GOOSE TO MQTT BRIDGE

USING MQTT FOR GOOSE APPLICATION STAGING

Revision 0.9

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INTRODUCTION AND THEORY

The GOOSE to MQTT Bridge was developed out of a need to support the integration of a GOOSE application amongst participating companies located around the globe. The first thought was to utilize some internal technology to convert Layer 2 GOOSE to an encapsulation over TCP/IP. However, this would have required a TCP "message broker" to be created and hosted by a company infrastructure. The MQTT broker that has been tested is Mosquito.

MQTT is an publish/subscribe message exchange technology that is the equivalent to encapsulation of a payload in TCP.

The use of MQTT is may be restricted to individuals that have a username/password accounts for the MQTT broker. However, for the purposes of the IOP staging, Triangle Microworks has staged a Mosquito MQTT broker located at: **45.20.211.173**.

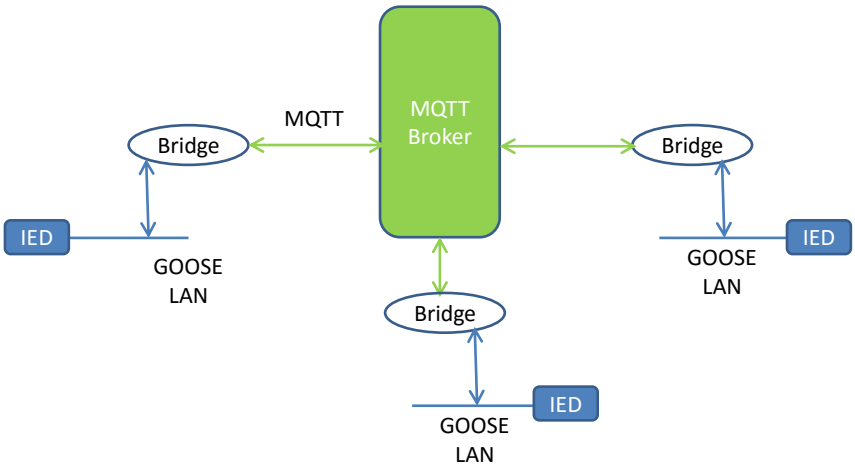


Figure 1: Architecture of GOOSE Exchange using Bridge

Figure 1 depicts the high level architectural view of the use of a broker by the GOOSE to MQTT Bridges. Instances of the bridge are connected to a GOOSE Local Area Network (LAN) through an Ethernet Network Interface Card (NIC). The bridge subscribes to ALL Layer 2 GOOSE messages all the LAN and then encapsulates the GOOSE messages in MQTT and sends the message to the connected broker. The broker then distributes the messages to the other MQTT clients connected to the broker who have subscribed to a specific topic. The bridges that receive the messages distributed by the broker de-encapsulate the GOOSE messages and transmit the messages onto the GOOSE LAN. The bridges are bi-directional (e.g. send and receive GOOSE messages), but will not receive messages that they transmit.

How does an MQTT broker know which messages to send to which clients? This is based upon a specified MQTT topic. Applications that need GOOSE exchanges need to subscribe and publish to the same topic. In order to allow multiple interactions (e.g. staging of different parts of the application simultaneously) different topics should be used. A separate GOOSE/MQTT bridge instance is needed per topic.

CONTENTS

INSTALLATION

The installation is a *.zip. Unzip the contents into a directory.

PRE-REQUISITES

Prior to using the GOOSE to MQTT Bridge, the following should be performed:

- The participants will need to choose a name for the topic and provide that name to the users that will be using the Bridge to access the broker (see page 5).
- Each Bridge requires at least one Ethernet NIC and access to the Internet.

