

Wi-Fi HaLow Development Forum

802.11ah use cases, application, and business challenges in Japan and requests for Taiwanese companies

June 6th, 2024

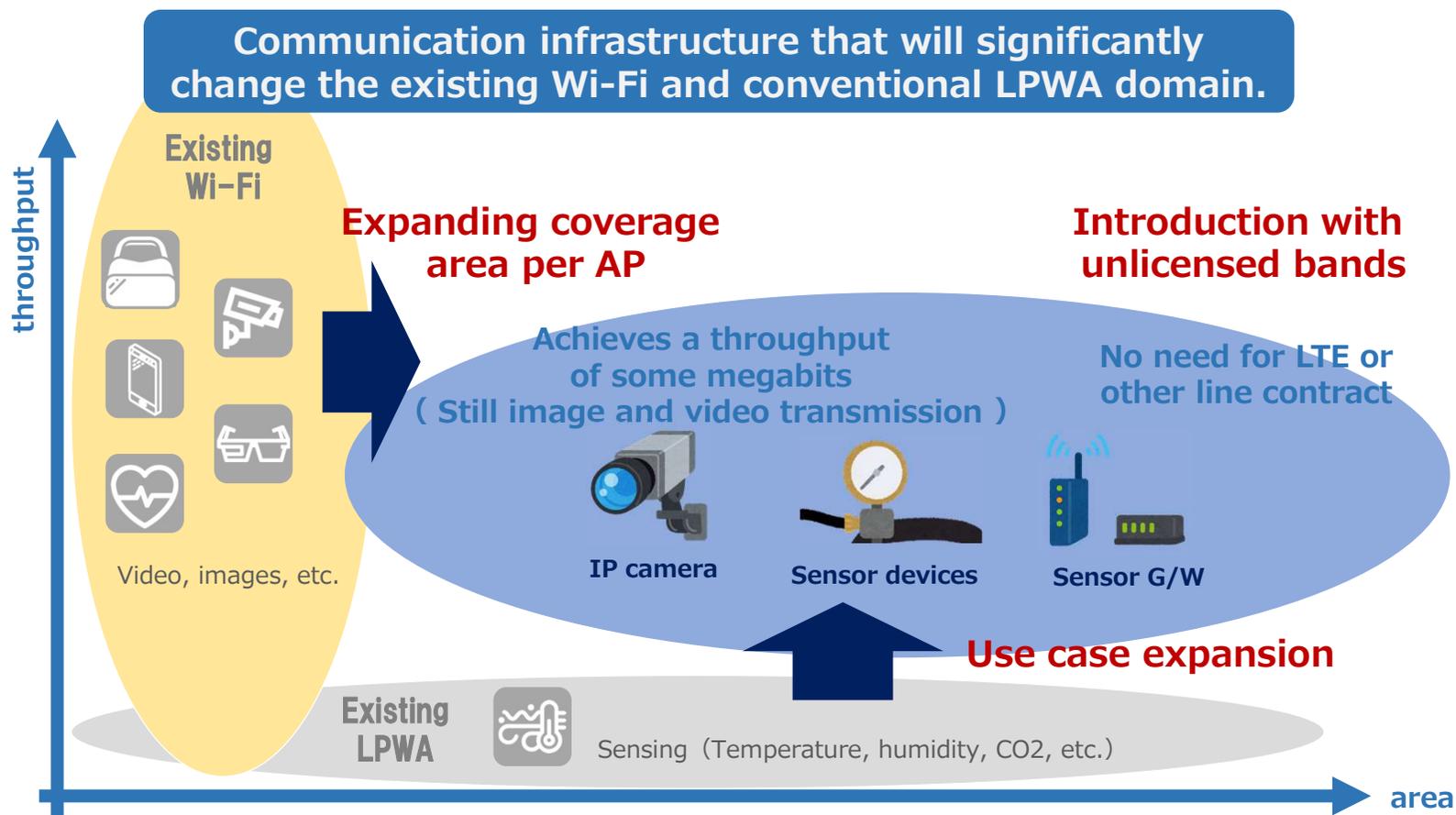
802.11ah Promotion Council

Marketing TG Motoyasu Morita

Agenda

- **Wi-Fi HaLow features**
- **Market adoption and deployment of 11ah Wi-Fi HaLow**
- **Companies participating in the Wi-Fi HaLow business and AHPC member companies**
- **Market demand forecast in Japan**
- **Introduction of Japan deployment status and latest use cases**
- **Summary of demonstration experiment**
- **Issues and strategies**
- **Requests to Taiwanese companies**
- **Frequency expansion – Further evolution and possibilities**
- **Wireless Japan 2024 quick report**

Wi-Fi HaLow features



Wi-Fi HaLow is an innovative wireless LAN standard for the IoT that began commercialization in Japan in September 2022.

