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MQTT with LabVIEW

A Communication Protocol popular in Internet of Things Applications

Hans-Petter Halvorsen

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MQTT

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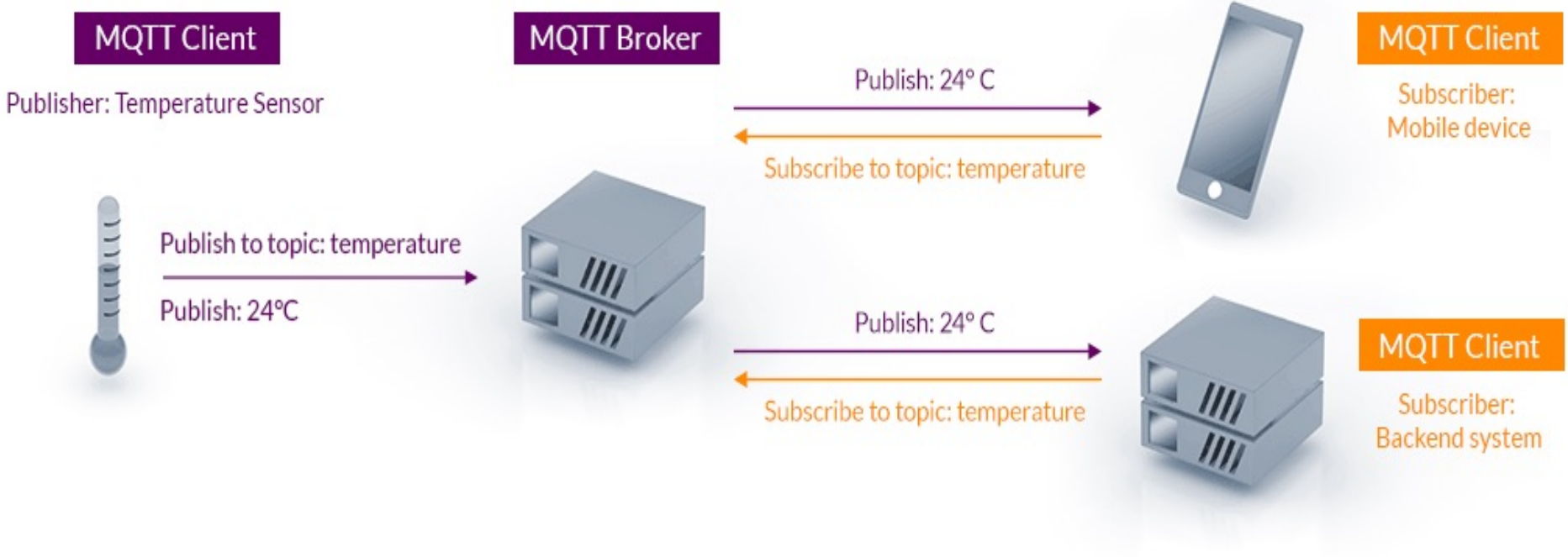
MQTT

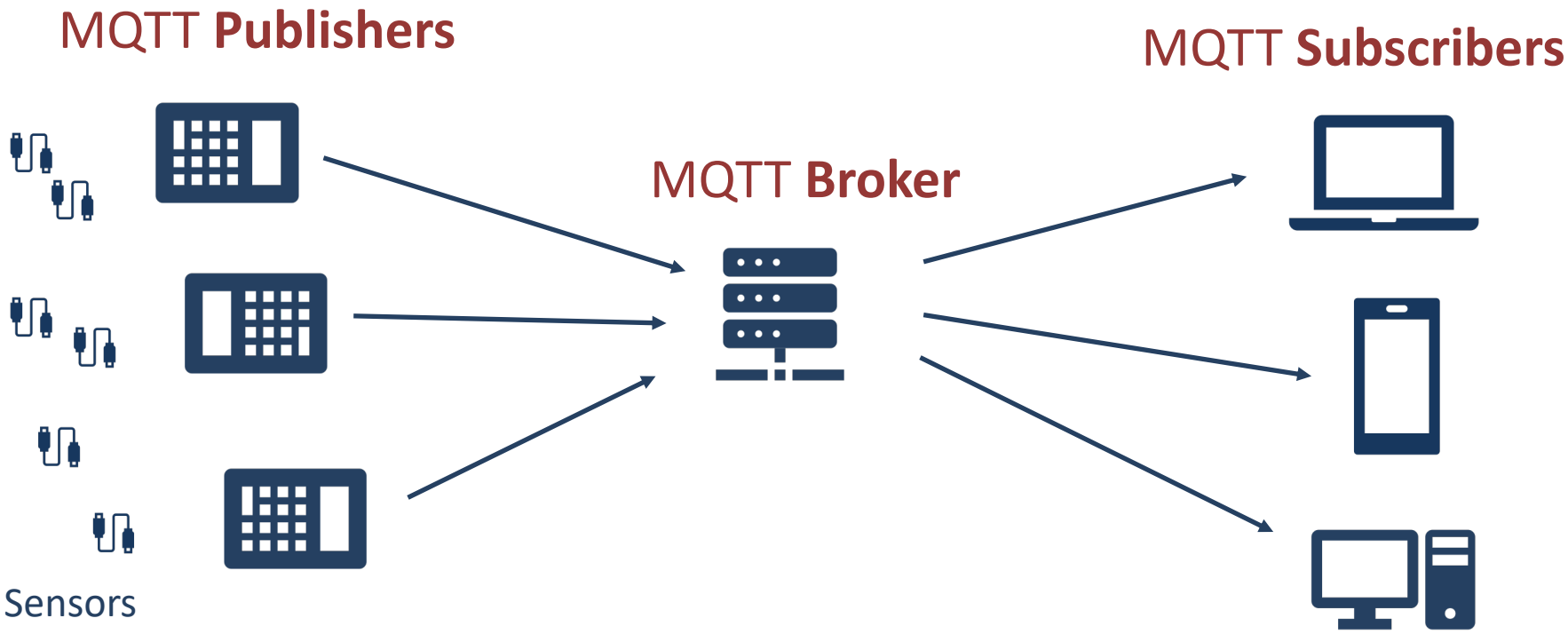
- **MQTT is a Communication Protocol popular in Internet of Things (IoT) Applications**
- https://mqtt.org
- You can use or implement MQTT in all the most popular Programming environments
- **Default Port is 1883** (and 8883 for secured SSL/TSL communication)
- MQTT can be used on all the popular platforms like Windows, macOS, Linux, Arduino, Raspberry Pi
- You can use an existing API, or you can implement and use the MQTT protocol from scratch
- We will LabVIEW in this Tutorial

MQTT



https://mqtt.org

MQTT Scenario



Publish/Subscribe Model

Typically, we have what we call **Producers** (Publishers), and we have **Consumers**, which can be both Publishers and Subscribers.

Client

Server

Client

Client that Writes Data

Client that Reads Data

MQTT Terms

- MQTT Broker
  - Server
- MQTT Publishers
  - Clients that Write/Publish Data
- MQTT Subscribers
  - Clients that Read/Subscribe to Data

MQTT Topics

- Data in MQTT are Published to Topics
- Topics are made up of one or more topic levels, separated by a forward slash

Example:

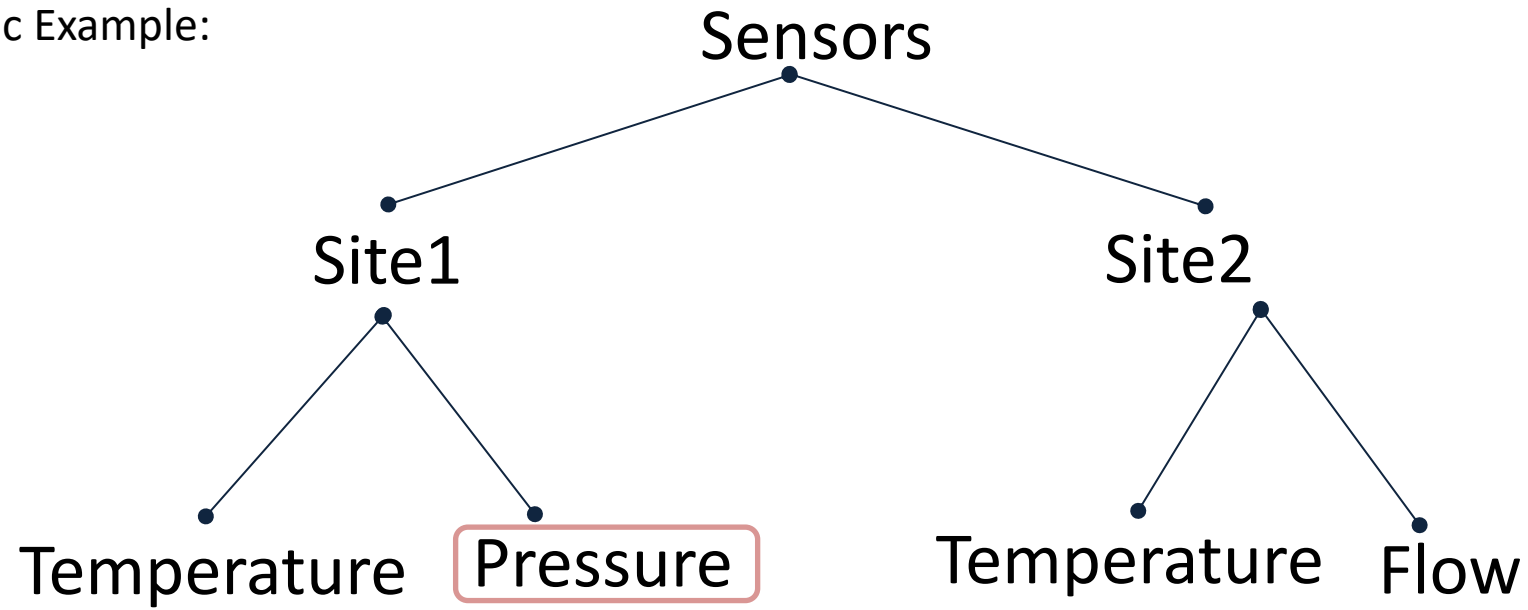
Sensor/Temperature/Temp1

- Topics are used to organize the data
- Topics are case sensitive
- Topics don’t have to be pre-registered at the broker

MQTT Topics

Topics are used to organize the data

Basic Example:



Sensors/Site1/Pressure

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LabVIEW

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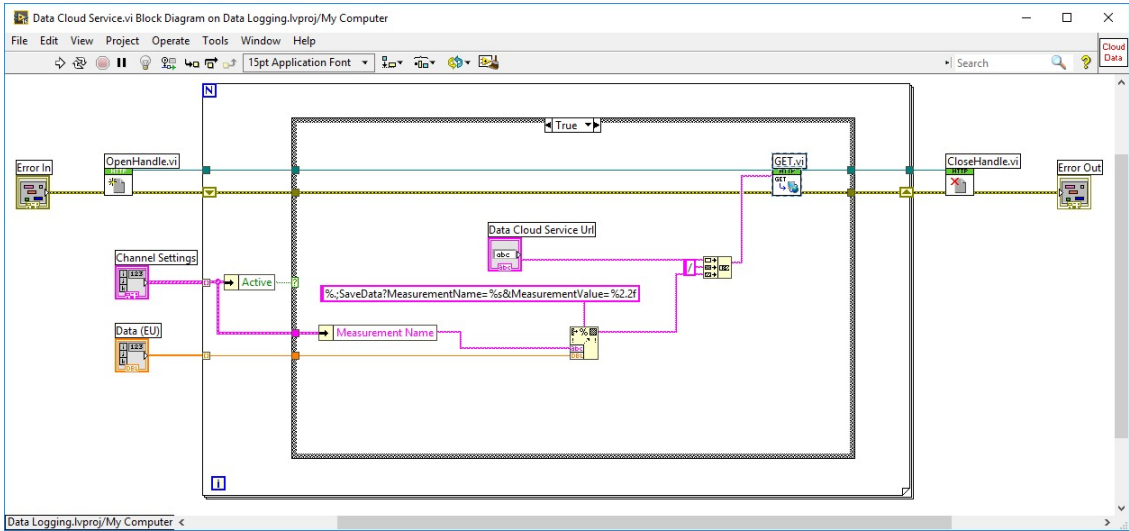
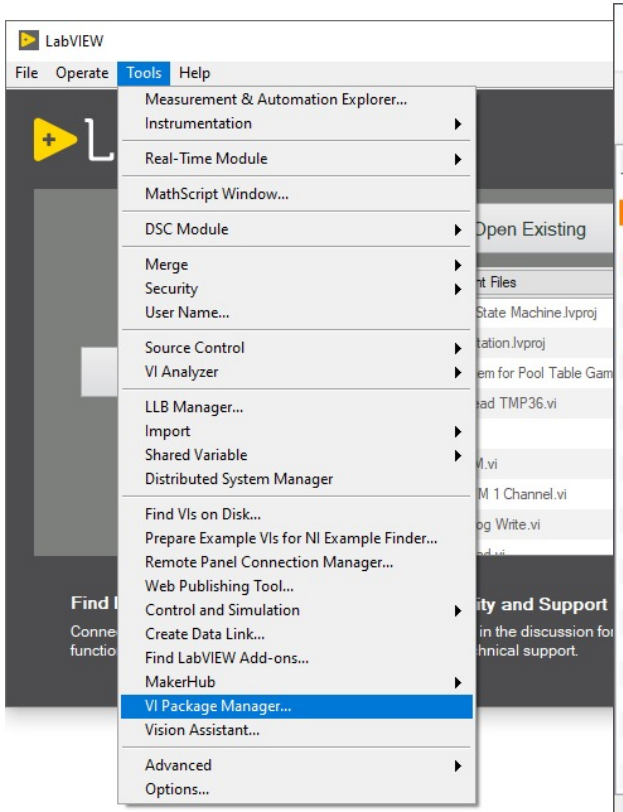
LabVIEW

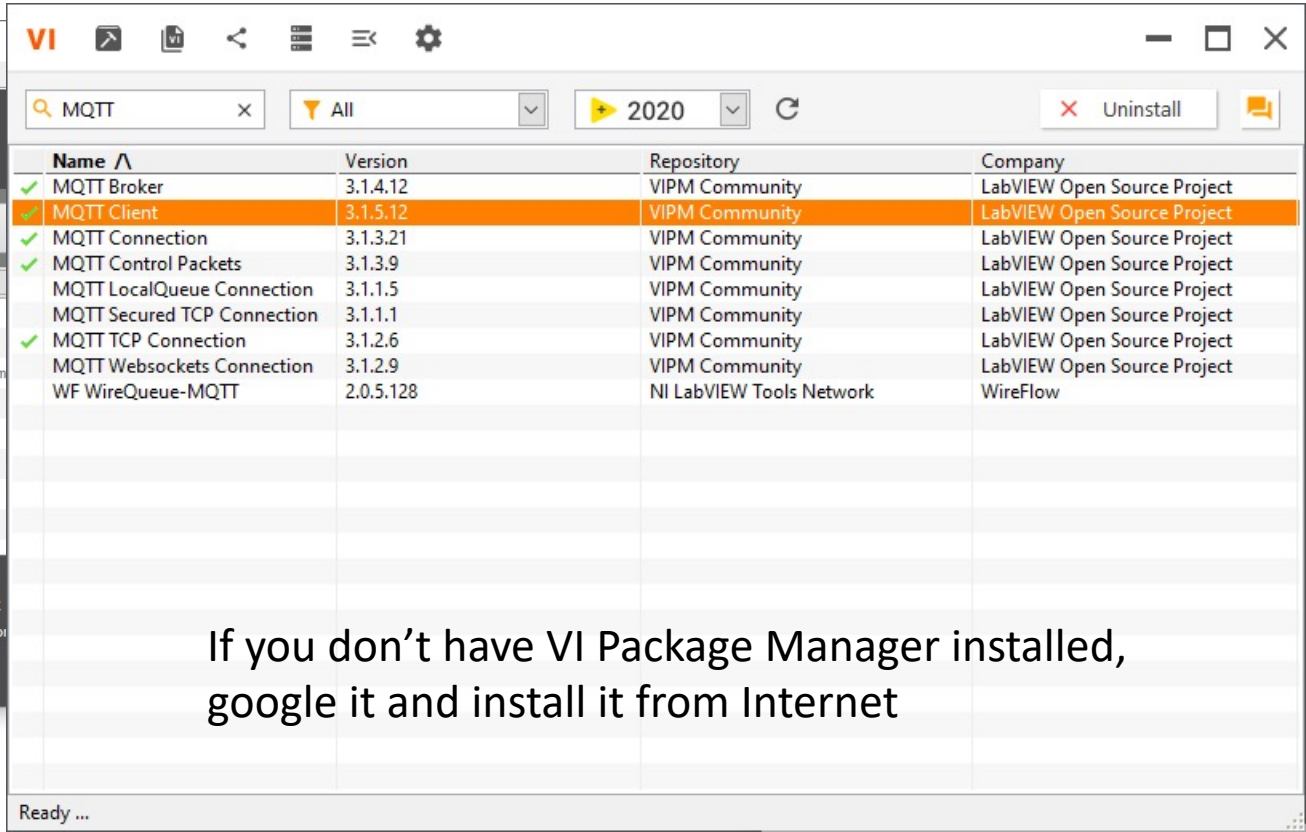
- LabVIEW is a Graphical Programming Language
- LabVIEW has powerful features for Simulation, Control and DAQ Applications
- Example:



VI Package Manager

Search for **MQTT** in VI Package Manager:





If you don't have VI Package Manager installed, google it and install it from Internet

