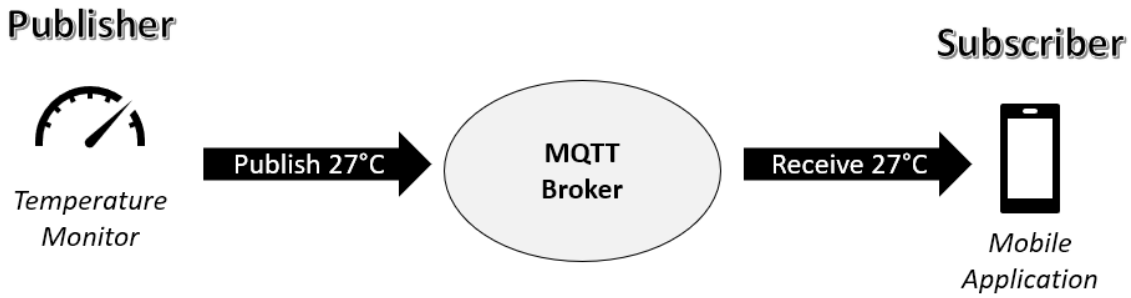
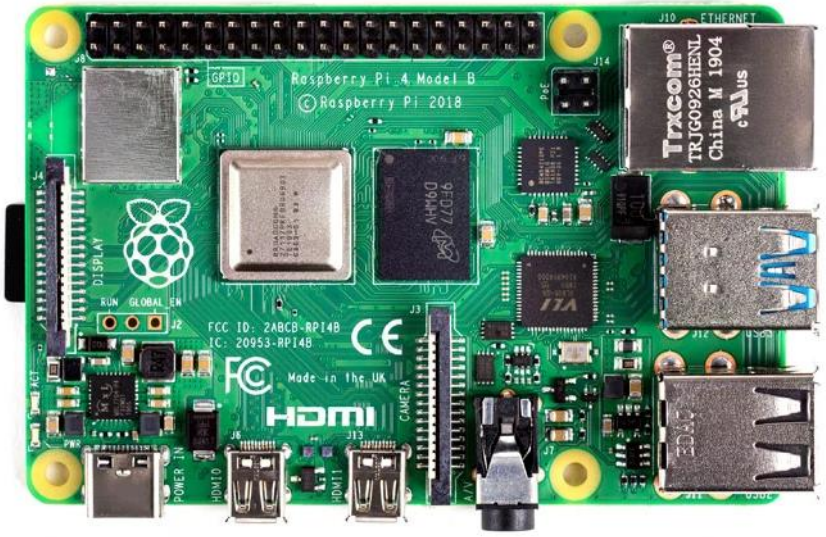
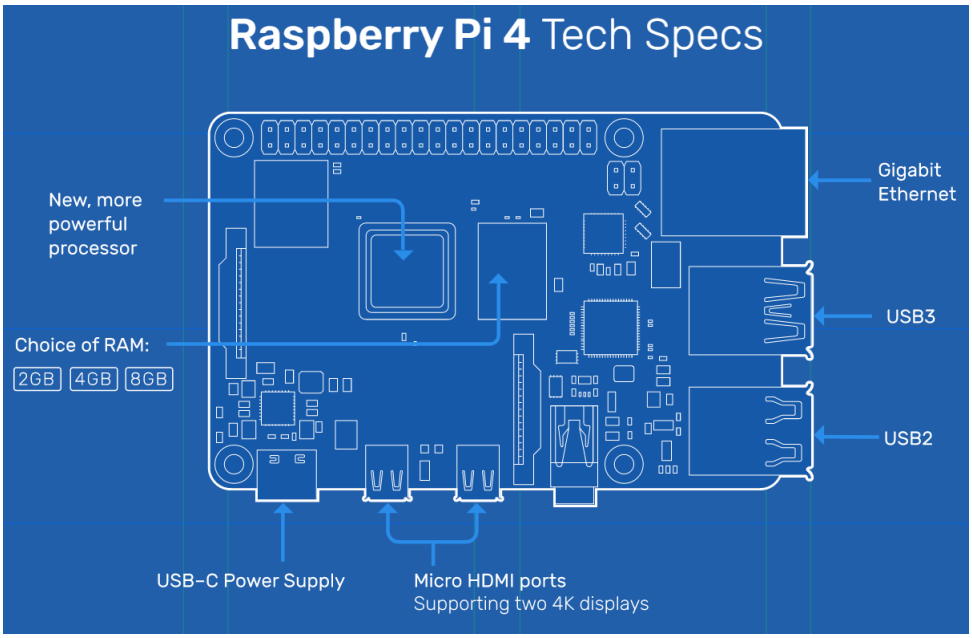
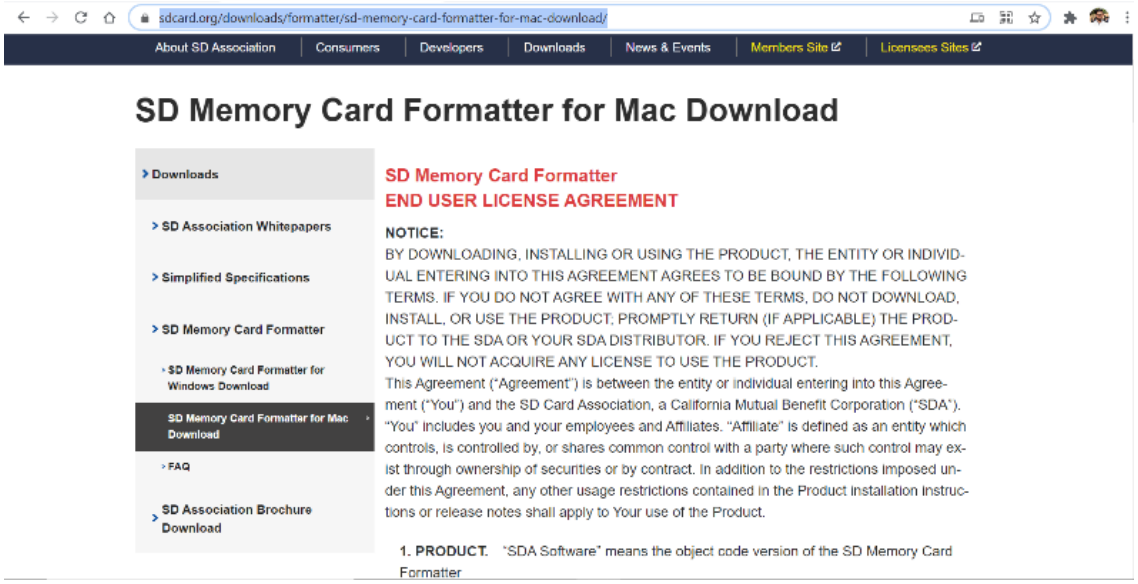
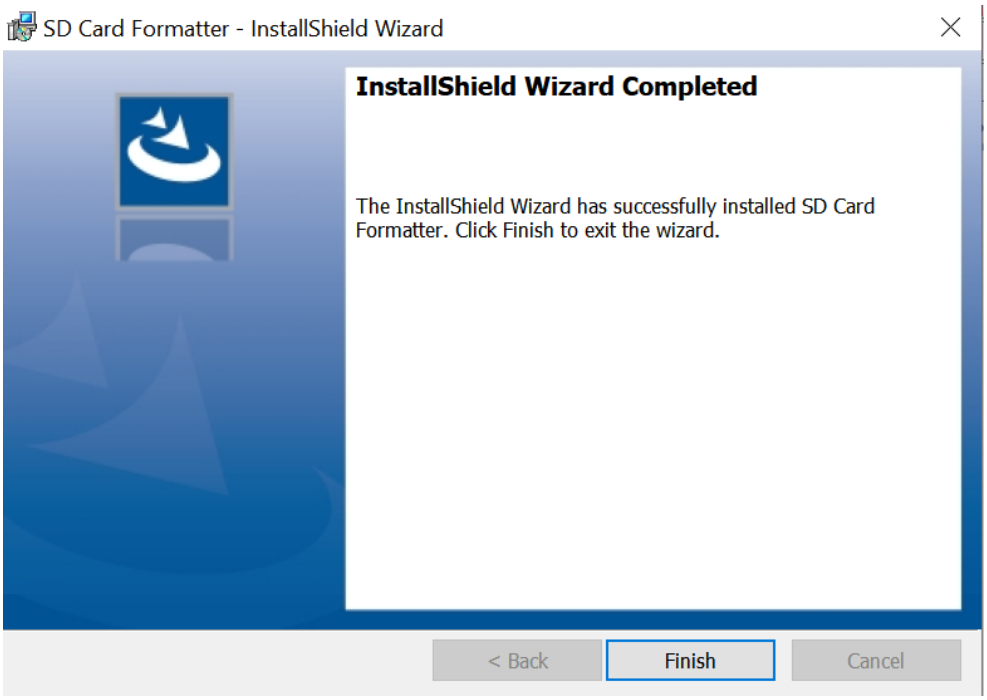
Chapter 1: Introduction to Raspberry PI and MQTT