CHOOSING A TOPIC NAME

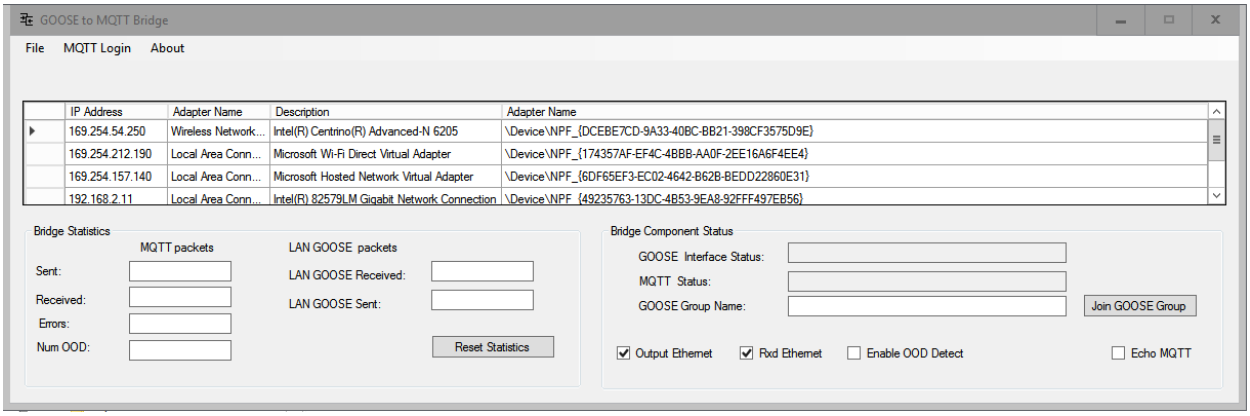
The Bridge attempts to isolate the chosen set of integrated applications from other integration streams. In order to accomplish this isolation, the Bridge encapsulates the name chosen GOOSE Group Name (e.g. MQTT topic) .As an example “foo”.

EXECUTION

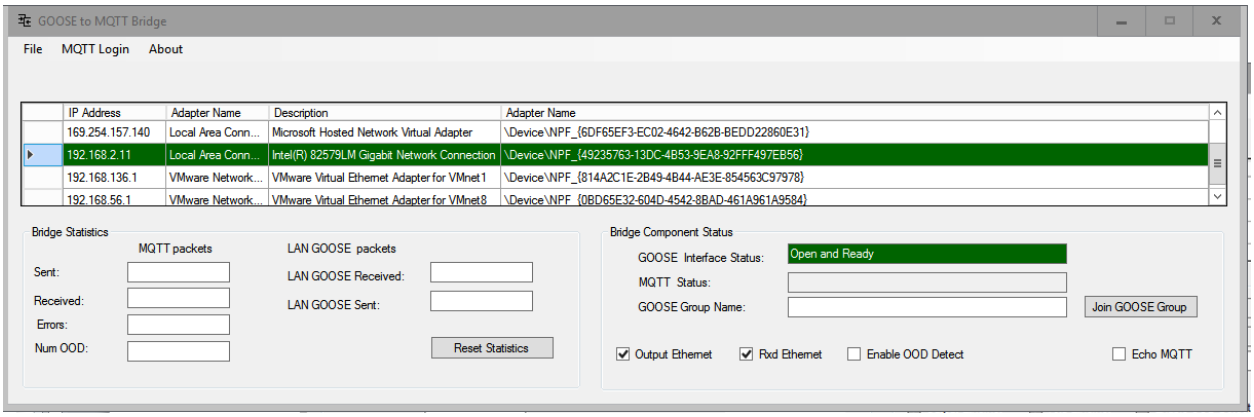
This section will detail the general execution pattern for the bridge.

- Execute the GOOSEtoMQTT executable.

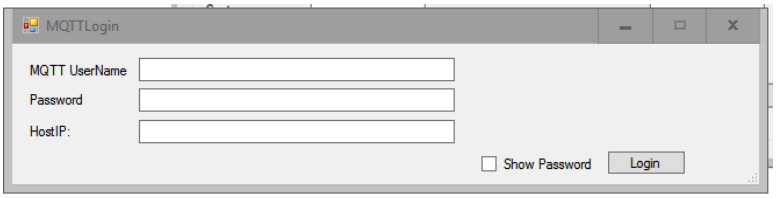
  This should result in a display similar to the following:



- Select the appropriate Ethernet Interface that is attached to the GOOSE LAN. This is accomplished by selecting the row of the appropriate NIC. A selection will be indicated by the row being highlighted in “green”.



