

LoRa Workshop (IoT World 2017)

Semtech/MultiTech/Telit

LoRa Hands-On “Sensor to Cloud”



IoT MODULES



IoT CONNECTIVITY



IoT PLATFORMS



IoT KNOW-HOW

Welcome to the TechMart...



You are in the right place...



MAY
16


**MultiTech, Semtech,
and Telit LoRaWAN
Prototype-
to-Production
Workshop**

And Again, Welcome From Your Hosts...



Agenda

Instruction Provided By: MultiTech, Semtech, and Telit

Introductions MultiTech, Semtech, and Telit	5 Minutes
MultiTech LoRaWAN and LPWA- Hardware Platforms	15 Minutes
Semtech--Technology Foundation	15 Minutes
Telit Platform deviceWise	15 Minutes
Demonstration XDot Development Kit	10 Minutes
Lab 1 mDot Hello World	30 Minutes
Lab 2 Add Sensors X-Nucleo-IKS01A1	30 Minutes
 Lab 3 Publishing Data to Telit Platform	30 Minutes
Refreshments / Networking	30 Minutes

Workshop Goals

Attendees will have the opportunity learn...

- Rapid prototyping using a cloud based compiler
- Cellular communication to add macro-network
- Crowd sourcing libraries to add drivers from common sensors and peripherals
- How to use an AEP (application enablement platform) to collect and store IoT data
- How to use an AEP to obtain insights from and securely publish the data
- Best practices for “concept-to-commercial” development and launch of IoT solutions



Publishing Data to the Cloud Platform

Telit IoT Platform Architecture (Smart Sensor to Cloud)

CONNECT

(Smart Sensors)



MQTT/TR50 API



Cloud-Ready Modules



Asset Gateway

LoRa
SIGFOX



Proxy



LPWA Clouds

MANAGE

- Device Management
- Security
- Data-at-Rest
- Data-in-Transit
- Flexible Data Model
- Multi Tenant



