

# Enabling IOT with off the shelf hardware

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Moxa Europe

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# Industrial Internet Consortium Reference Architecture: Future-proof Architecture

**Moxa Focus:**  
IoT Gateway /  
Edge Computing &  
Connectivity

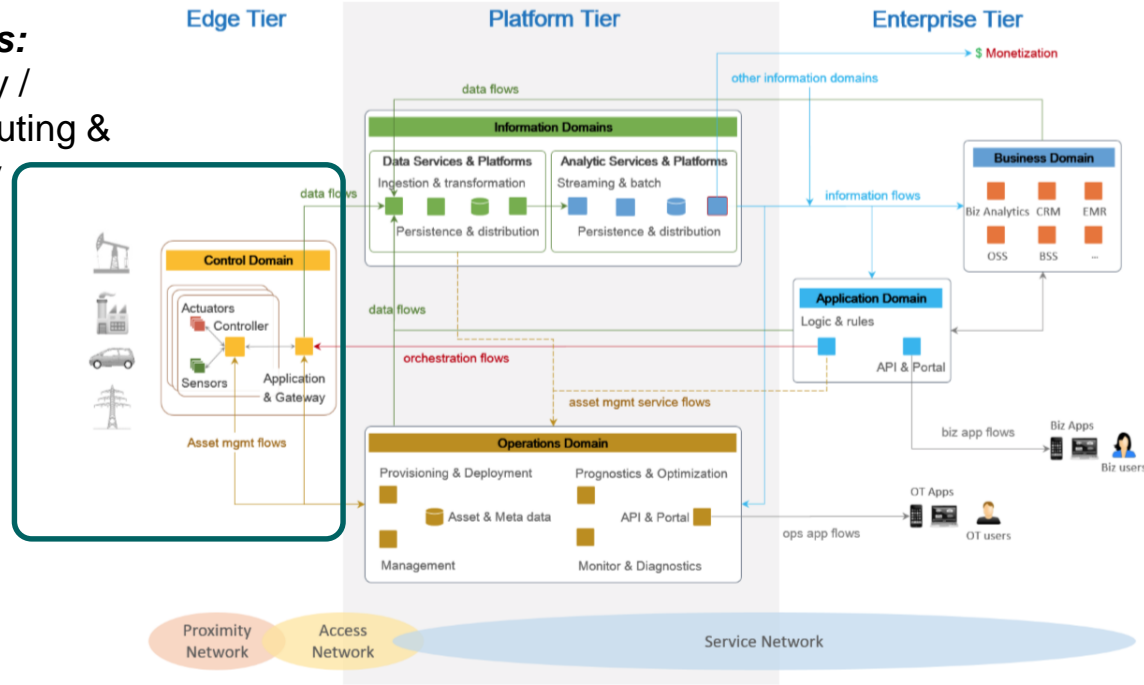


Figure 7-2: Mapping between a three-tier architecture to the functional domains

# IIoT Applications



**Industrial Applications** (Manufacturing, Smart Grid, Transportation...)

Cloud  
Infrastructure



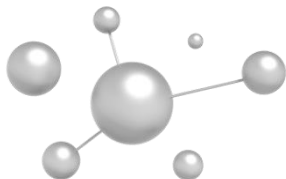
Data Processing  
& Analytics



Enterprise  
Applications



## Connectivity



Moxa provides OT-IT-IIoT **Connectivity Solutions**  
for your mission-critical applications **from edge-to-cloud**



