Nessum Standardization and Profiles

Jean-Philippe Faure
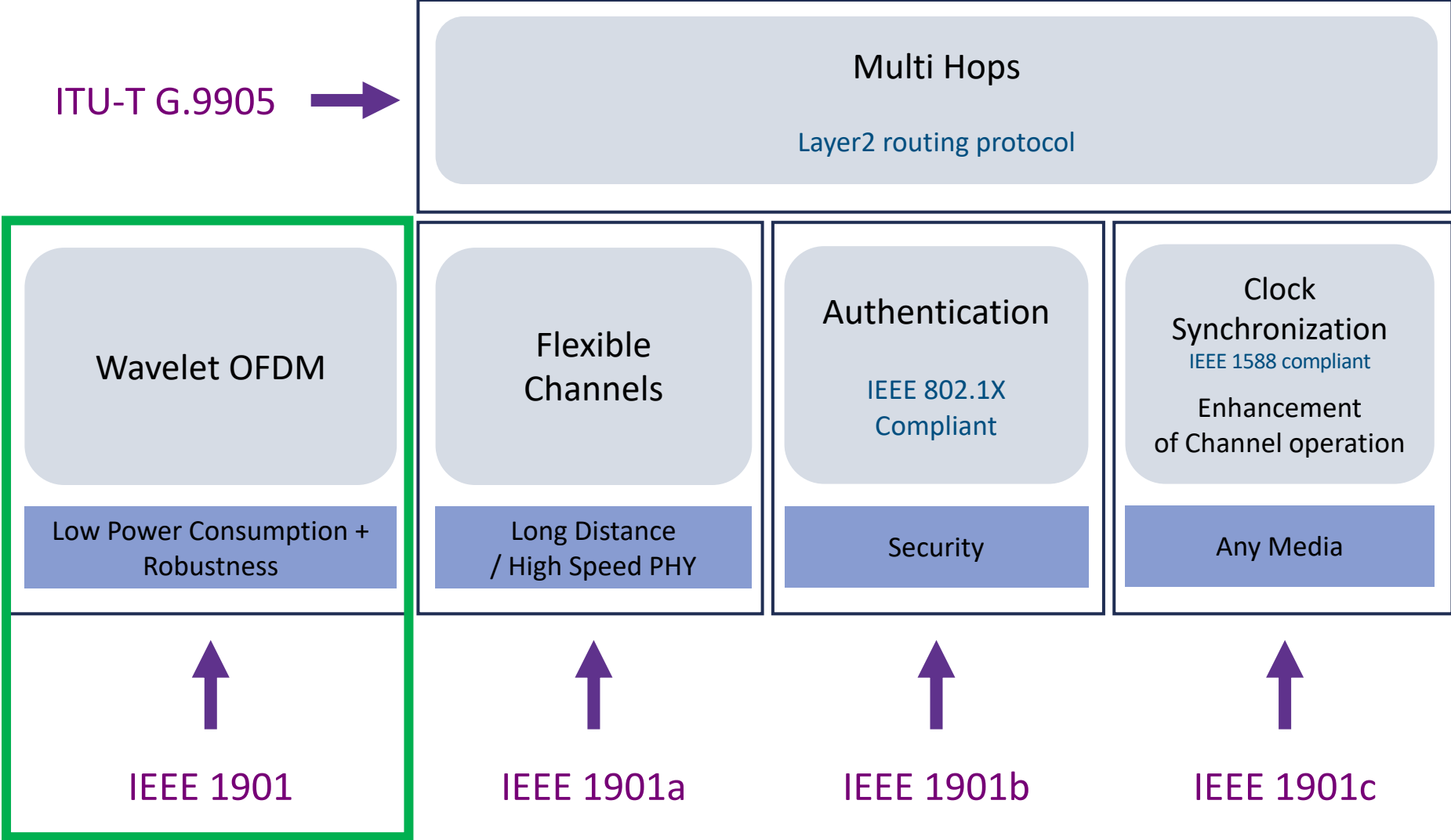
About myself

Jean-Philippe Faure
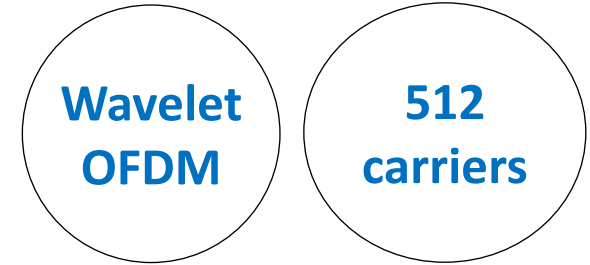
     CEO, Progilon

     Chair, IEEE 1901 Working Group

     Chair, Nessum Technical Working Group and Strategy and Marketing Working Group
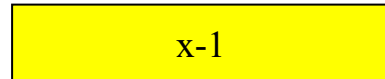
Standardization of the Nessum technology

ITU-T G.9905 →

Multi Hops

Layer2 routing protocol

Wavelet OFDM

Low Power Consumption + Robustness

Flexible Channels

Long Distance / High Speed PHY

Authentication

IEEE 802.1X Compliant

Security

Clock Synchronization

IEEE 1588 compliant

Enhancement of Channel operation

Any Media

IEEE 1901

IEEE 1901a

IEEE 1901b

IEEE 1901c

Single Channel Wavelet physical layer

Wavelet OFDM

512 carriers

1 channel @ 240 Mbps

x-1	

frequency

31.25MHz   62.5MHz   93.75MHz   125MHz

Main application: Ethernet adapters

Standardization of the Nessum technology

ITU-T G.9905 ➡

Multi Hops

Layer2 routing protocol

| Wavelet OFDM | Flexible Channels | Authentication

IEEE 802.1X Compliant | Clock Synchronization
IEEE 1588 compliant

Enhancement of Channel operation |
|---|---|---|---|
| Low Power Consumption + Robustness | Long Distance / High Speed PHY | Security | Any Media |