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MQTT in LabVIEW

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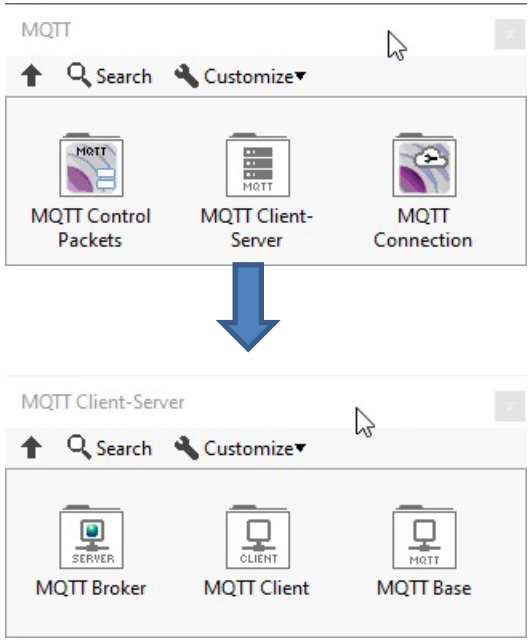
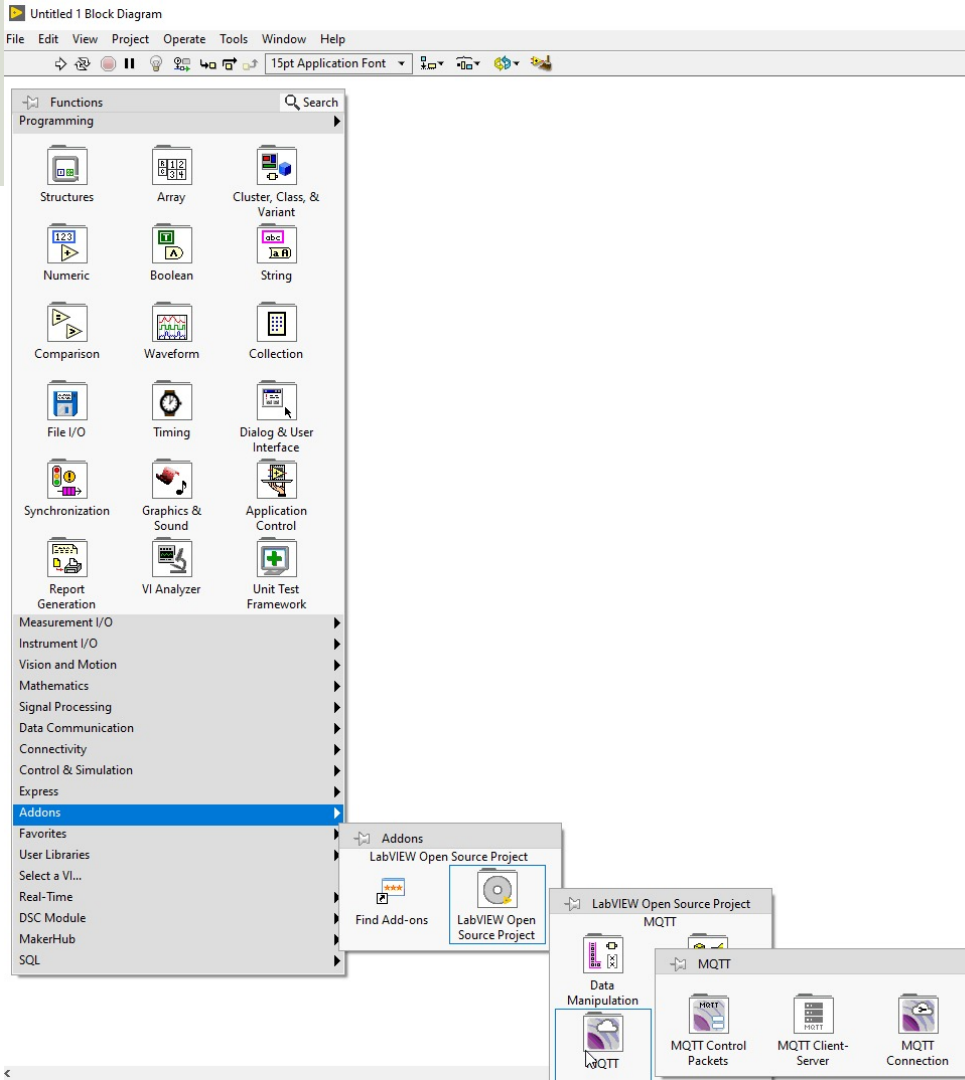
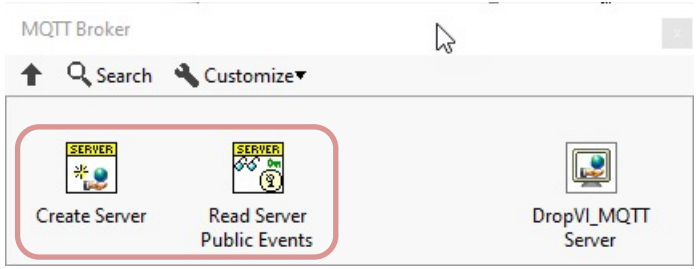
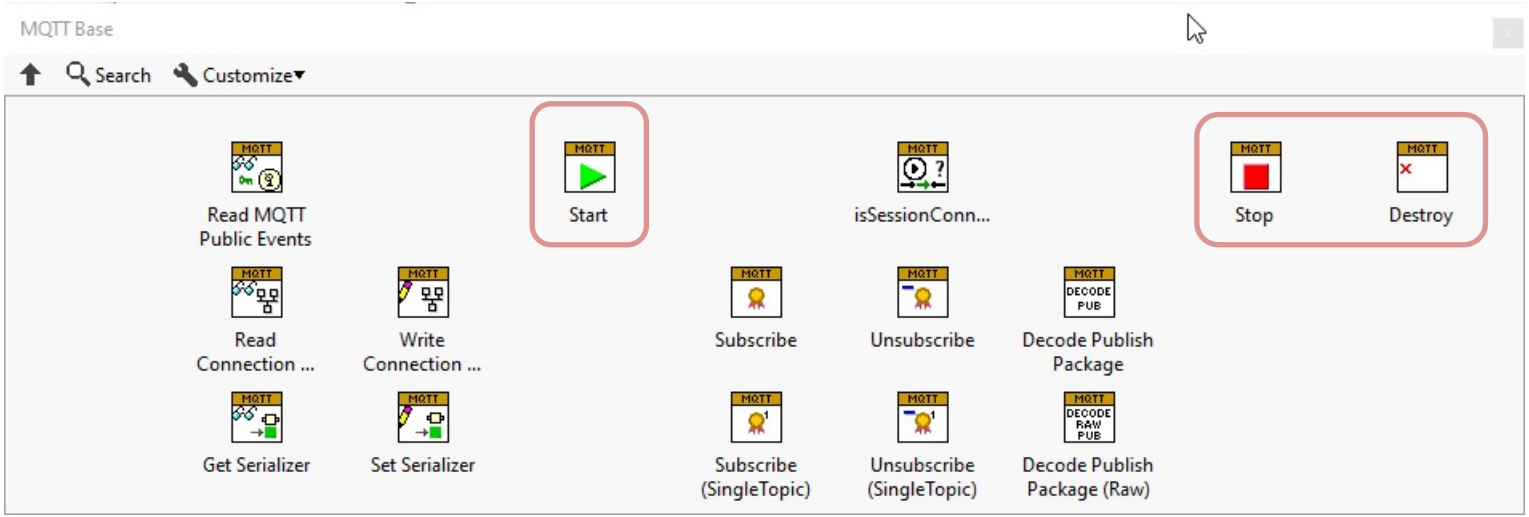
MQTT in LabVIEW



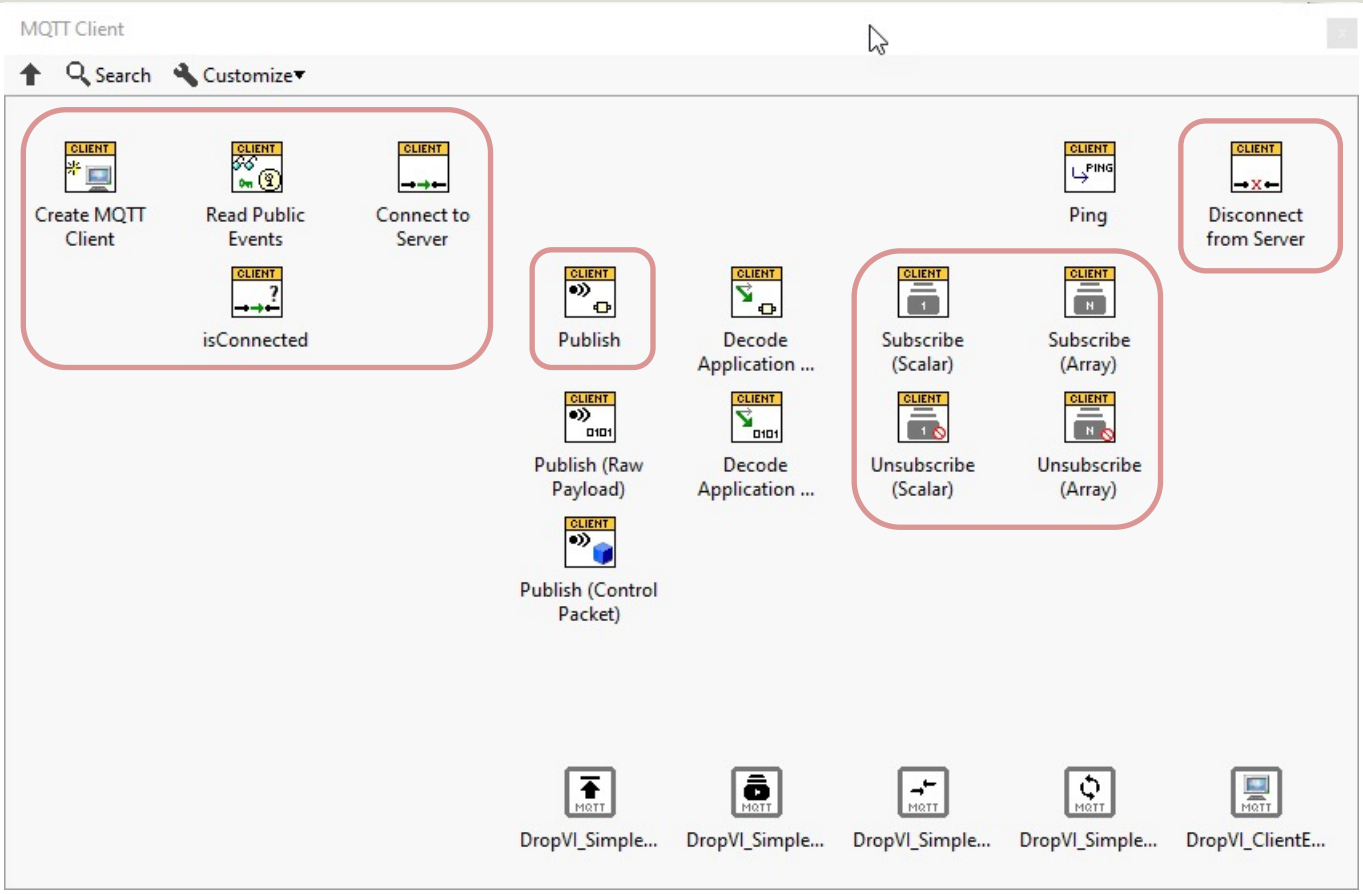


MQTT in LabVIEW





MQTT Client in LabVIEW



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LabVIEW Examples

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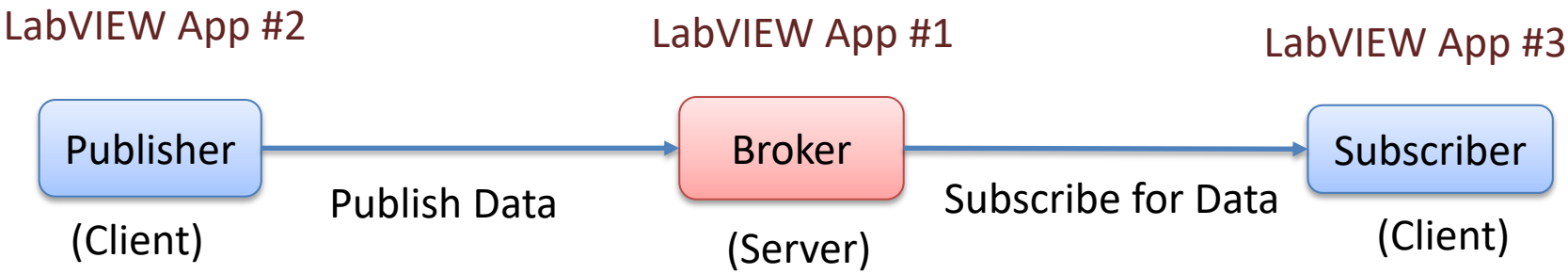
LabVIEW Examples

In this Example we Create 3 different LabVIEW Applications:



Get Data from a Temperature Sensor and Publish the Data to the Broker

The Broker is responsible for forwarding the Data to the Clients that Subscribe on the given Topic