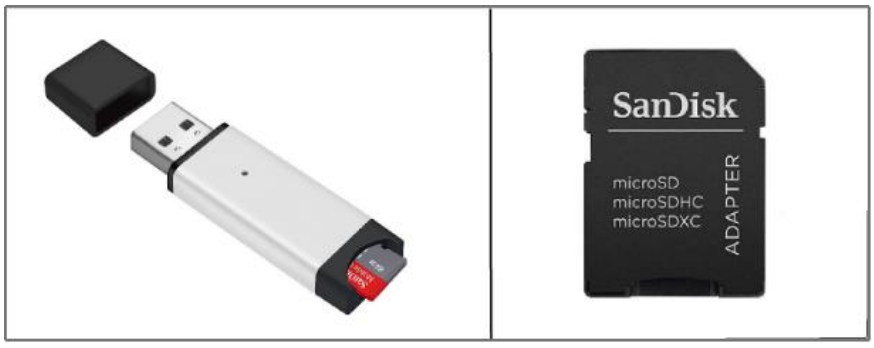


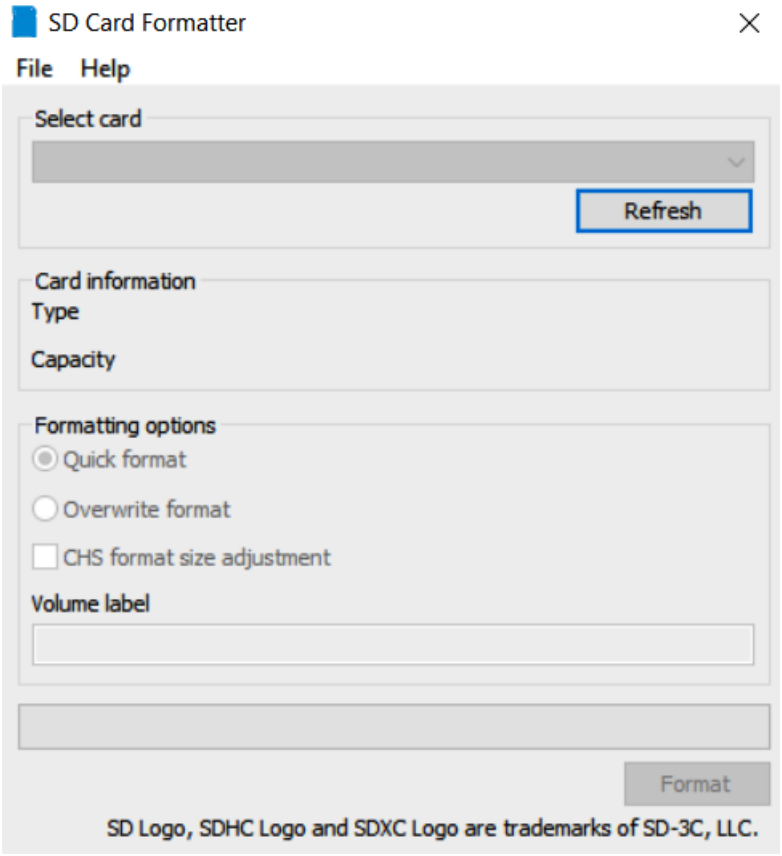


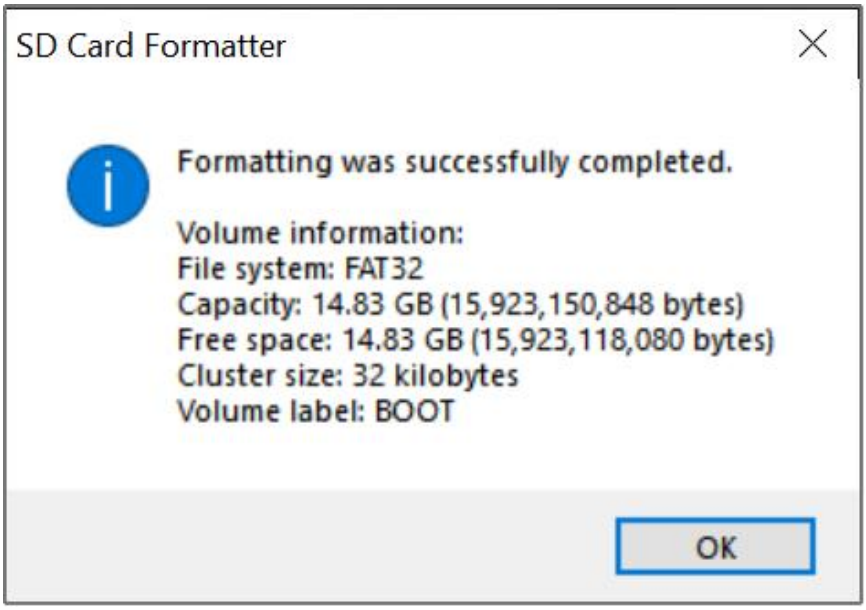



sdcard.org/downloads/formatter/sd-memory-card-formatter-for-mac-download/
About SD Association
Consumers
Developers
Downloads
News & Events
Members Site
Licensees Sites
SD Memory Card Formatter for Mac Download
Downloads
SD Association Whitepapers
Simplified Specifications
SD Memory Card Formatter
SD Memory Card Formatter for Windows Download
SD Memory Card Formatter for Mac Download
FAQ
SD Association Brochure Download
SD Memory Card Formatter
END USER LICENSE AGREEMENT
NOTICE:
BY DOWNLOADING, INSTALLING OR USING THE PRODUCT, THE ENTITY OR INDIVIDUAL ENTERING INTO THIS AGREEMENT AGREES TO BE BOUND BY THE FOLLOWING TERMS. IF YOU DO NOT AGREE WITH ANY OF THESE TERMS, DO NOT DOWNLOAD, INSTALL, OR USE THE PRODUCT; PROMPTLY RETURN (IF APPLICABLE) THE PRODUCT TO THE SDA OR YOUR SDA DISTRIBUTOR. IF YOU REJECT THIS AGREEMENT, YOU WILL NOT ACQUIRE ANY LICENSE TO USE THE PRODUCT.
