Getting Started: Two Ignition Architecture

Prerequisites

- Have two machines available to run Ignition Gateway and Ignition Edge MQTT
 - Ignition Gateway can run on a laptop, in the cloud via an AWS EC2 instance or some other development computer
 - Ignition Edge MQTT can run on one of many supported embedded edge of network gateways, a laptop or development computer, or also in a cloud service

Summary

In conjunction with the Sparkplug specification, it is very useful to set up a working system that uses the MQTT Sparkplug specification in order to observe a simple but fully functional system. This section of the tutorial will provide step by step instructions for installing and configuring Ignition Edge MQTT and an Ignition Gateway to show tags being published from Ignition Edge to the Ignition Gateway running MQTT Distributor and MQTT Engine.

- Central Ignition Gateway Installation
 - ° MQTT Distributor An MQTT Server that runs as an Ignition module.
 - MQTT Engine Engine is an MQTT Client that implements the Sparkplug specification and automatically creates Ignition tag structures for Edge Node and Device metadata and process variables.
- Ignition Edge MQTT
 - MQTT Transmission Transmission is an MQTT Client that implements the Sparkplug specification to bridge local Ignition tags (OPC-
 - UA and Memory tags) and publish the resulting structure to an MQTT infrastructure.
 - Additional Ignition Edge MQTT devices could (and normally would) be added to the architecture.

Upon completion of this tutorial you will have all of the required components to configure, deploy, and observe the Sparkplug MQTT specification in action.

Architecture



Tutorial

Step 1: Download and Install the Central Ignition Gateway

Ignition is an Industrial Application Platform that can be used to create SCADA and HMI solutions. A fully functional Ignition system can be downloaded and run in trial mode. Using Ignition as a tool in this way, we can install the Sparkplug MQTT Modules and observe everything working.

Go to the Inductive Automation download page and download the desired version of Ignition installer for Windows, Linux or MacOS; https://inductiveautomation.com/downloads/archive.

Once the Ignition installer has been downloaded, follow the instructions provided by Inductive Automation to install and start Ignition.

- Install on Windows: https://docs.inductiveautomation.com/display/DOC79/Windows+-+Install
- Install on Linux: https://docs.inductiveautomation.com/display/DOC79/Linux+-+Install
- Install on Mac: https://docs.inductiveautomation.com/display/DOC79/Mac+OS+X+-+Install

Important Note: For this test infrastructure, MQTT Distributor will be installed as an Ignition module. Remember to either turn off firewalls or at a minimum allow inbound connections to TCP/IP port #1883 and port #8883, as remote MQTT Clients will need to be able to establish a TCP/IP socket connection to these ports.

Step 2: Download and Install Ignition Edge MQTT

Ignition Edge MQTT is a new stripped down version of Ignition that is specifically designed for use as an Edge of Network device.

See the Ignition Edge installation guide here. Follow the sections for Ignition Edge MQTT and for your specific Operating System. Make sure this is being installed on a different machine than was used to install Ignition in step 1. https://docs.inductiveautomation.com/display/DOC79/Installing+Edge

Step 3: Download and Install the Cirrus Link MQTT Modules

Go to the Inductive Automation download page again and scroll down to the Third Party modules section. Find the Cirrus Link modules section and download the MQTT Distributor, MQTT Engine, MQTT Transmission modules. https://inductiveautomation.com/downloads/archive. The download links should look similar to what is shown below.

Third Party Modules

All third party Ignition modules require the Ignition platform to be installed.

To install third party modules:

1. Install Ignition: See Ignition installation guide

2. Once Ignition is installed, download the module and install it in the Ignition Gateway: See module installation guide

Cirrus Link Solutions MQTT Modules for Ignition

To learn more about how to use the MQTT modules, click here.

MQTT Distributor Module	MQTT-Distributor-signed.modl (16MB)	Version: 3.2.2
MQTT Engine Module	MQTT-Engine-signed.modl (17MB)	Version: 3.2.2
MQTT Transmission Module	MQTT-Transmission-signed.modl (13MB)	Version: 3.2.2

- In Step 4 you will:
 - Install MQTT Distributor and MQTT Engine into the Central Ignition Gateway installed in step 1.
 - Install MQTT Transmission into Ignition Edge MQTT that was installed in step 2.