Receive Data from the Broker and Plot the Data

LabVIEW MQTT Broker

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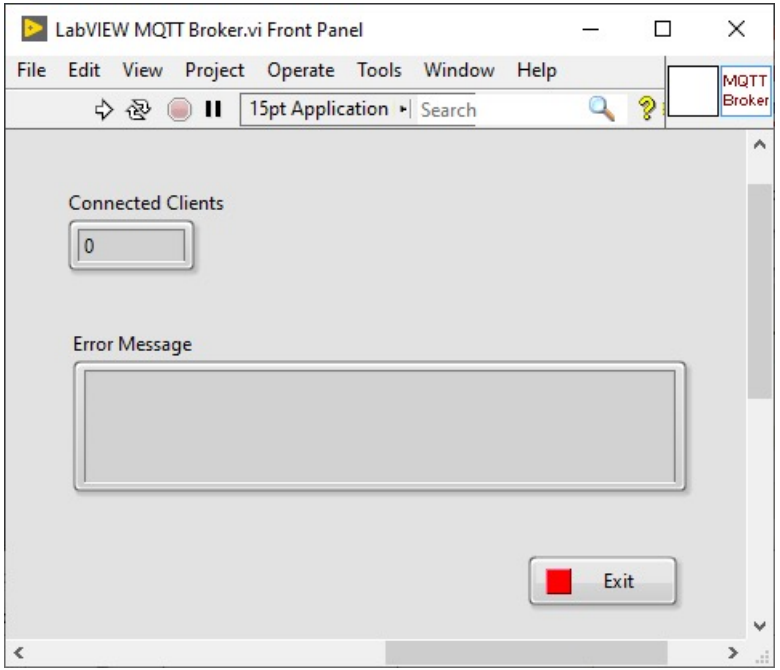
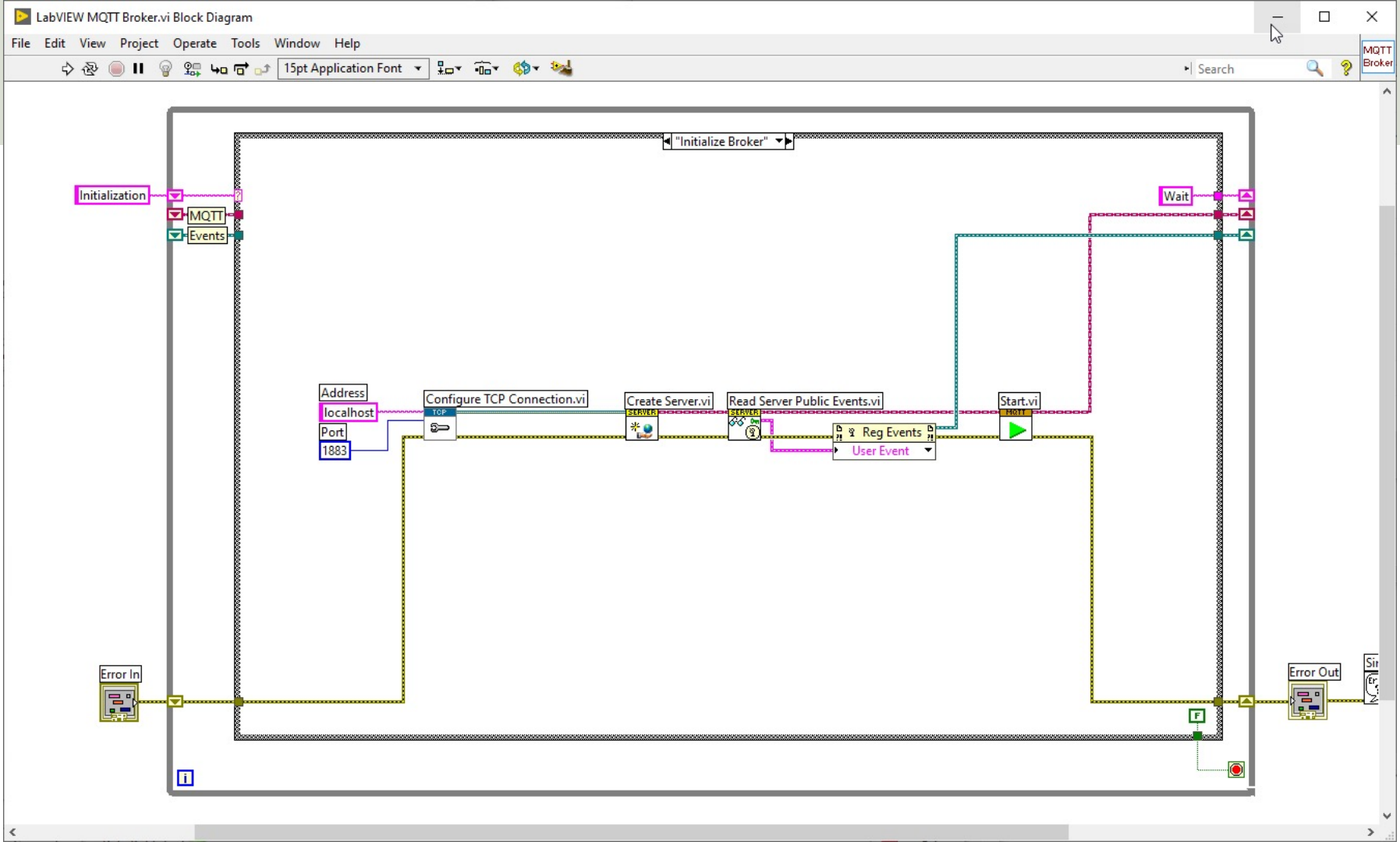
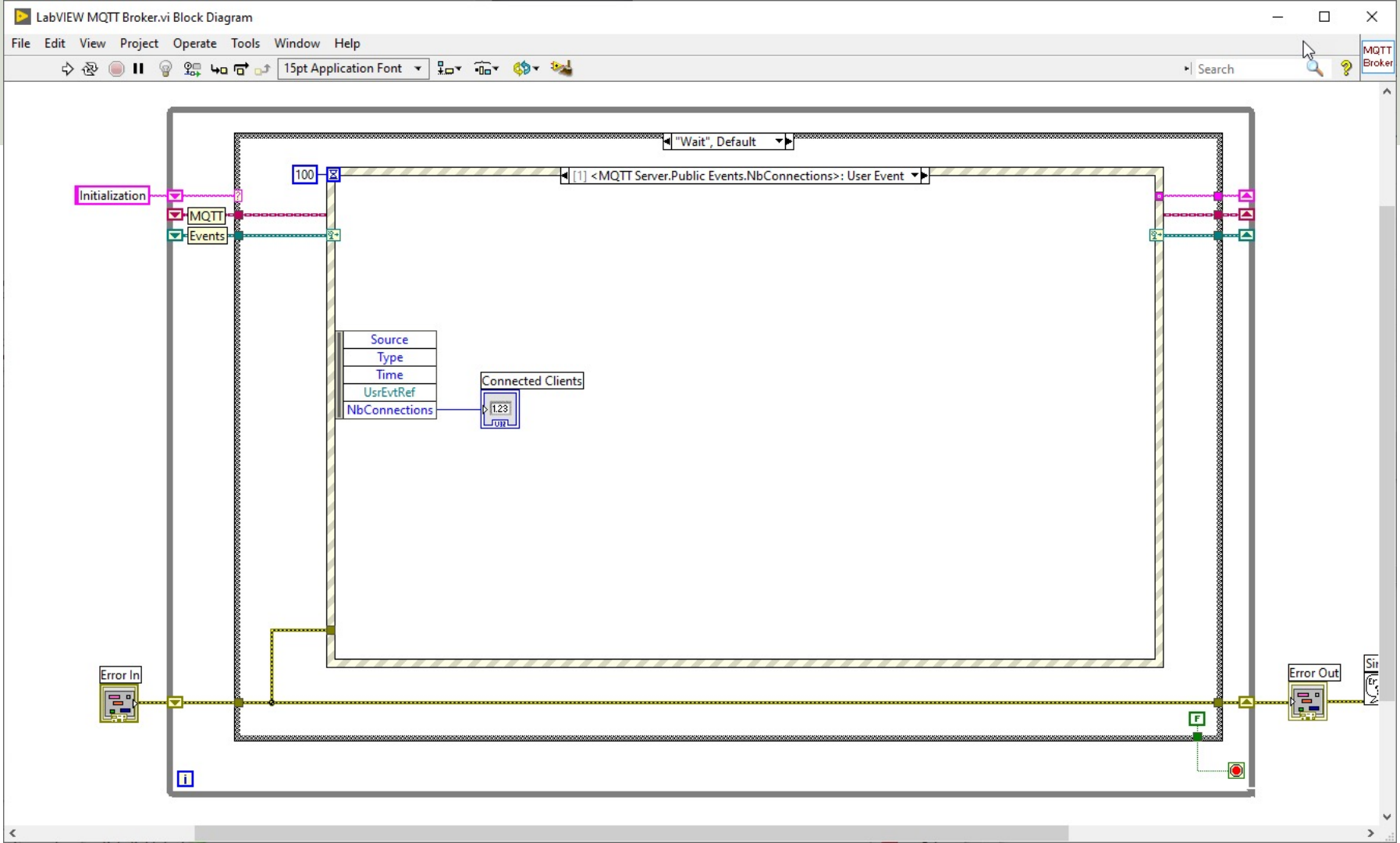
LabVIEW MQTT Broker




LabVIEW MQTT Broker.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Broker
"Initialize Broker"
Initialization
MQTT
Events
Wait
Address
localhost
Port
1883
Configure TCP Connection.vi
Create Server.vi
Read Server Public Events.vi
Reg Events
User Event
Start.vi
Error In
Error Out
F


LabVIEW MQTT Broker.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Broker
"Wait", Default
100
[1] <MQTT Server.Public Events.NbConnections>: User Event
Initialization
MQTT
Events
Source
Type
Time
UsrEvtRef
NbConnections
Connected Clients
1.23
Error In
Error Out
F
i