This Agreement ("Agreement") is between the entity or individual entering into this Agreement ("You") and the SD Card Association, a California Mutual Benefit Corporation ("SDA"). "You" includes you and your employees and Affiliates. "Affiliate" is defined as an entity which controls, is controlled by, or shares common control with a party where such control may exist through ownership of securities or by contract. In addition to the restrictions imposed under this Agreement, any other usage restrictions contained in the Product installation instructions or release notes shall apply to Your use of the Product.
1. PRODUCT. "SDA Software" means the object code version of the SD Memory Card Formatter

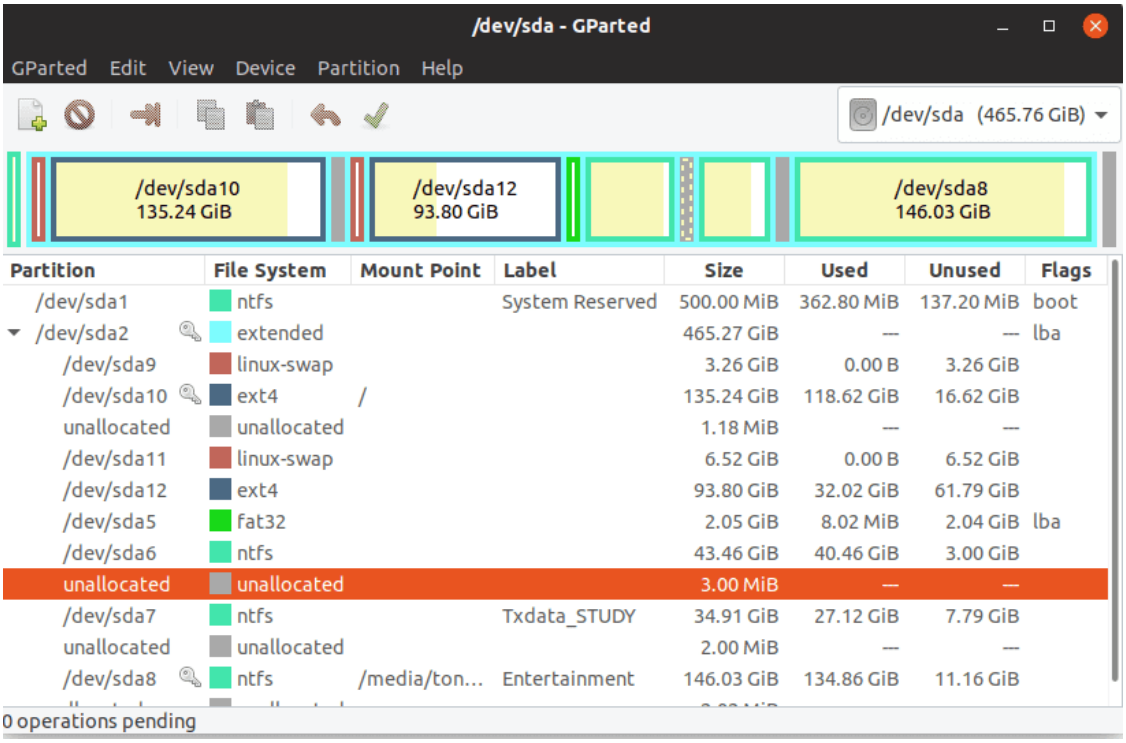

SD Card Formatter - InstallShield Wizard
InstallShield Wizard Completed
The InstallShield Wizard has successfully installed SD Card Formatter. Click Finish to exit the wizard.
< Back
Finish
Cancel

