How to Configure Gateways in ThingsPro Edge Using Azure Device Twins

Moxa Technical Support Team

support@moxa.com

Contents

Copyright © 2021 Moxa Inc.   Released on Nov 19, 2021

About Moxa

Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things (IIoT). With over 30 years of industry experience, Moxa has connected more than 71 million devices worldwide and has a distribution and service network that reaches customers in more than 80 countries. Moxa delivers lasting business value by empowering industries with reliable networks and sincere service. Information about Moxa's solutions is available at www.moxa.com.

How to Contact Moxa

Tel: 1-714-528-6777
Fax: 1-714-528-6778

MOXA®

1   Azure Device Twin

Device twins are JSON documents that store device state information including metadata, configuration, and conditions. Azure IoT Hub maintains a device twin for each device that you connect to the IoT Hub and leverages it to synchronize device configuration and conditions.

The JSON content of a device twin includes:

- **Desired Properties**: Can be modified by back-end applications and are readable by the device application, i.e., ThingsPro Edge.

- **Reported Properties**: Set by the device application and are readable by back-end applications.

- **Tags**: Device metadata assessable by back-end applications.
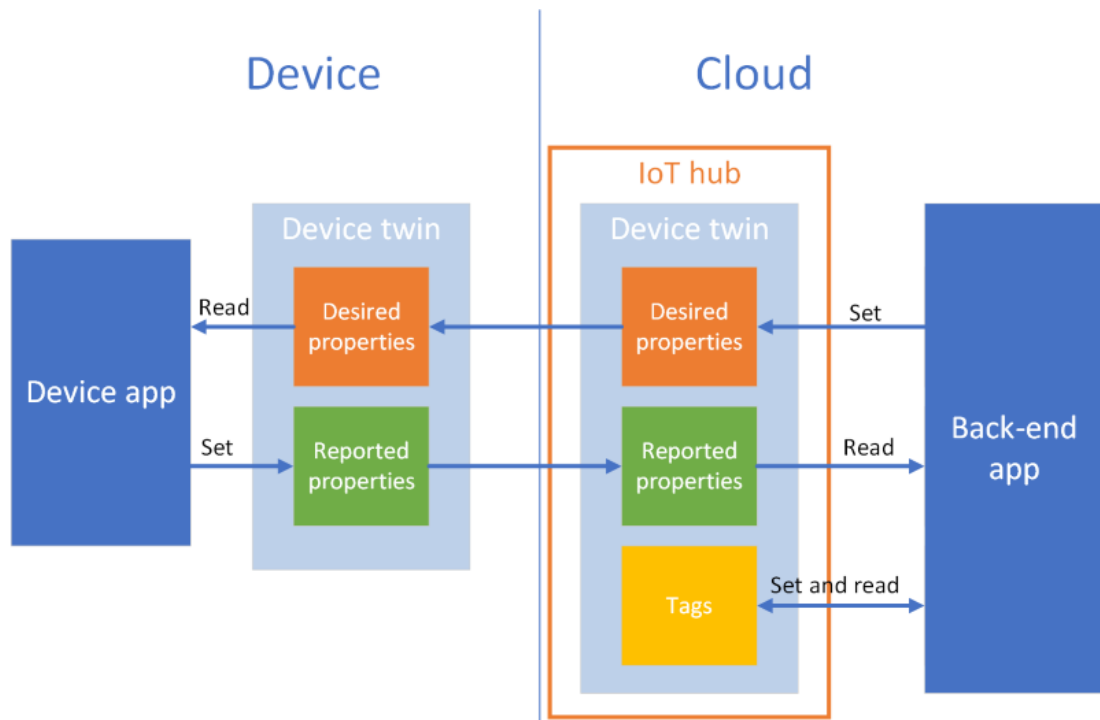
ThingsPro Edge integrates the device-twin design. The ThingsPro Edge device twin can be set by back-end applications using the *desired properties*. The device state information is updated in the *reported properties* of the device twin and the properties are readable by back-end applications. For example, when a back-end application requests to install a new software version, ThingsPro Edge reports back with updates on the progress.

