



SmartServer™ IoT LoRa Build 2.00.007

Mark Buckland: mark.buckland@diasemi.com

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Agenda: Essentials

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- SmartServer IoT LoRaWAN Overview
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Agenda: Adding Non-LoRa Devices

- Adding Non-LoRa Devices
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- Setting Datapoint Polling Rates & DBW
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- Q&A

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- Pre-requisites
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- Configuring MultiTech Gateway
- Configuring RAK7258 Gateway
- Cloning SmartServer IoT Image
- Creating The Gateway in ChirpStack
- Creating LoRa WAN Devices in ChirpStack
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- Using Yabe
- MQTT Debugging
- Backup
- Configuring Node-RED Cloud Connections
 - GCP
 - AWS
 - Azure
- Deleting Devices
- Q&A

The Essentials



Adesto

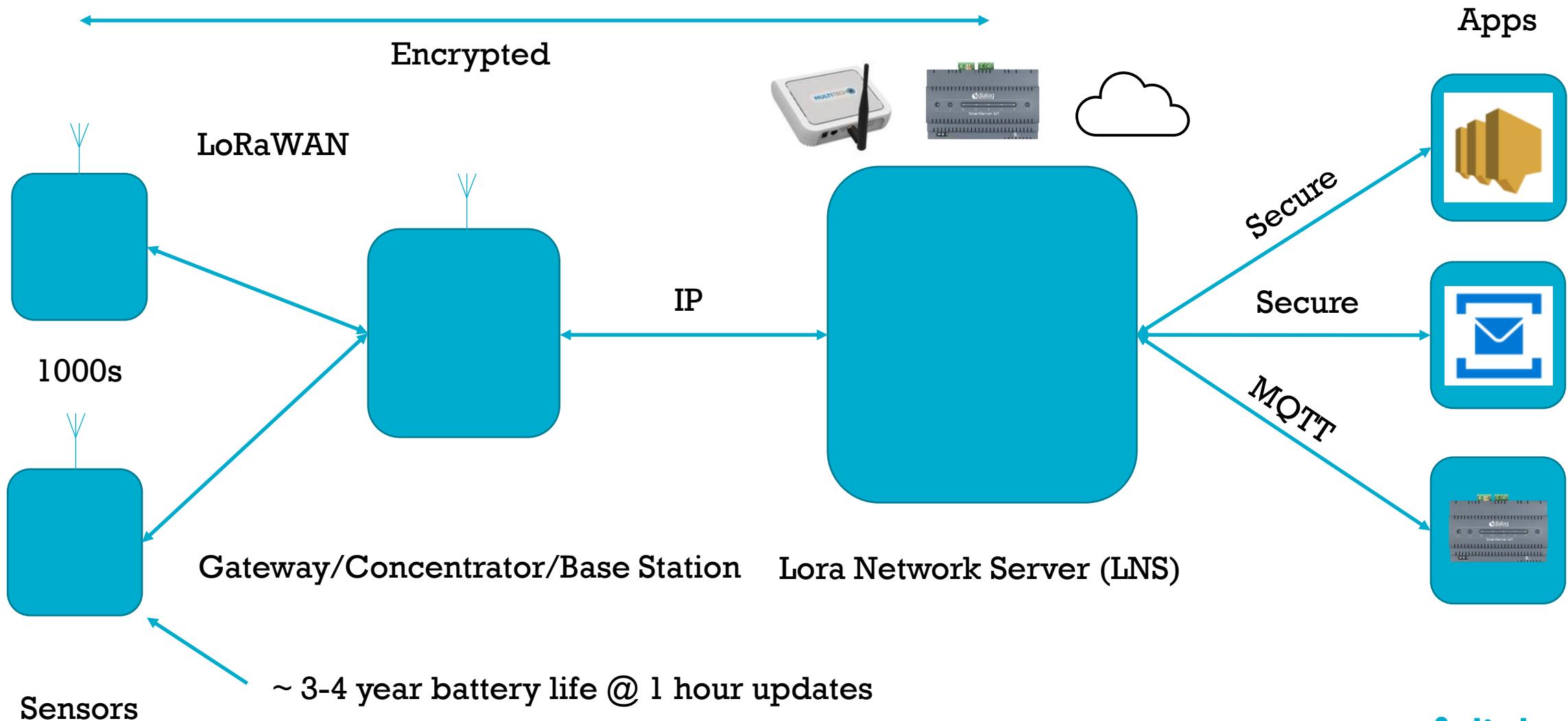
LoRa & LoRaWAN

- LoRa (Long Range) is a low-power wide-area network (LPWAN) protocol developed by Semtech.
 - Based on spread spectrum modulation
 - Uses license-free sub-gigahertz radio frequency bands like 433 MHz, 868 MHz (Europe), 915 MHz (Australia and North America), 865 MHz to 867 MHz (India) and 923 MHz (Asia).
 - Enables long-range transmissions (more than 10 km in rural areas) with low power consumption
 - Achieves data rates from 27 Kbps to 0.3 Kbps depending upon the spreading factor.
- LoRa covers the physical layer, while other technologies and protocols such as LoRaWAN (Long Range Wide Area Network) cover the upper layers.
- The LoRa Alliance® is an open, nonprofit association that has grown to more than 500 members whose mission is to develop and promote LoRaWAN® technology and its ecosystem to deliver massive IoT



RF Solutions
LoRa Module

LoRaWAN Architecture



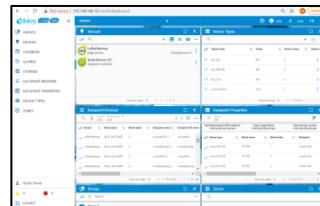
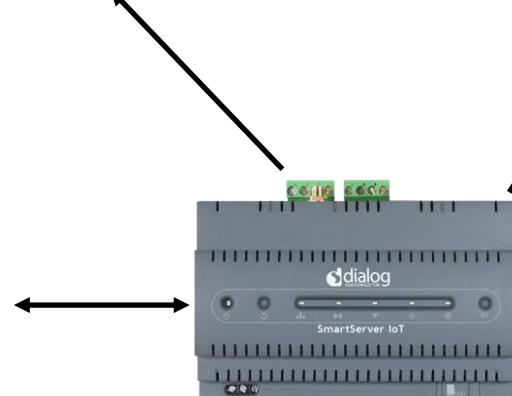
SmartServer IoT LoRaWAN Overview

LoRaWAN Sensors



ChirpStack LoRaWAN Network Server

The screenshot shows the ChirpStack web interface with a sidebar containing network servers, gateway profiles, organizations, users, API keys, and service profiles. The main area displays a dashboard with three circular gauges: 'Active devices' (green), 'Active gateways' (green), and 'Device data-rate usage' (red). Below the dashboard is a map showing gateway locations.



ANSI/CTA 709.10

2.00.007 Specification

- SmartServer 3.26.001
 - Ubunutu 20.04
 - TLS 1.3
 - PostgresSQL 12.0
 - Log4j hotfix applied
- ChirpStack 3.1.5
 - Improved data logging
- Auto LoRaWAN to BACnet mapping
- Tested with the following LoRaWAN gateways:
 - MultiTech MTCAP 868 Series
 - RAK 7258
 - RAK 7268
- Typical minimum LoRaWAN uplink rate 15 minutes (ex. alarms)
- CMS browser poll rate = 0 (for MQTT bandwidth reasons)
- Typically 20% CPU loading
- Additional BACnet, LON, Modbus & IAP devices may be added within certain constraints (EPS, CPU% etc.)
- OPC UA support

Support for 10* each of the following device types:

- Netvox R712
- Netvox R718N17
- Netvox R718N37
- Netvox R718N315
- Netvox R718E
- Netvox R718E
- Netvox R311FA
- Netvox R313WA
- Netvox 718AB
- Netvox 718AD
- Netvox 718DB
- IMBuildings IM_Counter_EU_W
- MC Climate MC_LW_TH01
- MC Climate Vicki
- Elsys ERS_LITE
- Elsys ERS_CO2
- Elsys ERS_CO2_LITE
- Elsys ERS_EYE
- EnLink ENL-AIR
- EnLink ENL_STS_AF
- Milesight AM319

*Can be adjusted
as required – 4096
DPs max

ChirpStack, open-source LoRaWAN® Network Server stack

The screenshot displays two side-by-side views of the ChirpStack web application interface.

Left View (Dashboard):

- Header:** ChirpStack, Not secure | 192.168.123.188:8080/#/organizations/1
- Search Bar:** Search organization, application, gateway or device
- User:** admin
- Left Sidebar:** Network-servers, Gateway-profiles, Organizations, All users, API keys, chirpstack (selected), Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, Multicast-groups.
- Active devices:** A donut chart showing the status of devices: Never seen (orange), Inactive (red), Active (green). The Active segment is large.
- Gateways:** A map showing gateway locations in "Great Wood".

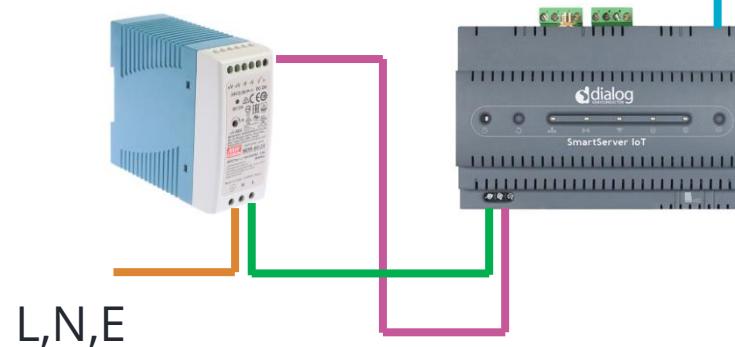
Right View (Applications):

- Header:** ChirpStack, localhost
- Search Bar:** Search organization, application, gateway or device
- User:** admin
- Left Sidebar:** Network-servers, Gateway-profiles, Organizations, All users, chirpstack (selected), Org. settings, Org. users, Service-profiles, Device-profiles, Gateways, Applications, Multicast-groups.
- Applications:** A table listing three applications:

ID	Name	Service-profile	Description
1	air-quality	EU868	Air quality application
2	parking-sensor	EU868	Parking sensor application
3	weather-station	EU868	Weather station application

Hardware/IP Configuration

10.5-30VDC, 10W or
isolated 12-30VAC, 12VA



LAN (ETH0) 192.168.1.50*
Default LAN Port
DHCP/192.168.1.222



192.168.1.1*



192.168.1.60*
Default 192.168.2.1



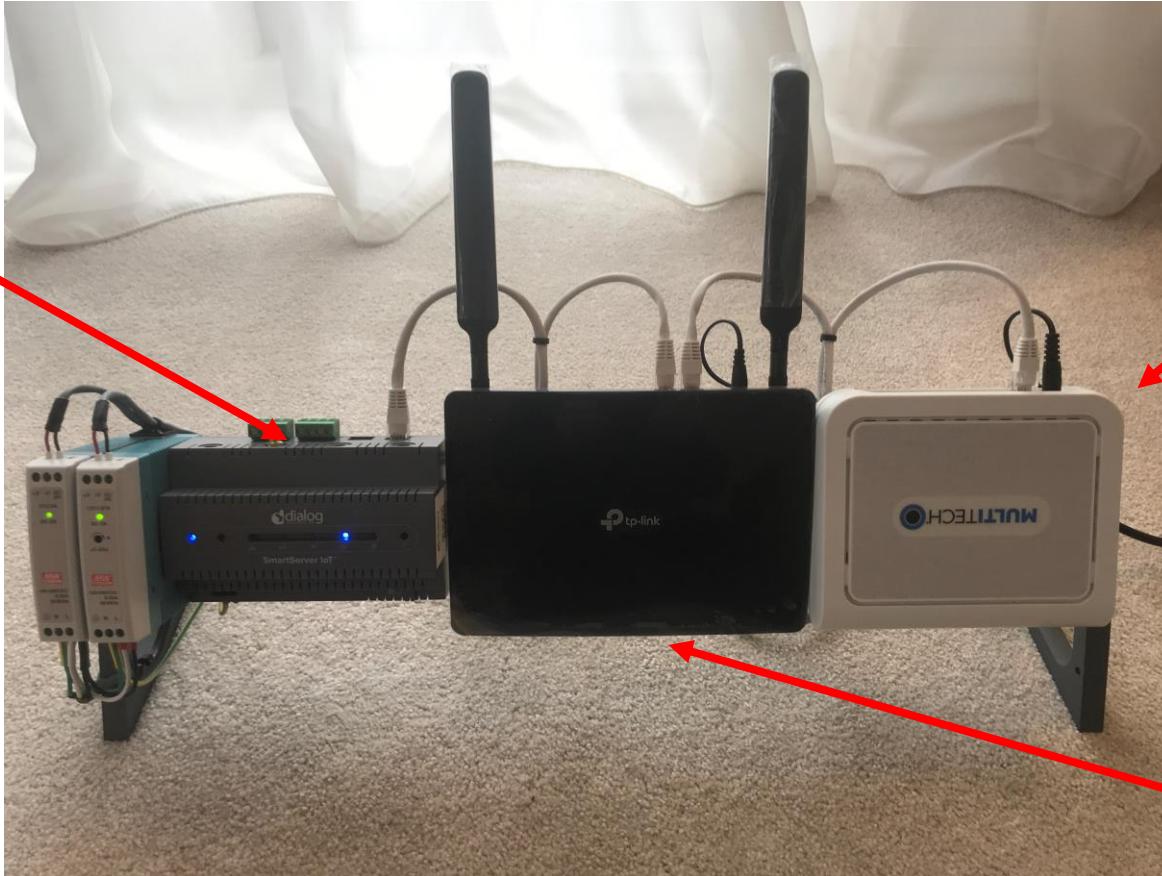
* As Required

Typical Hardware

SmartServer IoT

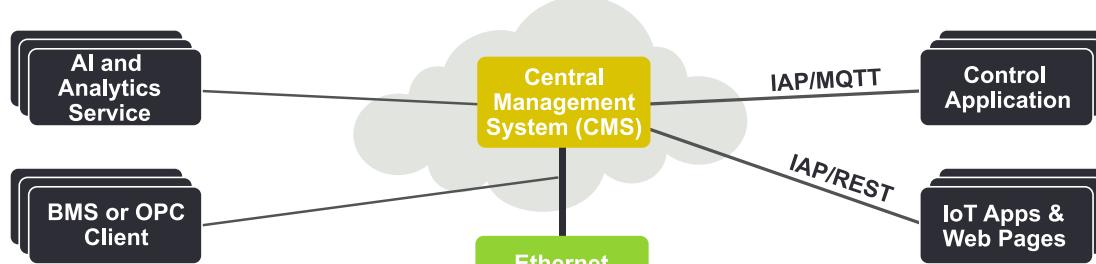
LoRa Gateway

IP Infrastructure



SmartServer IoT and IAP Architecture

Published Cloud Integrations

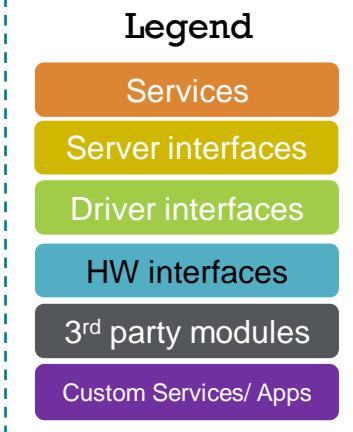
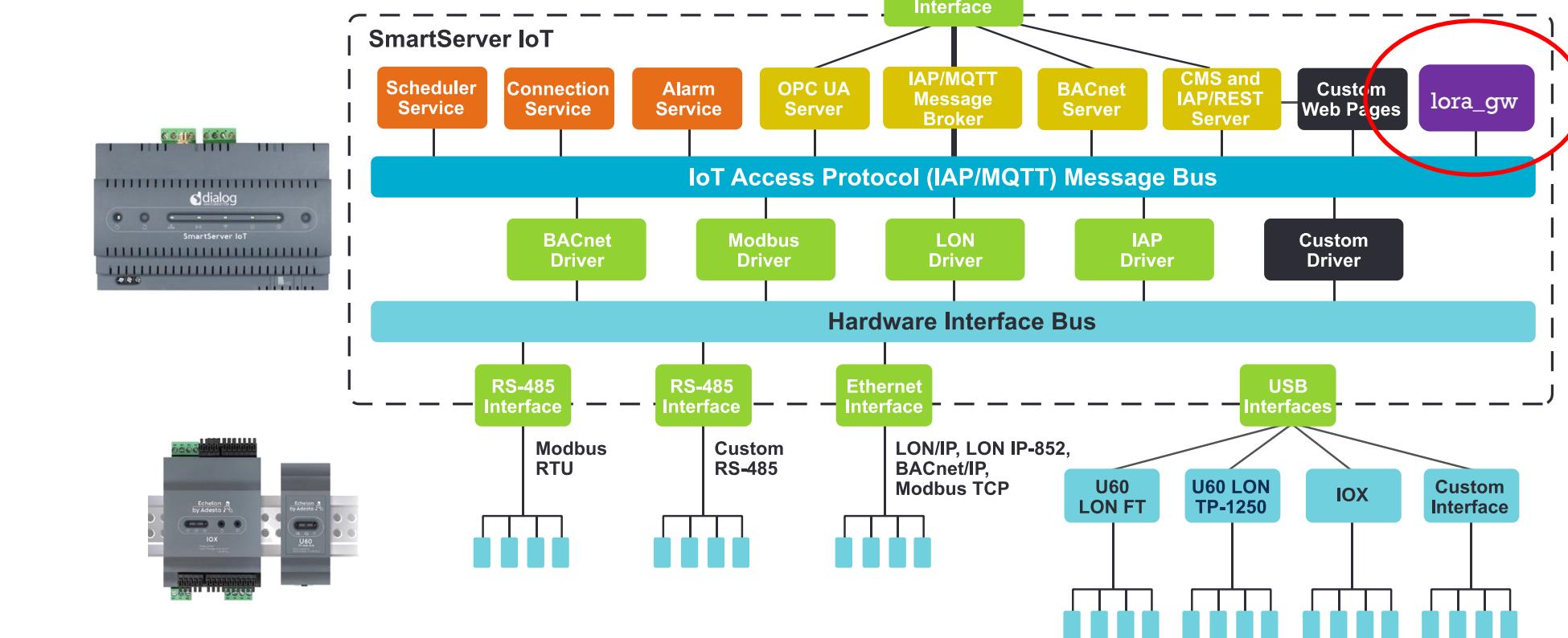


LoRa Integration

Docker Support

Node-RED Development

TALQ Support



Static LoRa Gateway Interface



ERS_CO2/0 – ERS_CO2/n-1



AM319/0 – AM319/n-1



Not secure | 192.168.168.19/cms/#/dashboard

dialog SEMICONDUCTOR 3.14.004 DMM

DEFAULT

Devices

- LoRaGateway Edge Device
- SmartServer IoT Segment Controller

Device Types

Device Type	Driver	Device Count
IOX_DIO	IAP	0
IOX_METER	IAP	0
IOX_SYS	IAP	0
Lora LON GW	LON	1

Datapoint Browser

Device	Block name	Block index	Datapoint name	Datapoint XIF name
LoRaGateway	MCF_LW12MET	0	nvoLoadCtl1_1	nvoLoadCtl
LoRaGateway	MCF_LW12MET	0	nvoActEnergy_1	nvoActEnergy
LoRaGateway	MCF_LW12MET	0	nvoActPwr_1	nvoActPwr
LoRaGateway	MCF_LW12MET	0	nvoAppEnergy_1	nvoAppEnergy

Datapoint Properties

Device type	Block name	Block index	Datapoint
Lora LON GW	R718E	1	nvoAccelX
Lora LON GW	R718E	9	nvoAccelX
Lora LON GW	R718E	2	nvoAccelX

Groups

Zones

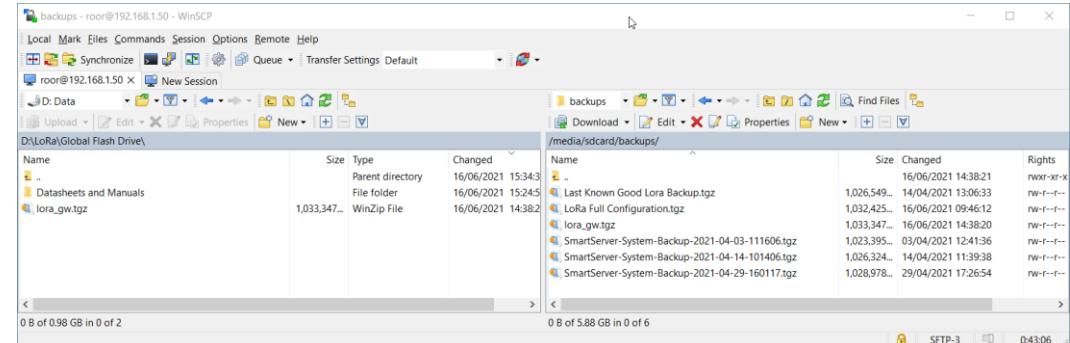
Apollo Owner

Logout

Integration Process Overview - As Minimalist As It Gets

Your key take aways:

- Configure external LoRaWAN gateway(s)
- Clone standard LoRa gateway image to target SmartServer
- Add Gateway in ChirpStack
- Add LoRaWAN devices in ChirpStack (Profile, Name, DevEUI, App Key)
- Check join requests/join accepts
- Go to lunch for 90 minutes
- Test & Backup



SmartServer IoT CMS

192.168.1.50/cms apollo/Sgq4-2FKQ

The screenshot shows the SmartServer IoT CMS interface on a web browser. The URL is 192.168.1.50/cms/#/dashboard. The top navigation bar includes a 'Not secure' warning, the IP address, and an 'Update' button. The left sidebar contains links for GROUPS, DEVICES, CALENDAR, ALARMS, STORAGE, DATAPPOINT BROWSER, DATAPPOINT PROPERTIES, DEVICE TYPES, and ZONES. The main area is titled 'DEFAULT' and contains several panels:

- Devices**: Shows two devices: 'LoRaGateway' (Edge Device) and 'SmartServer IoT' (Segment Controller).

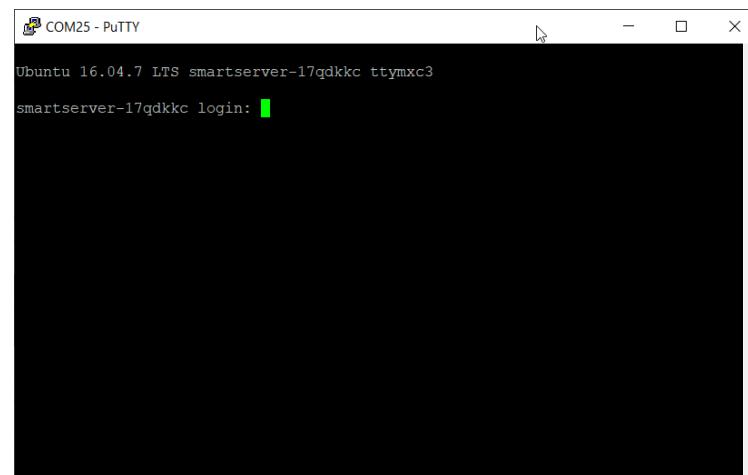
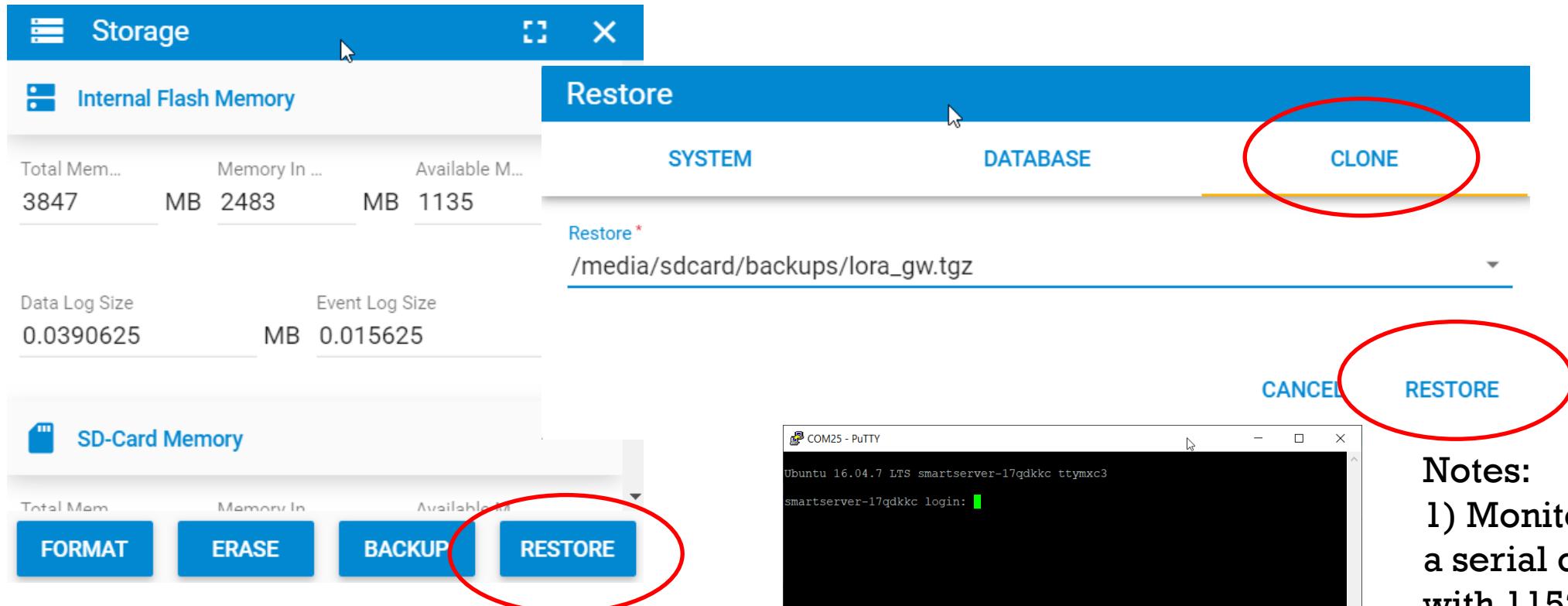
Device Type	Driver	Device Count	Actions
IOX_DIO	IAP	0	...
IOX_METER	IAP	0	...
IOX_SYS	IAP	0	...
Lora LON GW	LON	1	...
- Datapoint Browser**: Shows a list of datapoints for the LoRaGateway device.