Wi-Fi HaLow features

Enables application to a wide variety of use cases

Maintains compatibility with existing IP networks and enables effective use of assets

- ▣ IP-based communication standards

Provides secure communications

- ▣ Supports WPA3

Battery operation is possible

- ▣ Supports sleep mode for IoT

Implementing an IoT network tailored to the customer's environment

- ▣ Network construction using repeater and mesh functions

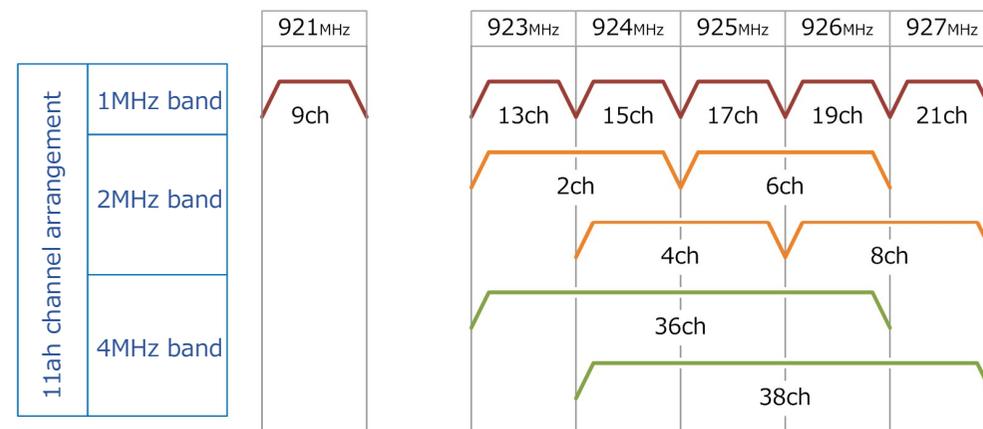
11ah will advance social implementation of IoT that could not be achieved with conventional Wi-Fi or LPWA.

Operation in the 920 MHz band (unlicensed band)

Operational parameters

- Transmit power: 20mW
- frequency band: 920.5-928.1MHz band (7.6MHz)
- 10% duty limit
- **1MHz, 2MHz, 4MHz modes**

Channel arrangement



Enables flexible wireless channel design based on usage environment and connected devices and terminals

Market adoption and deployment of 11ah Wi-Fi HaLow

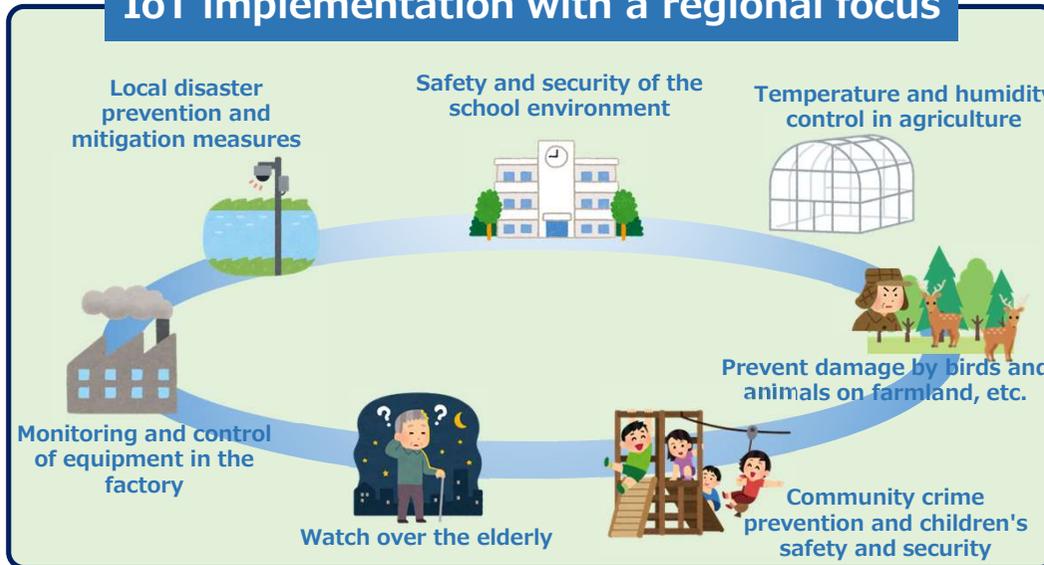
After 11ah commercialization, deployment and deepening of introductions into expected markets is in progress.

deployment



deepening

IoT implementation with a regional focus



New market expectations and developments



Companies participating in the Wi-Fi HaLow business and AHPC member companies

Various companies are participating in market creation activities.