⬆ | ⬆ | ⬆ | ⬆

IEEE 1901 | IEEE 1901a | IEEE 1901b | IEEE 1901c
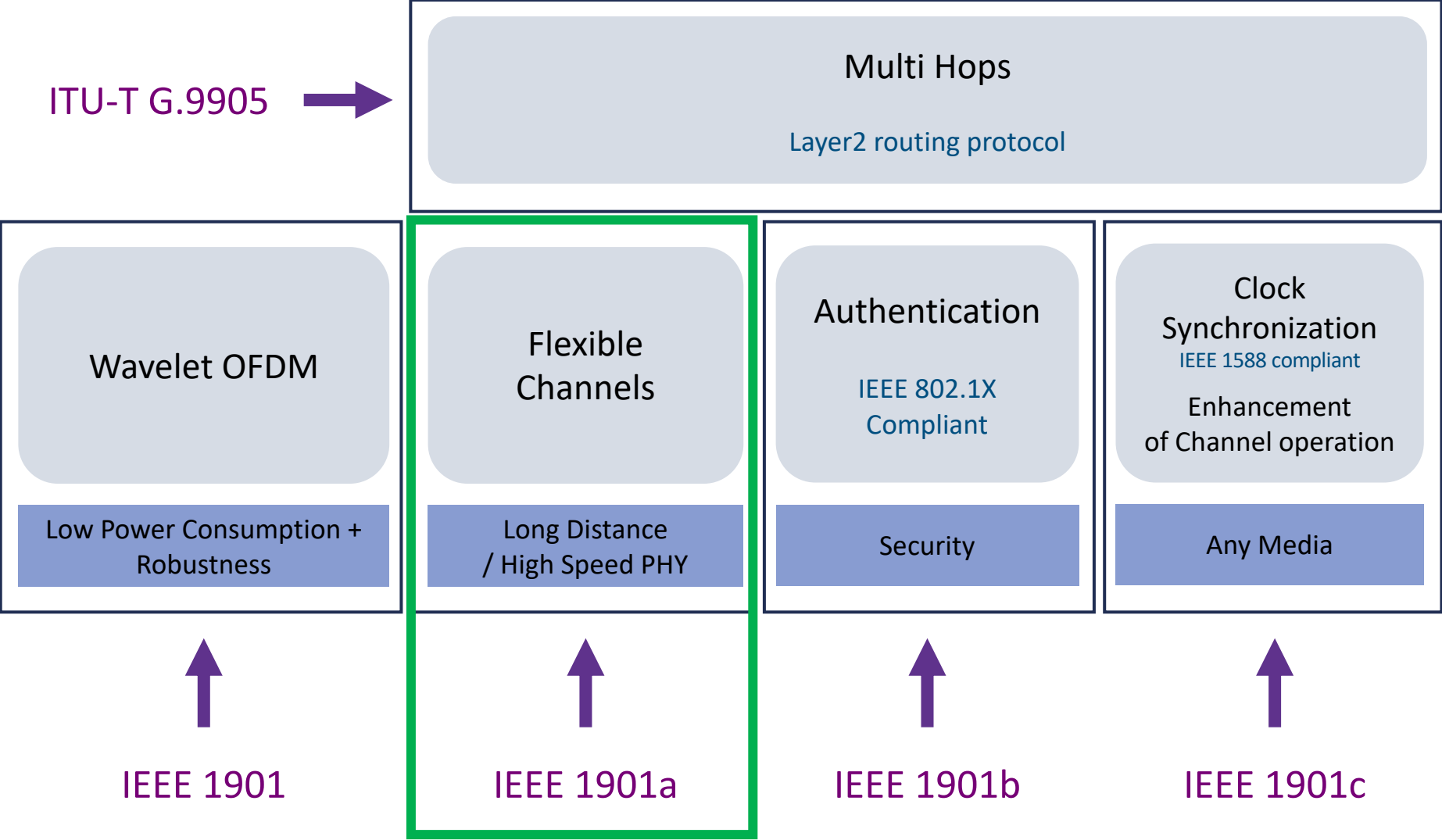
IEEE 1901a-2019: Flexible Channel Wavelet physical layer

15 selectable channels

Wavelet OFDM

512 carriers

4x, 2x, 1x, 1/2, 1/4 carrier spacing

4 channels @ 60 Mbps

x-4	x-5	x-6	x-7

Long distance

4 channels @ 120 Mbps

x-2	x-3	x-10	x-11

Long distance

1901-2010 compatible

4 channels @ 240 Mbps

x-1	x-9	x-14	x-15

High speed

2 channels @ 500 Mbps

x-8	x-13

High speed
E.g Coax lines

1 channel @ 1 Gbps

x-12

frequency

31.25MHz   62.5MHz   93.75MHz   125MHz

100MHz (limit on power lines)