CDP



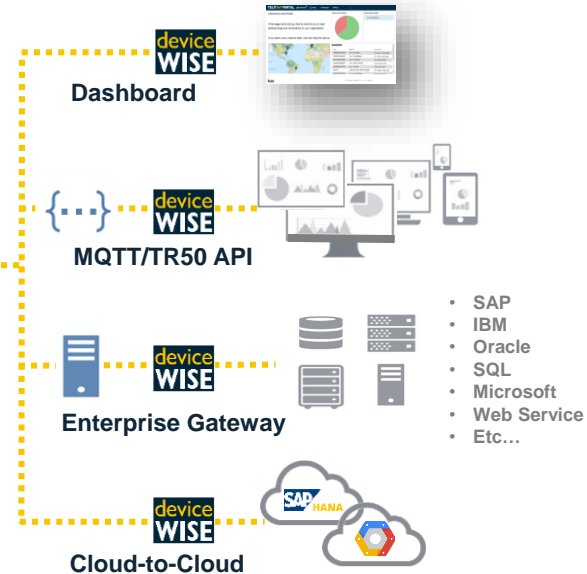
Aware



Intelligence

Connectivity Management

INTEGRATE



Dashboard

MQTT/TR50 API

Enterprise Gateway

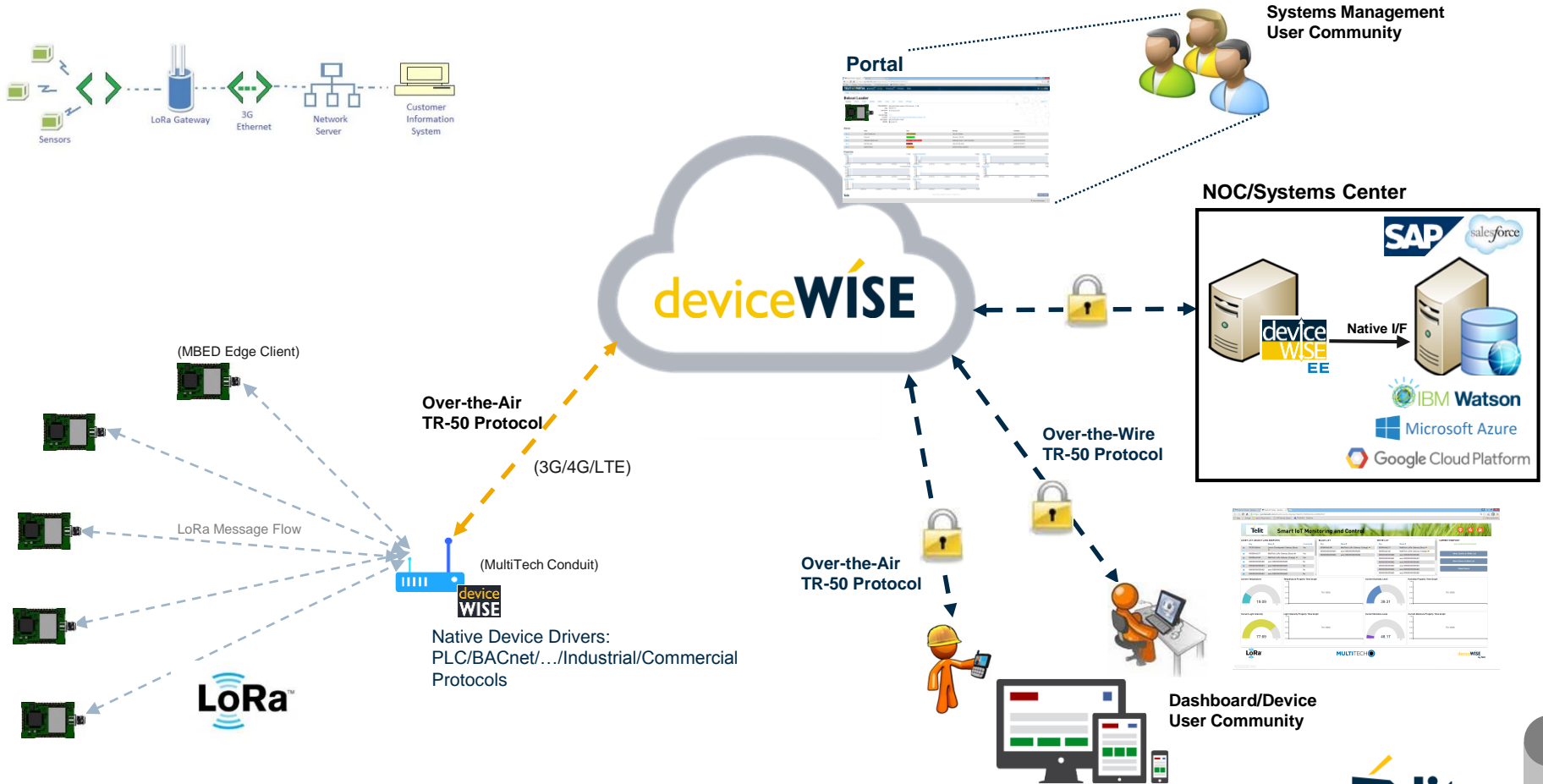
Cloud-to-Cloud

- SAP
- IBM
- Oracle
- SQL
- Microsoft
- Web Service
- Etc...

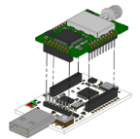
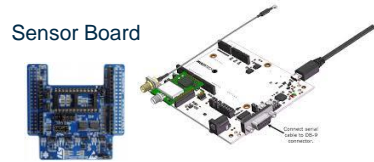
deviceWISE Enabled Gateway, Data Plan, and Cloud Platform...



Low-Power Wide-Area Sensor Nodes: Conduit LoRa Gateway to Cloud



LoRa Workshop End-to-End Connections



Stand-Alone mDot



mDotBox Multiple Sensors



LoRa 915 MHz



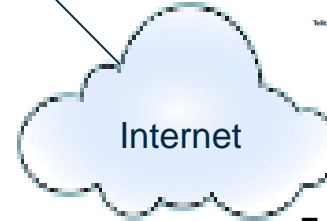
deviceWISE



MULTITECH

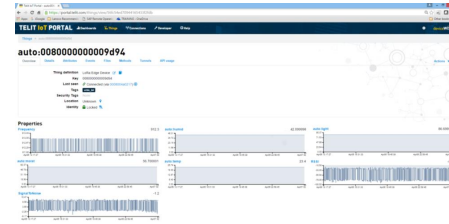


LTE / HSPA+



Internet

Telit IoT Platform- Visualization



Telit



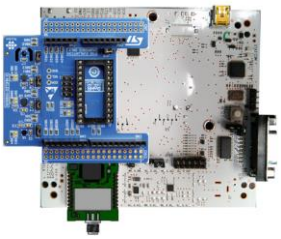
Telit IoT Platform



Telit deviceWISE Asset Gateway software running in the MultiTech Conduit functions as the LoRa Concentrator and sends data to the Telit IoT Cloud Platform using the TIA TR50 standard over LTE or 3G

