



# 基於Weightless-P長距離低功耗網路之智慧 電表應用

Reliable, Low energy, High Capacity LPWAN

Ubiik Inc

ubiik

# Ubiik & Weightless



Weightless SIG is a **Non profit organization** that exists to promote open standard for LPWAN connectivity.

Location: Cambridge, UK

Board member: ARM, Accenture, Ubiik

## Weightless-P

- ❖ LPWAN open standard
- ❖ Coverage Range: +2km (urban)
- ❖ NB and Synchronized network
- ❖ End-Device battery life: 5-10yrs

# ubiik

## 優必闊科技



Ubiik HQ  
Hsinchu, Taiwan



Japan Branch  
Osaka, Japan

## Ubiik Team

- ❖ IoT solution veterans
- ❖ Wireless connectivity experts

# AMI (Advanced Metering Infrastructure)

## AMI 電表目標

- 建立雙向通訊網路與數據管理
- 統計研究消費者行為和需量反應
- 增加能源管理以及使用效率

## 全球市場

- \$8.8bn/2016; \$10.7bn/2025
- 85mn pcs shipment expected 2025

## 智慧電表系統

- 電表、通訊模組、集中器等硬體次系統，統計研究消費者行為和需量反應
- 電表資料管理系統 (Meter Data Management System. MDMS) 等軟體方案



# 台電低壓 AMI系統

## 2012 設定目標

- 2015年完成100萬戶低壓用戶，2020年要完成低壓600萬戶
- 至今低壓用戶僅完成了1萬戶，完成率約 1%
- 通訊不良問題，導致需要透過人工抄表

## 2016 新設定目標

- 相較於電子式電表計畫，著重通訊功能
- 2017年開始建置20萬戶，2020年完成100萬戶，2024年預計完成300萬戶
- 通訊部分，計畫採用外掛「插拔式」新型設計
- 規劃採用以下通訊技術：low-power LAN, PLC, Cellular (LTE/NB-IoT), Long Range Radio, 並進行實測評選
- 建議採用839MHz~851MHz專用頻段

