Meeting Operational Challenges of the Future Energy & Environment

Chingpo Lin
AVP of Industrial IoT Group, Advantech
Pollution

Air Pollution

Global Warming

PM2.5

Smog

Water Shortage

Sewage Disposal

Water Shortage

Environment continues worsening
Key Technology for Three Key Applications for E&E

1. Remote Monitoring, Remote Control
2. Predictive Maintenance (Analytics)
3. Optimization & Intelligent Operation

Wireless Comm. & OPC UA Solution
Edge Intelligent Solution
Cloud Platform & Mgmt. Platform
Wireless Communication Map

Which one is best solution???
<table>
<thead>
<tr>
<th>Find Your Best Solution</th>
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</thead>
<tbody>
<tr>
<td><strong>Cellular (Licensed)</strong></td>
</tr>
<tr>
<td>Long Range W/ Battery</td>
</tr>
<tr>
<td>Wide Area Underground/Outdoor <em>(Nomadic)</em></td>
</tr>
<tr>
<td>Latency in Seconds</td>
</tr>
<tr>
<td>• Real Time <em>(LTE-M)</em></td>
</tr>
<tr>
<td>• Long Range</td>
</tr>
<tr>
<td>• Battery Life</td>
</tr>
<tr>
<td>• Device to Cloud</td>
</tr>
<tr>
<td>• Private Server</td>
</tr>
<tr>
<td>• Higher Data Rate</td>
</tr>
<tr>
<td><strong>Low Power Wan</strong></td>
</tr>
<tr>
<td>Long Range W/ Battery</td>
</tr>
<tr>
<td>15KM (L.O.S) Wide Area/Outdoor <em>(Static)</em></td>
</tr>
<tr>
<td>Latency in Seconds</td>
</tr>
<tr>
<td>• Long Range</td>
</tr>
<tr>
<td>• Battery Life</td>
</tr>
<tr>
<td>• Confirm Data</td>
</tr>
<tr>
<td>• Frequency Hopping</td>
</tr>
<tr>
<td>• Real Time</td>
</tr>
<tr>
<td>• Higher Data Rate</td>
</tr>
<tr>
<td><strong>LAN</strong></td>
</tr>
<tr>
<td>Short Range Communicating</td>
</tr>
<tr>
<td>100m Real Time</td>
</tr>
<tr>
<td>SMART FACTORY <em>(Equip. Connectivity)</em></td>
</tr>
<tr>
<td>• Real Time</td>
</tr>
<tr>
<td>• Higher Data Rate</td>
</tr>
<tr>
<td>• Well Established</td>
</tr>
<tr>
<td>• Crowded</td>
</tr>
<tr>
<td>• Battery Life</td>
</tr>
<tr>
<td><strong>Low Power Wan</strong></td>
</tr>
<tr>
<td>Long Range W/ Battery</td>
</tr>
<tr>
<td>3KM (L.O.S) Wide Area/Indoor</td>
</tr>
<tr>
<td>Latency in Seconds</td>
</tr>
<tr>
<td>SMART FACTORY <em>(Utility/Facility Monitoring)</em></td>
</tr>
<tr>
<td>• Penetration</td>
</tr>
<tr>
<td>• Long Range</td>
</tr>
<tr>
<td>• Battery Life</td>
</tr>
<tr>
<td>• Real Time</td>
</tr>
<tr>
<td>• Higher Data Rate</td>
</tr>
</tbody>
</table>
Modularized High Adaptability IoT Nodes

Advantech Wireless Sensing Node

Wireless Communication Map

- Wi-Fi
- LTE
- LPWAN Group
- LoRaWAN®
- ZigBee
- Bluetooth

Coverage

Data Rate (bps)