Device	Block name	Block index	Datapoint name	Datapoint XIF name
LoRaGateway	MCF_LW12MET	0	nvoLoadCtl1_1	nvoLoadCtl
LoRaGateway	MCF_LW12MET	0	nvoActEnergy_1	nvoActEnergy
LoRaGateway	MCF_LW12MET	0	nvoActPwr_1	nvoActPwr
LoRaGateway	MCF_LW12MET	0	nvoAppEnergy_1	nvoAppEnergy
- Datapoint Properties**: Shows monitoring and traffic indicators for various device types.

Device type	Block name	Block index	Datapoint
Lora LON GW	R718E	1	nvoAccelX
Lora LON GW	R718E	9	nvoAccelX
Lora LON GW	R718E	2	nvoAccelX
- Groups**: A search bar for groups.
- Zones**: A search bar for zones.

The bottom left corner shows user information: 'Apollo Owner', '4' alerts, '0' errors, and a 'LOGOUT' link. The bottom right corner features the Dialog Semiconductor logo.

Clone Image – Clone Image

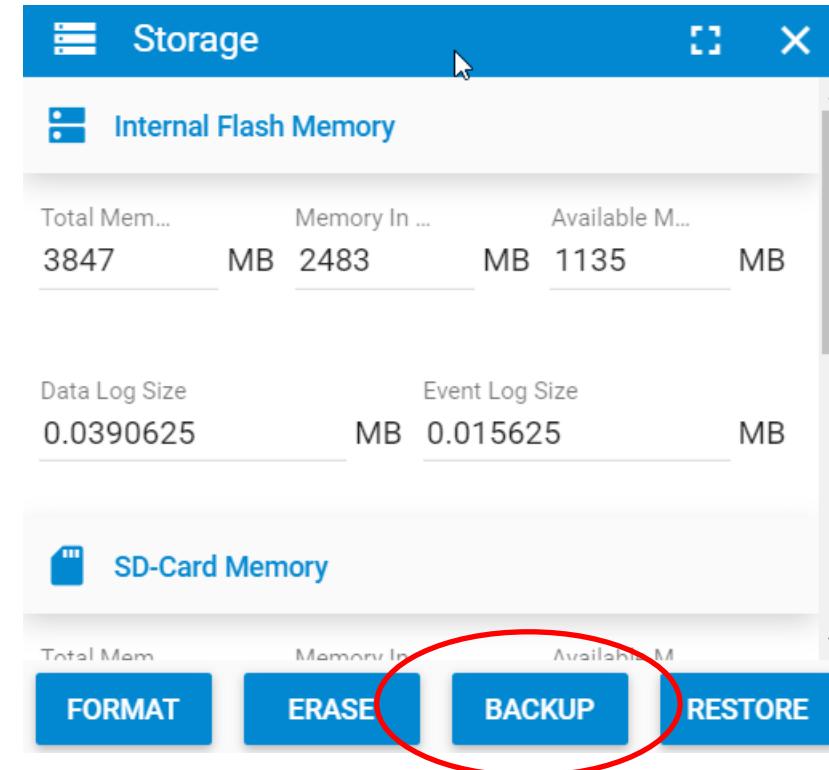


Notes:

- 1) Monitor progress using a serial console (Putty with 115200 baud) connection
- 2) SmartServer will have the password from the imaged device after cloning

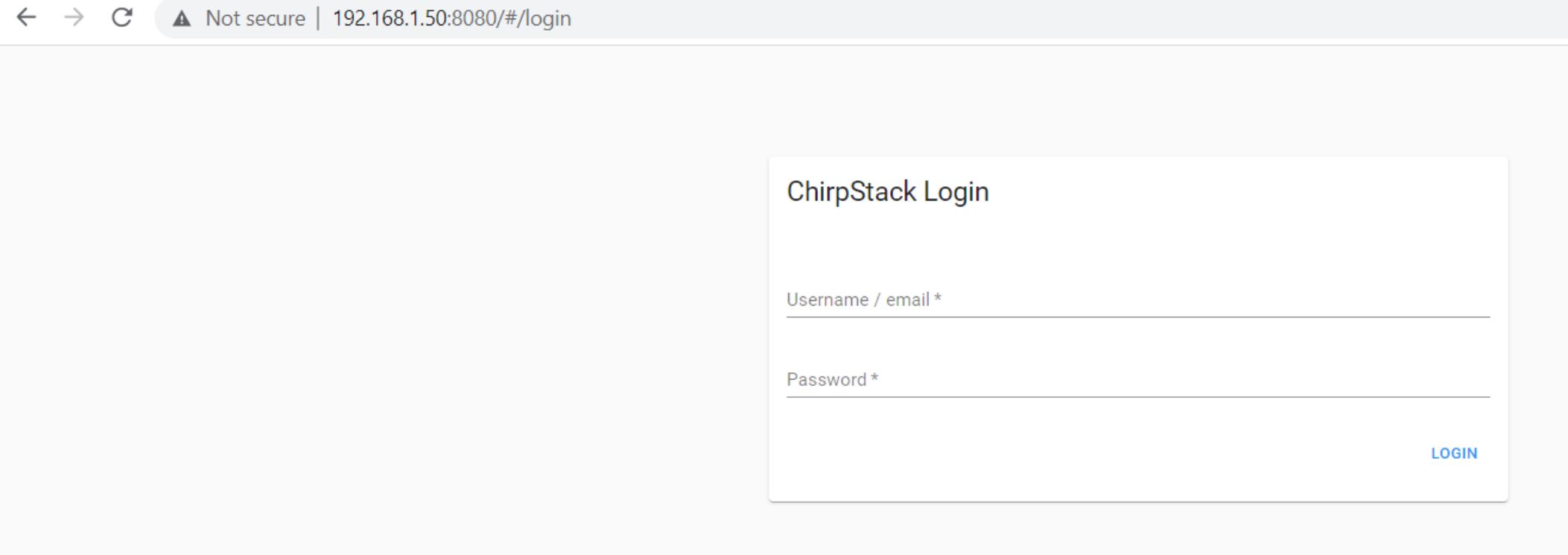
Backup

- Once configured, take a backup and save in a few places....
- Backup system, not database
- Takes around 35 minutes



Connecting to ChirpStack

192.168.1.50:8080 admin/Sgq4-2FKQ



Creating LoRaWAN Gateway in Chirpstack

The screenshot shows the ChirpStack Application Server interface. The left sidebar has a dropdown menu set to 'chirpstack' which contains the following items:

- Gateway-profiles
- Organizations
- All users
- API keys
- Org. dashboard
- Org. users
- Org. API keys
- Service-profiles
- Device-profiles
- Gateways
- Applications
- Multicast-groups

The main content area is titled 'Gateways'. At the top right of this area is a button labeled '+ CREATE' with a red circle around it. Below this button is a table header with columns: Last seen, Name, Gateway ID, Network server, and Gateway activity (30d). The table body is currently empty, showing '0-0 of 0' rows.

Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot shows the ChirpStack web interface with the following details:

- Header:** ChirpStack, Search organization, application, gateway or device, admin.
- Left Sidebar:** Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, chirpstack (selected), Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, Multicast-groups.
- Page Title:** Gateways / Create
- Form Fields (GENERAL tab):**
 - Gateway name *: MultiTech-MTCAP-868
 - Gateway description *: My Gateway
 - Gateway ID *: 00 80 00 00 00 01 9C 85 (MSB)
 - Network-server *: SmartServer IoT
 - Service-profile: SmartServer
 - Gateway-profile: MultiTech MTCAP-868
 - Gateway discovery enabled
- Buttons:** Create, Cancel

Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot shows the ChirpStack web interface for managing gateways. On the left, a sidebar menu lists various organizational and device management options. The main content area is titled "MultiTech MTCAP-868". It includes a checkbox for "Gateway discovery enabled" with a descriptive note about its function. A "Gateway altitude (meters)*" input field is set to 0. Below these, a map interface allows setting the gateway's location; a blue marker is placed on the map. At the bottom right of the map area, there are links to "Leaflet" and "OpenStreetMap contributors". A note below the map says, "Drag the marker to the location of the gateway. When the gateway has an on-board GPS, this value will be set automatically when the network receives statistics from the gateway." At the very bottom of the page, there are two buttons: "ADD BOARD CONFIGURATION" and a red-circled "CREATE GATEWAY" button.

Creating LoRaWAN Devices in ChirpStack

The screenshot shows the ChirpStack web interface for creating a new device. The left sidebar has a 'chirpstack' section with options like Dashboard, Network-servers, Gateway-profiles, Organizations, All users, and API keys. The main area shows the path Applications / Sensors / Devices / Create. The 'GENERAL' tab is selected, displaying fields for Device name (ERS_CO2), Device description (ERS CO2 Sensor), Device EUI (A8 17 58 FF FE 04 AB 14), and Device-profile (Elysys ERS_C02). There are also checkboxes for Disable frame-counter validation and Device is disabled, with a note about replay-attacks. A red circle highlights the 'CREATE DEVICE' button at the bottom right.

Dashboard

Network-servers

Gateway-profiles

Organizations

All users

API keys

chirpstack

Org. dashboard

Org. users

Org. API keys

Service-profiles

Device-profiles

Gateways

Applications

Multicast-groups

ChirpStack

Search organization, application, gateway or device

admin

Applications / Sensors / Devices / Create

GENERAL VARIABLES TAGS

Device name *

ERS_CO2

The name may only contain words, numbers and dashes.

Device description *

ERS CO2 Sensor

Device EUI *

A8 17 58 FF FE 04 AB 14 MSB C

Device-profile *

Elysys ERS_C02

Disable frame-counter validation

Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.

Device is disabled

ChirpStack Network Server will ignore received uplink frames and join-requests from disabled devices.

CREATE DEVICE

Creating LoRaWAN Devices in ChirpStack

The screenshot shows the ChirpStack web interface for creating a LoRaWAN device. The left sidebar has a search bar and a dropdown menu set to 'chirpstack'. The main area shows the path 'Applications / Sensors / Devices / ERS_CO2'. The 'KEYS (OTAA)' tab is selected. An application key 'f7 8a f4 e1 a7 fa b2 25 3b c1 38 60 9f 40 ae 7d' is entered. A red oval highlights the 'SET DEVICE-KEYS' button at the bottom right of the input field.

ChirpStack

Dashboard

Network-servers

Gateway-profiles

Organizations

All users

API keys

chirpstack

Org. dashboard

Org. users

Org. API keys

Service-profiles

Device-profiles

Gateways

Applications

Multicast-groups

Search organization, application, gateway or device

admin

Applications / Sensors / Devices / ERS_CO2

DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES

Application key *

f7 8a f4 e1 a7 fa b2 25 3b c1 38 60 9f 40 ae 7d

For LoRaWAN 1.0 devices. In case your device supports LoRaWAN 1.1, update the device-profile first.

MSB

SET DEVICE-KEYS

JoinRequest/JoinAccept

The screenshot shows the ChirpStack IoT Platform interface. The left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack' which includes Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, and Applications.

The main content area shows the path Applications / Sensors / Devices / ERS_CO2_test. Below this, there are tabs for DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES. The LORAWAN FRAMES tab is selected, indicated by a blue underline.

Two LORAWAN frames are listed:

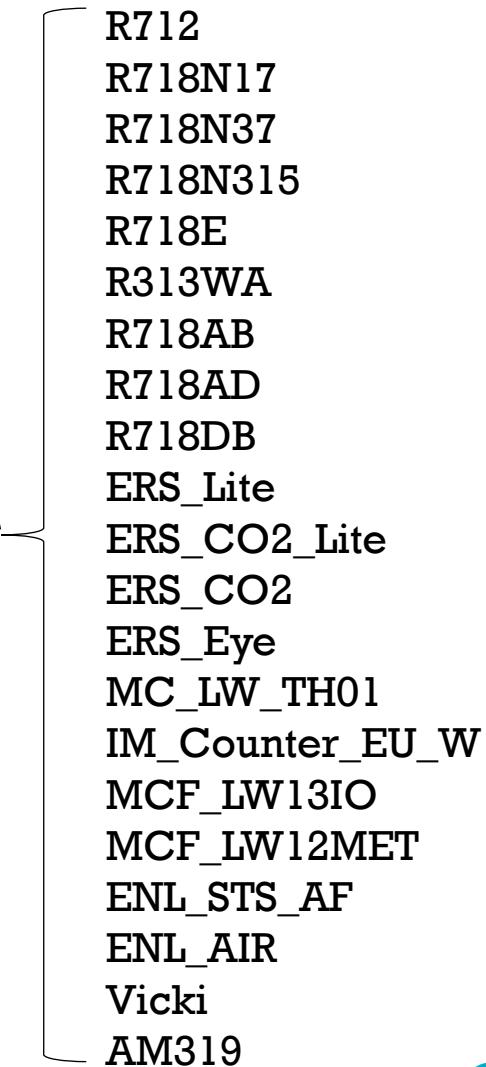
- Feb 01 9:25:58 PM: JoinAccept, 926.9 MHz, SF9, BW500, GW: 008000000001edb0
- Feb 01 9:25:58 PM: JoinRequest, 903.5 MHz, SF9, BW125, DevEUI: a81758fffe0700cd

Automatic Mapping

- LoRaWAN DevEUIs have to be statically mapped to internal application blocks and block indices
- Internal application datapoints have to be mapped to BACnet objects
- Both operations require accurate data entry, so this is automated

LoRaWAN Device Naming Convention

- LoRaWAN device names must include their type
- No spaces are allowed
- Only alphanumeric characters and underscores
- For example:
 - R712
 - R712_Outside
 - R313WA_Board_Room_Seat
 - AM319_Fourth_Floor_Air_Quality
- Later ChirpStack releases will include Device Profile Tags



R712
R718N17
R718N37
R718N315
R718E
R313WA
R718AB
R718AD
R718DB
ERS_Lite
ERS_CO2_Lite
ERS_CO2
ERS_Eye
MC_LW_TH01
IM_Counter_EU_W
MCF_LW13IO
MCF_LW12MET
ENL_STS_AF
ENL_AIR
Vicki
AM319

devices.csv File

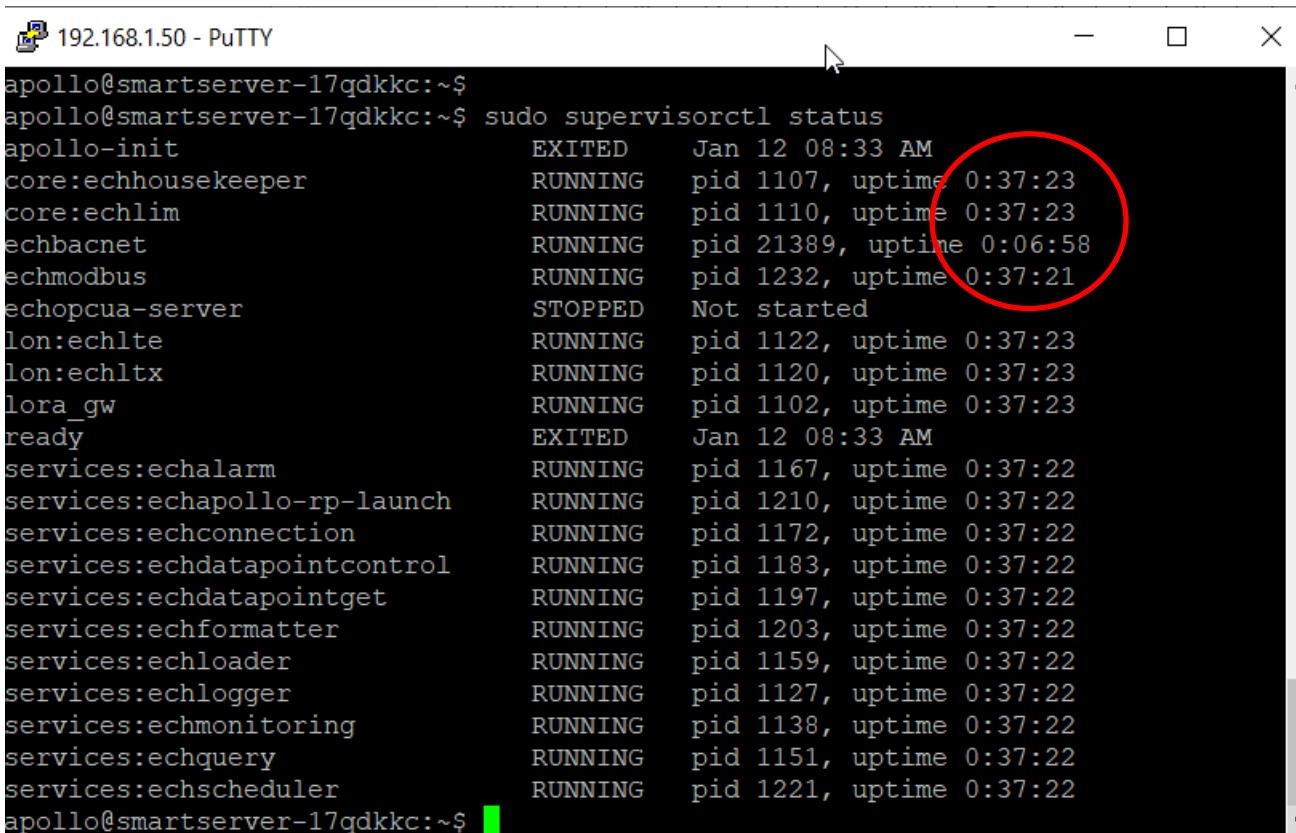
- Used to map LoRaWAN deveui to IAP/MQ blocks and block indices
- Automatically generated**
 - Do not edit**
- Includes the ChirpStack device name which includes the device type
- If necessary, add LoRaWAN devices in the order you wish them to appear in lora_gw.btm
- ChirpStack does not include the device profile tags in 3.1.5
- CSV file is initially unpopulated except for the headers
- Provides an as built BOM

A	B	C	D	E	F
1	pad	device_type	block_index	deveui	lora_application device_name
2		ENL_STS_AF		0 0004a30b01275427	1 ENL_STS_AF_400_Second_Floor_VAV_Duct
3		ERS_CO2_Lite		0 a81758ffffe0537a1	1 ERS_CO2_Lite_Fourth_Floor_Sales
4		R718E		0 00137a100000d69f	1 R718E_Heat_Exchanger_1
5		MCF_LW12MET		0 70b3d58ff10183b4	1 MCF-LW12MET
6		MCF_LW13IO		0 70b3d58ff10183ce	1 MCF-LW13IO
7		R718N315		0 00137a100000a2ac	1 R718N315_Third_Floor_Riser
8		R718N17		0 00137a100000966c	1 R718N17_Aux_Feed
9		R718E		1 00137a100000d69c	1 R718E_Heat_Exchanger_2
10		MC_LW_TH01		0 70b3d52dd40000a1	1 MC-LW-TH01_0_Plant_Room
11		ERS_Eye		0 a81758ffffe04d037	1 ERS_Eye_Board_Room
12		Vicki		0 70b3d52dd3000abc	1 Vicki_0
13		Vicki		1 70b3d52dd3000b65	1 Vicki_1
14		ERS_CO2		0 a81758ffffe0625c2	1 ERS_CO2_Third_Floor_Kitchen
15		Vicki		2 70b3d52dd3002eac	1 Vicki_2
16		ERS_Lite		0 a81758ffffe04b491	1 ERS_Lite_Engineering
17		AM319		0 24e124710b423509	1 AM319_First_Floor
18		R718AB		0 00137a1000013df0	1 R718AB
19		R718DB		0 00137a1000013cbc	1 Netvox_R718DB
20		R718AD		0 00137a1000011e6d	1 R718AD
21		IM_Counter_EU_W		0 0004a30b00edc875	1 IM-Counter-EU-W_0_Front_Door
22		R313WA		0 00137a100000f887	1 R313WA_Sample_Sofa
23		R712		0 00137a100000d1c1	1 R712_Outside

/var/apollo/data/lora_gw/support/devices.csv

Are We There Yet?

- Wait until the echbacnet service has been restarted - see by uptime difference to other services
- Use “sudo supervisorctl status” in a console/ssh connection (apollo/Sgq4-2FKQ)



```
192.168.1.50 - PuTTY
apollo@smartserver-17qdkkc:~$ sudo supervisorctl status
apollo-init          EXITED   Jan 12 08:33 AM
core:echhousekeeper  RUNNING  pid 1107, uptime 0:37:23
core:echlim           RUNNING  pid 1110, uptime 0:37:23
echbacnet             RUNNING  pid 21389, uptime 0:06:58
echmodbus              RUNNING  pid 1232, uptime 0:37:21
echopcua-server       STOPPED  Not started
lon:echlte             RUNNING  pid 1122, uptime 0:37:23
lon:echltx             RUNNING  pid 1120, uptime 0:37:23
lora_gw                RUNNING  pid 1102, uptime 0:37:23
ready                  EXITED   Jan 12 08:33 AM
services:echalarm      RUNNING  pid 1167, uptime 0:37:22
services:echapollo-rp-launch RUNNING  pid 1210, uptime 0:37:22
services:echconnection  RUNNING  pid 1172, uptime 0:37:22
services:echdatapointcontrol RUNNING  pid 1183, uptime 0:37:22
services:echdatapointget  RUNNING  pid 1197, uptime 0:37:22
services:echformatter   RUNNING  pid 1203, uptime 0:37:22
services:echloader      RUNNING  pid 1159, uptime 0:37:22
services:echlogger      RUNNING  pid 1127, uptime 0:37:22
services:echmonitoring  RUNNING  pid 1138, uptime 0:37:22
services:echquery        RUNNING  pid 1151, uptime 0:37:22
services:echscheduler    RUNNING  pid 1221, uptime 0:37:22
apollo@smartserver-17qdkkc:~$
```

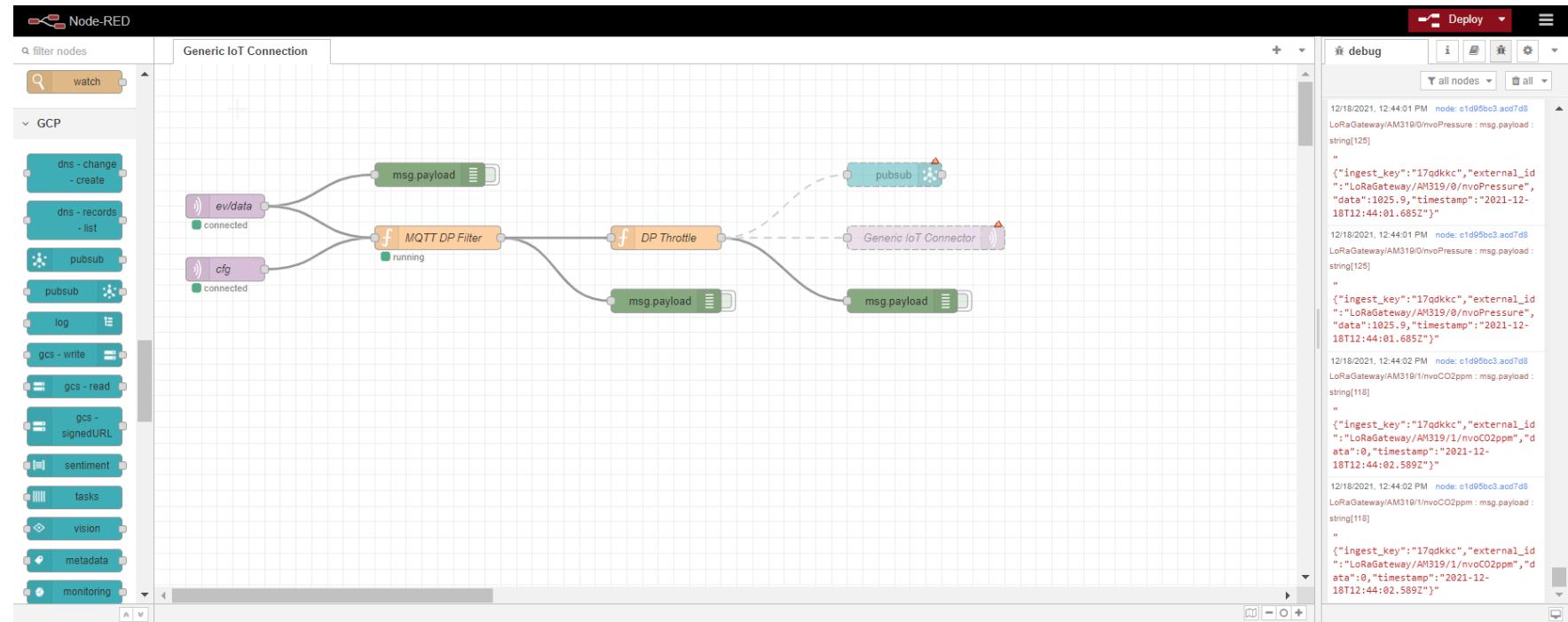
lora_gw.btm File

- Used to map internal application datapoints to BACnet datapoints
- Automatically generated, echbacnet is automatically restarted 90m after last new device found