6

IEEE 1901a-2019 - Long range PHY

Distance can be increased by 2.5 times by using a ¼ carrier spacing
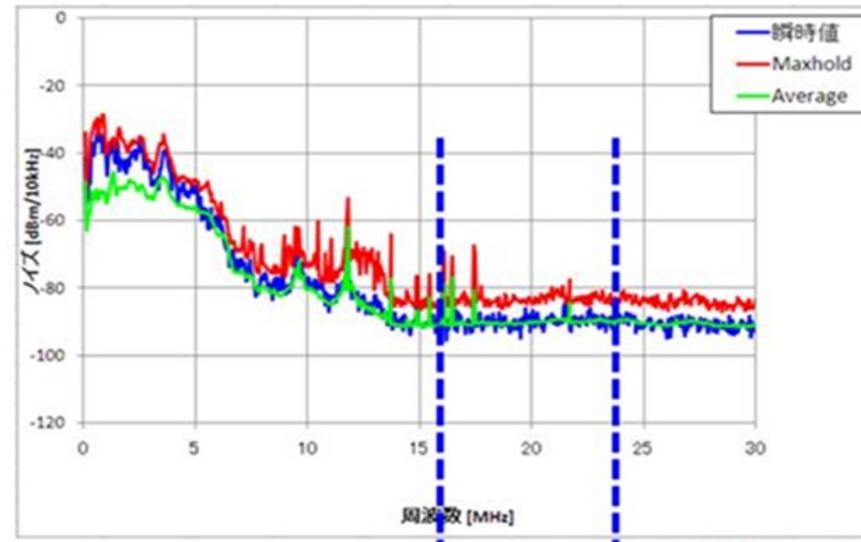

