

SmartServer™ IoT LoRa Build 2.00.007

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Agenda: Essentials

- LoRa & LoRaWAN
- LoRaWAN Architecture
- SmartServer IoT LoRaWAN Overview
- SmartServer IoT LoRaWAN 2.00.006 Specification
- ChirpStack LoRaWAN Network Server
- Hardware/IP Configuration
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- Server IoT and IAP Architecture
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Agenda: Adding Non-LoRa Devices

- Adding Non-LoRa Devices
- BACnet Discovery
- Types
- Setting Device and Datapoint Names
- Setting Datapoint Polling Rates & DBW
- EPS
- Q&A

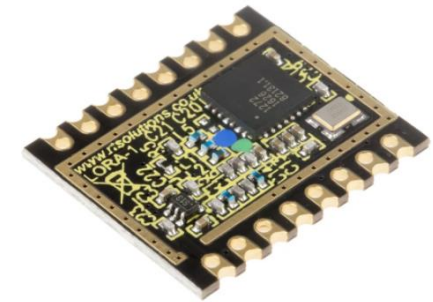
Agenda: Detailed Configuration Instructions

- Pre-requisites
- Under The Hood
- ChirpStack Application Server MQTT Output
- 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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- Log Files
- Using Yabe
- MQTT Debugging
- Backup
- Configuring Node-RED Cloud Connections
 - GCP
 - AWS
 - Azure
- Deleting Devices
- Q&A

The Essentials

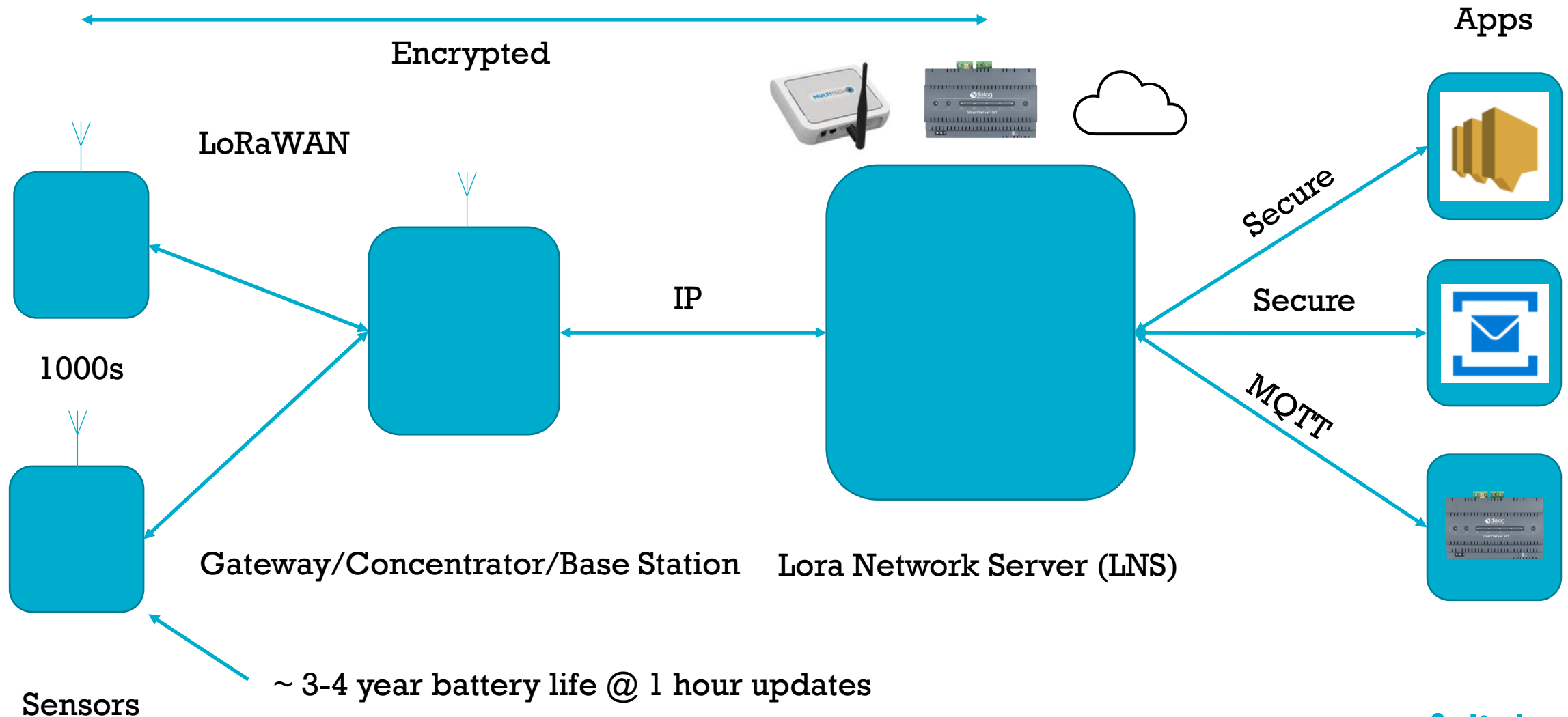
LoRa & LoRaWAN

- 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

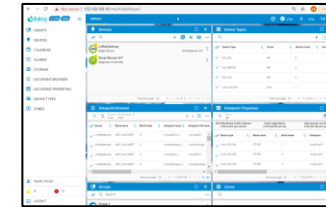
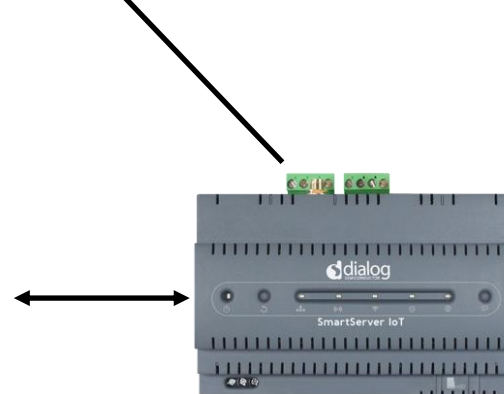
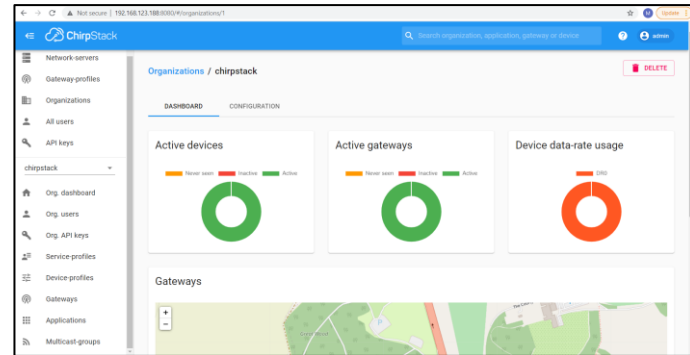
LoRaWAN Architecture



SmartServer IoT LoRaWAN Overview

ChirpStack LoRaWAN Network Server

LoRaWAN Sensors



MQTT Cloud

OPC UA



BACnet

LON

Modbus

IAP

LoRaWAN

ANSI/CTA 709.10

2.00.007 Specification

- SmartServer 3.26.001
 - Ubuntu 20.04
 - TLS 1.3
 - PostgreSQL 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 image displays two overlapping screenshots of the ChirpStack web interface, showing the 'Organizations / chirpstack' dashboard and the 'Applications' page.

Left Screenshot (Dashboard):

- Header:** ChirpStack logo, search bar, user profile (admin), and update button.
- Left Sidebar:** Navigation menu with items: Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown for 'chirpstack' containing: Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups.
- Main Content:**
 - Organizations / chirpstack:** DASHBOARD and CONFIGURATION tabs.
 - Active devices:** A donut chart showing the status of devices. Legend: Never seen (orange), Inactive (red), Active (green). The chart shows approximately 100% Active devices.
 - Gateways:** A map showing the location of gateways, with a label 'Great Wood' visible.

Right Screenshot (Applications):

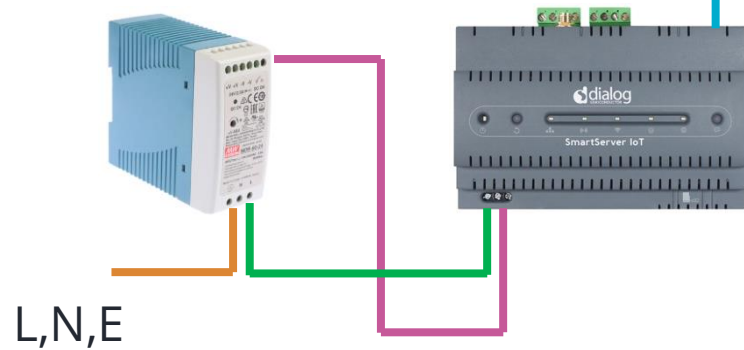
- Header:** ChirpStack logo, search bar, user profile (admin), and update button.
- Left Sidebar:** Same navigation menu as the left screenshot.
- Main Content:**
 - Applications:** A table listing applications with columns: ID, Name, Service-profile, and Description.

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

Rows per page: 10 1-3 of 3

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



192.168.1.60*
Default 192.168.2.1

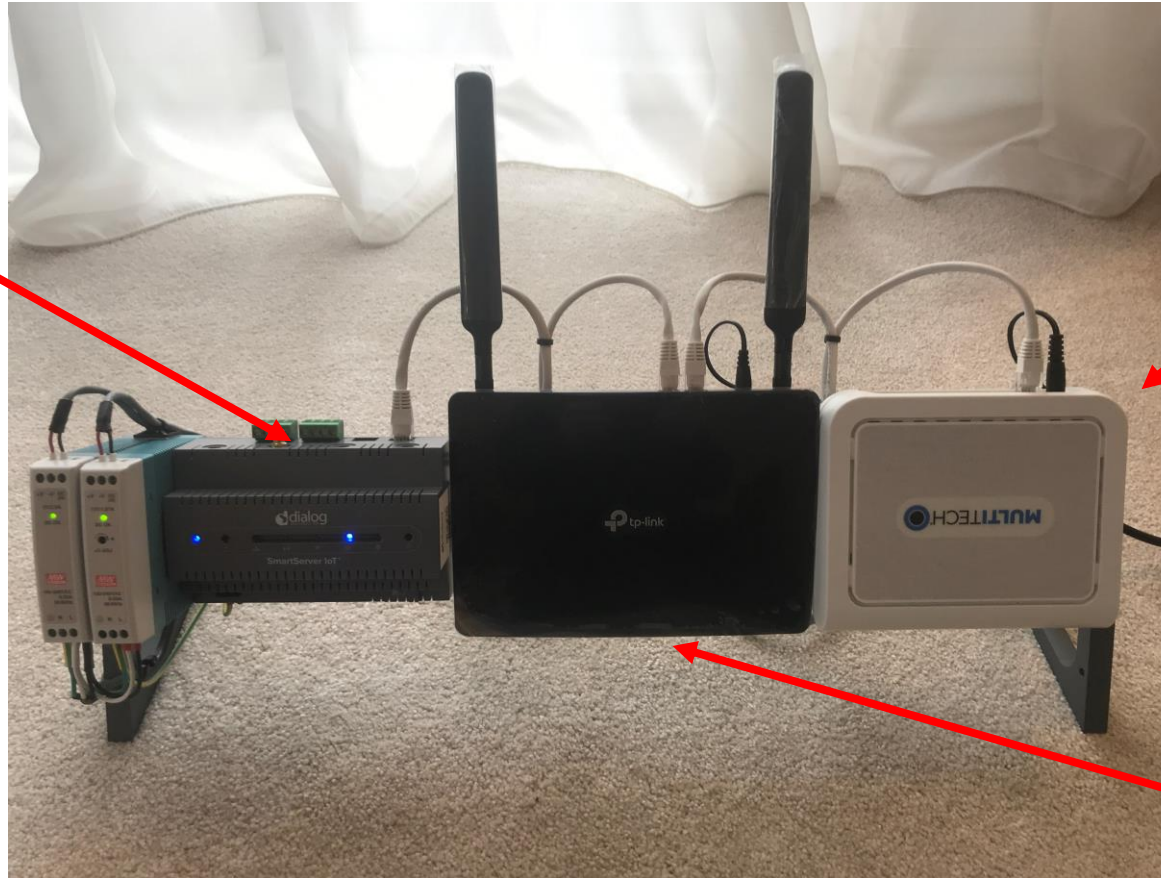


192.168.1.1*



Typical Hardware

SmartServer IoT

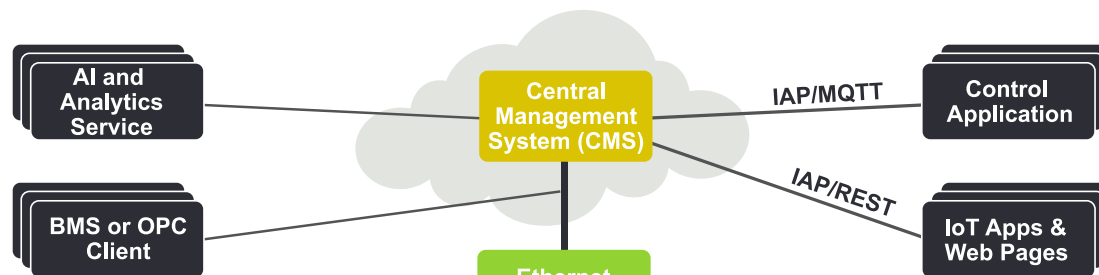


LoRa Gateway

IP Infrastructure

SmartServer IoT and IAP Architecture

Published Cloud Integrations

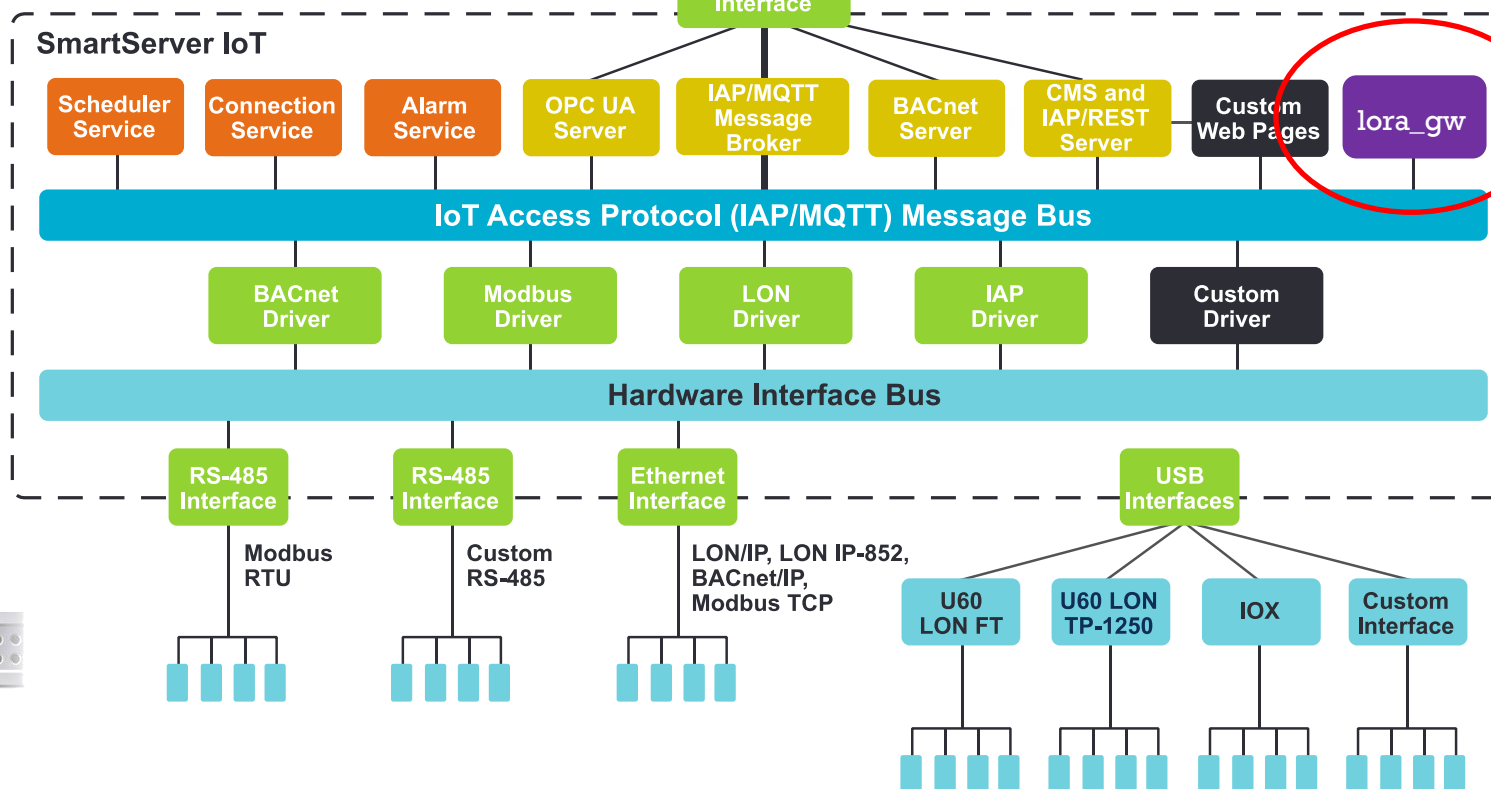


LoRa Integration

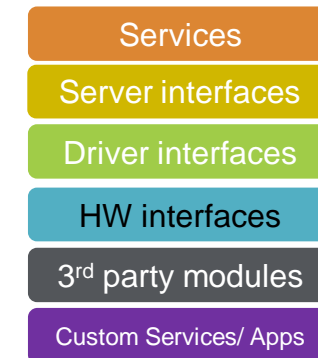
docker Support

Node-RED Development

TALQ Support



Legend



Static LoRa Gateway Interface



ERS_CO2/0 – ERS_CO2/n-1



AM319/0 – AM319/n-1



The screenshot displays the Dialog Semiconductor IoT dashboard interface. At the top, there's a navigation bar with the Dialog logo and user information. The main content area is divided into several panels:

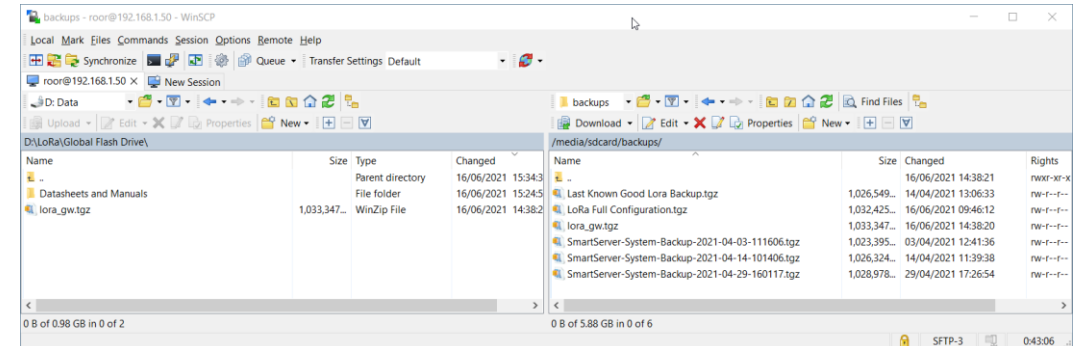
- Groups:** A sidebar menu on the left lists various system components like GROUPS, DEVICES, CALENDAR, ALARMS, STORAGE, DATAPOINT BROWSER, DATAPOINT PROPERTIES, DEVICE TYPES, and ZONES.
- Devices:** A central panel showing a list of devices. It includes a search bar and a table with columns for Device Name, Type, and Status. Two devices are listed: "LoRaGateway" (Edge Device) and "SmartServer IoT" (Segment Controller).
- Datapoint Browser:** A panel below the devices list, showing a table of data points. It includes columns for Device, Block Name, Block Index, Datapoint Name, and Datapoint XIF Name. Several data points are listed, including "MCF_LW12MET" and "nvlLoadCh1_1".
- Device Types:** A panel on the right showing a table of device types. It includes columns for Device Type, Driver, Device Count, and Actions. Three device types are listed: "IOX_DIO", "IOX_METER", and "IOX_SYS".
- Datapoint Properties:** A panel at the bottom right showing a table of datapoint properties. It includes columns for Device type, Block name, Block index, and Datapoint. Three properties are listed: "Lora LON GW", "Lora LON GW", and "Lora LON GW".