Industrial Network Infrastructure



Industrial Edge Connectivity



Industrial Computing

## Edge Device



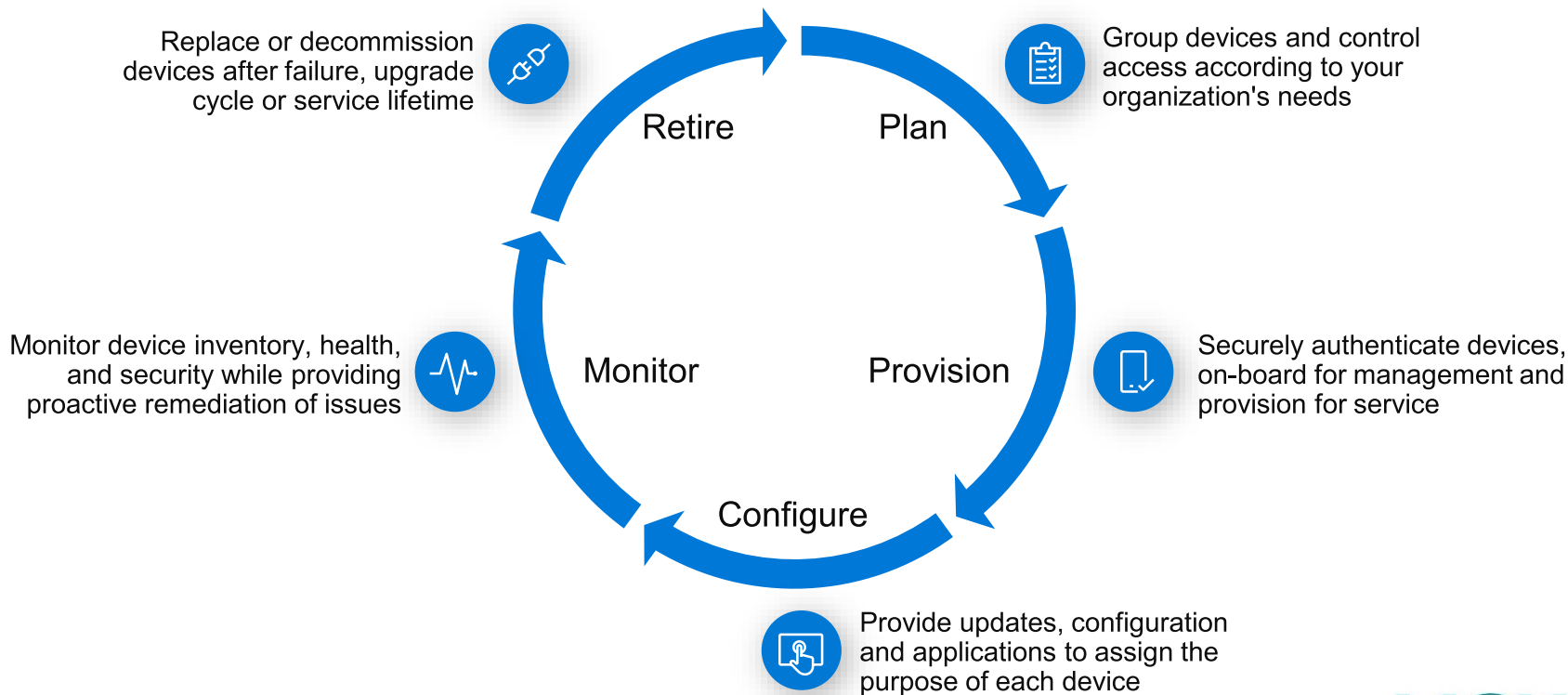
## Smart / Legacy Components

Sensors, Actuators, Processors, Data Storages/Control, and Embedded OS/Software

# Agenda

- **The 7 Principles of Device Lifecycle Management**
- **Demo**

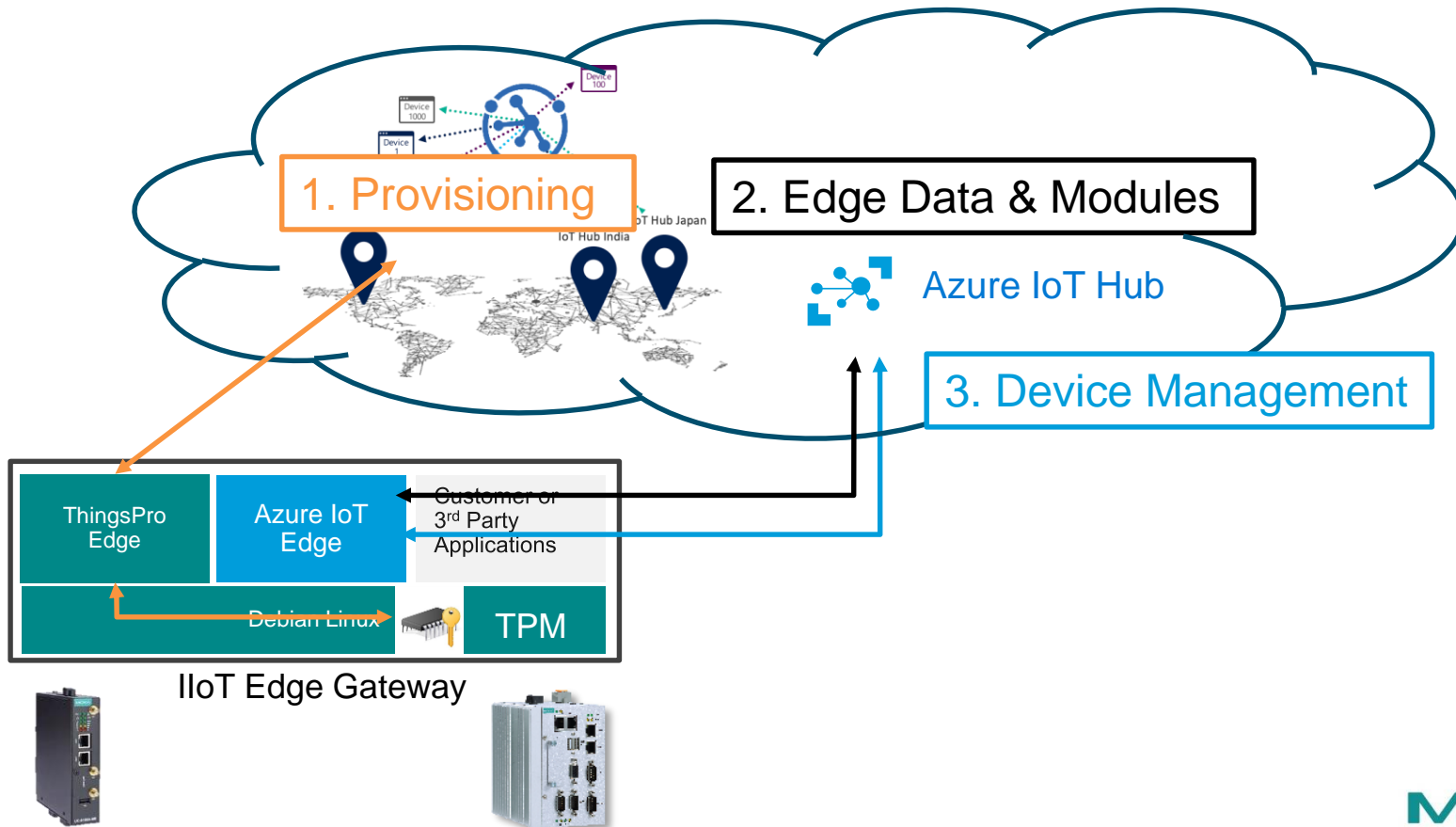
# IoT Device Lifecycle Management



# Seven Principles of Device Lifecycle Management (DLM)

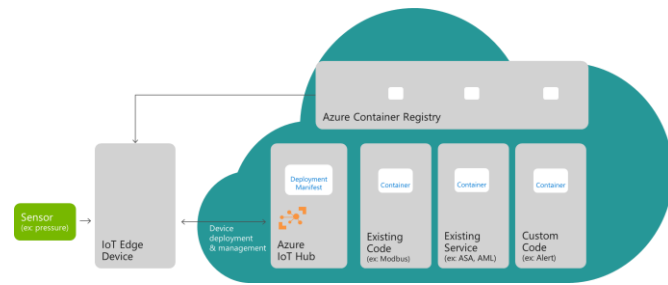
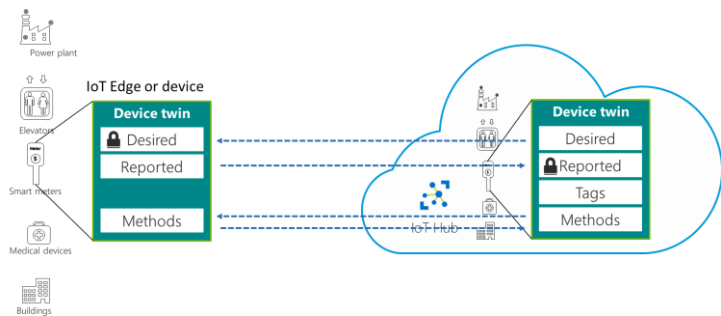
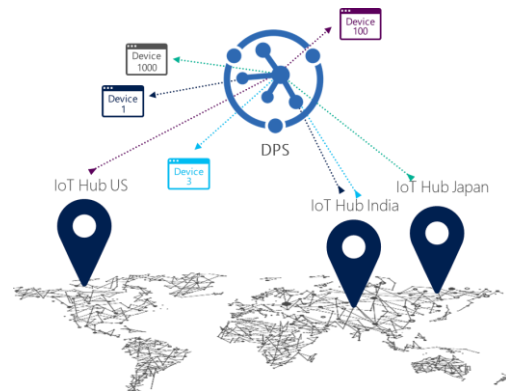
- ➡ 1. Provisioning – DPS
- 2. Commissioning
- 3. Remote Software Updates (Containers)
- ➡ 4. Device Management (IP, Cellular, and other hardware Settings)
- 5. Remote Security Patches
- ➡ 6. Updates to “Edge” Software
- 7. Updates to OS Kernel