Simulation on VVF cable

IEEE 1901a-2019 - Channel Flexibility

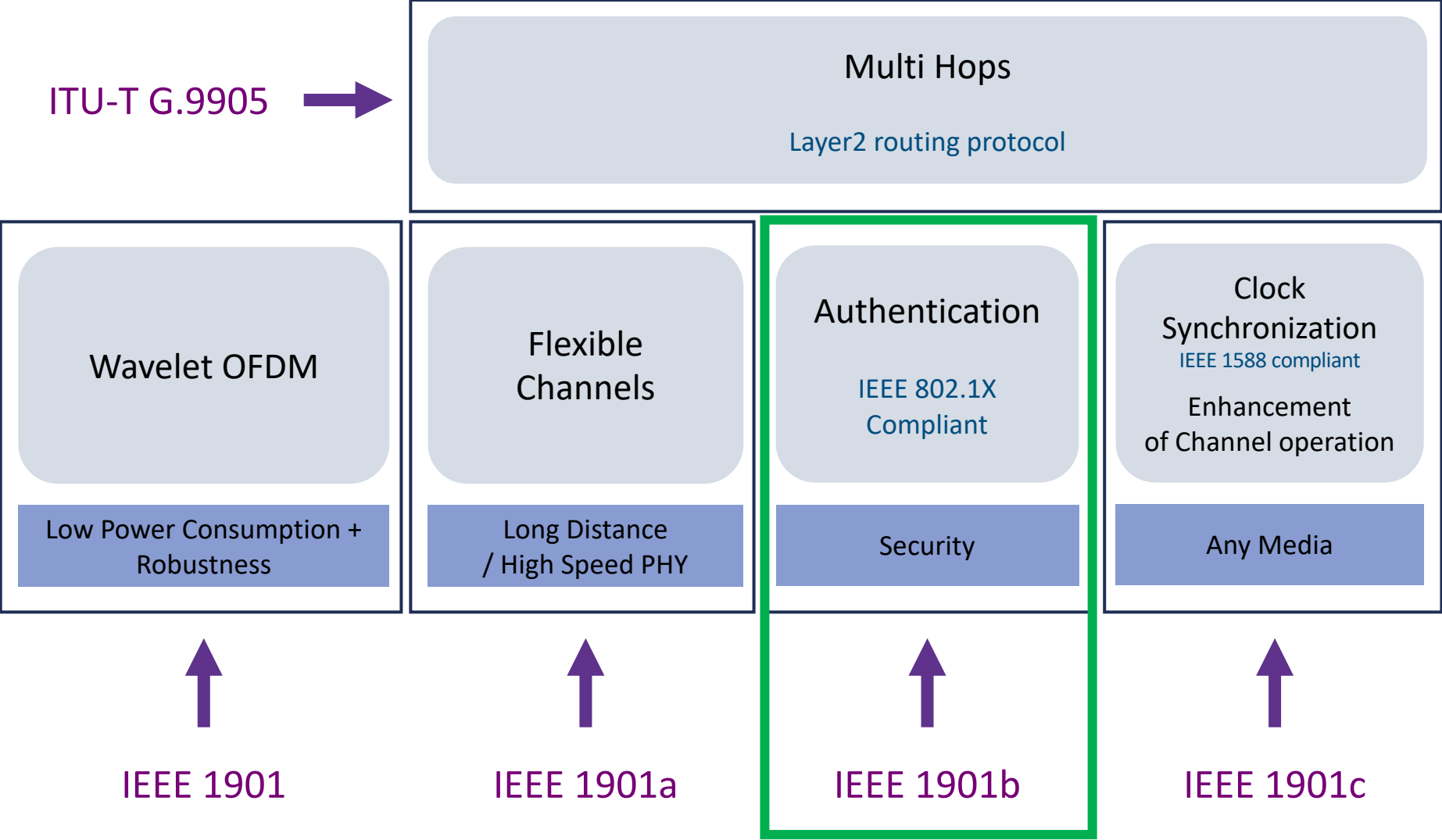**If attenuation is an issue, select a channel in low frequencies**
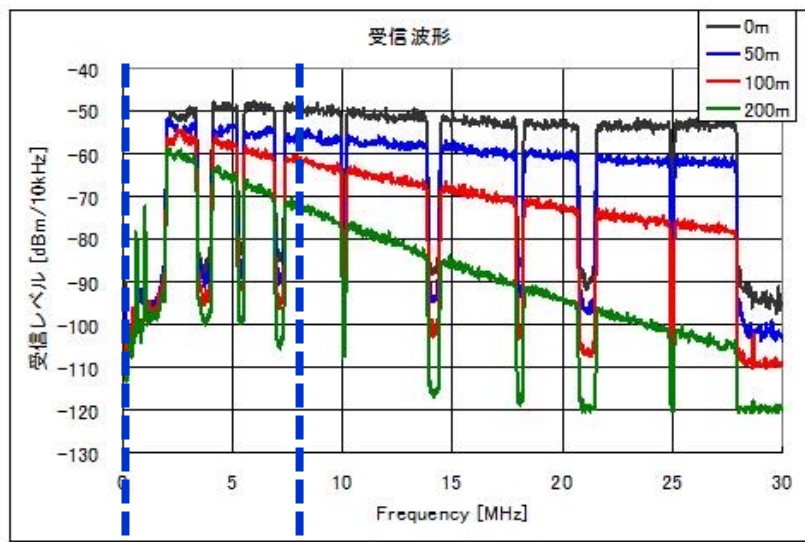
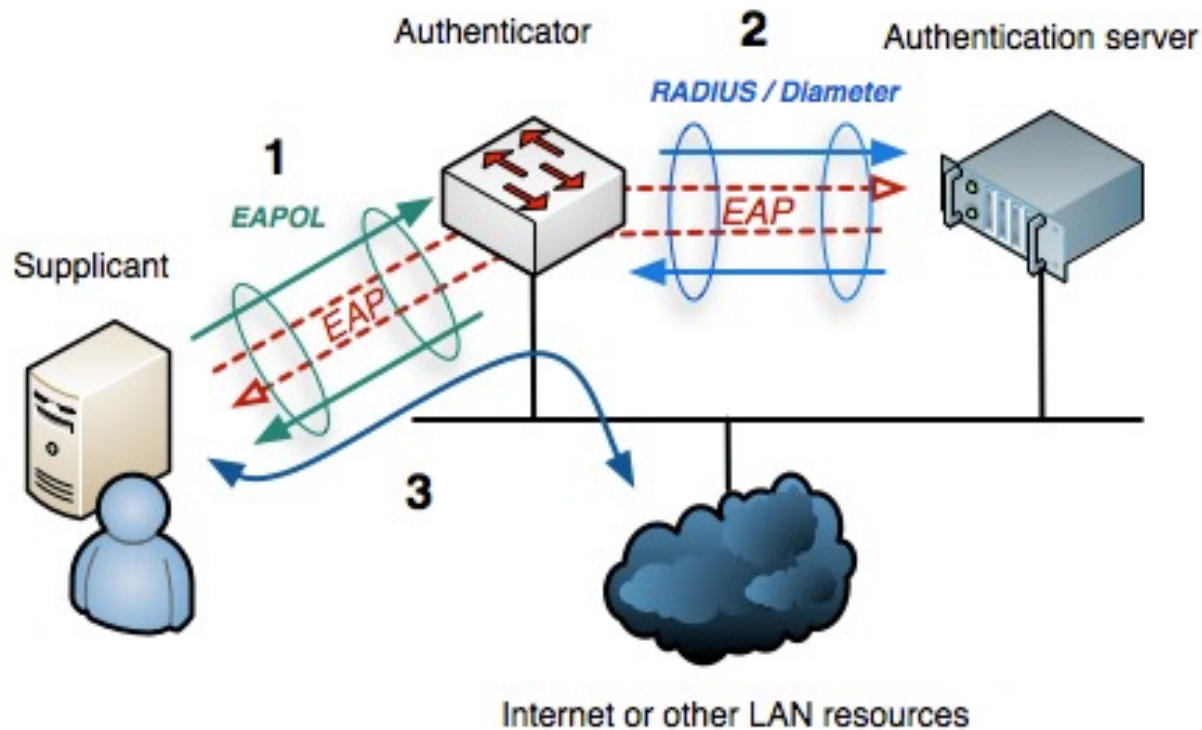**If noise is an issue, select a channel in a quiet frequency band**

