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

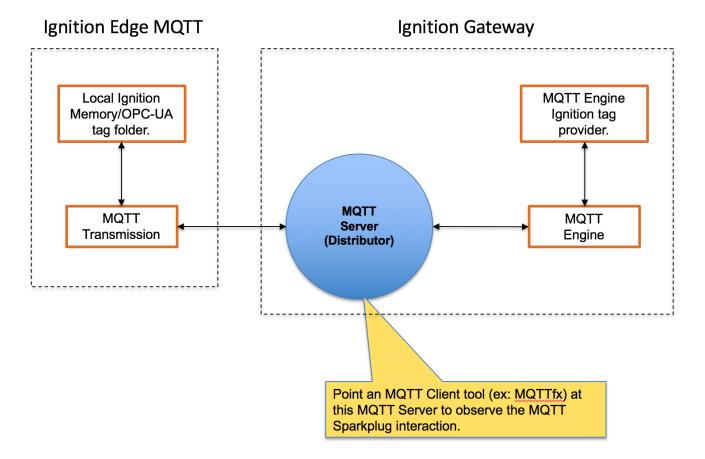
Summary

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/config/system.modules?3 Symbol Factory	2.3.3 (DX0180816XX)	vector graphics clipart library for the vision module.	Irial Loaded	☆ & More ▼ restart
	CHÂRTS 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 👻 restart
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 👻 🔽 restart
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 👻 resta
						More 🔻 restart
		MQTT Engine	3.4.3 (b2018070923)	An MQTT connector to multiple MQTT servers	Trial Running	More 👻 🛛 restar
		→ 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.

	the second se	in/web/config/system.modules?9	Version	Description	License State	
	NETWORKING Email Settings	Allen-Bradley Driver	4.9.9 (b2018081614)	Allen-Bradley driver suite for the OPC-UA module.	Trial 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 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 Running	More 🔻 🛛 restart
	ALARMING	User Manual	4.9.9 (b2018081614)	Provides an offline version of http://docs.inductiveautomation.com.	Free Running	More 🔻 🛛 restart
	Journal Schedules	Vision	9.9.9 (b2018081622)	A module that provides web-launched HMI/SCADA clients.	Trial Running	More 🔻 restart
	OPC COM	Cirrus Link Solutions View Certificate Name	Version	Description	License State	
	Quick Client MQTT TRANSMISSION History	MQTT Transmission	3.4.3 (b2018070923)	An Ignition Tag to MQTT Bridge	Trial Running	More 🕶 restart
	Settings	→ Install or Upgrade a Module Note: For details about a module's s	tatus, see the Module Statu	s page.		
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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.

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\leftrightarrow \rightarrow C (i) localhost:808	88/main/web/config/mqtte	engine.settings?7	\$ 6 0	:
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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		
OPC CONNECTIONS 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.

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Licensing		
Modules Project	General Servers Sets Transmitters Records	
Redundancy		
Gateway Settings	Name URL Server Type Server Set Username Certificate Files Connected	
NETWORKING Gateway Network	Charlot SCADA tcp://localhost:1883 MQTT_Distributor Default admin 0 of 0	delete edit
Email Settings	→ Create new MOTT Server	
SECURITY Audit Log Viewer	· create new mont detver	
Users, Roles	Note: For additional details on configuring MQTT Transmission, see the documentation	
Service Security Security Zones	here	
ALARMING		
Journal Notification		
On-Call Rosters		
Schedules		
OPC-UA SERVER		

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://10.10.123:1883. Then save your settings.