AHPC membership trends

Before revision of law

Overseas companies and organizations



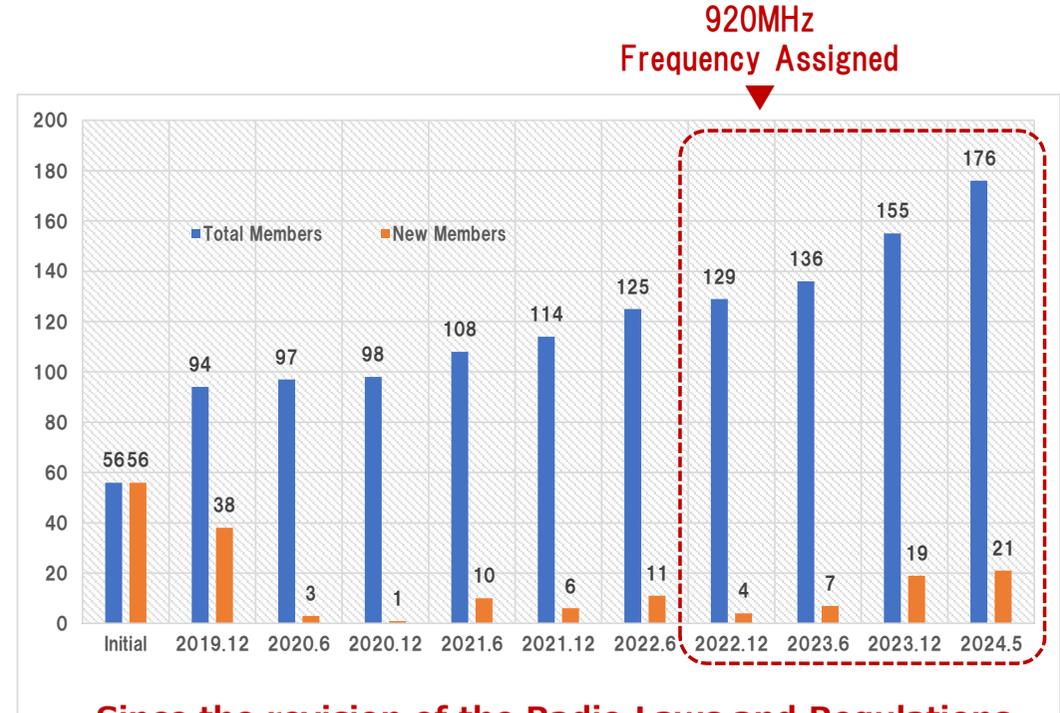
Japanese companies



Module vendors



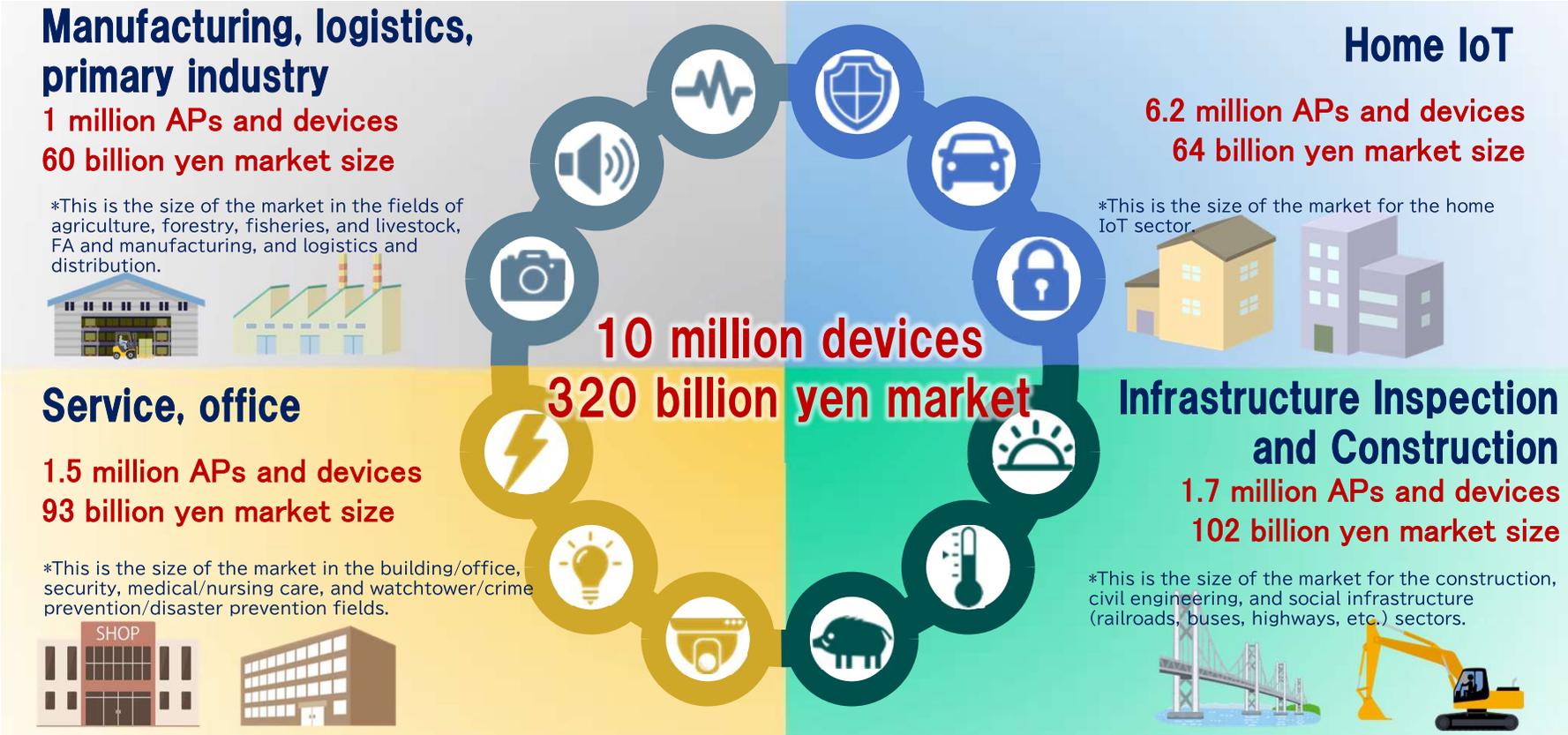
After revision of law



Since the revision of the Radio Laws and Regulations, 50 new member companies have been added.