A	B	C	D	E	F	G	H	I		
1	#filetype	bacnet_type_map								
2	#version	v0.0.0								
3	#product_name	lora_gw								
4	Technology	Block Type	Block Handle	Point Name	bacnet_type	Instance	Name	Description	Units	SNV
5	Ion	ENL_STS_AF		0 nvoBattV	AI	1	ENL_STS_AF/0 Battery Voltage	ENL_STS_AF_400_Second_Floor_VAV_Duct - Battery Voltage	volts	value
6	Ion	ENL_STS_AF		0 nvoAirFlow	AI	2	ENL_STS_AF/0 Air Flow	ENL_STS_AF_400_Second_Floor_VAV_Duct - Air Flow	meters-per-second	value
7	Ion	ENL_STS_AF		0 nvoDiffPress	AI	3	ENL_STS_AF/0 Diff Pressure	ENL_STS_AF_400_Second_Floor_VAV_Duct - Diff Pressure	millibars	value
8	Ion	ENL_STS_AF		0 nvoHumidity	AI	4	ENL_STS_AF/0 Humidity	ENL_STS_AF_400_Second_Floor_VAV_Duct - Humidity	percent-relative-humidity	value
9	Ion	ENL_STS_AF		0 nvoTemp	AI	5	ENL_STS_AF/0 Temperature	ENL_STS_AF_400_Second_Floor_VAV_Duct - Temperature	degrees-celsius	value
10	Ion	ERS_CO2_Lite		0 nvoBattV	AI	6	ERS_CO2_Lite/0 Battery Voltage	ERS_CO2_Lite_Fourth_Floor_Sales - Battery Voltage	volts	value
11	Ion	ERS_CO2_Lite		0 nvoCO2ppm	AI	7	ERS_CO2_Lite/0 CO2 ppm	ERS_CO2_Lite_Fourth_Floor_Sales - CO2 ppm	parts-per-million	value
12	Ion	ERS_CO2_Lite		0 nvoHumidity	AI	8	ERS_CO2_Lite/0 Humidity	ERS_CO2_Lite_Fourth_Floor_Sales - Humidity	percent-relative-humidity	value
13	Ion	ERS_CO2_Lite		0 nvoTemp	AI	9	ERS_CO2_Lite/0 Temperature	ERS_CO2_Lite_Fourth_Floor_Sales - Temperature	degrees-celsius	value
14	Ion	R718E		0 nvoAccelX	AI	10	R718E/0 Acceleration X	R718E_Heat_Exchanger_1 - Acceleration X	meters-per-second	value
15	Ion	R718E		0 nvoAccelY	AI	11	R718E/0 Acceleration Y	R718E_Heat_Exchanger_1 - Acceleration Y	meters-per-second	value
16	Ion	R718E		0 nvoAccelZ	AI	12	R718E/0 Acceleration Z	R718E_Heat_Exchanger_1 - Acceleration Z	meters-per-second	value
17	Ion	R718E		0 nvoBattV	AI	13	R718E/0 Battery Voltage	R718E_Heat_Exchanger_1 - Battery Voltage	volts	value
18	Ion	R718E		0 nvoTemp	AI	14	R718E/0 Temperature	R718E_Heat_Exchanger_1 - Temperature	degrees-celsius	value
19	Ion	R718E		0 nvoVelocityX	AI	15	R718E/0 Velocity X	R718E_Heat_Exchanger_1 - Velocity X	millimeters-per-second	value
20	Ion	R718E		0 nvoVelocityY	AI	16	R718E/0 Velocity Y	R718E_Heat_Exchanger_1 - Velocity Y	millimeters-per-second	value
21	Ion	R718E		0 nvoVelocityZ	AI	17	R718E/0 Velocity Z	R718E_Heat_Exchanger_1 - Velocity Z	millimeters-per-second	value
22	Ion	MCF_LW12MET		0 nvoLoadCtl	BO	18	MCF_LW12MET/0 Load Control	MCF-LW12MET - Load Control	no-units	state
23	Ion	MCF_LW12MET		0 nvoLoadSts	BI	19	MCF_LW12MET/0 Load Status	MCF-LW12MET - Load Status	no-units	state
24	Ion	MCF_LW12MET		0 nvoActEnergy	AI	20	MCF_LW12MET/0 Active Energy	MCF-LW12MET - Active Energy	watt-hours	value

Generic IoT Node-RED Cloud Connector

- Included in image
- Connection for:
 - AWS
 - Azure
 - Watson
 - GCP
- Directories are set established for TLS certs
- Disabled out of the box
- Set polling rates in Datapoint Properties widget for DPs in question apart from for LoRa DPs which are automatically handled



```
{"ingest_key": "17qdkkc", "external_id": "LoRaGateway/AM319/0/nvoPressure", "data": 1025.9, "timestamp": "2021-12-18T12:44:01.685Z"}
```

/var/apollo/data/certs/tls

Redundant LoRaWAN Gateways

- Additional routers can be incorporated for:
 - Redundancy
 - Better coverage



Not secure | 192.168.1.50:8080/#/organizations/1/gateways

ChirpStack

Dashboard Network-servers Gateway-profiles Organizations All users API keys chirpstack

Gateways

Last seen	Name	Gateway ID	Network server	Gateway activity (30d)
2 days ago	MultiTechMTCAP868A	0080000000019c85	SmartServer IoT	
2 days ago	MultiTechMTCAP868B	008000000001b6b0	SmartServer IoT	
a few seconds ago	RAK_7258	ac1f0ffffe05225f	SmartServer IoT	

Rows per page: 10 ▾ 1-3 of 3 < >

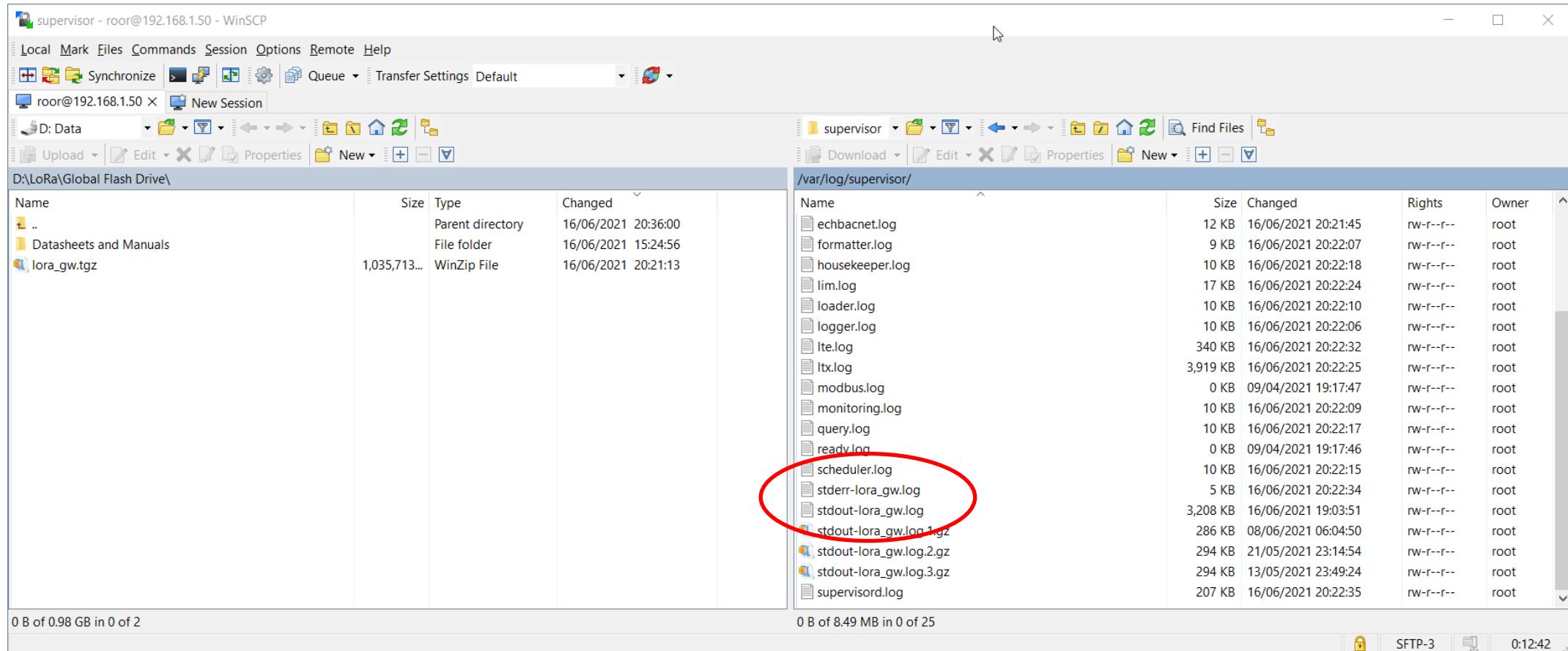
The View From BACnet Using YABE

The screenshot displays the Yet Another Bacnet Explorer (YABE) application interface. The main window is divided into several panes:

- Devices:** Shows a tree view of devices under "Udp:47808". One node is expanded to show "Device 20039 - 192.168.1.50:47808" and its sub-node "17dkkc_lora_gw_00D0710C85B5 [1701003]."
- Address Space:** Lists 128 objects, including "AM319/0 Temperature (Analog_Input:124)" which is circled in red.
- Subscriptions, Periodic Polling, Events/Accidents:** A table with columns: Device, ObjectId, Name, Value, Time, Status, Description.
- Properties:** A detailed view of the selected object's properties:
 - BacnetProperty**:
 - Acked Transitions: 111
 - Cov Increment: 1
 - Deadband: 1
 - Description: AM319_First_Floor - Temperature
 - Event Detection Enable: True
 - Event Enable: 000
 - Event State: 0: Normal
 - Event Time Stamps: High Limit: 100, Low Limit: 00, Object[] Array: 0
 - Notification Class: 4194303
 - Notify Type: 0: Alarm
 - Object Identifier: OBJECT_ANALOG_INPUT:124
 - Object Name: AM319/0 Temperature
 - Object Type: 0: Object_Analog_Input
 - Out Of Service: false
 - Present Value: 24.4
 - Reliability: 0: No Fault Detected
 - Status Flags: 0000
 - Time Delay: 0
 - Units: 62 : Degrees Celsius
 - Acked Transitions:** BACNET_APPLICATION_TAG_BIT_STRING
- Graph:** A line graph showing the present value of the temperature over time, ranging from 0.00 to 1.20 on the y-axis and 00:00 to 00:00 on the x-axis.
- Last seen:** A status bar at the top right indicating "a few seconds ago".
- Device name:** A list of device names on the right side, each with a red circle around it:
 - AM319_First_Floor
 - ENL_AIR
 - ENL_STS_AF_400_Second_Floor_VAV
 - ERS_CO2_Lite_Fourth_Floor_Sales
 - ERS_CO2_Third_Floor_Kitchen
 - ERS_Eye_Board_Room

Log Files

- Log files can be found at: /var/log/supervisor



Deleting/Renaming Devices in ChirpStack

- Deleting a device in Chirpstack will not delete it from within IAP
 - It will also leave the device in the ChirpStack database
 - Legacy data will re-appear if DevEUIs are re-used
- To delete devices from IAP, from a console/SSH session, run the script:
 - `sudo /var/apollo/data/lora_gw/support/reset.sh`
- Or from the support folder
 - `sudo ./reset.sh`

MQTT Ports

- MQTT Ports 1883 and 8883 are open by default
- Close them down if not needed

```
sudo ufw status numbered  
sudo ufw delete <number>
```

- Repeat as necessary

Adding New Device Types/Counts

- For new device types and count changes ask Dialog!
- 4096 DPs max

Passwords

You should change the SmartServer system and CMS password along with the ChirpStack password.

For the SmartServer use the System tab in the Configuration User interface

The image shows two screenshots of the SmartServer Configuration User Interface. The left screenshot displays the 'SYSTEM INFORMATION' tab, listing details such as Version (3.26.001), Serial Number (442021D00502), MACID (00:d0:71:0c:85:af), Install Code (17qampp), Segment Provisioning Status (Provisioned), Segment ID (17qdkko), LON Network Management Mode (Device), and System Uptime (44 minutes). Below this are three buttons: 'Change Password', 'Reboot', and 'Reset To Default'. The right screenshot shows the 'CHANGE PASSWORD' tab, which includes fields for Username (apollo), Current Password, New Password, and Confirm New Password, along with a 'Change Password' button.

ChirpStack

- For the ChirpStack use the admin button at the top right

The screenshot shows the ChirpStack web interface. At the top, there is a search bar with the placeholder "Search organization, application, gateway or device". To its right is a user profile icon labeled "admin". A red circle highlights this "admin" button. Below the search bar are two links: "Change password" and "Logout".

Below the header, the URL "Users / admin / Change password" is visible. The main content area contains a form with a "Password *" input field and a "UPDATE PASSWORD" button.

A secondary window or dropdown menu is also visible on the right side of the screen, containing the same "Change password" and "Logout" links as the header.



Q&A

Adding Non-LoRa Devices

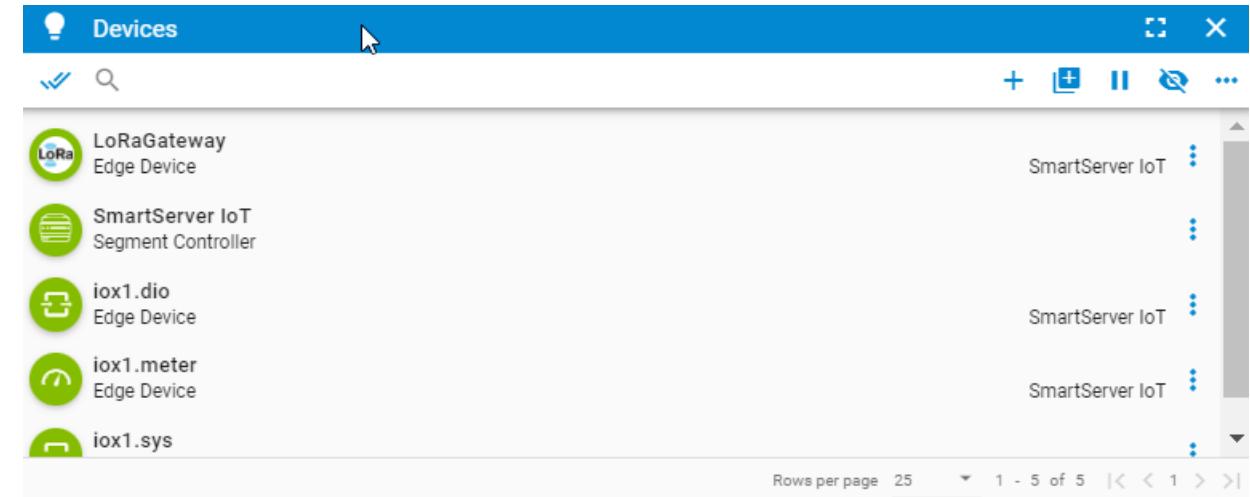


Adesto

Adding Non-LoRa Devices

- Support device types can be added manually (types and instantiation) or by using discovery
- BACnet, LON and Modbus discovery is supported
- Discovered devices have a unique naming convention
- Any device can be renamed as required in the Devices widget
- An unobtrusive approach must be taken, so as not to affect existing control strategies
- Polling rates must be sympathetic to the channel in question and SmartServer EPS and CPU%
- Do not rely on BACnet COV
- Detailed guidance can be found at:

<http://iecdocs.diasemi.com/display/PortSSIoT/Discovering%2C+Defining%2C+or+Importing+Devices>



BACnet Discovery - Overview

- BACnet discovery may take a while to run to completion
- BACnet initially uses broadcast addressing initially
 - BBMDs must be in place
- It may not find everything in one pass
 - Validate the discovered device count
- To start discovery, simply click the discover icon in the Device widget

/var/apollo/data/bacnetrouter/res/
Before starting discovery



/var/apollo/data/bacnetrouter/res/		
Name	Size	Changed
..		22/12/2021 13:16:59
lora_gw.btm	2 KB	29/03/2022 15:14:01
lora_gw.btm.backup	1 KB	02/02/2022 14:17:01
readme.txt	1 KB	25/10/2021 20:04:05

The View From Wireshark

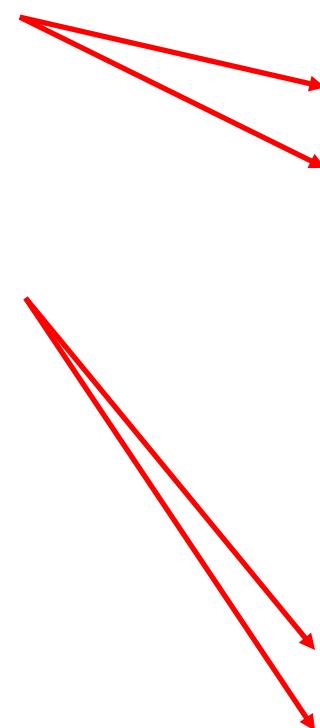
- Only the broadcast traffic will be visible

The screenshot shows the Wireshark interface capturing traffic from a Wi-Fi interface. The main window displays a list of 19 BACnet protocol frames, all of which are broadcast messages. The 'Info' column provides details for each frame, such as 'Unconfirmed-REQ who-Is' or 'Who-Is-Router-To-Network'. The bottom status bar indicates 'Wi-Fi: <live capture in progress>' and shows statistics: 'Packets: 5158 · Displayed: 19 (0.4%)'. The interface includes standard Wireshark tools like file operations, search, and zoom.

No.	Time	Source	Destination	Protocol	Length	Info
2810	147.641846	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is
2811	147.641846	192.168.168.9	192.168.168.255	BACnet...	62	Unconfirmed-REQ i-Am device,17800
2812	147.670083	192.168.168.68	192.168.168.255	BACnet...	75	Unconfirmed-REQ i-Am device,68
2899	152.650015	192.168.168.5	192.168.168.255	BACnet...	60	Who-Is-Router-To-Network
2900	152.657805	192.168.168.68	192.168.168.255	BACnet...	60	I-Am-Router-To-Network
2984	157.643190	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is
2985	157.643191	192.168.168.9	192.168.168.255	BACnet...	62	Unconfirmed-REQ i-Am device,17800
2986	157.678528	192.168.168.68	192.168.168.255	BACnet...	75	Unconfirmed-REQ i-Am device,68
2987	157.901666	192.168.168.5	192.168.168.255	BACnet...	61	Unconfirmed-REQ who-Is 17801 4194302
2990	157.942661	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 69 17799
3126	168.004694	192.168.168.5	192.168.168.255	BACnet...	62	Unconfirmed-REQ who-Is 1701004 4194302
3127	168.046836	192.168.168.5	192.168.168.255	BACnet...	61	Unconfirmed-REQ who-Is 17801 1701002
3128	168.102717	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 15156 17799
3129	168.148401	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 69 15154
3130	168.207277	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 0 67
3223	178.199960	192.168.168.5	192.168.168.255	BACnet...	62	Unconfirmed-REQ who-Is 1701004 4194302
3231	178.248627	192.168.168.5	192.168.168.255	BACnet...	61	Unconfirmed-REQ who-Is 17801 1701002
3233	178.301210	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 15156 17799
3237	178.401471	192.168.168.5	192.168.168.255	BACnet...	60	Unconfirmed-REQ who-Is 0 67

Device and Device Types Widget

- Discovered devices will appear in the Devices widget
- Discovered devices must be provisioned from the Devices Widget
- Associated types will appear in the Device Types widget



Devices	
<input checked="" type="checkbox"/>	<input type="text"/>
Discovered-BACnet-151_TP1273-15155-1	Edge Device
Discovered-BACnet-178_LIOB-550-17800-1	Edge Device
LoRaGateway	Edge Device
SmartServer IoT	Segment Controller
iox1.dio	

Device Types					
	Device Type	Driver	Device Count	Actions	
<input checked="" type="checkbox"/>	BACnet-151_TP1273	BACnet	1		
<input checked="" type="checkbox"/>	BACnet-178_LIOB-550	BACnet	1		
<input checked="" type="checkbox"/>	IOX_DIO	IAP	1		
<input checked="" type="checkbox"/>	IOX_METER	IAP	1		

Changing Device Names

- You can rename a device in the Devices widget
- Useful to tagging
- Useful for discovered devices

The screenshot illustrates the process of renaming a device within a software application. It shows three distinct windows:

- Devices Screen:** A list of discovered devices. One device, "Discovered-BACnet-151_TP1273-15155-1", is highlighted with a red oval. Its details are shown in the context menu.
- Context Menu (Top Right):** A modal window titled "Device: Discovered-BACnet-151_TP1273-15155-1::15155". It displays the current name "Titon Sensor Fourth Floor" and the category "Edge Device". The "Name" field is also visible.
- Configuration Dialog (Bottom Right):** A detailed configuration window for the device. It shows the new name "Titon Sensor Fourth Floor::15155" in the "UID" field. Other fields include "Integration method" (Manual assignment), "Owner" (SmartServer IoT), "Driver" (BACnet), "Device type" (BACnet-151_TP1273), "Firmware Version" (1.1.11), and "Model Number". Buttons for "CANCEL", "BACK", and "SAVE" are at the bottom. The "SAVE" button is highlighted with a mouse cursor.

/var/apollo/data/bacnetrouter/res .bac Files

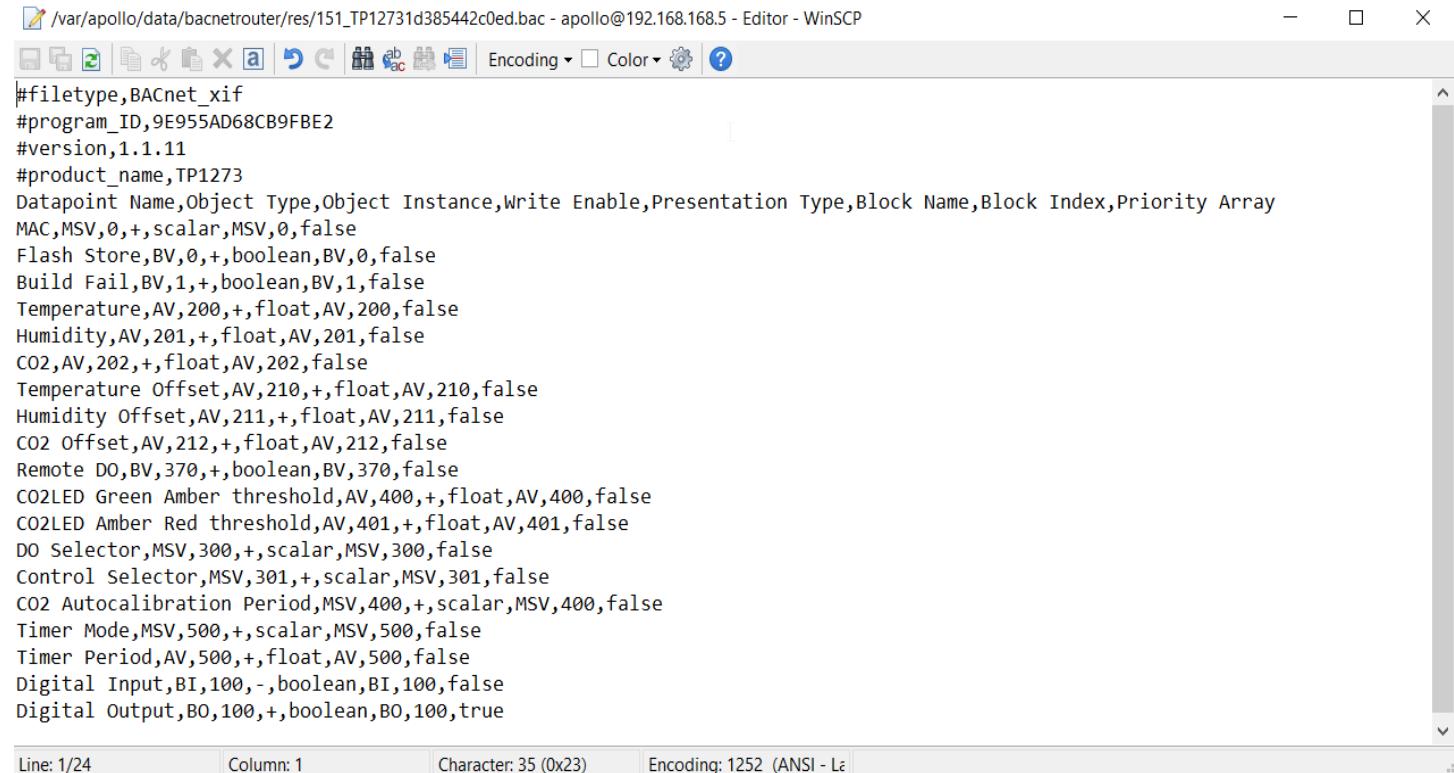
- The BACnet external interface files (*.bac) can be found in /var/apollo/data/bacnetrouter/res
- CSV format



/var/apollo/data/bacnetrouter/res/		
Name	Size	Changed
..		22/12/2021 13:16:59
151_TP12731d385442.bac	1 KB	07/04/2022 14:28:15
178_LIOB-5503e684824c7ce.bac	2 KB	07/04/2022 14:28:20
lora_gw.btm	2 KB	29/03/2022 15:14:01
lora_gw.btm.backup	1 KB	02/02/2022 14:17:01
readme.txt	1 KB	25/10/2021 20:04:05

Setting Datapoint Names

- You can rename BACnet and Modbus device type datapoints if required
- Restart the relevant service afterwards
- Useful for discovered datapoint names
- Rename datapoints in the relevant file
- Check in the Device Types widget for the file prefix in question
- Reboot or restart the relevant service after editing



The screenshot shows a WinSCP Editor window displaying a configuration file for BACnet and Modbus datapoints. The file path is /var/apollo/data/bacnetrouter/res/151_TP12731d385442c0ed.bac. The file contains several lines of text defining datapoints, each consisting of a name, object type, instance, write enable, presentation type, block name, block index, and priority array. The names include MAC, MSV, Flash Store, Build Fail, Temperature, Humidity, CO2, Temperature Offset, Humidity Offset, CO2 Offset, Remote DO, CO2LED Green Amber threshold, CO2LED Amber Red threshold, DO Selector, Control Selector, CO2 Autocalibration Period, Timer Mode, Timer Period, Digital Input, and Digital Output.

```
#filetype,BACnet_xif
#program_ID,9E955AD68CB9FBE2
#version,1.1.11
#product_name,TP1273
Datapoint Name,Object Type,Object Instance,Write Enable,Presentation Type,Block Name,Block Index,Priority Array
MAC,MSV,0,+,scalar,MSV,0,false
Flash Store,BV,0,+,boolean,BV,0,false
Build Fail,BV,1,+,boolean,BV,1,false
Temperature,AV,200,+,float,AV,200,false
Humidity,AV,201,+,float,AV,201,false
CO2,AV,202,+,float,AV,202,false
Temperature Offset,AV,210,+,float,AV,210,false
Humidity Offset,AV,211,+,float,AV,211,false
CO2 Offset,AV,212,+,float,AV,212,false
Remote DO,BV,370,+,boolean,BV,370,false
CO2LED Green Amber threshold,AV,400,+,float,AV,400,false
CO2LED Amber Red threshold,AV,401,+,float,AV,401,false
DO Selector,MSV,300,+,scalar,MSV,300,false
Control Selector,MSV,301,+,scalar,MSV,301,false
CO2 Autocalibration Period,MSV,400,+,scalar,MSV,400,false
Timer Mode,MSV,500,+,scalar,MSV,500,false
Timer Period,AV,500,+,float,AV,500,false
Digital Input,BI,100,-,boolean,BI,100,false
Digital Output,B0,100,+,boolean,B0,100,true
```

Data Browser Widget

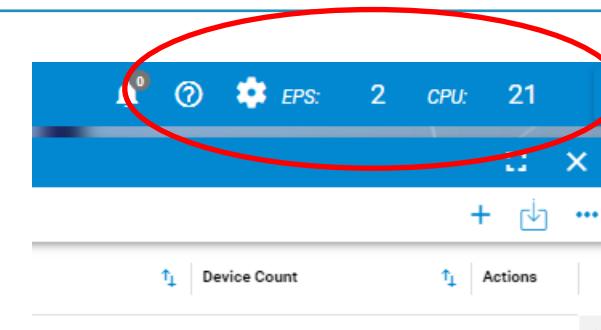
The screenshot shows two main interface components. On the left is the 'Devices' widget, listing various edge devices: LoRaGateway, Loytec IO Plant Room, SmartServer IoT, Titon Sensor Fourth Floor, and iox1.dio. On the right is the 'Datapoint Browser' for the Titon Sensor Fourth Floor, displaying a table of data points. A red circle highlights the 'View datapoints' option in the context menu of the Devices widget, and another red circle highlights the polling rate setting (30 s.) in the Datapoint Browser.