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teway Network nail Settings	Main		
RITY		Chariot SCADA	
dit Log Viewer ers, Roles	Name	The friendly name of this MQTT Server	
rvice Security curity Zones	URL	tcp://localhost:1883	
MING	URL	The URL of the MQTT Server to connect to. Should be of the form tcp://mydomain.com:1883 or ssl://mydomain.com:8883	
urnal tification		MQTT_Distributor *	
r-Call Rosters hedules	Server Type	The type of MQTT Server to connect to (default: MQTT_Distributor)	
UA SERVER rtificates		Default v	
vices ttings	Server Set	The Server Set this MQTT Server is associated with	
CONNECTIONS	Username	admin	
rvers lick Client	03emane	The username for this MQTT connection if required by the MQTT Server (optional)	
LE	Change Password?	Check this box to change the existing password.	
ttings RPRISE			
NISTRATION ent Setup	Password	The password for this MQTT connection if required by the MQTT Server (optional)	
IENTIAL FUNCTION	Password		
ttings	Password	Re-type password for verification.	
RPRISE SERVICES g History Sync	TLS		_
DISTRIBUTOR		Drawson Na Sile celested	
ttings	Certificate File Upload	Browse No file selected. Files: Considerate files to unlead. This will consider all nonviously unleaded contificate files. Continents files.	
T TRANSMISSION story		Certificate files to upload. This will replace all previously uploaded certificate files.	
ttings	Change Password?	Check this box to change the existing password.	
	Password		
		The password associated with the certificate's private key (optional)	

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

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by inductive automation		We're glad you're test driving our software. Hav			Activate Ignition
	riat version 1:44:11	We're glad you're test driving our software. Hav	e tun.		Activate ignition
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Licensing Modules Project Redundancy	General Servers	Sets Transmitters Record	S		
Gateway Settings	Name	Description	Primary Host ID		
NETWORKING Gateway Network Email Settings	Default	Default server set			delete
ECURITY Audit Log Viewer	→ Create new MQTT Set	erver Set			
Users, Roles Service Security Security Zones	Note: For additional deta here	ails on configuring MQTT Transmission, see the do	umentation		
ILARMING Journal Notification					
On-Call Rosters Schedules					
PC-UA SERVER					

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.

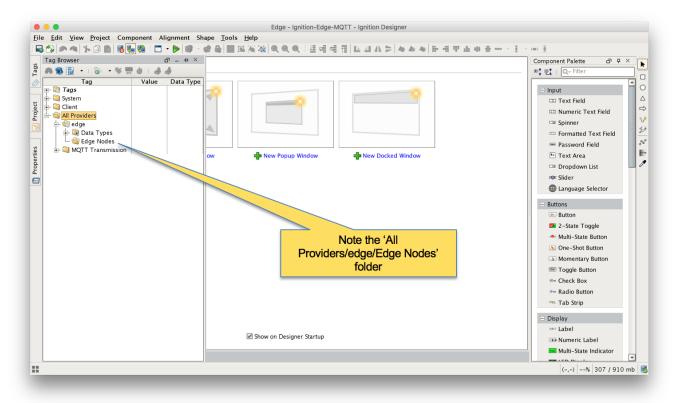
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Service Security Security Zones	Description	Default server set		
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Journal Notification				
Notification On-Call Rosters	Primary Host ID	lamHost		
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C-UA SERVER		Save Chan	zes	
Certificates Devices				
Settings				
C CONNECTIONS Servers				

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.

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Ignition-Edge-MQTT - Ignition >		Θ
O localhost:8088/main/web/c nition-Edge-MQTT	onfig/mqttransmission.settings?13	SER MANUAL SUPPORT
	E JI STATUS OP CONFIGURE	Ladmin Sign Out
Search Trial \	ersion 1:51:11 We're glad you're test driving our software. Have fun.	Activate Ignition
(STEM Overview Backup/Restore MOT	T Transmission Settings	
Licensing Modules	neral Servers Sets Transmitters	
	ngs?13-6.ILinkListener-config-contents-tab-2-tablink	

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.