Note: LoRa Frequency - North America = 915 MHz, Europe = 868 MHz

Connecting the “Dots”



mDot
UDK-2
MEMS



LoRa
Conduit Gateway
(LoRa MTAC)

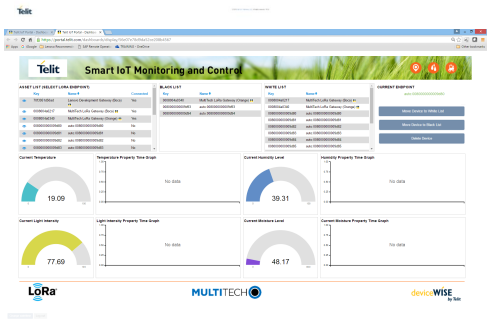
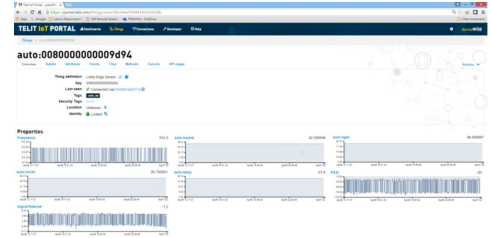


Cellular Network



Cloud Platform

Management Portal



Dashboard

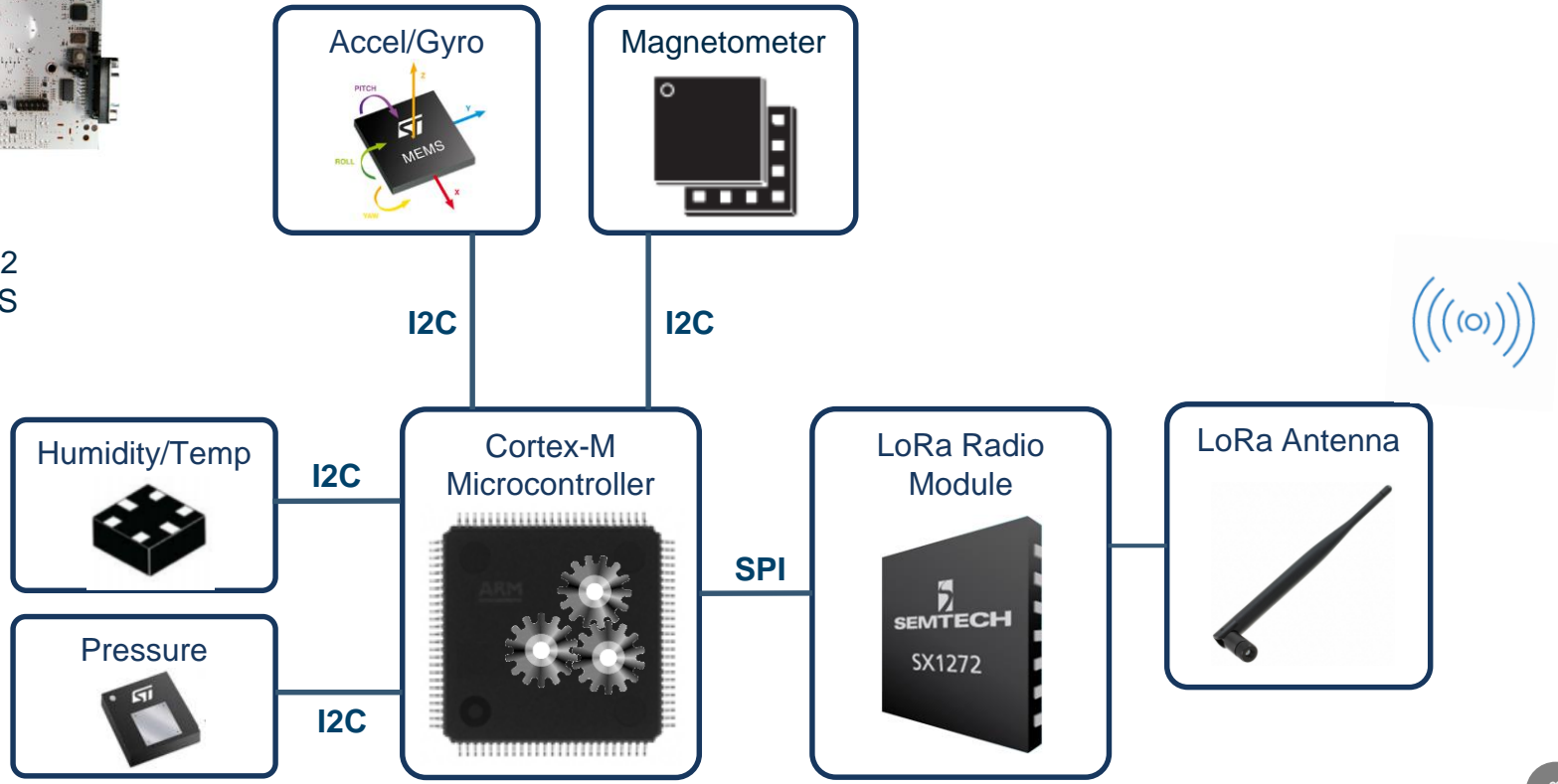


MultiTech mDOT with ST-Micro MEMS Board

1



mDot
UDK-2
MEMS



Connecting the “Dots” ... Step 1

1



mDot
UDK-2
MEMS

a.) Set the LoRa Private Network Access (Conduit)

```
static std::string config_network_name = "MTCDDT-19186797";  
static std::string config_network_pass = "MTCDDT-19186797";  
static uint8_t config_frequency_sub_band = 1;
```

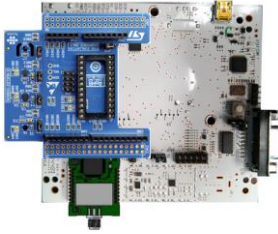
b.) Enable the MBED code to JOIN Lora Network (*)

c.) Publish Data “Byte Vector” to Conduit Gateway

```
//-----  
// Byte Vector Format: More Data Payload, Less Human Readible  
//-----  
sprintf(sensor_text, "ax:%d,ay:%d,az:%d,gx:%d,gy:%d,gz:%d,mx:%d,my:%d,mz:%d,p:%s,t:%s,h:%s",  
accel_vector[0],  
accel_vector[1],  
accel_vector[2],  
gyro_vector[0],  
gyro_vector[1],  
gyro_vector[2],  
mag_vector[0],  
mag_vector[1],  
mag_vector[2],  
printDouble(buffer3, pressure_value),  
printDouble(buffer1, temp_value),  
printDouble(buffer2, humid_value));
```

Connecting the “Dots” ... Step 1

1



mDot
UDK-2
MEMS

b.) Enable the MBED code to JOIN Lora Network

```