Device	Source	Block	Block Index	Datapoint	Value
Titon Sensor Fourth Floor	AV	200	Temperature	25.20000076	
Titon Sensor Fourth Floor	AV	201	Humidity	37.72999954	
Titon Sensor Fourth Floor	AV	202	CO2	582	
Titon Sensor Fourth Floor	AV	210	Temperature Offset	0	
Titon Sensor	AV	211	Humidity Offset	0	

- Can be used to test data retrieval without having setup polling rates
- Uses GETs
- Use view datapoints for the device in the Devices widget
- Use suitable polling rate
- Be conscious of polling rate
- Never use a non-zero polling rate for LoRa Gateway device

Setting Datapoint Polling Rates

- This must be done sympathetically to:
 - Not impeded control strategy requirements
 - BACnet MS/TP and Modbus RTU are slow channels
 - Take advantage of slow changing datapoints such as temperatures
 - Keep SmartServer EPS to <40 and CPU% to <40%
 - Cloud service time resolution requirements
 - Cloud storage availability
- Datapoint Properties are set by type, not device instance
- Worst case, the LoRa Gateway with 15 minute uplinks can generate ~5 EPS



Datapoint Properties											
Total Monitoring Traffic Indicator 0.00 events per second				Total Logged Bytes 0.00 byte (B) per day				Data Annual Log Size 0.00 byte (B) per year			
Device Type	Block Name	Block Index	Datapoint XIF Name	Datapoint Type	Monitored	Logged	Alarmed	Actions			
BACnet-151_TP1273	BV	1	Build Fall	boolean	Off	Off	Off	Edit	Export	⋮	
BACnet-151_TP1273	AV	202	C02	float	Off	Off	Off	⋮			
BACnet-151_TP1273	MSV	400	C02 Autocalibration Period	scalar	Off	Off	Off	⋮			
BACnet-151_TP1273	AV	212	C02 Offset	float	Off	Off	Off	⋮			
BACnet-151_TP1273	AV	401	C02LED Amber Red threshold	float	Off	Off	Off	⋮			
BACnet-151_TP1273	AV	400	C02LED Green Amber threshold	float	Off	Off	Off	⋮			
BACnet-151_TP1273	MSV	301	Control Selector	scalar	Off	Off	Off	⋮			
BACnet-151_TP1273	MSV	300	D0 Selector	scalar	Off	Off	Off	⋮			
BACnet-151_TP1273	BI	100	Digital Input	boolean	Off	Off	Off	⋮			
BACnet-151_TP1273	BO	100	Digital Output	boolean	Off	Off	Off	⋮			
BACnet-151_TP1273	BV	0	Flash Store	boolean	Off	Off	Off	⋮			
BACnet-151_TP1273	AV	201	Humidity	float	Off	Off	Off	⋮			
BACnet-151_TP1273	AV	211	Humidity Offset	float	Off	Off	Off	⋮			
BACnet-178_LU08-550	AQ	1001	L1 1 AO1	float	Off	Off	Off	⋮			
BACnet-178_LU08-550	AI	1009	L1 1 AO1 FEEDBACK	float	Off	Off	Off	⋮			

Setting Datapoint Polling Rates (continued)

- Filter as required
- Show unconfigured DPs
- Select edit for the DP

Datapoint Properties															
Driver BACnet				Total Monitoring Traffic Indicator 0.00 events per second				Total Logged Bytes 0.00 byte (B) per day				Data Annual Log Size 0.00 byte (B) per year			
Device Type	Block Name	Block Index	Datapoint XIF Name	Datapoint Type	Monitored	Logged	Alarmed	Actions							
BACnet-151_TP1273	BV	1	Build Fail	boolean	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	202	CO2	float	Off	Off	Off	Edit							
BACnet-151_TP1273	MSV	400	CO2 Autocalibration Period	scalar	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	212	CO2 Offset	float	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	401	CO2LED Amber Red threshold	float	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	400	CO2LED Green Amber threshold	float	Off	Off	Off	Edit							
BACnet-151_TP1273	MSV	301	Control Selector	scalar	Off	Off	Off	Edit							
BACnet-151_TP1273	MSV	300	DO Selector	scalar	Off	Off	Off	Edit							
BACnet-151_TP1273	BI	100	Digital Input	boolean	Off	Off	Off	Edit							
BACnet-151_TP1273	BO	100	Digital Output	boolean	Off	Off	Off	Edit							
BACnet-151_TP1273	BV	0	Flash Store	boolean	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	201	Humidity	float	Off	Off	Off	Edit							
BACnet-151_TP1273	AV	211	Humidity Offset	float	Off	Off	Off	Edit							
BACnet-178_LIOB-550	AO	1001	L1 A01	float	Off	Off	Off	Edit							
BACnet-178_LIOB-550	AI	1009	L1 A01 FEEDBACK	float	Off	Off	Off	Edit							
Rows per page:															
1 - 25 of 44 < > >>															

Setting Datapoint Polling Rates (continued)

- Edit DP properties as required

Edit Datapoint Properties: BACnet-151_TP1273[AV/202/CO2]

INFO MONITORING AND LOGGING CONFIGURATION ALARM TYPE CONFIGURATION PRESET DEFINITIONS LOCALIZATION

Monitored Yes Monitoring Method Event-Driven Polled Logged No

Interval Poll Interval (Seconds) 60 Publish Interval (Heartbeat) 60

Minimum Publish Interval (Seconds) 60 Expected Update Interval (Seconds) 60

Publish Minimum Delta Value Value

Log 1 Log 2 Log 3

Multiple 0 Multiple 0 Multiple 0

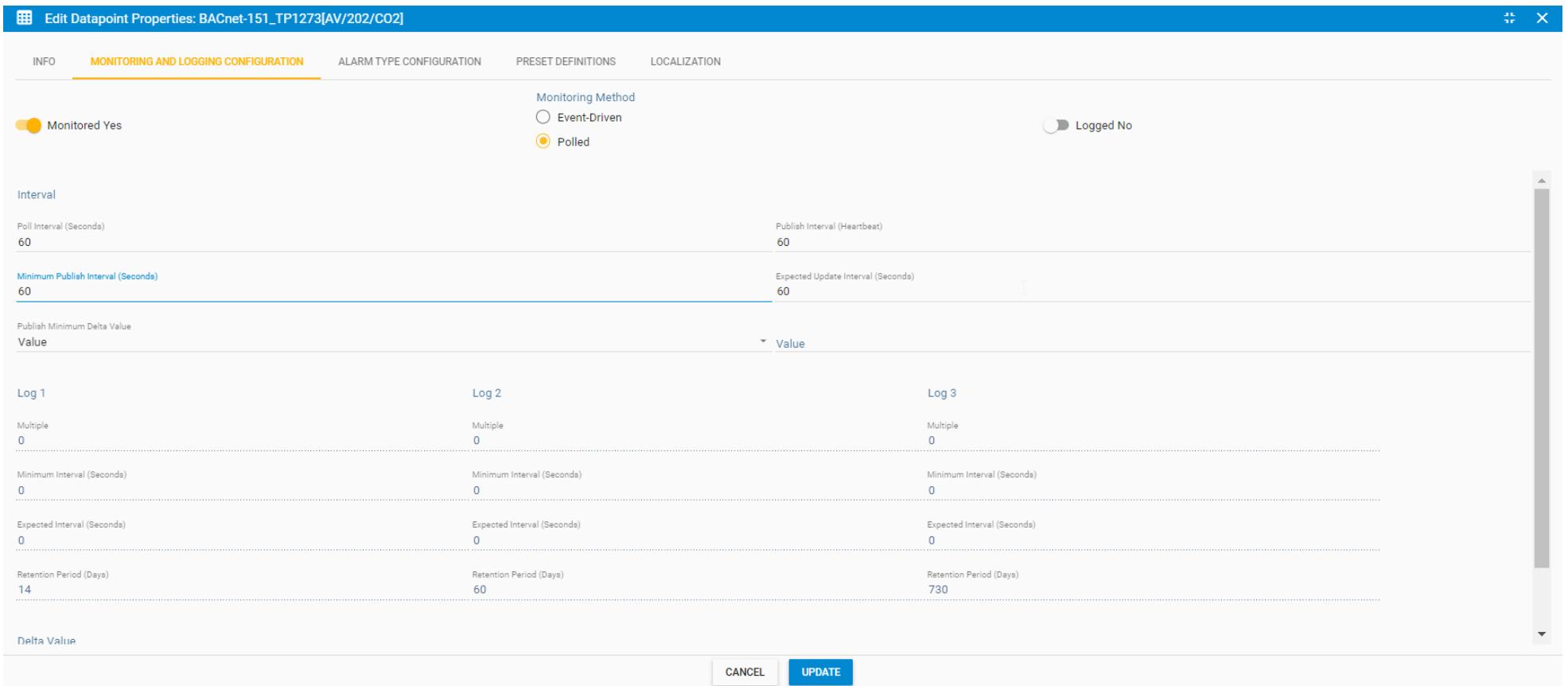
Minimum Interval (Seconds) 0 Minimum Interval (Seconds) 0 Minimum Interval (Seconds) 0

Expected Interval (Seconds) 0 Expected Interval (Seconds) 0 Expected Interval (Seconds) 0

Retention Period (Days) 14 Retention Period (Days) 60 Retention Period (Days) 730

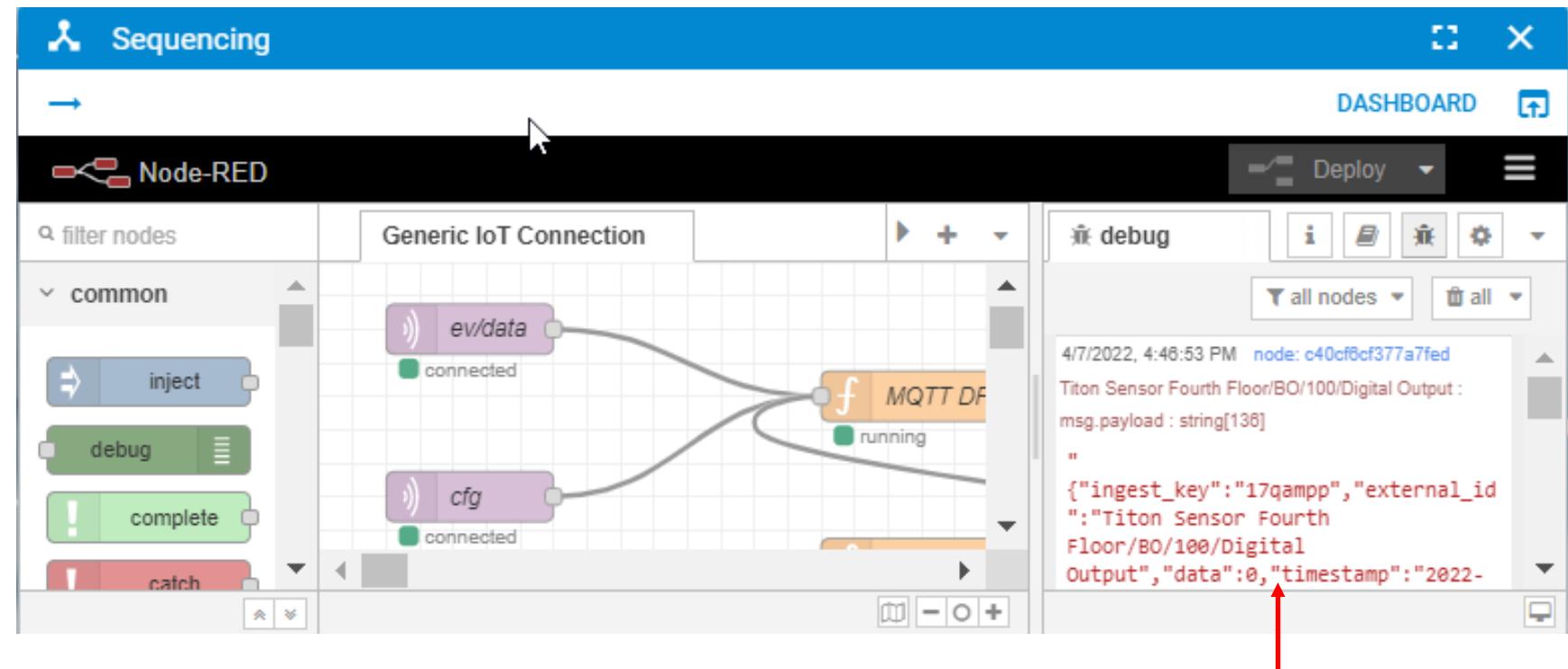
Delta Value

CANCEL UPDATE



Sequencing Widget

- Once polling rate has been set, or the Datapoint Browser widget has a non-zero polling rate set, data will be sent to the endpoint once it is configured



Discovered BACnet device



Q&A

Detailed Configuration Instructions



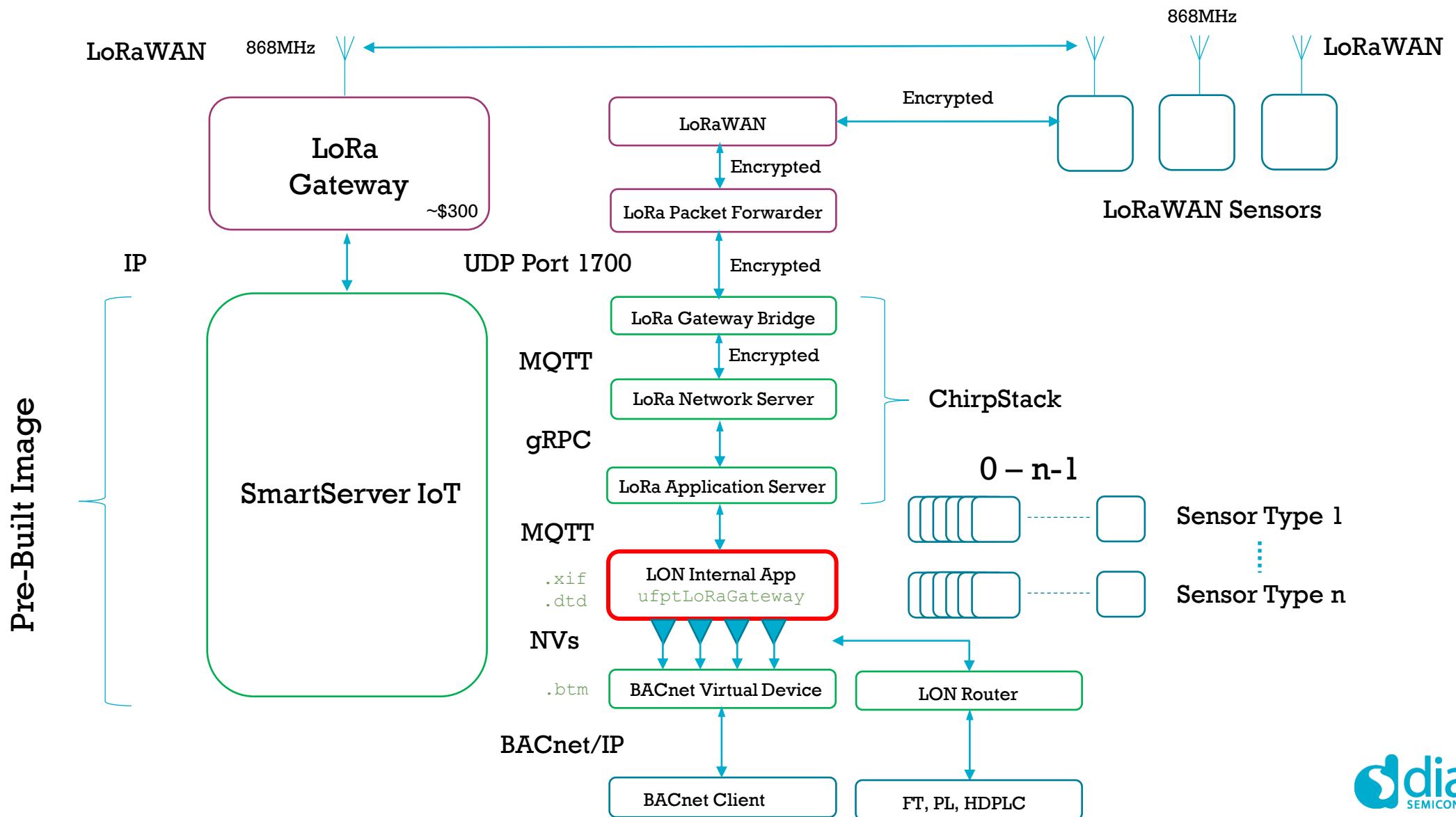
Adesto

Pre-Requisites

The following applications are necessary for integration:

- WinSCP
- Putty
- Chrome
- YABE
- *Don't forget a lot of sensors use 3.6V AA batteries – please check the specifications*

Under The Hood: SmartServer IoT LoRa Integration



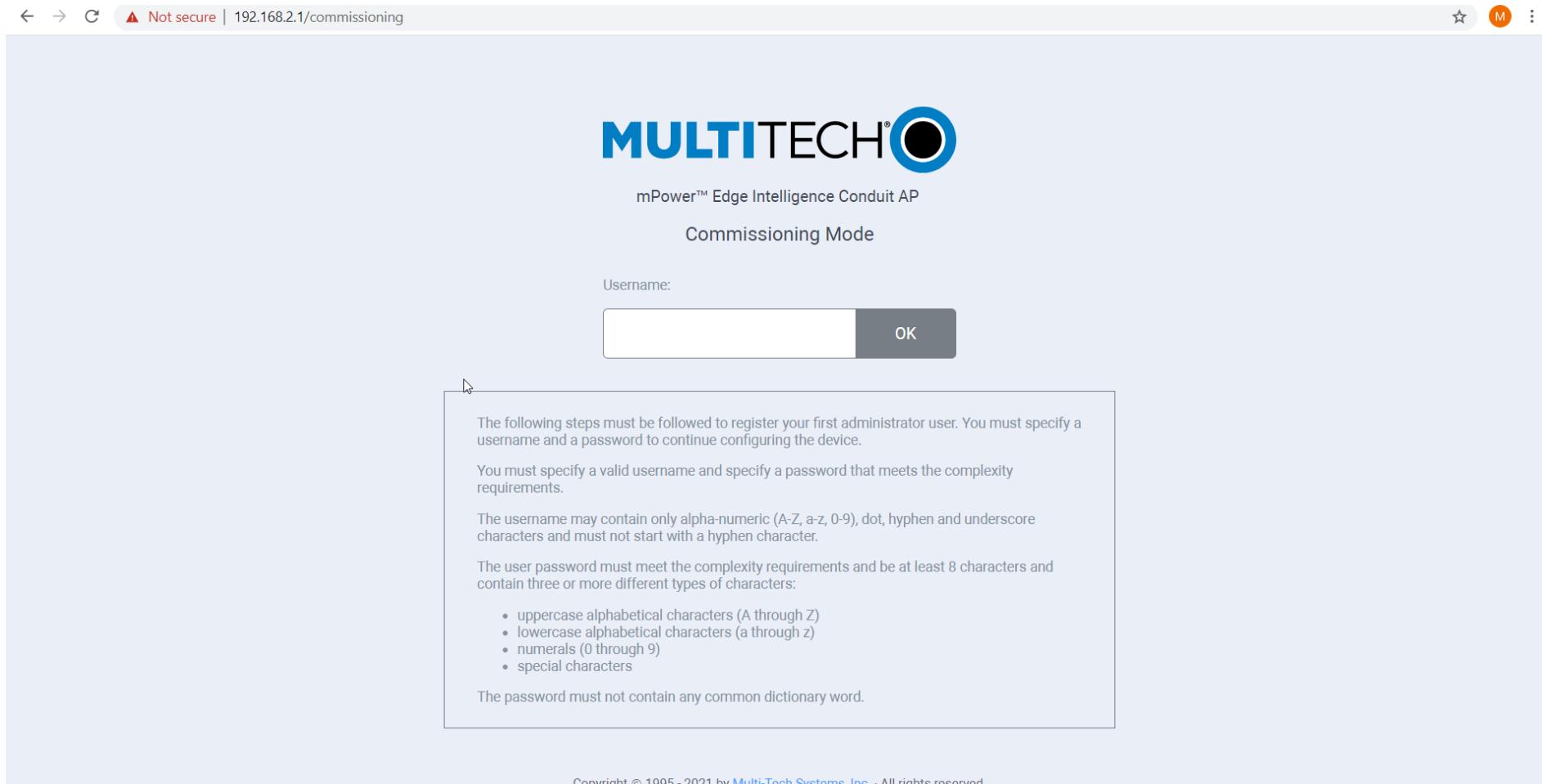
ChirpStack Application Server MQTT Output

```
192.168.123.188 - PuTTY
500000,"dr":0,"adr":true,"fCnt":161,"fPort":5,"data":"AQDgAi8EAPsFAQYCWgcOHA==","object":{"co2":602,"humidity":47,"light":251,"motion":1,"temperature":22.4,"vdd":3612}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8679
00000,"dr":0,"adr":true,"fCnt":1065,"fPort":6,"data":"AQEBHgjUEtkAAAAA=","object":{"Humidity":48.25,"Temperature":22.6,"Volts":3}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8685
00000,"dr":0,"adr":true,"fCnt":1066,"fPort":6,"data":"AQEBHgjUEuAAAAA=","object":{"Humidity":48.32,"Temperature":22.6,"Volts":3}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8673
00000,"dr":0,"adr":true,"fCnt":1067,"fPort":6,"data":"AQEBHgjUEvoAAAAA=","object":{"Humidity":48.58,"Temperature":22.6,"Volts":3}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8685
00000,"dr":0,"adr":true,"fCnt":1068,"fPort":6,"data":"AQEBHgjYEvgAAAAA=","object":{"Humidity":48.56,"Temperature":22.64,"Volts":3}}
application/2/device/a81758ffffe04ab14/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Elsys_ERS_CO2", "devEUI": "a81758ffffe04ab14", "txInfo": {"frequency": 867
700000,"dr":0,"adr":true,"fCnt":162,"fPort":5,"data":"AQDfAjAEArcFAgYCugcOHA==","object":{"co2":698,"humidity":48,"light":695,"motion":2,"temperature":22.3,"vdd":3612}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8681
00000,"dr":0,"adr":true,"fCnt":1070,"fPort":6,"data":"AQEBHgjqEu8AAAAA=","object":{"Humidity":48.47,"Temperature":22.82,"Volts":3}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8671
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application/2/device/a81758ffffe04ab14/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Elsys_ERS_CO2", "devEUI": "a81758ffffe04ab14", "txInfo": {"frequency": 867
100000,"dr":0,"adr":true,"fCnt":163,"fPort":5,"data":"AQDdAjAEAxEFAAYCvwcOHA==","object":{"co2":700,"humidity":48,"light":785,"motion":0,"temperature":22.1,"vdd":3612}}
application/2/device/00137a100000d1c1/event/up {"applicationID": "2", "applicationName": "Sensors", "deviceName": "Netvox_R712B", "devEUI": "00137a100000d1c1", "txInfo": {"frequency": 8681
00000,"dr":0,"adr":true,"fCnt":1074,"fPort":6,"data":"AQEBHgj/Eq4AAAAA=","object":{"Humidity":47.82,"Temperature":23.03,"Volts":3}}
```