採資格審查、實際測試，後進行資格招標

# AMI 系統架構圖

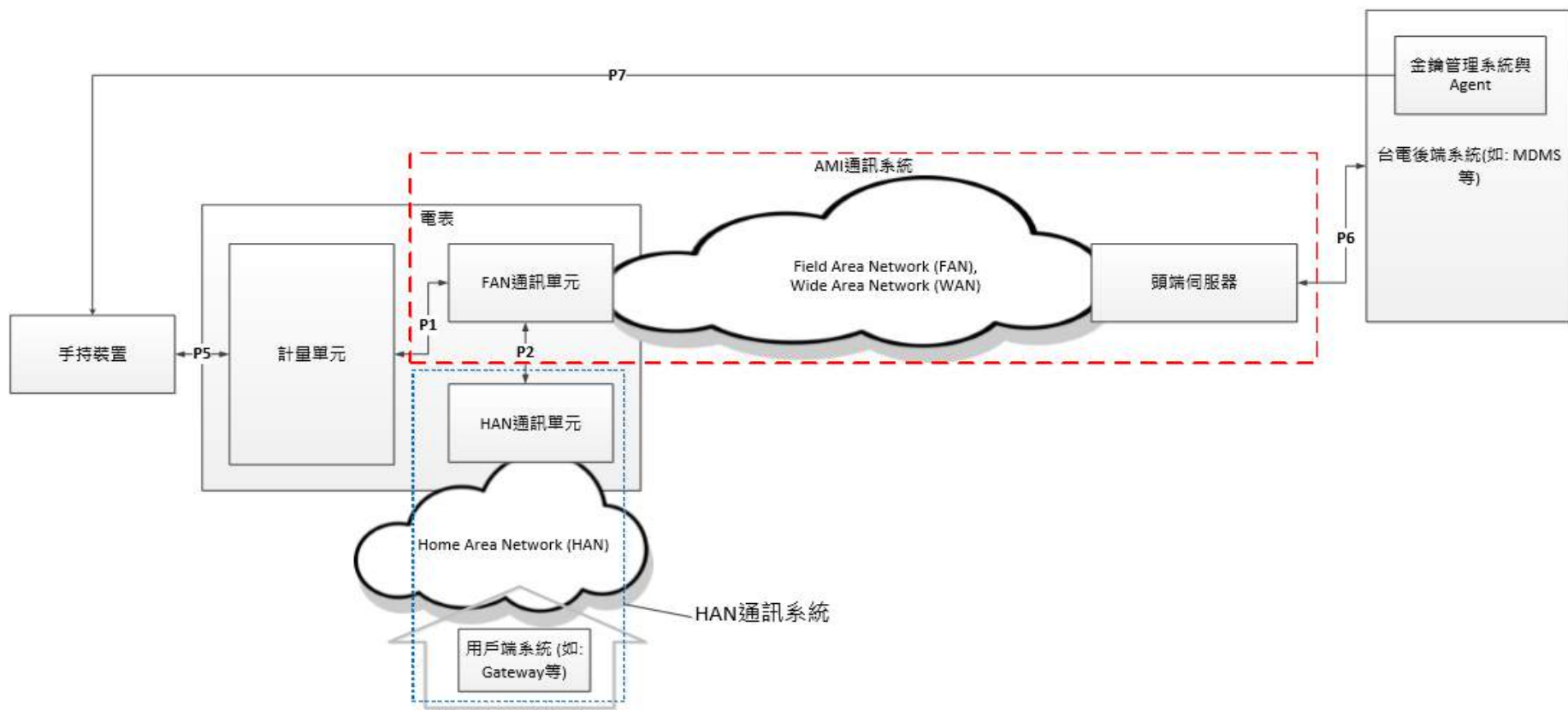


圖 1-1 AMI 系統架構圖

# AMI 系統 Communication Profile

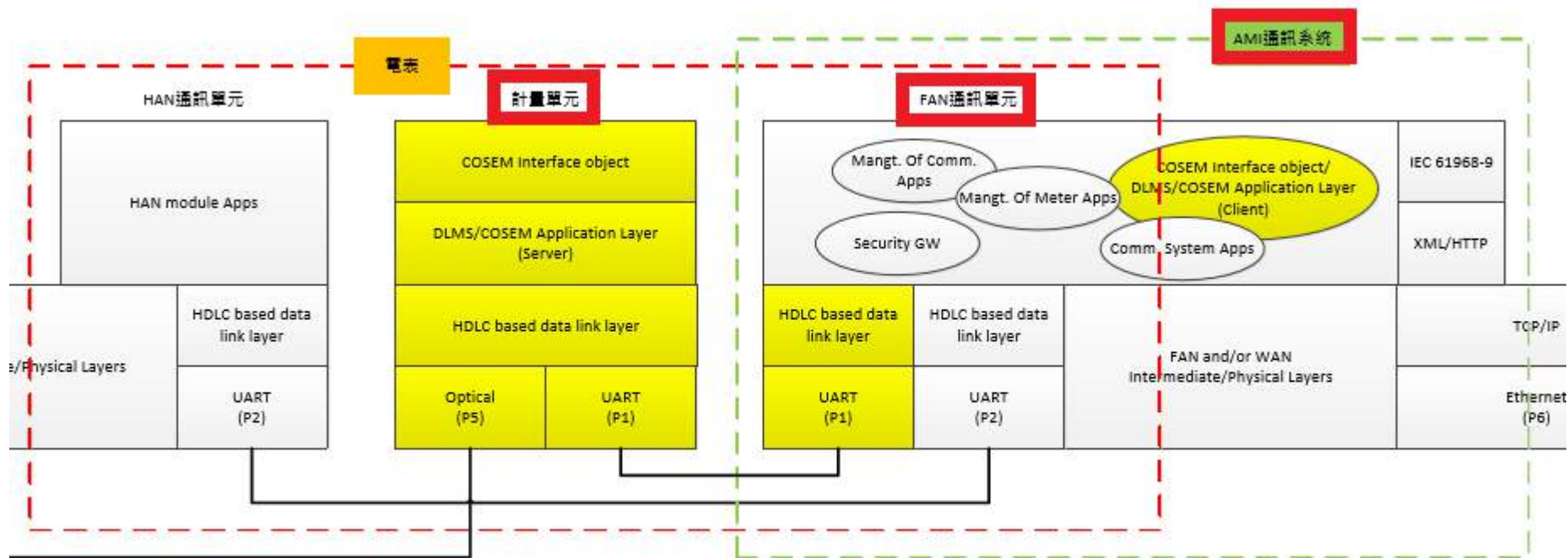


圖 1-2 AMI 系統 Communication profile

# 低壓 AMI 通訊介面規格要求

目標: 建立雙向通訊網路與數據管理智慧電表

<b>Down Link</b>	<ol style="list-style-type: none"><li>1. 金鑰建立, 單一電表 Control &amp; Reconfiguration</li><li>2. 韌體更新功能</li><li>3. 遠端操作的能力 (包含: Firewall 功能啟閉、設定HDLC frame 流量限制、讀取Log 資訊等)</li></ol>
<b>Up Link</b>	<ol style="list-style-type: none"><li>1. 單一電表, 蒐集每日讀表要求 (15分鐘一筆), 夜間讀表要求</li><li>2. 單一或群組電表進行on-demand 讀表,</li><li>3. 停電時將電表資料上傳</li></ol>
<b>Security</b>	具備雙向 <b>end-to-end</b> 的資料傳輸安全, 確保通訊網路之資料保密性與完整性
<b>Battery Backup</b>	電表發生停電時, <b>FAN</b> 通訊單元(模組)要能維持足夠的電力成功上傳Last Gasp 訊息至HES, 並通知台電後端系統。