2.1   The Device Twin Reported Properties in ThingsPro Edge

The *reported properties* in ThingsPro Edge device twins are described in the table below:

No.	Section	Description
1	`applications`	Lists all applications installed in ThingsPro Edge.

```
{
"applications": {
        "list": {
            "0": {
                "description": "MOXA Modbus TCP Client (Master)",
                "desiredState": "ready",
                "displayName": "Modbus TCP Client (Master)",
                "hardwares": {
                    "arraySize": 0
                },
                "health": "good",
                "icon": "/app-icons/modbusmaster-tcp.png",
                "id": "modbusmaster-tcp",
                "name": "modbusmaster-tcp",
                "state": "ready",
                "version": "3.14.0-278"
            },
            "arraySize": 1
        }
    }
}
```

No.	Section	Description
2	`httpserver`	Displays the HTTP server settings and status.

```
{
"httpserver": {
        "certFileName": "default.crt",
        "httpEnable": true,
        "httpPort": 80,
        "httpsEnable": true,
        "httpsPort": 8443,
        "keyFileName": "default.key"
    }
}
```

No.	Section	Description
3	`sshserver`	Displays SSH server status and settings

```
{
"sshserver": {
        "enable": true,
        "port": 22
    }
}
```

No.	Section	Description
4	`discovery`	Status of the discovery service: enable/disable
	```{ "discovery": { "enable": true } }```	
5	`serialconsole`	Serial console status: enable/disable
	```{ "serialconsole": { "enable": true } }```	
6	`wan`	Displays information on the WAN interface
	```{ "wan": { "displayName": "LAN1", "dns": { "0": "10.128.8.5", "arraySize": 1 }, "gateway": "10.144.51.254", "ip": "10.144.48.128", "name": "eth0", "netmask": "255.255.252.0", "type": "wan" } }```	
7	`route`	Lists routing priority of network interfaces
	```{ "route": { "priorityList": { "0": "Cellular1", "1": "LAN1", "arraySize": 2 }, "type": "route" } }```	
8	`dhcpservers`	Displays DHCP server settings and status
	```{ "dhcpservers": { "0": { "available": false, "displayName": "LAN1", "domainName": "", "domainNameServers": { "0": "8.8.8.8",```	

No.	Section	Description
| | | ```
        "1": "8.8.4.4",
        "arraySize": 2
    },
    "enable": false,
    "endIp": "192.168.3.250",
    "id": 1,
    "leaseTime": 3600,
    "name": "eth0",
    "netmask": "255.255.255.0",
    "startIp": "192.168.3.200",
    "status": false,
    "type": "dhcpservers"
    },
    "arraySize": 1
    }
}
``` |
| 9 | **serials** | Lists the serial port configurations on the device |
| | | ```
{
"serials": {
    "0": {
        "baudRate": 9600,
        "dataBits": 8,
        "device": "/dev/ttyM0",
        "displayName": "PORT 1",
        "flowControl": "none",
        "id": 1,
        "mode": "rs232",
        "parity": "none",
        "stopBits": 1,
        "type": "serials"
    },
    "arraySize": 1
    }
}
``` |
| 10 | **time** | Displays system time zone and NTP settings |
| | | ```
{
"time": {
    "ntp": {
        "enable": false,
        "interval": 7200,
        "server": "pool.ntp.org"
    },
    "timezone": "Asia/Taipei",
    "type": "time"
    }
}
``` |

No.	Section	Description
11	**general**	Lists general device information such as CPU type, firmware version, and ThingsPro Edge version

		``
		{
		"general": {
		        "cpu": "ARMv7 Processor rev 2 (v7l)",
		        "description": "",
		        "deviceType": "gateway",
		        "firmwareVersion": "3.0",
		        "hostName": "Moxa",
		        "lastBootTime": "2019-11-13T11:42:51Z",
		        "lastRebootTime": "",
		        "memorySize": 524333056,
		        "modelName": "UC-8112-LX",
		        "serialNumber": "TAIAB1021075",
		        "thingsproVersion": "1.1.0-348",
		        "type": "general"
		    }
		}
		``

12	**ethernets**	Lists the status and configuration of Ethernet interfaces on the device

		``
		{
		"ethernets": {
		        "0": {
		            "broadcast": "10.144.51.255",
		            "displayName": "LAN1",
		            "dns": {
		                "0": "10.128.8.5",
		                "arraySize": 1
		            },
		            "enable": true,
		            "enableDhcp": false,
		            "gateway": "10.144.51.254",
		            "id": 1,
		            "ip": "10.144.48.128",
		            "mac": "00:90:e8:77:06:61",
		            "name": "eth0",
		            "netmask": "255.255.252.0",
		            "status": "connected",
		            "subnet": "10.144.48.0",
		            "type": "ethernets",
		            "wan": true
		        },
		        "arraySize": 1
		    }
		}
		``