// Reset mDot Configuration to Known State
mdot_radio->resetConfig();

// Read node ID
mdot_EUI = mdot_radio->getDeviceId();

// Setting up the mDot with network information.

// This call sets up private or public mode on the MTDOT.
printf("Setting Private Network Mode...\r\n");
if ((mdot_ret = mdot_radio->setPublicNetwork(false)) != mDot::MDOT_OK) {
    log_error(mdot_radio, "ERROR: Failed to set Public Network Mode", mdot_ret);
}

// Frequency sub-band is valid for NAM only and for Private networks should be set
// to a value between 1-8 that matches the the LoRa gateway setting.
printf("Setting Frequency Sub-Band...\r\n");
if ((mdot_ret = mdot_radio->setFrequencySubBand(config_frequency_sub_band)) != mDot::MDOT_OK) {
    log_error(mdot_radio, "ERROR: Failed to set Frequency Sub-Band", mdot_ret);
}

// Setting TX power for radio. Max allowed is +14dBm for EU and +20 dBm for NAM. Default is +11 dBm
printf("Setting TX Power Level to %2d dBm...\r\n", pwr_val);
if ((mdot_ret = mdot_radio->setTxPower(pwr_val)) != mDot::MDOT_OK) {
    log_error(mdot_radio, "ERROR: Failed to set TX Power Level", mdot_ret);
}

// Setting TX data rate for radio. Max allowed is SF_12 for EU and SF10 dBm for NAM.
// Default is SF_10
printf("Setting TX data rate to SF_7...\r\n");
if ((mdot_ret = mdot_radio->setTxDataRate(sf_val)) != mDot::MDOT_OK) {
    log_error(mdot_radio, "ERROR: Failed to set TX Data Rate", mdot_ret);
}
```