# ThingsPro Edge and Azure Integration



# Three key concepts to support device provisioning at scale (with minimal 'touch')

- **Device Provisioning Service**
- **Device Twins**
- **Deployment Manifest**
  - **Device Twin**
  - **Edge Software**





# Device Management Features



## Configuration

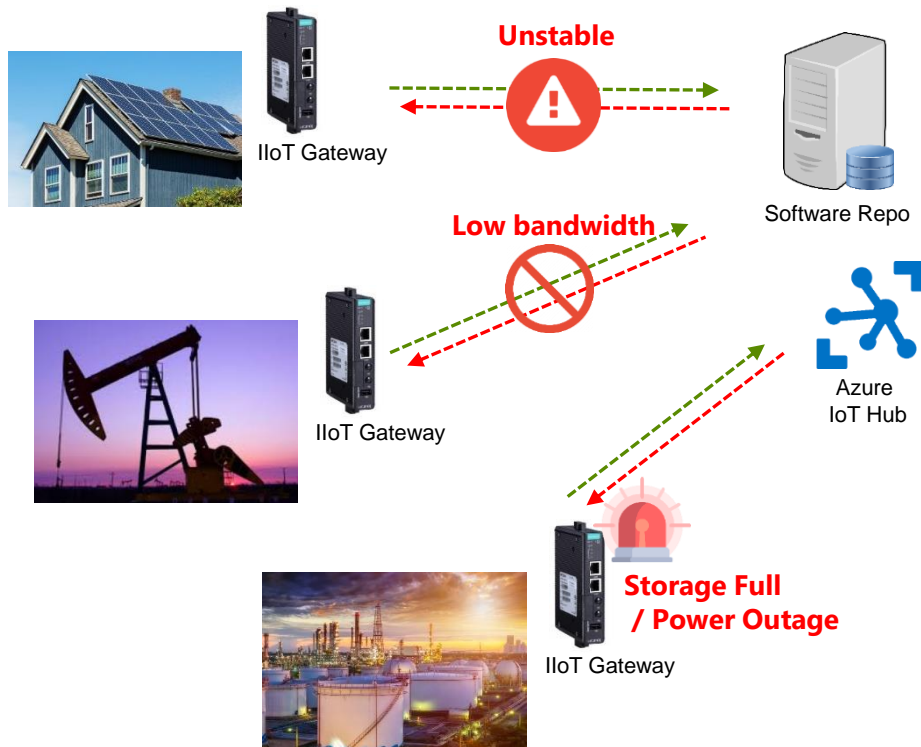
- Ethernet, Cellular, GPS, Serial, Console port
- DHCP, Route, Time, DNS, Firewall
- HTTP, SSH, Certificates

## Operation

- Reboot
- Application start/stop/restart
- Application (Over-the-air) OTA upgrade

## Management from Azure

# Industrial-Grade OTA Software Upgrade



## Robust AND Intelligent process

- Resume download from last break point
- Intelligence to confirm upgrade AND ensure download
- Redundant BIOS and Linux Kernel w/ Auto roll-back

## Security

- SAS or X.509 certificate
- Hardware-level (with TPM)

## Management from Azure

# Seven Principles of Device Lifecycle Management (DLM)

1. Provisioning
2. Commissioning
3. Remote Software Updates (Containers)
4. Device Management
5. Remote Security Patches
6. Updates to “Edge” Software
7. Updates to OS Kernel



Azure IoT Edge



**ThingsPro Edge**

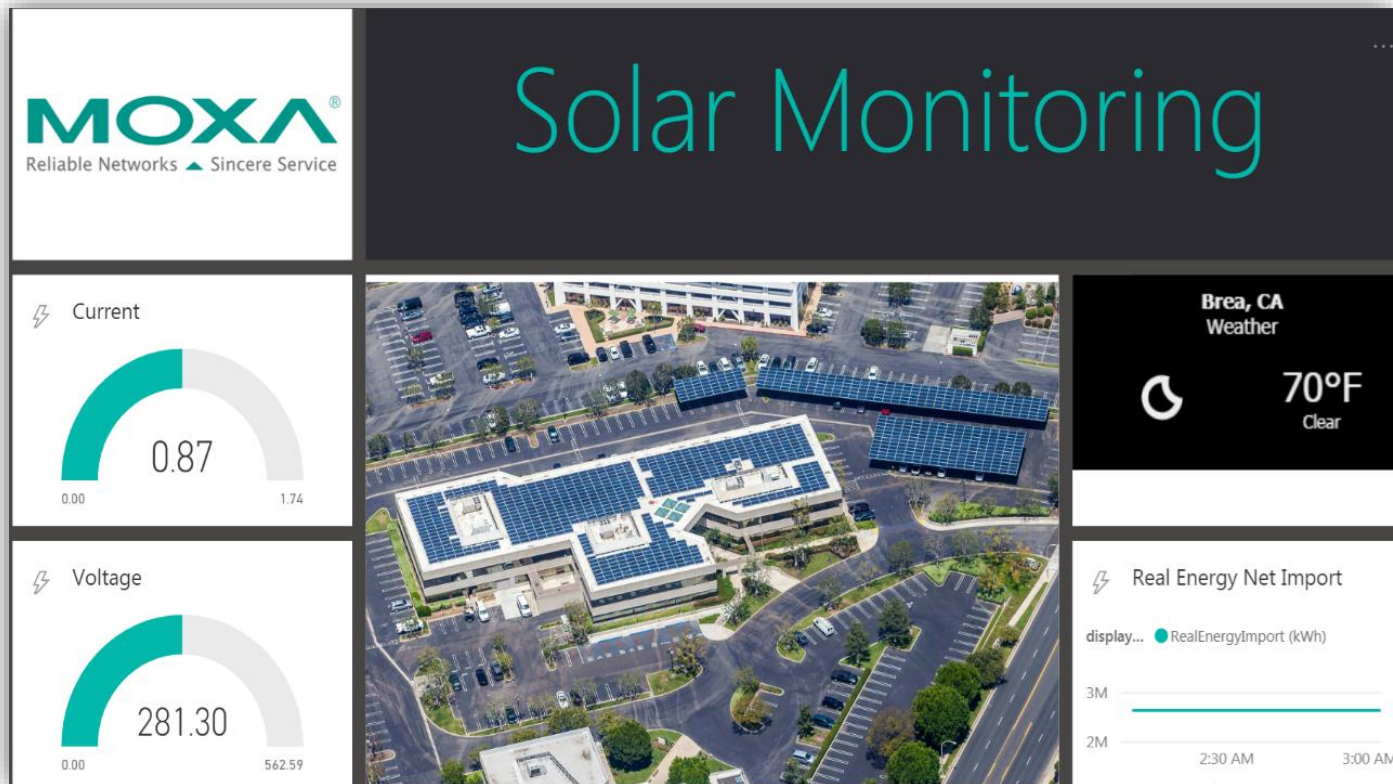
IIoT Software with Azure Cloud Connectivity