Arrows from the physical gateway and sensor images point to the corresponding entries in the dashboard, illustrating the static interface configuration.

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

← → ↻ Not secure | 192.168.168.19/cms/#/dashboard 🔍 ☆ M Update

dialog 3.14.004 DMM

DEFAULT ? ⚙️ EPS: 0 CPU: 14 🇺🇸

GROUPS

DEVICES

CALENDAR

ALARMS

STORAGE

DATAPoint BROWSER

DATAPoint PROPERTIES

DEVICE TYPES

ZONES

Devices

LoRaGateway
Edge Device

SmartServer IoT
Segment Controller

Rows per page 25 1 - 2 of 2

Device Types

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

Rows per page 25 1 - 4 of 4

Datapoint Browser

Source Block Name X
Live met 0 s. ↻

Device	Block name	Block index	Datapoint name	Datapoint XIF name
✓ LoRaGateway	MCF_LW12MET	0	nviLoadCtl1_1	nviLoadCtl
✓ LoRaGateway	MCF_LW12MET	0	nvoActEnergy_1	nvoActEnergy
✓ LoRaGateway	MCF_LW12MET	0	nvoActPwr_1	nvoActPwr
✓ LoRaGateway	MCF_LW12MET	0	nvoAppEnergy_1	nvoAppEnergy

Rows per page 25 1 - 25 of 130

Datapoint Properties

Driver All

Total Monitoring Traffic Indicator		Total Logged Bytes		Data Annual Log Size	
0.00 events per second		0.00 byte (B) per day		0.00 byte (B) per year	
Device type	Block name	Block index	Datapoint		
✓ Lora LON GW	R718E	1	nvoAccelIX		
✓ Lora LON GW	R718E	9	nvoAccelIX		
✓ Lora LON GW	R718E	2	nvoAccelIX		

Rows per page 25 1 - 25 of 770

Groups

Search

Group 1

Zones

Search

Apollo Owner

4 0

LOGOUT

Clone Image – Clone Image

Storage

Internal Flash Memory

Total Mem...	Memory In ...	Available M...
3847	MB 2483	MB 1135

Data Log Size: 0.0390625 MB
Event Log Size: 0.015625 MB

SD-Card Memory

FORMAT ERASE BACKUP **RESTORE**

Restore

SYSTEM DATABASE **CLONE**

Restore *
/media/sdcard/backups/lora_gw.tgz

CANCEL **RESTORE**

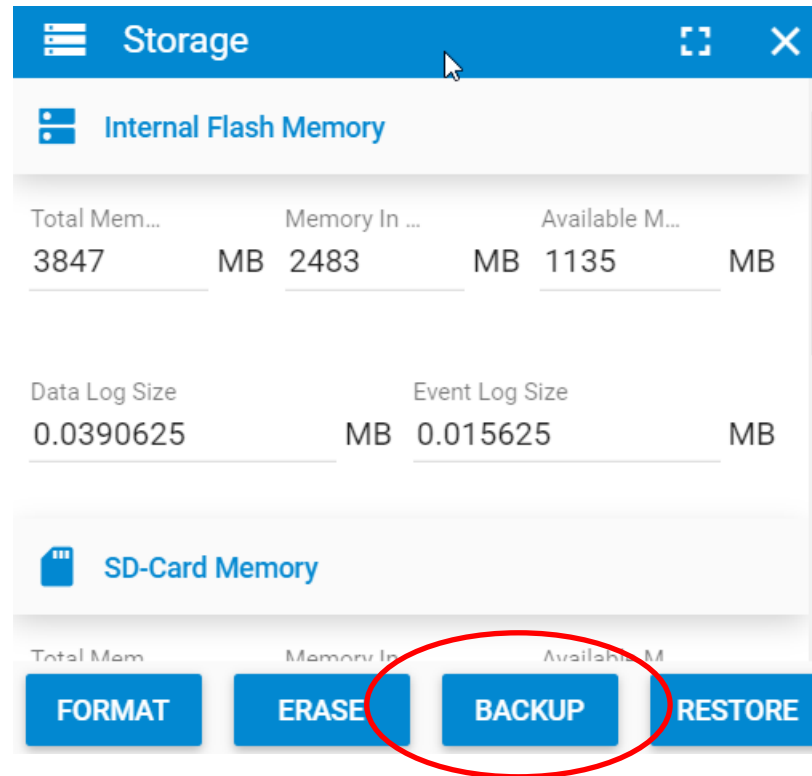
```
COM25 - PuTTY
Ubuntu 16.04.7 LTS smartserver-17qdkkc ttymsc3
smartserver-17qdkkc login: █
```

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

← → ↻ ⚠ Not secure | 192.168.1.50:8080/#/login

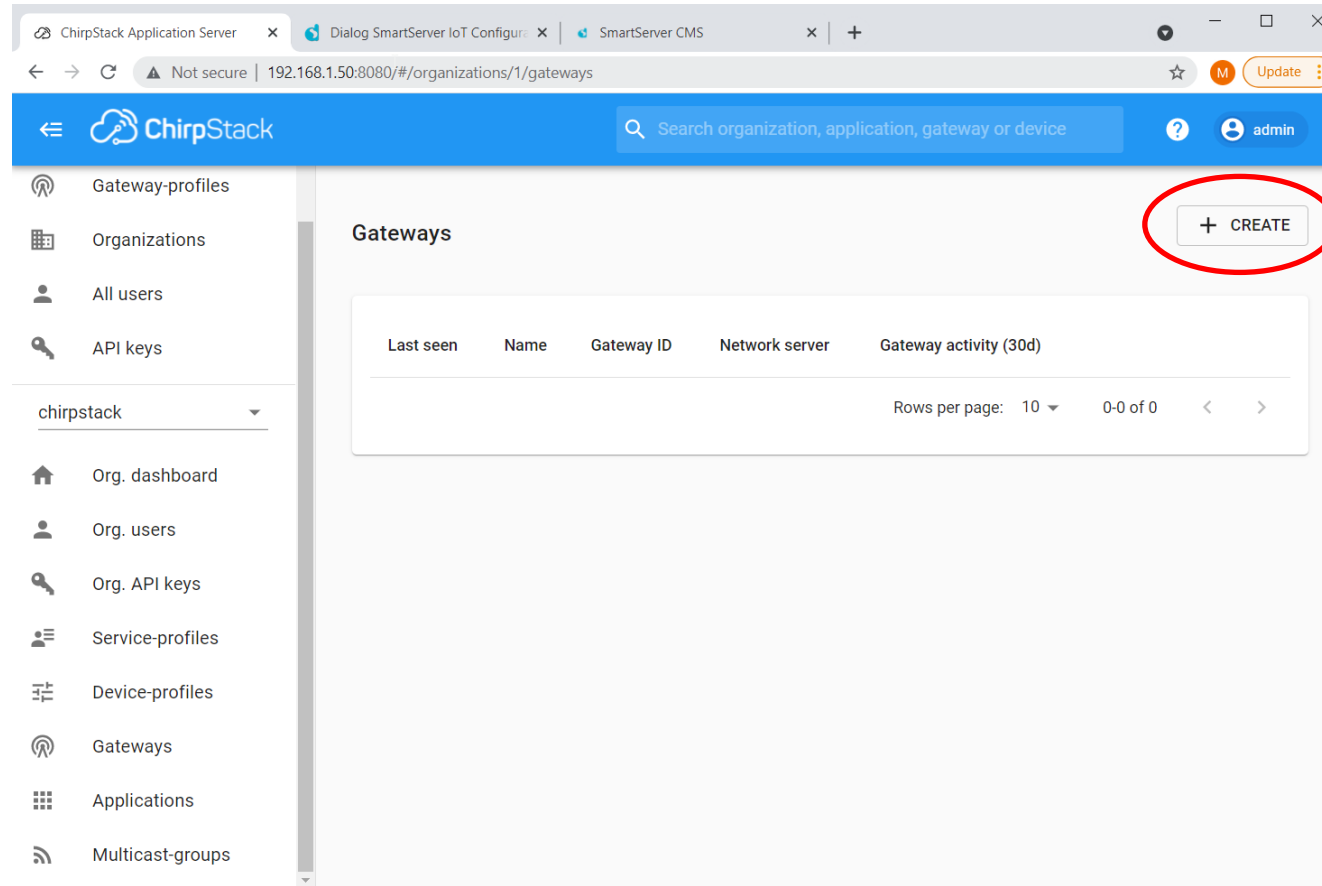
ChirpStack Login

Username / email *

Password *

LOGIN

Creating LoRaWAN Gateway in Chirpstack



Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot shows the ChirpStack web interface for creating a new gateway. The interface has a blue header with the ChirpStack logo, a search bar, and a user profile for 'admin'. A left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, and API keys. Below these are links for 'chirpstack' (selected), Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups. The main content area is titled 'Gateways / Create' and contains a form with three tabs: GENERAL, TAGS, and METADATA. The GENERAL tab is active and contains the following fields:

- Gateway name ***: MultiTech-MTCAP-868. A note below states: 'The name may only contain words, numbers and dashes.'
- Gateway description ***: My Gateway
- Gateway ID ***: 00 80 00 00 00 01 9C 85. A button labeled 'MSB' and a refresh icon are to the right.
- Network-server ***: SmartServer IoT. A note below states: 'Select the network-server to which the gateway will connect. When no network-servers are available in the dropdown, make sure a service-profile exists for this organization.'
- Service-profile**: SmartServer. A note below states: 'Select the service-profile under which the gateway must be added. The available service-profiles depend on the selected network-server, which must be selected first.'
- Gateway-profile**: MultiTech MTCAP-868. A note below states: 'Optional. When assigning a gateway-profile to the gateway, ChirpStack Network Server will attempt to update the gateway according to the gateway-profile. Note that this does require a gateway with ChirpStack Concentratord.'
- ☐ Gateway discovery enabled

The URL in the browser's address bar is 192.168.1.50:8080/#/organizations/1/gateways.

Creating LoRaWAN Gateway in Chirpstack (cont.)

ChirpStack

Search organization, application, gateway or device

admin

MultiTech MTCAP-868

☐ Gateway discovery enabled

When enabled (and ChirpStack Network Server is configured with the gateway discover feature enabled), the gateway will send out periodical pings to test its coverage by other gateways in the same network.

Gateway altitude (meters) *

0

When the gateway has an on-board GPS, this value will be set automatically when the network has received statistics from the gateway.

Gateway location ([set to current location](#))

+

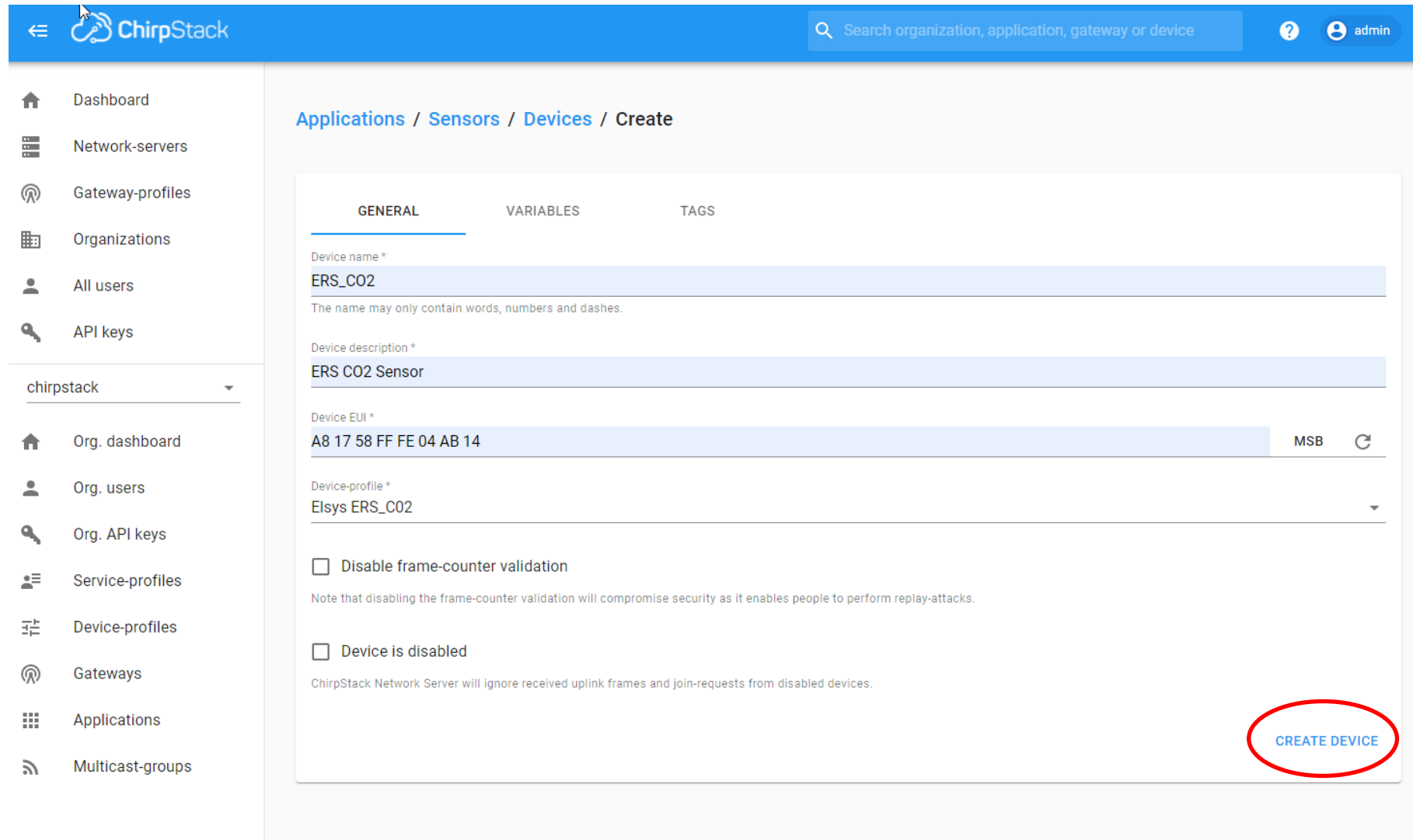
-

Leaflet | © OpenStreetMap contributors

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.

ADD BOARD CONFIGURATION **CREATE GATEWAY**

Creating LoRaWAN Devices in ChirpStack



The screenshot displays the ChirpStack web interface for creating a new LoRaWAN device. The interface has a blue header with the ChirpStack logo, a search bar, and a user profile icon labeled 'admin'. A left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, and API keys. Below these is a dropdown menu for 'chirpstack' with sub-links for Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups. The main content area shows the breadcrumb 'Applications / Sensors / Devices / Create' and a form with three tabs: GENERAL, VARIABLES, and TAGS. The GENERAL tab is active and contains the following fields: 'Device name *' with the value 'ERS_CO2', 'Device description *' with the value 'ERS CO2 Sensor', and 'Device EUI *' with the value 'A8 17 58 FF FE 04 AB 14'. There are also checkboxes for 'Disable frame-counter validation' and 'Device is disabled', both of which are currently unchecked. A red circle highlights the 'CREATE DEVICE' button at the bottom right of the form.

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

Device-profile *

Elsys ERS_CO2

☐ 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. The top navigation bar is blue with the ChirpStack logo, a search bar, and a user profile icon labeled 'admin'. The left sidebar contains a menu with icons and labels for various sections: 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 displays the breadcrumb 'Applications / Sensors / Devices / ERS_CO2' and a 'DELETE' button. Below this is a tabbed interface with tabs for DETAILS, CONFIGURATION, KEYS (OTAA) (which is active), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES. The 'KEYS (OTAA)' tab shows the 'Application key *' as a hexadecimal string 'f7 8a f4 e1 a7 fa b2 25 3b c1 38 60 9f 40 ae 7d'. To the right of the key are icons for 'MSB', refresh, copy, and a lock. Below the key is a note: 'For LoRaWAN 1.0 devices. In case your device supports LoRaWAN 1.1, update the device-profile first.' A red circle highlights the 'SET DEVICE-KEYS' button in the bottom right corner of the key input area.

