MQTT Engine Tag Latching

Prerequisites

Familiarity with creating event scripts and tag trees in Designer

Installation of Cirrus Link Modules at v4.0.10 or greater and familiarity with configuring the modules

- Distributor
- Transmission
- Engine

Abstract

Tag Latching is used for synchronizing events at an Ignition Gateway running MQTT Engine when using tag change scripts.

If tag change events are occurring very quickly (many times per second) this can lead to synchronization problems in tag change scripts and the use of trigger and latch tags can be used resolve this. Another scenario for rapidly changing tags is when the Edge Node is flushing large volumes of historical data and MQTT Engine is configured to write these historical events directly to the tag.

In this tutorial we will show how to use trigger and tag latches to synchronize events.

System Setup - Transmission

In the MQTT Transmission module, create a Transmitter pointing to the default Tag Provider with Edge Nodes as the Tag Path:

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.lu Status	Backup/Restore		
\$	Licensing	General Servers Sets Transmitters Records Files	
onfig	Modules		
	Projects	Name Enabled Tag Provider Tag Path Set History Store Sparkplug IDs	
	Gateway Settings	Example Transmitter true default Edge Nodes Default	delete
	NETWORKING	→ Create new Settings	
	Q Search]	

System Setup - Designer

In Designer, create a file structure under the default tag provider as shown below and confirm that the data tags are reported in MQTT engine:

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						🎎 2 233 / 1024 m

Now to simulate change events at the Edge (MQTT Transmission), we will add the following Gateway Event Timer script with a delay of 1,000ms which will write the same value to both Data1 and Data2 tags once per second. (Scripts to use/copy can be found here)

Name	
Change Events at Ed	ge
Delay (ms)	Enabled
1,0	000 🚔 🗹 true
Delay Type	
🔾 Fixed Delay	Fixed Rate
Threading	
Shared	O Dedicated
01	

	Gateway Event Scr	pts
Gateway Event Scripts	Gateway Timer Scripts Timer scripts that are always running on the Gateway Counge Lovens at Edge (01.000m) 2 wilds = 1 3 UBL wilds = 5 0 4 wilds = 5 0	taj.read("[default]Ebpe Nodes/G1/E1/D1/Data1").value
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	+ 6 0	

We will also add a Gateway Tag Change script for that compares the Data1 and Data2 tags at MQTT Engine to verify they are the same using [MQTT Engine]Edge Nodes/G1/E1/D1/Data1 as our trigger tag. (Scripts to use/copy can be found here)

•		Gateway Event Scripts		•••	Gateway Event Scripts
teway Event Scripts	Gateway Tag Change Scri Tag change event scripts that r Tag Change on Data1	Catency Event Sortes pts un on the Catency Trags Sorget Sorget Rease Trag Catency Orbital Canage Taggers © Value © Quality © Trenstamp	Evabled Trace	Catarwy Event Sories ☐ Sonap ☐ Upton ☐ Sonap ☐ Sonap ☐ Sonapon ☐ Sonap	Category Tag Change Scripts Category Fag Change Scripts Tag beging rest types faint in the Gamay Tag beging rest types faint in the Gamay
	+ 8	i aj Antoso MQTT Ergine)[Edge Hodes/G1/E1/D1/Data1 }	Å		+ B
			QK Apply Cancel		QK Apply Cance

Make sure to save your project in Designer for these changes to take effect.

Now when we look the the Logs in Ignition, we can see the following output as expected showing Data1 and Data2 have the same value.

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nitior	n			∠ ≜admin	Log
init	tion			Help 🛛 Get Des	signe
	SYSTEMS	Ju Status > Diagnostics > Logs			
1e	Overview	Trial Mode 0:41:08 We're glad yo	u're test driving our software. Have fun.	Activa	te Igni
us fig	Performance Alarm Pipelines Gateway Scripts Modules			51053 items 《 〈 1 of 511 ›	»
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	Reports				
	SFCs			Live Values 🔍 😳	
	Voice Alarming	Logger	Time	Message	
	Tags	I latching	05Aug2022 13:47:00	Values: 92 => 92	
	Transaction Groups	I latching	05Aug2022 13:46:59	Values: 91 => 91	
	CONNECTIONS	I latching	05Aug2022 13:46:58	Values: 90 => 90	
	Databases	I latching	05Aug2022 13:46:57	Values: 89 => 89	
	Designers	I latching	05Aug2022 13:46:56	Values: 88 => 88	
	Devices	I latching	05Aug2022 13:46:55	Values: 87 => 87	
	Gateway Network	I latching	05Aug2022 13:46:54	Values: 86 => 86	
	Store & Forward	I latching	05Aug2022 13:46:53	Values: 85 => 85	
	OPC Connections	1 latching	05Aug2022 13:46:52	Values: 84 => 84	
	Perspective Sessions	I latching	05Aug2022 13:46:51	Values: $83 \Rightarrow 83$	
	• Search	I latching	0540-2022 12:40-50	values. 65 = 7 65	