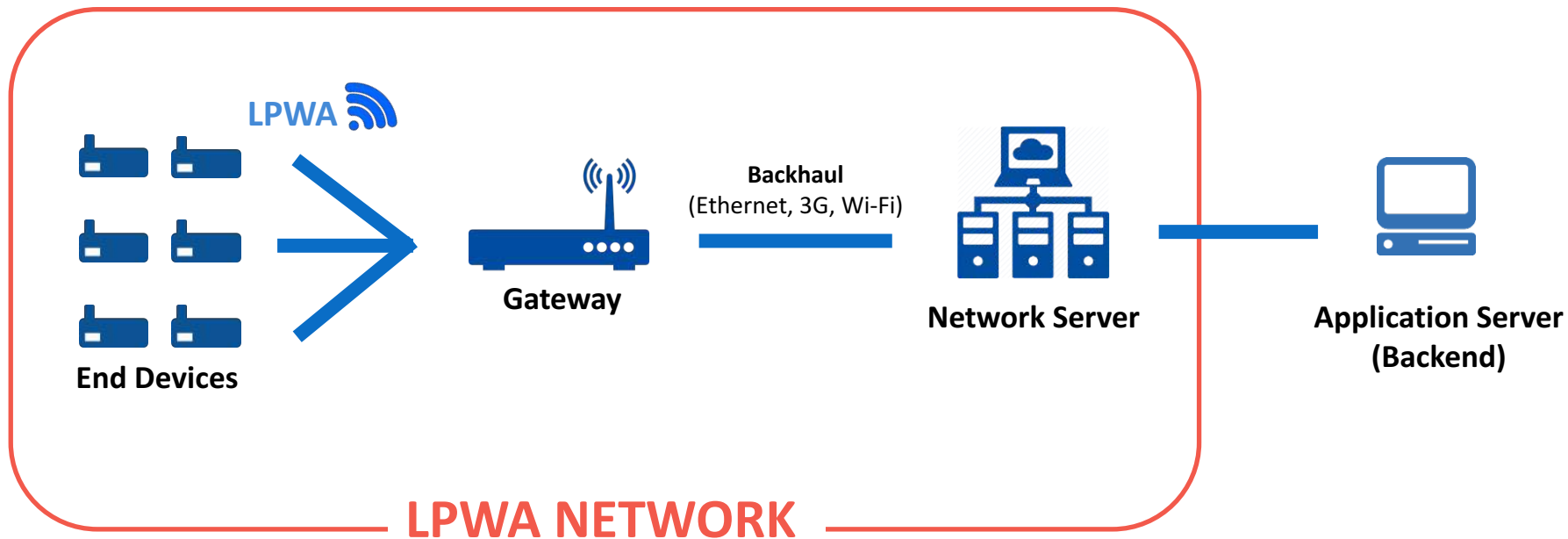
# 低壓 AMI 效能要求

1	<b>單一電表 Data Collection, FAN 每15分鐘上傳一筆資料</b>
2	<b>每日mid-night 讀表性能要求 (Mid-night register, Event data)</b> 經過午夜12 點後, 4 小時內, 要回傳99%電表資料。
3	<b>各別的遠端讀表(隨選讀表 On-Demand) : 隨選讀取電表資訊</b> 操作響應應在30 分鐘內有90%資料回傳量。 操作響應應在60 分鐘內有99%資料回傳量。
4	<b>停電偵測能力</b> 停電事警示訊息應在1 小時內完成90%的回報/接收。
5	<b>遠端電表設定、遠端讀取電表設定參數及組態、遠端讀取電表事件狀態(events)</b> 30 分鐘內完成90% ; 1 小時內完成99%。
6	<b>韌體更新</b>
7	<b>停電後復電, 30分鐘內完成聯網。</b>