Connecting the “Dots” ... Step 2

2

LoRa



Conduit Gateway
(LoRa MTAC)



- a.) Install LoRa MTAC in Conduit Gateway, Antenna
- b.) Use AEP Manager to Configure LoRa Network Server
- c.) Assure deviceWISE LoRa Extensions Are Installed
- d.) Assure deviceWISE LoRa Gateway Project Is Running

Connecting the "Dots" ... Step 2

2



Conduit Gateway (LoRa MTAC)



MULTITECH® MultiConnect® Conduit - Application Execution Platform
MTCDD-LAT1-210A Firmware 1.4.1

Logged In: admin Logout
Search:

- Home
- Save and Restart
- Setup
 - Network Interfaces
 - WAN
 - DDNS
 - DHCP
 - LoRa**
 - Time
- Cellular
- Firewall
- Administration
- Status & Logs
- Commands
- Apps
- Help

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LoRa Networking ? Reset To Default

LoRa Mode

Mode: NETWORK SERVER

LoRa Network Server Configuration Show Advanced Settings

Frequency Band	915		
Channel Plan			
Channel Plan	US915	Frequency Sub-Band	1
Network			
Network ID	Name	Public	<input type="checkbox"/>
Name	MTCDDT-19186797	Join Delay	1
Network Key	Passphrase	Rx1 Delay	1
Passphrase	MTCDDT-19186797	Lease Time	00:00:00
Base Key	<input type="text"/>	Address Range Start	00:00:00:01
Salt	<input type="text"/>	Address Range End	FF:FF:FF:FE
NetID	000000	Queue Size	16
Settings			
Tx Power (dBm)	26	Duty Cycle Period	60
Antenna Gain	3	Adr Step	30
Rx 1 DR Offset	0	Min Datarate	0
Rx 2 Datarate	12	Max Datarate	4

Sub-Band

Network Name

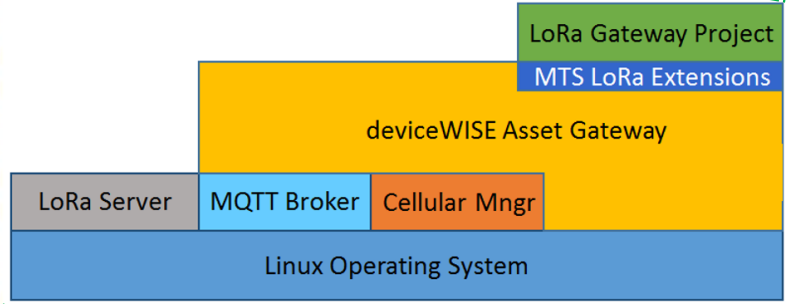
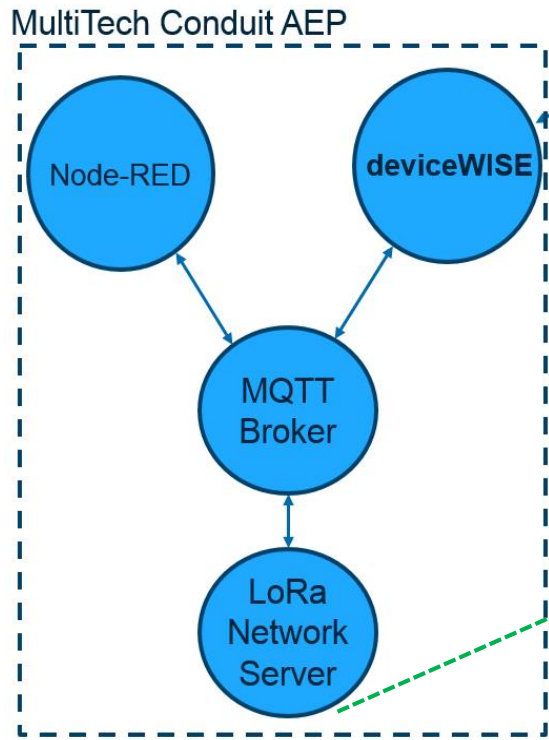
Passphrase

Connecting the "Dots" ... Step 2

2



Conduit Gateway (LoRa MTAC)