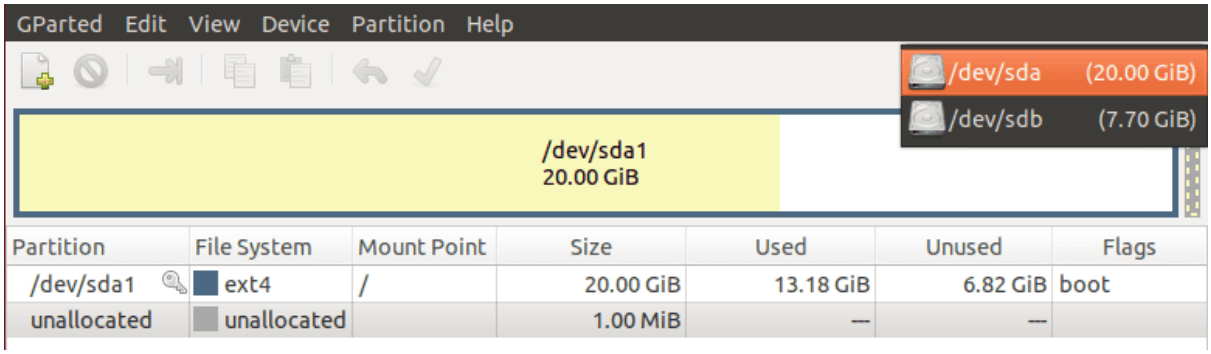

SanDisk
microSD
microSDHC
microSDXC
ADAPTER

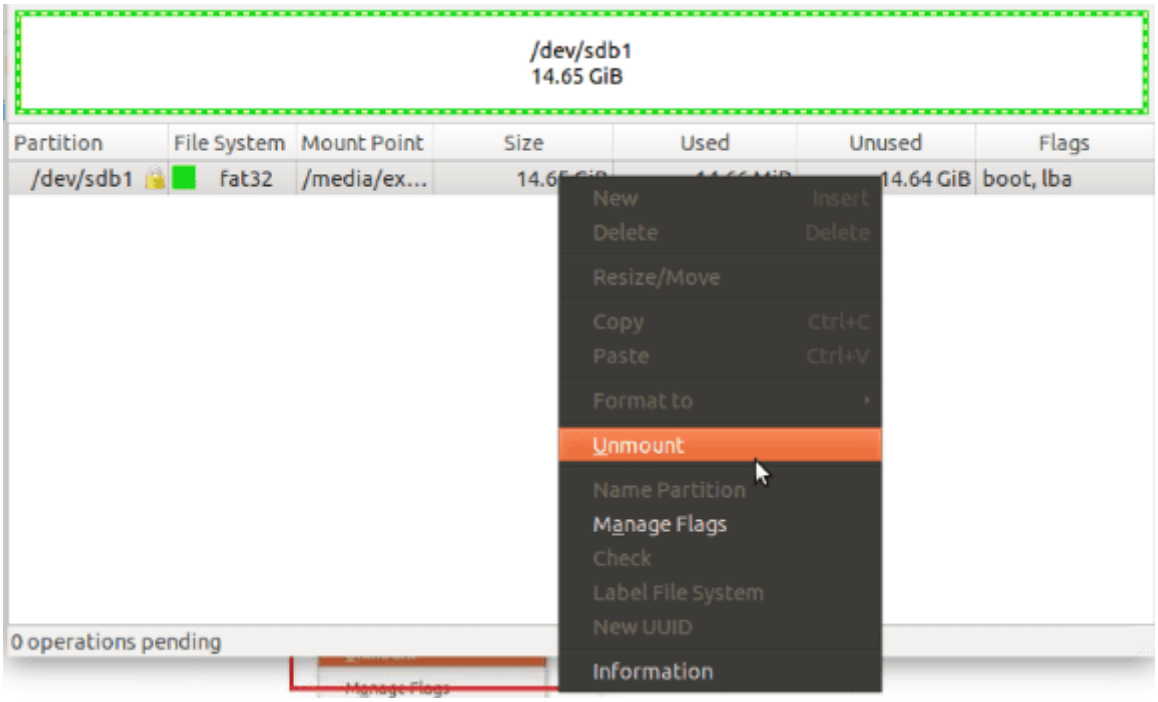

SD Card Formatter
File Help
Select card
Refresh
Card information
Type
Capacity
Formatting options
Quick format
Overwrite format
CHS format size adjustment
Volume label
Format
SD Logo, SDHC Logo and SDXC Logo are trademarks of SD-3C, LLC.