0.1M 1M 100M 1KM 10KM

Private Server

Public Cloud

Telem Cloud

WISE-PaaS
Iot Edge Intelligence

WISE-S614
4AI & 4DI

WISE-S250
6DI, 2DO & 2COM Ports

WISE-S472
1DI & 2RD-485

WISE-S215
RTD

WISE-S231
Built-In Humidity & Temperature Sensor
Intelligent Water Management

- **WISE-4610**: LoRaWAN Module
- **WISE-S617**: 2AI/2DI/1DO/1RS-485 I/O Module
- **PH Sensors**: NB-IoT/LTE-M Module
- **WISE-S614**: 4AI/4DI I/O Module
- **Reservoir Water Quality**: WISE-2410 LoRaWAN Smart Vibration Sensor
- **Tank Level**: WISE-4671 NB-IoT/LTE-M Module
- **Water Pressure**: WISE-S617 2AI/2DI/1DO/1RS-485 I/O Module
- **Water Meter**: WISE-4671 NB-IoT/LTE-M Module
- **Water Level**: WISE-S62 6AI/1RS-485/1RS-485 or 1RS-232 I/O Module
- **Facility Health Monitoring**: WISE-4671 NB-IoT/LTE-M Module
- **Leakage Detection**: WISE-4610 LoRaWAN Module
- **Drainage Flow Control**: WISE-S672 6DI/1RS-485/1RS-485 or 1RS-232 I/O Module
- **Valve Control**: WISE-4610 LoRaWAN Module
What should We Pay Attention to when Large Number of Modules in the IoT

- Object-oriented
- standard protocols for Cloud/MES/SCADA system
- Security
- M2M decentralized structure

- More I/O demand for data analysis
- Privacy and security requirement
- Compatibility to integrate with system (Cloud, SCADA, MES...)
- IT / OT convergence

OPC UA & Security
Intelligent OPC UA Ready Solutions

Plant & Enterprise
Integrated MES / Increased Interaction / Data Analytics

HMI / SCADA
Centralized Supervision

Edge Controllers
Distributed Control & Virtual PLCs

ADAM-6300 Series

Edge Gateway & Sensing Devices
Open & Intelligent Integrated Sensing
Intelligent Edge Device

Intelligent Gateway

WISE-EdgeLink

Intelligent Sensing Node
Intelligent Gateway - WISE-EdgeLink
From Edge Device to Cloud without Coding

Data Collection
- I/O Drivers
- Data Management
- Customized Tags
- System Tags

Connectivity
- Open VPN
- Connection to WebAccess
- Data forwarding
- Protocols (MQTT/FTP/ODBC/AMQP/Webservice/RESTful)

Protocol Conversion
- Modbus
- BACNet
- DNP3

Security
- Project Encryption
- Whitelisting
- SSL Encryption
- Data Authority Management

Intelligence
- Event hub for SMS/email alerts
- SoftLogic Runtime
- Data Preprocessing

Public & Private cloud connection
- MQTT
- AMQP
- LWM2M

Wireless Connections:
- Wi-Fi
- 3G, 4G, GPS/GPS

EdgeLink Studio (Windows)
- Project Configuration
- Online device monitoring
- Device configuration
- Data forwarding configurations
- System settings

EdgeLink Runtime (Linux)
- End devices connection
- Data acquisition and transfer
- 200+ Drivers support
- Real time / historical data log
- Connectivity to cloud or 3rd party systems

Data Acquisition
- Multiple I/O interfaces

Notification & reports
Web API
**Feature Highlight**

**Inspection Standard**
- Without Coding or Algorithm implementation with ISO 10816 standard

**Remote Detection**
- Long Range with Low Power Consumption

**Computing On-Board**
- Directly calculate total 8 vibration characteristic values

**3-axis Detection**
- 10 ~ 1KHz Frequency Range with max ± 16 g Measurement Range

**Battery-Powered**
- 2 years Battery life cycle
Pumps in Factory Facility

- Increase the Production Efficiency
- Decrease the probability of system sudden break
- Easy Maintenance with Long Wireless Coverage
- Cost Effective without wire installation and regular inspection by workers

WISE-2410 Vibration Sensor

LoRaWAN

880m
1180m
Cloud Platform

Biz Integration Platform

Eco-system Partner
Advantech I.App

Domain-Focused SI (DFSI)

Huge Opportunity: From Traditional SI Biz to Operations, Services and Optimization Model

Key Values
• Domain Service Knowledge
• Solution Integration
• Customization O&M Services
• Online to offline Service

Industrial Domain I.App

Cloud Services & SW Module

DeviceOn/BI

WebAccess/SCADA

WISE-EdgeLink

Co-Creation

Partner: I.App Developers
• Domain Industrial Application
• Open API to get Domain Service

Co-Creation

Enabling Your Digital Intelligence O&M Management
Quickly Build Your IoT Cloud Management Platform

3Step - Build up your Cloud Management Platform
1. Connect Device
2. Create your Digital twin object
3. Select your application Dashboard

ECO-system Partner
Enable Equipment Maker into the IoT era
Manage all your “things” from any where

ECO-system Partner
Enable DFSI into the IoT Solutions

Vertical Domain

Edge sensing devices, platform devices synchronize data and configuration to cloud.
DeviceOn/BI Business Integration Management Portal

Built to fit into your business organization flexibly

- Equipment twin object and dashboards are categorized in the organization with respect to owner and role privileges within the organization, designed from management perspective.
- Advanced features such as API plugin and data forwarding making DeviceOn/BI a true accelerator to domain ecosystem.