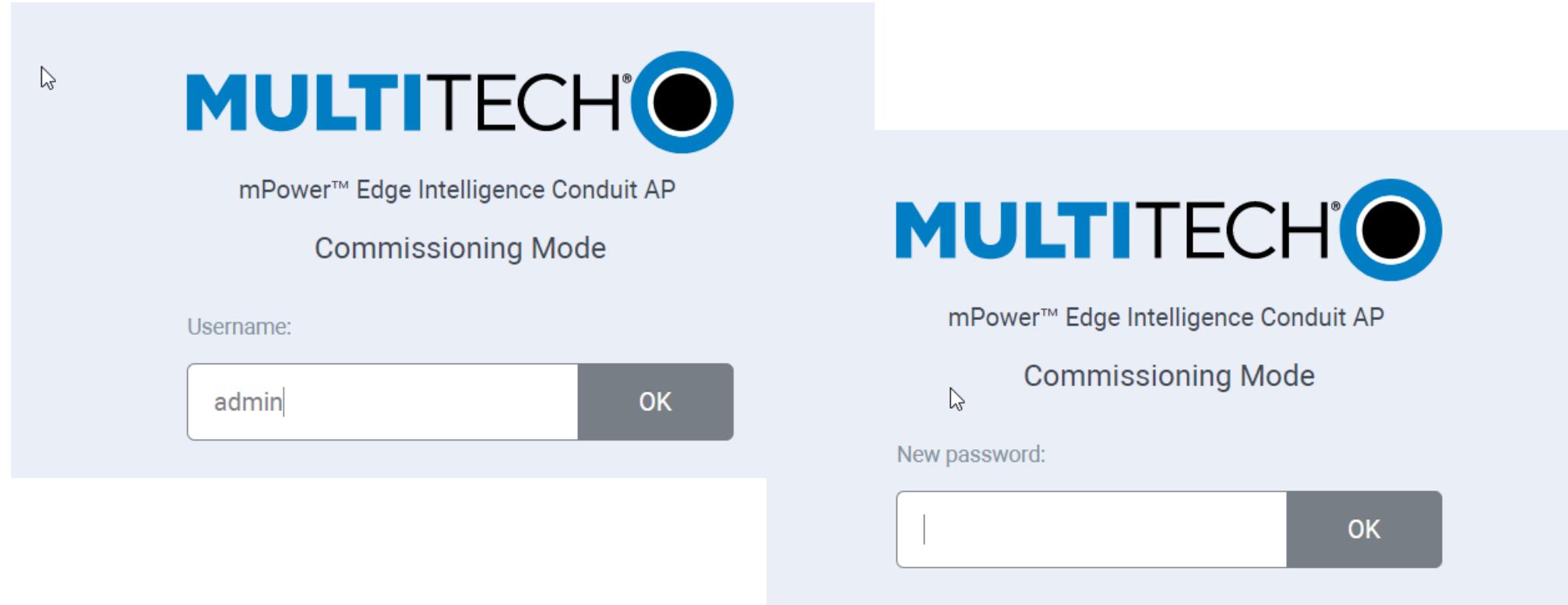


`"object": {"Humidity": 47.82, "Temperature": 23.03, "Volts": 3}`

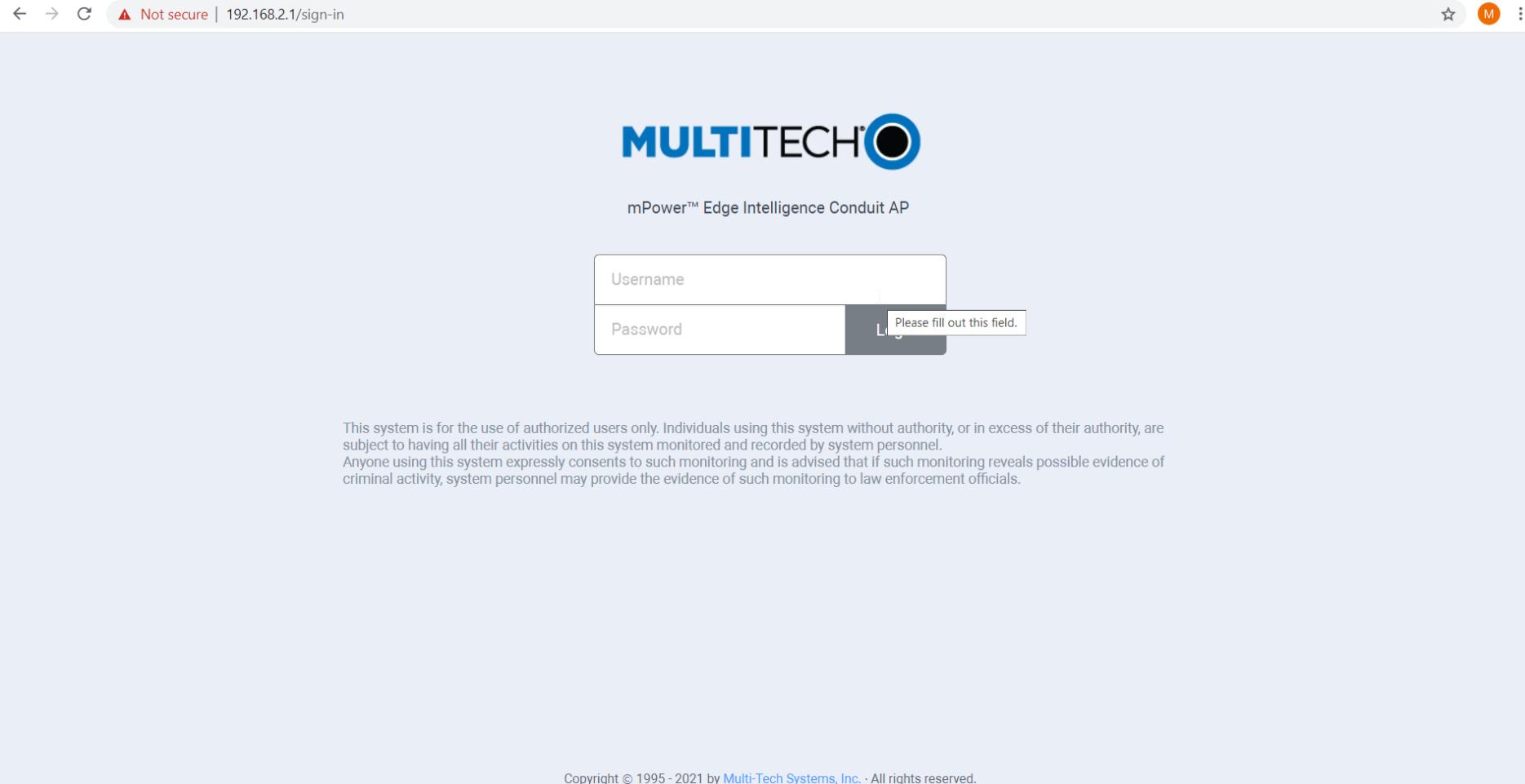
Configure MultiTech Gateway – Initialize



Configure MultiTech Gateway – Initialize (cont.)



Configure MultiTech Gateway – Initialize (cont.)



Configure MultiTech Gateway – Initialize (cont.)

Do not use the First-Time Setup Wizard



Configure MultiTech Gateway – Setup eth0

The screenshot shows the 'Network Interfaces Configuration' page of the MultiTech mPower Edge Intelligence Conduit AP. The left sidebar has a 'Save and Apply' button highlighted in red, indicating an action has been taken. The main table lists three network interfaces: eth0, ppp0, and br0. The 'Options' column for each row contains a pencil icon, which is circled in red to highlight it.

Name	Direction	Type	IP Mode	IP Address	Bridge	Options
eth0	LAN	ETHER	--	--	br0	
ppp0	WAN IPv4	PPP	PPP			
br0	LAN IPv4	BRIDGE	Static	192.168.2.1/24	br0	

Configure MultiTech Gateway – Setup eth0 (cont.)

The screenshot shows the MultiTech Gateway's web-based configuration interface. The URL in the address bar is `192.168.2.1/setup/network/interfaces/eth0`. The page title is "mPower™ Edge Intelligence Conduit AP - Application Enablement Platform" with the model number "MTCAP-L4E1-868-041A" and firmware version "5.2.1". The top right corner shows the user is "admin as administrator".

The left sidebar menu is visible, with "Setup" selected and highlighted in blue. Other options include Home, Save and Apply (highlighted in red), LoRaWAN®, Network Interfaces (selected), WAN Configuration, Global DNS, DDNS Configuration, DHCP Configuration, SMTP Configuration, SNMP Configuration, Time Configuration, Cellular, Firewall, SMS, Tunnels, Administration, and Status & Logs.

The main content area is titled "NETWORK INTERFACE CONFIGURATION - ETH0 ⓘ". It contains two dropdown menus: "Direction" set to "LAN" (which is circled in red) and "Bridge" set to "br0". Below these are "Submit" and "Cancel" buttons.

Configure MultiTech Gateway – Setup eth0 (cont.)

- Default address: 192.168.2.1
- Required address: 192.168.1.60
- Default user: admin/admin
- Note: ping is disabled

The screenshot shows the 'NETWORK INTERFACE CONFIGURATION - ETH0' page. The 'Direction' dropdown is set to 'WAN'. Under 'IPv4 Settings', the 'Mode' is 'Static', 'IP Address' is '192.168.1.60', and 'Mask' is '255.255.255.0'. To the right, 'Gateway' is '192.168.1.1', 'Primary DNS Server' is '8.8.8.8', and 'Secondary DNS Server' is '4.4.4.4'. At the bottom left of the configuration form, there are 'Submit' and 'Cancel' buttons, with the 'Submit' button circled in red.

Configure MultiTech Gateway – Set As LoRa Packet Forwarder

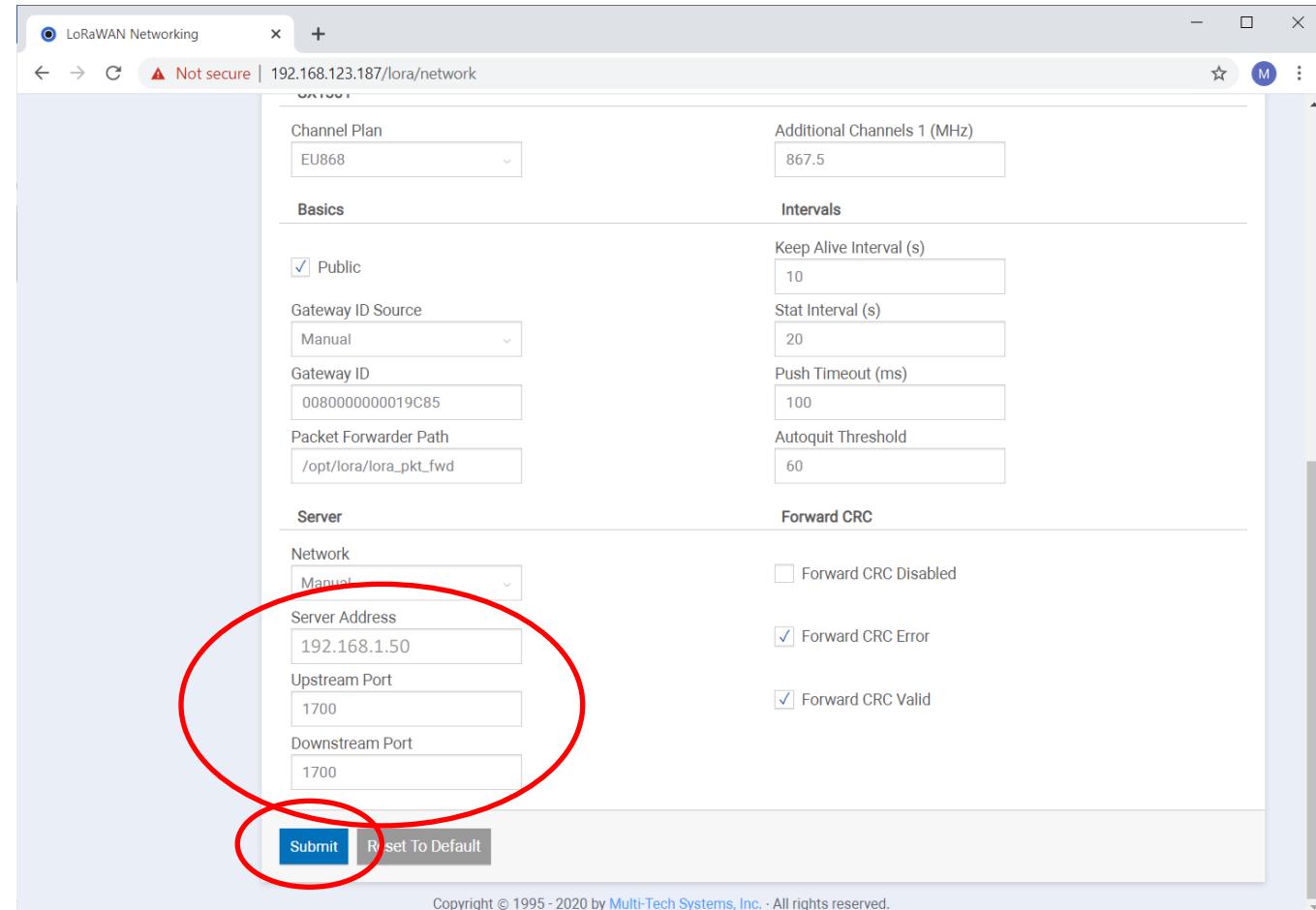
- Make a note of the Gateway EUI
- As required

The screenshot shows the 'LoRa Networking' configuration page of the mPower™ Edge Intelligence Conduit AP - Application Enablement Platform. The left sidebar has 'LoRaWAN ®' selected under 'Network Settings'. The main area is titled 'LORAWAN NETWORKING'.

- LoRa Mode:** Mode is set to 'PACKET FORWARDER' (circled in red).
- Status:** Status is 'RUNNING' (circled in red).
- LoRa Card Information:** Gateway EUI is listed as '00-80-00-00-01-9C-85' (circled in red).
- SX1301:** Channel Plan is set to 'EU868' (circled in red).

Configure MultiTech Gateway – Set As LoRa Packet Forwarder (cont.)

Server Address: 192.168.1.50
Upstream/Downstream Port: 1700



Configure MultiTech Gateway – Set WAN Access

The screenshot shows the 'mPower™ Edge Intelligence Conduit AP - Application Enablement Platform' interface. The left sidebar has a 'Save And Restart' button highlighted with a red oval. The main 'ACCESS CONFIGURATION' page shows several sections: 'HTTP Redirect to HTTPS' (with 'Via LAN' and 'Via WAN' checkboxes circled), 'Authorization' (Session Timeout set to 5 minutes), 'HTTPS Security', 'SSH Settings' (Port 22, 'Via LAN' and 'Via WAN' checkboxes), 'SSH Security', 'Reverse SSH Tunnel' (Server and Remote Port fields), and 'Notifications'. A red arrow points from the 'Save And Restart' button down to the 'Via WAN' checkboxes.

Scroll Down and
Click Submit then
Click Save and
Restart

Configuring RAK7258

The screenshot shows the RAK7258 configuration interface. The left sidebar contains navigation links: Status, Network (selected), Ethernet Port, WAN Interface, Wi-Fi, Diagnostics, Firewall, Multi WAN, Channel Plan, LoRa Network, Services, System, and WisDM. The main content area is titled "WAN Interface". It displays system status metrics: Uptime (17d 22h 42m 57s), MAC-Address (AC:1F:09:05:22:5F), RX (102.86 MB / 1577136 Pkts.), TX (73.37 MB / 1226759 Pkts.), and IPv4 addresses (192.168.1.100/24 and 169.254.34.95/16). Configuration fields include Protocol (Static address), IPv4 address (192.168.1.60), IPv4 netmask (255.255.255.0), IPv4 gateway (192.168.1.1), Use custom DNS servers (8.8.8.8), IPv6 assignment length (disabled), IPv6 address, IPv6 gateway, and IPv6 routed prefix. A note at the bottom states: "Assign a part of given length of every public IPv6-prefix to this interface". The footer includes "UNSAVED CHANGES: 2", "AUTO REFRESH ON", "Logout", and copyright information: "Copyright © RAKwireless Technology Co., Ltd. All Rights Reserved."

RAK®

UNSAVED CHANGES: 2 AUTO REFRESH ON Logout

Status WAN Interface

Uptime: 17d 22h 42m 57s
MAC-Address: AC:1F:09:05:22:5F
RX: 102.86 MB (1577136 Pkts.)
TX: 73.37 MB (1226759 Pkts.)
IPv4: 192.168.1.100/24
IPv4: 169.254.34.95/16

Protocol: Static address

IPv4 address: 192.168.1.60

IPv4 netmask: 255.255.255.0

IPv4 gateway: 192.168.1.1

Use custom DNS servers: 8.8.8.8

IPv6 assignment length: disabled

Assign a part of given length of every public IPv6-prefix to this interface

IPv6 address:

IPv6 gateway:

IPv6 routed prefix:

Public prefix routed to this device for distribution to clients.

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Configuring RAK7258 (continued)

The screenshot shows the RAK7258 configuration interface. The left sidebar has a dark theme with white icons and text. The 'LoRa Network' option is selected, indicated by a blue vertical bar.

LoRaWAN Network Settings

- Gateway EUI: ac1f09ffe05225f
- Mode: Packet Forwarder
- Log Level: NOTICE

Packet Forwarder Settings

General Setup (selected)

- Protocol: Semtech UDP GWMP Protocol
- Server Address: 192.168.1.50
- Server Port Up: 1700
- Server Port Down: 1700
- Push Timeout (ms): 200
- Statistic Interval (s): 30
- Keepalive Interval (s): 5

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Configuring RAK7258 (continued)

The screenshot shows the RAK7258 configuration interface with the 'LoRa Network' tab selected in the sidebar. The main area displays the 'General Setup' tab under the 'Packet Filter' section. The configuration parameters are as follows:

- Protocol: Semtech UDP GWMP Protocol
- Server Address: 192.168.1.50
- Server Port Up: 1700
- Server Port Down: 1700
- Push Timeout (ms): 200
- Statistic Interval (s): 30
- Keepalive Interval (s): 5
- Automatic data recovery: Enabled (switch is on)
- DGRAM MTU: 1400
- Auto-restart Threshold: 30
- Is LoRaWAN Network: YES

Below the 'Automatic data recovery' section, there is a note: "Data messages are automatically stored when the connection to the server is lost". Under the 'Auto-restart Threshold' section, there is a note: "Packet forwarder will automatically restart when the keepalive timeout exceeds this threshold. Set '0' to disable".

At the bottom of the page, the copyright notice reads: "Copyright © RAKwireless Technology Co., Ltd. All Rights Reserved."

Configuring RAK7258 (continued)

For US, adjust channel plan to channel 0 – channel 7, channel 64

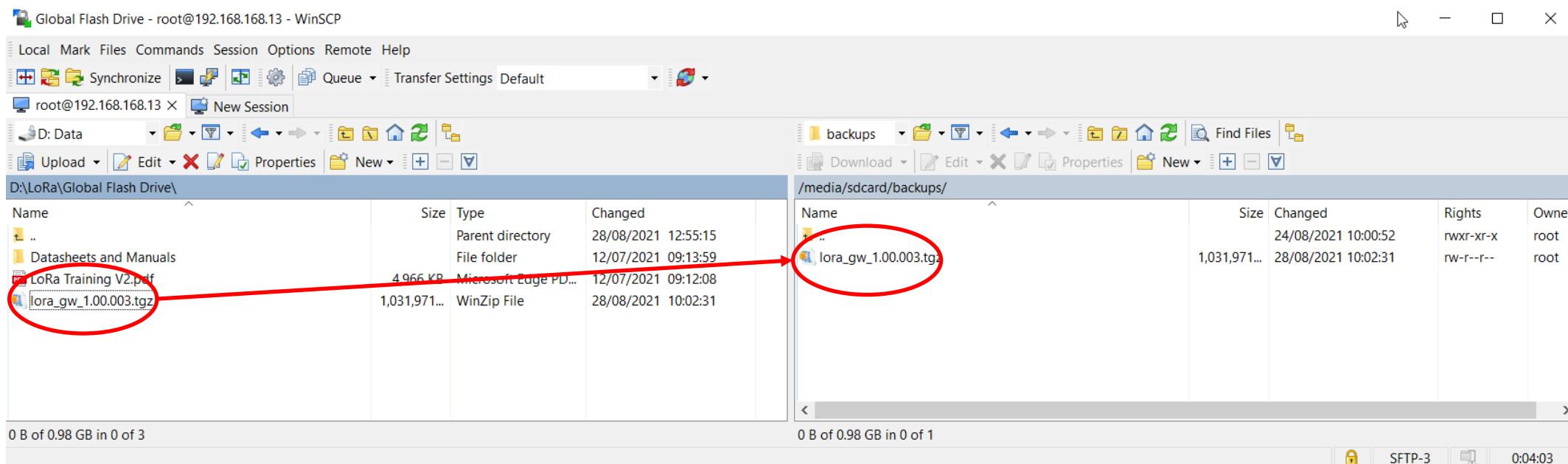
The screenshot shows the RAK7258 web interface with the URL <https://192.168.1.60/cgi-bin/luci;stok=2ae90beccbbb9901cc5e7174a51947db/admin/loraradio>. The left sidebar menu includes Status, Network, Channel Plan (selected), LoRa Network, Services, System, and WisDM. The main content area is titled "Channel Plan". It displays the following settings:

- Region: US902-928
- LoRaWAN Public:
- Standard Mode: [Switch to Advanced Mode](#)
- Frequency Sub-Band: channel 0 ~ channel 7, channel 64

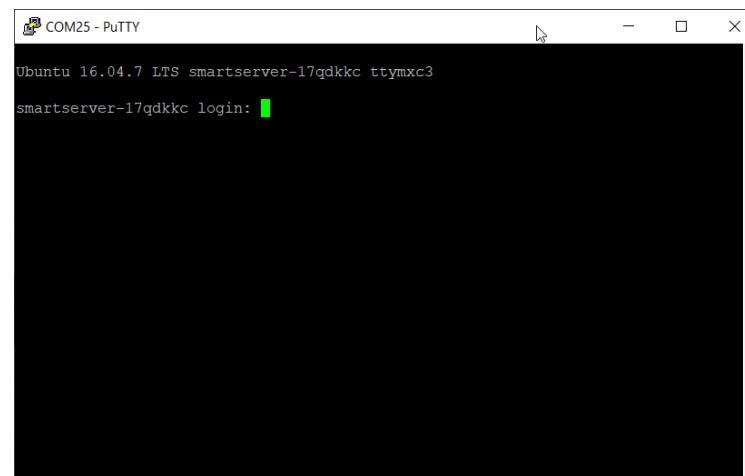
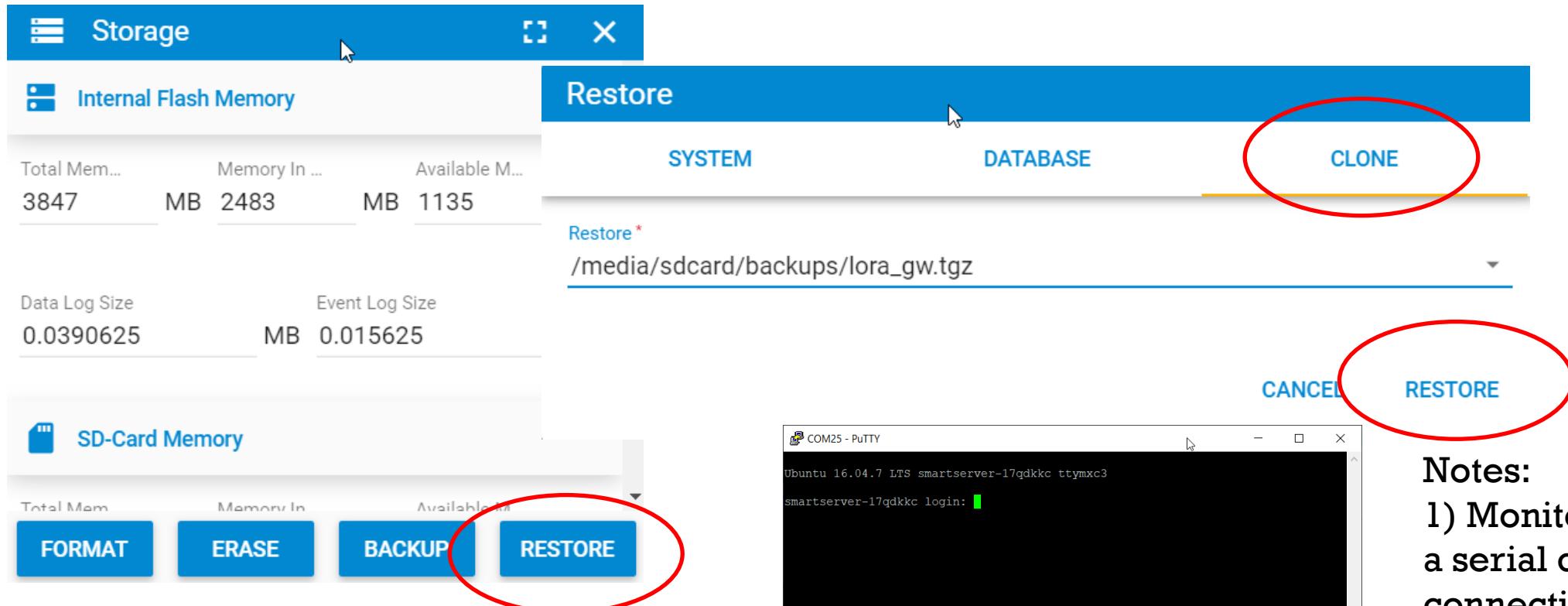
At the bottom right are "Save & Apply" and "Reset" buttons.