Frequency spectrum of noise
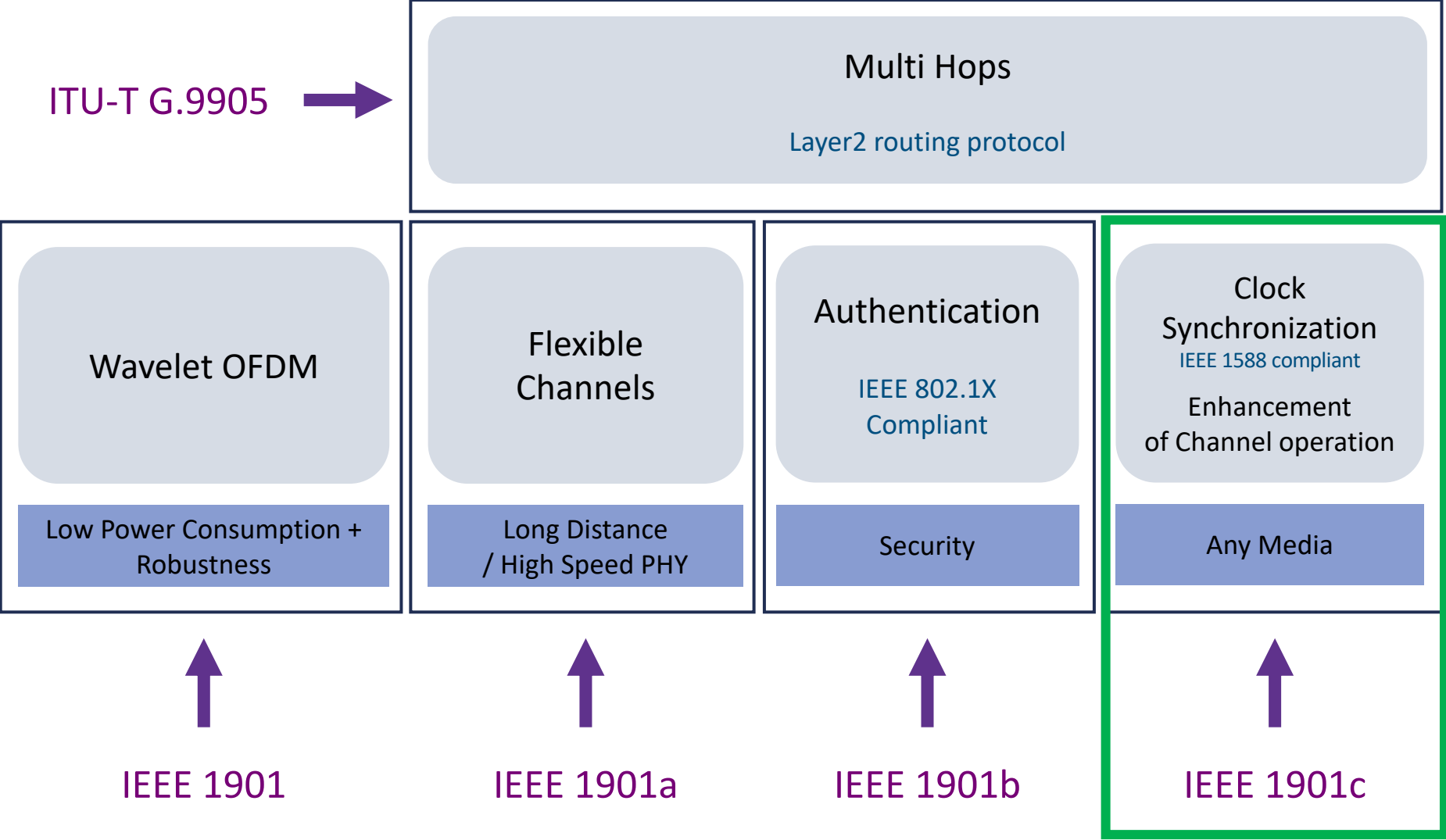
Standardization of the Nessum technology

ITU-T G.9905 → Multi Hops

Layer2 routing protocol

Wavelet OFDM	Flexible Channels	Authentication IEEE 802.1X Compliant	Clock Synchronization IEEE 1588 compliant Enhancement of Channel operation
Low Power Consumption + Robustness	Long Distance / High Speed PHY	Security	Any Media