LoRa deviceWISE Extensions and Project Logic

Trigger: LoRa Conduit AEP Gateway.LoRa_Gateway.LoRa_ReceiveProcess

Name: LoRa_ReceiveProcess

Event: Local Variables | Static Variables | Settings | Details

Trigger Event Type: MQTT Publish Receive

MQTT Client: LoraMQTT

Topic Filter: lora/+/#

Quality of Service: 0

Payload Type: String

```
graph TD; Start([Start]) --> L1[1. Log Message: Write message >>> LoRa Message Received (Start) - MQTT Topic]; L1 --> L8[8. LoRa Topic Parser: Parse LoRa Topic]; L8 --> L9[9. Log Message: Write message Topic Parsed - Identity: Local/variables. Identity, Direction:]; L9 --> L19[19. Get String Length: Get length of Event/variables: Payload]; L19 --> L12[12. Execute SubTrigger: ST_CheckRegistry from Project LoRa_Gateway]; L12 --> L22[22. Log Message: Write message ERROR: Trigger Failure - LoRa_ReceiveProcess]; L22 --> E21([21. End Execution]); E21 --> E22[Error Handling]; E22 --> L22;
```

Expression

- Generate Random Number
- Set
- Wait
- Array
- Asset
- Binary
- Bit Manipulation
- CloudLINK
- Date & Time
- Device
- Experimental
- Hash Map
- Internal
- Local Database
- Location
- Lua Scripting
- MTS LoRa Custom Actions
 - Base64 Decode
 - Base64 Decode Binary
 - Base64 Encode
 - Format BATCH
 - Format Mac
 - LoRa Data Parser
 - LoRa Data Parser Binary
 - LoRa Message Parser
 - LoRa Topic Parser
 - Lora Server Commands
- Management Portal
- Management Portal (Gateway)
- Networking
- Routing
- Staging File System
- String
- TR50
- Thing
- Trigger

Mode: Select Drag: Move/Route/Multi-select Ctrl-drag: Pan Click: Select Shift-click: Select Add Ctrl-click: Select Toggle Double-click: Edit Mousewheel

Save Validate Search

Connecting the “Dots” ... Step 3

3



Conduit Gateway
(LoRa MTAC)



Cellular Network

- a.) Install LTE SIM in Conduit Gateway, Antenna
- b.) Use AEP Manager to Configure/Enable Cellular LTE
- c.) Assure deviceWISE TR-50 is Configured/Connected
- d.) Assure deviceWISE LoRa Gateway Project Is Running

LoRa Gateway Conduit Setup

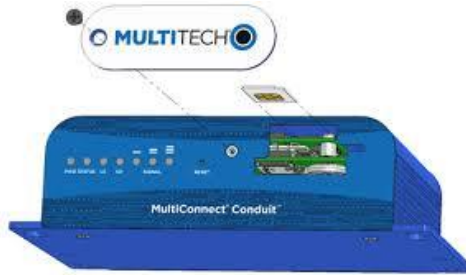


Conduit AEP

Configuration with LTE/HSPA+ Radio

Configuration uses one mCard (915 LoRa):

SIM Installation



MTAC Installation



Connecting the "Dots" ... Step 3

3



Conduit Gateway (LoRa MTAC)



Cellular Network

MULTITECH MultiConnect® Conduit - Application Execution Platform
MTCDT-LAT1-210A Firmware 1.4.1

Logged In: admin Logout
Search:

- Home
- Save and Restart
- Setup
- Cellular
 - Cellular Configuration
 - Radio Status
- Firewall
- Administration
- Status & Logs
- Commands
- Apps
- Help

Cellular Configuration ? Reset To Default

General Configuration

Enabled	<input checked="" type="checkbox"/>	Dial-on-Demand	<input type="checkbox"/>
Connect Timeout	<input type="text" value="90"/>		
Dialing Max Retries	<input type="text" value="0"/>		

Modem Configuration

Dial Number	<input type="text" value="*99***1#"/>	Init String1	<input type="text" value="AT+CSQ"/>
Connect String	<input type="text" value="CONNECT"/>	Init String2	<input type="text"/>
Dial Prefix	<input type="text" value="ATDT"/>	Init String3	<input type="text"/>
SIM Pin	<input type="text"/>	Init String4	<input type="text"/>
APN	<input type="text" value="11583.mcs"/>		

Authentication

Authentication Type	<input type="text" value="NONE"/>
---------------------	-----------------------------------