Cloning the SmartServer Image

- Start with a SmartServer re-imaged to 3.26
- Connect SmartServer to the internet
- Establish a connection to the SmartServer using WinSCP with user “root” **NOT** “apollo”
- Copy lora_gw_<build>_<region>.tgz Image to SmartServer’s /media/sdcard/backup folder
- Maintains original MAC IDs and host name
- Hit F5 in the CMS to refresh



Clone Image – Clone Image



CANCEL RESTORE

Notes:

- 1) Monitor progress using a serial console connection
- 2) SmartServer will have the password from the imaged device after cloning

Creating LoRaWAN Gateway in Chirpstack

192.168.1.50:8080 admin/Sgq4-2FKQ

The screenshot shows the ChirpStack Application Server interface. The top navigation bar includes tabs for 'ChirpStack Application Server', 'Dialog SmartServer IoT Configuration', and 'SmartServer CMS'. The main content area has a blue header with the ChirpStack logo and a search bar. On the left, a sidebar menu lists various management options under 'chirpstack': 'Gateway-profiles', 'Organizations', 'All users', 'API keys', 'Org. dashboard', 'Org. users', 'Org. API keys', 'Service-profiles', 'Device-profiles', 'Gateways' (which is selected and highlighted in blue), 'Applications', and 'Multicast-groups'. The main panel displays a table titled 'Gateways' with columns: Last seen, Name, Gateway ID, Network server, and Gateway activity (30d). A red circle highlights the '+ CREATE' button in the top right corner of the table header. The bottom of the table shows pagination controls: 'Rows per page: 10', '0-0 of 0', and navigation arrows.

Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot shows the ChirpStack web interface with a blue header bar. The header includes the ChirpStack logo, a search bar with the placeholder "Search organization, application, gateway or device", and a user icon labeled "admin". On the left, there is a sidebar with a navigation menu. The "chirpstack" section of the menu is expanded, showing options like Dashboard, Network-servers, Gateway-profiles, Organizations, All users, and API keys. Below this, under "chirpstack", are "Org. dashboard", "Org. users", "Org. API keys", "Service-profiles", "Device-profiles", "Gateways", "Applications", and "Multicast-groups". The main content area is titled "Gateways / Create". It has three tabs: "GENERAL" (which is selected), "TAGS", and "METADATA". The "GENERAL" tab contains fields for "Gateway name *" (MultiTech-MTCAP-868), "Gateway description *" (My Gateway), "Gateway ID *" (00 80 00 00 00 01 9C 85), "Network-server *" (SmartServer IoT), "Service-profile" (SmartServer), and "Gateway-profile" (MultiTech MTCAP-868). There is also a checkbox for "Gateway discovery enabled". The URL at the bottom of the page is 192.168.1.50:8080/#/organizations/1/gateways.

Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot shows the ChirpStack web interface for managing gateways. On the left, a sidebar menu lists various organizational and device management options. The main content area is titled "MultiTech MTCAP-868". It includes a checkbox for "Gateway discovery enabled" with a descriptive note about its function. A "Gateway altitude (meters)*" input field is set to 0. Below these, a map interface allows setting the gateway's location; a blue marker is placed on the map. At the bottom right of the map area, there are links to "Leaflet" and "OpenStreetMap contributors". A note below the map says, "Drag the marker to the location of the gateway. When the gateway has an on-board GPS, this value will be set automatically when the network receives statistics from the gateway." At the very bottom of the page, there are two buttons: "ADD BOARD CONFIGURATION" and a red-circled "CREATE GATEWAY" button.

Creating LoRaWAN Devices in ChirpStack

The screenshot shows the ChirpStack web interface for creating a new device. The left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack' which includes Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups.

The main content area shows the 'Create' page under 'Applications / Sensors / Devices'. The 'GENERAL' tab is selected. The 'Device name *' field contains 'ERS_CO2'. The 'Device description *' field contains 'ERS CO2 Sensor'. The 'Device EUI *' field contains 'A8 17 58 FF FE 04 AB 14'. The 'Device-profile *' dropdown is set to 'Elysys ERS_C02'. There are two checkboxes at the bottom: 'Disable frame-counter validation' (unchecked) and 'Device is disabled' (unchecked). A note below the first checkbox states: 'Note that disabling the frame-counter validation will compromise security as it enables people to perform replay-attacks.' A note below the second checkbox states: 'ChirpStack Network Server will ignore received uplink frames and join-requests from disabled devices.'

A red circle highlights the 'CREATE DEVICE' button at the bottom right of the form.

Creating LoRaWAN Devices in ChirpStack

The screenshot shows the ChirpStack web interface for managing LoRaWAN devices. On the left, a sidebar lists various organization and device management options. The main area displays the details for a device named "ERS_CO2" under the "Applications / Sensors / Devices" path. The "KEYS (OTAA)" tab is currently selected. An application key "f7 8a f4 e1 a7 fa b2 25 3b c1 38 60 9f 40 ae 7d" is entered in the field. A red oval highlights the "SET DEVICE-KEYS" button at the bottom right of the form. Other tabs visible include "DETAILS", "CONFIGURATION", "ACTIVATION", "DEVICE DATA", and "LORAWAN FRAMES". A "DELETE" button is also present in the top right corner.

Datapoint Browser Widget Polling Rate = 0

- Ensure polling rate is set to 0 while in use to reduce MQTT traffic
- Close browser after use

The screenshot shows the Dialog Semiconductor CMS dashboard at the URL 192.168.168.19/cms/#/dashboard. The left sidebar includes links for GROUPS, DEVICES, CALENDAR, ALARMS, STORAGE, DATAPPOINT BROWSER, DATAPPOINT PROPERTIES, DEVICE TYPES, and ZONES. The user is currently in the DATAPPOINT BROWSER section. A red arrow points from the first bullet point in the list above to the 'Polling' dropdown in the Datapoint Browser header. The header also shows 'Source Live' and 'Block Name met'. The main area displays four panels: 'Devices' (listing LoRaGateway and SmartServer IoT), 'Device Types' (listing IOX_DIO, IOX_METER, IOX_SYS, and Lora LON GW), 'Datapoint Properties' (listing monitoring traffic and log details), and 'Zones' (listing Lora LON GW zones R718E). The 'Datapoint Browser' panel contains a table of datapoints for the LoRaGateway device.

Device	Block name	Block index	Datapoint name	Datapoint XIF name
LoRaGateway	MCF_LW12MET	0	nvoLoadCtl1_1	nvoLoadCtl
LoRaGateway	MCF_LW12MET	0	nvoActEnergy_1	nvoActEnergy
LoRaGateway	MCF_LW12MET	0	nvoActPwr_1	nvoActPwr
LoRaGateway	MCF_LW12MET	0	nvoAppEnergy_1	nvoAppEnergy

SmartServer Upgrades

Note: Do not upgrade or re-image a SmartServer once cloned

The screenshot shows the CMS (Cloud Management System) interface for Dialog Semiconductor. The top navigation bar indicates the URL as 192.168.168.19/cms/#/dashboard, with a note about the connection being 'Not secure'. The top right corner shows system status with CPU usage at 14%.

The left sidebar menu includes:

- dialog SEMICONDUCTOR 3.14.004 DMM
- GROUPS
- DEVICES
- CALENDAR
- ALARMS
- STORAGE
- DATAPoint BROWSER
- DATAPoint PROPERTIES
- DEVICE TYPES
- ZONES

The bottom left corner shows user information: Apollo Owner, 4 alerts, 0 errors, and a LOGOUT link.

The main content area displays several panels:

- Devices**: Shows two devices: LoRaGateway (Edge Device) and SmartServer IoT (Segment Controller). The SmartServer IoT is listed under the 'SmartServer IoT' category.
- Device Types**: A table listing device types with their drivers and counts:

Device Type	Driver	Device Count
IOX_DIO	IAP	0
IOX_METER	IAP	0
IOX_SYS	IAP	0
Lora LON GW	LON	1
- Datapoint Browser**: A table showing datapoints for LoRaGateway, categorized by Block name (MCF_LW12MET) and Block index (0). Examples include nvoLoadCtl_1, nvoActEnergy_1, nvoActPwr_1, and nvoAppEnergy_1.
- Datapoint Properties**: A table showing properties for Lora LON GW, specifically for R718E blocks 1, 9, and 2, with datapoints nvoAccelX.
- Groups**: Shows a single group named 'Group 1'.
- Zones**: An empty panel.

Set The SmartServer IoT Date

- SmartServer 3.26 is configured for automatic date and time from the internet.
- Connect the SmartServer to the internet and it should set the time and date automatically.

Setting App Keys & Adjusting TX Rates

**** Do not use default app keys, as this is a security issue, set policies with suppliers ****

Netvox keys are either default or set by supplier (<https://kms.alliot.co.uk/index>)

Netvox TX rates etc. are adjusted via ChirpStack using Base64 encoded data
(see Netvox user's guide & cheat sheet)

Netvox keys can be changed over the air if needed

Elsys keys are set using their NFC Android app (write the key down somewhere safe)

Elsys TX rates are set using their NFC Android app

MC Climate keys are typically set by supplier

MC Climate TX rates are set using their NFC Android app

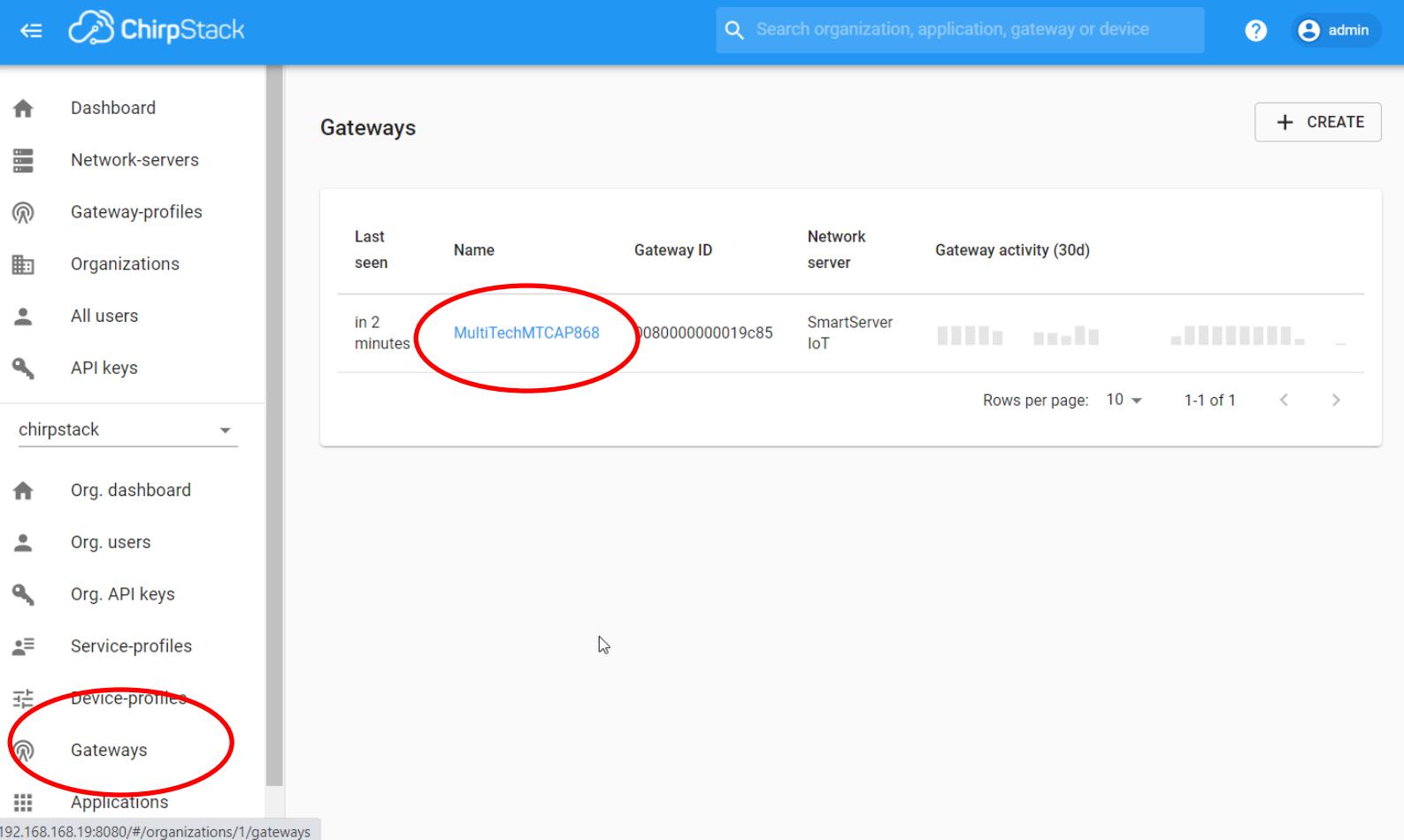
IMBuildings keys are typically set by supplier

IMBuildings TX rates are set using their NFC Android app

MileSight keys are typically set by the supplier

Use NFC app to configure devices

Testing The Gateway



The screenshot shows the ChirpStack web interface. The left sidebar has a tree view with the following items:

- Dashboard
- Network-servers
- Gateway-profiles
- Organizations
- All users
- API keys
- chirpstack
- Org. dashboard
- Org. users
- Org. API keys
- Service-profiles
- Device-profiles
- Gateways** (highlighted with a red circle)
- Applications

The main content area is titled "Gateways". It contains a table with the following data:

Last seen	Name	Gateway ID	Network server	Gateway activity (30d)
in 2 minutes	MultiTechMTCAP868	0080000000019c85	SmartServer IoT	

Below the table are buttons for "Rows per page:" (set to 10), "1-1 of 1", and navigation arrows.

The URL in the address bar is 192.168.168.19:8080/#/organizations/1/gateways.

Testing The Gateway (cont.)

ChirpStack

GATEWAY DETAILS GATEWAY CONFIGURATION CERTIFICATE GATEWAY DISCOVERY LIVE LORAWAN FRAMES

Gateway details

Gateway ID	0080000000019c85
Altitude	0 meters
GPS coordinates	0, 0
Last seen at	Jun 16, 2021 11:33 AM

Frames received

Frames transmitted

Search organization, application, gateway or device

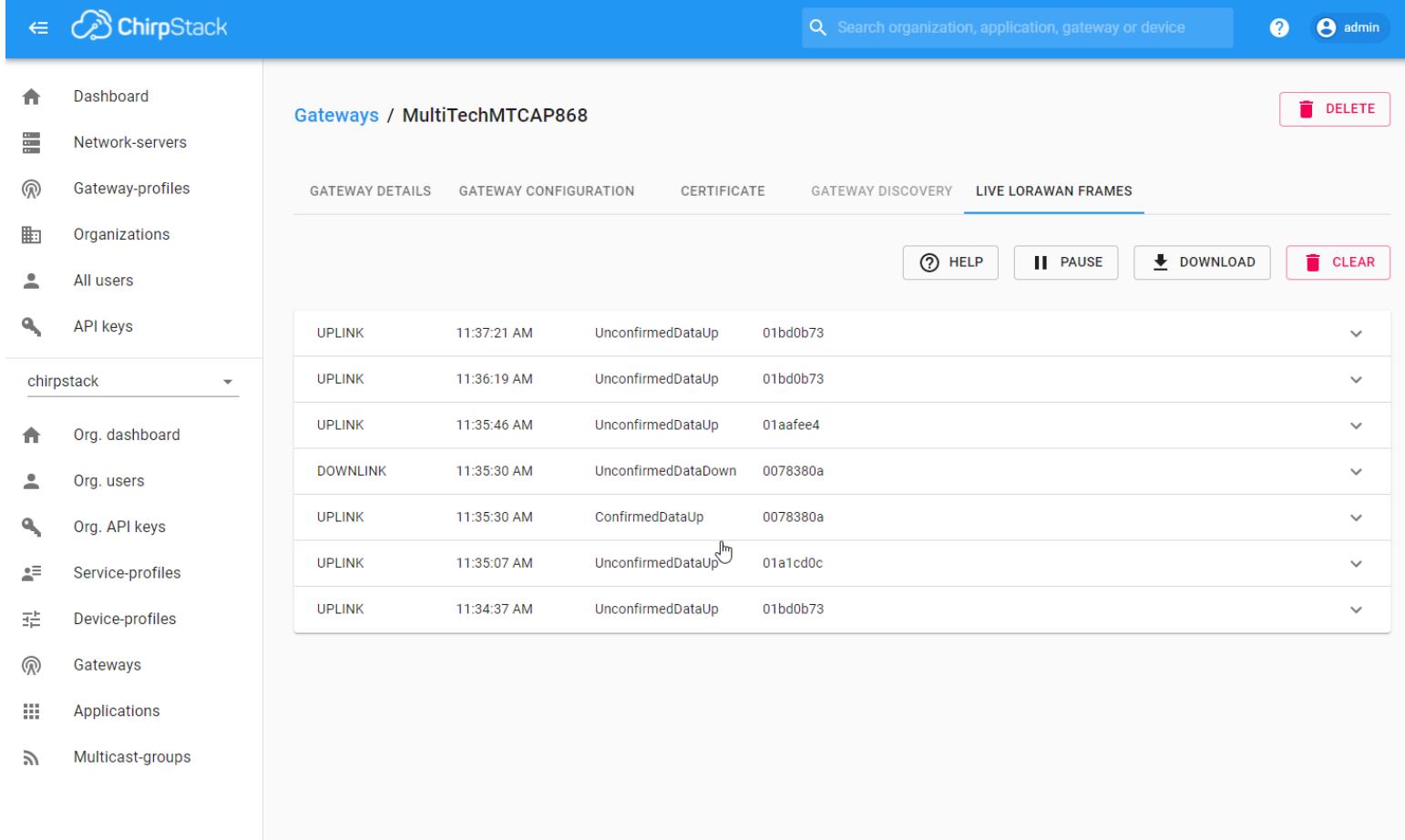
admin

Leaflet | © OpenStreetMap contributors

17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st 1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th

17th 18th 19th 20th 21st 22nd 23rd 24th 25th 26th 27th 28th 29th 30th 31st 1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th

Testing The Gateway – Live Frames



The screenshot shows the ChirpStack web interface for managing gateways. On the left is a sidebar with navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and various organization-specific sections like Org. dashboard, Org. users, and Org. API keys. The main content area is titled "Gateways / MultiTechMTCAP868". It features tabs for GATEWAY DETAILS, GATEWAY CONFIGURATION, CERTIFICATE, GATEWAY DISCOVERY, and LIVE LORAWAN FRAMES, with the latter being active. Below these tabs are buttons for HELP, PAUSE, DOWNLOAD, and CLEAR. A large table lists seven LORAWAN frames, each with columns for Type (UPLINK/DOWNLINK), Time, Message Type, and Device ID. The first frame is UnconfirmedDataUp from device 01bd0b73 at 11:37:21 AM. The last frame listed is UnconfirmedDataUp from device 01a1cd0c at 11:35:07 AM.

Type	Time	Message Type	Device ID
UPLINK	11:37:21 AM	UnconfirmedDataUp	01bd0b73
UPLINK	11:36:19 AM	UnconfirmedDataUp	01bd0b73
UPLINK	11:35:46 AM	UnconfirmedDataUp	01aafee4
DOWNLINK	11:35:30 AM	UnconfirmedDataDown	0078380a
UPLINK	11:35:30 AM	ConfirmedDataUp	0078380a
UPLINK	11:35:07 AM	UnconfirmedDataUp	01a1cd0c
UPLINK	11:34:37 AM	UnconfirmedDataUp	01bd0b73

Note: You may see data from devices you are not interested in, such as join requests

Testing Devices

The screenshot shows the ChirpStack application interface. The top navigation bar includes the ChirpStack logo, a search bar, and an 'admin' button. The left sidebar lists various organization-level options like Dashboard, Network-servers, and Applications, with 'Applications' being highlighted by a red circle. The main content area shows a table of devices with columns for Last seen, Device name, Device EUI, Device profile, Link margin, and Battery. Two specific device entries are circled in red: 'ERS_CO2_0' and 'ERS_CO2_Lite'. The table data is as follows:

Last seen	Device name	Device EUI	Device profile	Link margin	Battery
in a minute	ERS_CO2_0	a81758ffe04ab14	Elsys ERS_CO2	n/a	n/a
2 minutes ago	ERS_CO2_Lite	a81758ffe0537a1	Elsys ERS_CO2_Lite	n/a	n/a
in a minute	ERS_Eye_0	a81758ffe04d037	Elsys ERS_Eye	n/a	n/a
in 2 minutes	ERS_Lite_0	a81758ffe04b47c	Elsys ERS_Lite	n/a	n/a
11 minutes ago	IM-Counter-EU-W_0	0004a30b00edc875	IMBuildings IM-Counter-EU-W	n/a	n/a
a minute ago	MC-LW-TH01_0	70b3d52dd40000a1	MClimate MC-LW-TH01	n/a	n/a
a month ago	MCF-LW12MET_0	70b3d58ff10183b4	mcf88 MCF-LW12MET	n/a	n/a
a month ago	MCF-LW13IO_0	70b3d58ff10183ce	mcf88 MCF-LW13IO	n/a	n/a
a month ago	MCF-LW23MET_1	70b3d58ff10183f2	mcf88 MCF-LW12MET	n/a	n/a
43 minutes ago	PR13WA_0	00137a100000f887	Native PR13WA	n/a	n/a

Testing Specific Devices

The screenshot shows the ChirpStack interface for managing devices. On the left is a sidebar with various navigation links. The main area displays a device's details, including its name (ERS_CO2_0), description (ERS_CO2_0), and device-profile (Elsys ERS_CO2). The status section indicates the device was last seen at Jun 16, 2021 11:39 AM and is currently enabled. A red oval highlights the "LORAWAN FRAMES" tab in the top navigation bar. Below this, a form titled "Enqueue downlink payload" is shown. It includes fields for "Port *", a checkbox for "Confirmed downlink" (which is circled in red), and a dropdown for "BASE64 ENCODED" or "JSON OBJECT". A red arrow points from the "Confirmed downlink" checkbox to the "Base64 encoded string *" field, which also has a red arrow pointing to it.

Note: This is where you put downlink base 64 data to send to devices – always set the port and use confirmed downlink

Testing Devices – Live LoRaWAN Frames

The screenshot shows the ChirpStack web interface. The left sidebar has a 'chirpstack' section expanded, containing: Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups. The main area shows the path Applications / Sensors / Devices / ERS_CO2_0. A search bar and an admin button are at the top right. Below is a table with tabs: DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES (which is selected). Buttons include HELP, PAUSE, DOWNLOAD, and CLEAR. The table lists three UPLINK frames with details: timestamp, message type, payload, and device ID. A blue arrow points from the text 'See detail with the drop-down arrow' to the down arrow icon in the third row of the table.

UPLINK	11:52:43 AM	UnconfirmedDataUp	00b704d3
UPLINK	11:47:43 AM	UnconfirmedDataUp	00b704d3
UPLINK	11:42:43 AM	UnconfirmedDataUp	00b704d3

192.168.168.19:8080/#/organizations/1/applications/1/devices/a81758ffe04ab14/frames

- See detail with the drop-down arrow

JoinAccept/JoinRequest

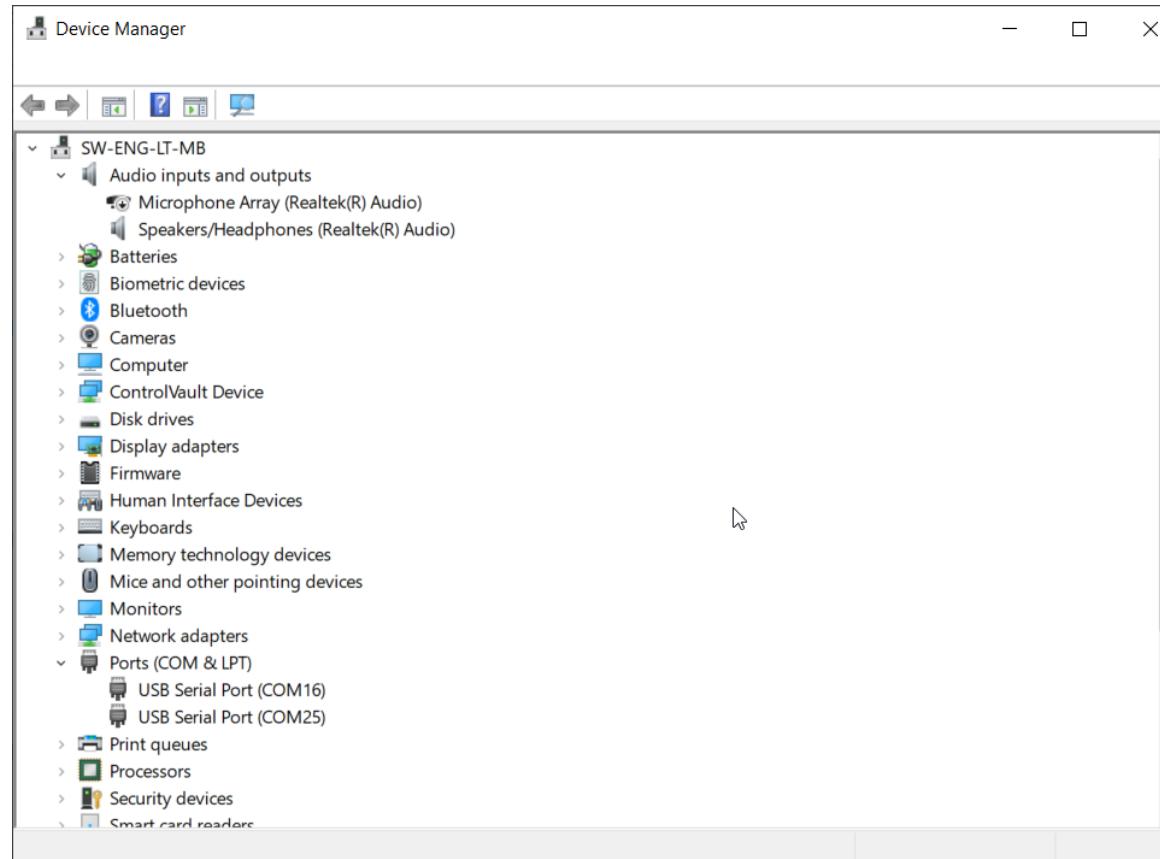
The screenshot shows the ChirpStack web interface for managing IoT devices. The left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack' which includes Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, and Applications.