Step 4: Install the MQTT Modules

Once you have Ignition installed and running, and the MQTT Distributor, MQTT Engine and MQTT Transmission modules downloaded, browse to the Ignition Gateway console (e.g. http://localhost:8088).

Log in to the Ignition Gateway installed in step 1 using the default credentials of <u>admin/password</u>. Click on Configuration tab and then click on the Modules tab on the left side of the page. Scroll to the bottom of the Modules section and click on the Download/Upgrade modules button. When prompted, select the MQTT Distributor module from the file browser and install it. Do the same for the MQTT Engine module. When complete, the Ignition Gateway Web UI module section should look similar to what is shown below.

	SEQUENTIAL FUNCTION	8/main/web/contig/system.modules?3 Symbol Factory	2.3.3 (DX0180816XX)	vector graphics clipart library for the vision module.	Irial Loaded	More 🔻 restar
	CHARTS Settings	Tag Historian	2.9.9 (b2018081614)	Turns any database into a powerful historian that can store and drive data in Ignition.	Trial Running	More 👻 restar
Click here to install the Cirrus	MQTT DISTRIBUTOR Settings	UDP and TCP Drivers	4.9.9 (b2018081614)	Drivers for receiving and parsing UDP or TCP packets.	Trial Running	More 👻 restar
LINK MQTT MODULES	MQTT ENGINE Settings	User Manual	4.9.9 (b2018081614)	Provides an offline version of http://docs.inductiveautomation.com.	Free Running	More 🔻 🔽 restar
		Vision	9.9.9 (b2018081622)	A module that provides web-launched HMI/SCADA clients.	Trial Running	More 🔻 🛛 restar
		View Certificate Name MQTT Distributor	Version 3.4.3 (b2018070923)	Description An MQTT server	License State Trial Running	More 🔻 🛛 restat
		MQTT Distributor	3.4.3 (b2018070923)	An MQTT server	Trial Running	More 🔻 🔽 restar
		mQ11 Engine	5.4.5 (02018070525)	An experience of multiple experience	mai Rummig	More 🔻 restan
		→ Install or Upgrade a Module				
		→ Install or Upgrade a Module Note: For details about a module's st	atus, see the Module Status	page.		

Now log in to the Ignition Edge MQTT installed in step 2 using the default credentials of <u>admin/password</u>. Click on Configuration tab and then click on the Modules tab on the left side of the page. Scroll to the bottom of the Modules section and click on the Download/Upgrade modules button. When prompted, select the MQTT Transmission module from the file browser and install it. When complete, the Ignition Edge MQTT Web UI module section should look similar to what is shown below.

		Name	Version	Description	License §	State		
	NETWORKING Email Settings	Allen-Bradley Driver	4.9.9 (b2018081614)	Allen-Bradley driver suite for the OPC-UA module.	Trial F	Running	More 🔻	restart
Click here to install the Cirrus	SECURITY Audit Log Viewer	Modbus Driver	5.9.9 (b2018081614)	A driver for communicating with devices via Modbus-TCP.	Trial F	Running	More 🔻	restart
Link MQTT Modules	Users, Roles Service Security Security Zones	OPC-UA	4.9.9 (b2018081621)	A cross-platform OPC-UA server.	Trial F	Running	More 👻	restart
	ALARMING	User Manual	4.9.9 (b2018081614)	Provides an offline version of http://docs.inductiveautomation.com.	Free F	Running	More 🔻	restart
	Schedules	Vision	9.9.9 (b2018081622)	A module that provides web-launched HMI/SCADA clients.	Trial F	Running	More 🔻	restart
	OPC COM Servers ONIC FULLAT	Cirrus Link Solutions View Certificate Name	Version	Description	License 5	State		
	Quick Client MQTT TRANSMISSION History Settings	MQTT Transmission	3.4.3 (b2018070923)	An Ignition Tag to MQTT Bridge	Trial F	Running	dore 🔻	restart
		→ Install or Upgrade a Module Note: For details about a module's s	tatus, see the Module Statu	s page.				