# Demo

# Device Management in practice

- **Example Dashboard: Moxa US Office Solar Monitoring**
- **Moxa Device Provisioning (reference software)**
- **ThingsPro Edge Device Management in Azure Portal**
- **ThingsPro Edge Local GUI**
- **ThingsPro Edge web-based user manual (optional)**
- **ThingsPro Cloud Device Management (reference)**

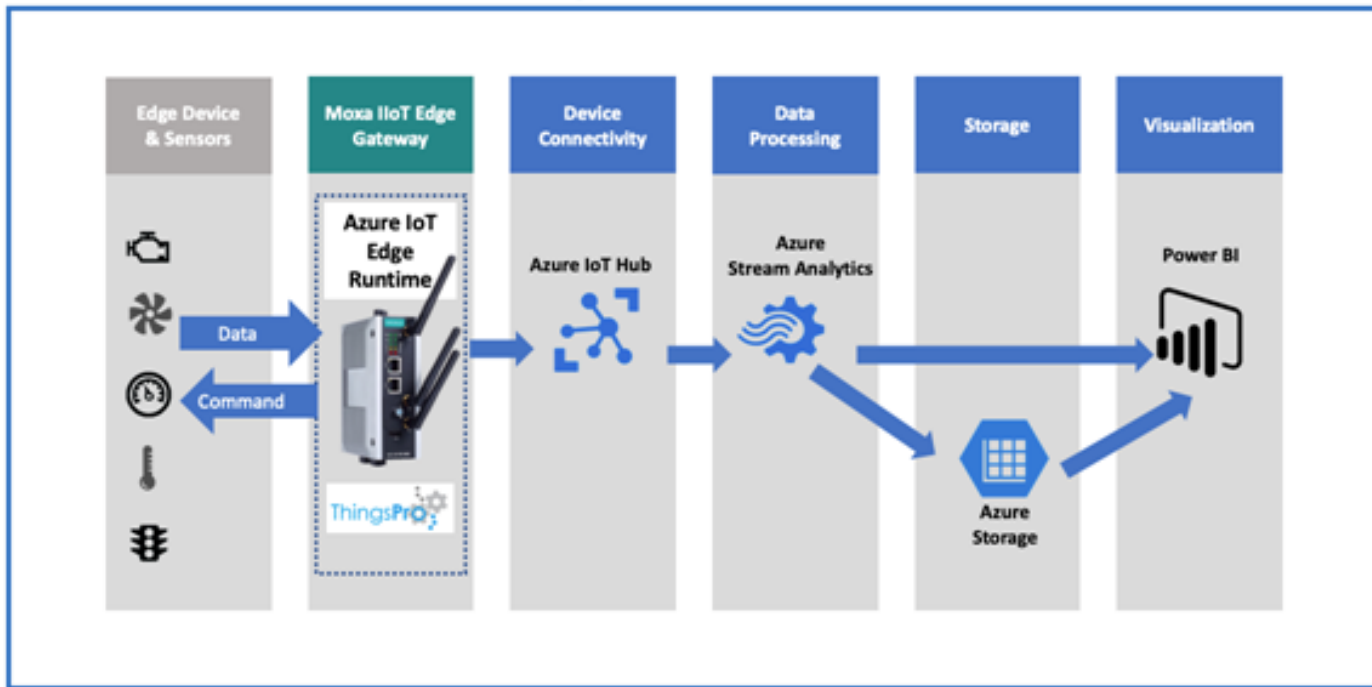
# Example Dashboard: Moxa US Office Solar Monitoring



<https://app.powerbi.com/groups/me/dashboards/077670cb-5208-4bf5-b06e-53fa052b4d6c>

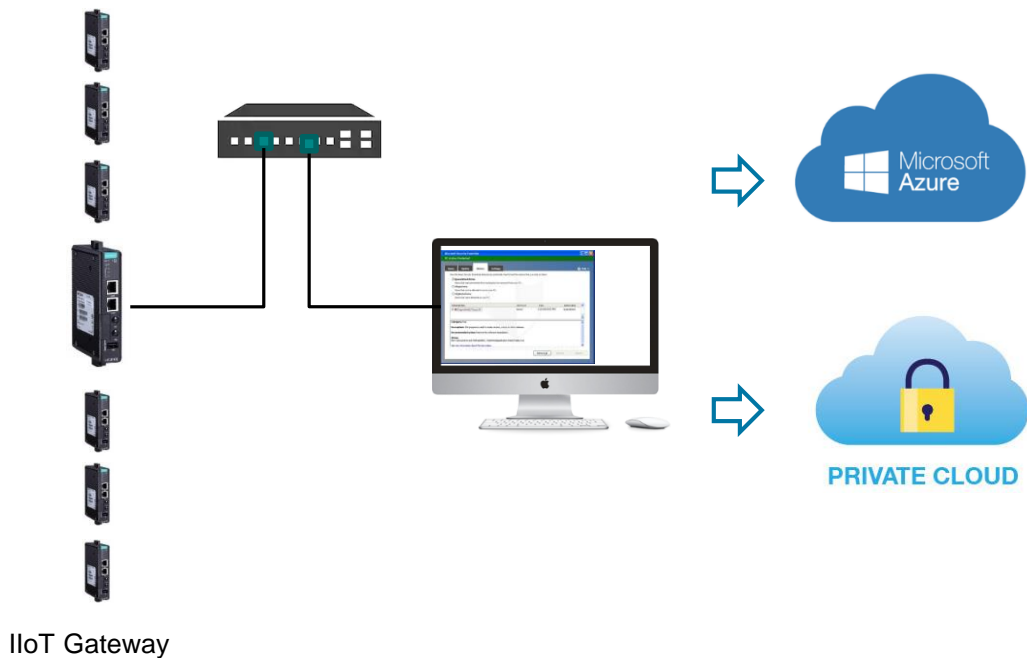
# Example Dashboard: Moxa US Office Solar Monitoring

## Reference Architecture Design



# Moxa Device Provisioning Tool

ThingsPro Edge provision APIs allows SI to register devices to customer's backend application in secure, mass and easy.



## ThingsPro Edge Provision API

- Retrieve TPM EK and Registration ID
- Apply Azure DPS configuration
- Enable/Disable H/W interface (lock console port ...)
- Enable/Disable S/W service (disable SSH ...)
- Start/Stop Application (start Azure IoT Edge ...)
- Change default password ...