LabVIEW MQTT Publisher

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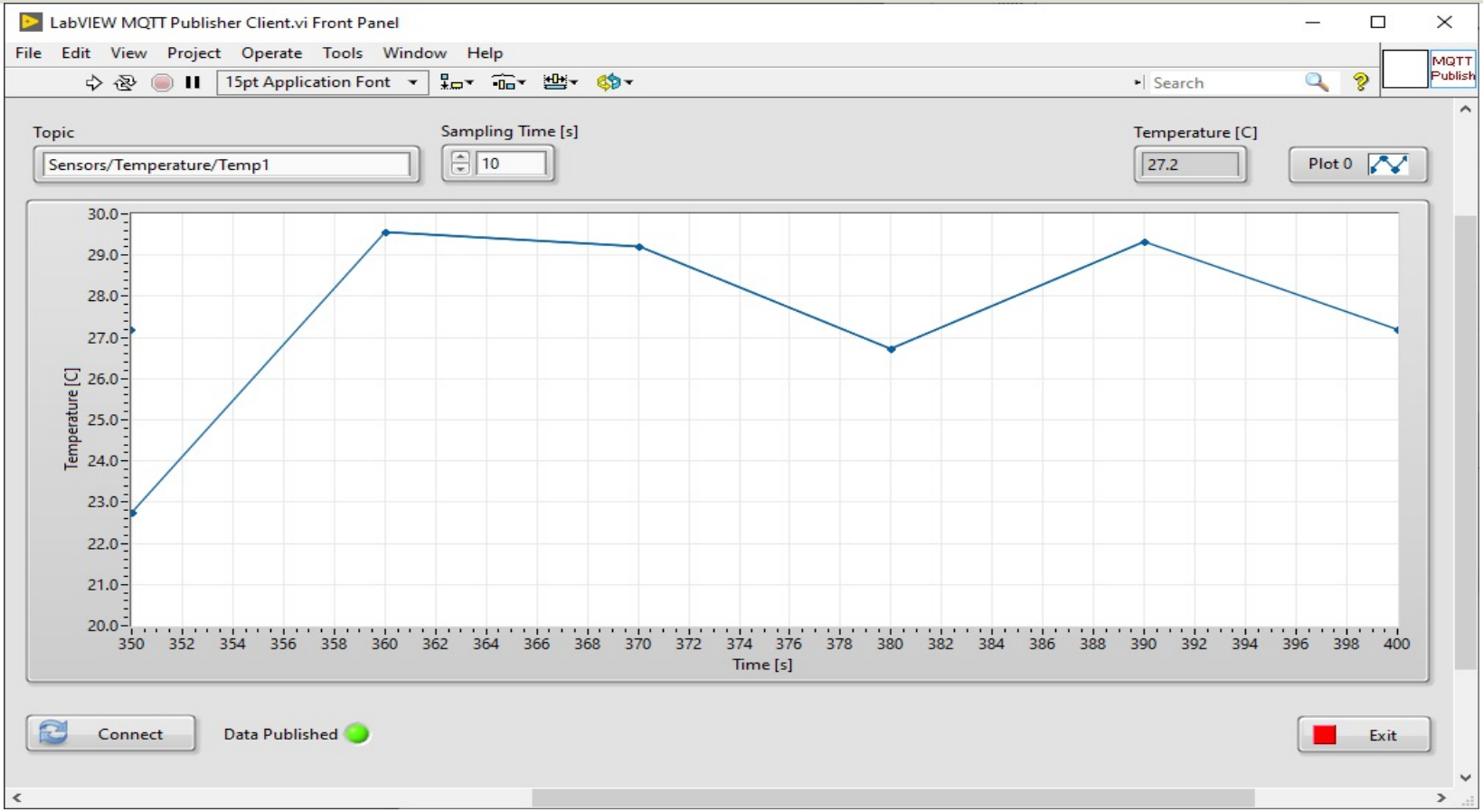
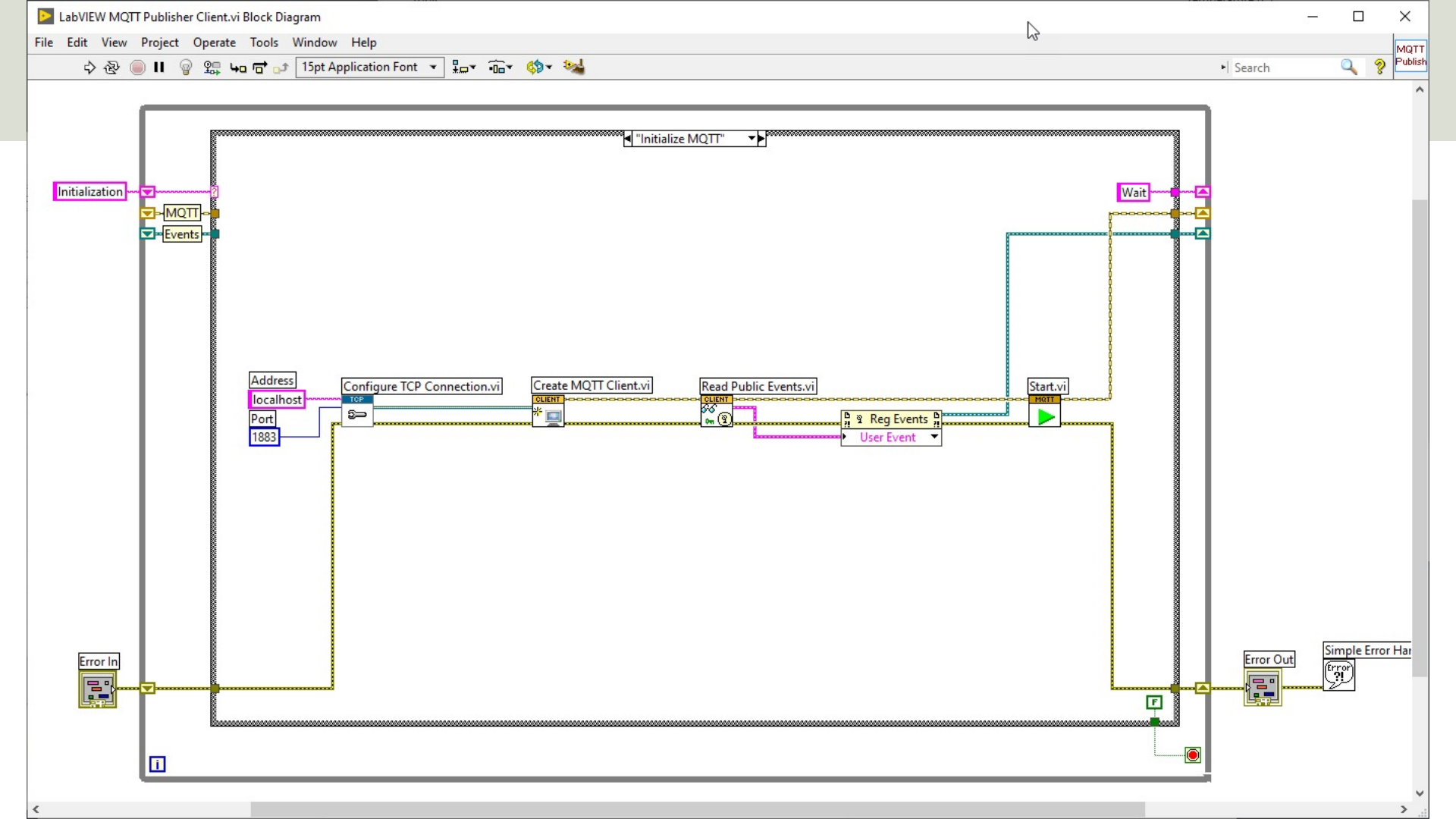
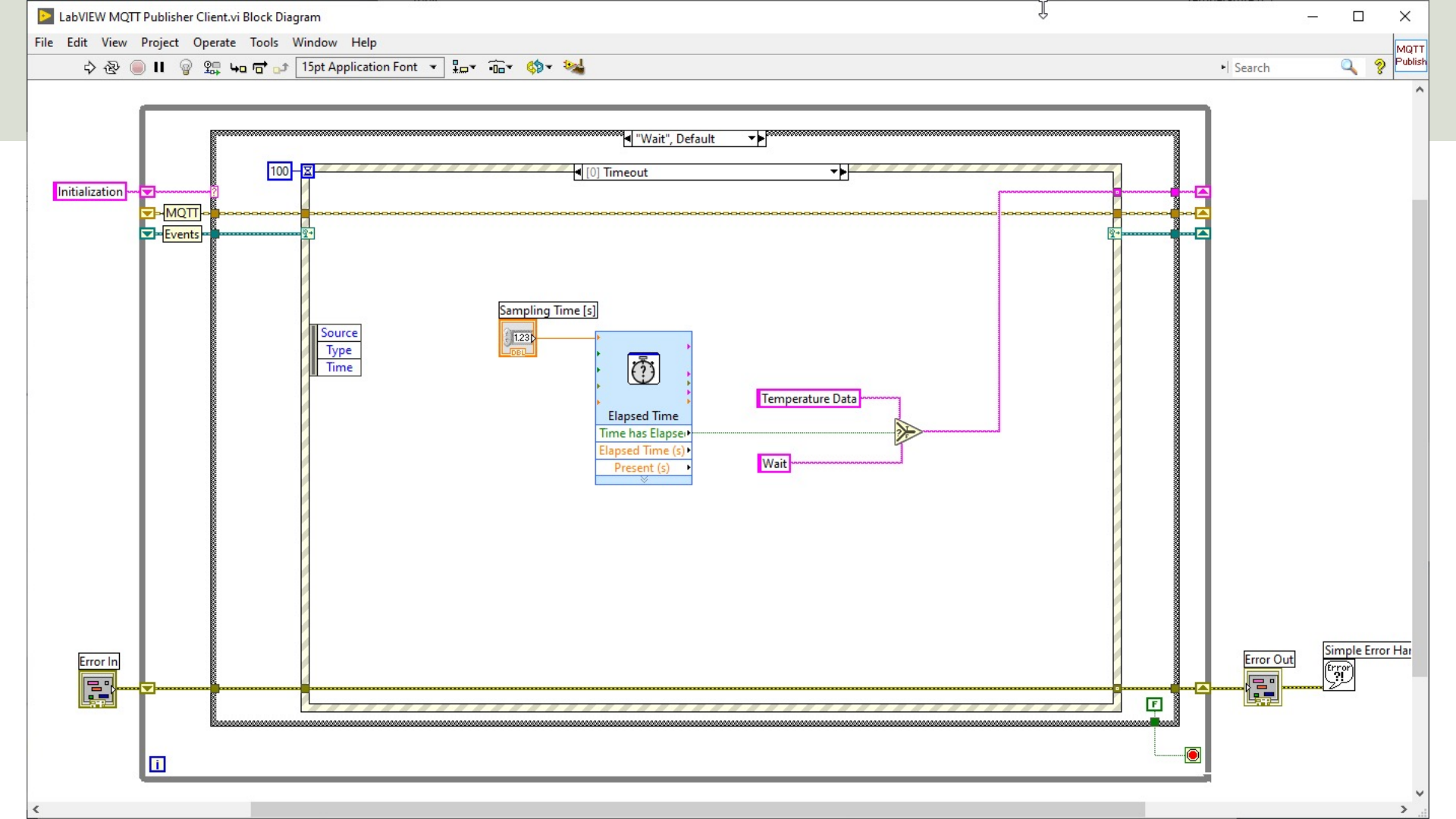
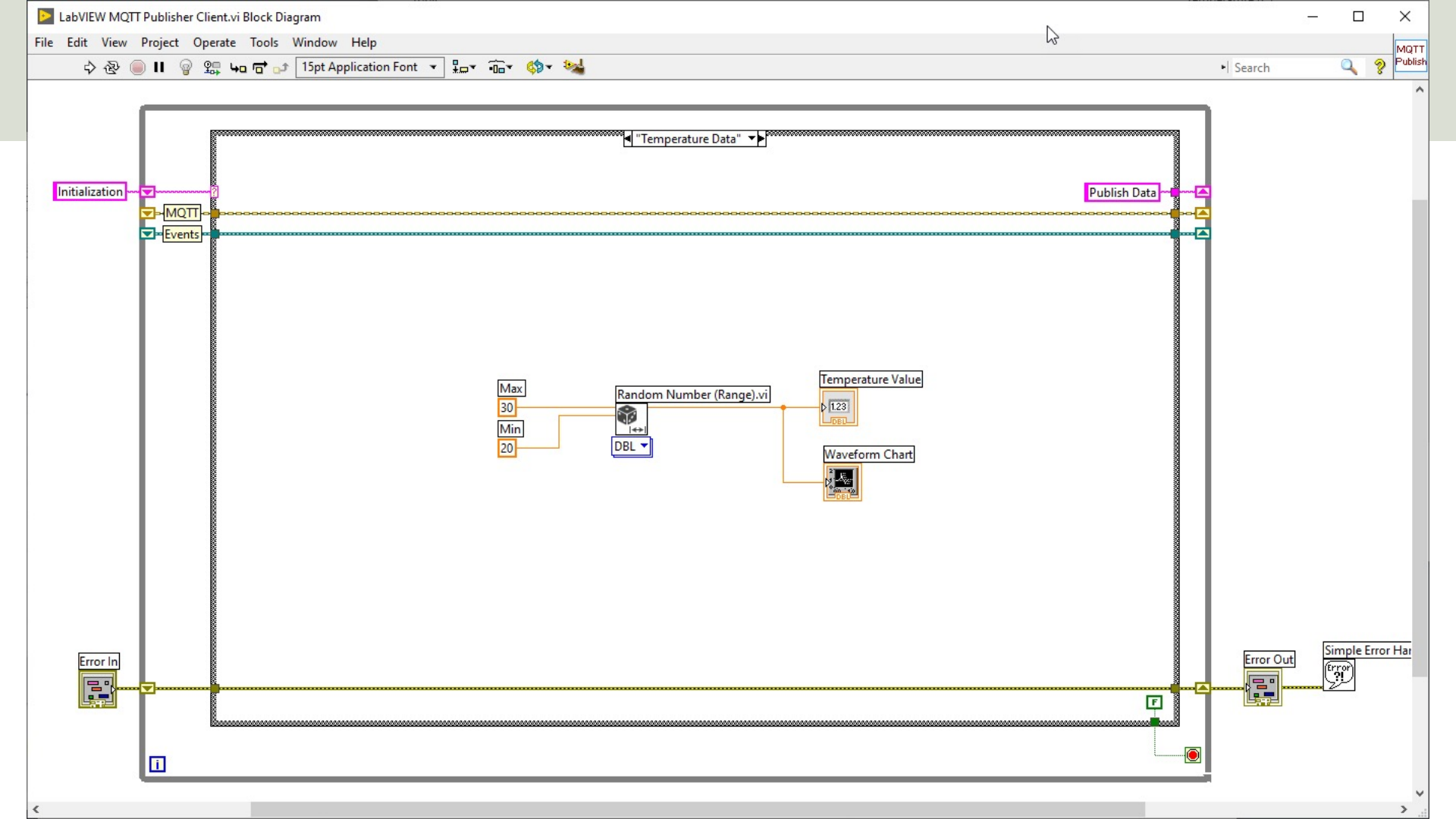
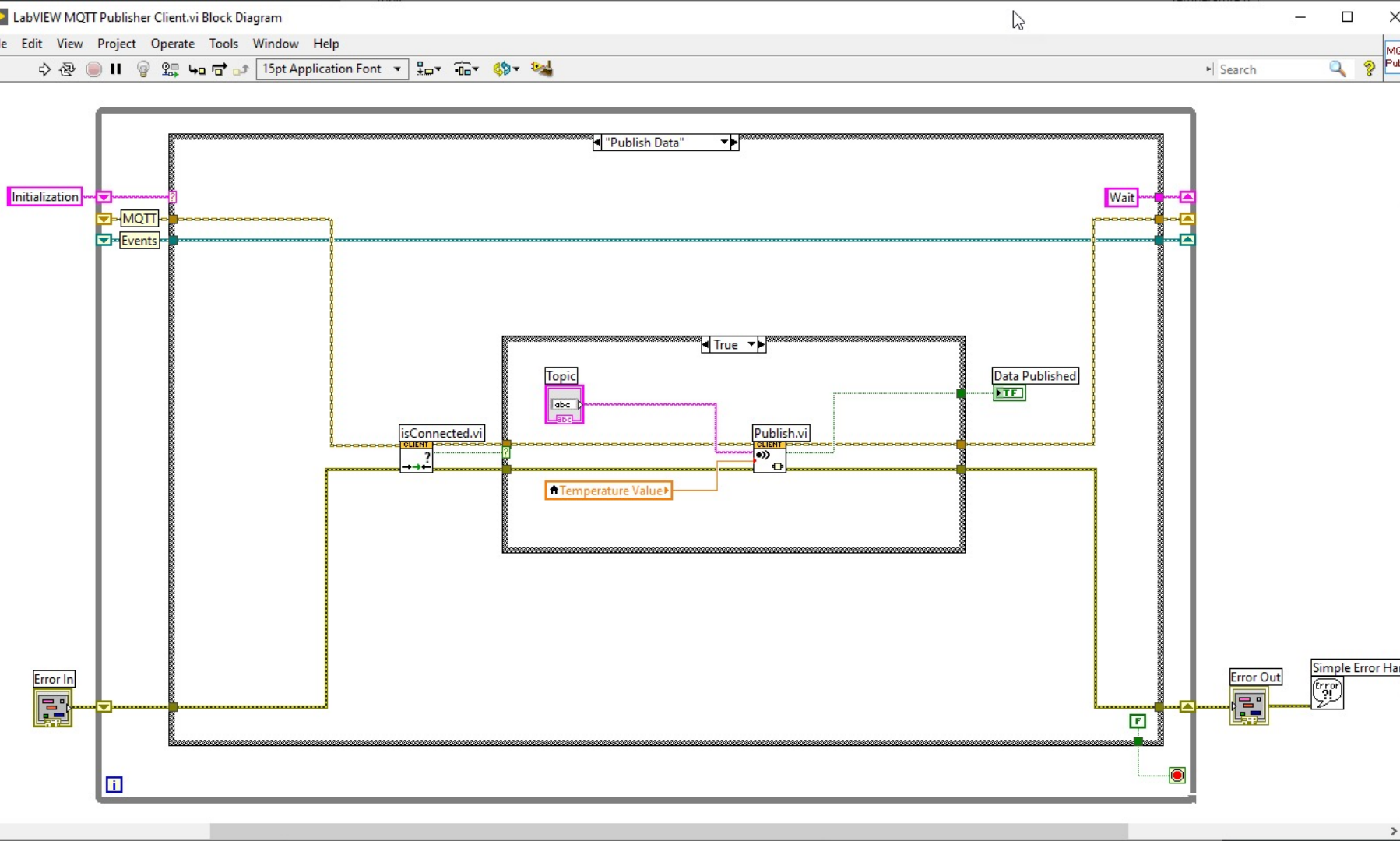
LabVIEW MQTT Publisher