13	**gps**	Displays the GPS settings on the device

		``
		{
		"gps": {
		``

No.	Section	Description

		`"interface": "",`
		`    "location": {`
		`        "lat": 14,`
		`        "lng": 15`
		`    },`
		`    "mode": "manual",`
		`    "type": "gps"`
		`  }`
		`}`

14	**installations**	Displays information on the OTA upgrade progress and the results

		`{`
		`"installations": {`
		`        "completedTask": 0,`
		`        "id": 3,`
		`        "isDeleted": false,`
		`        "jobID": 3,`
		`        "lastState": "",`
		`        "owner": "admin",`
		`        "parameter": {`
		`          "download": false,`
		`          "install": true,`
		`          "jobID": 2`
		`        },`
		`        "state": "created"`
		`  }`
		`}`

15	**wifi**	Display the Wi-Fi settings on the device

		`{`
		`"wifi": {`
		`        "0": {`
		`          "ap": {`
		`            "band": "band24",`
		`            "broadcastSsid": true,`
		`            "channel": 6,`
		`            "region": "TW",`
		`            "security": {`
		`              "mode": "wpa2",`
		`              "password": "",`
		`              "encryption": "aes"`
		`            },`
		`            "ssid": "moxa-sample-ap"`
		`          },`
		`          "enable": true,`
		`          "id": 1,`
		`          "type": "wifi",`
		`          "name": "wlan0",`
		`          "mode": "ap"`

No.	Section	Description

		`},`
		`    "arraySize": 1`
		`  }`
		`}`

16	**cellular**	Lists the cellular interface status and configuration

```
{
"cellulars": {
        "0": {
          "autoDetect": false,
          "available": true,
          "capabilities": {
            "sim": 1
          },
          "currentProfileId": 0,
          "displayName": "Cellular1",
          "enable": false,
          "iccid": "",
          "id": 1,
          "imei": "",
          "imsi": "",
          "keepalive": {
            "enable": false,
            "intervalSec": 120,
            "targetHost": "8.8.8.8"
          },
          "mac": "02:01:02:18:00:0b",
          "module": "u-blox TOBY-L2 series",
          "name": "usb0",
          "operatorName": "",
          "pinRetryRemain": 0,
          "profileTimeout": 140,
          "profiles": {
            "0": {
              "id": 1,
              "init": {
                "0": "sim:1",
                "arraySize": 1
              },
              "name": "SIM1",
              "pdpContext": {
                "apn": "internet",
                "auth": {
                  "password": "",
                  "protocol": "none",
                  "username": ""
                },
                "id": 1,
                "static": true,
                "type": "ipv4"
```

No.	Section	Description
| | | ```
        },
        "pinCode": "0000"
      },
      "arraySize": 1
    },
    "rat": "",
    "status": "disconnected",
    "type": "cellulars",
    "wan": true
  },
  "arraySize": 1
    }
  }
``` |

Note	The properties mentioned in this document are from ThingsPro Edge 2.2.0. Moxa reserves the right to determine the scope of reported properties. For more information about reported properties, see ThingsPro Edge online user manual.

2.2   The Device Twin Desired Properties in ThingsPro Edge

The ThingsPro Edge *desired properties* use the following two common keys:

- **id:** A device can have multiple interfaces of the same kind such as Ethernet. This key is used to specify the interface and start counting from **1**.

- **arraySize:** An array is encoded in an object containing sub objects and an arraySize key is used to index the sub objects. The value of arraySize should be equal to the number of sub objects; otherwise, the remaining sub objects will be discarded.

The *desired properties* in ThingsPro Edge device twins are described in the table below:

No.	Section	Description
1	**httpserver**	Used to enable/disable the HTTP(S) service and change the HTTP(S) port
| | | ```
{
    "desired": {
        "httpserver": {
            "httpEnable": true,
            "httpPort": 80,
            "httpsEnable": true,
            "httpsPort": 8443
        }
    }
}
``` |

No.	Section	Description
2	`sshserver`	Used to enable/disable the SSH service and change the port

```
{
    "desired": {
        "sshserver": {
            "enable": true,
            "port": 22
        }
    }
}
```

No.	Section	Description
3	`discovery`	Used to enable/disable device discovery service

```
{
    "desired": {
        "discovery": {
            "enable": true
        }
    }
}
```