The main content area displays the device details for 'ERS_CO2_test'. The breadcrumb navigation shows Applications / Sensors / Devices / ERS_CO2_test. Below the breadcrumb, there are tabs for DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES, with LORAWAN FRAMES being the active tab.

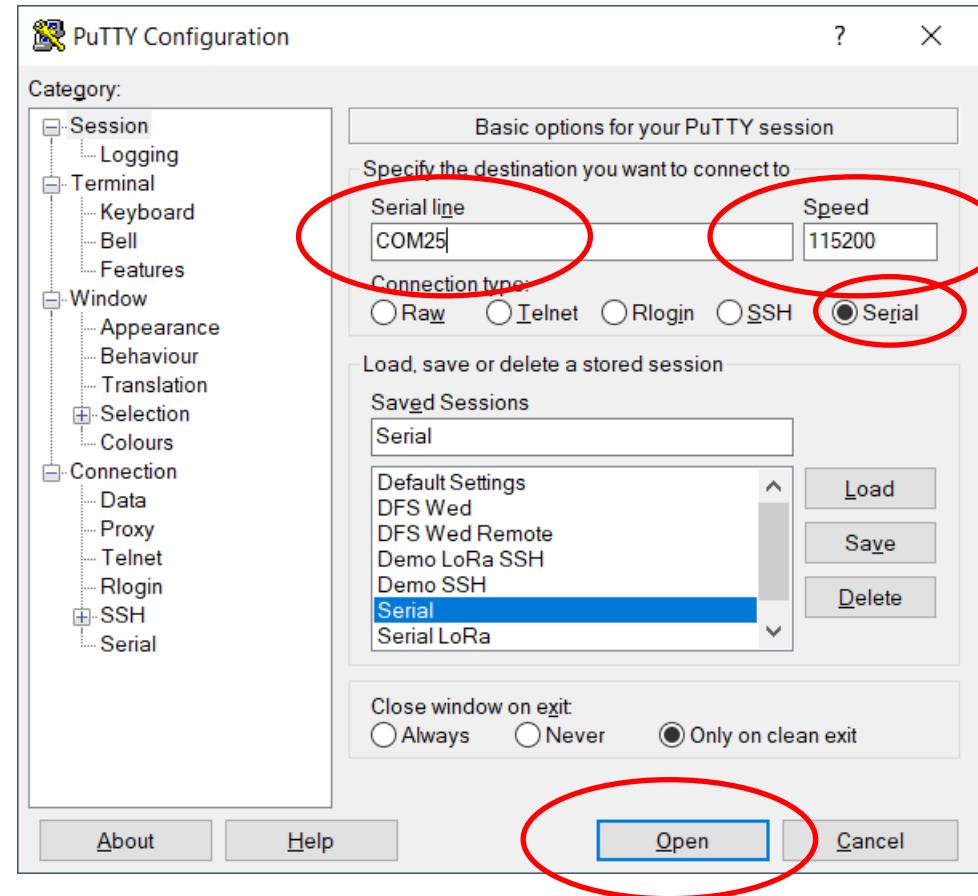
The LORAWAN FRAMES section lists two entries:

- Feb 01 9:25:58 PM: JoinAccept, 926.9 MHz, SF9, BW500, GW: 008000000001edb0
- Feb 01 9:25:58 PM: JoinRequest, 903.5 MHz, SF9, BW125, DevEUI: a81758ffffe0700cd

Finding PC Serial Port – Device Manager



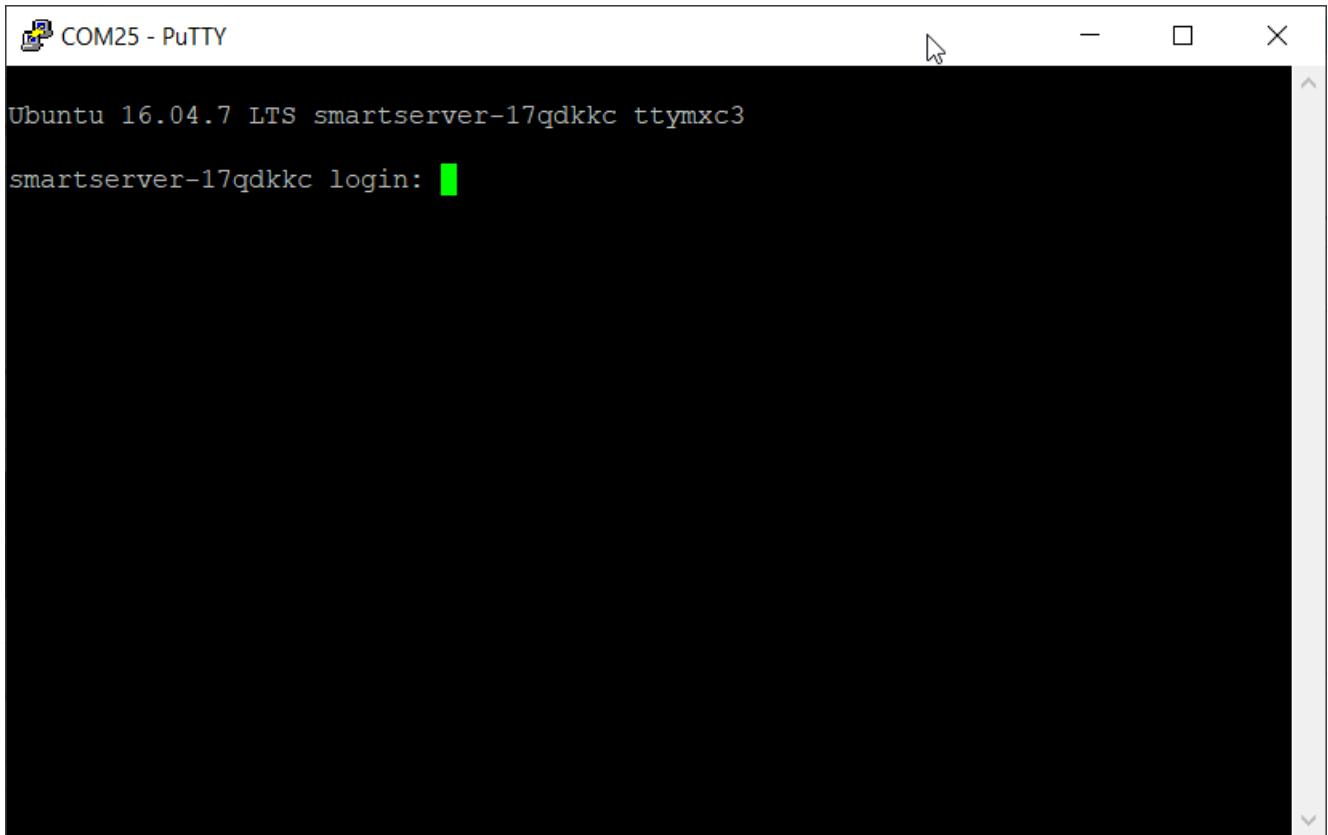
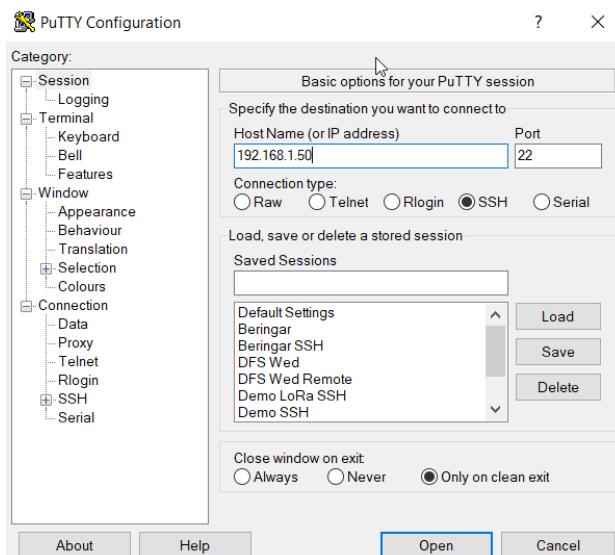
Putty Serial Connection



Putty Serial Connection - Login

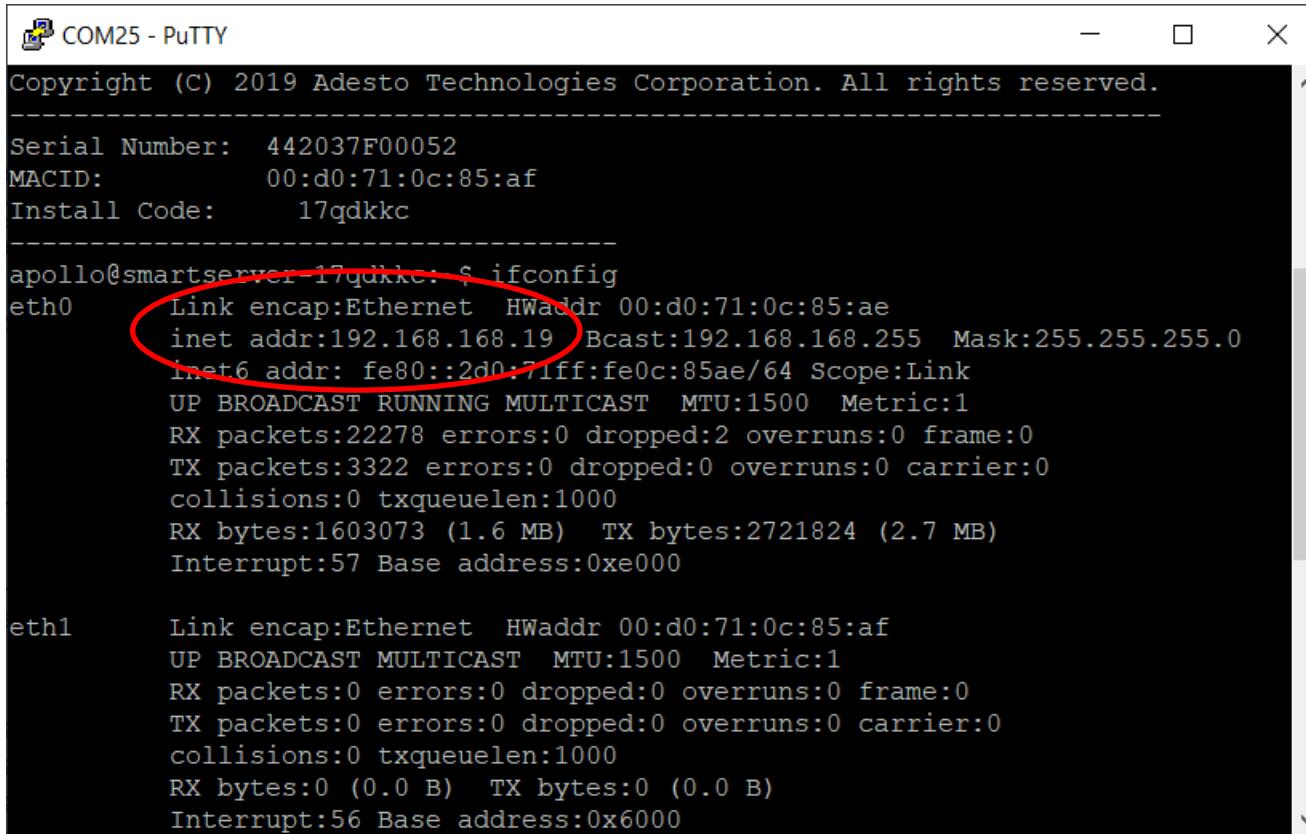
Note: Serial connections are similar to SSH connections, but SSH connections are not persistent over reboots

You might need to hit enter to get the login prompt up



Putty Determine IPV4 Address: ifconfig

- Use the command: ifconfig



```
COM25 - PuTTY
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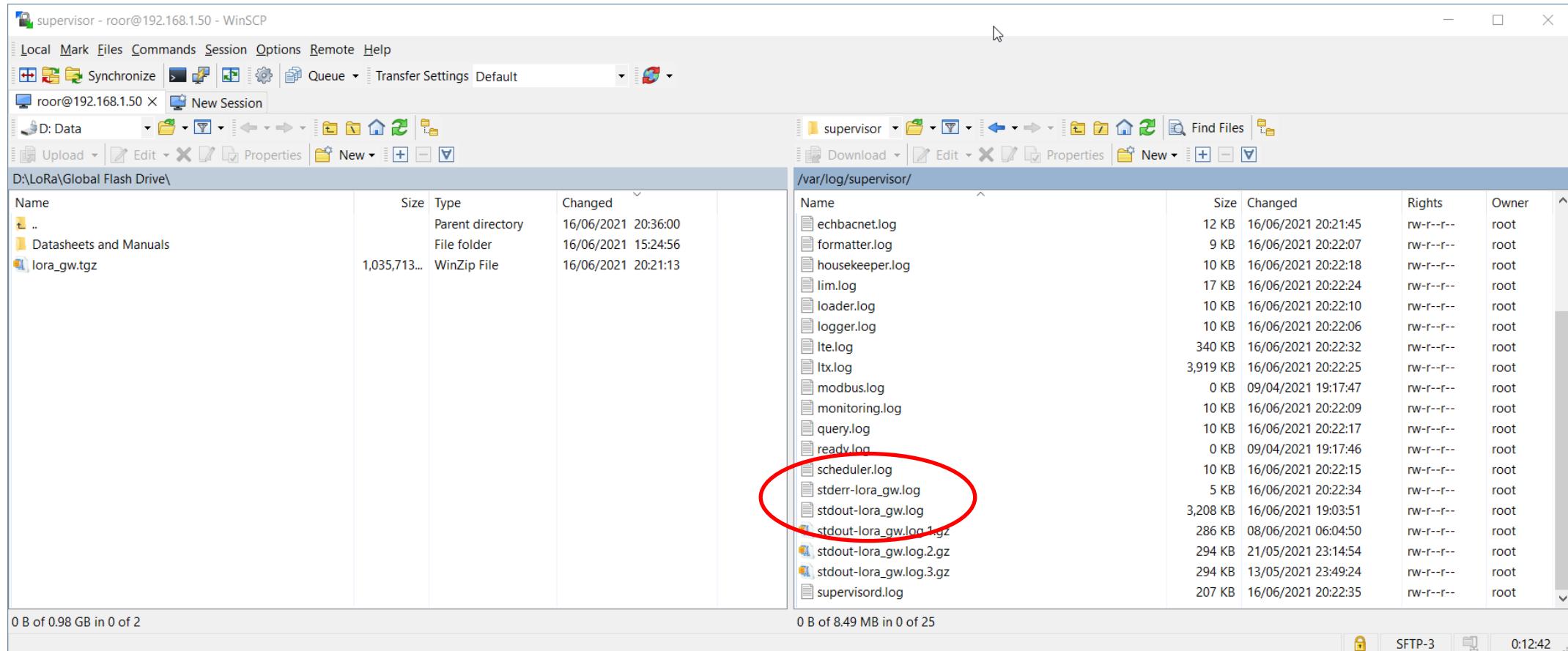
Serial Number: 442037F00052
MACID: 00:d0:71:0c:85:af
Install Code: 17qdkkc

apollo@smartserver: ~ % ifconfig
eth0      Link encap:Ethernet HWaddr 00:d0:71:0c:85:ae
          inet addr:192.168.168.19 Bcast:192.168.168.255 Mask:255.255.255.0
            inet6 addr: fe80::2d0:71ff:fe0c:85ae/64 Scope:Link
              UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
              RX packets:22278 errors:0 dropped:2 overruns:0 frame:0
              TX packets:3322 errors:0 dropped:0 overruns:0 carrier:0
              collisions:0 txqueuelen:1000
              RX bytes:1603073 (1.6 MB) TX bytes:2721824 (2.7 MB)
              Interrupt:57 Base address:0xe000

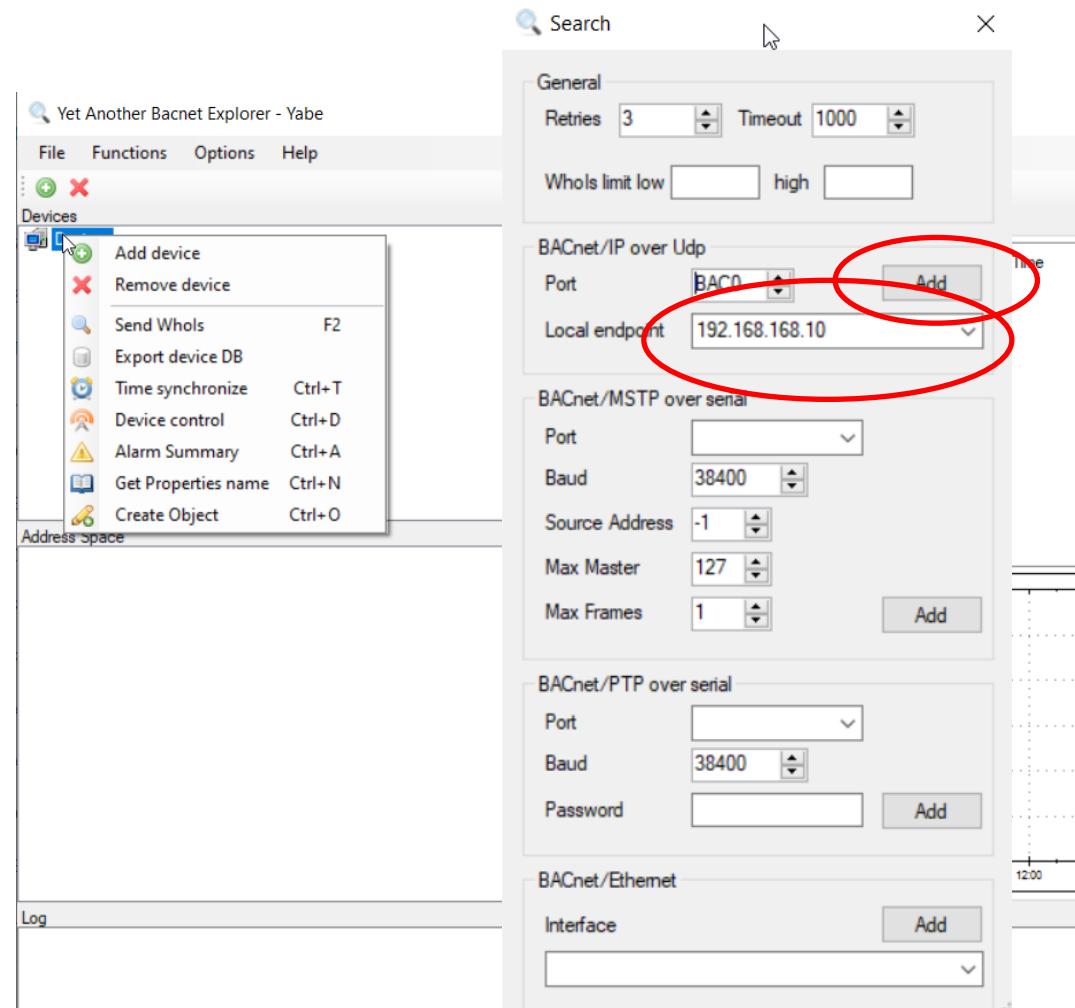
eth1      Link encap:Ethernet HWaddr 00:d0:71:0c:85:af
          UP BROADCAST MULTICAST MTU:1500 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
          Interrupt:56 Base address:0x6000
```

Log Files

- Log files can be found at: /var/log/supervisor

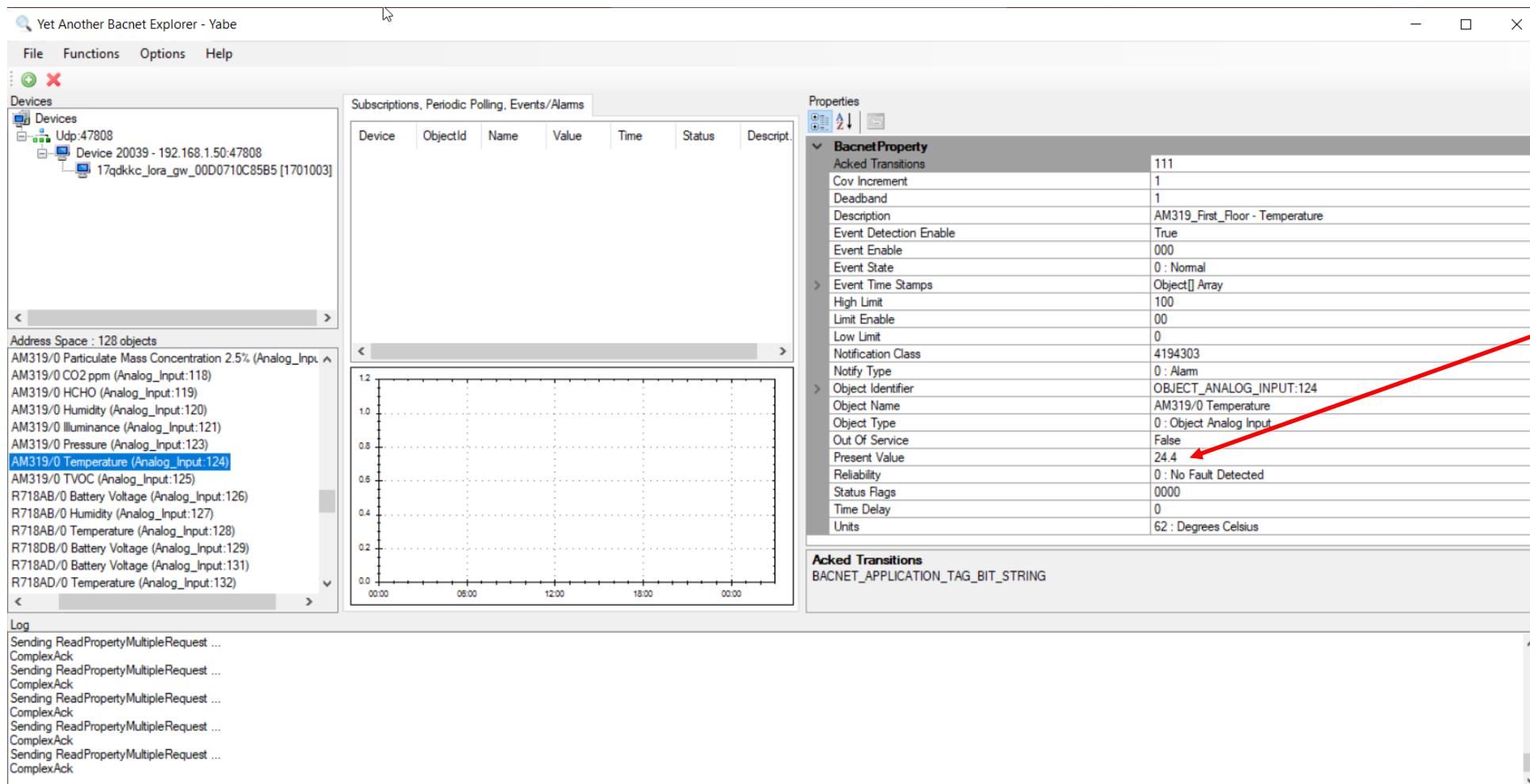


YABE Adding Device (local)



YABE & BACnet Datapoints

- Present value will only be valid after LoRa update has been received after echbacnet has been restarted



Look for
Present Value

MQTT Debugging

The ChirpStack application topic can be monitored from a Putty SSH session using:

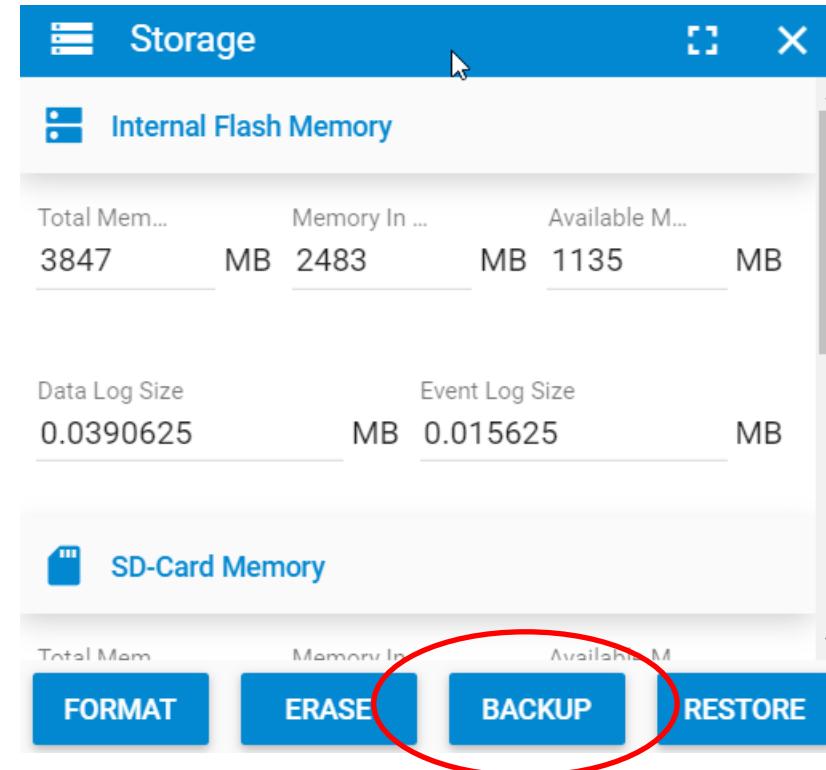
```
mosquitto_sub -v -t application/#
```