Market demand forecast in Japan

Including the frequency extension of 11ah, use cases that take advantage of its characteristics are expanding, and its introduction into various fields is expected.



*This figure is based on statistical information from a research company, using the number of units shipped in the domestic Wi-Fi market as the base value, and calculating the ratio of 11ah to that number over a five-year period after full-scale deployment.
 *The number of devices is calculated based on the ratio of one camera and five devices per 11ah product.
 *The number of units listed is the cumulative number of APs, cameras, and sensors compatible with 11ah that have been shipped.
 *The amount shown is the cumulative business scale of hardware sales (11ahAP, devices, etc.) and software sales (cloud usage fees, etc.).
 *calculated by AHPC based on information from research company.

Tourism Sector – Ensuring the safety and security of tourist destinations

■ Demonstration overview

- Lake safety and security monitoring
- Monitoring of illegal operations
- Automatic measurement of water temperature
- Creation of a database of water temperatures

■ Purpose of the demonstration

- Safety management on lakes in tourist areas
 - ▶ Early response to water accidents and disasters through alerts and video recording
- Monitoring of no-take zones
 - ▶ Improved speed of initial response through video with person detection and motion detection
- Real-time measurement of water temperature
 - ▶ Significant improvement in labor through automatic measurement and visualization, and response to human resource shortages.
 - Analyze fish behavior by collecting detailed daily water temperature changes throughout the year

■ Photo



Surveillance cameras on the lakeshore & Solar panels and batteries



Detects people on board (green frame)

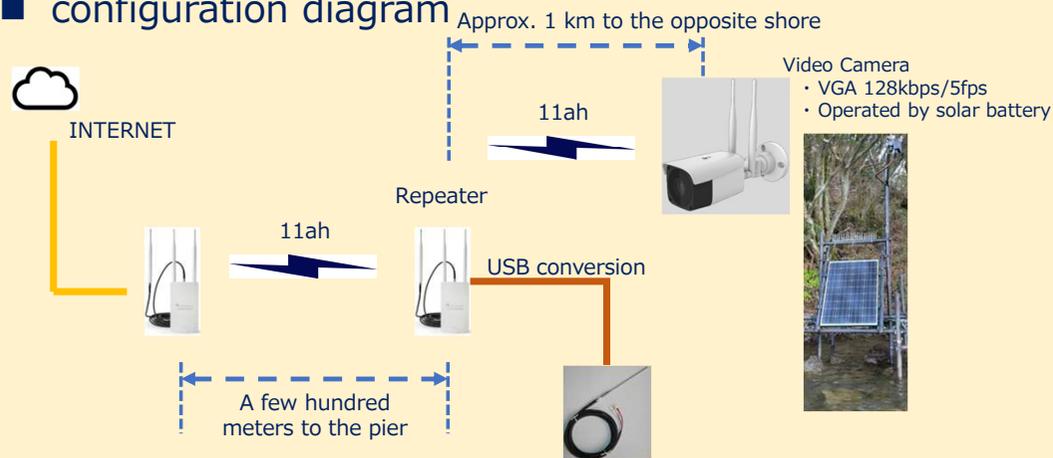


Surveillance camera images
*Recording status in moonlight (around 7pm)



Check water temperature with a smartphone

■ configuration diagram



■ Challenges encountered in the course of the demonstration and their countermeasures

- Solar panels and batteries are installed in locations where there is no power supply to support the project.
- Because of the location's short daylight hours, the solar panels are sized for a larger setting.
- Water temperature measurement at the pier is handled by a repeater because it is far from the AP parent unit.

■ Final results and implementation

- Video transmission is possible in environments without a power source by utilizing solar panels.
- It will be able to measure and remotely monitor water temperatures without going to the site, and will be able to take measurements throughout the lake.
- HaLow can be used as a communication network in areas where mobile signals are not available.

■ Quantitative Effects

- Efficient and effective video surveillance by person detection without human intervention.
- A total of two hours of monitoring work four times a day is reduced to "zero" through remote monitoring.

HaLow solves the problem of monitoring with real-time video transmission from a difficult location 1 km away with no power supply.

Agriculture sector – There are many different fields of agriculture.

■ Demonstration overview

- Image analysis of pest outbreaks from camera images
- Sequential monitoring of temperature, humidity, CO2, and soil conditions (moisture content, temperature)

■ Purpose of the demonstration

- Image analysis and quantification of pest infestation on traps.
- Verify whether optimal ventilation, watering, and temperature control are possible based on various sensor data.
- Verify whether the opening and closing status of ventilation curtains can be remotely monitored from real-time images.