No.	Section	Description
4	`serialconsole`	Used to enable/disable the serial console port

```
{
    "desired": {
        "serialconsole": {
            "enable": true
        }
    }
}
```

No.	Section	Description
5	`dhcpservers`	Used to set up the DHCP servers

```
{
    "desired": {
        "dhcpservers": {
            "0": {
                "id": 1,
                "enable": true,
                "startIp": "192.168.3.100",
                "endIp": "192.168.3.200",
                "netmask": "255.255.255.0",
                "domainNameServers": {
                    "0": "8.8.8.8",
                    "arraySize": 1
                },
                "domainName": "example.com",
                "leaseTime": 2592000
            },
            "arraySize": 1
        }
    }
}
```

No.	Section	Description
6	`serials`	Used to set up the serial ports

```
{
    "desired": {
        "serials": {
            "0": {
                "id": 1,
                "mode": "rs232",
                "displayName": "PORT 1",
                "baudRate": 115200,
                "parity": "none",
                "dataBits": 8,
                "stopBits": 1,
                "flowControl": "software"
            },
            "arraySize": 1
        }
    }
}
```

No.	Section	Description
7	`time`	Used to set up a time zone and set up / enable / disable the NTP server

Updating NTP Settings
```
{
    "desired": {
        "time": {
            "ntp": {
                "enable": true,
                "interval": 6000,
                "server": "tock.stdtime.gov.tw"
            }
        }
    }
}
```

Updating the Time Zone
```
{
    "desired": {
        "time": {
            "timezone": "Asia/Taipei"
        }
    }
}
```

No.	Section	Description
8	`ethernets`	Used to configure the Ethernet interfaces

Updating an Ethernet Interface for Dynamic IP

```
{
    "desired": {
        "ethernets": {
            "0": {
                "id": 1,
                "enable": true,
                "enableDhcp": true,
                "wan": true
            },
            "arraySize": 1
        }
    }
}
```

Updating an Ethernet Interface for Static IP

```
{
    "desired": {
        "ethernets": {
            "0": {
                "id": 1,
                "dns": {
                    "0": "1.2.3.4",
                    "arraySize": 1
                },
                "enable": true,
                "enableDhcp": false,
                "gateway": "1.2.3.5",
                "ip": "1.2.3.6",
                "netmask": "255.255.255.0",
                "wan": true
            },
            "arraySize": 1
        }
    }
}
```

No.	Section	Description
9	`general`	Used to update the device profile

Updating the Device Host Name

```
{
    "desired": {
        "general": {
            "hostName": "MyHost"
        }
    }
}
```

No.	Section	Description
	Updating the Device Description	

```
{
    "desired": {
        "general": {
            "description": "MyDevice"
        }
    }
}
```

No.	Section	Description
10	**gps**	Used to switch between the GPS modes: auto and manual

Updating the GPS lat and lng by the Manual Mode

```
{
    "desired": {
        "gps":{
            "mode": "manual",
            "location": {
                "lat": 11,
                "lng": 12
            }
        }
    }
}
```

Updating GPS by the Auto Mode

```
{
    "desired": {
        "gps":{
            "mode": "auto",
            "interface": "/dev/ttyUSB0"
        }
    }
}
```

No.	Section	Description
11	**wifi**	Used to configure the Wi-Fi AP

```
{
    "desired": {
        "wifi": {
            "0": {
                "ap": {
                    "band": "band24",
                    "broadcastSsid": true,
                    "channel": 6,
                    "region": "TW",
                    "security": {
                        "mode": "wpa2",
                        "password": "",
                        "encryption": "aes"
                    },
                    "ssid": "moxa-sample-ap"
                },
                "enable": true,
```

No.	Section	Description

		``json
		            "id": 1,
		            "type": "wifi",
		            "name": "wlan0",
		            "mode": "ap"
		        },
		        "arraySize": 1
		    }
		  }
		}```

12	cellulars	Used to configure the cellular interfaces

		``json
		{
		  "desired": {
		    "cellulars": {
		      "0": {
		        "autoDetect": false,
		        "available": true,
		        "capabilities": {
		          "sim": 1
		        },
		        "currentProfileId": 0,
		        "displayName": "Cellular1",
		        "enable": false,
		        "iccid": "",
		        "id": 1,
		        "imei": "358503060483337",
		        "imsi": "",
		        "keepalive": {
		          "enable": false,
		          "intervalSec": 120,
		          "targetHost": "8.8.8.8"
		        },
		        "mac": "02:01:02:18:00:0b",
		        "module": "u-blox TOBY-L2 series",
		        "name": "usb0",
		        "operatorName": "",
		        "pinRetryRemain": 0,
		        "profileTimeout": 140,
		        "profiles": {
		          "0": {
		            "id": 1,
		            "init": {
		              "0": "sim:1",
		              "arraySize": 1
		            },
		            "name": "SIM1",
		            "pdpContext": {
		              "apn": "internet",
		              "auth": {
		                "password": "",```