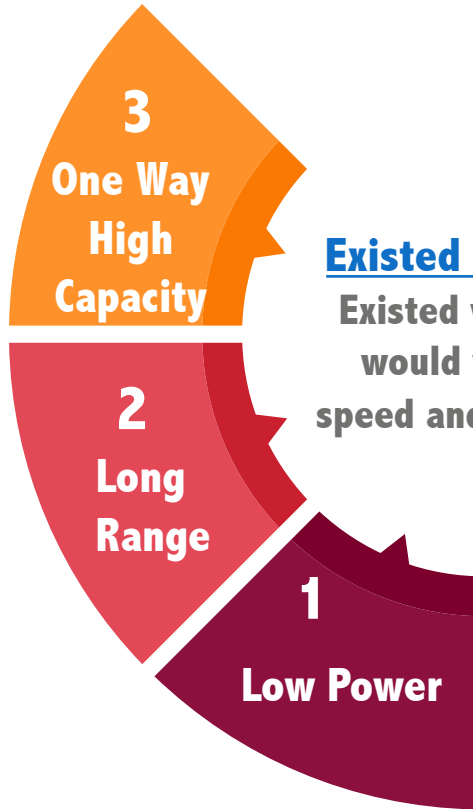


# Weightless-P Network Overview

LPWAN/W-P general network architecture

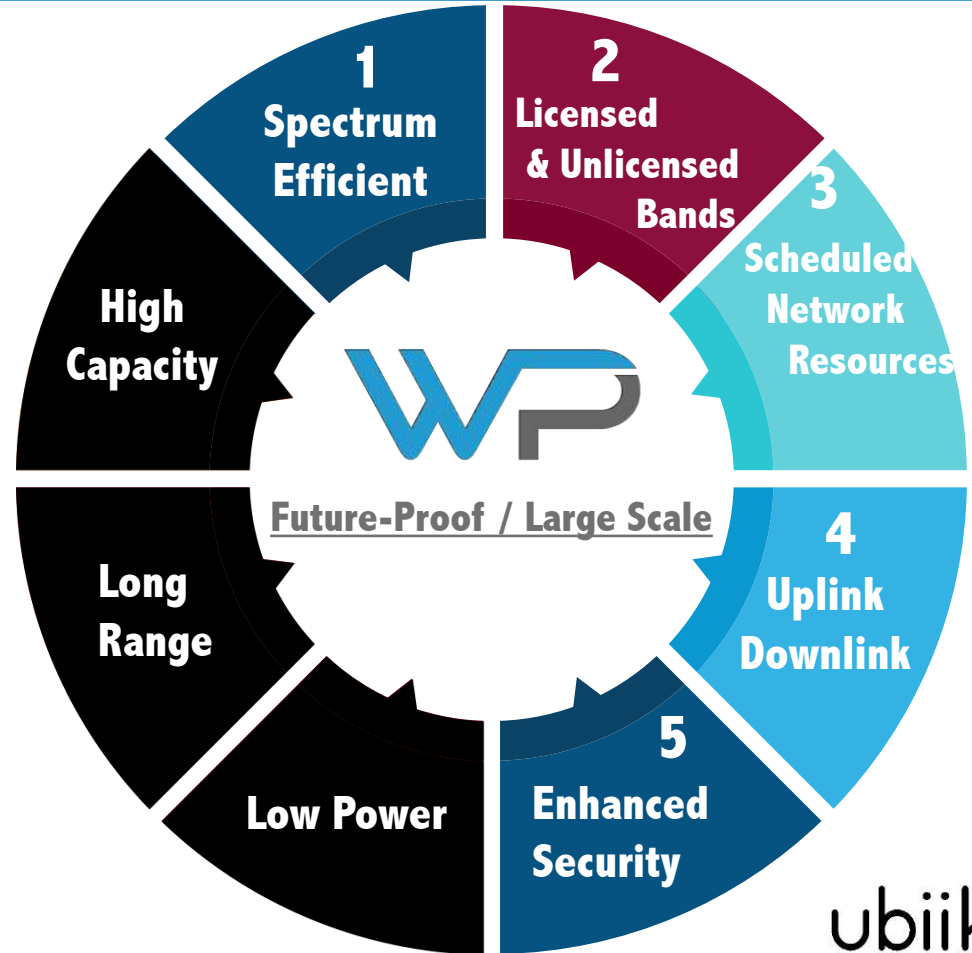


# Weightless-P Advanced Features



## Existed LPWAN Solution

Existed wireless solution would work as long as speed and downlink are not required





## Bi-directional communication

- True 2 way communication
- Standard MCS: GMSK / PSK modulation combined with Convolutional FEC
- -134dBm sensitivity at 625bps (10% PER)
- >5Km range in urban area with AMI system Tx power

## W-P Features (2) Low-energy consumption



### Ultra-Low Power

- Adaptive data rate for optimally-short air time
- Efficient FDMA+TDMA in 12.5kHz to avoid collisions and retransmissions
- Supports flexible periodic traffic for extended sleep periods
- Adaptive transmit power to reduce battery drain
- Lean protocol stack design to reduce overhead