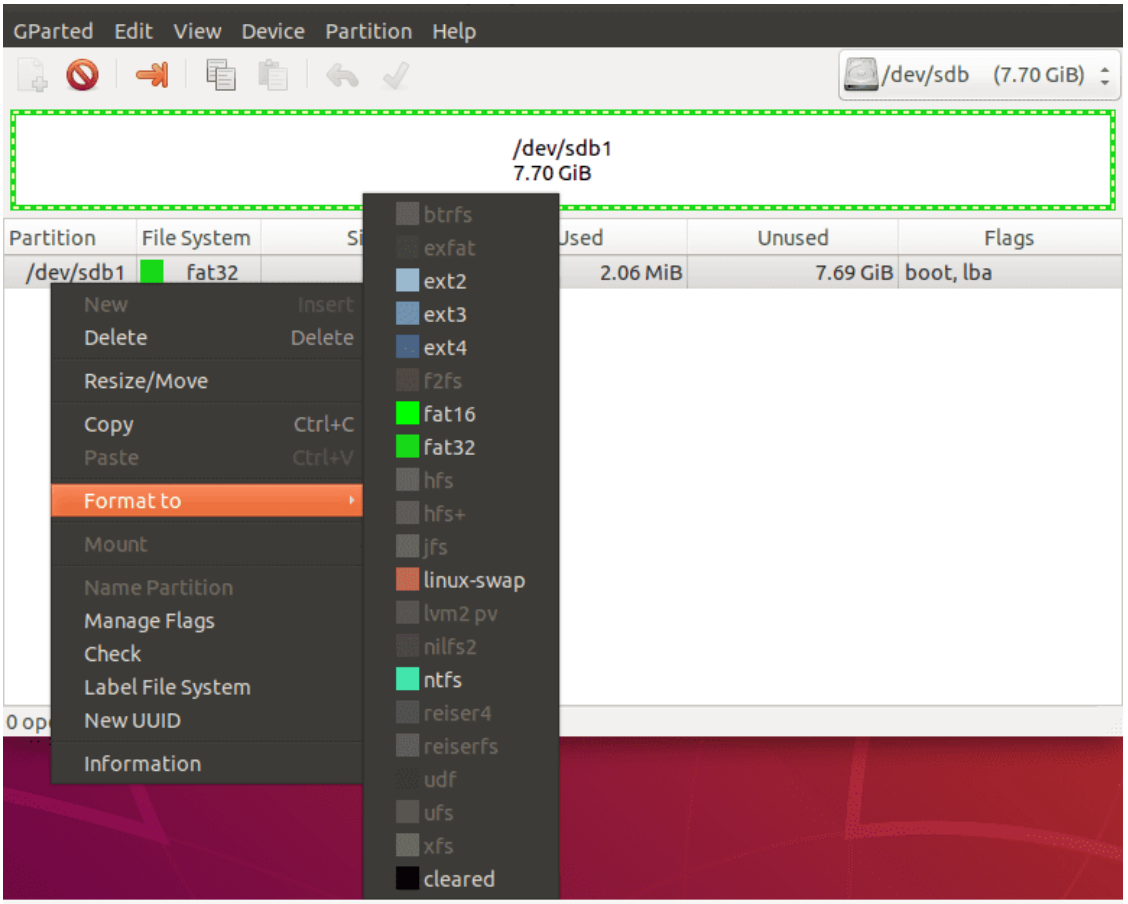

SD Card Formatter
Formatting was successfully completed.
Volume information:
File system: FAT32
Capacity: 14.83 GB (15,923,150,848 bytes)
Free space: 14.83 GB (15,923,118,080 bytes)
Cluster size: 32 kilobytes
Volume label: BOOT
OK

gparted
GParted

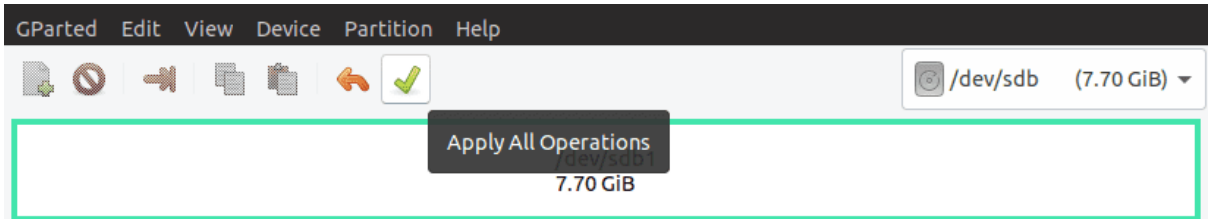

/dev/sda - GParted
GParted Edit View Device Partition Help
/dev/sda (465.76 GiB)
/dev/sda10
135.24 GiB
/dev/sda12
93.80 GiB
/dev/sda8
146.03 GiB
Partition File System Mount Point Label Size Used Unused Flags
/dev/sda1 ntfs System Reserved 500.00 MiB 362.80 MiB 137.20 MiB boot
/dev/sda2 extended 465.27 GiB --- --- lba
/dev/sda9 linux-swap 3.26 GiB 0.00 B 3.26 GiB
/dev/sda10 ext4 / 135.24 GiB 118.62 GiB 16.62 GiB
unallocated unallocated 1.18 MiB --- ---
/dev/sda11 linux-swap 6.52 GiB 0.00 B 6.52 GiB
/dev/sda12 ext4 93.80 GiB 32.02 GiB 61.79 GiB
/dev/sda5 fat32 2.05 GiB 8.02 MiB 2.04 GiB lba
/dev/sda6 ntfs 43.46 GiB 40.46 GiB 3.00 GiB
unallocated unallocated 3.00 MiB --- ---
/dev/sda7 ntfs Txdata_STUDY 34.91 GiB 27.12 GiB 7.79 GiB
unallocated unallocated 2.00 MiB --- ---
/dev/sda8 ntfs /media/ton... Entertainment 146.03 GiB 134.86 GiB 11.16 GiB
0 operations pending

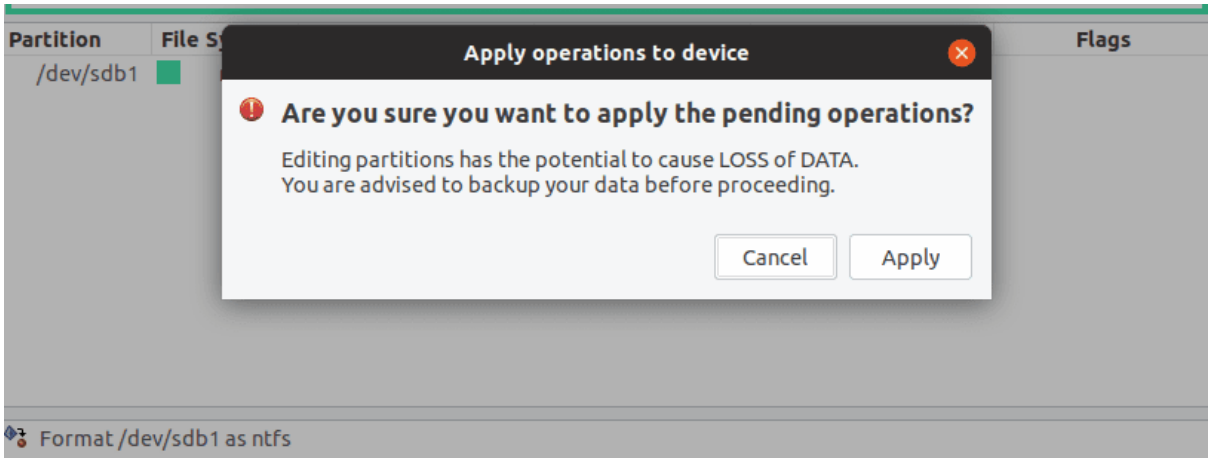

GParted Edit View Device Partition Help
/dev/sda (20.00 GiB)
/dev/sdb (7.70 GiB)
/dev/sda1
20.00 GiB
Partition File System Mount Point Size Used Unused Flags
/dev/sda1 ext4 / 20.00 GiB 13.18 GiB 6.82 GiB boot
unallocated unallocated 1.00 MiB --- ---