Step 4: Configure the MQTT Modules on the Central Ignition Gateway

By default, MQTT Engine is already configured to point to an MQTT Server at tcp://localhost:1883. This means it will automatically connect to MQTT Distributor which is installed with it. There are some other configuration parameters that could optionally be set. The first is the 'Primary Host ID'. This is a setting that is highly recommended and should be set on both MQTT Engine and any MQTT Transmission instances that are reporting in as well. The ASCII string should match exactly on MQTT Engine and all MQTT Transmission instances. Also, optionally the 'Block Node Commands' and 'Block Device Commands' could be unchecked if you want to allow tag writes in MQTT Engine to result in tag writes on the MQTT Transmission instances (i.e. remote tag writes). Save the settings after making the changes.

🗧 🔍 🚺 Ignition-Gateway	- Ignition Gat ×			θ
\leftrightarrow \rightarrow C (i) localhost:808	88/main/web/config/mqtte	engine.settings?7	\$ 5 0	:
Overview Backup/Restore Licensing	MQTT Engine	e Settings		
Modules Projects Redundancy	General Se	rvers Namespaces		
Gateway Settings NETWORKING Gateway Network	General Set	ttings		
Email Settings	Main			
SECURITY Auditing Users, Roles	Enabled	C Enable the MQTT Engine (default: true)		
Service Security Security Zones	Primary Host ID	lamHost The Primary Host ID to allow connecting clients to ensure they remain connected to this application (optional)		
DATABASES Connections Drivers Store and Forward	Group ID Filters	A comma separated list of Group IDs to listen for (optional)		
ALARMING				
General Journal	Chariot Access			
Notification On-Call Rosters Schedules	Chariot Cloud Access Key	The optional Chariot Cloud Access Key used for Cirrus Link hosted Chariot MQTT Servers (optional)		
TAGS History Realtime	Chariot Cloud Secret Key	The optional Chariot Cloud Secret Key used for Cirrus Link hosted Chariot MQTT Servers (optional)		
OPC-UA SERVER				
Certificates Devices	Miscellaneous			
Settings	Block Node Commands	Enable blocking of outbound edge node tag writes		
Servers Quick Client	Block Device Commands	Enable blocking of outbound device tag writes		
MOBILE Settings	Block Property Changes	Enable blocking of incoming Tag property changes		
ENTERPRISE		Imaxa		Ш

Step 4: Configure MQTT Transmission on Ignition Edge MQTT

MQTT Transmission needs to be modified to point to the MQTT Server (MQTT Distributor) in order to get data into MQTT Engine. To do so, browse to Ignition Edge MQTT with a web browser. Then click 'Configure' at the top, log in, and select MQTT Transmission 'Settings' on the left panel near the bottom. Then select the 'Servers' tab. Finally, click the 'edit' button to the right of the 'Chariot SCADA' definition as shown below.

\rightarrow C (i) localhost:80	088/main/web/config/mqtttransmission.settings?9	*
EDGE y inductive automation	♠ HOME Ju STATUS & CONFIGURE	Launch Designer 🖏
Search	Trial Version 1:59:10 We're glad you're test driving our software. Have fun.	Activate Ignition
/STEM Overview Backup/Restore Licensing Modules Project	MQTT Transmission Settings	
Redundancy Gateway Settings	Name URL Server Type Server Set Username Certificate Files Connected	
NETWORKING Email Settings	Chariot SCADA tcp://localhost:1883 MQTT_Distributor Default admin 0 of 0	delete edit
ECURITY Audit Log Viewer Users, Roles Service Security Security Zones	 → Create new MQTT Server Note: For additional details on configuring MQTT Transmission, see the documentation 	
LARMING Journal Schedules	here	
PC-UA SERVER Certificates Devices Settings		
DPC CONNECTIONS Servers Quick Client		
IQTT TRANSMISSION History		

At this point, modify the URL to point to the Central Ignition Gateway's IP address. For example, if you central Ignition gateway is at 10.10.10.123, set the URL to tcp://10.10.10.123:1883. Then save your settings.