# W-P Features (3) Secure & Reliable



## Secure

- Firmware over the air (FOTA)
- Mutual authentication with trusted third-party
- Cipher suite negotiation
- EAP-GPSK authentication scheme as baseline
- AES-128 defined as the minimum



## Reliable

- frequency hopping for robustness to multi-path and narrowband interference
- Supports Acknowledged and unacknowledged transport channels

# W-P Features (4) High-capacity & Scalable



## Capacity and Scalability

- Synchronized network
- Adaptive and optimized resource allocation
- Adaptive data rate: 625bps to 100kbps
- Narrowband operation (12.5kHz/100kHz)
- Spectrum-efficient PSK modulation
- Operate in both licensed and license-exempt sub-GHz ISM/SRD band

# W-P Features (5): Advanced networking features

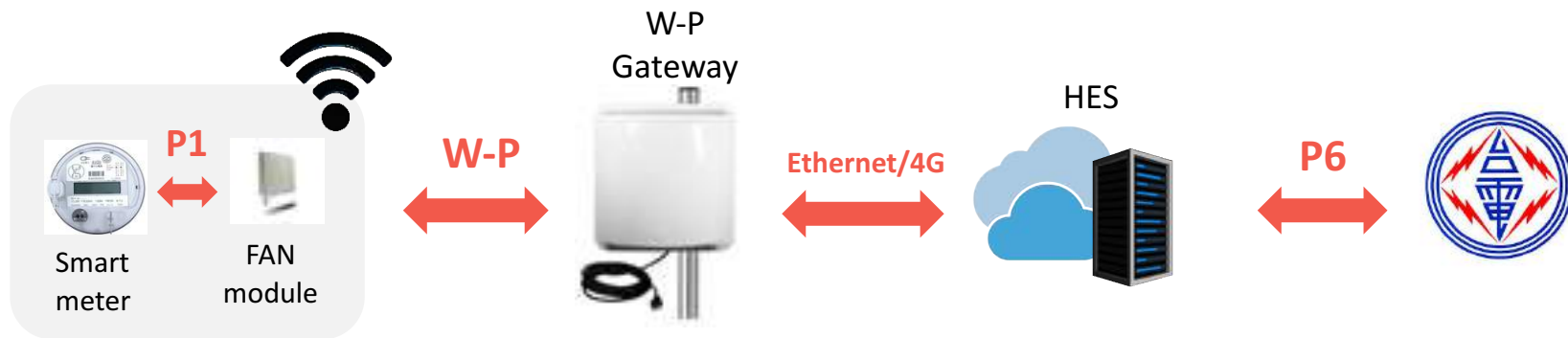
Weightless-P has **advanced features** than any other LPWAN technologies.