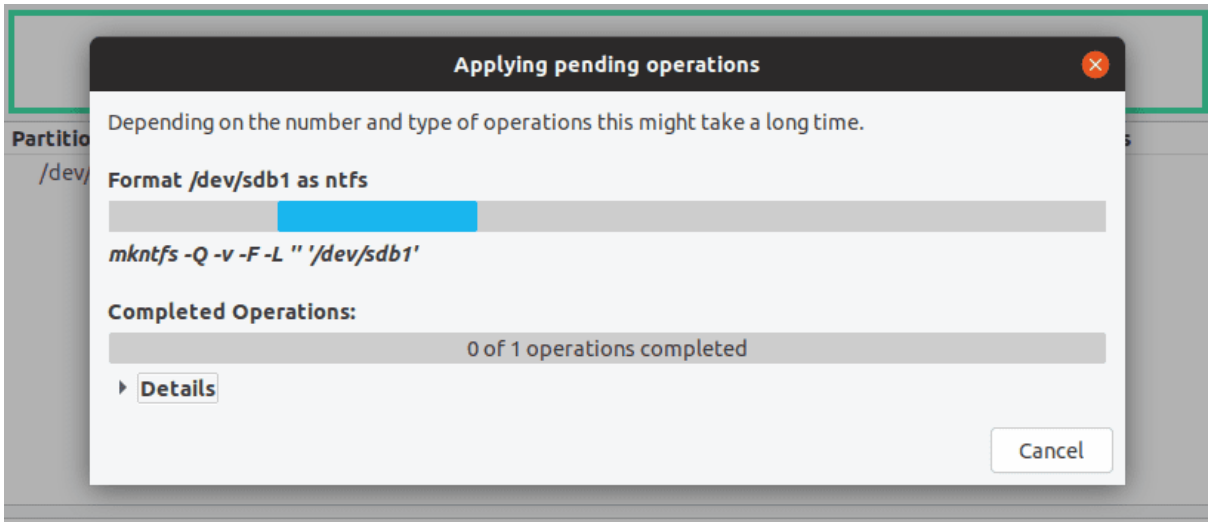

/dev/sdb1
14.65 GiB
Partition File System Mount Point Size Used Unused Flags
/dev/sdb1 fat32 /media/ex... 14.64 GiB boot, lba
New Insert
Delete Delete
Resize/Move
Copy Ctrl+C
Paste Ctrl+V
Format to
Unmount
Name Partition
Manage Flags
Check
Label File System
New UUID
Information
0 operations pending

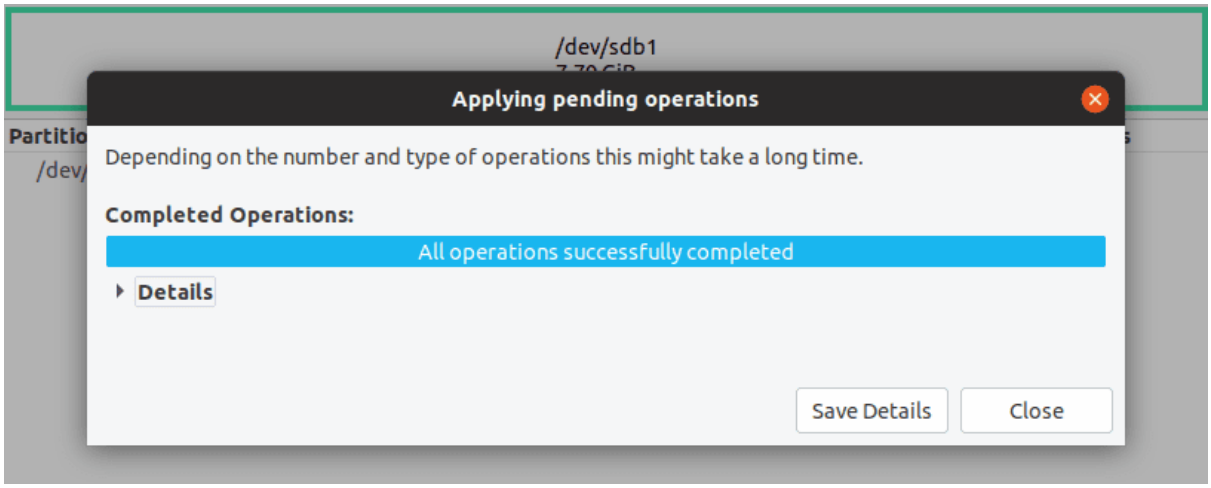

GParted Edit View Device Partition Help
/dev/sdb (7.70 GiB)
/dev/sdb1
7.70 GiB
Partition File System Size Used Unused Flags
/dev/sdb1 fat32 2.06 MiB 7.69 GiB boot, lba
New Insert
Delete Delete
Resize/Move
Copy Ctrl+C
Paste Ctrl+V
Format to
Mount
Name Partition
Manage Flags
Check
Label File System
New UUID
Information
btrfs
exfat
ext2
ext3
ext4
f2fs
fat16
fat32
hfs
hfs+
jfs
linux-swap
lvm2 pv
nilfs2
ntfs
reiser4
reiserfs
udf
ufs
xfs
cleared

Format /dev/sdb1 as ntfs
1 operation pending


GParted Edit View Device Partition Help
/dev/sdb (7.70 GiB)
Apply All Operations
/dev/sdb1
7.70 GiB


Partition File System Flags
/dev/sdb1
Apply operations to device
Are you sure you want to apply the pending operations?
Editing partitions has the potential to cause LOSS of DATA.
You are advised to backup your data before proceeding.
Cancel
Apply
Format /dev/sdb1 as ntfs





Install Raspberry Pi OS using Raspberry Pi Imager

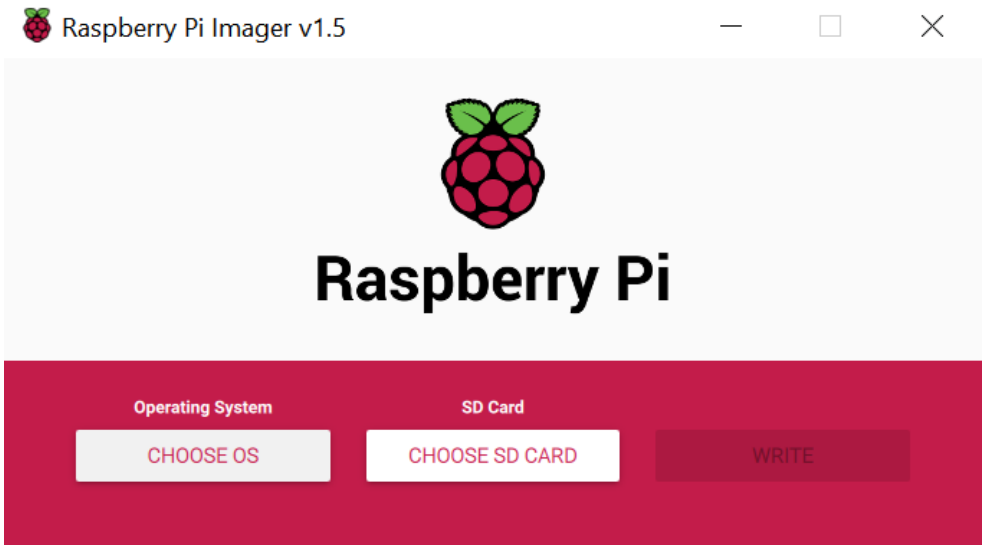
Raspberry Pi Imager is the quick and easy way to install Raspberry Pi OS and other operating systems to a microSD card, ready to use with your Raspberry Pi. Watch our 40-second video to learn how to install an operating system using Raspberry Pi Imager.