C i localhost:8088/main/web/config/mqt	ttransmission.settings?10	0- 7	c 🛆	ł I
rview kup/Restore MQTT Trar nsing	nsmission Settings			
ect General	Servers Sets Transmitters			
eway Settings Brking Edit MQT	T Server			
il Settings		_		
ITY Main				
rs, Roles Name vice Security vitra Constant Security	Chariot SCADA The friendly name of this MQTT Server			
ING URL rnat edules	tcp://IP_ADDRESS_OF_GATEWAY:1883 The URL of this MQTT Server. Should be of the form tcp://mydomain.com:1883 or ssl://mydomain.com:8883			
A SERVER Server Type ficates ces intes	MQTT_Distributor The type of MQTT Server to connect to (default: MQTT_Distributor)			
ONNECTIONS Server Set	Default The Server Set this MQTT Server is associated with			
k Client RANSMISSION Username Dry	admin The username for this MQTT connection if required by the MQTT Server (optional)			
ngs Change Password?	Check this box to change the existing password.			
Password	The password for this MQTT connection if required by the MQTT Server (optional)			
Password	Re-type password for verification.			

Now select 'Sets' at the top and click the 'edit' button next to the 'Default' Server Set as shown below.

ion-Edge-MQTT				USER MANUAL SUP Ladmin Sig
DGE nductive automation	A HOME பி ST.	ATUS & CONFIGURE		Launch Designer
Search	Trial Version	1:54:36 We're glad you're test driving our software. Ha	ive fun.	Activate Ignitio
'EM verview ackup/Restore	MQTT Transm	nission Settings		
censing odules roject edundancy	General Ser	vers Sets Transmitters		
ateway Settings	Name	Description	Primary Host ID	
WORKING nail Settings	Default	Default server set		delete edit
JRITY Idit Log Viewer Sers, Roles	→ Create new MQT	T Server Set		
curity Zones	Note: For additional	details on configuring MQTT Transmission, see the documer	itation	
eming	nere			

Now set the 'Primary Host ID' to the same ASCII string that was set in MQTT Engine previously as shown below and save the changes.

• • • Ignition-Edge-	-MQTT - Ignition ×		6
\leftrightarrow \rightarrow C (i) localhost:8	088/main/web/config/mqtttr	ansmission.settings?12	☆ & ○ :
Ignition-Edge-MQTT	А НОМЕ Ти	STATUS & CONFIGURE	USER MANUAL SUPPORT ≜admin Sign Out Launch Designer ∛
q Search	Trial Versior	1:52:55 We're glad you're test driving our software. Have fun.	Activate Ignition
SYSTEM Overview Backup/Restore Licensing Modules Project Redundancy Gateway Settings NETWORKING Email Settings SECURITY	MQTT Trans General S Edit MQTT Main	mission Settings ervers Sets Transmitters Server Set	
Audit Log Viewer Users, Roles Service Security Security Zones	Name	Default The friendly name of this MQTT Server Set	
ALARMING Journal Schedules	Description	Default server set Description of this MQTT Server Set	
DPC-UA SERVER Certificates	Primary Host ID	lamHost	
Devices Settings DPC CONNECTIONS Servers Ouick Client		Save Changes	

Step 5: Create Edge Tags

At this point we must launch Ignition Designer to create some tags to send to MQTT Engine using the MQTT protocol. Launch Designer from Ignition Edge MQTT as shown below.

		Click here to launch the Ignit Designer on your desktop
Ignition-Edge-MQ	TT - Ignition ×	Θ
enition-Edge-MQTT	I/main/web/config/mqtttransmission.settings?13 ♠ HOME → STATUS ♣ CONFIGURE	SER MANUAL SUPPORT ▲ admin Sign Out Launch Designer ∛
	Tuisl Meusien	Activate Ignition
Search	IFIAL VERSION 1:51:11 We're glad you're test driving our software. Have fun.	Activite Ignition
NSTEM Overview Backup/Restore Licensing	MQTT Transmission Settings	Active Burger

Below shows the Ignition Designer. Expand the 'Tag Browser' pane to get a better look. Note the 'All Providers/edge/Edge Nodes' folder. This is where we will add some specific folders and tags to work with the 'Default Transmitter' of MQTT Transmission.