No.	Section	Description

		<pre> "protocol": "none",
		          "username": ""
		        },
		        "id": 1,
		        "static": true,
		        "type": "ipv4"
		      },
		      "pinCode": "0000"
		    },
		    "arraySize": 1
		  },
		  "rat": "",
		  "signal": {
		    "csq": 0,
		    "ecio": 0,
		    "indicator": "",
		    "level": 0,
		    "rat": "",
		    "rscp": 0,
		    "rsrp": 0,
		    "rsrq": 0,
		    "rssi": 0,
		    "rxqual": 0
		  },
		  "status": "disconnected",
		  "type": "cellulars",
		  "wan": true
		},
		"arraySize": 1
		      }
		    }
		  }</pre>

Note The properties mentioned in this document are from ThingsPro Edge 2.2.0. Moxa reserves the right to determine the scope of reported properties. For more information about reported properties, see ThingsPro Edge online user manual.

The attributes and available values for serial port configuration are listed in the table below:

Attributes	Available Values
mode	rs232, rs422, rs4852w, rs4854w
baudRate	300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600
parity	none, even, space, mark
dataBits	5,6,7,8
stopBits	1,2,1.5
flowControl	none, hardware, software

3 Configuring the Desired Properties in Azure IoT Hub

Once you create an Azure IoT Hub and add a device to the identity registry, a device twin for the device is available in the **Device twin** tab.

To use the *desired properties* of the device twin, locate the key `desired` in the JSON file as shown in the code below:

3.1   Adding Desired Properties

You can modify the JSON file to set values for the desired properties.

For example, to enable a HTTP server on port 80:

1. Add the following JSON object to the file in the **Device twin** tab.

```
18          "desired": {
19            "httpserver": {
20              "httpEnable": true,
21              "httpPort": 80
22          }
23              ,"$metadata": {
24                "$lastUpdated": "2021-10-27T09:21:12.3944362Z",
25                "$lastUpdatedVersion": 9
26              },
27              "$version": 9
28          }
```

2. Click the **Save** button on the top-right corner.
The update will be shown in the metadata with a timestamp (UTC format).

```
17      "properties": {
18        "desired": {
19          "httpserver": {
20            "httpEnable": true,
21            "httpPort": 80
22          },
23          "$metadata": {
24            "$lastUpdated": "2021-10-28T02:02:00.6415414Z",
25            "$lastUpdatedVersion": 10,
26            "httpserver": {
27              "$lastUpdated": "2021-10-28T02:02:00.6415414Z",
28              "$lastUpdatedVersion": 10,
29              "httpEnable": {
30                "$lastUpdated": "2021-10-28T02:02:00.6415414Z",
31                "$lastUpdatedVersion": 10
32              },
33              "httpPort": {
34                "$lastUpdated": "2021-10-28T02:02:00.6415414Z",
35                "$lastUpdatedVersion": 10
36              }
37            }
38          },
39          "$version": 10
40        },
```

3. Click the **Reload** button.
The reported properties will also be updated.

```
94          "httpserver": {
95            "certFileName": "default.crt",
96            "httpEnable": true,
97            "httpPort": 80,
98            "httpsEnable": true,
99            "httpsPort": 8443,
100           "ipv6Enable": false,
101           "keyFileName": "default.key"
102         }
```

3.2   Removing a Desired Property

To remove a *desired property*, set the value of the property to **null**. When a property is removed, the corresponding metadata will also be removed.

```
17 ⌄    "properties": {
18 ⌄        "desired": {
19              "httpserver":null,
20 ⌄            "$metadata": {
```

4   References

- N. (2021, August 12). Understand Azure IoT Hub device twins. Microsoft Docs. https://docs.microsoft.com/en-us/azure/iot-hub/iot-hub-devguide-device-twins

- W. (2021b, January 23). Tutorial - Synchronize device state from Azure IoT Hub. Microsoft Docs. https://docs.microsoft.com/en-us/azure/iot-hub/tutorial-device-twins