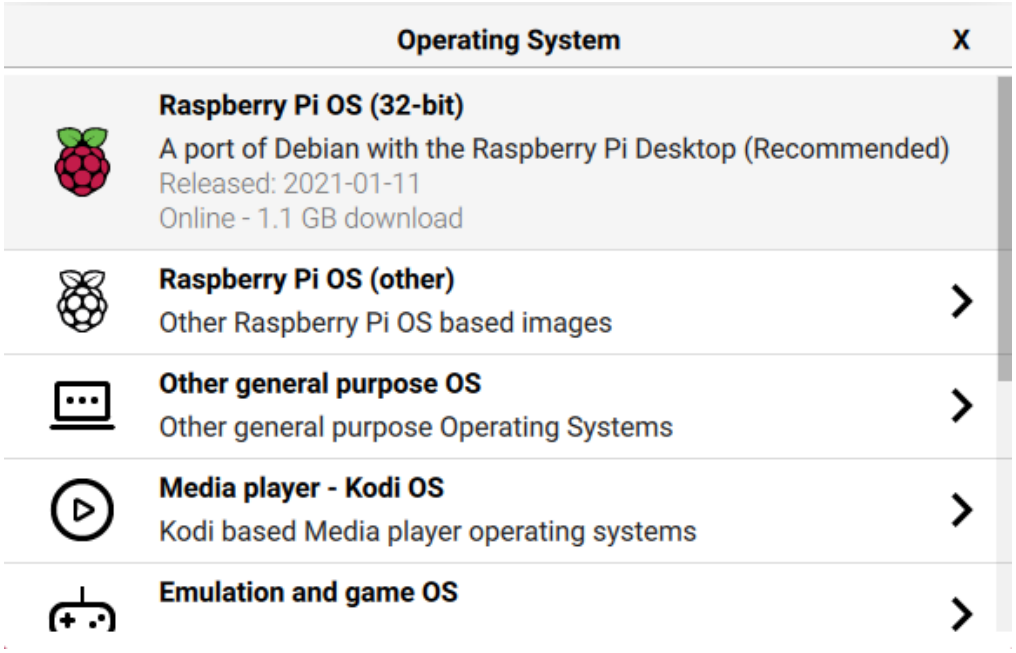
Download and install Raspberry Pi Imager to a computer with an SD card reader. Put the SD card you'll use with your Raspberry Pi into the reader and run Raspberry Pi Imager.