JoinRequest/JoinAccept

The screenshot displays the ChirpStack web interface. The left sidebar contains a navigation menu with the following items: 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 breadcrumb 'Applications / Sensors / Devices / ERS_CO2_test' and a tabbed interface with tabs for DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES. The LORAWAN FRAMES tab is active, showing a table of frames:

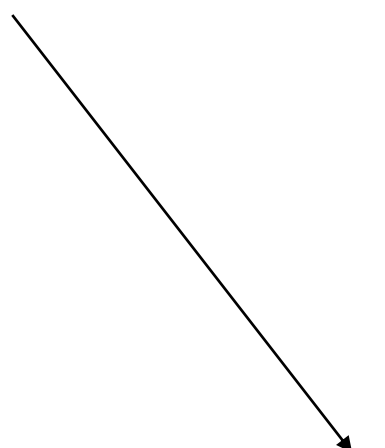
Timestamp	Frame Type	Frequency	Spreading Factor	Bandwidth	Gateway ID
Feb 01 9:25:58 PM	JoinAccept	926.9 MHz	SF9	BW500	GW: 008000000001edb0
Feb 01 9:25:58 PM	JoinRequest	903.5 MHz	SF9	BW125	DevEUI: a81758fffe0700cd

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

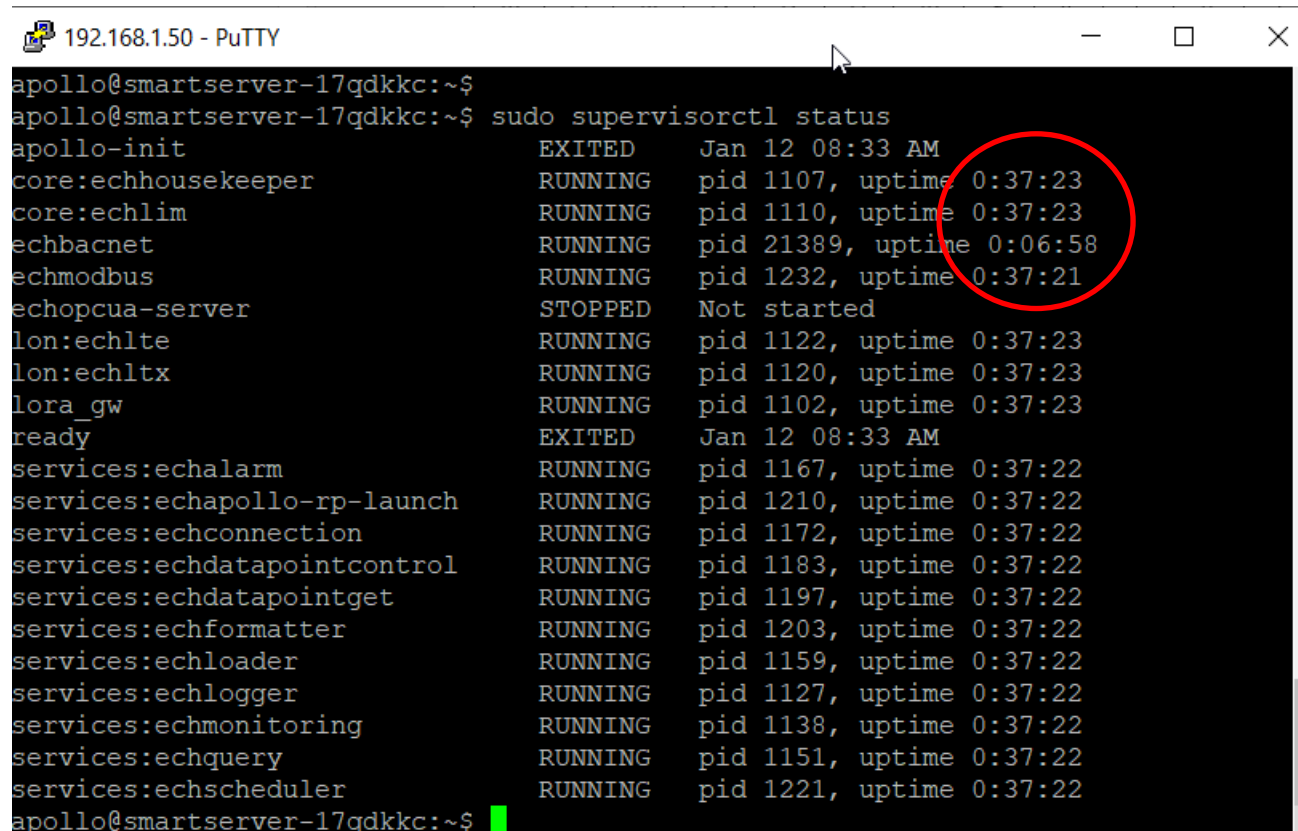
- Used to map LoRaWAN deveui to IAP/MQ blocks and block indices
- Automatically** generated
 - Do not edit**
- Includes the ChirpStack device name which includes the device type
- If necessary, add LoRaWAN devices in the order you wish them to appear in lora_gw.btm
- ChirpStack does not include the device 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	a81758fffe0537a1	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	a81758fffe04d037	1	ERS_Eye_Board_Room
12		Vicki	0	70b3d52dd3000abc	1	Vicki_0
13		Vicki	1	70b3d52dd3000b65	1	Vicki_1
14		ERS_CO2	0	a81758fffe0625c2	1	ERS_CO2_Third_Floor_Kitchen
15		Vicki	2	70b3d52dd3002eac	1	Vicki_2
16		ERS_Lite	0	a81758fffe04b491	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:~$
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:~$
```

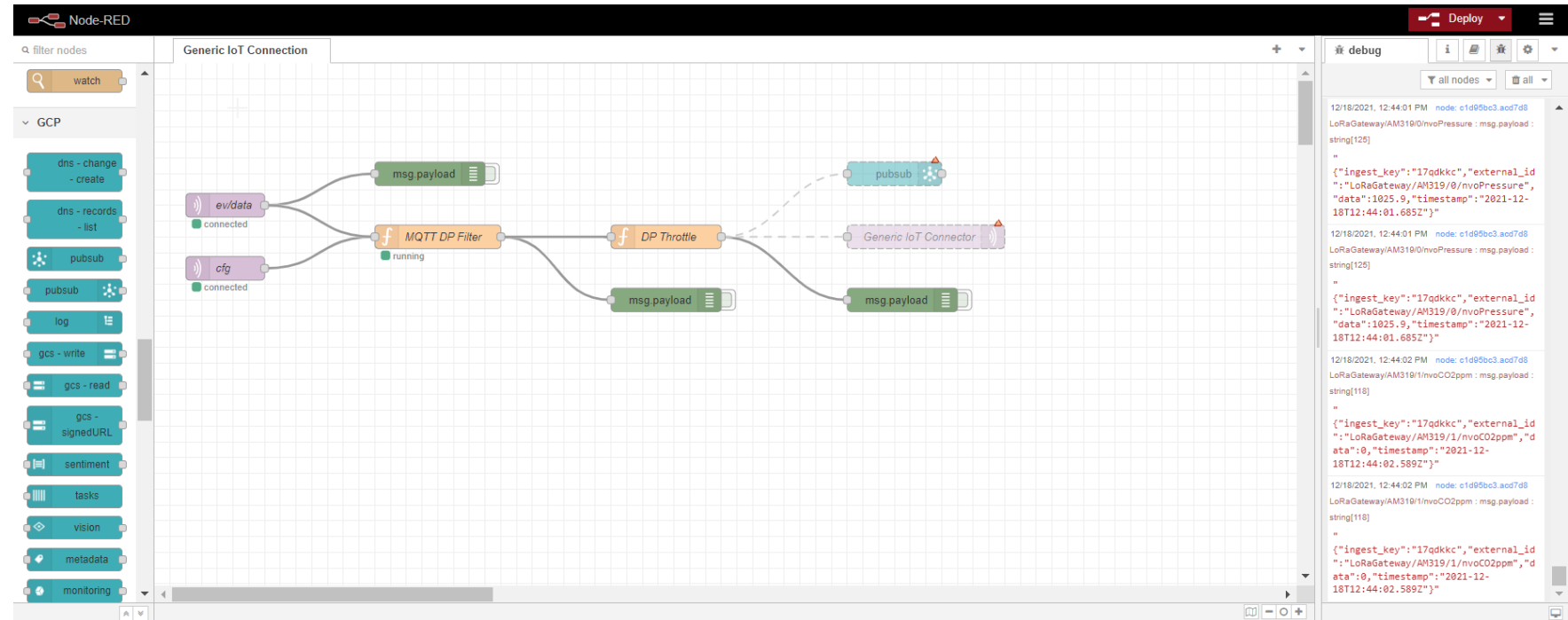
lora_gw.btm File

- 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	J
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	valu
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	valu
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	valu
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	valu
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	valu
10	Ion	ERS_CO2_Lite	0	nvoBattV	AI	6	ERS_CO2_Lite/0 Battery Voltage	ERS_CO2_Lite_Fourth_Floor_Sales - Battery Voltage	volts	valu
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	valu
12	Ion	ERS_CO2_Lite	0	nvoHumidity	AI	8	ERS_CO2_Lite/0 Humidity	ERS_CO2_Lite_Fourth_Floor_Sales - Humidity	percent-relative-humidity	valu
13	Ion	ERS_CO2_Lite	0	nvoTemp	AI	9	ERS_CO2_Lite/0 Temperature	ERS_CO2_Lite_Fourth_Floor_Sales - Temperature	degrees-celsius	valu
14	Ion	R718E	0	nvoAccelX	AI	10	R718E/0 Acceleration X	R718E_Heat_Exchanger_1 - Acceleration X	meters-per-second	valu
15	Ion	R718E	0	nvoAccelY	AI	11	R718E/0 Acceleration Y	R718E_Heat_Exchanger_1 - Acceleration Y	meters-per-second	valu
16	Ion	R718E	0	nvoAccelZ	AI	12	R718E/0 Acceleration Z	R718E_Heat_Exchanger_1 - Acceleration Z	meters-per-second	valu
17	Ion	R718E	0	nvoBattV	AI	13	R718E/0 Battery Voltage	R718E_Heat_Exchanger_1 - Battery Voltage	volts	valu
18	Ion	R718E	0	nvoTemp	AI	14	R718E/0 Temperature	R718E_Heat_Exchanger_1 - Temperature	degrees-celsius	valu
19	Ion	R718E	0	nvoVelocityX	AI	15	R718E/0 Velocity X	R718E_Heat_Exchanger_1 - Velocity X	millimeters-per-second	valu
20	Ion	R718E	0	nvoVelocityY	AI	16	R718E/0 Velocity Y	R718E_Heat_Exchanger_1 - Velocity Y	millimeters-per-second	valu
21	Ion	R718E	0	nvoVelocityZ	AI	17	R718E/0 Velocity Z	R718E_Heat_Exchanger_1 - Velocity Z	millimeters-per-second	valu
22	Ion	MCF_LW12MET	0	nviLoadCtl	BO	18	MCF_LW12MET/0 Load Control	MCF-LW12MET - Load Control	no-units	stat
23	Ion	MCF_LW12MET	0	nvoLoadSts	BI	19	MCF_LW12MET/0 Load Status	MCF-LW12MET - Load Status	no-units	stat
24	Ion	MCF_LW12MET	0	nvoActEnergy	AI	20	MCF_LW12MET/0 Active Energy	MCF-LW12MET - Active Energy	watt-hours	valu

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

Search organization, application, gateway or device

admin

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

Gateways

+ CREATE

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	ac1f09fffe05225f	SmartServer IoT	

Rows per page: 10 1-3 of 3

The View From BACnet Using YABE

The screenshot displays the YABE (Yet Another Bacnet Explorer) interface. The main window is titled "Yet Another Bacnet Explorer - Yabe" and contains several panes:

- Devices:** A tree view on the left showing the device hierarchy. The selected device is "Device 20039 - 192.168.1.50:47808". Below it, a list of objects is shown, with "AM319/0 Temperature (Analog_Input:124)" highlighted by a red circle.
- Subscriptions, Periodic Polling, Events/Alarms:** A table with columns: Device, ObjectID, Name, Value, Time, Status, and Descript. It is currently empty.
- Properties:** A detailed view of the selected object's properties. The "BacnetProperty" section is expanded, showing various parameters. The "Description" field is circled in red and contains the text "AM319_First_Floor - Temperature". The "Present Value" field is also circled in red and contains the value "24.4".
- Log:** A bottom pane showing a sequence of BACnet messages, including "Sending ReadPropertyMultipleRequest ..." and "ComplexAck".

On the right side of the image, there is a separate table with two columns: "Last seen" and "Device name". The first row is circled in red and contains the values "a few seconds ago" and "AM319_First_Floor". A red arrow points from this row to the "Description" field in the Properties pane.

Last seen	Device name
a few seconds ago	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`

The screenshot shows the WinSCP interface with the local drive on the left and the remote drive on the right. The remote drive is at `/var/log/supervisor/`. The file list is as follows:

Name	Size	Changed	Rights	Owner
echbacnet.log	12 KB	16/06/2021 20:21:45	rw-r--r--	root
formatter.log	9 KB	16/06/2021 20:22:07	rw-r--r--	root
housekeeper.log	10 KB	16/06/2021 20:22:18	rw-r--r--	root
lim.log	17 KB	16/06/2021 20:22:24	rw-r--r--	root
loader.log	10 KB	16/06/2021 20:22:10	rw-r--r--	root
logger.log	10 KB	16/06/2021 20:22:06	rw-r--r--	root
lte.log	340 KB	16/06/2021 20:22:32	rw-r--r--	root
ltx.log	3,919 KB	16/06/2021 20:22:25	rw-r--r--	root
modbus.log	0 KB	09/04/2021 19:17:47	rw-r--r--	root
monitoring.log	10 KB	16/06/2021 20:22:09	rw-r--r--	root
query.log	10 KB	16/06/2021 20:22:17	rw-r--r--	root
ready.log	0 KB	09/04/2021 19:17:46	rw-r--r--	root
scheduler.log	10 KB	16/06/2021 20:22:15	rw-r--r--	root
stderr-lora_gw.log	5 KB	16/06/2021 20:22:34	rw-r--r--	root
stdout-lora_gw.log	3,208 KB	16/06/2021 19:03:51	rw-r--r--	root
stdout-lora_gw.log.1.gz	286 KB	08/06/2021 06:04:50	rw-r--r--	root
stdout-lora_gw.log.2.gz	294 KB	21/05/2021 23:14:54	rw-r--r--	root
stdout-lora_gw.log.3.gz	294 KB	13/05/2021 23:49:24	rw-r--r--	root
supervisord.log	207 KB	16/06/2021 20:22:35	rw-r--r--	root

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 screenshot displays the SmartServer Configuration User Interface. It is divided into two main panels. The left panel contains 'SYSTEM INFORMATION' and 'SYSTEM CONFIGURATION'. The right panel is titled 'CHANGE PASSWORD'.

SYSTEM INFORMATION

Version	3.26.001
Serial Number	442021D00502
MACID	00:d0:71:0c:85:af
Install Code	17qampp
Segment Provisioning Status	Provisioned
Segment ID	17qdkkc
LON Network Management Mode	Device
System Uptime	44 minutes

Buttons: Change Password, Reboot, Reset To D

SYSTEM CONFIGURATION

Password Recovery

☒ Allow password reset via the SmartServer Connect button

Security Setting

☐ Enable signed certificates

CMS

User Name: apollo

Password: ☐ Show Password

☐ Remote CMS

Update

CHANGE PASSWORD

Username: apollo

Current Password:

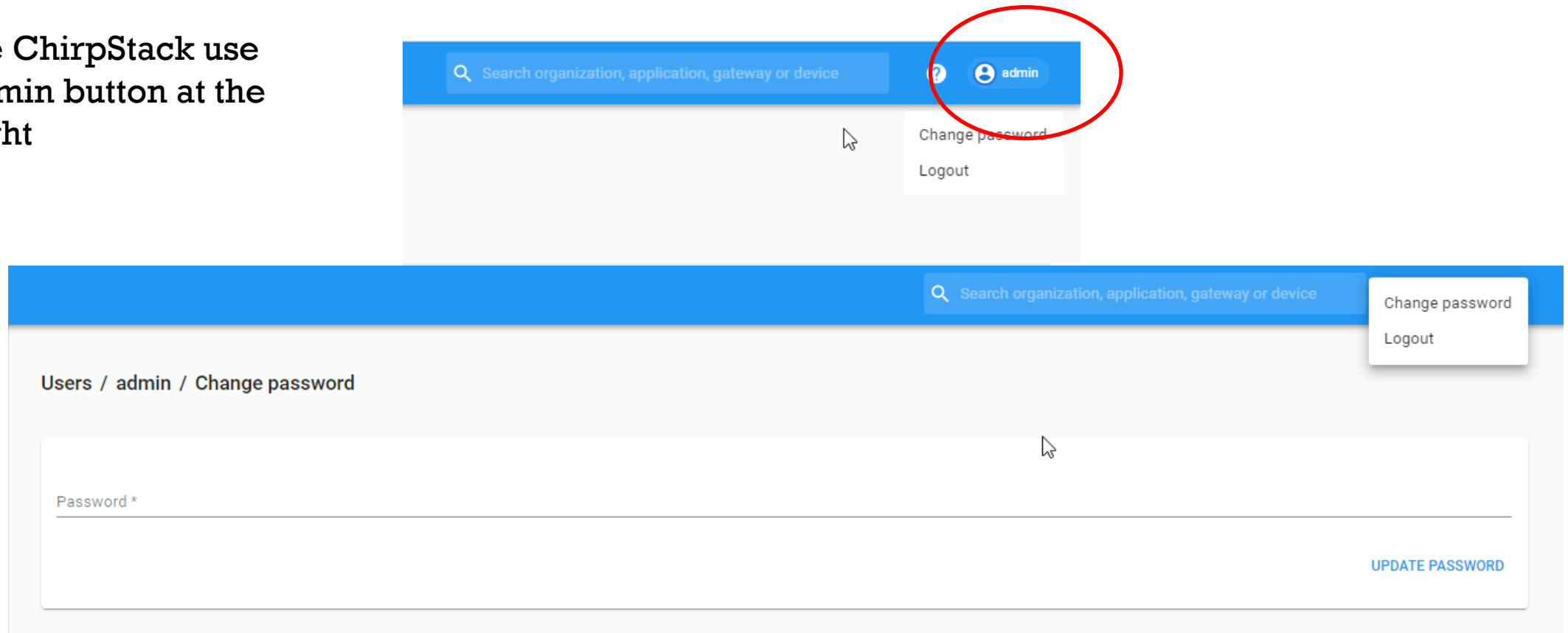
New Password:

Confirm New Password:

Change Password

ChirpStack

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



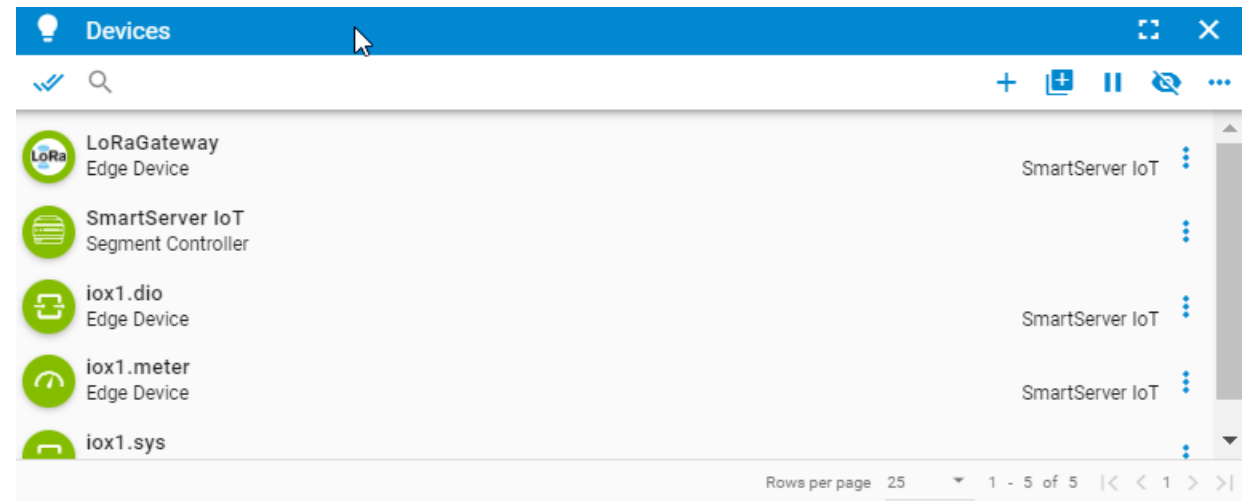
Q&A

Adding Non-LoRa Devices

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



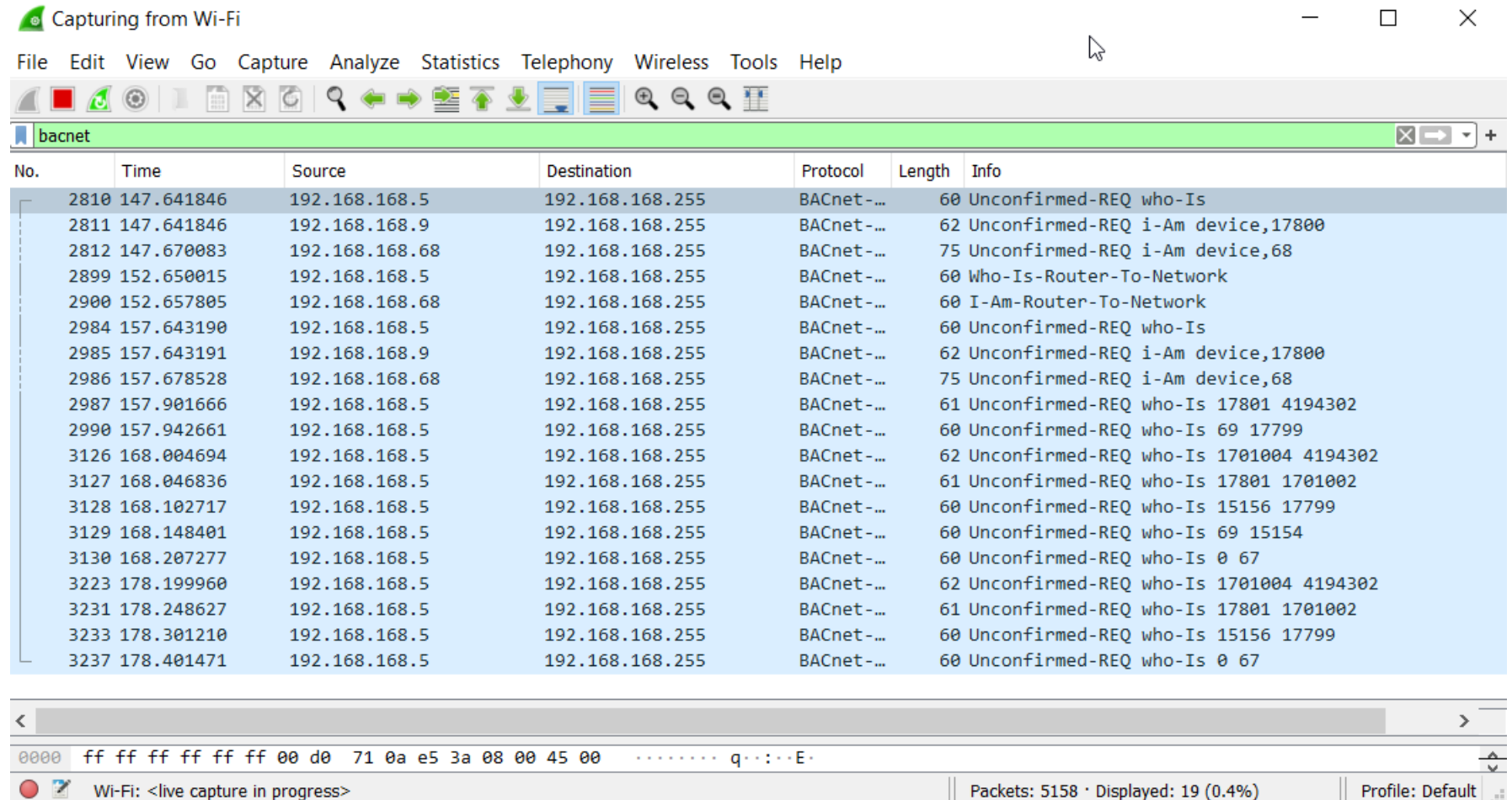
/var/apollo/data/bacnetrouter/res/
Before starting discovery



/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



Wireshark interface showing a capture of BACnet traffic. The filter is set to 'bacnet'. The packet list shows 19 packets, all of which are broadcast traffic (destination 192.168.168.255). The packet details pane shows the selected packet (No. 2810) and its raw data (hex and ASCII).

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

0000 ff ff ff ff ff ff 00 d0 71 0a e5 3a 08 00 45 00 q...E.

Wi-Fi: <live capture in progress> | Packets: 5158 · Displayed: 19 (0.4%) | Profile: Default

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

The screenshot displays two widgets from a management interface. The top widget, titled 'Devices', lists discovered devices with their names, types, and associated SmartServer IoT instances. The bottom widget, titled 'Device Types', shows a table of device types, drivers, and counts. Red arrows indicate the mapping between the devices listed in the top widget and the device types in the bottom widget.

Device Type	Driver	Device Count	Actions
BACnet-151_TP1273	BACnet	1	⋮
BACnet-178_LIOB-550	BACnet	1	⋮
IOX_DIO	IAP	1	⋮
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 in the Dialog Semiconductor IoT platform. It features two overlapping windows. The background window, titled 'Devices', shows a list of discovered devices. The device 'Discovered-BACnet-151_TP1273-15155-1' is highlighted with a red circle. The foreground window, titled 'Device: Discovered-BACnet-151_TP1273-15155-1::15155', shows the details for this device. The 'Name' field is highlighted with a red circle and contains the text 'Titon Sensor Fourth Floor'. The 'Device category' is set to 'Edge Device'. The 'Group' field is empty. The 'Latitude' is 51.4964 and the 'Longitude' is -0.1224. The 'Integration method' is 'Manual assignment'. The 'Owner' is 'SmartServer IoT' and the 'Driver' is 'BACnet'. The 'Device type' is 'BACnet-151_TP1273' and the 'Firmware Version' is '1.1.11'. The 'Model Number' field is empty. The 'NEXT' button is highlighted with a red circle.

Devices

Discovered-BACnet-151_TP1273-15155-1
Edge Device

Discovered-BACnet-178_LIOB-550-17800-1
Edge Device

Device: Discovered-BACnet-151_TP1273-15155-1::15155

Name*
Titon Sensor Fourth Floor

Device category*
Edge Device

Group

Latitude*
51.4964

Longitude*
-0.1224

CANCEL NEXT

Device: Titon Sensor Fourth Floor::15155

UID
15155

Integration method*
Manual assignment

Owner*
SmartServer IoT

Driver*
BACnet

Device type*
BACnet-151_TP1273


Firmware Version
1.1.11

Model Number

CANCEL BACK SAVE

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

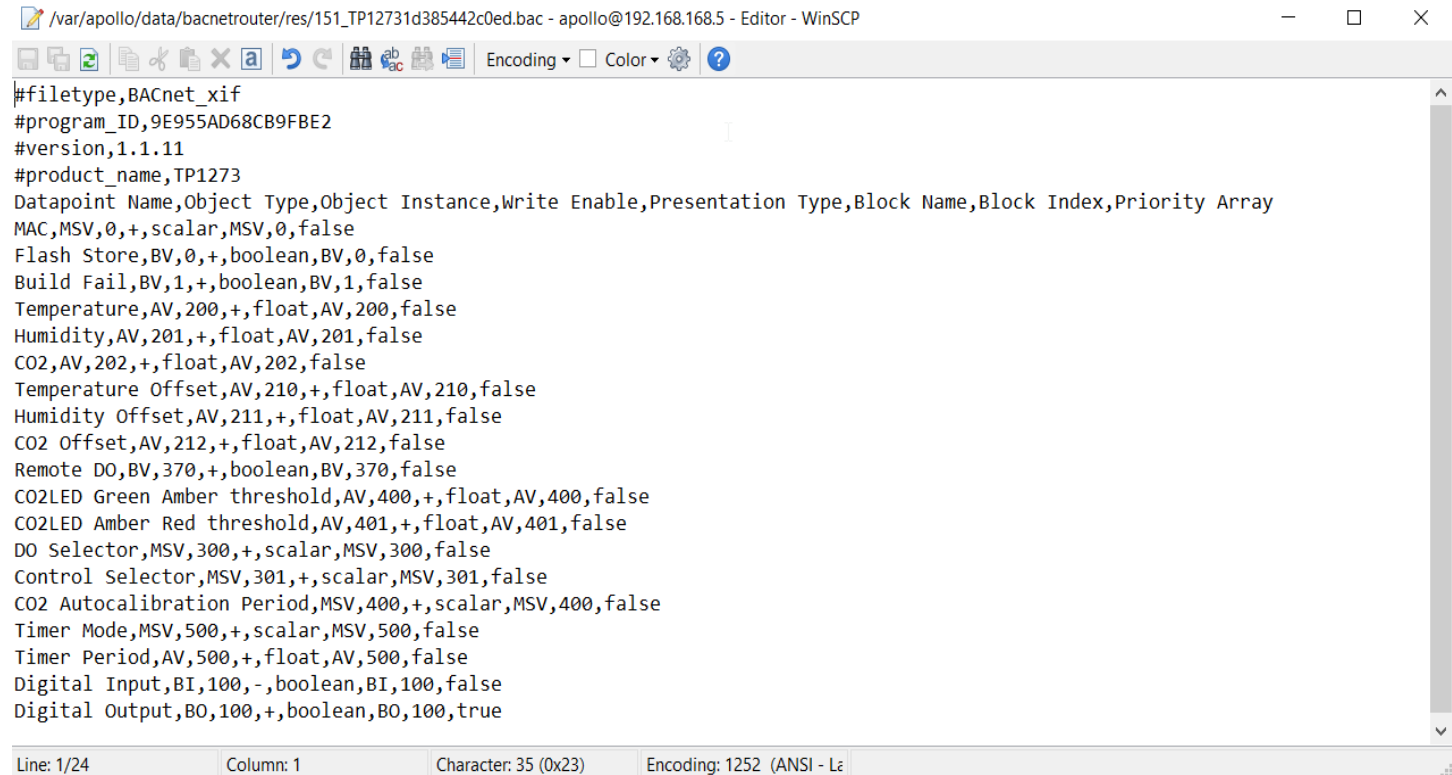
- The BACnet external interface files (*.bac) can be found in /var/apollo/data/bacnetrouter/res
- CSV format



/var/apollo/data/bacnetrouter/res/		
Name	Size	Changed
..		22/12/2021 13:16:59
151_TP12731d385442ded.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 with the title bar indicating the file path: `/var/apollo/data/bacnetrouter/res/151_TP12731d385442c0ed.bac`. The editor displays a configuration file with the following content:

```
#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,BO,100,+,boolean,BO,100,true
```

The status bar at the bottom of the editor shows: Line: 1/24, Column: 1, Character: 35 (0x23), Encoding: 1252 (ANSI - L).

Data Browser Widget

The screenshot displays the 'Data Browser Widget' interface. On the left, the 'Devices' list includes:

- LoRaGateway Edge Device
- Loytec IO Plant Room Edge Device
- SmartServer IoT Segment Controller
- Titon Sensor Fourth Floor Edge Device (selected)
- iox1.dio

A context menu is open for the selected device, with the following options:

- Deprovision device
- Reprovision device
- View device dashboard
- View datapoints (highlighted with a red circle)
- Replace device

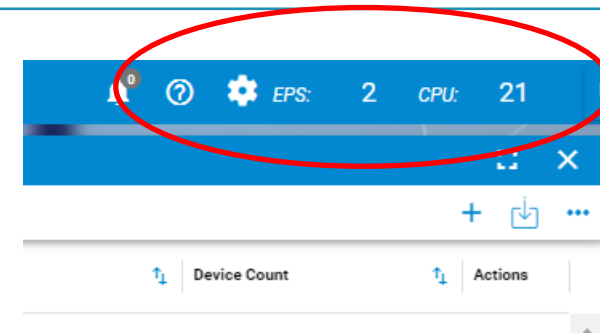
The 'Datapoint Browser' for the 'Titon Sensor Fourth Floor' device is shown on the right. The header indicates a polling rate of '30 s.' (highlighted with a red circle). The table below lists the datapoints:

Device	Block	Block Index	Datapoint	Value	Preset	Actions
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

A screenshot of the 'Datapoint Properties' table in the SmartServer interface. The table lists various datapoints with columns for Device Type, Block Name, Block Index, Datapoint XOF Name, Datapoint Type, Monitored, Logged, and Alarmed. A red box highlights the 'Edit' and 'Export' buttons in the Actions column for the first row.

Device Type	Block Name	Block Index	Datapoint XOF Name	Datapoint Type	Monitored	Logged	Alarmed	Actions
BACnet-151_TPI273	BV	1	Build Fail	boolean	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	202	CO2	float	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	MSV	400	CO2 Auto calibration Period	scalar	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	212	CO2 Offset	float	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	401	CO2LED Amber Red threshold	float	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	400	CO2LED Green Amber threshold	float	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	MSV	301	Control Selector	scalar	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	MSV	300	DO Selector	scalar	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	BI	100	Digital Input	boolean	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	BO	100	Digital Output	boolean	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	BV	0	Flash Store	boolean	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	201	Humidity	float	OFF	OFF	OFF	Edit Export
BACnet-151_TPI273	AV	211	Humidity Offset	float	OFF	OFF	OFF	Edit Export
BACnet-178_LUOB-550	AO	1001	L1 1 A01	float	OFF	OFF	OFF	Edit Export
BACnet-178_LUOB-550	AI	1009	L1 1 A01 FEEDBACK	float	OFF	OFF	OFF	Edit Export

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				
✓	BACnet-151_TP1273	AV	202	CO2	float	Off	Off	Off				
✓	BACnet-151_TP1273	MSV	400	CO2 Autocalibration Period	scalar	Off	Off	Off				
✓	BACnet-151_TP1273	AV	212	CO2 Offset	float	Off	Off	Off				
✓	BACnet-151_TP1273	AV	401	CO2LED Amber Red threshold	float	Off	Off	Off				
✓	BACnet-151_TP1273	AV	400	CO2LED Green Amber threshold	float	Off	Off	Off				
✓	BACnet-151_TP1273	MSV	301	Control Selector	scalar	Off	Off	Off				
✓	BACnet-151_TP1273	MSV	300	DO 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_LI0B-550	AO	1001	L1 1 AO1	float	Off	Off	Off				
✓	BACnet-178_LI0B-550	AI	1009	L1 1 AO1 FEEDBACK	float	Off	Off	Off				

Rows per page: 25 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

Multiple
0

Minimum Interval (Seconds)
0

Expected Interval (Seconds)
0

Retention Period (Days)
14

Log 2

Multiple
0

Minimum Interval (Seconds)
0

Expected Interval (Seconds)
0

Retention Period (Days)
60

Log 3

Multiple
0

Minimum Interval (Seconds)
0

Expected Interval (Seconds)
0

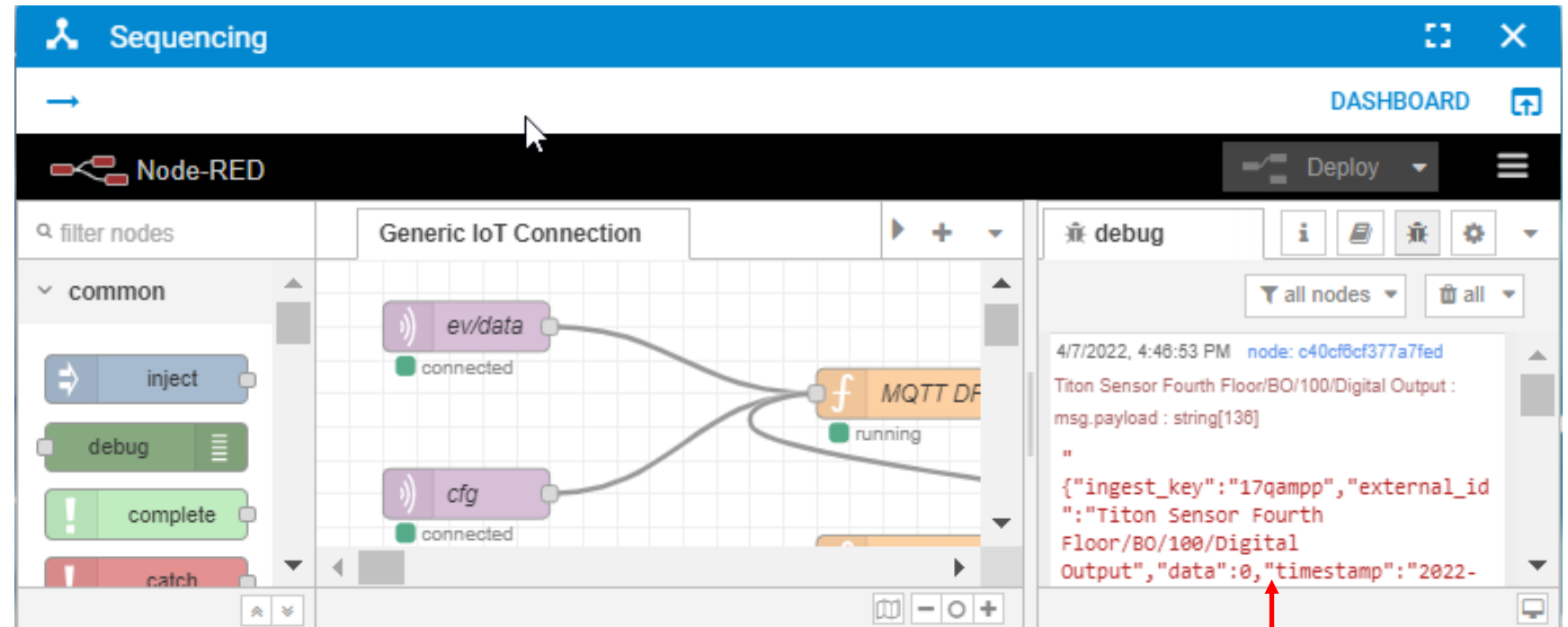
Retention Period (Days)
730

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

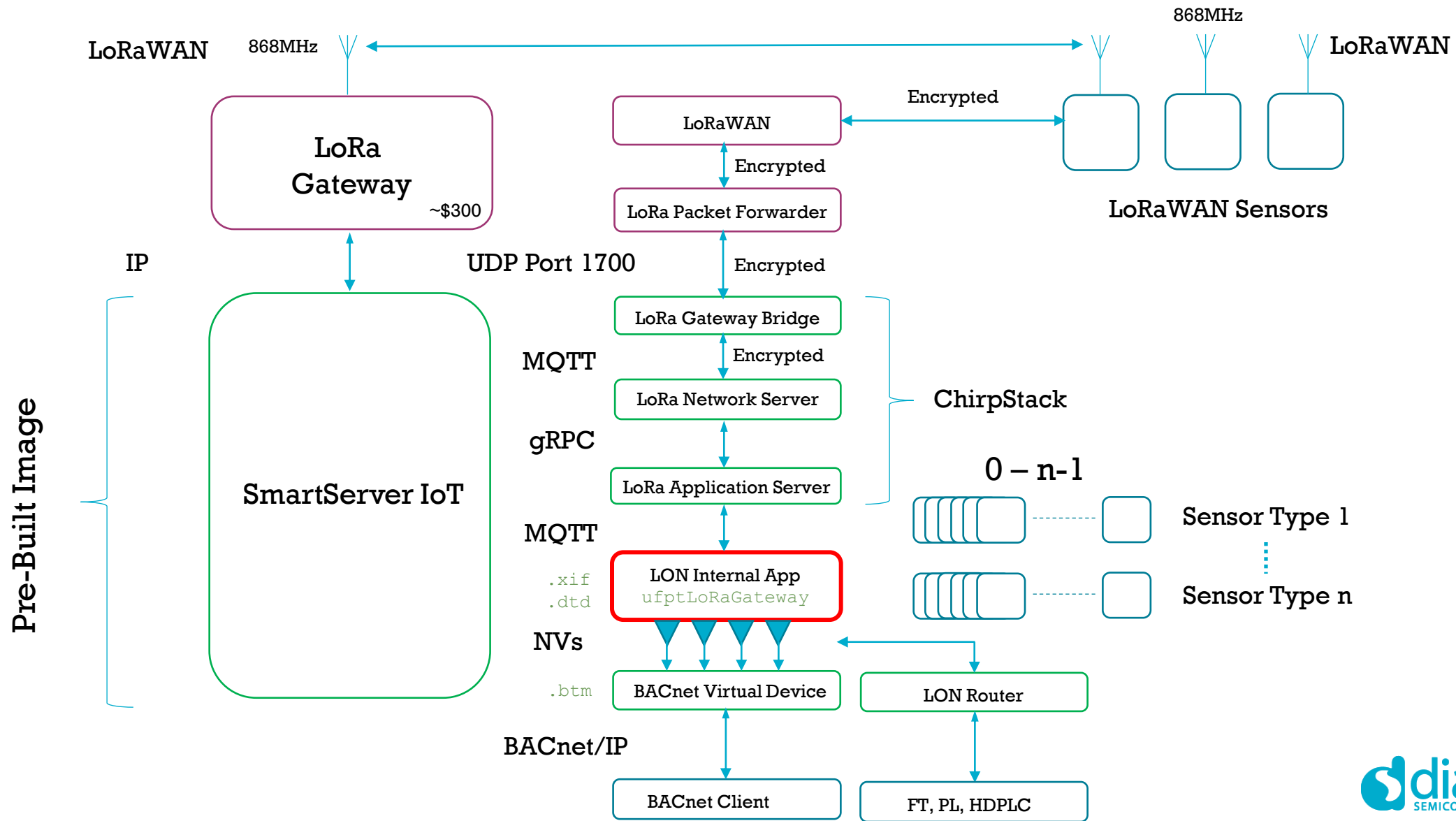
Detailed Configuration Instructions

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":"AQEBHgJUEtkAAAA=","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":"AQEBHgJUEuAAAA=","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":"AQEBHgJUEvoAAAA=","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":"AQEBHgJYEvgAAAA=","object":{"Humidity":48.56,"Temperature":22.64,"Volts":3}}
application/2/device/a81758fffe04ab14/event/up {"applicationID":"2","applicationName":"Sensors","deviceName":"Elsys_ERS_CO2","devEUI":"a81758fffe04ab14","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":"AQEBHgJqEu8AAAA=","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
00000,"dr":0},"adr":true,"fCnt":1071,"fPort":6,"data":"AQEBHgJwEuUAAAA=","object":{"Humidity":48.37,"Temperature":22.88,"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":1072,"fPort":6,"data":"AQEBHgJ0EtYAAAA=","object":{"Humidity":48.22,"Temperature":22.92,"Volts":3}}
application/2/device/00137a100000d1c1/event/up {"applicationID":"2","applicationName":"Sensors","deviceName":"Netvox_R712B","devEUI":"00137a100000d1c1","txInfo":{"frequency":8679
00000,"dr":0},"adr":true,"fCnt":1073,"fPort":6,"data":"AQEBHgJ3EssAAAA=","object":{"Humidity":48.11,"Temperature":22.95,"Volts":3}}
application/2/device/a81758fffe04ab14/event/up {"applicationID":"2","applicationName":"Sensors","deviceName":"Elsys_ERS_CO2","devEUI":"a81758fffe04ab14","txInfo":{"frequency":867
100000,"dr":0},"adr":true,"fCnt":163,"fPort":5,"data":"AQDdAjAEAxEFAAYCvwcoHA==","object":{"co2":703,"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/Eq4AAAA=","object":{"Humidity":47.82,"Temperature":23.03,"Volts":3}}
```