Keep Alive

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Set APN



Connecting the “Dots” ... Step 4

4



Cloud Platform

- a.) Log into the Telit Cloud Platform at...
'<http://portal.telit.com>'
- b.) Use Username/Password You Have Configured
- c.) You will access the 'IOT-WORLD' organization
- d.) Navigate to the 'Thing' Manager Table View
- e.) Select Your mDot 'Thing Key' (Address) from list

Connecting the “Dots”... Step 4

4




































Cloud Platform

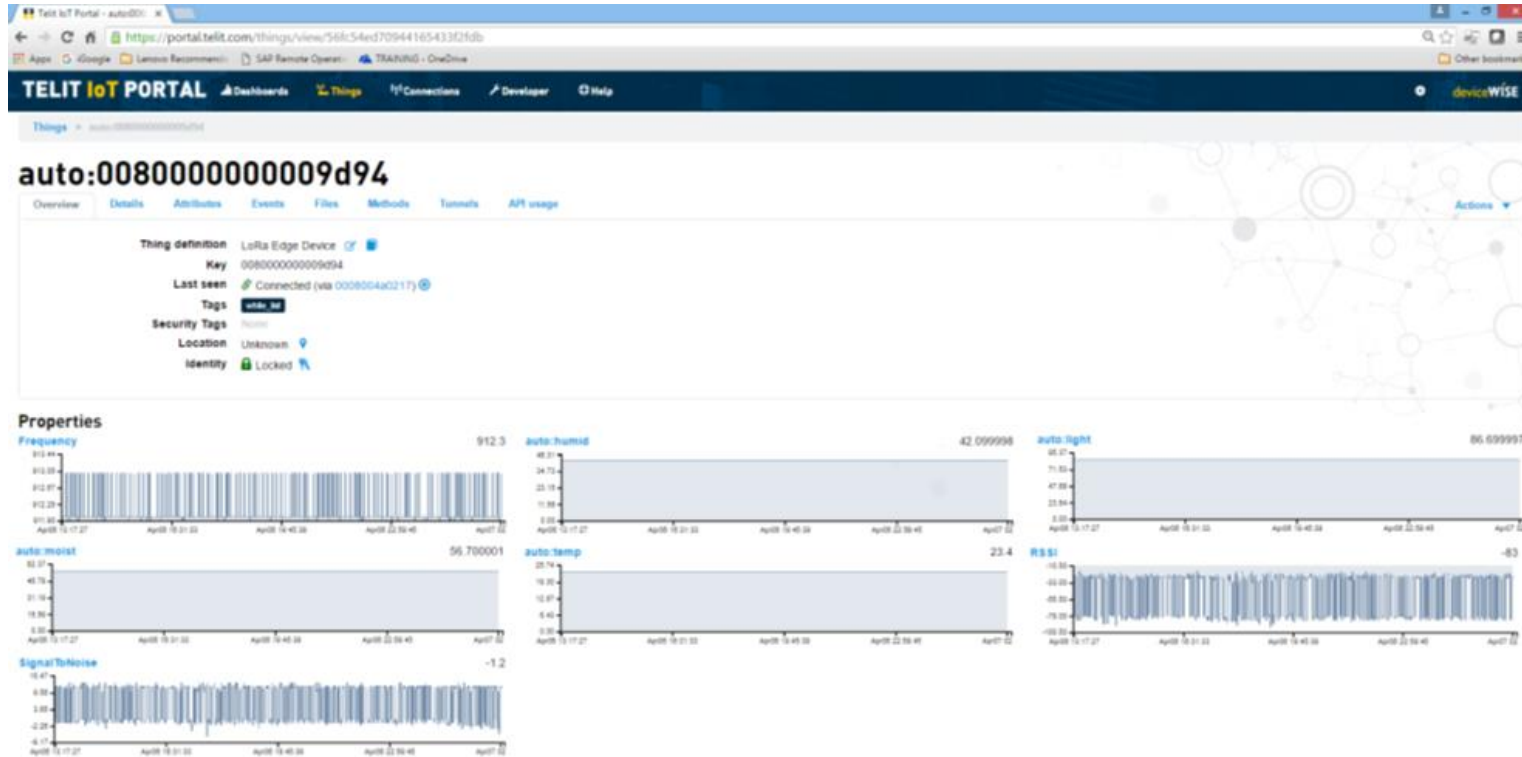
You should have received an e-mail invitation from the Telit Cloud Platform...