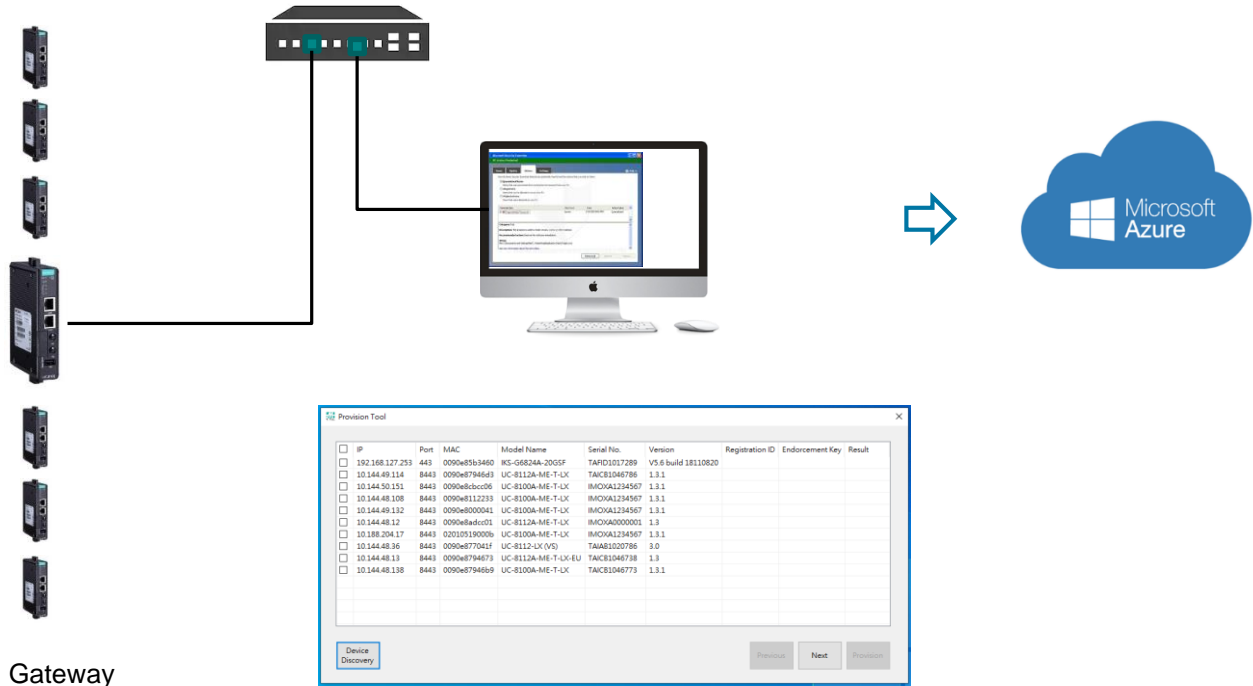
## Support Cloud

- Azure IoT Hub
- Azure DPS
- MQTT Service (Private Cloud) \*

\* In roadmap



# Demo Provisioning Tool



# Moxa Device Provisioning

## reference software

The screenshot displays the Moxa Provision Tool interface, specifically the 'Provision Destination' window. The window is divided into several sections:

- Device Default Credential:** Includes fields for 'Log' and 'Pass'.
- Azure DPS Settings:** A section containing five input fields, all of which are highlighted with a red border:
  - Service Endpoint:
  - ID Scope:
  - Shared Access Policy:
  - Shared Access Key:
  - IoT Hub Host Name:
- Initial Tags of Device Twin:** A table with two columns, 'Key' and 'Value', containing one row with 'project' and 'demo' respectively, highlighted with a red border.
- Advance Setting:** A section with two checked checkboxes, also highlighted with a red border:
  - ☒ Generate Downstream Certificate
  - ☒ Enable Azure IoT Edge Service

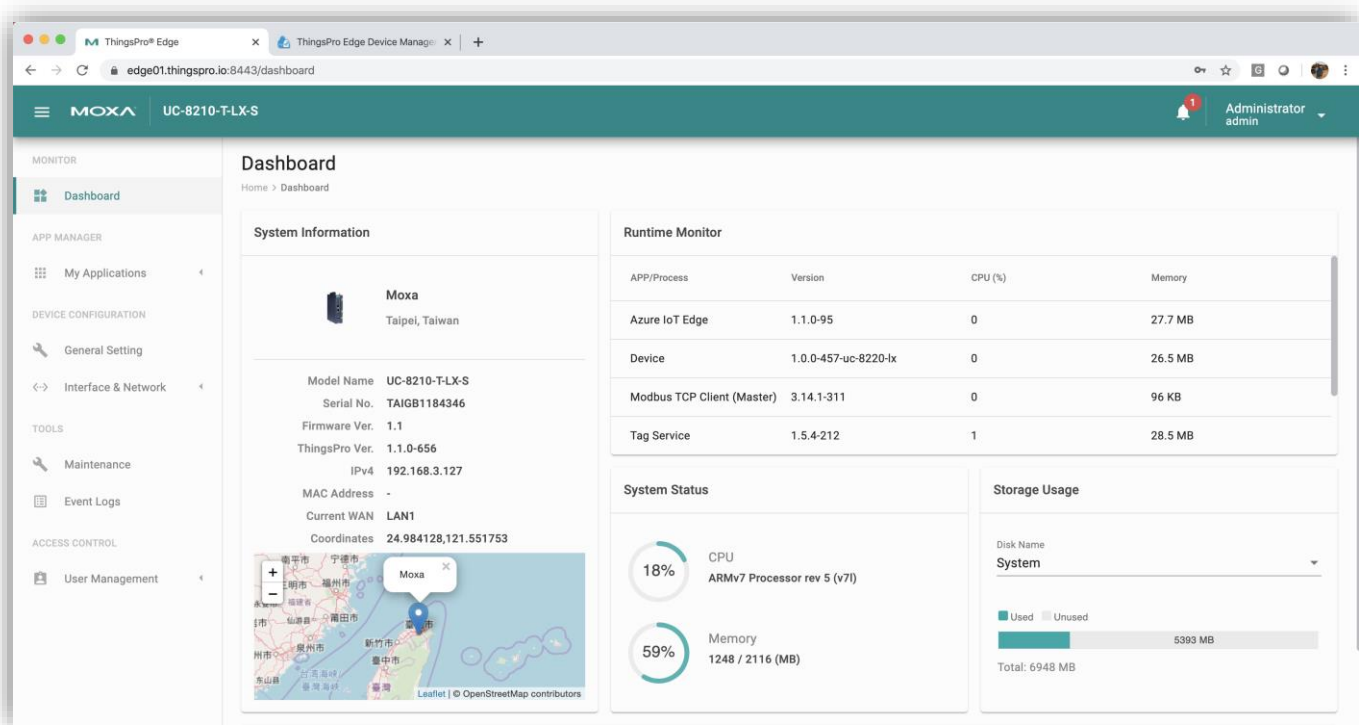
At the bottom of the window, there are three buttons: 'Device Discovery', 'Previous', and 'Provision'. The 'Provision' button is highlighted with a red border. A 'Use My DPS' button is also present below the Azure DPS Settings section.