Base64 data


application/2/device/00137a100000c425/event/up

App ID DEVEUI Uplink Decoded JSON Object

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

Configure MultiTech Gateway – Initialize

← → ↻ ⚠ Not secure | 192.168.2.1/commissioning ☆ M ⋮



mPower™ Edge Intelligence Conduit AP

Commissioning Mode

Username:

OK

The following steps must be followed to register your first administrator user. You must specify a username and a password to continue configuring the device.

You must specify a valid username and specify a password that meets the complexity requirements.

The username may contain only alpha-numeric (A-Z, a-z, 0-9), dot, hyphen and underscore characters and must not start with a hyphen character.

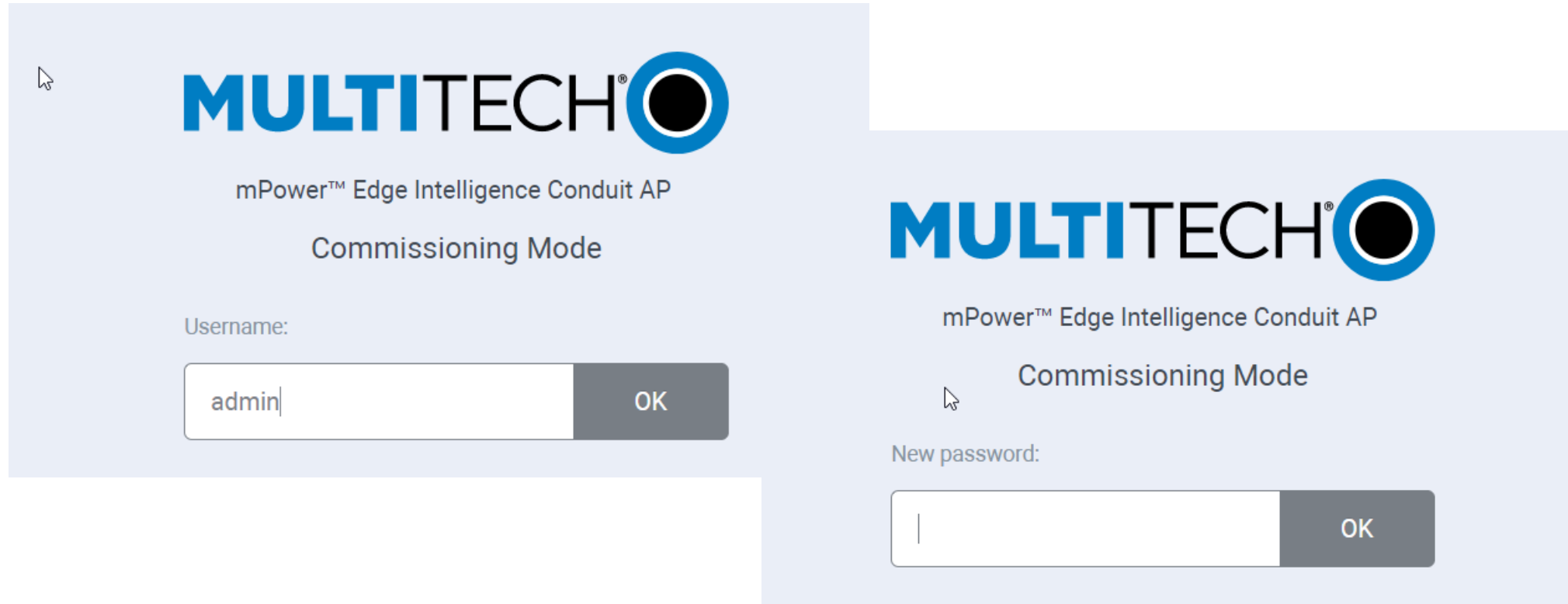
The user password must meet the complexity requirements and be at least 8 characters and contain three or more different types of characters:

- uppercase alphabetical characters (A through Z)
- lowercase alphabetical characters (a through z)
- numerals (0 through 9)
- special characters

The password must not contain any common dictionary word.

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Configure MultiTech Gateway – Initialize (cont.)



MULTITECH[®]

mPower™ Edge Intelligence Conduit AP

Commissioning Mode

Username:

admin | OK

MULTITECH[®]

mPower™ Edge Intelligence Conduit AP


Commissioning Mode

New password:

| OK

Configure MultiTech Gateway – Initialize (cont.)

← → ↻ ⚠ Not secure | 192.168.2.1/sign-in ☆ ⓘ ⋮



mPower™ Edge Intelligence Conduit AP

Please fill out this field.

This system is for the use of authorized users only. Individuals using this system without authority, or in excess of their authority, are subject to having all their activities on this system monitored and recorded by system personnel.
Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity, system personnel may provide the evidence of such monitoring to law enforcement officials.

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Configure MultiTech Gateway – Initialize (cont.)

Do not use the First-Time Setup Wizard



Configure MultiTech Gateway – Setup eth0




← → ↻ ⚠ Not secure | 192.168.2.1/setup/network/interfaces ☆ M ⋮

MULTITECH
mPower™ Edge Intelligence Conduit AP - Application Enablement Platform
MTCAP-L4E1-868-041A Firmware 5.2.1

admin as administrator

[Home](#)
[Save and Apply](#)
[LoRaWAN ®](#)
[Setup](#)
[Network Interfaces](#)
[WAN Configuration](#)
[Global DNS](#)
[DDNS Configuration](#)
[DHCP Configuration](#)
[SMTP Configuration](#)
[SNMP Configuration](#)
[Time Configuration](#)
[Cellular](#)
[Firewall](#)
[SMS](#)
[Tunnels](#)
[Administration](#)
[Status & Logs](#)

NETWORK INTERFACES CONFIGURATION ⓘ [Reset To Default](#)

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.)

← → ↻ Not secure | 192.168.2.1/setup/network/interfaces/eth0 ☆ M

MULTITECH mPower™ Edge Intelligence Conduit AP - Application Enablement Platform
MTCAP-L4E1-868-041A Firmware 5.2.1 admin as administrator

Home
Save and Apply
LoRaWAN®
Setup
 Network Interfaces
 WAN Configuration
 Global DNS
 DDNS Configuration
 DHCP Configuration
 SMTP Configuration
 SNMP Configuration
 Time Configuration
 Cellular
 Firewall
 SMS
 Tunnels
 Administration
 Status & Logs

NETWORK INTERFACE CONFIGURATION - ETH0 ?

Direction	Bridge
LAN	br0

Submit Cancel

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

← → ↻ ⚠ Not secure | 192.168.168.3/setup/network/interfaces/eth0 ☆ M Update

MULTITECH mPower™ Edge Intelligence Conduit AP - Application Enablement Platform
MTCAP-868-041A Firmware 5.1.6 admin as administrator

Home
Save And Restart
LoRaWAN®
Setup
Network Interfaces
Global DNS
DDNS Configuration
DHCP Configuration
SMTP Configuration
SNMP Configuration
Time Configuration
Firewall
Tunnels
Administration
Status & Logs

NETWORK INTERFACE CONFIGURATION - ETH0

Direction
WAN

IPv4 Settings

Mode Static	Gateway 192.168.1.1
IP Address 192.168.1.60	Primary DNS Server 8.8.8.8
Mask 255.255.255.0	Secondary DNS Server 4.4.4.4

Submit **Cancel**

Configure MultiTech Gateway – Set As LoRa Packet Forwarder

- Make a note of the Gateway EUI

- As required

The screenshot shows the MultiTech mPower Edge Intelligence Conduit AP web interface. The browser address bar shows the URL 192.168.123.187/lora/network. The page title is "mPower™ Edge Intelligence Conduit AP - Application Enablement Platform". The user is logged in as "admin as administrator".

The left sidebar contains the following menu items: Home, Save And Restart, LoRaWAN®, Network Settings, Setup, Firewall, Tunnels, Administration, Status & Logs, Commands, Apps, and Help.

The main content area is titled "LORAWAN NETWORKING". It contains several sections:

- LoRa Mode**: A table with four columns: Mode, Packet Forwarder, Network Server, and Lens Server. The Mode is set to "PACKET FORWARDER" (circled in red). The Packet Forwarder is "4.0.1-r26.0". The Network Server is "2.3.0". The Lens Server is "2.3.0". Below the table is a "Restart LoRa Services" button and a "Status" column with a "RUNNING" status (circled in red).
- LoRa Card Information**: A table with two columns: Gateway EUI and Frequency Band. The Gateway EUI is "00-80-00-00-01-9C-85" (circled in red). The Frequency Band is "868".
- LoRa Packet Forwarder Configuration**: A section with a "Manual Configuration" link. It contains a "Gateway Info" table with two columns: UUID and Serial Number. The UUID is "6F083F56-1884-E2F0-12EC-CE9A05B52FF1" and the Serial Number is "20980528".
- SX1301**: A section with a "Channel Plan" dropdown menu set to "EU868" (circled in red) and an "Additional Channels 1 (MHz)" input field with the value "867.5".
- Basics**: A section with an "Intervals" table containing a "Keep Alive Interval (s)" input field.

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

Server Address: 192.168.1.50
Upstream/Downstream Port: 1700

LoRaWAN Networking

Not secure | 192.168.123.187/lora/network

Channel Plan: EU868

Additional Channels 1 (MHz): 867.5

Basics

☒ Public

Gateway ID Source: Manual

Gateway ID: 008000000019C85

Packet Forwarder Path: /opt/lora/lora_pkt_fwd

Intervals

Keep Alive Interval (s): 10

Stat Interval (s): 20

Push Timeout (ms): 100

Autoquit Threshold: 60

Server

Network: Manual

Server Address: 192.168.1.50

Upstream Port: 1700

Downstream Port: 1700

Forward CRC

☐ Forward CRC Disabled

☒ Forward CRC Error

☒ Forward CRC Valid

Submit **Reset To Default**

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Configure MultiTech Gateway – Set WAN Access

← → ↻ ⚠ Not secure | 192.168.168.3/administration/access-configuration ☆ M Update

MULTITECH mPower™ Edge Intelligence Conduit AP - Application Enablement Platform
MTCAP-868-041A Firmware 5.1.6 admin as administrator

Home
Save And Restart
LoRaWAN®
Setup
Firewall
Tunnels
Administration
User Accounts
Self-Diagnostics (beta)
Access Configuration
RADIUS Configuration
X.509 Certificate
X.509 CA Certificates
Remote Management
Notifications

ACCESS CONFIGURATION ?

Web Server

HTTP Redirect to HTTPS

☒ Enabled
☐ Via LAN
☒ Via WAN
Port: 80

HTTPS

☒ Via WAN
Port: 443

Authorization

Session Timeout (minutes): 5

HTTPS Security

[Show ↓](#)

SSH Settings

☐ Enabled
Port: 22
☐ Via LAN
☐ Via WAN

SSH Security

[Show ↓](#)


Reverse SSH Tunnel

☐ Enabled
Server:
Remote Port: 2222

Scroll Down and
Click Submit then
Click Save and
Restart



Configuring RAK7258



Status

Network

Ethernet Port

WAN Interface

Wi-Fi

Diagnostics

Firewall

Multi WAN

Channel Plan

LoRa Network

Services

System

WisDM

WAN Interface

Status

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.


UNSAVED CHANGES: 2

AUTO REFRESH ON

Logout

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Configuring RAK7258 (continued)



UNSAVED CHANGES: 2

Logout

Status

Network

Channel Plan

LoRa Network

Network Settings

Services

System

WisDM

LoRaWAN Network Settings

Gateway EUI

ac1f09fffe05225f

Mode

Packet Forwarder

Log Level

NOTICE

Packet Forwarder Settings

General Setup

Packet Filter

GPS Information

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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70

Configuring RAK7258 (continued)



Status

Network

Channel Plan

LoRa Network

Network Settings

Services

System

WisDM

UNSAVED CHANGES: 2

Logout

General Setup

Packet Filter

GPS Information

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

☐

Data messages are automatically stored when the connection to the server is lost

DGRAM MTU

1400

Auto-restart Threshold

30

Packet forwarder will automatically restart when the keepalive timeout exceeds this threshold. Set '0' to disable

Is LoRaWAN Network

YES

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Configuring RAK7258 (continued)

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

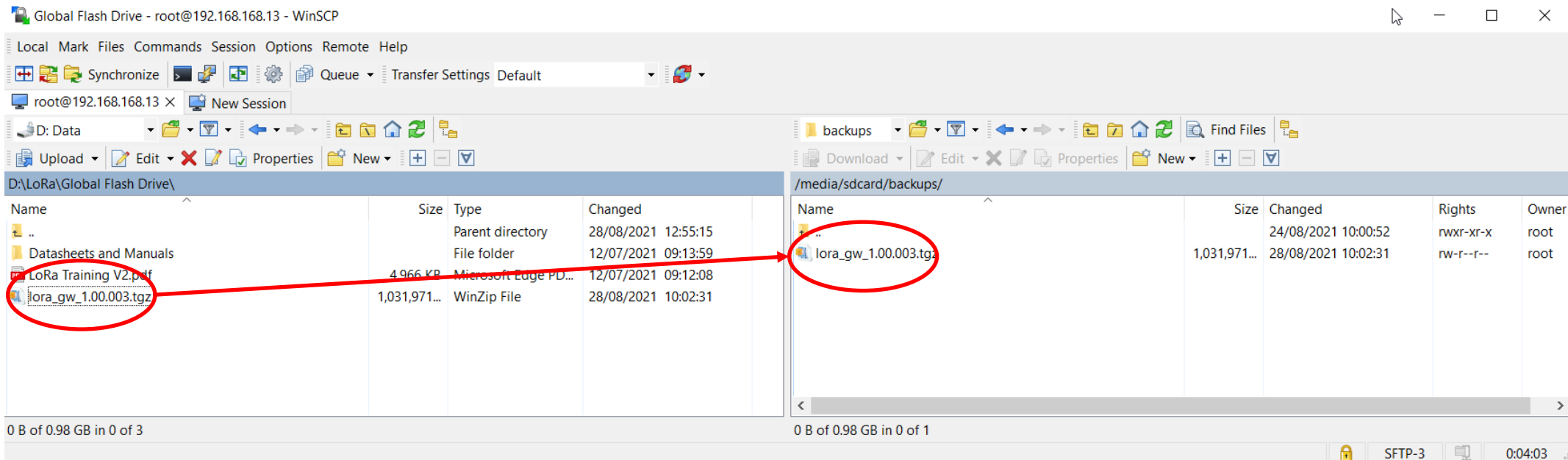
The screenshot shows the RAK7258 web interface. The browser address bar displays a URL starting with 'https://192.168.1.60/cgi-bin/luci/stok=2ae90becb901cc5e7174a51947db/admin/loraradio'. The interface has a dark sidebar on the left with the RAK logo and navigation links: Status, Network, Channel Plan (highlighted), LoRa Network, Services, System, and WisDM. The main content area is titled 'Channel Plan' and contains the following settings:

- Region: A dropdown menu showing 'US902-928'.
- LoRaWAN Public: A toggle switch that is currently turned on.
- Standard Mode: A button labeled 'Switch to Advanced Mode'.
- Frequency Sub-Band: A dropdown menu showing 'channel 0 ~ channel 7, channel 64'.