LabVIEW MQTT Publisher Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Publish
"Initialize MQTT"
Initialization
MQTT
Events
Wait
Address
localhost
Port
1883
Configure TCP Connection.vi
Create MQTT Client.vi
Read Public Events.vi
Reg Events
User Event
Start.vi
Error In
Error Out
Simple Error Ha


LabVIEW MQTT Publisher Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Publish
"Wait", Default
100
[0] Timeout
Initialization
MQTT
Events
Source
Type
Time
Sampling Time [s]
1.23
DBL
Elapsed Time
Time has Elapse
Elapsed Time (s)
Present (s)
Temperature Data
Wait
Error In
Error Out
Simple Error Har
Error
?!
F
i


LabVIEW MQTT Publisher Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Publish
"Temperature Data"
Initialization
MQTT
Events
Publish Data
Max
30
Min
20
Random Number (Range).vi
DBL
Temperature Value
1.23
Waveform Chart
Error In
Error Out
Simple Error Ha
Error
?!
F
i


LabVIEW MQTT Publisher Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
MQTT Publish
"Publish Data"
Initialization
MQTT
Events
Wait
True
Topic
abc
Data Published
TF
isConnected.vi
CLIENT
Publish.vi
CLIENT
Temperature Value
Error In
Error Out
Simple Error Ha
Error
F
i