■ Photo



11ah AP (rooftop)



Temperature, humidity, CO2, soil sensor

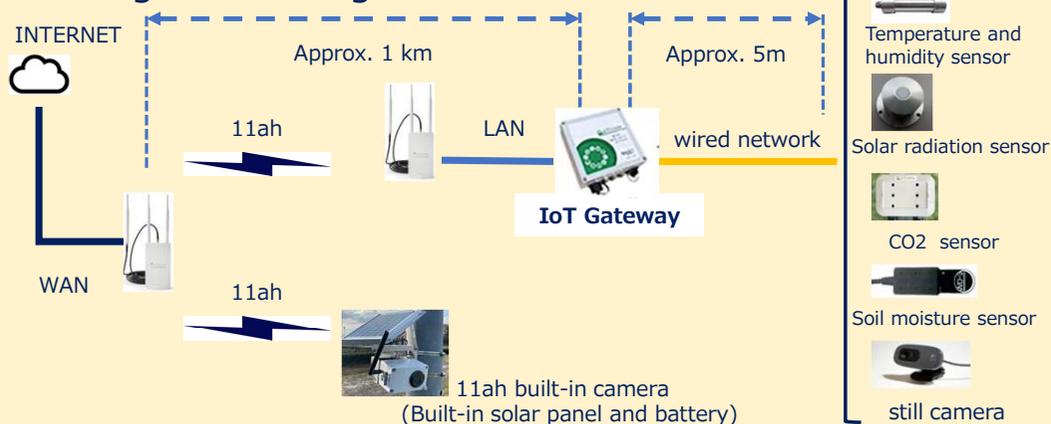


11ah built-in camera



Image processing of moths caught in traps

■ configuration diagram



■ Challenges encountered in the course of the demonstration and their countermeasures

- Sensors and cameras are installed so as not to interfere with the farmer's work.
- An AP child unit was installed in a plastic greenhouse, and throughput of about 120 kbps was secured even at 1 MHz BW.

■ Final results and implementation

- Various types of environmental data are acquired in real time and visualized in a database.
 - ▶ Contributes to efficient operations and efforts to increase harvest yields
- Moth image analysis processing enables sharing with neighboring farmers via SNS and early countermeasures.

■ Quantitative Effects

- It can be automated without the need for workers to make rounds.
- The total of one hour of work to watch over three times a day has been reduced to "zero" through automation.

Leave it to HaLow to transmit video and sensor data over a distance of 1 km, which has been difficult with other LPWA and existing Wi-Fi.

Industrial Sector – IoT implementation in FA environment is just starting

■ Demonstration overview

- Data collection for carbon neutral plan
- Visualization of CO2 emissions
 - ▶ Electricity measurement・・・Measurement by electric power sensor
 - ▶ Measuring gas usage: A camera takes a picture of the gas meter and AI analysis converts it into a numerical value.

■ Purpose of the demonstration

- Collect data for the presentation of a carbon neutral plan for 2050.
 - ▶ Confirm the extent to which existing facilities can support the project.
- Data will be collected in order to materialize measures through the visualization of CO2 emissions.
 - ▶ Analysis of current status and visualization of countermeasures

■ Photo



Power sensor module



Power sensor devices



Camera module

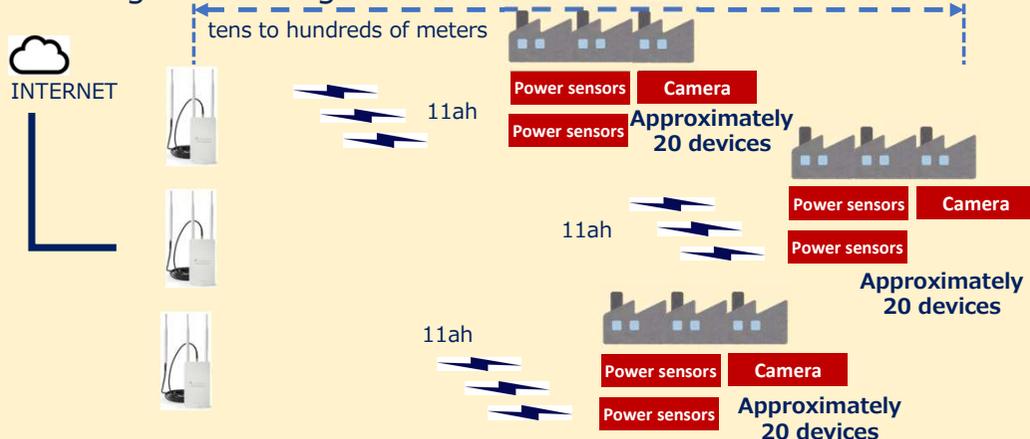


Meter reading camera device



Gas meter and camera view
Camera captures gas usage and AI analysis

■ configuration diagram



■ Challenges encountered in the course of the demonstration and their countermeasures

- Reading accuracy has been improved in response to changes in the reflection of lighting in the factory.
- The system has been adapted to accurately read even weak power changes.