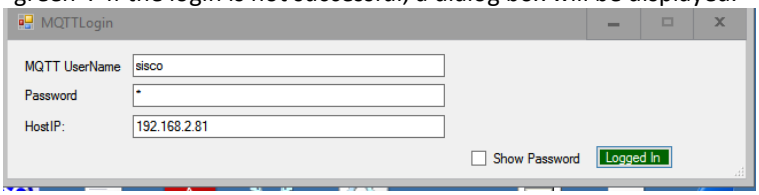
- Select MQTT Login which will result in a login screen into which the GMAIL username and password can be entered.



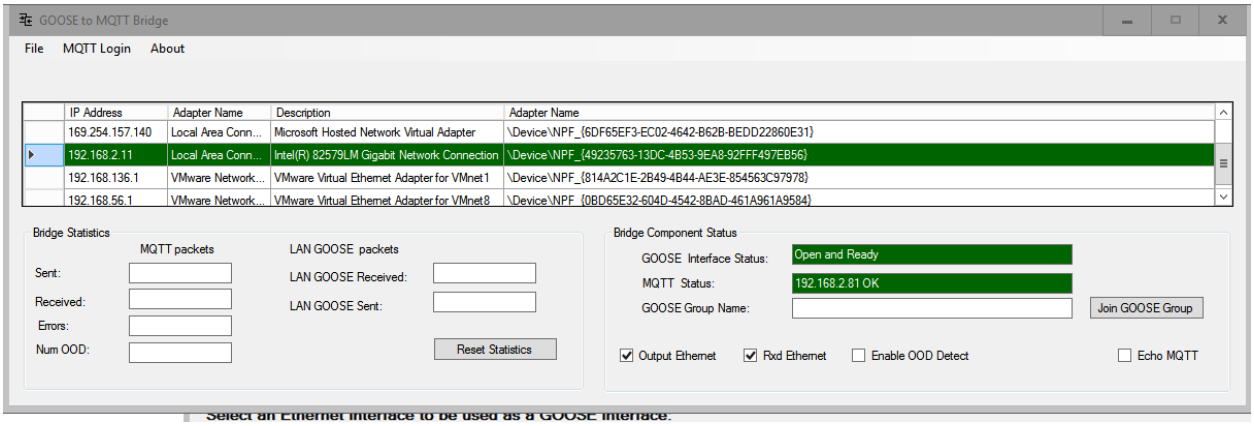
The UserName must be unique amongst the other clients connected to the broker. This name is used to make sure that messages issued by a particular client are not re-published to the GOOSE LAN. If the broker requires a password, then the password must be entered and match the configuration of the MQTT broker. If the broker does not require a password, then any value can be entered. Both the UserName and Password must have values.

Once the user name and password is entered, select “Login”.

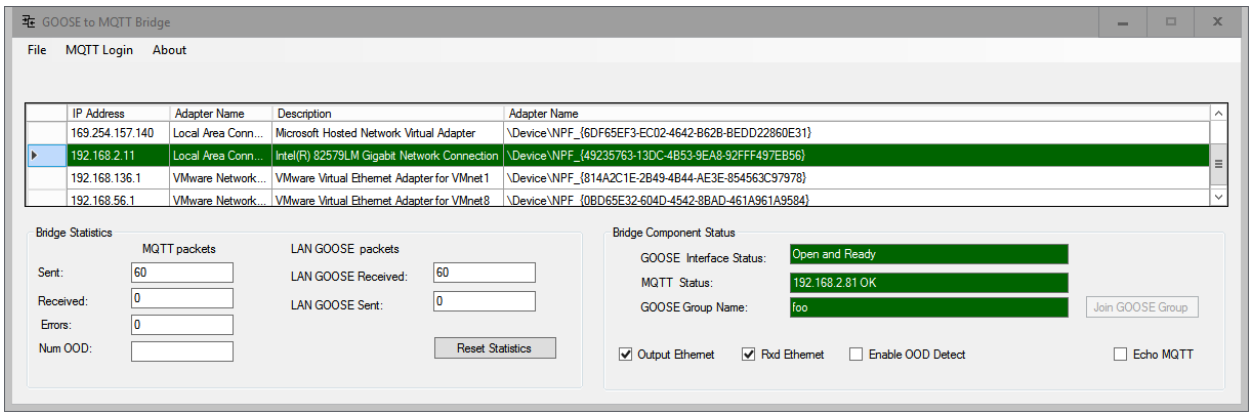
It may take up to 50 seconds to achieve a login. Upon a successful login, the Login button will turn “green”. If the login is not successful, a dialog box will be displayed.