The problem arises when MQTT Engine is calling 'update tag' on both Data1 and Data2 very quickly (many times a second). This can lead to synchronization problems in our tag change script because by the time the script is reading Data2, MQTT Engine has already written a new value to it and we end up with an erroneous output.

To simulate this scenario, let's edit the Gateway Timer Script and set the delay to only 5ms

name	
Change Events at Ec	ige
Delay (ms)	Enabled
	5 🌲 🗹 true
Delay Type	
Fixed Delay	Fixed Rate
Threading	
Shared	 Dedicated
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Now when we look the the Logs in Ignition, we can see the following output showing that the values are out of synchronization.

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$\leftarrow \ \ \rightarrow \ \ \mathbf{G}$	🔿 🔁 192.168.1.117:8088/web/statu	s/diag.logviewer?19	☆	⊚ ⊀ ◻ ≡
SFCs	Ju Status > Diagnostics > Logs			
Home Voice Alarming	Trial Mode 0:23:44 We're glad	you're test driving our software. Have fun.	Wessage	Activate Ignition
.hı ^{Tags}	1 latching	05Aug2022 14:04:21	Values: 159 => 159	
Status Transaction Groups	I latching	05Aug2022 14:04:21	Values: 158 => 159	
	I latching	05Aug2022 14:04:21	Values: 157 => 158	
Databases	I latching	05Aug2022 14:04:21	Values: 156 => 157	
Designers	I latching	05Aug2022 14:04:21	Values: 155 => 156	
Devices	1 latching	05Aug2022 14:04:21	Values: 154 => 155	
Gateway Network	1 latching	05Aug2022 14:04:21	Values: 153 => 154	
Store & Forward	1 latching	05Aug2022 14:04:21	Values: 152 => 153	
OPC Connections	1 latching	05Aug2022 14:04:21	Values: 151 => 152	
Perspective Sessions	I latching	05Aug2022 14:04:21	Values: 150 => 151	
Vision Clients	I latching	05Aug2022 14:04:21	Values: 149 => 150	
DIAGNOSTICS	I latching	05Aug2022 14:04:21	Values: 148 => 149	
Execution	I latching	05Aug2022 14:04:21	Values: 147 => 148	
Logs	I latching	05Aug2022 14:04:21	Values: 146 => 147	
Metrics Dashboard	I latching	05Aug2022 14:04:21	Values: 145 => 146	
Running Scripts	I latching	05Aug2022 14:04:21	Values: 144 => 145	
Threads	I latching	05Aug2022 14:04:21	Values: 143 => 144	
	I latching	05Aug2022 14:04:21	Values: 142 => 143	
	I latching	05Aug2022 14:04:21	Values: 141 => 142	
	I latching	05Aug2022 14:04:21	Values: 140 => 141	
	I latching	05Aug2022 14:04:21	Values: 139 => 140	
	1 latching	05Aug2022 14:04:21	Values: 138 => 139	
Search	1 latching	05Aug2022 14:04:21	Values: 137 => 138	
- Searchin	I latching	05Aug2022 14:04:21	Values: 136 => 137	

Configuring Tag Latching

When this happens, we can use tag latching to synchronize MQTT Engine with the tag change script.

The configuration for Tag Latching is available under MQTT Engine General tab > Advanced Settings with the following properties:

• Enable Tag Latching

• Whether or not to enable Tag latching to synchronize MQTT Tag updates with events in Ignition.