IEEE 1901   IEEE 1901a   IEEE 1901b   IEEE 1901c

Support of IEEE 802.1X Port-Based Network Access Control

Source: Wikipedia

Needed for Smart Grid and other applications

Standardization of the Nessum technology

ITU-T G.9905 →

Multi Hops

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IEEE 1901

IEEE 1901a

IEEE 1901b

IEEE 1901c

IEEE 1901c-2024: Extended Flexible Channel Wavelet physical layer

12 new selectable 1901c channels

0.98 MHz width

Wavelet OFDM

512 carriers

1/8, 1/16, 1/32 carrier spacing

Longer range

Longer range

x-24	x-25	x-26	x-27

New channels

x-20	x-21	x-22	x-23

x-16	x-17	x-18	x-19

1901a channels

x-4	x-5

x-2

frequency

3.90625 MHz   7.8125 MHz   11.71875 MHz   15.625 MHz
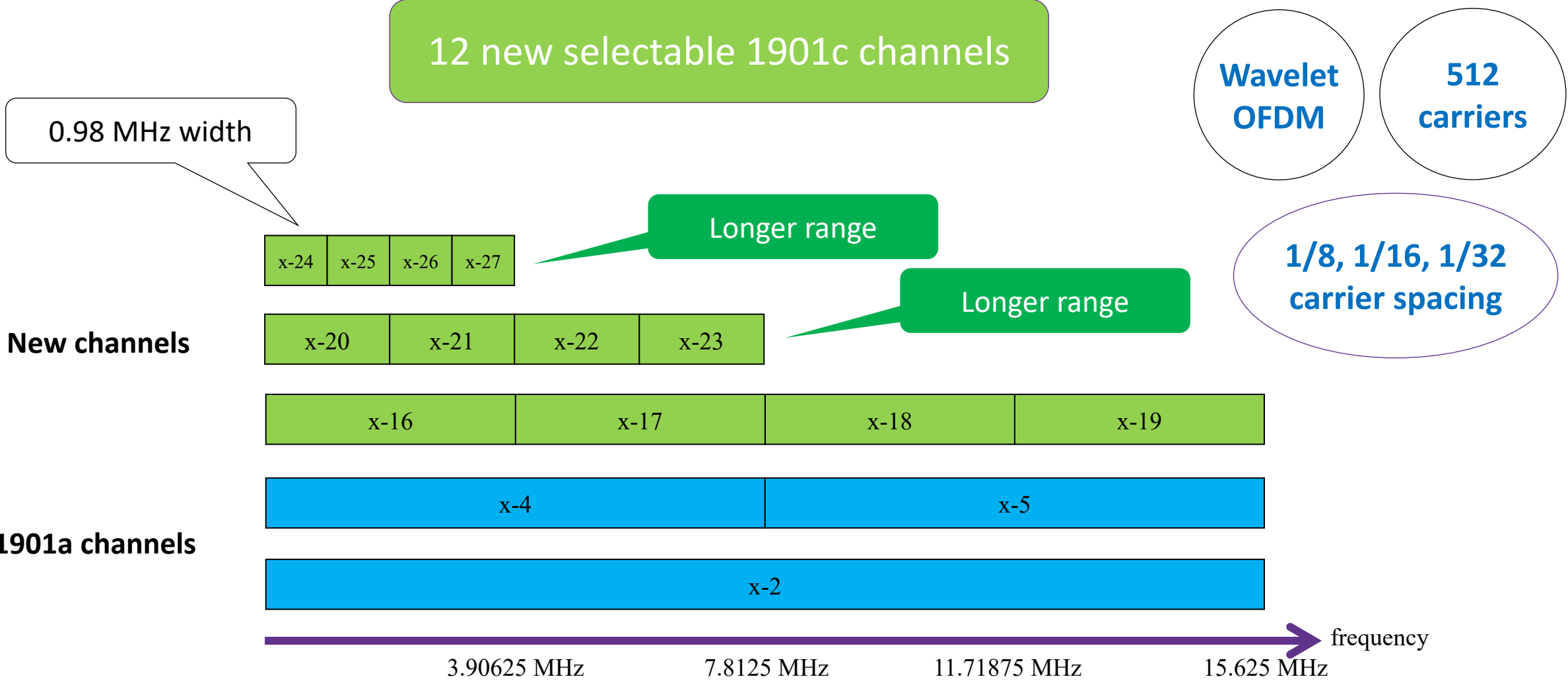
Usable for communications on any media

- Communications on power lines (AC or DC), coaxial cables, signal cables, optical fiber, and communications using light (visible, infrared), and radio waves
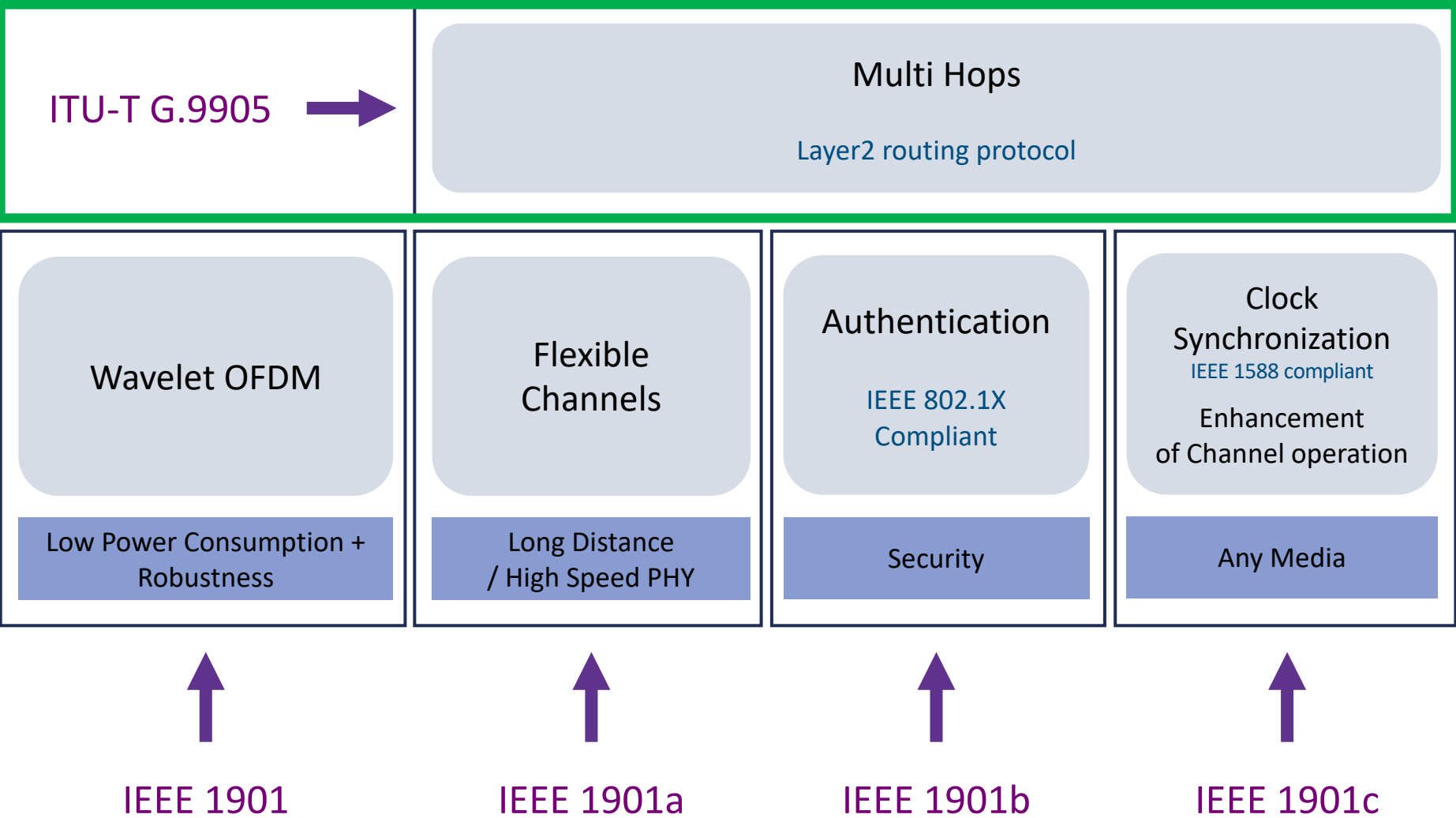
Supports IEEE 1588-2019 Precision Time Protocol (PTP version 2.1)