	Symmetric DL/UL	Multicast / Broadcast	Message Ack	Battery operation	Power control	Location services*	Handover support	Firmware upgrade
LoRa	●	●	●	○	●	●	●	●
UNB/SigFox	●	●	●	○	○	●	●	●
Weightless-P	○	○	○	○	○	○	○	○
RPMA	○	○	○	○	○	●	○	○
Telensa UNB	○	○	○	○	○	○	●	○
LTE Cat-1	○	○	○	●	○	○	○	○
LTE Cat-m1	○	○	○	○	○	○	○	○
LTE NB-IoT	○	○	○	○	○	○	●	○

Legend:  
○: Supported | ●: Not supported | ●: Partial support; optional support | ○: Not required  
\* Location services include paging capability.

Source: “Mobile Experts: Mobile and Wide-Area IOT: LPWA and LTE connectivity. 2016”

# Ubiik AMI System Architecture



- 針對透天厝及公寓, 將使用戶外的 W-P Gateway, 通訊距離 >2km
- 大樓(電表在地下室), 使用W-P repeater或替代方式, 將訊號傳至雲端 server
- 電表在不同樓層的大樓, 使用戶外的 W-P Gateway,通訊距離 >2km



# Ubiik 使用電表專用頻段

- 使用台灣的smart meters專用頻段 (839MHz~851MHz)，不與其他無線傳輸系統發生干擾
- 發射功率可達1W，拉長通訊距離或拉高 datarate
- Ubiik系統設計為8 個頻道、共100 kHz頻寬；針對極高密度的區域，可使用更大頻寬，或採其他方式，增加單一Gateway 可控制的ED數量



# Gateway 到 FAN 的上・下行資料傳輸



**Downlink**

- Multicast and broadcast 通訊模式 (ACK & ACK response)
- ADR: 6.25kbps to 100kbps



**Gateway**



**End Device**

Data Rate: 100/50/12.5/6.25 kbps single channel or 10/5/0.625 kbps with 8 subchannels