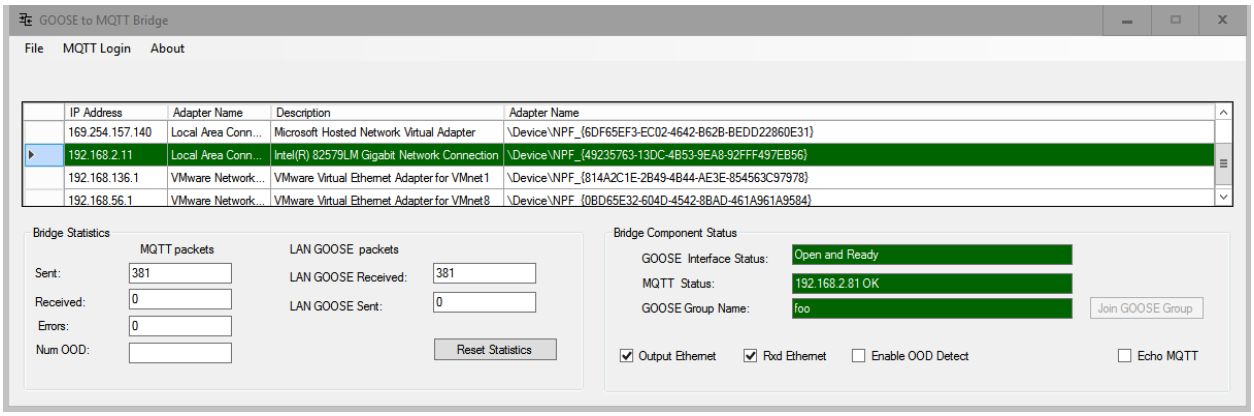
Upon successful login, close the login dialog and this will result in the XMPP status box becoming “green”.



- The user should then enter the GOOSE Group Name (MQTT Topic).



UNDERSTANDING THE INTERFACE



The interface has a couple of options:

- Echo MQTT: This is provided in order to do MQTT performance test. If checked, the Bridge will echo back the received MQTT packet (e.g. encapsulated GOOSE). This option should only be used when there are only two (2) Bridges connected to the broker in a given GOOSE Group.
- Rxd Ethernet: If checked, the Bridge will process GOOSE messages received on the selected NIC.
- Output Ethernet: If checked, the Bridge will transmit the received GOOSE message (e.g. encapsulated in MQTT) and publish it onto the selected Ethernet.
- Reset Statistics: If selected, it will reset the statistics that are being updated.

The statistics include:

- LAN GOOSE Received: This is the number of the GOOSE packets received from the selected Ethernet NIC.
- MQTT packets Sent: This represents the number of encapsulated GOOSE messages that are sent to the broker via MQTT. This number should track closely with the number displayed in LAN GOOSE Received.
- MQTT packets Received: This represents the number of MQTT packets received from the broker that contain an encapsulated GOOSE message.
- LAN GOOSE Sent: This represents the number of GOOSE messages published by the Bridge onto the selected Ethernet LAN. This number should closely track the value of MQTT packets Received.
- Errors: Number of MQTT packets received that contain error information.