Market needs

- IoT / Smart Building / Smart City / Smart Grid
- Underwater using radio waves

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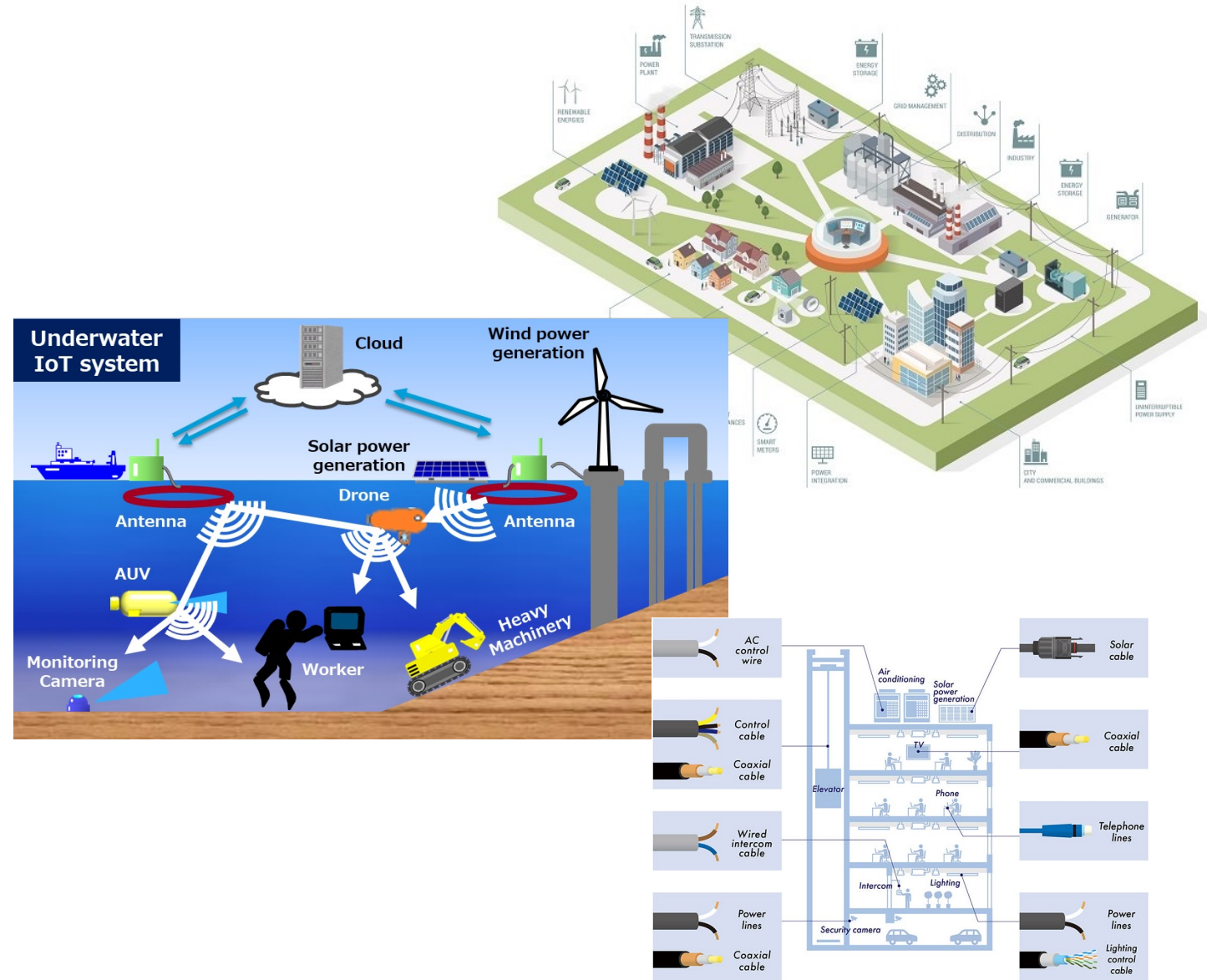
What is Multi-hop?