At the bottom right of the configuration area, there are two buttons: 'Save & Apply' and 'Reset'.

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

Storage

Internal Flash Memory

Total Mem...	Memory In ...	Available M...
3847	MB 2483	MB 1135

Data Log Size: 0.0390625 MB
Event Log Size: 0.015625 MB

SD-Card Memory

FORMAT ERASE BACKUP **RESTORE**

Restore

SYSTEM DATABASE **CLONE**

Restore *
/media/sdcard/backups/lora_gw.tgz

CANCEL **RESTORE**

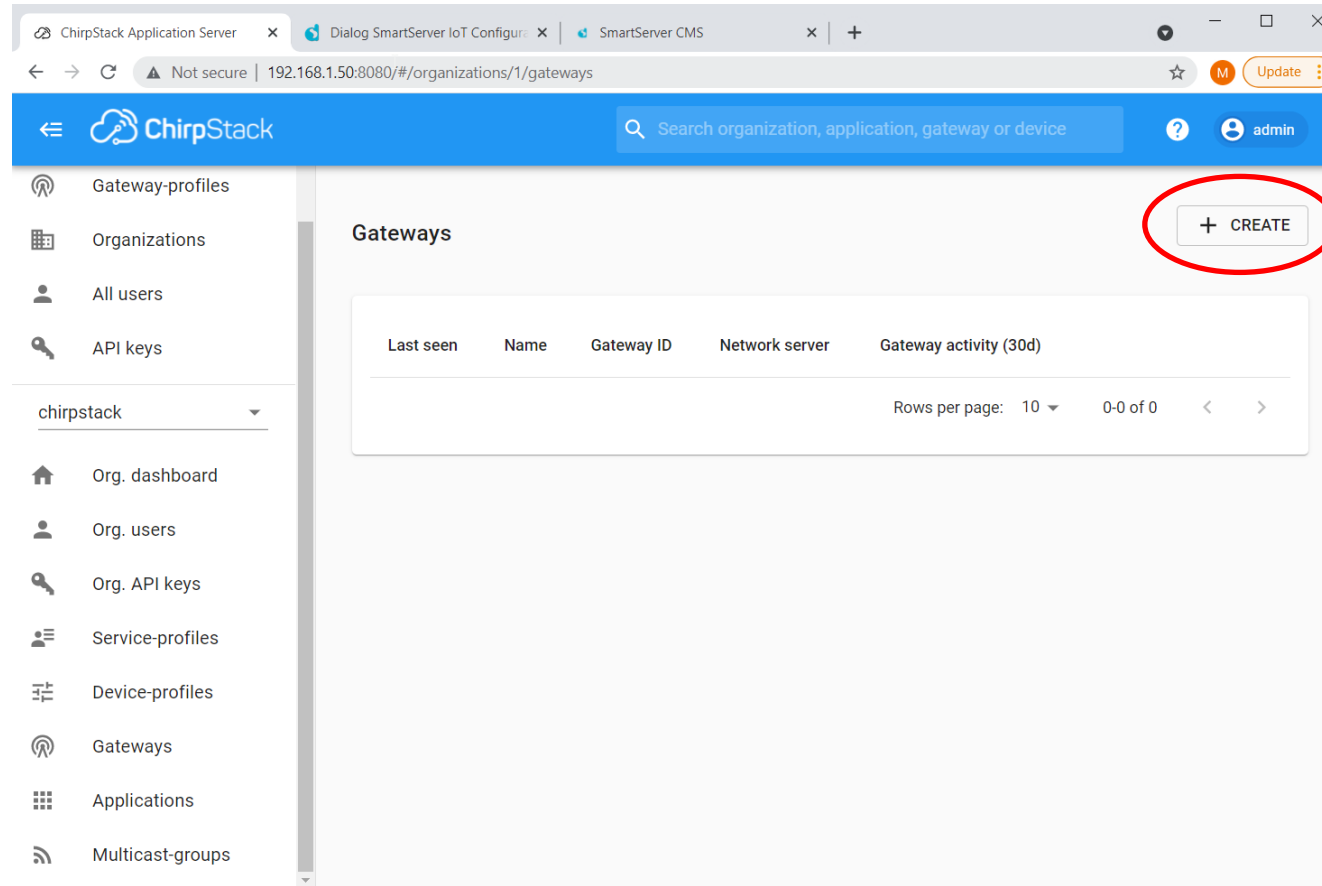
```
COM25 - PuTTY
Ubuntu 16.04.7 LTS smartserver-17qdkkc ttymsc3
smartserver-17qdkkc login: █
```

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



Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot displays the ChirpStack web interface for creating a new gateway. The interface has a blue header with the ChirpStack logo, a search bar, and a user profile for 'admin'. A left sidebar contains navigation links for Dashboard, Network-servers, Gateway-profiles, Organizations, All users, and API keys. Below these is a dropdown menu for 'chirpstack' with sub-links for Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups. The main content area is titled 'Gateways / Create' and features three tabs: GENERAL, TAGS, and METADATA. The GENERAL tab is active and contains the following fields:

- Gateway name ***: MultiTech-MTCAP-868. A note below states: 'The name may only contain words, numbers and dashes.'
- Gateway description ***: My Gateway
- Gateway ID ***: 00 80 00 00 00 01 9C 85. A 'MSB' button and a refresh icon are to the right.
- Network-server ***: SmartServer IoT. A note below states: 'Select the network-server to which the gateway will connect. When no network-servers are available in the dropdown, make sure a service-profile exists for this organization.'
- Service-profile**: SmartServer. A note below states: 'Select the service-profile under which the gateway must be added. The available service-profiles depend on the selected network-server, which must be selected first.'
- Gateway-profile**: MultiTech MTCAP-868. A note below states: 'Optional. When assigning a gateway-profile to the gateway, ChirpStack Network Server will attempt to update the gateway according to the gateway-profile. Note that this does require a gateway with ChirpStack Concentratord.'
- ☐ Gateway discovery enabled

The browser's address bar at the bottom shows the URL: 192.168.1.50:8080/#/organizations/1/gateways

Creating LoRaWAN Gateway in Chirpstack (cont.)

The screenshot displays the ChirpStack web interface for configuring a gateway. The top navigation bar includes the ChirpStack logo, a search bar, and a user profile labeled 'admin'. The left sidebar lists various system components: Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack' which contains links to Org. dashboard, Org. users, Org. API keys, Service-profiles, Device-profiles, Gateways, Applications, and Multicast-groups.

The main content area is titled 'MultiTech MTCAP-868' and contains the following configuration options:

- ☐ Gateway discovery enabled
When enabled (and ChirpStack Network Server is configured with the gateway discover feature enabled), the gateway will send out periodical pings to test its coverage by other gateways in the same network.
- Gateway altitude (meters) *
0
When the gateway has an on-board GPS, this value will be set automatically when the network has received statistics from the gateway.
- Gateway location ([set to current location](#))
A map interface with a blue location pin. The map is powered by Leaflet and OpenStreetMap contributors.

At the bottom of the configuration area, there are two buttons: 'ADD BOARD CONFIGURATION' and 'CREATE GATEWAY'. The 'CREATE GATEWAY' button is circled in red.

Creating LoRaWAN Devices in ChirpStack

←

ChirpStack

Search organization, application, gateway or device

?

admin

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

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 ↺

Device-profile *
Elsys ERS_CO2

☐ 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. The top navigation bar is blue with the ChirpStack logo and a search bar. The left sidebar contains a menu with icons and labels for various sections: Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown 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 breadcrumb 'Applications / Sensors / Devices / ERS_CO2' and a 'DELETE' button. Below this is a tabbed interface with 'KEYS (OTAA)' selected. The 'Application key *' field contains the hexadecimal string 'f7 8a f4 e1 a7 fa b2 25 3b c1 38 60 9f 40 ae 7d'. To the right of the key are icons for 'MSB', refresh, copy, and delete. A red circle highlights the 'SET DEVICE-KEYS' button in the bottom right corner of the key field.

ChirpStack

Search organization, application, gateway or device

admin

Applications / Sensors / Devices / ERS_CO2

DELETE

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

MSB

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

SET DEVICE-KEYS

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 dashboard interface. The browser address bar indicates the URL `192.168.168.19/cms/#/dashboard`. The dashboard includes a sidebar with navigation options: GROUPS, DEVICES, CALENDAR, ALARMS, STORAGE, DATAPPOINT BROWSER, DATAPPOINT PROPERTIES, DEVICE TYPES, and ZONES. The main content area displays several widgets: 'Devices' (listing LoRaGateway and SmartServer IoT), 'Device Types' (listing various device types like IOX_DIO, IOX_METER, etc.), 'Datapoint Browser' (showing a table of datapoints with columns for Device, Block name, Block index, Datapoint name, and Datapoint XIF name), 'Datapoint Properties' (showing monitoring traffic and logged bytes), 'Groups' (showing Group 1), and 'Zones'.

A red arrow points from the text 'Ensure polling rate is set to 0 while in use to reduce MQTT traffic' to the '0 s.' value in the 'Datapoint Browser' widget's polling rate field, which is circled in red.

Device	Block name	Block index	Datapoint name	Datapoint XIF name
LoRaGateway	MCF_LW12MET	0	nviLoadCtl1_1	nviLoadCtl1
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 displays the SmartServer IoT dashboard interface. The top navigation bar includes a search icon, a star, a user profile icon, and an 'Update' button. The main content area is divided into several panels:

- Groups:** A sidebar menu on the left with options: GROUPS, DEVICES, CALENDAR, ALARMS, STORAGE, DATAPPOINT BROWSER, DATAPPOINT PROPERTIES, DEVICE TYPES, and ZONES.
- Devices:** A panel showing a list of devices. The first device is 'LoRaGateway' (Edge Device) and the second is 'SmartServer IoT' (Segment Controller).
- Device Types:** A table listing device types and their associated drivers and counts.
- Datapoint Browser:** A table showing data points for the 'LoRaGateway' device, including block names, indices, and data point names.
- Datapoint Properties:** A panel showing properties for the 'Driver' (All), including monitoring traffic, logged bytes, and log size.
- Groups:** A panel showing a search bar and a list of groups.
- Zones:** A panel showing a search bar and a list of zones.

The bottom status bar shows the user 'Apollo Owner', a warning icon with the number 4, a red circle with the number 0, and a 'LOGOUT' button.

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

Device	Block name	Block index	Datapoint name	Datapoint XIF name
LoRaGateway	MCF_LW12MET	0	nviLoadCtl1_1	nviLoadCtl
LoRaGateway	MCF_LW12MET	0	nvoActEnergy_1	nvoActEnergy
LoRaGateway	MCF_LW12MET	0	nvoActPwr_1	nvoActPwr
LoRaGateway	MCF_LW12MET	0	nvoAppEnergy_1	nvoAppEnergy

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

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

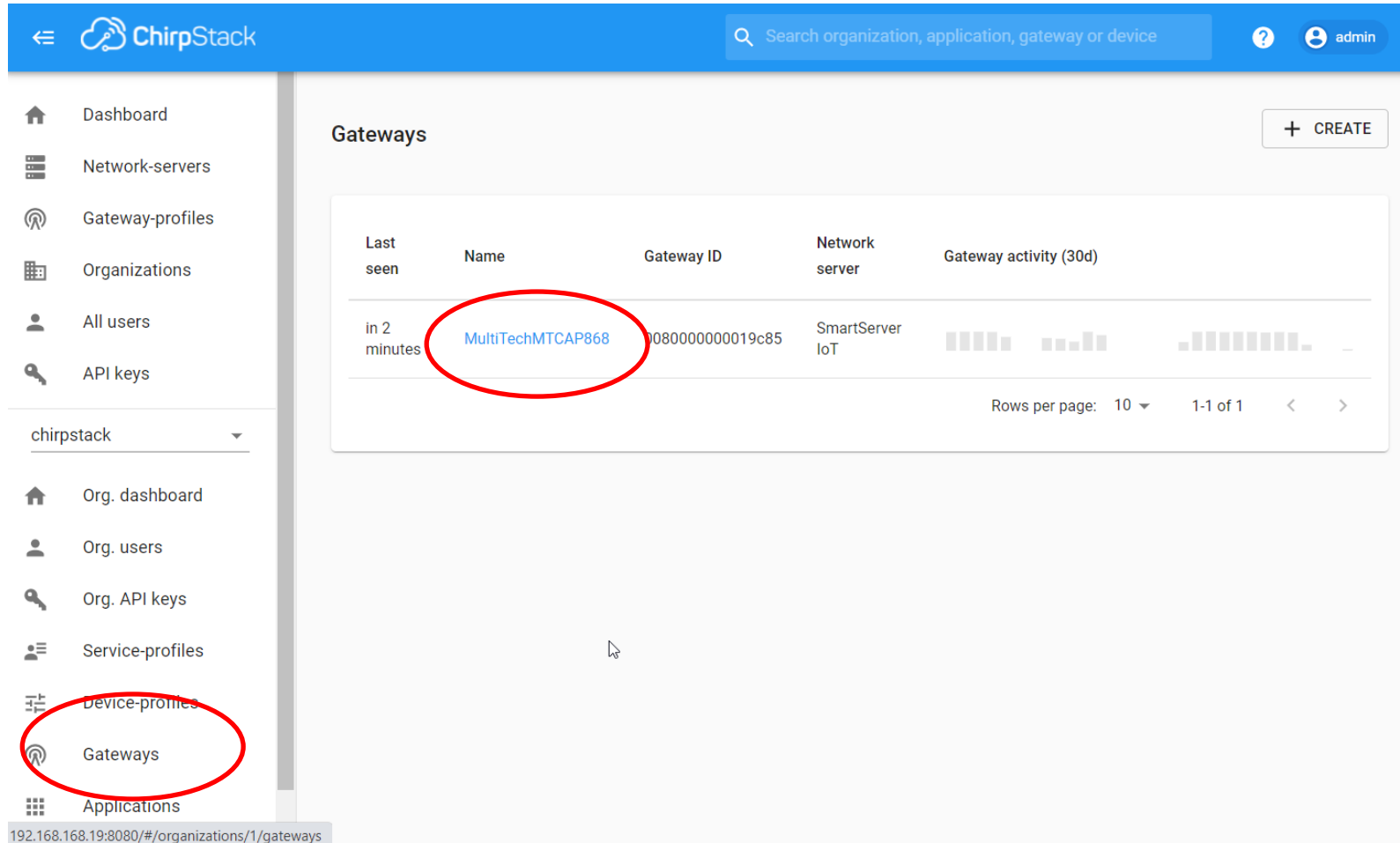
IMBuildings keys are typically set by supplier

IMBuildings TX rates are set using their NFC Android app


MileSight keys are typically set by the supplier

Use NFC app to configure devices

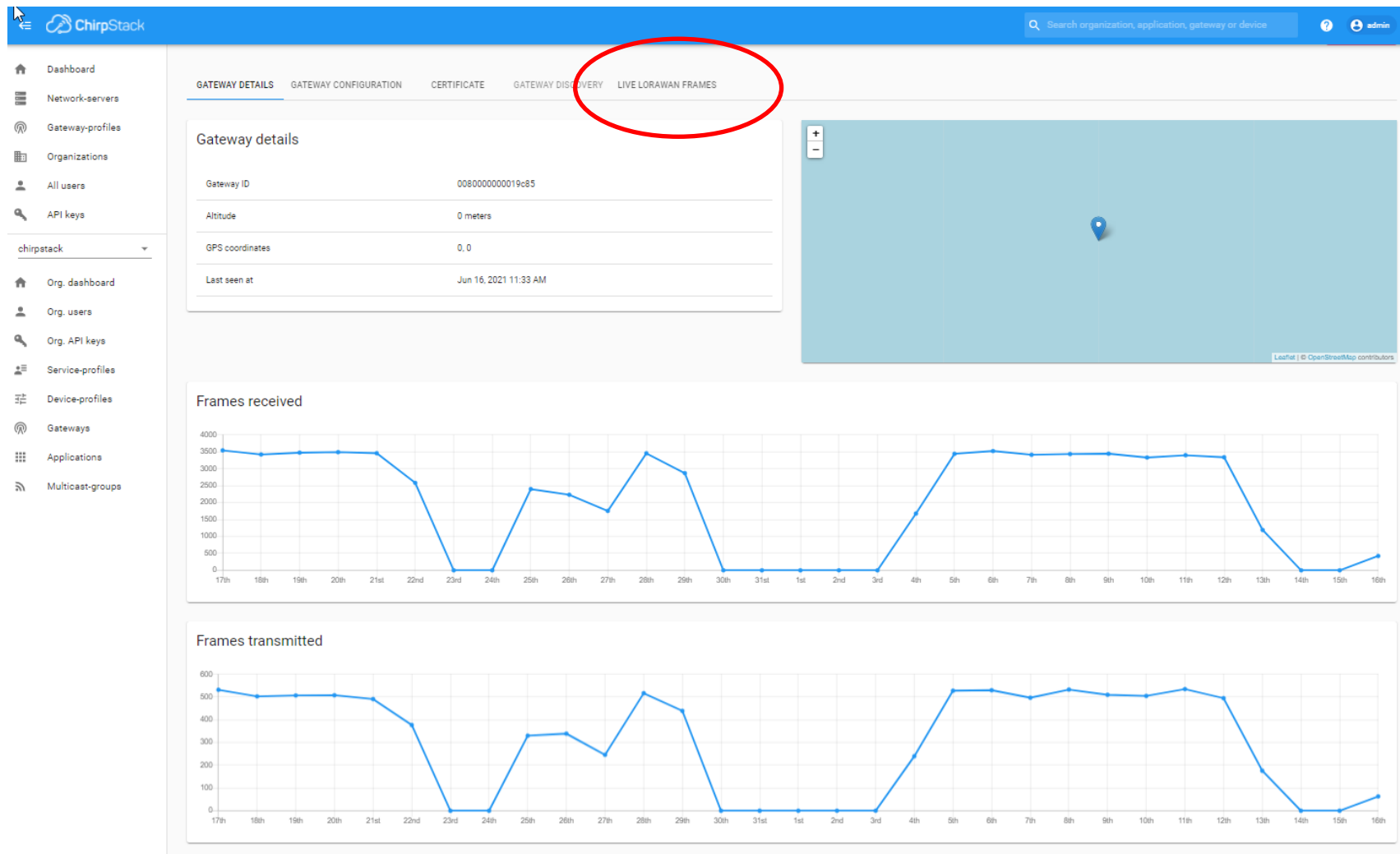
Testing The Gateway



The screenshot displays the ChirpStack web interface. The top navigation bar is blue with the ChirpStack logo, a search bar, and a user profile labeled 'admin'. The left sidebar contains a list of navigation items: Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack'. The 'chirpstack' dropdown is open, showing 'Org. dashboard', 'Org. users', 'Org. API keys', 'Service-profiles', 'Device-profiles', 'Gateways' (circled in red), and 'Applications'. The main content area is titled 'Gateways' and features a '+ CREATE' button. Below this is a table with the following columns: Last seen, Name, Gateway ID, Network server, and Gateway activity (30d). The table contains one row with the following data: 'in 2 minutes' for Last seen, 'MultiTechMTCAP868' for Name (circled in red), '0080000000019c85' for Gateway ID, 'SmartServer IoT' for Network server, and a bar chart for Gateway activity. The bottom of the sidebar shows the URL '192.168.168.19:8080/#/organizations/1/gateways'.