■ Final results and implementation

- Stable data acquisition was achieved even in configurations with many devices connected.
- Valid data has been obtained and studies are underway to achieve carbon neutral.
- In a limited space such as inside a factory, fewer APs can cover the area even if there are obstructions.

■ Quantitative Effects

- The area covered by 10 Wi-Fi APs could be covered by a single 11ah AP.
- The installation cost could be reduced to 1/4 of the conventional cost.

With HaLow, one AP covers each factory site - conventional Wi-Fi requires multiple APs

Leisure sector – Wi-Fi HaLow can be used in large outdoor environments.

■ Demonstration overview

- Improved customer comfort
- Improved efficiency of greens and other maintenance operations
- Customer safety and security monitoring

■ Purpose of the demonstration

- Before leaving the clubhouse, we want to check real-time crowds at the driving range and holes.
- Check the status of popular courses (I would like to see how other players are doing.)
- Check the condition of the turf on the greens and verify how much efficiency can be improved by remotely checking the labor-intensive work required to manage the greens.

■ Photo



Check the clubhouse to see how crowded the driving range is.

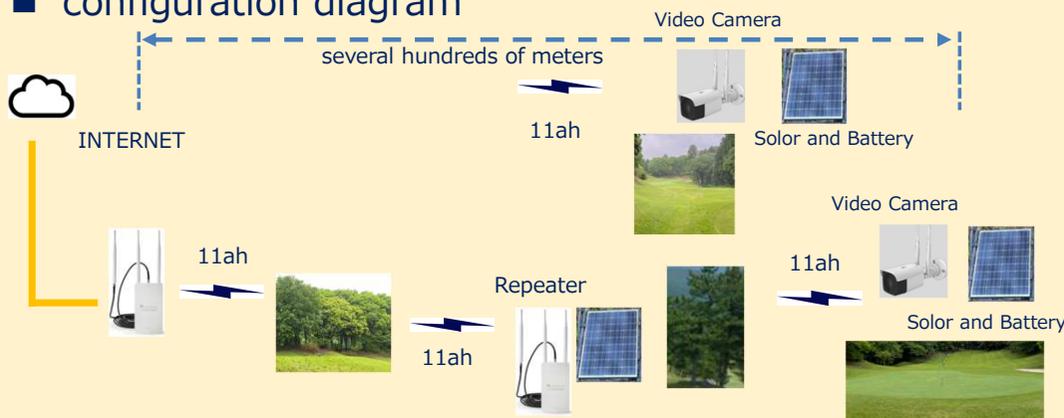


overgrown trees



Installation of solar panels and cameras

■ configuration diagram



■ Challenges encountered in the course of the demonstration and their countermeasures

- If there are trees growing between communications, the radio transmission distance will be short and the speed will be slow.
- The environment with trees needs to be improved by the location of antennas and the use of repeaters to bypass them.

■ Final results and implementation

- Golf courses are often LTE dead zones, and HaLow can cover the areas that Wi-Fi cannot cover due to the large size of the course.
- The environment is harsh even on HaLow due to the many trees, but remote monitoring is possible using a repeater.
- Camera installation and repeater installation are handled using solar panels and batteries.

■ Quantitative Effects

- The area that was covered by four Wi-Fi APs was now covered by one 11ah AP.
- Installation cost is reduced to 1/2 of the conventional cost.

Only HaLow can provide comfort for customers in fields where LTE and Wi-Fi cannot provide a signal.

Summary of demonstration experiment

- Wi-Fi HaLow is expected to be effective in a variety of industries and business categories

Work and Time Improvement

- Significantly reduces human travel time
- IoT, not people, greatly improves workability and man-hours
- Reduces human man-hours and promotes efficiency and rationalization through automation



Installation and Running Costs

- Reduce installation costs of equipment by half at the time of introduction
- Network wiring facility construction can also be accommodated by 1/2 to 1/3
- Reduced running costs for installed systems



11ah Wi-Fi HaLow

Overcome distance challenges

- Can overcome the distance of conventional Wi-Fi
- Wide-area wireless networking can be easily achieved.



Advancement of information

- Greatly improved information freshness
- Dramatically improved granularity of information