# ThingsPro Edge Device Management in Azure Portal (Module Identity Twin/JSON)

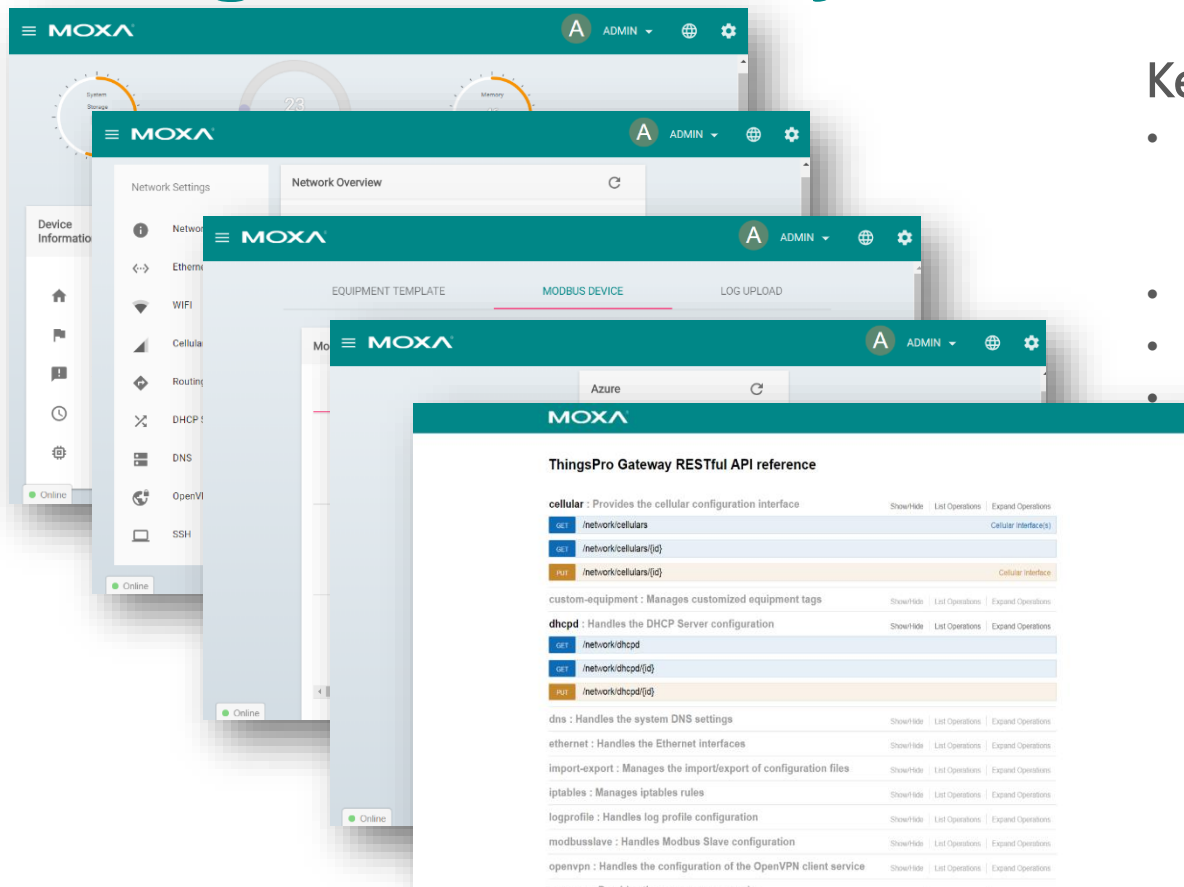
The screenshot displays the Microsoft Azure portal interface. At the top, the navigation bar shows the Microsoft Azure logo, a search bar, and the user profile 'Hermann\_Berg@moxa.c... MOXA INC'. Below the navigation bar, the breadcrumb trail reads: Home > Moxa-GMKT-IoTHub - IoT Edge > TAICB1046750 > IoT Edge Module Details > Module Identity Twin. The main heading is 'Module Identity Twin' with a sub-label 'thingspro-agent'. A 'Save' button is visible. A message box states: 'The module twin for 'thingspro-agent' is shown below. You can add tags and desired properties to your module twin here. To remove a tag or desired property, set the value of the item to be removed to 'null'.' Below this, a JSON object is displayed in a code editor with line numbers 1 through 25.

```
1 {
2   "deviceId": "TAICB1046750",
3   "moduleId": "thingspro-agent",
4   "etag": "AAAAAAAAAA=",
5   "deviceEtag": "NDgyOTIwOTE3",
6   "status": "enabled",
7   "statusUpdateTime": "0001-01-01T00:00:00Z",
8   "connectionState": "Disconnected",
9   "lastActivityTime": "2019-10-19T00:06:09.3968425Z",
10  "cloudToDeviceMessageCount": 0,
11  "authenticationType": "sas",
12  "x509Thumbprint": {
13    "primaryThumbprint": null,
14    "secondaryThumbprint": null
15  },
16  "version": 1000,
17  "properties": {
18    "desired": {
19      "general": {
20        "hostName": "TAICB1046750",
21        "deviceName": "TAICB1046750"
22      },
23      "$metadata": {
24        "$lastUpdated": "2019-11-24T19:22:49.873421Z",
25        "$lastUpdatedVersion": 6,
```

# ThingsPro Edge Local GUI



# ThingsPro Gateway Local GUI



## Key Features

- Device Configuration:
  - Networking and System settings
  - Cellular Configuration
- Industrial Protocol Gateway
- Cloud and SCADA Connectors
- RESTful API

# ThingsPro Edge Restful API Doc

<https://thingspro-edge.moxa.online/>

The screenshot displays the Moxa ThingsPro Edge Restful API documentation. The top navigation bar includes the Moxa logo and links for OAPI, ThingsPro Agent, and Bugs/Feedback. A search bar is located on the left. A sidebar menu on the left lists API categories: general, time, zoneinfo, dns, route, network, ethernets (expanded), and serials. The main content area shows the 'PATCH /device/ethernets/{id}' endpoint. It includes a 'Request samples' section with a 'Payload' button and a 'Response samples' section with a '200' button. Both sections show the content type as 'application/json' and an example payload/response.