Users

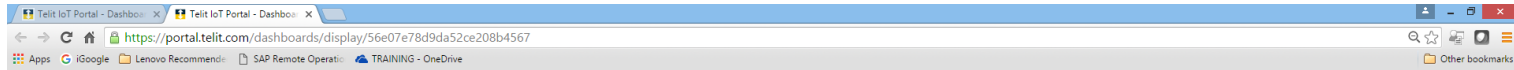
Profiles | Invitations

	Email Address
  	terrihellman1@gmail.com
  	akhoche@smartconnectedsystems.com
  	taher.nabulsi@actility.com
  	suleman@sonic.net
  	outreach888@gmail.com
  	markh@symmetryelectronics.com
  	uchil.shreya@gmail.com
  	mlg@gelphman.com
  	hans.masli@huvomo.com
  	jcruz@usglobalsat.com
  	lan_dian66@hotmail.com

LoRa deviceWISE Telit Management Portal



Telit Additions... LoRa User Interface Dashboard



ASSET LIST (SELECT LORA ENDPOINT)

Key	Name	Connected
70f3951d50ad	Lenovo Development Gateway (Boca)	Yes
0008004a0217	MultiTech LoRa Gateway (Boca)	Yes
0008004a0340	MultiTech LoRa Gateway (Orange)	Yes
0080000000009d80	auto: 0080000000009d80	No
0080000000009d81	auto: 0080000000009d81	No
0080000000009d82	auto: 0080000000009d82	No
0080000000009d83	auto: 0080000000009d83	No

BLACK LIST

Key	Name
0008004a0340	MultiTech LoRa Gateway (Orange)
0080000000009d93	auto: 0080000000009d93
0080000000009d94	auto: 0080000000009d94

WHITE LIST

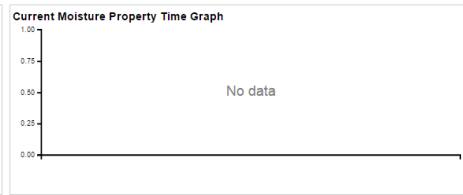
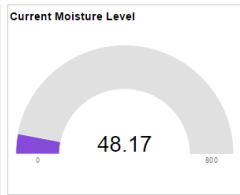
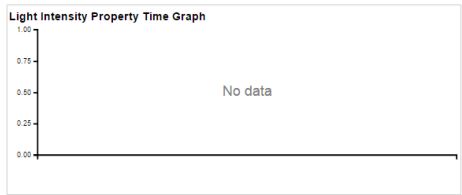
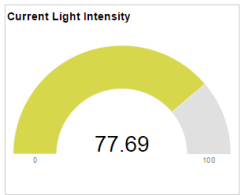
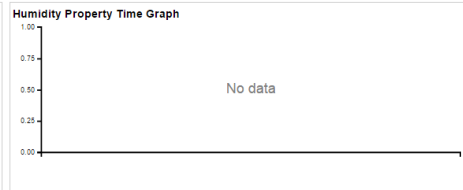
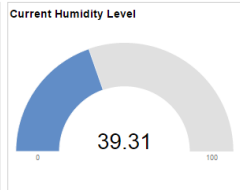
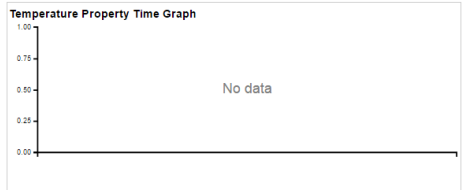
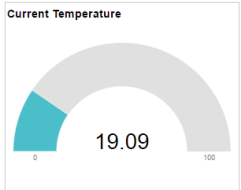
Key	Name
0008004a0217	MultiTech LoRa Gateway (Boca)
0008004a0340	MultiTech LoRa Gateway (Orange)
0080000000009d80	auto: 0080000000009d80
0080000000009d81	auto: 0080000000009d81
0080000000009d82	auto: 0080000000009d82
0080000000009d83	auto: 0080000000009d83
0080000000009d84	auto: 0080000000009d84
0080000000009d85	auto: 0080000000009d85

CURRENT ENDPOINT
auto:0080000000009d80

Move Device to White List

Move Device to Black List

Delete Device



Change Dashboard | Logout



ENABLING END-TO-END **IoT SOLUTIONS**

Any Market. Any Industry. Anywhere.

Thank You!



IoT MODULES



IoT CONNECTIVITY



IoT PLATFORMS



IoT KNOW-HOW