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

Testing The Gateway (cont.)



Testing The Gateway – Live Frames

ChirpStack

Search organization, application, gateway or device

admin

Gateways / MultiTechMTCAP868

DELETE

GATEWAY DETAILS GATEWAY CONFIGURATION CERTIFICATE GATEWAY DISCOVERY **LIVE LORAWAN FRAMES**

HELP PAUSE DOWNLOAD CLEAR

UPLINK	11:37:21 AM	UnconfirmedDataUp	01bd0b73	▼
UPLINK	11:36:19 AM	UnconfirmedDataUp	01bd0b73	▼
UPLINK	11:35:46 AM	UnconfirmedDataUp	01aafec4	▼
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 web interface. The breadcrumb navigation at the top reads "Applications / Sensors", which is circled in red. The left sidebar contains a list of navigation items, with "Gateways" and "Applications" circled in red. The main content area displays a table of sensors under the "DEVICES" tab. The table has columns for "Last seen", "Device name", "Device EUI", "Device profile", "Link margin", and "Battery".

Last seen	Device name	Device EUI	Device profile	Link margin	Battery
in a minute	ERS_CO2_0	a81758fffe04ab14	Elsys ERS_CO2	n/a	n/a
2 minutes ago	ERS_CO2_Lite_0	a81758fffe0537a1	Elsys ERS_CO2_Lite	n/a	n/a
in a minute	ERS_Eye_0	a81758fffe04d037	Elsys ERS_Eye	n/a	n/a
in 2 minutes	ERS_Lite_0	a81758fffe04b47c	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	MCClimate 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	D313WA_0	00137a100000f887	Netvov D313WA	n/a	n/a

Testing Specific Devices

The screenshot shows the ChirpStack web interface. The top navigation bar includes the ChirpStack logo, a search bar, and a user profile icon labeled 'admin'. The left sidebar contains a menu with items like Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and various organizational settings. The main content area displays the breadcrumb 'Applications / Sensors / Devices / ERS_CO2_0' and a 'DELETE' button. Below this are tabs for DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES. The 'LORAWAN FRAMES' tab is circled in red. The 'Details' section shows the device name 'ERS_CO2_0', description 'ERS_CO2_0', and a link to the device profile. The 'Status' section shows the last seen time as 'Jun 16, 2021 11:39 AM' and the state as 'enabled'. The 'Enqueue downlink payload' section includes a 'Port' field with a note that the value must be greater than 0, a 'Confirmed downlink' checkbox which is circled in red, and a 'Base64 encoded string' field. Red arrows point from the 'LORAWAN FRAMES' tab and the 'Confirmed downlink' checkbox to a note on the right.

ChirpStack

Search organization, application, gateway or device

admin

Applications / Sensors / Devices / ERS_CO2_0

DELETE

DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION DEVICE DATA LORAWAN FRAMES

Details

Name	ERS_CO2_0
Description	ERS_CO2_0
Device-profile	Elsys ERS_CO2

Status

Last seen at	Jun 16, 2021 11:39 AM
State	enabled

Enqueue downlink payload

Port *

Please note that the fPort value must be > 0.

☐ Confirmed downlink

BASE64 ENCODED JSON OBJECT

Base64 encoded string *

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 top navigation bar is blue with the ChirpStack logo, a search bar, and a user profile icon labeled 'admin'. The left sidebar contains a list of navigation items: Dashboard, Network-servers, Gateway-profiles, Organizations, All users, API keys, and a dropdown menu for 'chirpstack'. The main content area displays the breadcrumb 'Applications / Sensors / Devices / ERS_C02_0' and a 'DELETE' button. Below this is a tabbed interface with tabs for DETAILS, CONFIGURATION, KEYS (OTAA), ACTIVATION, DEVICE DATA, and LORAWAN FRAMES. The LORAWAN FRAMES tab is active, showing a table of frames. Above the table are buttons for HELP, PAUSE, DOWNLOAD, and CLEAR. The table has four columns: UPLINK, Time, Data, and ID. There are three rows of data, each with a drop-down arrow on the right. A blue arrow points from the text 'See detail with the drop-down arrow' to the first drop-down arrow in the table.

UPLINK	Time	Data	ID
UPLINK	11:52:43 AM	UnconfirmedDataUp	00b704d3
UPLINK	11:47:43 AM	UnconfirmedDataUp	00b704d3
UPLINK	11:42:43 AM	UnconfirmedDataUp	00b704d3

- See detail with the drop-down arrow

JoinAccept/JoinRequest

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

Applications / Sensors / Devices / ERS_CO2_test

DETAILS

CONFIGURATION

KEYS (OTAA)

ACTIVATION

DEVICE DATA

LORAWAN FRAMES

Feb 01 9:25:58 PM

JoinAccept

926.9 MHz

SF9

BW500

GW: 008000000001edb0

Feb 01 9:25:58 PM

JoinRequest

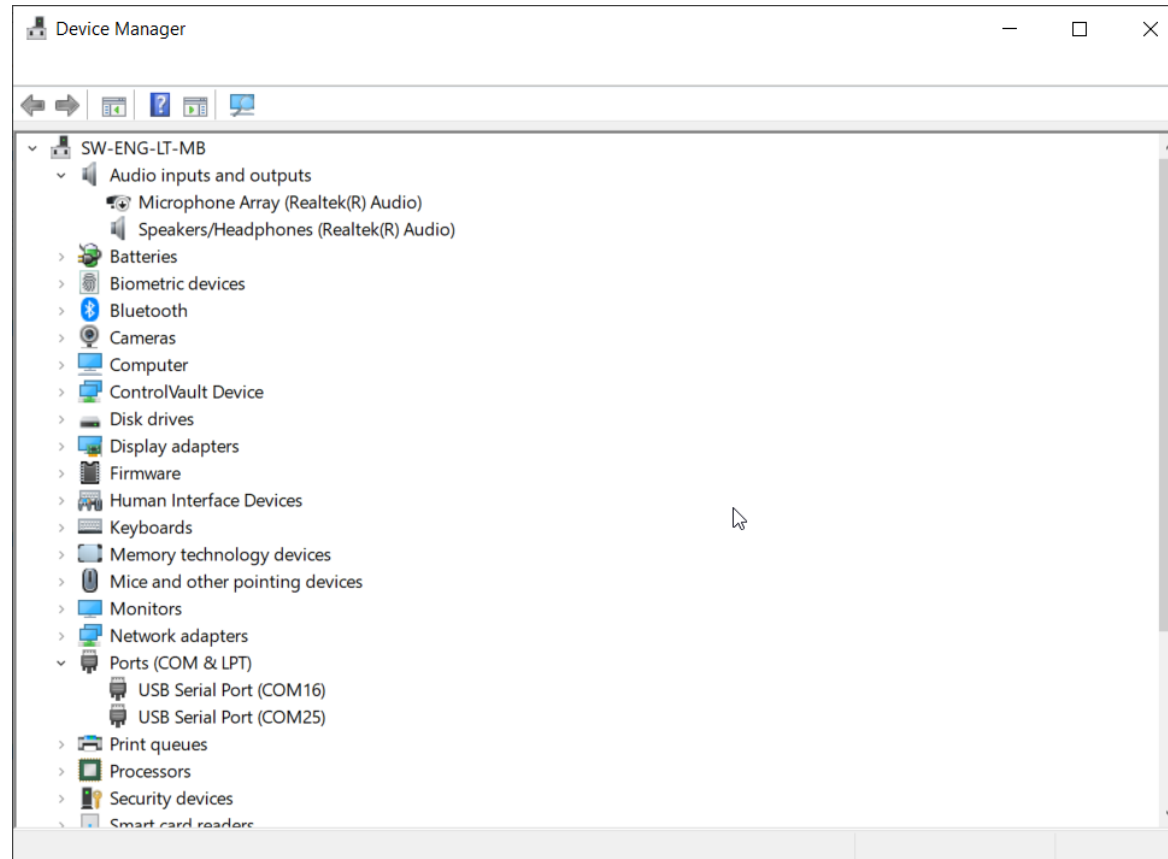
903.5 MHz

SF9

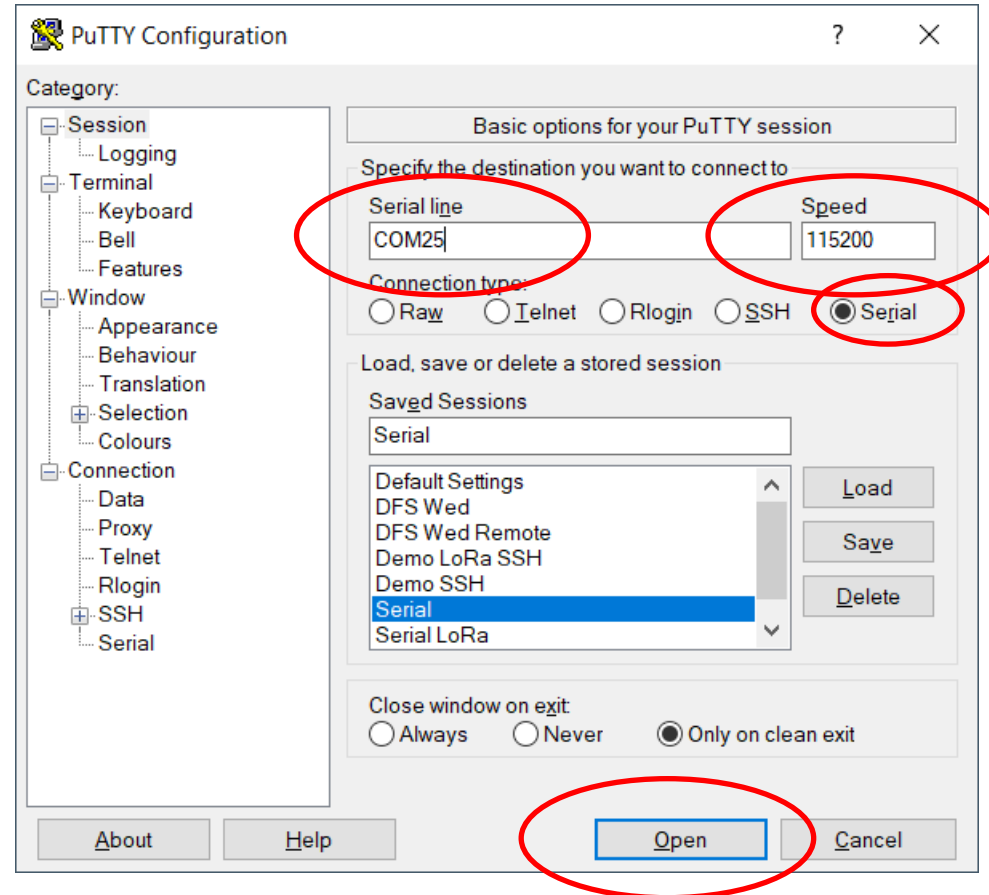
BW125

DevEUI: a81758fffe0700cd

Finding PC Serial Port – Device Manager



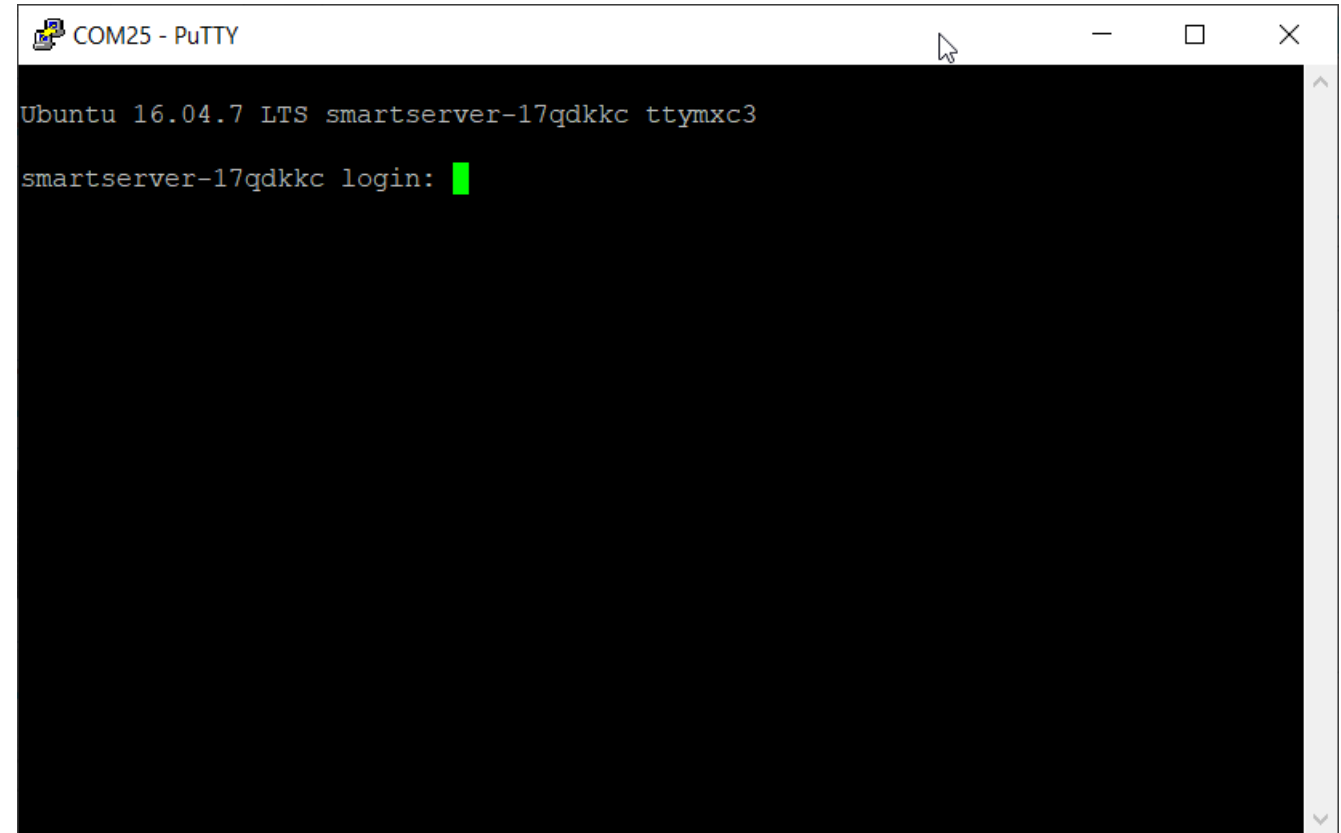
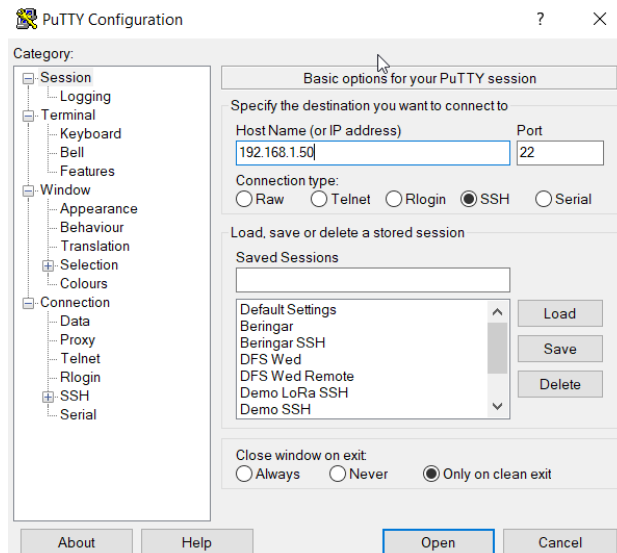
Putty Serial Connection



Putty Serial Connection - Login

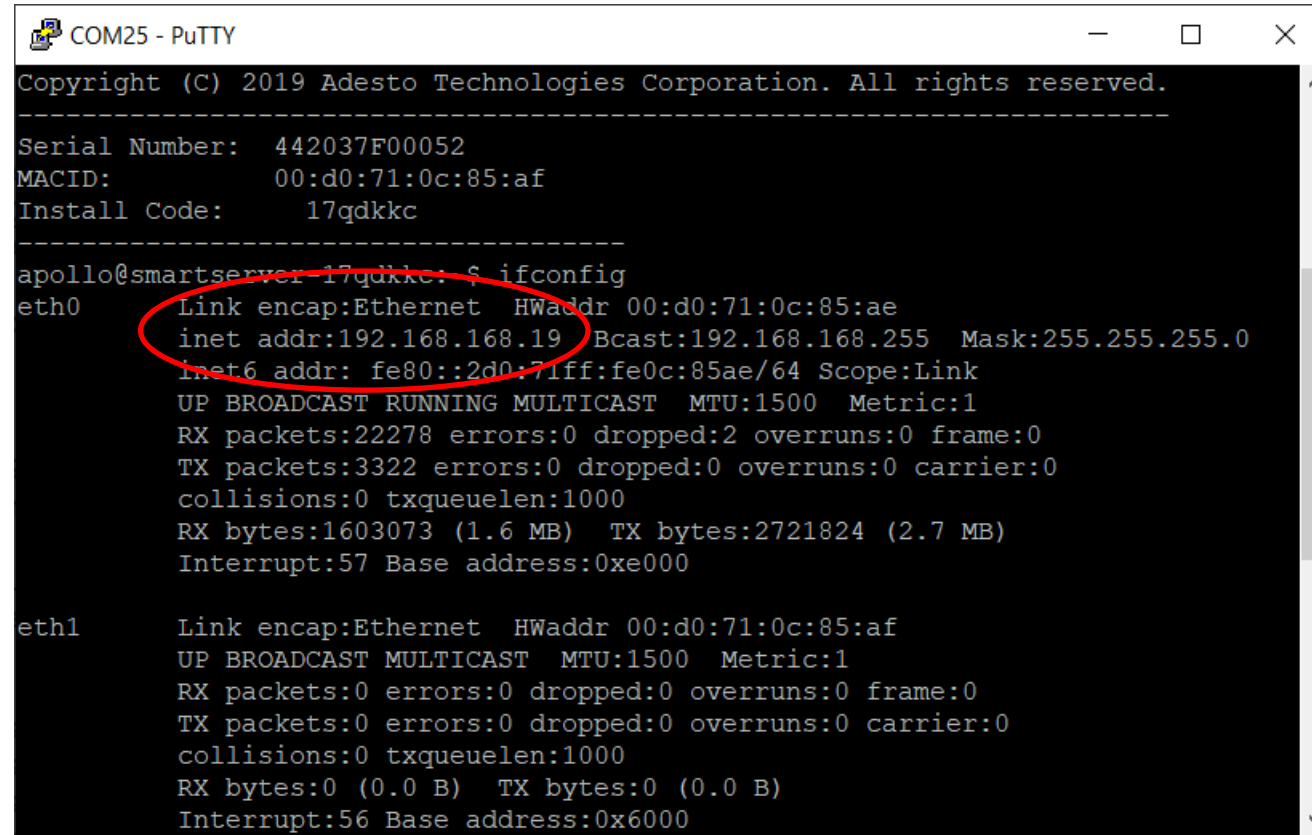
Note: Serial connections are similar to SSH connections, but SSH connections are not persistent over reboots

