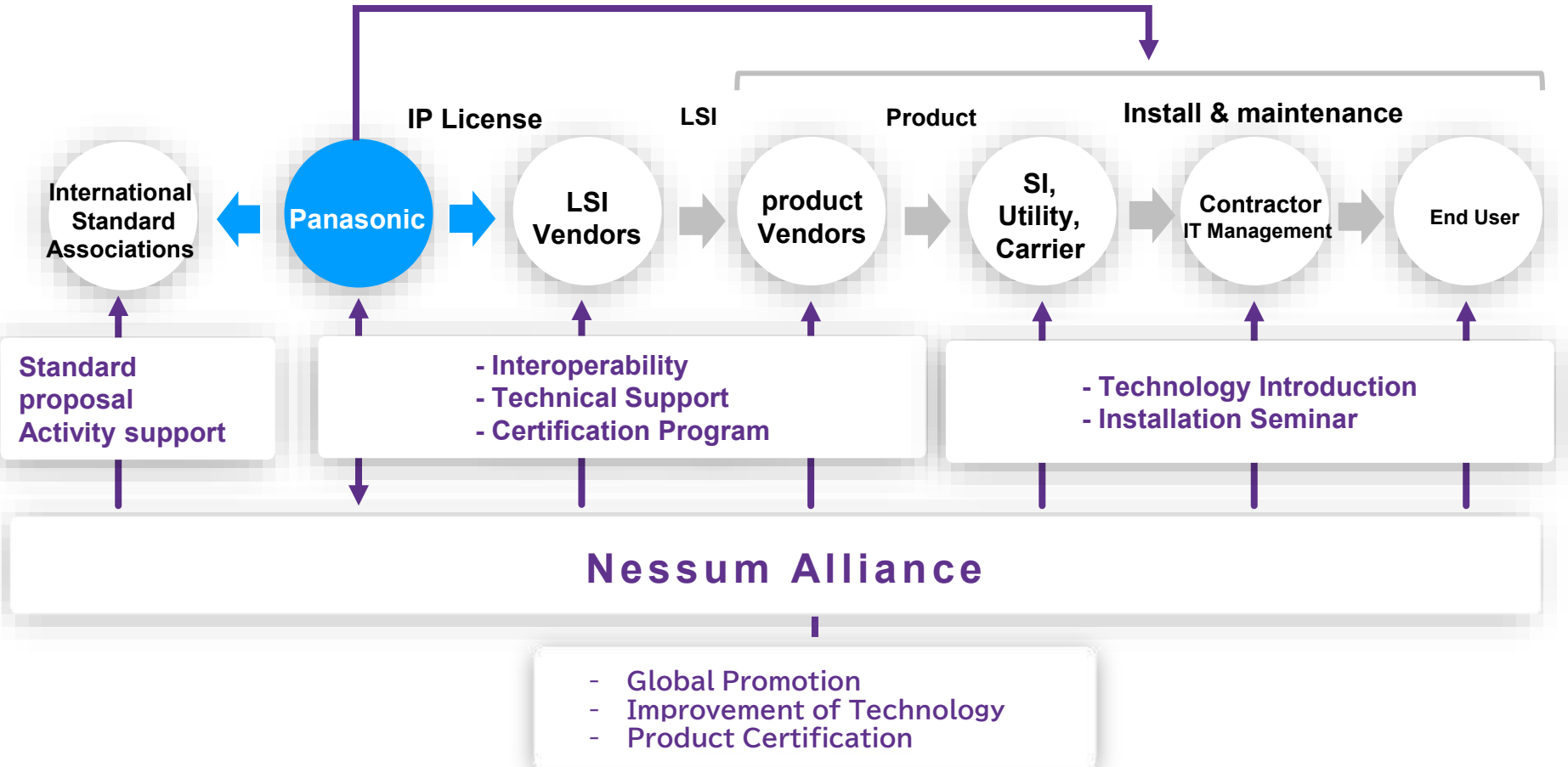
Electronics Firmware Software PPM

Special Member

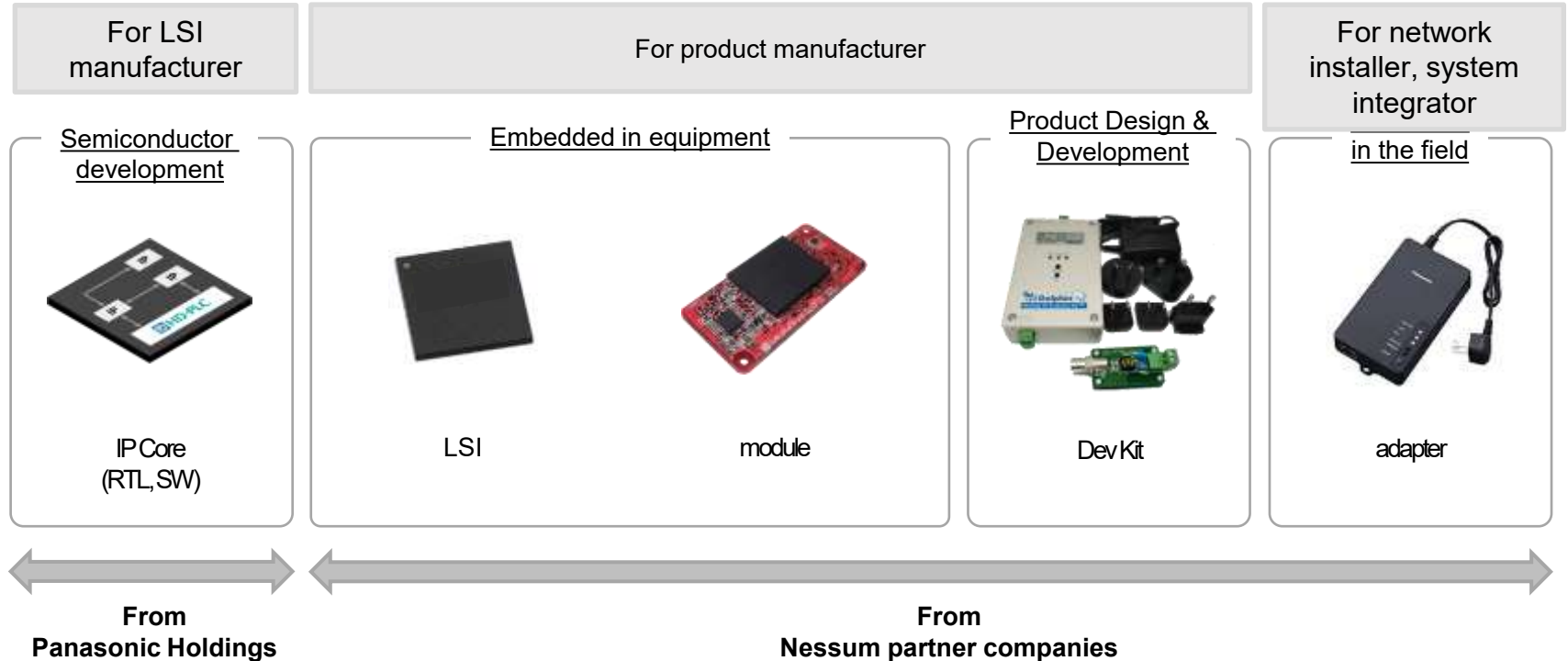
Associate Partner

Industrial Technology Research Institute
Telecommunications Technology Council

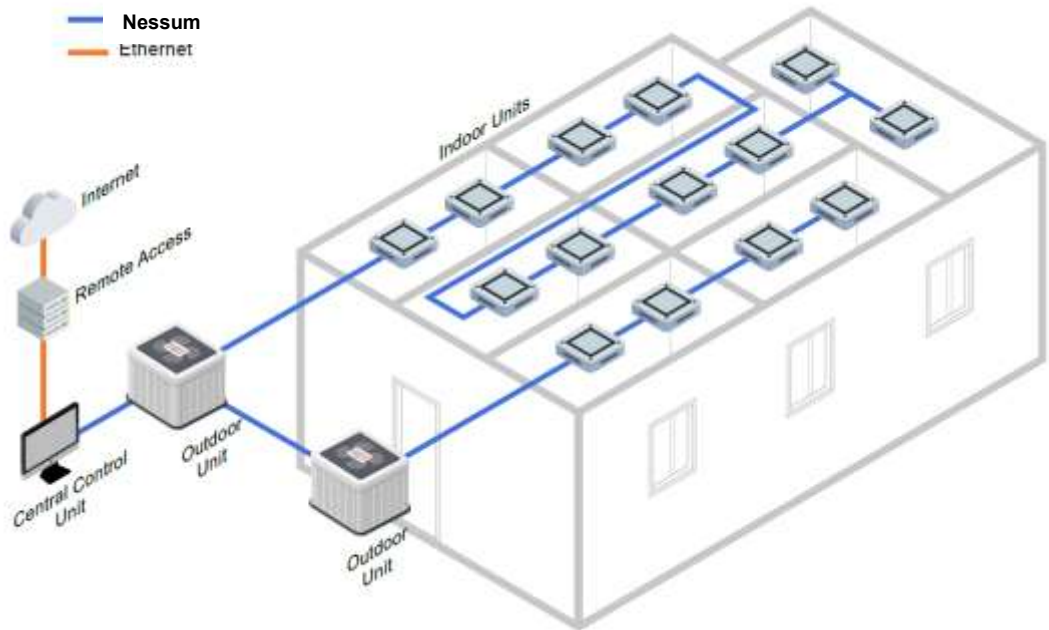
Supported Total Value Chain



Products and expertise to suit your application



Commercial Air Conditioner (Global)



NEEDS

The current communication for indoor-outdoor unit systems is about 10kbps. They want to frequently monitor and control to improve energy efficiency, but the speed is not enough.



With Nessum WIRE using the same wiring, the speed has improved by **1,000** to **10,000** times!

Don't miss the latest Nessum news!

Free newsletter subscription



Sample article:

Nessum Contributes to Daikin Industries' Next-Generation Technology by Enhancing Installation Efficiency and Creating Comfortable Spaces

2026/01/06

TECHNOLOGY BLOG USE CASE

Post > XFB 0 In Share



Overview (What You'll Discover in This Article)

- › Daikin Industries, Ltd. (hereinafter referred to as Daikin) has adopted Nessum as the next-generation communication technology for the air conditioning system.
- › Achieves advanced air conditioning control through high-speed communication, balancing comfort and energy efficiency.
- › Enables remote air conditioner settings via IP communication using existing wiring, realizing simplified installation.



Thank you