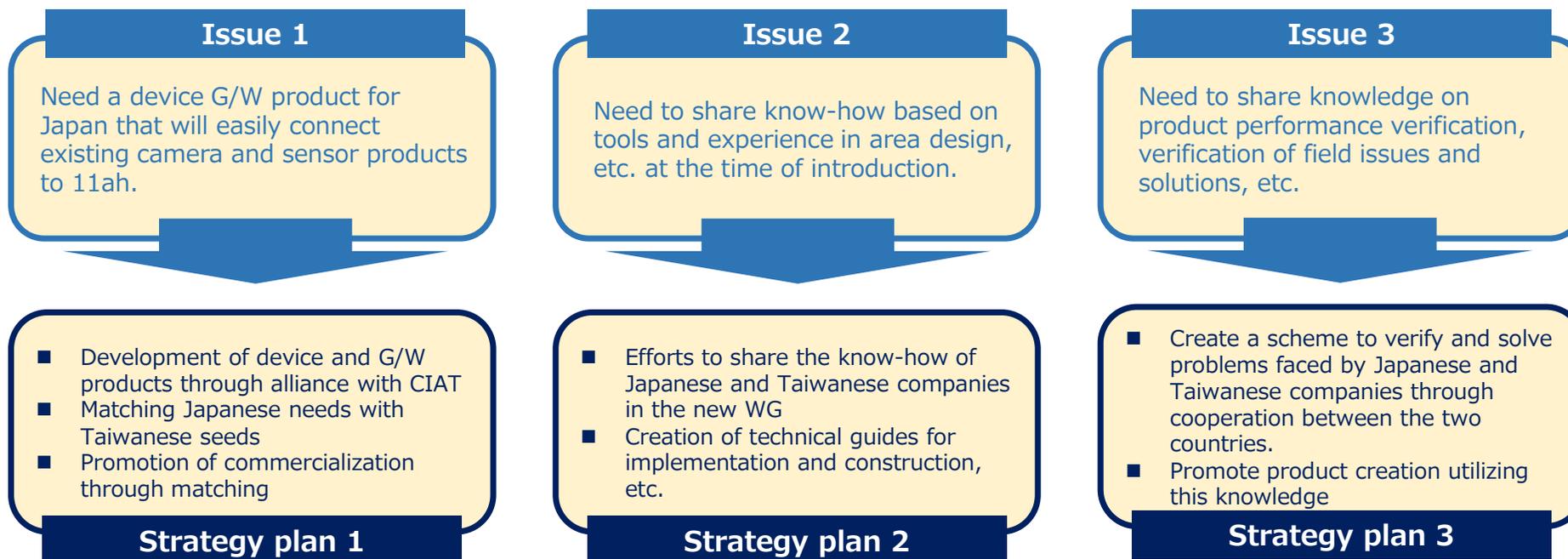


Issues and strategies

■ Strategies for Social Implementation of Wi-Fi HaLow

To provide Wi-Fi HaLow with systems and solutions in various environments

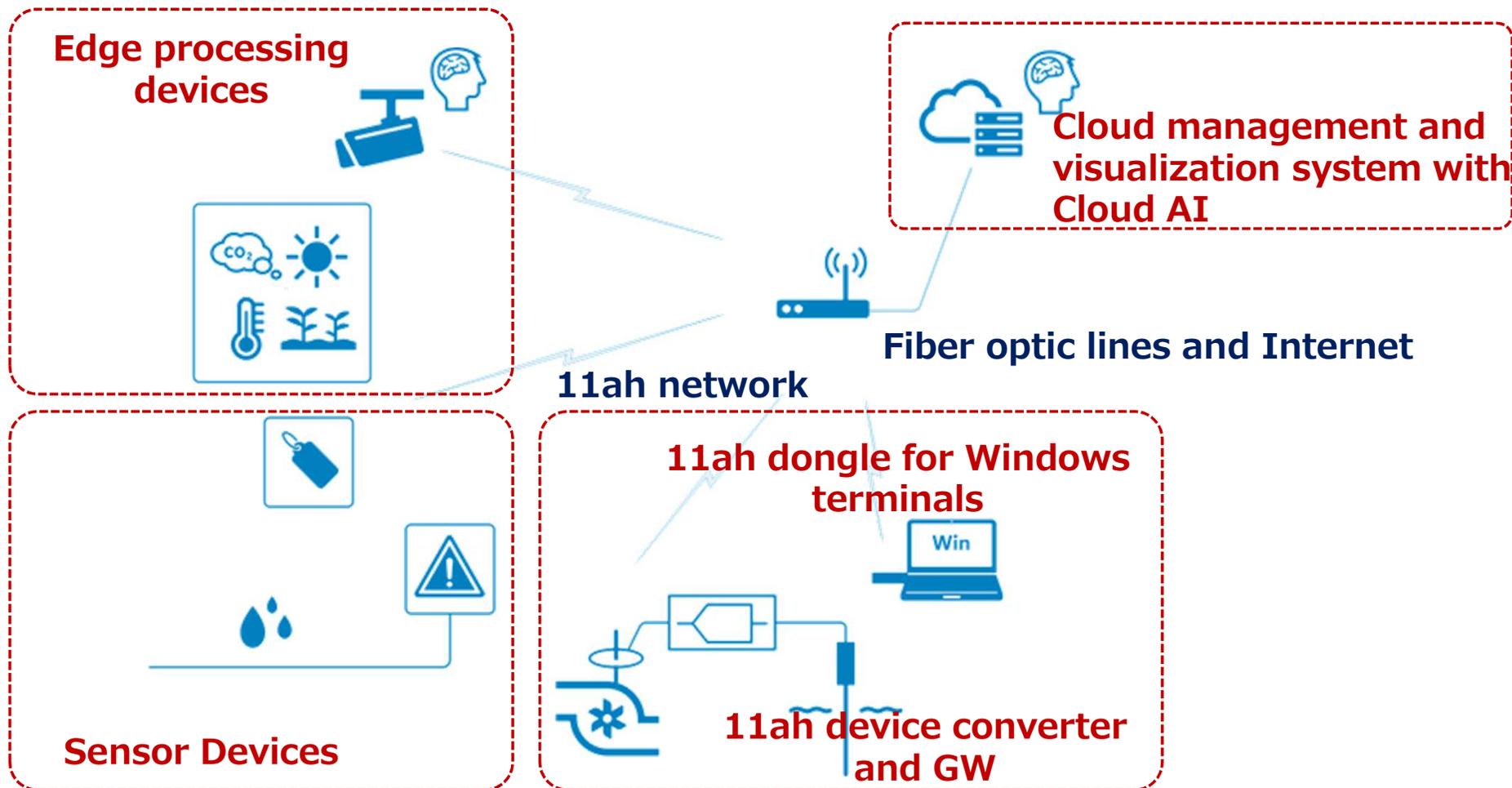
Taiwanese and Japanese companies build business in alliance activities.