- Equipment Twin Object Management
- Dashboard & Command Center Wizard
- Hierarchical User Role & Group Management
- Event Configuration & Rules
- Notification & User Group Management
- Patrol Inspection
- Domain Data Sources & Calculations Plugin
- Customized Format Data Forwarding
- Automated Data Sorting & Archiving
DeviceOn/BI
Business Integration
Patrol Inspection Workflow

1. **Inspection process**
   - **Inspection Setting**
     - Inspection route
     - Inspection cycle
     - Check item
     - Assign personnel
   - **Execute Inspection**
     - Mobile APP Report to System
     - Alarm

2. **Handling abnormal**
   - **Abnormal return**
     - From inspection personnel or system monitoring
   - **Execute Dispatch**
     - Mobile APP Report to System
     - Unqualified

3. **Inspection process Mgmt.**
   - **Dispatch workers**
     - Set dispatch work content & SOP
     - Set deadline
     - Assign staff
   - **Execute**
     - Check & Accept
   - **Equipment Mgmt.**
     - Create site & automatically generate QR Code
   - **Accounts and groups**
     - Quickly create account groups
   - **Report analysis**
     - Display, query the statistics of Patrol inspection

**WISE I.App**
**Mobile App iOS/Android**
Patrol Inspection Mobile App

- Patrol Diary
  Tasks Today 2/5
  Tasks Assigned 2
  Tasks Reported 2
  Tasks Expired 1

- My Tasks
  Assigned 2
  Reported 2
  Expired 1

- Administrator Functions
  Abnormal Events
  Unprocessed 1
  Processing 4

- Patrol Management
  Assigned
  Reported
  Expired

- Inspection Records
  Assign Tasks Calendar

- Station Details
  Station Record

- Finished Tasks
  Pause Timing

- Total Tasks
  Inflow Station
  Gate
  Sand Precipitation
  2nd Basement
  Inventing motor SW-EJC repair
  Total Tasks
Energy & Environment Solution Suite

iWater Multiple Control and Data Management Layers

- Operation Management System
- Inventory Management System
- Asset Management System
- Supplier Management System

- Enterprise
- O&M Services & DAT MANAGEMENT
- Control
- Edge AI
- Device
- Instruments
- Sensor

IT - OT

Solution Suite

Co-Creation
Case Study: Equipment PHM Monitoring

Wireless Vibration Sensor Node Directly to connect DeviceOn/BI

Preventive Maintenance with ISO 10816-3
Case Study: Industrial Park Wastewater Treatment

Application industry: Wastewater Treatment
Application area: Pingtung, Taiwan

Solution:
- Biological A2O (IWS-42A)
- ADAM-3600
- WebAccess/SCADA

Case background:
Pingtung Agricultural Biotechnology Park

Solution Suite

H/W+SW+ Domain Know-how ➔ Intelligent Water Quality Control

<table>
<thead>
<tr>
<th>Water Quality Parameters</th>
<th>Range Value</th>
<th>Average Value +/- Standard error</th>
<th>Emission Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD (mg/L)</td>
<td>11.57 ~ 16.97</td>
<td>16.01 ± 1.57</td>
<td>100</td>
</tr>
<tr>
<td>NH₄-N (mg/L)</td>
<td>6.23 ~ 8.82</td>
<td>8.13 ± 0.59</td>
<td>75</td>
</tr>
<tr>
<td>NOₓ-N (mg/L)</td>
<td>1.06 ~ 1.94</td>
<td>1.56 ± 0.29</td>
<td>50</td>
</tr>
<tr>
<td>PO₄-P (mg/L)</td>
<td>0 ~ 0.57</td>
<td>0.04 ± 0.11</td>
<td>4</td>
</tr>
</tbody>
</table>

Energy efficiency greater than 23%
Go Together,
We Go Far and Grow Big