Relaying communication packets enables long distance communication over several kilometers
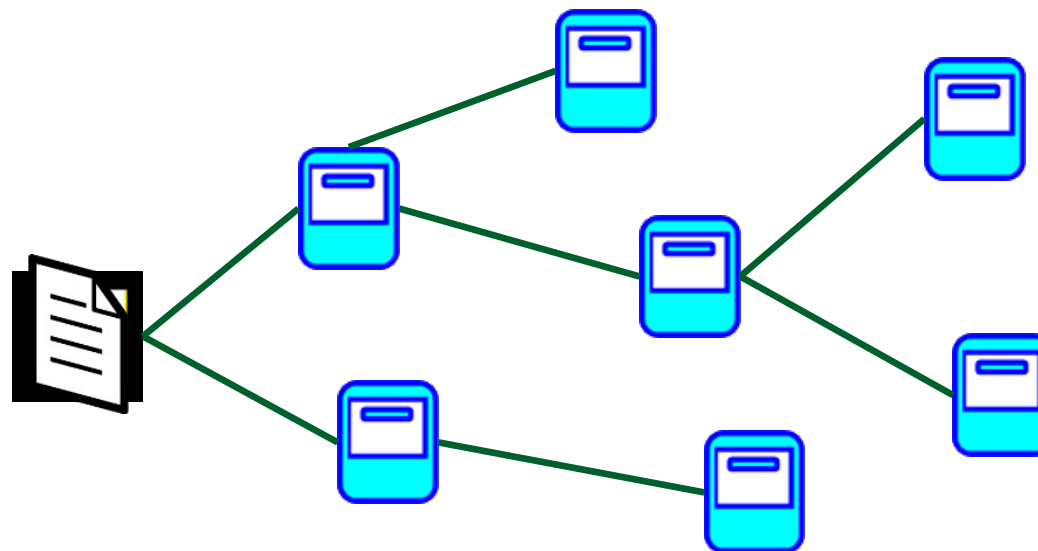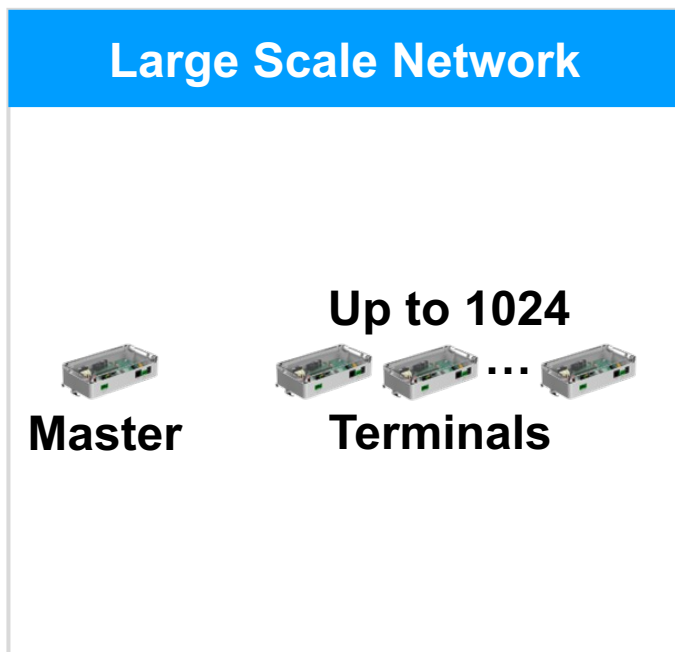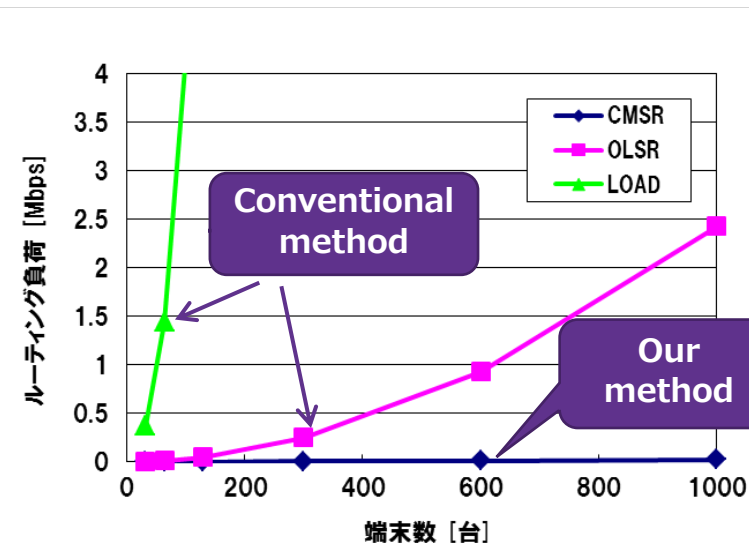
Multi-hop - Method for determining Communication Path

- **Exchange bidirectional routing information**
- **Choose the path with the most stable communication**
- **Limited to route information related to parent machine**

Ensure high communication reliability

Suitable for large scale networks

Communication overhead for establishing communication paths

Multi-hop - Reliable and Efficient Communication

Unicast

- Maintain optimum route any time, follow environmental changes
- Preserve alternate routes in advance
- Route switches immediately when a communication error occurs

→ Reduce communication delay time

Improve communication throughput

Broadcast

- Limit the number of relays, reduce excessive traffic
- High efficiency communication achieved by avoiding congestions during relays

→ Suitable for large scale networks

Nessum certification

Many options are available in IEEE 1901

- Channels
- MAC services (CSMA/CA, PHY 1-level concatenation, …)
- Security and authentication services (Encryption, shared keys, …)

Interoperability and performance check is provided by Nessum certification

- Connectivity Verification Tests
- Tests performed with a golden device

Test labs

- Panasonic test house
- UL Taiwan

Nessum profiles

A profile is a minimum list of standard features to be supported

Profiles under development
- LV/MV smart grid (Flexible channel, multi-hop)
- High speed (Flexible channel, single-hop)
- In-home networking (Legacy single channel)
- (Others in consideration)

Purpose
- Make implementation easy for specific use cases for OEMs and end users
- Promote Nessum for specific use cases

Nessum technology - Take away

A robust and versatile communication technology that seamlessly bridges the IoT gap

Standardized in IEEE and ITU-T

The Nessum alliance certification program assures interoperability, performance and security

Thank you

Jean-Philippe Faure

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