**Uplink**

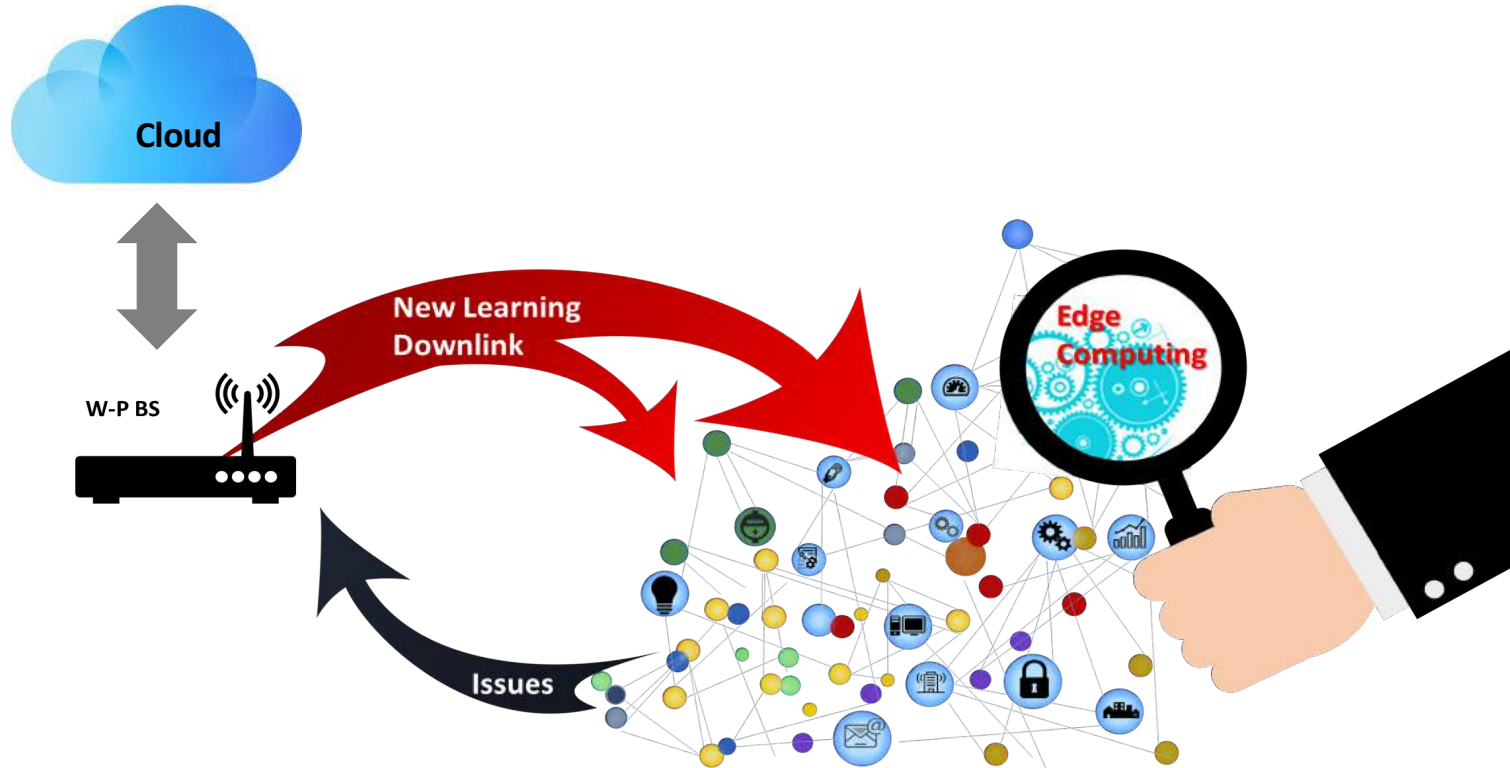
# UBIIK AMI 系統效能評估/1200電表、1 GATEWAY

單一電表 Data Collection, FAN 每15分鐘UL 一筆資料	7 Min/60 minutes' data
每日mid-night 讀表性能要求 (Mid-night register, Event data) 經過午夜12 點後, 4 小時內, 要回傳99%電表資料。	8 min/4 hours time limit
各別的遠端讀表(隨選讀表 On-Demand) : 隨選讀取電表資訊 停電偵測能力 遠端電表設定 遠端讀取電表設定參數及組態 遠端讀取電表事件狀態(events)	5 min/30~60 min time limit
遠端韌體更新(FOTA)	200 kB/ 50 min
停電後復電, 電表在30分鐘內完成聯網	22 min/30 min time limit

# LPWAN + Machine Learning & Edge Computing

## W-P Downlink for Machine learning

Peer to peer machine learning



# UBIK Weightless-P AMI 相關市場

- LPG: 需具備事故發生時，遠端遙控暫時切斷LPG供應之功能
- Water meters: 需具備特定事件發生時，遠端遙控斷水的功能
- 具備強大downlink 功能才可能是future proof 的LPWAN 技術

## SMART METERS







# Weightless-P Open Standard



Weightless SIG is a not-for-profit organization that exists to promote open standard for LPWAN connectivity. Weightless SIG is base in Cambridge, UK with ARM, Accenture, Ubiik as board members.

## Benefits of an Open Standard

<p><b>Innovation</b></p>  A black and white icon of a lit lightbulb with several short lines radiating from it to represent light or an idea.	<p><b>Interoperable</b></p>  A cluster of three interlocking gears of different sizes and shades of grey and blue.	<p><b>Royalty Free</b></p>  A large blue downward-pointing arrow with a white dollar sign (\$) inside it.	<p><b>Ecosystem for Innovation</b></p>  An icon showing three stylized human figures standing on a three-tiered podium. The figures are black, and the podium tiers are numbered 2, 1, and 3 from left to right.
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**Thank You!**

[www.ubiik.com](http://www.ubiik.com)