LabVIEW MQTT Subscriber

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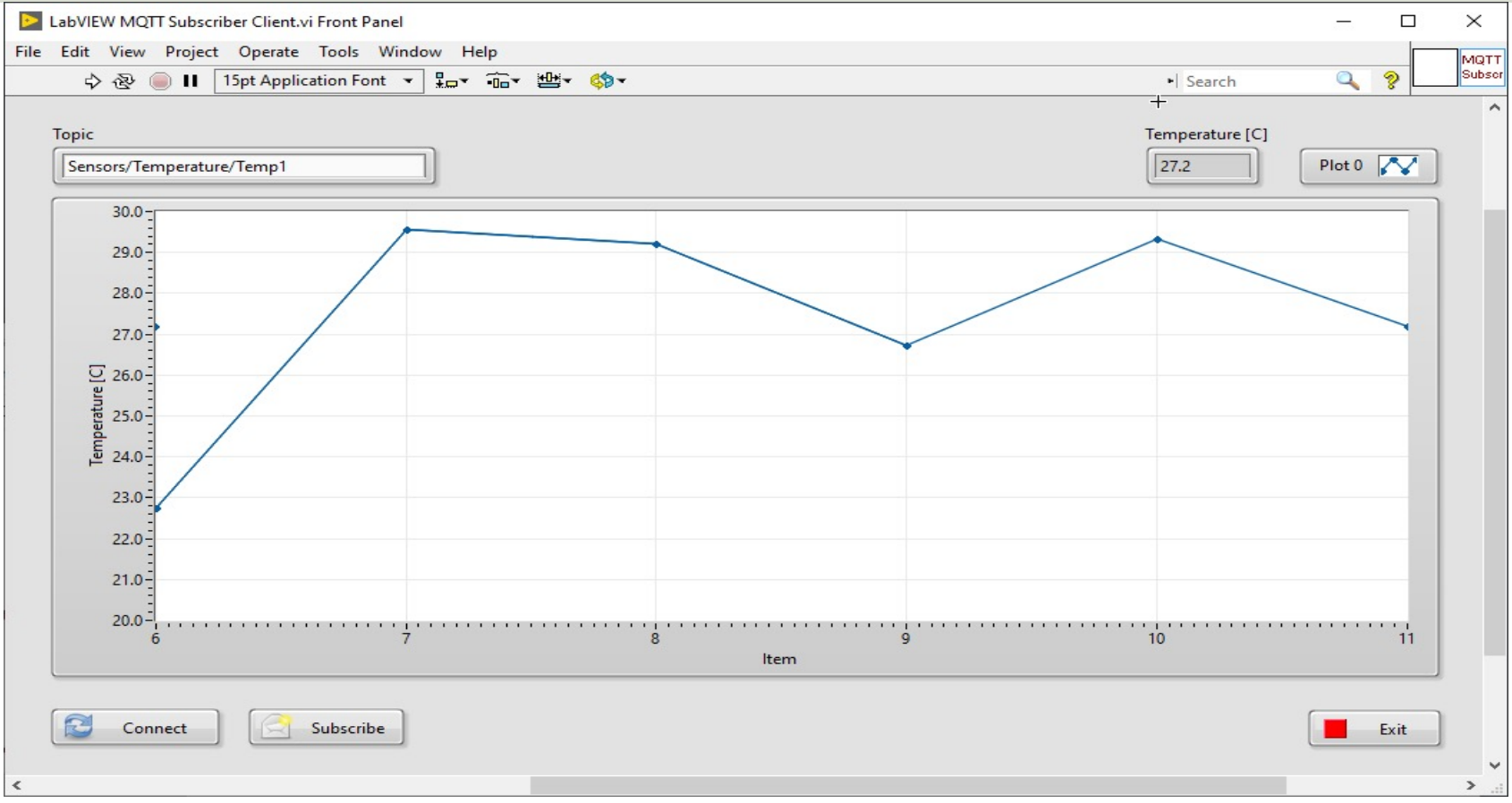
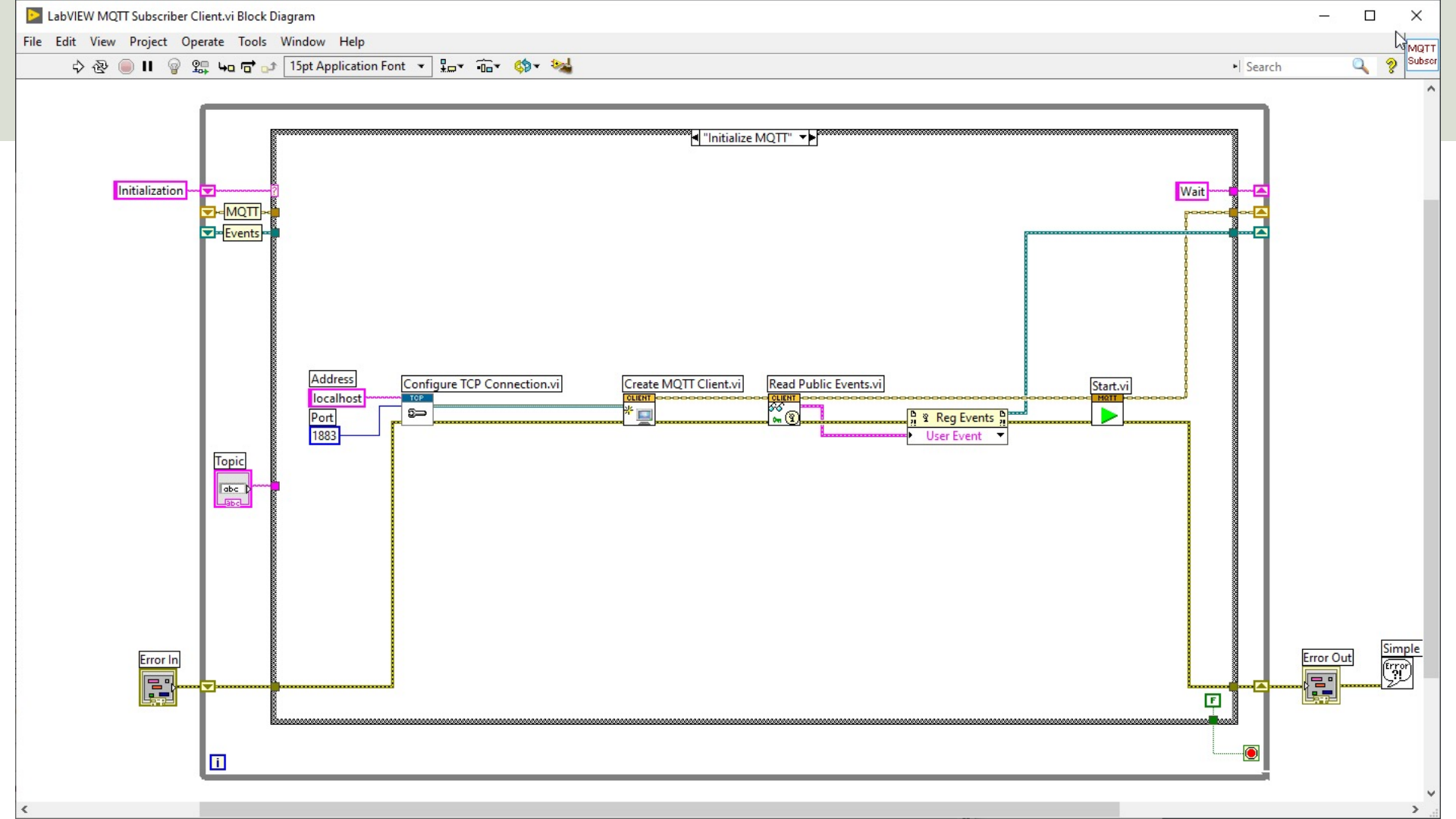
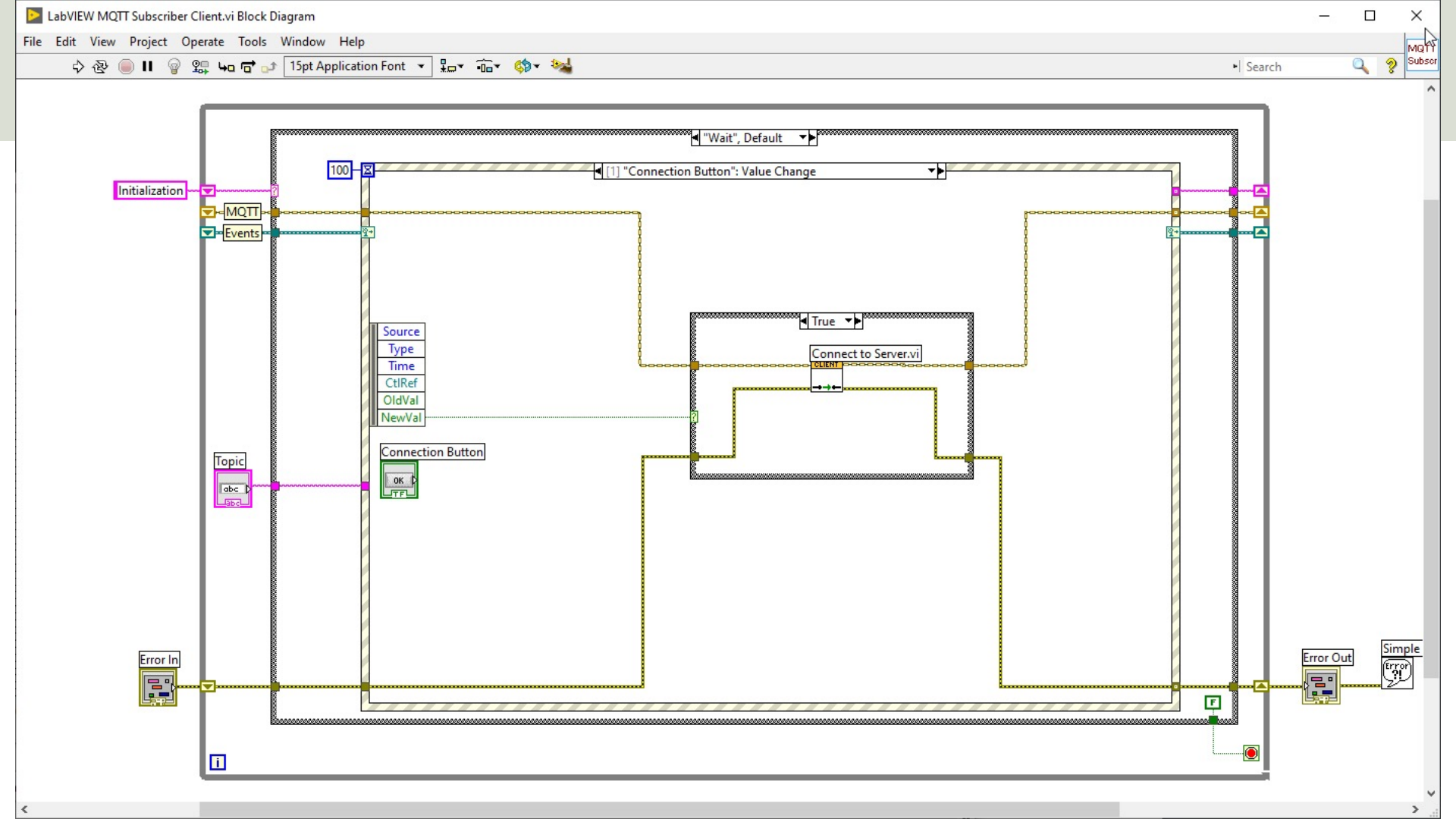
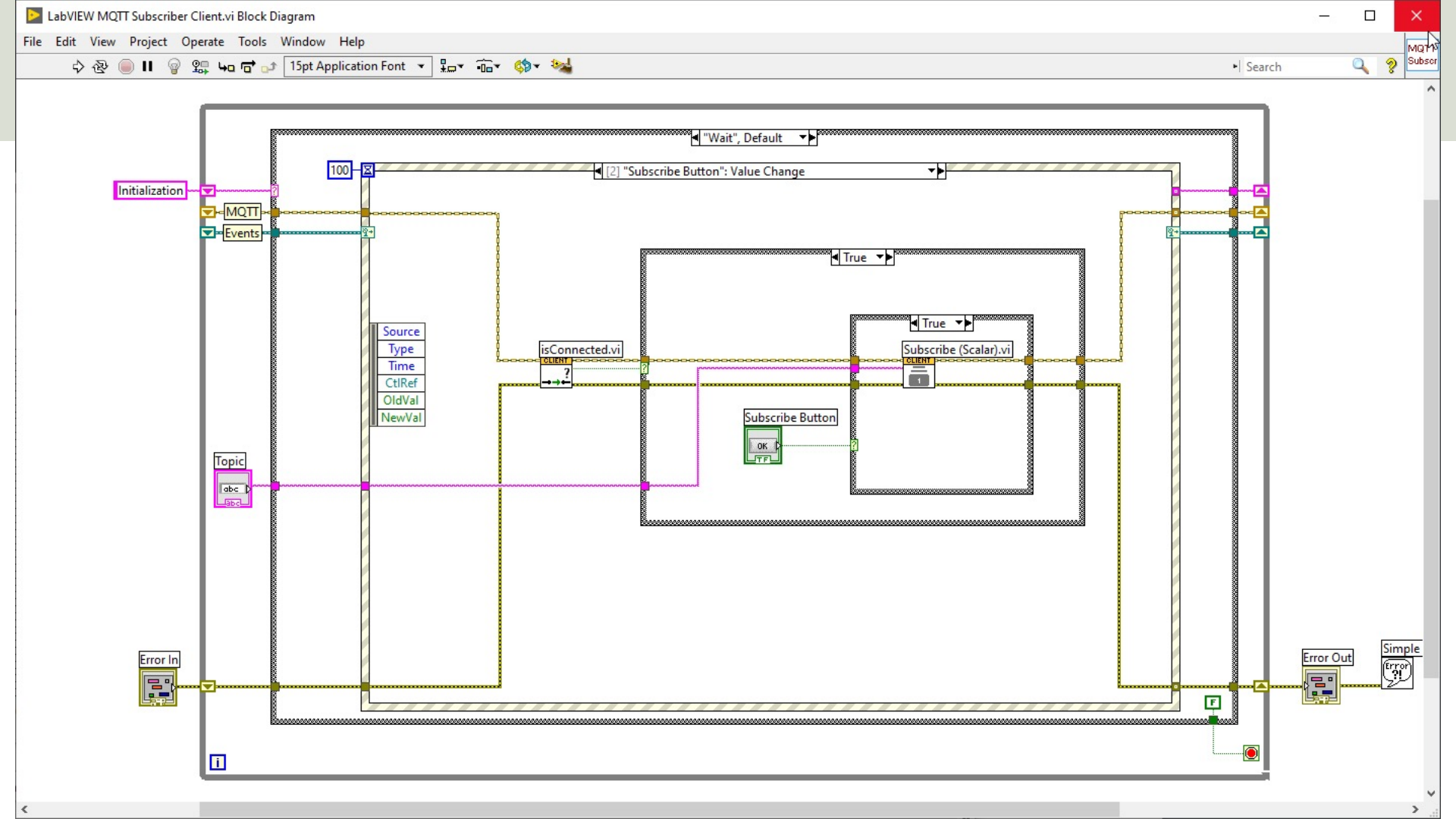
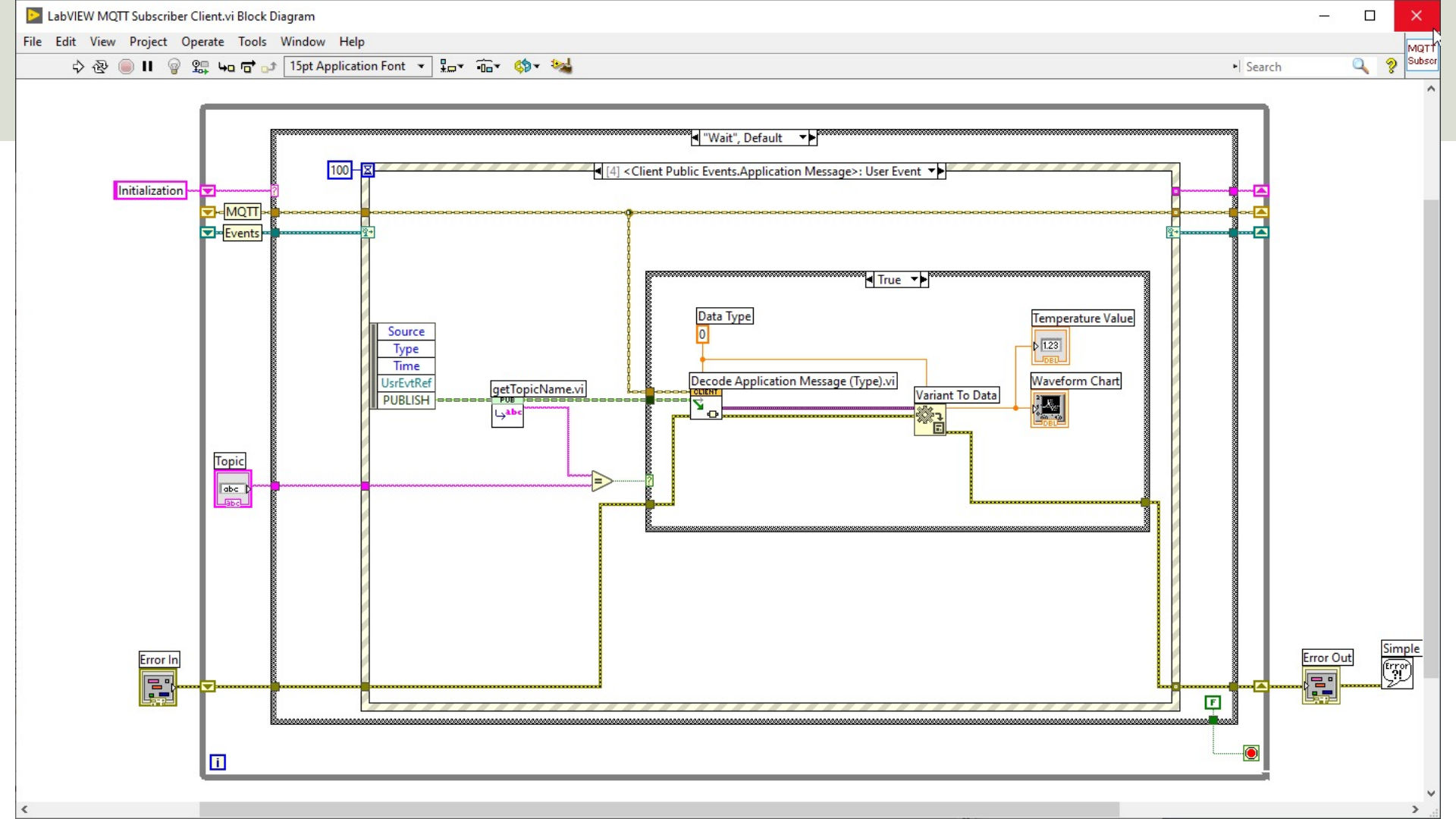
LabVIEW MQTT Subscriber