Maximize the use of WG activities and vLab environment in both countries to boost the HaLow market in both countries.

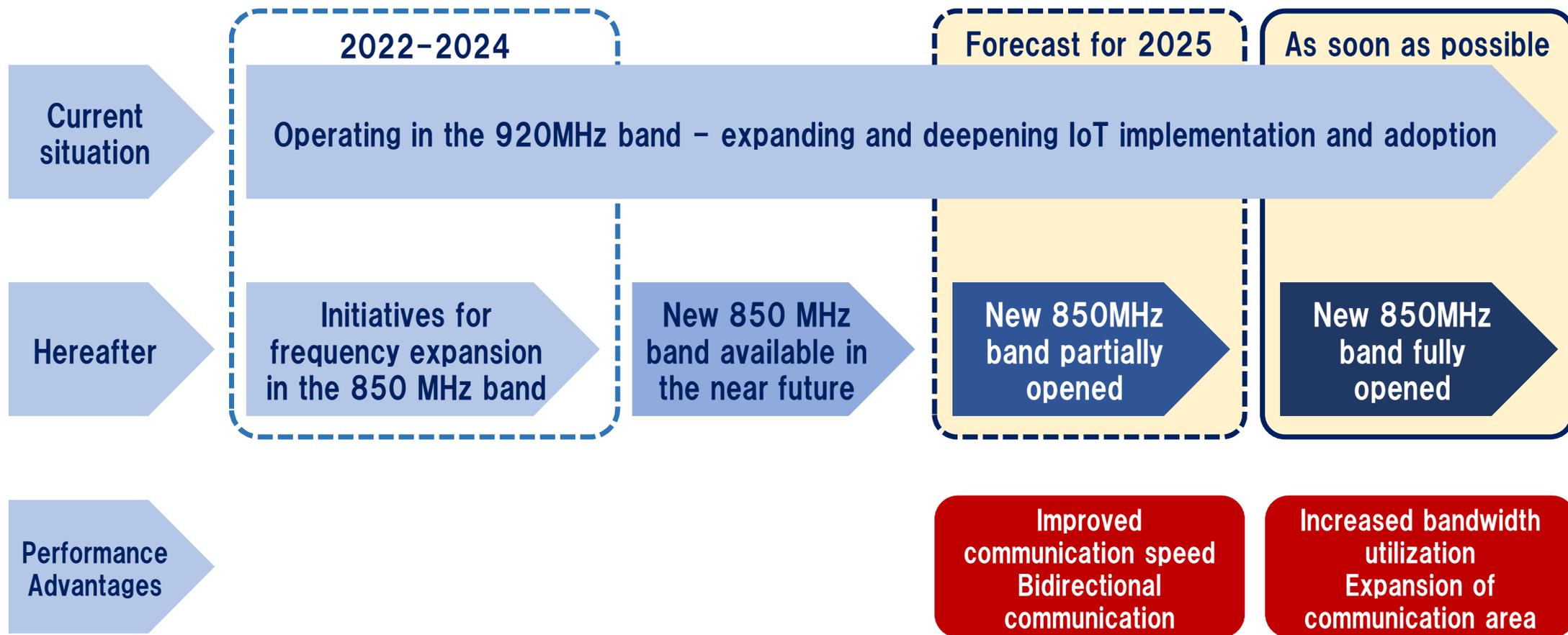
Requests to Taiwanese companies

- Devices and cloud products that build entire systems with Wi-Fi HaLow products are demanded in a variety of markets.



Frequency expansion – Further evolution and possibilities

■ Activities for Wi-Fi HaLow frequency expansion with 850 MHz band



Wireless Japan 2024 Quick report

- Interest in Wi-Fi HaLow is growing every year.
 - Questions about HaLow's performance and functions.
 - Visitors would like to hear about specific examples of demonstrations and implementation results.

■ Booth visitors

	2021		2022		2023		2024		
Day 1		111		114		150		452	300.0%
Day 2		70		168		233		357	153.2%
Day 3		100		205		256		388	151.5%
		281		487		639		1,197	187.3%

■ Photo of the booth