Now perform the following actions.

- Under the 'Edge Node' folder, create a new folder called 'Group 1'
- Under the 'Group 1' folder, create a new folder called 'Edge Node 1'
- Under the 'Edge Node 1', create a new folder called 'Device 1'
- Under the 'Device 1' folder, create a new Memory Tag as shown below.

	Tag Editor
🖞 General	General Properties
🛚 Numeric	General Properties
🕽 Metadata	Name *
Permissions	My Tag
) History	Value *
🕻 Alarming	100
	Data Type Enabled Access Rights
	Integer Yes Read/Write
	- Scan Class
	<u>O</u> K <u>Apply</u> <u>C</u> ancel
-	

When done with the steps above, you should have a folder/tag structure as shown below.



Note additional tags could be added to the 'Device 1' folder as well. These could be OPC tags, UDTs, or other types of tags. Also, additional folders could be added below this level as well. The structure of the 'default transmitter' requires that the first three folder levels represent the Sparkplug Group ID, Edge Node ID, and Device ID respectively.

At this point, we can start the Transmitter by writing to the 'Transmission Control/Refresh' boolean tag. Writing to this tag tells MQTT Transmission to rescan the entire tag tree, detect the folders and tags present, and then begin publishing Sparkplug messages to the MQTT Server. The location of the tag to write to is shown below.



Step 6: Verify MQTT Transmission is Connected

Open the Ignition Edge MQTT Web UI and browse to 'Configure MQTT Transmission Settings Servers' and verify the connected status shows '1 of 1'. If it does not, double check the firewall and antivirus settings on the Central Ignition Gateway and ensure port 1883 is open.

MQTT - Ignition ×	Θ
088/main/web/config/mqttransmission.settings?20	☆ 🙆 😳 🗄 USER MANUAL SUPPORT ≗admin Sign Out Launch Designer 🖌
номе л status configure Trial Version 0:48:28 We're glad you're test driving our software. Have fun.	Activate Ignition
MQTT Transmission Settings General Servers Sets Transmitters Successfully updated MQTT Server "Chariot SCADA" Server Type Server Set Username Certificate Files Chariot SCADA tcp://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin	Connected 1 of 1 delete edit
→ Create new MQTT Server Note: For additional details on configuring MQTT Transmission, see here Make sure the 'Connected' status shows '1 of 1'	
	MUTT - Ignition × DBB/main/web/config/mqtttransmission.settings?20 A HOME ▲ STATUS ♦ CONFIGURE Trial Version 9:48:28 We're glad you're test driving our software. Have fun. MQTT Transmission Settings General Servers Sets Transmitters V Successfully updated MQTT Server "Chariot SCADA" Name URL Server Type Server Set Username Certificate Files Chariet SCADA tep://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin Amin Certificate Files Chariet SCADA tep://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin Chariet Scada tep://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin Chariet SCADA tep://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin

Step 7: Verify Data Flowing into MQTT Engine

With MQTT Transmission now connected, open Ignition Designer on the Central Ignition Gateway. Expand the Tag Browser and look expand the folder tree as shown below. You should see the 'My Tag' tag published from the Ignition Edge MQTT Edge Node.



Extra Activities

At this point you have a fully functional system that can be expanded or modified as required. Below are some additional activities you may want to try on your own.

- TLS enable the MQTT Distributor module and disable port 1883
- Note production MQTT Infrastructures should never run on the open Internet without using TLS enabled MQTT connections!
- Modify the MQTT Transmission default transmitter tag tree to add additional tags and get them to show up in the Central Ignition Gateway
- Write to a tag in MQTT Engine to show it update in MQTT Transmission
- Disable MQTT Transmission in Ignition Edge MQTT to see the tags go stale in MQTT Engine
- Set up store and forward in MQTT Transmission to show data being saved in Ignition Edge MQTT when the connection goes down
- Use a Custom Transmitter rather than the Default Transmitter to provide more flexibility on the MQTT Transmission side in terms of tag tree /arrangement
- Add a second or more Ignition Edge MQTT instances pointed at the same MQTT Distirbutor instance that was set up in this tutorial