LabVIEW MQTT Subscriber Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
"Initialize MQTT"
Initialization
MQTT
Events
Wait
Address
localhost
Port
1883
Configure TCP Connection.vi
Create MQTT Client.vi
Read Public Events.vi
Reg Events
User Event
Start.vi
Topic
Error In
Error Out
Simple


LabVIEW MQTT Subscriber Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
"Wait", Default
100
[1] "Connection Button": Value Change
Initialization
MQTT
Events
Source
Type
Time
CtlRef
OldVal
NewVal
True
Connect to Server.vi
CLIENT
Topic
Connection Button
OK
TF
Error In
Error Out
Simple
Error
F


LabVIEW MQTT Subscriber Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
"Wait", Default
100
[2] "Subscribe Button": Value Change
Initialization
MQTT
Events
True
True
Source
Type
Time
CtlRef
OldVal
NewVal
isConnected.vi
Subscribe (Scalar).vi
Subscribe Button
OK
Topic
Error In
Error Out
Simple
Error


LabVIEW MQTT Subscriber Client.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
"Wait", Default
100
[4] <Client Public Events.Application Message>: User Event
Initialization
MQTT
Events
True
Data Type
0
Temperature Value
Source
Type
Time
UsrEvtRef
PUBLISH
getTopicName.vi
Decode Application Message (Type).vi
Variant To Data
Waveform Chart
Topic
Error In
Error Out
Simple

Summary

- A short introduction to **MQTT** has been given
- Exploration of the “LabVIEW MQTT Toolkit” from “LabVIEW Open Source Project”
- Practical **LabVIEW MQTT Examples** has been explored
  - LabVIEW **MQTT Broker**
  - LabVIEW **MQTT Publisher** Client Application
  - LabVIEW **MQTT Subscriber** Client Application
- Next Step:
  - Next step is to explorer and test if the LabVIEW MQTT Toolkit can connect to different free MQTT Brokers like Eclipse Mosquitto, HiveMQ Community Edition, HiveMQ Cloud, ThingSpeak, etc.
  - It would also be interesting to see if we can use a MQTT Client like MQTT X to connect to the LabVIEW MQTT Broker.

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