The SmartServer ev/data topic can be monitored a Putty SSH session using:

```
mosquitto_sub -v -t glp/0/+/ev/data
```

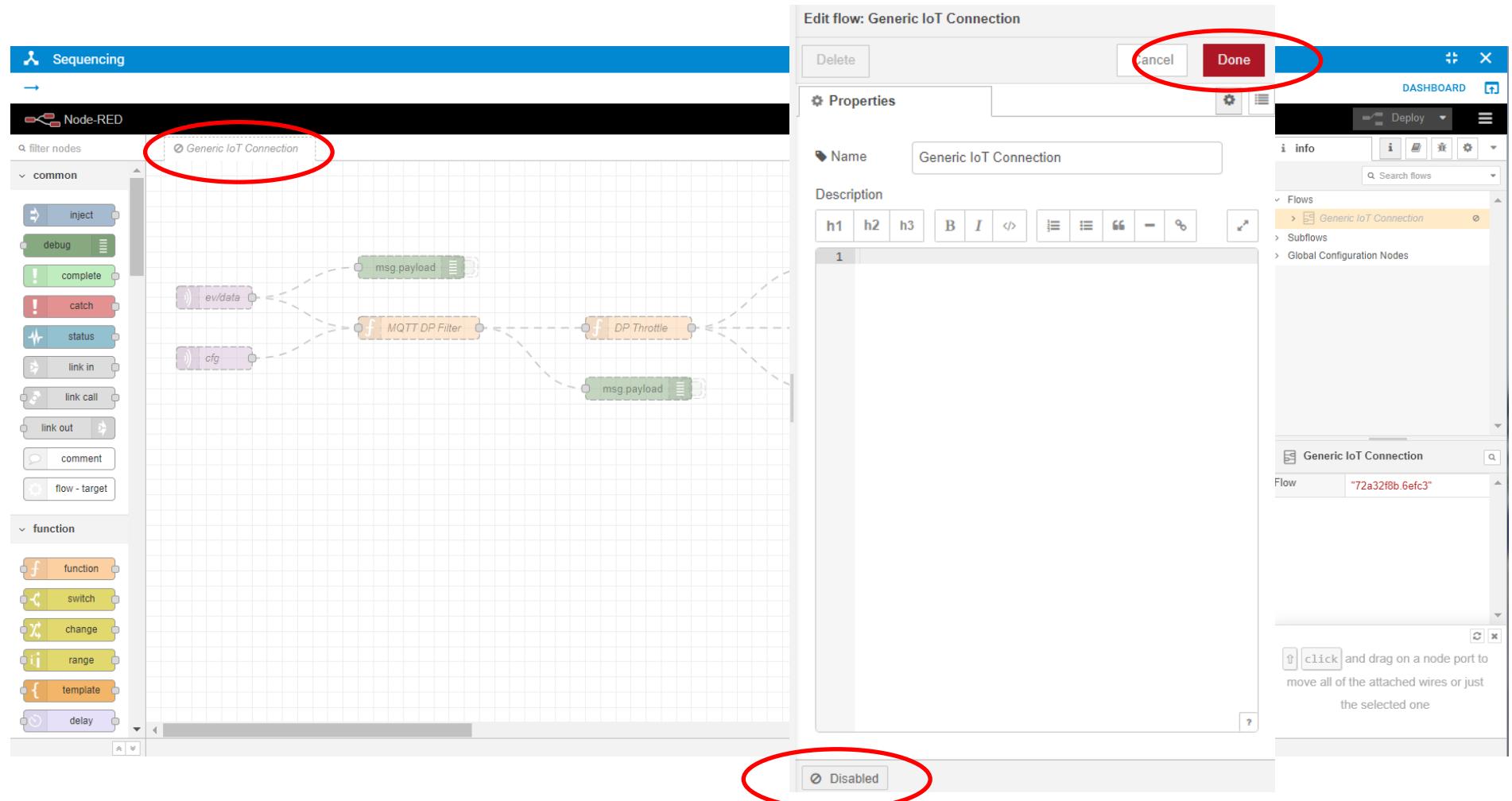
Backup

- Once configured, take a backup and save in a few places....
- Backup system, not database
- Takes around 35 minutes



Configuring Node-RED Flow

- Disabled by default
- Double click flow tab
- Click disabled
- Click done

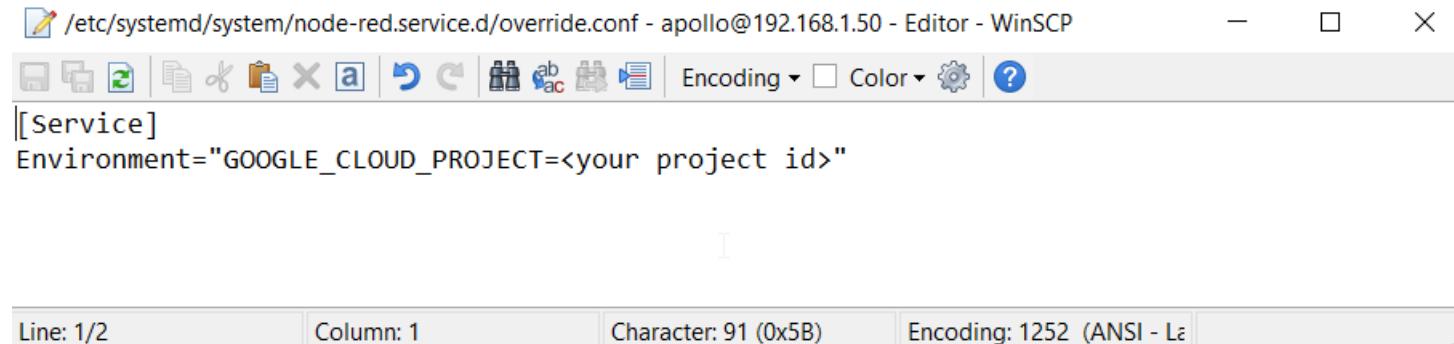


Configuring Node-RED Google Cloud Platform (GCP) Connections

- Please see the following for details on setting up GCP connections:

[http://iecdocs.diasemi.com/display/PortSSIoT/Google+Cloud+Platform+\(GCP\)+Application+Example](http://iecdocs.diasemi.com/display/PortSSIoT/Google+Cloud+Platform+(GCP)+Application+Example)

- The file `/etc/systemd/system/node-red.service.d` is already established in the image
 - Just add project id

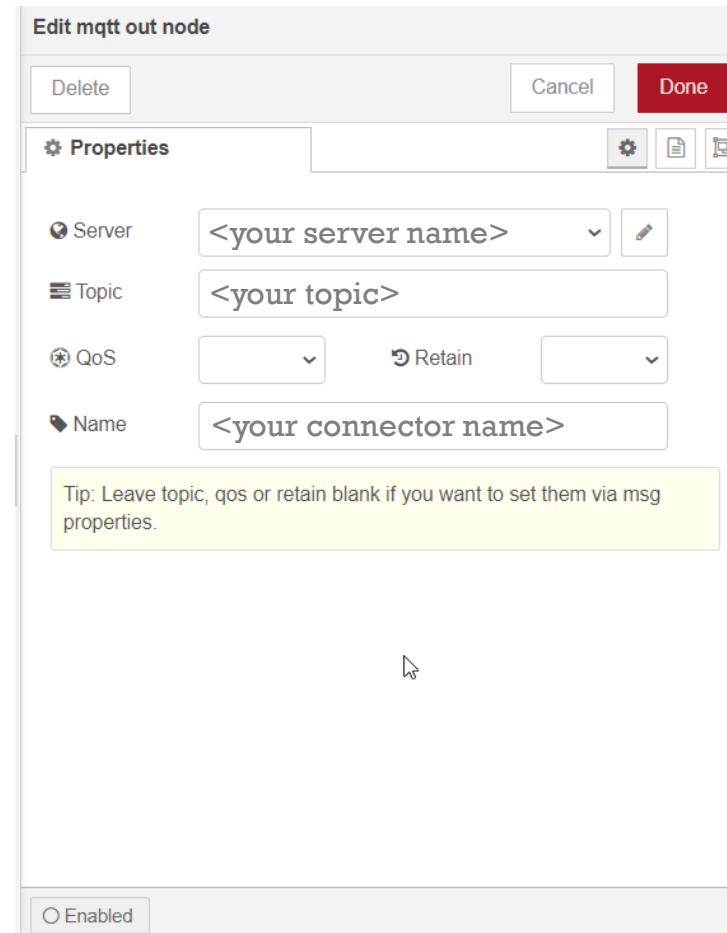


```
[Service]
Environment="GOOGLE_CLOUD_PROJECT=<your project id>"
```

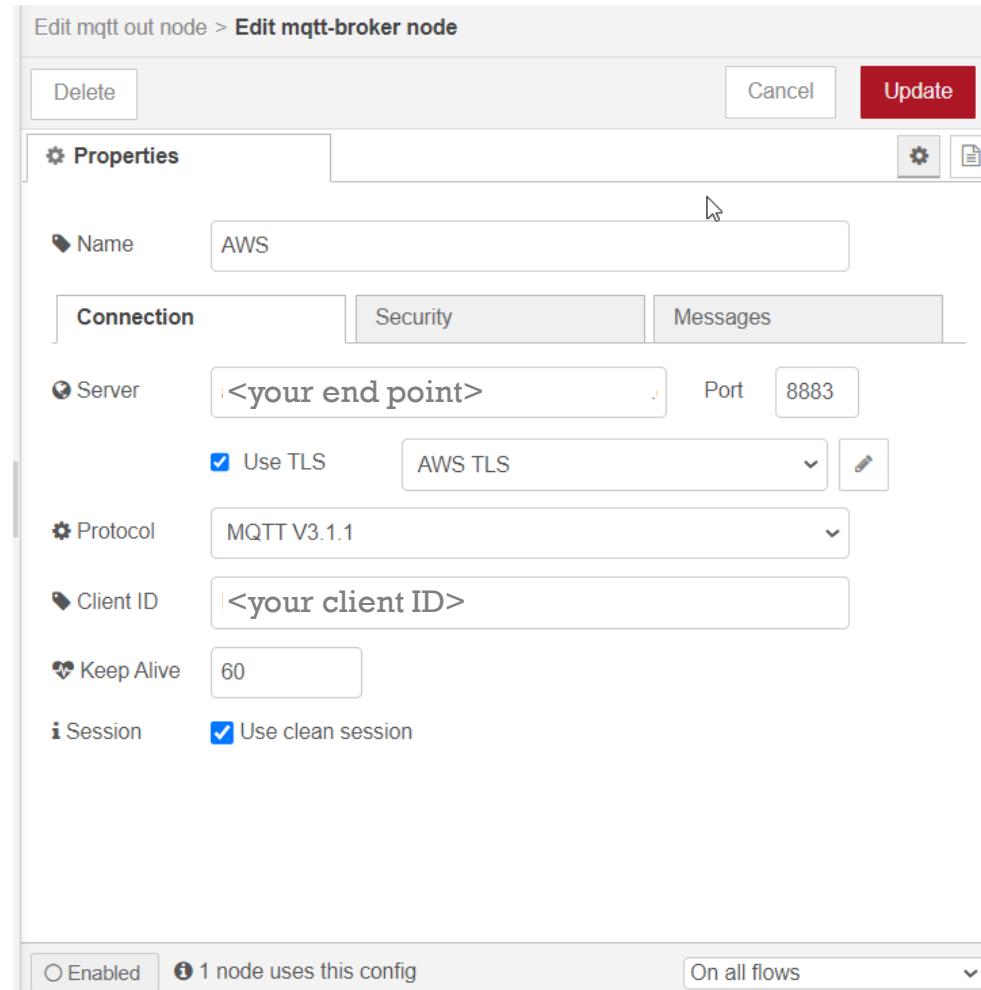
Configuring Node-RED AWS Connections

Information you will need:

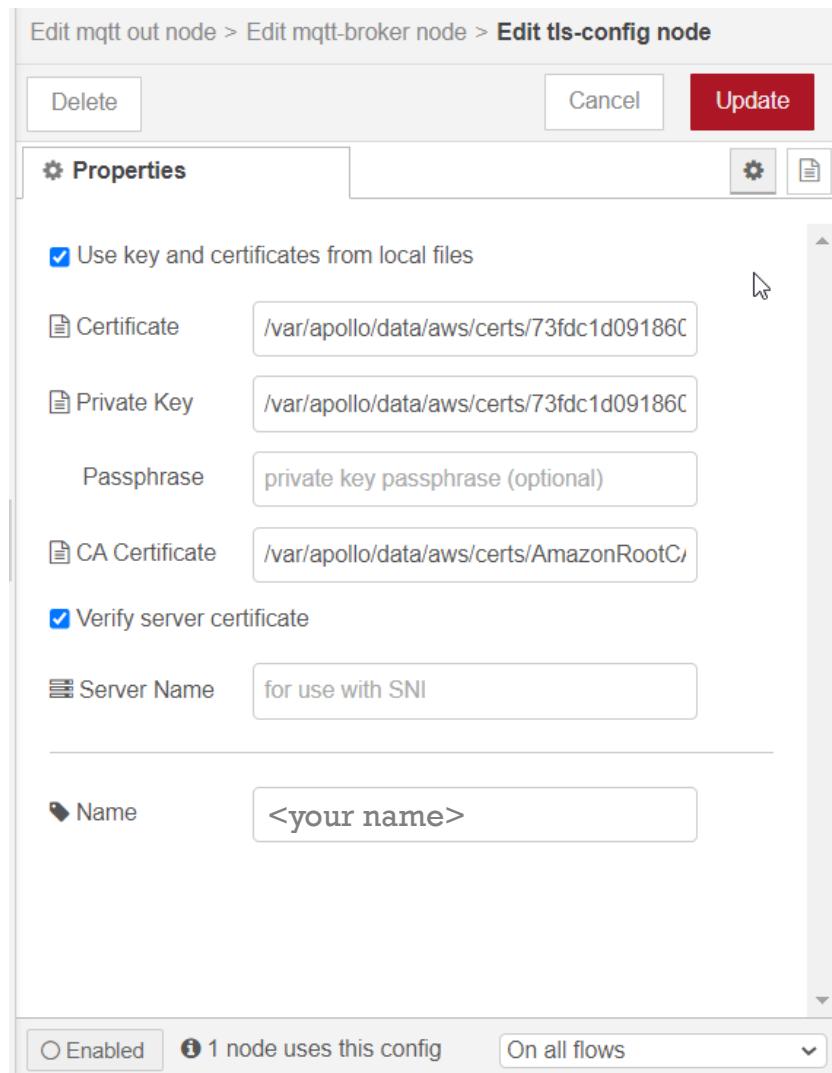
- Topic
- End point
- Client ID
- Certificate (pem format)
- Private Key (pem format)
- CA Cert (pem format)



Configuring Node-RED AWS Connections (continued)



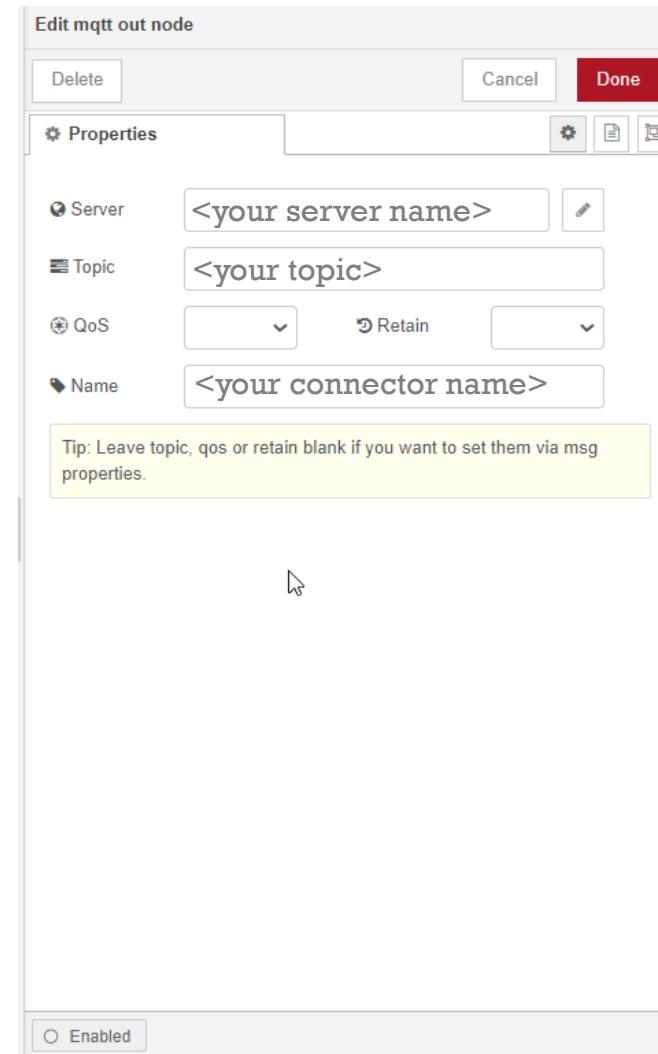
Configuring Node-RED AWS Connections (continued)



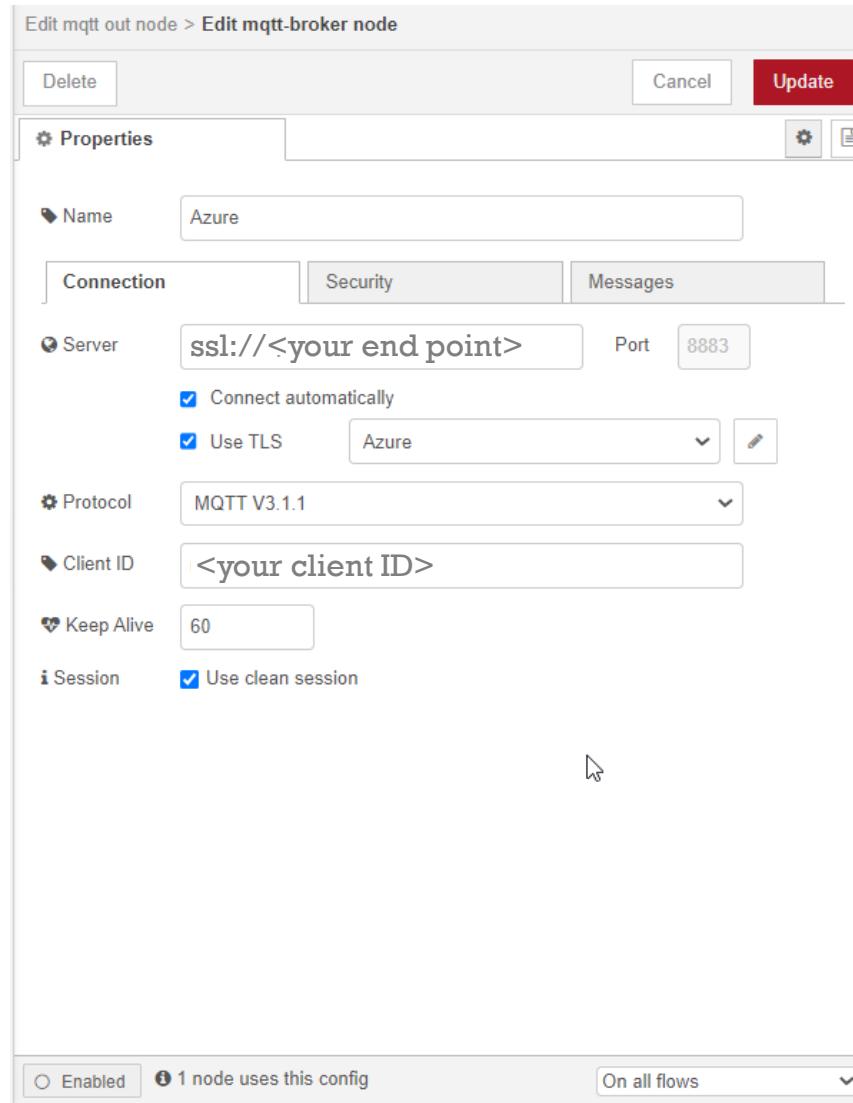
Configuring Node-RED Azure Connections

Information you will need:

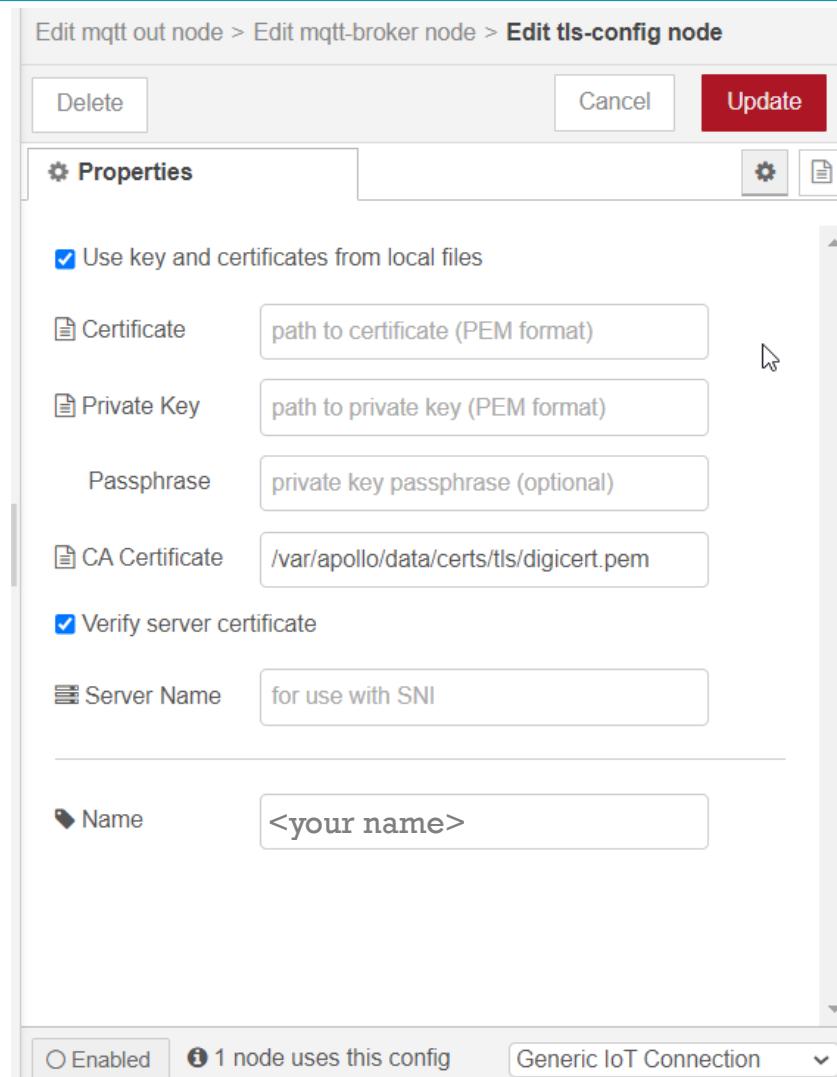
- Topic
- End point
- Client ID
- CA Cert (pem format)
- Username
- Password



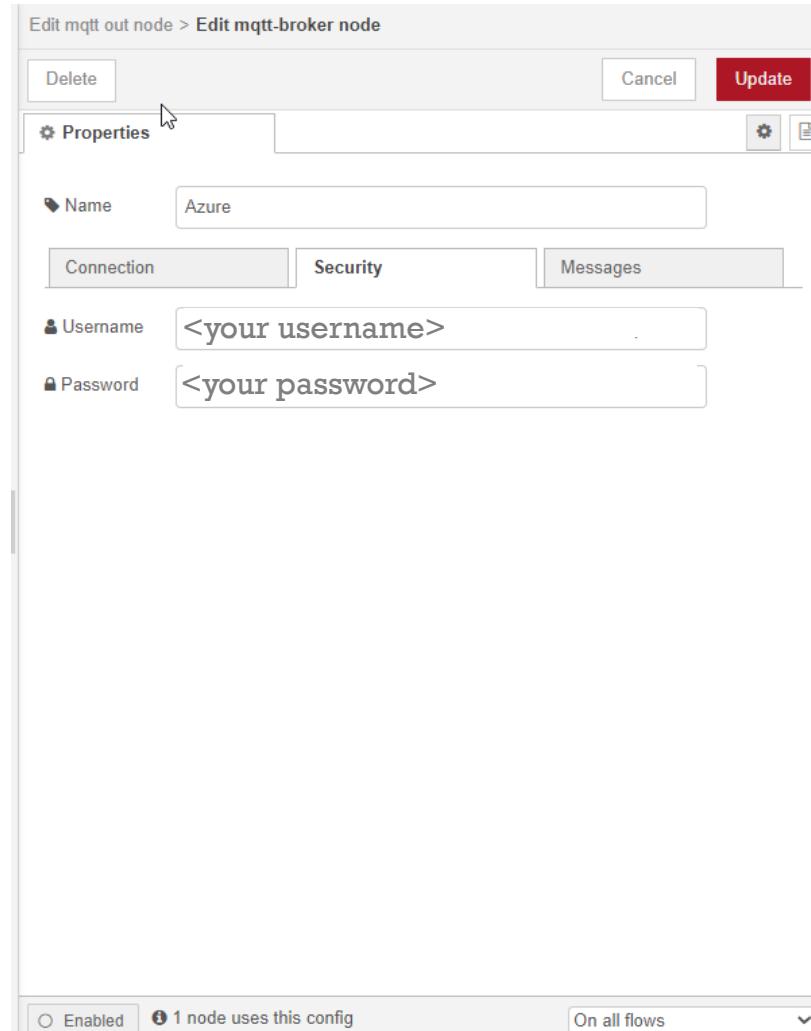
Configuring Node-RED Azure Connections (continued)



Configuring Node-RED Azure Connections (continued)



Configuring Node-RED Azure Connections (continued)





Q&A



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