**MOXA** OAPI ThingsPro Agent Bugs/Feedback

Search...

general >

time >

zoneinfo >

dns >

route >

network >

ethernets ▾

**GET** Get ethernet interfaces configuration.

**PATCH** Update ethernet interfaces configuration.

**GET** Get ethernet interface configuration.

**PATCH** Update ethernet interface configuration.

serials >

**PATCH** /device/ethernets/{id}

**Request samples**

Payload

Content type  
application/json

Example  
dhcp

Copy Expand all Collapse all

```
{
  "enable": true,
  "enableDhcp": true,
  "wan": true
}
```

**Response samples**

200

Content type  
application/json

Example  
dhcp

# ThingsPro Cloud Device Management

<http://training.thingspro.io:8080/>

ThingsPro Cloud DM Demo  
Author : Kevin Kao | Date : 2019-10

### Moxa IIoT Gateway List

Show 10 entries Search:

No	Edge Name	Host Name	Status	Telemetry	Firmware Version	ThingsPro Version	Uplink	IP Address
1	ThingsProEdge001	Moxa	Connected	-	3.0	1.1.0-315	LAN1	10.144.48.128
2	ThingsProEdge002	-	-	-	-	-	-	-

Showing 1 to 2 of 2 entries

Previous 1 Next

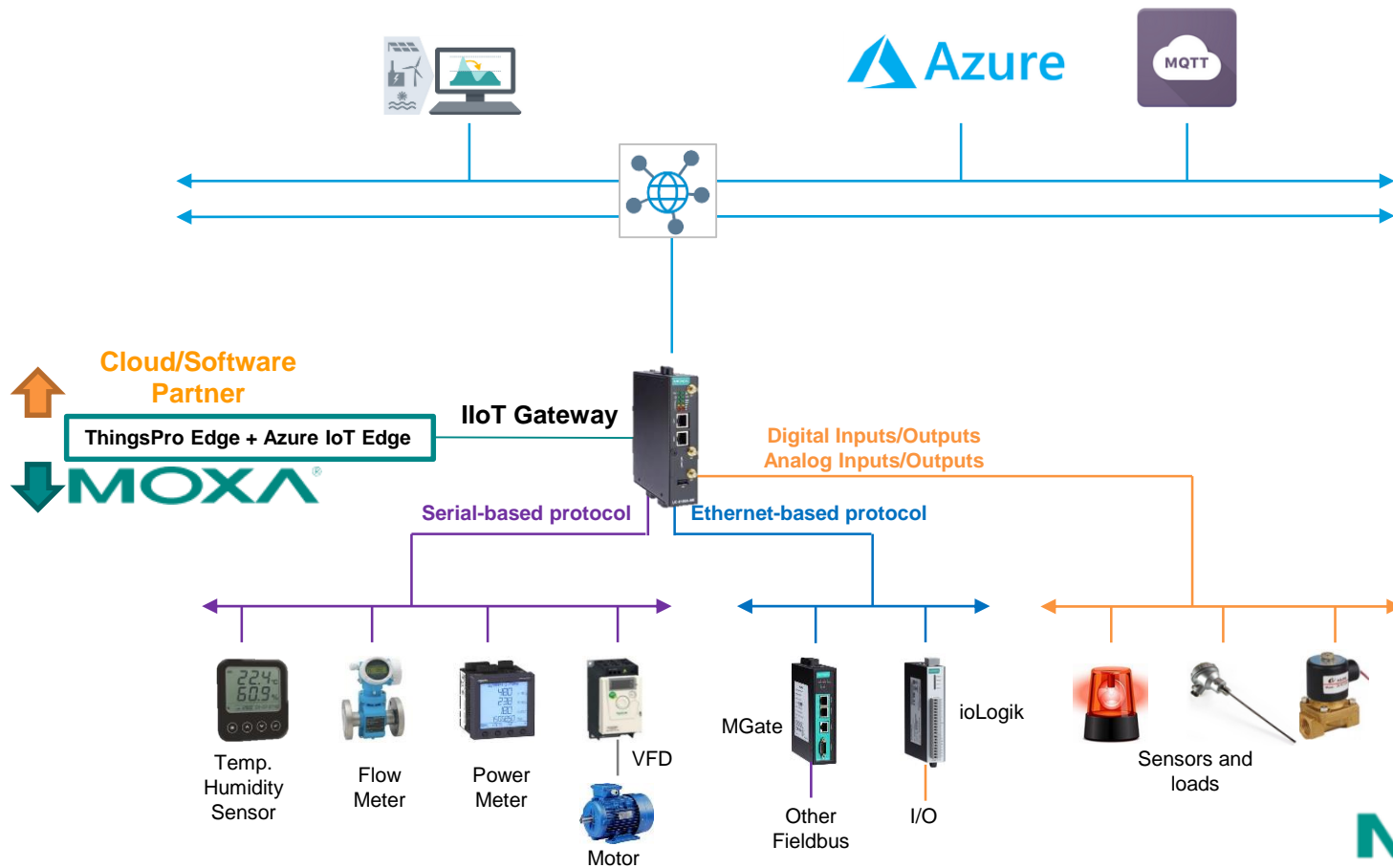
### Configure

Save

Device Type : gateway WAN Interface : LAN1 NTP Enable : false Host Name : Moxa

Model Name : UC-8112-LX (VS) IP Address : 10.144.48.128 NTP Server : pool.ntp.org Description :