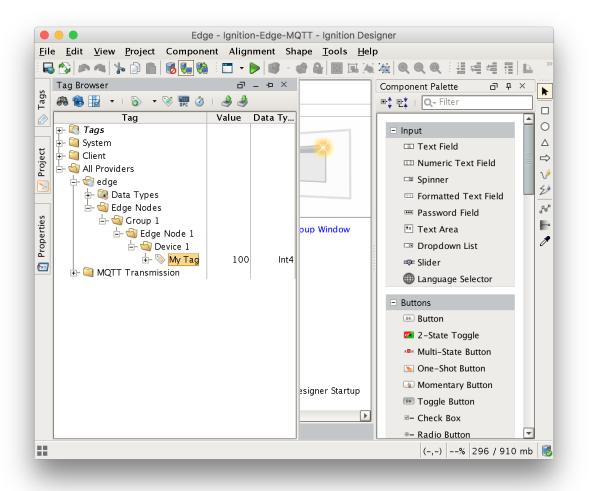
Now perform the following actions.

- 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.

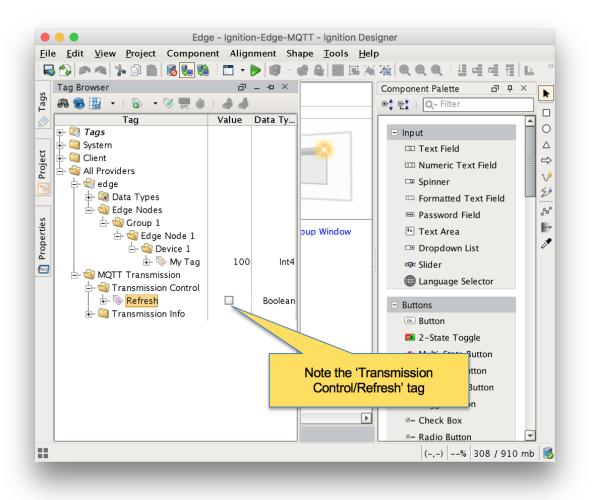
General Properties General Properties Name * My Tag Value *		10	
Name * My Tag Value *		10	
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Data Type Integer -Scan Class Scan Class Default	Enabled Yes	Access Rights	•
L	QK	<u>Apply</u>	:el
	-Scan Class Scan Class	-Scan Class Scan Class Default	-Scan Class Scan Class Default

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.



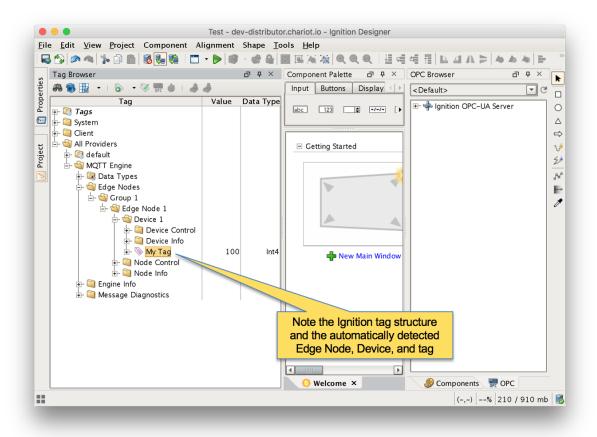
Step 6: Verify MQTT Transmission is Connected

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.

e e e Ignition-Edge-I		e
	88/main/web/config/mqtttransmission.settings?20	☆ & ○ :
Ignition-Edge-MQTT	A HOME III STATUS & CONFIGURE	USER MANUAL SUPPORT Ladmin Sign Out
Q Search	Trial Version 0:48:28 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 Transmission Settings General Servers Sets Transmitters Successfully updated MQTT Server "Chariot SCADA" Server Type Server Set Username Certificate Files Connected Name URL Server Type Server Set Username Certificate Files Connected Chariot SCADA tcp://dev-distributor.chariot.io:1883 MQTT_Distributor Default admin 1 of 1	delete edit
Audit Log Viewer Users, Roles Service Security Security Zones ALARMING	Create new MQTT Server Note: For additional details on configuring MQTT Transmission, see Make sure the 'Connected'	
Journal Schedules OPC-UA SERVER Certificates Devices	here status shows '1 of 1'	

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