- Latch Timeout
 - The amount of time in milliseconds MQTT Engine will to wait for a tag latch to be released before does it on its own.
- Latch Tags
 - A semicolon separated list comma separated list of Trigger Tag and Latch Tag pairs.
 - A 'Trigger Tag' is a 'real tag' that you would normally use in a standard Transaction Group or Tag Change Script as a trigger.
 The 'Latch Tag' is a tag that will be created in the [MQTT Engine]Engine Info/Latches folder. Each latch tag will be set to true when MQTT Engine calls updateTag for that given trigger tag. Then MQTT Engine waits until the timeout or until the latch tag gets set back to false by a script, transaction group, etc which ever comes first. The latch tag is what should be used by scripts or transaction groups and must be set back to false at the end of the operation to allow MQTT Engine to continue processing incoming Sparkplug messages.
 - The 'Latch Tags' must be of the form:
 - Group ID/Edge Node ID/Device ID/Trigger Tag, Group ID/Edge Node ID/Device ID/Latch Tag for example:
 - G1/E1/D1/Trigger Tag 1,G1/E1/D1/Latch Tag 1
 - You can also have longer folder paths on any trigger tag or latch tag. For example:
 - G1/E1/D1/my/longer/tag/path/Trigger Tag 1,G1/E1/D1/my/longer/path/Latch Tag 1
 - If you want to specify two or more latches, separate them with a semicolon:
 - G1/E1/D1/Trigger Tag 1,G1/E1/D1/Latch Tag 1;G1/E1/D1/Trigger Tag 2,G1/E1/D1/Latch Tag 2
 - You can also specify multiple trigger tags for any given latch. Just create two or more entries that each point to the same latch tag:
 G1/E1/D1/Trigger Tag 1,G1/E1/D1/Latch Tag 1;G1/E1/D1/Trigger Tag 2,G1/E1/D1/Latch Tag 1
 - You can specify as many as trigger and latch tags as you want.

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♠	OPC VA	🌣 Config	; > Mqttengine > MQ	TT Engine Settings			
Home	Device Connections	Trial Mo	ode 0:11:13 We'reg	lad you're test driving our software. Have fun.		Activate Ig	nitio
.ht	Security		Show advanced	properties			
Status	Server Settings		Advanced Settin	gs			
Config	BACNET		Enable Tag Latching	☐ Enable latching on tags to synchronize MQTT Engine tag updates with events in Ignition projects overall system performance when enabled.	. This will impac	ct	
	ENTERPRISE ADMINISTRATION		Latch Timeout	2000 The amount of time to wait for the latch to be released by the Ignition project component in millise out (default: 2,000)	conds before tir	ning	
Ŧ	Sequential function charts		Latch Tags	A semicolon separated list of comma separated trigger tag/latch tag pairs (e.g. 'trigger1,latch1;trigg	ger2,latch2;')		

Edit the configuration as shown below to set the Latch Tags field as 'G1/E1/D1/Data1,G1/E1/D1/Latch'.

Note we are using Data1 as the trigger tag since that is the 'trigger' for our existing tag change script.



With this set, MQTT Engine will now set a new tag '[MQTT Engine]Engine Info/Latches/G1/E1/D1/Latch' to true every time the trigger tag changes.



It is the responsibility of the script, transaction group, or external application to reset the latch tag to allow MQTT Engine to continue processing data normally. If this is not done MQTT Engine will stop processing incoming change events until the 'Latch Timeout' elapses.

It should also be noted that this does have a performance impact on MQTT Engine. Because we must synchronize the processing of incoming events MQTT Engine will not process these events as quickly. From the time MQTT Engine sets the latch and the script releases it, MQTT Engine pauses all processing of tag change events.

So for this example, the tag change script is modified as follows to release the latch at the end of the script. (Scripts to use/copy can be found here)

•		Gateway Event Scripts	
Gateway Event Scripts	Gateway Tag Change Script: Tag change event scripts that run Tag Change on Data1	Gateway Event Scripts Tags Script #add logger logger = system.util.logger("com.cirruslink.test.MQTTEngine.latching") dataOneValue = newValue.getValue() dataOneValue = system.tag.read("IMQTT Engine]Edge Nodes/G1/E1/D1/Data2").value logger.info("Values: " + str(dataOneValue) + " ⇒ " + str(dataTwoValue)) # Free the latch system.tag.writ6Suphronous("IMOTT Engine_Engine_Info/Latches/G1/E1/D1/Latch".	False. 45)
	+ 11	system reg.writesynchronodst (nyrr Engine)Engine inno/Latches/03/Li/Di/Latch	(19)
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Now with this setup, we can see the output is correct as shown below. Note all of this output came from within the same second.