# Azure IoT Edge provides a perfect platform for cooperation





# Thank You

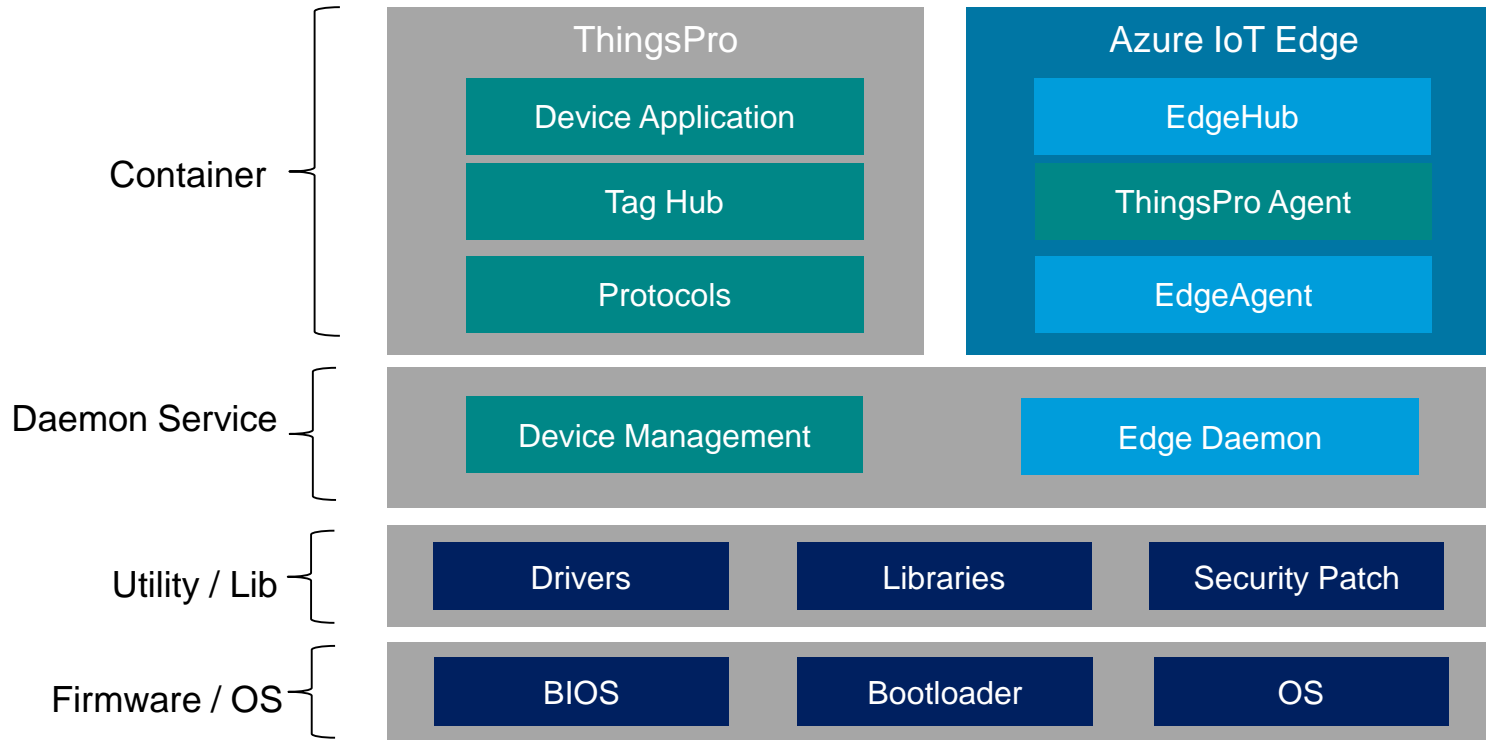


# Backup Slides

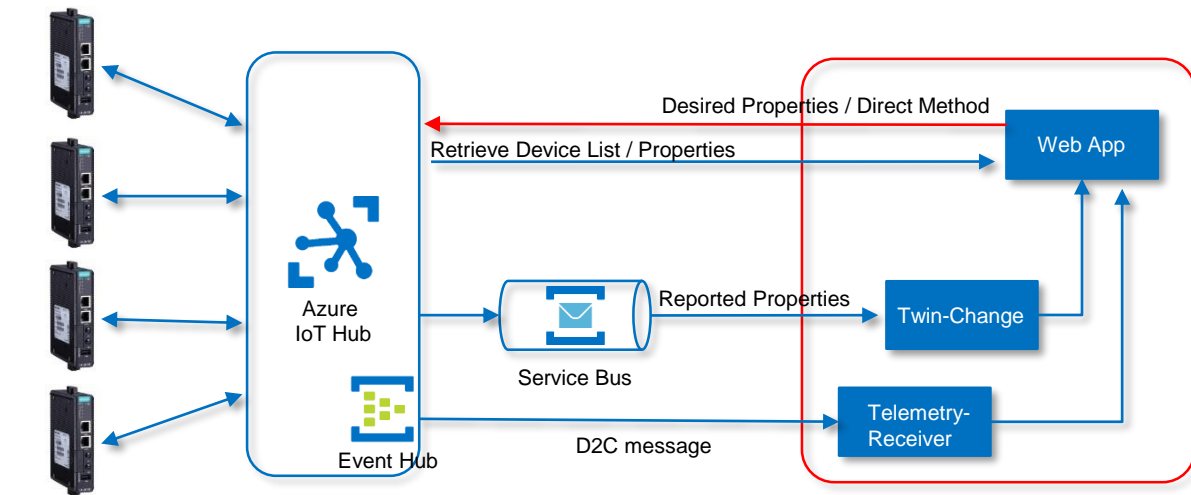
- **ThingsPro Edge Architecture Overview**
- **Cloud Application Reference Architecture**

# Architecture Overview

■ Microsoft  
■ Moxa



# Cloud Application Reference Architecture



IIoT Gateway

## Config message route to Service Bus

- Twin Change
- Device Lifecycle

## IoT Hub service SDK or Restful API

- Retrieve Edge devices from IoT Hub
- Retrieve Reported Properties
- Apply Desired Properties
- Invoke Direct Method

## Azure Service Bus SDK

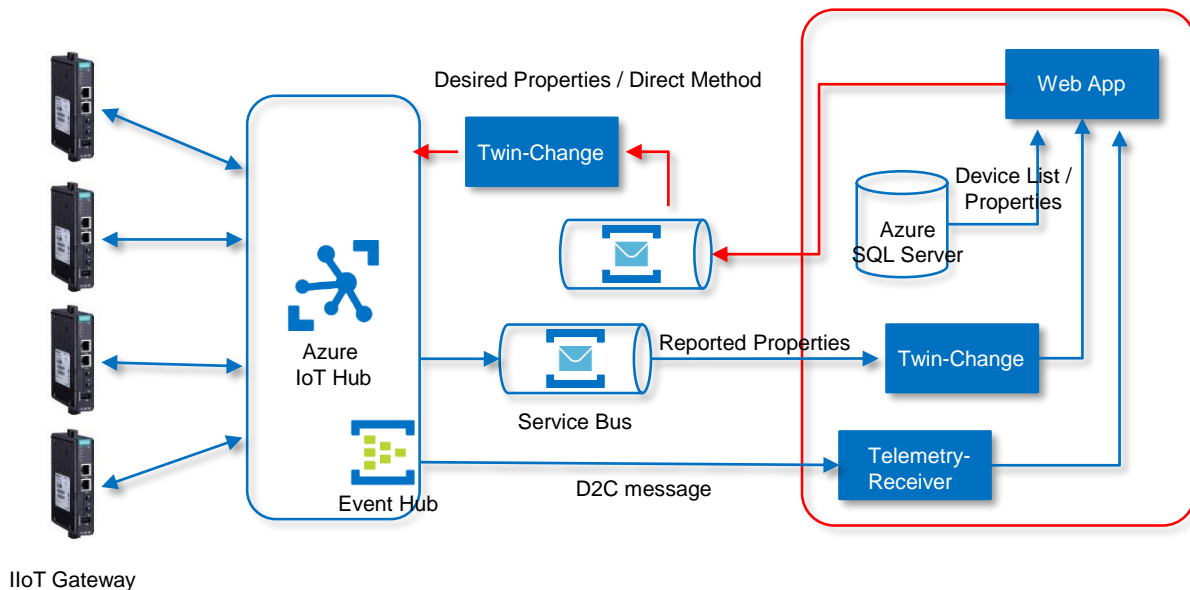
- Receive message from Queue
- Push message to Web App

## Azure Event Hub SDK

- Receive D2C message from Event Hub
- Push message to Web App

# Cloud Application Reference Architecture

Better Architecture



## Azure SQL Server

- Store Device meta data
- Connection Status
- Reported Properties

## Queue and Microservice

- Apply Desired Properties
- Invoke Direct Method
- Invoke Direct Method when device online

# Links

- **Github for ThingsPro installation:**
- <https://github.com/FrankSHLi/ThingsProDoc/blob/master/ModbusToCloudFromScratch.md#provision-tool>
- 
- **Github for the ThingsPro Edge Cloud Reference Application**
- <https://github.com/MOXA-ISD/cloud-dm-demo>
-