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



Putty Determine IPV4 Address: ifconfig

- Use the command: ifconfig



```
COM25 - PuTTY
Copyright (C) 2019 Adesto Technologies Corporation. All rights reserved.
-----
Serial Number: 442037F00052
MACID: 00:d0:71:0c:85:af
Install Code: 17qdkkc
-----
apollo@smartserver-17qdkkc: $ 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
```

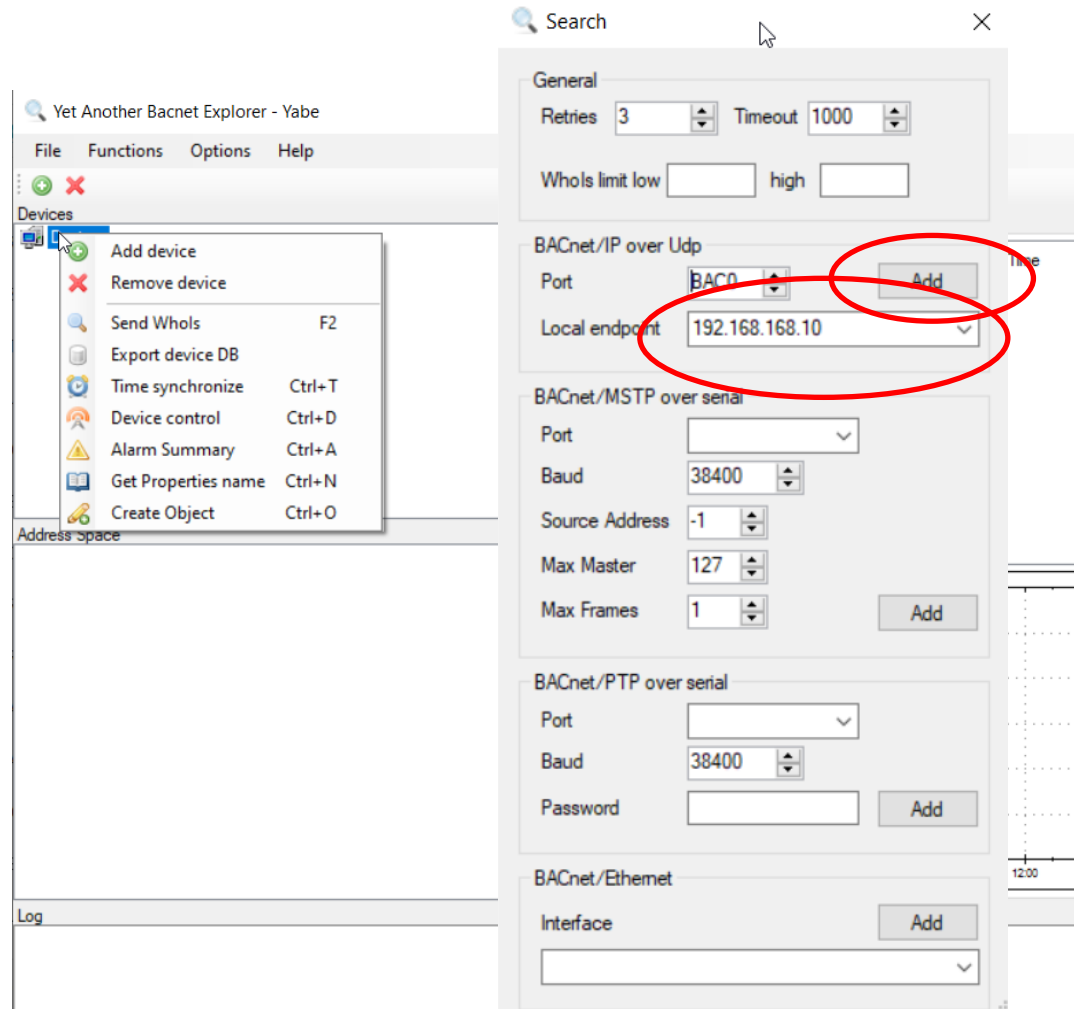
Log Files

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

The screenshot shows the WinSCP interface with two panes. The left pane displays the local drive `D:\LoRa\Global Flash Drive\` with files `..`, `Datasheets and Manuals`, and `lora_gw.tgz`. The right pane displays the remote directory `/var/log/supervisor/` with a list of log files. The file `scheduler.log` is circled in red.

Name	Size	Changed	Rights	Owner
echbacnet.log	12 KB	16/06/2021 20:21:45	rw-r--r--	root
formatter.log	9 KB	16/06/2021 20:22:07	rw-r--r--	root
housekeeper.log	10 KB	16/06/2021 20:22:18	rw-r--r--	root
lim.log	17 KB	16/06/2021 20:22:24	rw-r--r--	root
loader.log	10 KB	16/06/2021 20:22:10	rw-r--r--	root
logger.log	10 KB	16/06/2021 20:22:06	rw-r--r--	root
lte.log	340 KB	16/06/2021 20:22:32	rw-r--r--	root
ltx.log	3,919 KB	16/06/2021 20:22:25	rw-r--r--	root
modbus.log	0 KB	09/04/2021 19:17:47	rw-r--r--	root
monitoring.log	10 KB	16/06/2021 20:22:09	rw-r--r--	root
query.log	10 KB	16/06/2021 20:22:17	rw-r--r--	root
ready.log	0 KB	09/04/2021 19:17:46	rw-r--r--	root
scheduler.log	10 KB	16/06/2021 20:22:15	rw-r--r--	root
stderr-lora_gw.log	5 KB	16/06/2021 20:22:34	rw-r--r--	root
stdout-lora_gw.log	3,208 KB	16/06/2021 19:03:51	rw-r--r--	root
stdout-lora_gw.log.1.gz	286 KB	08/06/2021 06:04:50	rw-r--r--	root
stdout-lora_gw.log.2.gz	294 KB	21/05/2021 23:14:54	rw-r--r--	root
stdout-lora_gw.log.3.gz	294 KB	13/05/2021 23:49:24	rw-r--r--	root
supervisord.log	207 KB	16/06/2021 20:22:35	rw-r--r--	root

YABE Adding Device (local)



YABE & BACnet Datapoints

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

Yet Another Bacnet Explorer - Yabe

File Functions Options Help

Devices

- Udp:47808
- Device 20039 - 192.168.1.50:47808
 - 17qdkkc_lora_gw_00D0710C85B5 [1701003]

Address Space : 128 objects

- AM319/0 Particulate Mass Concentration 2.5% (Analog_Input:118)
- AM319/0 CO2 ppm (Analog_Input:119)
- AM319/0 HCHO (Analog_Input:120)
- AM319/0 Humidity (Analog_Input:121)
- AM319/0 Illuminance (Analog_Input:122)
- AM319/0 Pressure (Analog_Input:123)
- AM319/0 Temperature (Analog_Input:124)**
- AM319/0 TVOC (Analog_Input:125)
- R718AB/0 Battery Voltage (Analog_Input:126)
- R718AB/0 Humidity (Analog_Input:127)
- R718AB/0 Temperature (Analog_Input:128)
- R718DB/0 Battery Voltage (Analog_Input:129)
- R718AD/0 Battery Voltage (Analog_Input:131)
- R718AD/0 Temperature (Analog_Input:132)

Subscriptions, Periodic Polling, Events/Alarms

Device	ObjectID	Name	Value	Time	Status	Descript.
--------	----------	------	-------	------	--------	-----------

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	Object[] Array
High Limit	100
Limit Enable	00
Low Limit	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

Log

- Sending ReadPropertyMultipleRequest ...
- ComplexAck
- Sending ReadPropertyMultipleRequest ...
- ComplexAck
- Sending ReadPropertyMultipleRequest ...
- ComplexAck
- Sending ReadPropertyMultipleRequest ...
- ComplexAck
- Sending ReadPropertyMultipleRequest ...
- ComplexAck

Look for
Present Value

MQTT Debugging

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

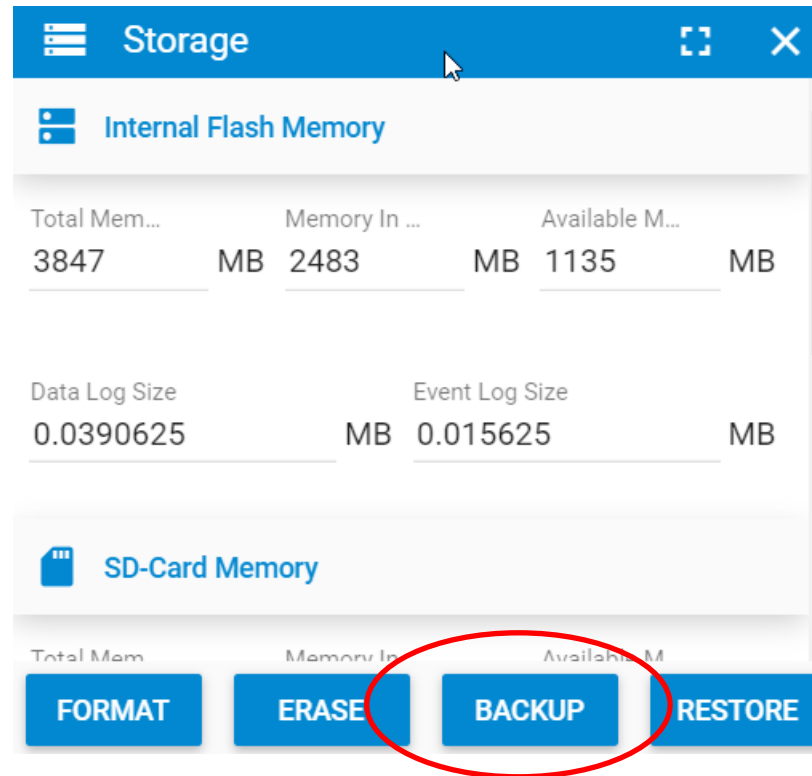
```
mosquitto_sub -v -t application/#
```

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

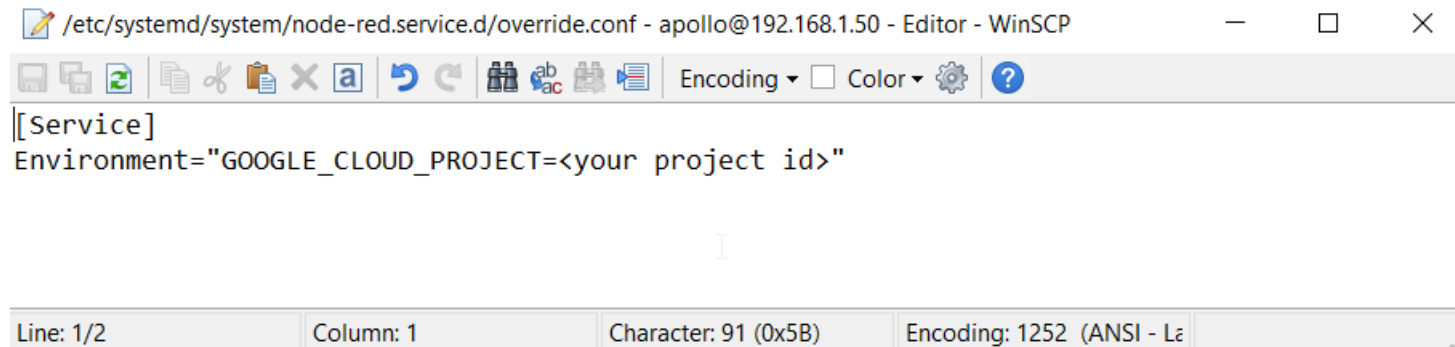
The screenshot displays the Node-RED web interface. On the left, the 'Sequencing' tab is active, and the 'Generic IoT Connection' flow is selected and circled in red. The main workspace shows a flow diagram with nodes: 'ev/data', 'msg.payload', 'MQTT DP Filter', 'DP Throttle', and another 'msg.payload'. On the right, the 'Edit flow: Generic IoT Connection' dialog is open. The 'Done' button is circled in red. Below the dialog, the 'Disabled' button is also circled in red. The right sidebar shows the 'info' tab with a search bar and a list of flows, including 'Generic IoT Connection'.

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 your add project id



```
/etc/systemd/system/node-red.service.d/override.conf - apollo@192.168.1.50 - Editor - WinSCP  
[Service]  
Environment="GOOGLE_CLOUD_PROJECT=<your project id>"  
  
Line: 1/2 Column: 1 Character: 91 (0x5B) Encoding: 1252 (ANSI - La)
```

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)

The screenshot shows the 'Edit mqtt out node' configuration window in Node-RED. At the top, there are 'Delete', 'Cancel', and 'Done' buttons. Below is a 'Properties' section with a settings icon, a document icon, and a preview icon. The configuration fields include: 'Server' (a dropdown menu with '<your server name>' and an edit icon), 'Topic' (a text input field with '<your topic>'), 'QoS' (a dropdown menu), 'Retain' (a checkbox with a circular arrow icon), and 'Name' (a text input field with '<your connector name>'). A yellow tip box at the bottom of the properties section states: 'Tip: Leave topic, qos or retain blank if you want to set them via msg properties.' At the bottom of the window, there is an 'Enabled' checkbox.

Configuring Node-RED AWS Connections (continued)

Edit mqtt out node > Edit mqtt-broker node

Delete Cancel Update

Properties

Name AWS

Connection Security Messages

Server <your end point> Port 8883

☒ Use TLS AWS TLS

Protocol MQTT V3.1.1

Client ID <your client ID>

Keep Alive 60

Session ☒ Use clean session

Enabled 1 node uses this config On all flows


Configuring Node-RED AWS Connections (continued)


Edit mqtt out node > Edit mqtt-broker node > **Edit tls-config node**

Delete Cancel **Update**


Properties

☒ Use key and certificates from local files


 Certificate


 Private Key


Passphrase

 CA Certificate

☒ Verify server certificate

 Server Name

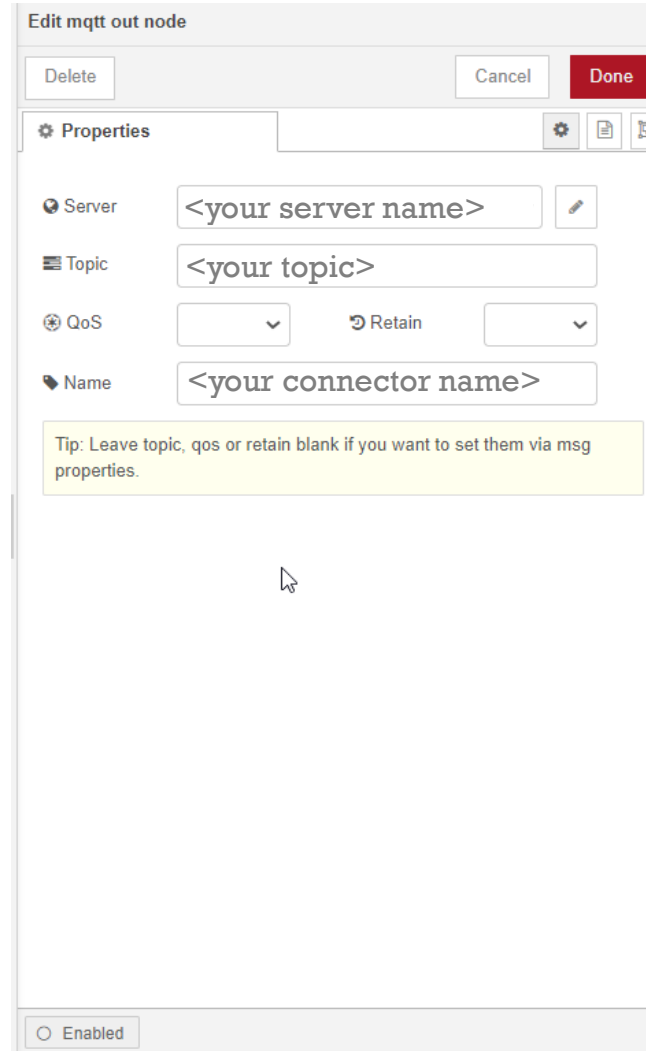
 Name

☐ Enabled **1 node uses this config** On all flows 

Configuring Node-RED Azure Connections

Information you will need:

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



The screenshot shows the 'Edit mqtt out node' configuration window in Node-RED. At the top, there are 'Delete', 'Cancel', and 'Done' buttons. Below is a 'Properties' section with a search bar and three icons (gear, document, and a square with an 'x'). The configuration fields include: 'Server' with a text input containing '<your server name>' and an edit icon; 'Topic' with a text input containing '<your topic>'; 'QoS' with a dropdown menu and a 'Retain' checkbox; and 'Name' with a text input containing '<your connector name>'. A yellow tip box states: 'Tip: Leave topic, qos or retain blank if you want to set them via msg properties.' At the bottom, there is an 'Enabled' checkbox.

Configuring Node-RED Azure Connections (continued)

Edit mqtt out node > Edit mqtt-broker node

Delete Cancel Update

⚙ Properties

🔖 Name Azure

Connection Security Messages

🌐 Server ssl://<your end point> Port 8883

☒ Connect automatically

☒ Use TLS Azure

⚙ Protocol MQTT V3.1.1

🔖 Client ID <your client ID>

💓 Keep Alive 60

📄 Session ☒ Use clean session

Enabled ⓘ 1 node uses this config On all flows

Configuring Node-RED Azure Connections (continued)

Edit mqtt out node > Edit mqtt-broker node > **Edit tls-config node**

Delete Cancel Update

Properties

☒ Use key and certificates from local files

Certificate path to certificate (PEM format)

Private Key path to private key (PEM format)

Passphrase private key passphrase (optional)

CA Certificate /var/apollo/data/certs/tls/digicert.pem

☒ Verify server certificate

Server Name for use with SNI

Name <your name>

☐ Enabled ⓘ 1 node uses this config Generic IoT Connection

Configuring Node-RED Azure Connections (continued)

Edit mqtt out node > Edit mqtt-broker node

Delete Cancel Update

⚙ Properties

📌 Name Azure

Connection Security Messages

👤 Username <your username>

🔒 Password <your password>

☐ Enabled ⓘ 1 node uses this config On all flows ▼

Q&A



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