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Redundancy	Ju Status > Diagnostics > Logs				
Reports	Trial Mode 0:03:34 We're glad	you're test driving our software. Have fun.		Activate Igniti	
- SFCs					
s Tage	Logger	Time	Message		
Transaction Groups	I latching	05Aug2022 14:24:34	Values: 193 => 193		
	I latching	05Aug2022 14:24:34	Values: 192 => 192		
CONNECTIONS	I latching	05Aug2022 14:24:34	Values: 191 => 191		
Databases	I latching	05Aug2022 14:24:34	Values: 190 => 190		
Designers	I latching	05Aug2022 14:24:34	Values: 189 => 189		
Devices	I latching	05Aug2022 14:24:34	Values: 188 => 188		
Gateway Network	1 latching	05Aug2022 14:24:34	Values: 187 => 187		
Store & Forward	I latching	05Aug2022 14:24:34	Values: 186 => 186		
OPC Connections	I latching	05Aug2022 14:24:34	Values: 185 => 185		
Perspective Sessions	I latching	05Aug2022 14:24:34	Values: 184 => 184		
Vision Clients	I latching	05Aug2022 14:24:34	Values: 183 => 183		
DIAGNOSTICS	I latching	05Aug2022 14:24:34	Values: 182 => 182		
Execution	I latching	05Aug2022 14:24:34	Values: 181 => 181		
Logs	I latching	05Aug2022 14:24:34	Values: 180 => 180		
Metrics Dashboard	I latching	05Aug2022 14:24:34	Values: 179 => 179		
Running Scripts	I latching	05Aug2022 14:24:34	Values: 178 => 178		
Threads	I latching	05Aug2022 14:24:34	Values: 177 => 177		
	I latching	- 05Aug2022 14:24:34	Values: 176 => 176		
	I latching	- 05Aug2022 14:24:34	Values: 175 => 175		
	I latching	05Aug2022 14:24:34	Values: 174 => 174		
	I latching	05Aug2022 14:24:34	Values: 173 => 173		
C. Securit	I latching	05Aug2022 14:24:34	Values: 172 => 172		
q Search	L Jatching	0541/2022 14:24:24	Voluces 171 172		

Gateway Event Scripts

Gateway Timer Script

```
value = system.tag.read("[default]Edge Nodes/G1/E1/D1/Data1").value
value += 1
if value > 500:
  value = 0
system.tag.writeSynchronous("[default]Edge Nodes/G1/E1/D1/Data2", value, 30)
system.tag.writeSynchronous("[default]Edge Nodes/G1/E1/D1/Data1", value, 30)
```

Gateway Tag Change Script

```
#add logger
logger = system.util.logger("com.cirruslink.test.MQTTEngine.latching")
dataOneValue = newValue.getValue()
```

```
dataTwoValue = system.tag.read("[MQTT Engine]Edge Nodes/G1/E1/D1/Data2").value
logger.info("Values: " + str(dataOneValue) + " => " + str(dataTwoValue))
```

Gateway Tag Change Script with Latching

```
#add logger
logger = system.util.logger("com.cirruslink.test.MQTTEngine.latching")
dataOneValue = newValue.getValue()
dataTwoValue = system.tag.read("[MQTT Engine]Edge Nodes/G1/E1/D1/Data2").value
logger.info("Values: " + str(dataOneValue) + " => " + str(dataTwoValue))
# Free the latch
```

```
system.tag.writeSynchronous("[MQTT Engine]Engine Info/Latches/G1/E1/D1/Latch", False, 45)
```

Additional Resources

- Inductive Automation's Ignition download with free trial
 https://inductiveautomation.com/downloads/
- Azure Injector download with free trial
- https://inductiveautomation.com/downloads/third-party-modules
 Questions about this tutorial?
 - Check out the Cirrus Link Forum: https://forum.cirrus-link.com/
 - Contact support: support@cirrus-link.com
- Sales questions
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