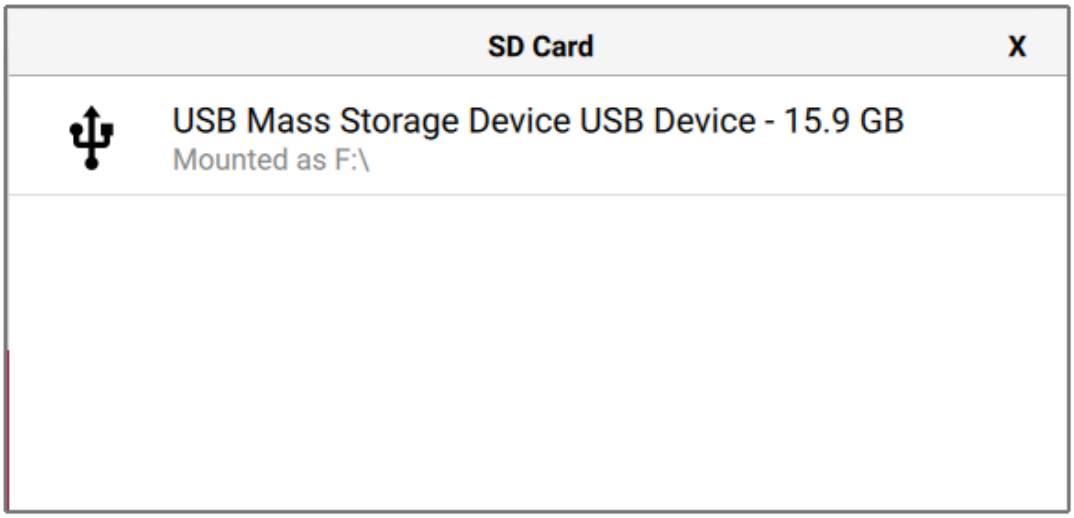
Download for Windows

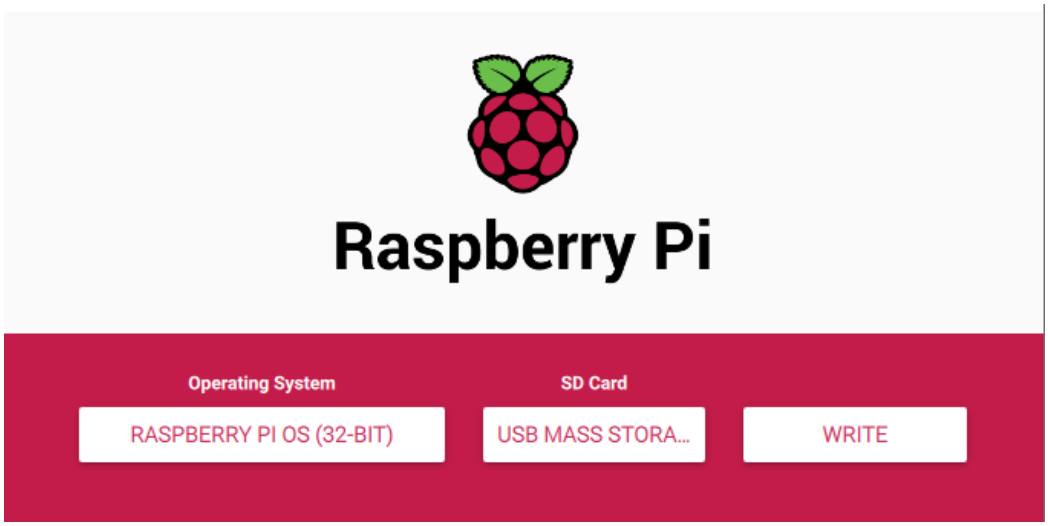
Download for macOS

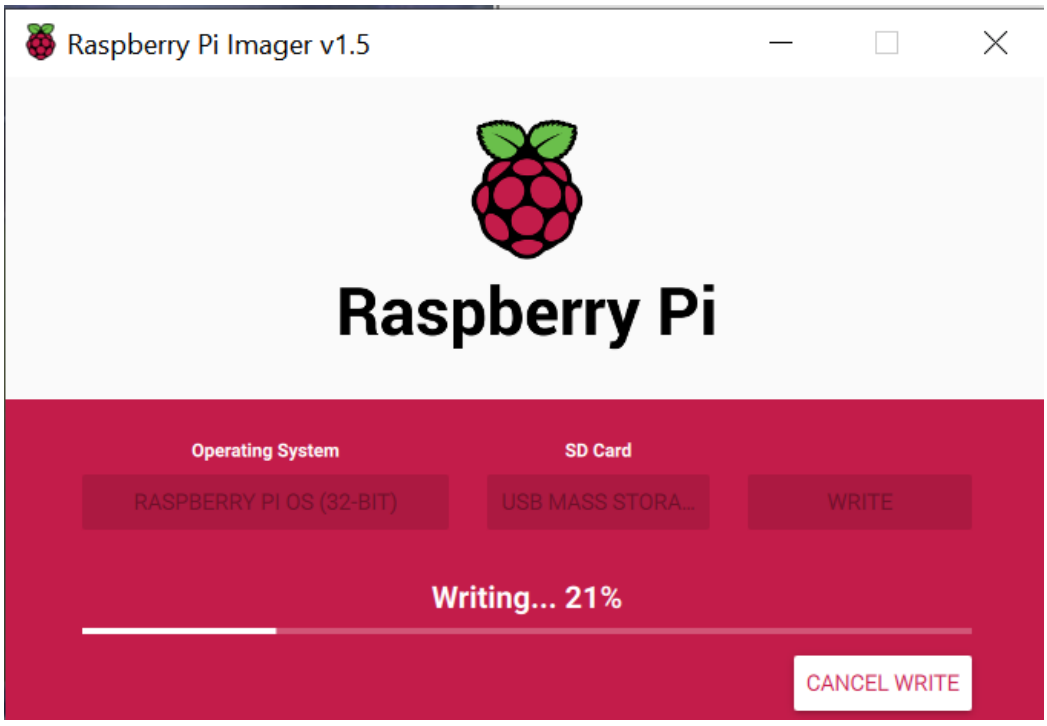
Download for Ubuntu for x86

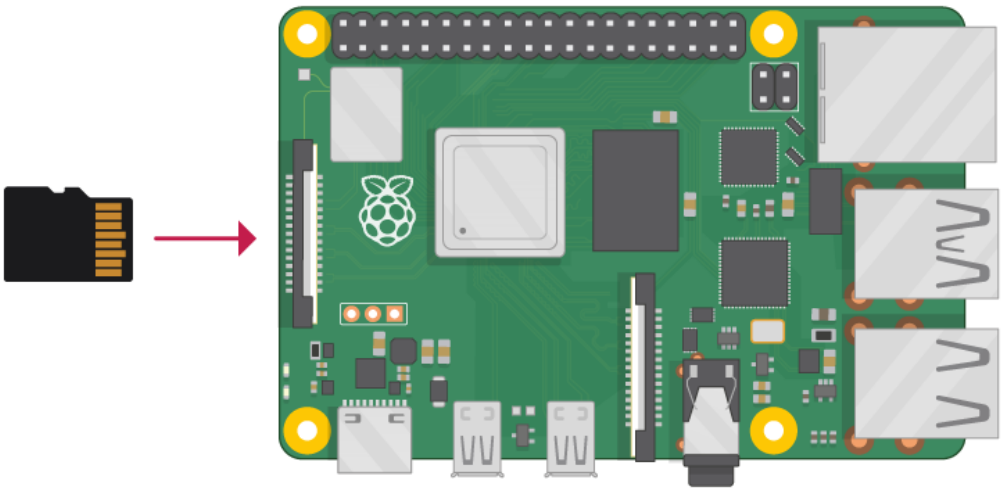

Raspberry Pi Imager v1.5
Raspberry Pi
Operating System
SD Card
CHOOSE OS
CHOOSE SD CARD
WRITE

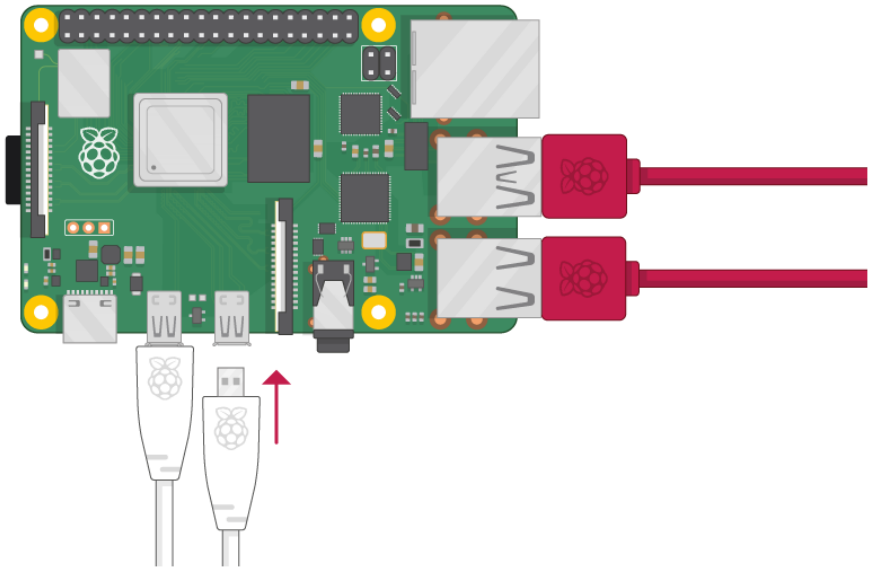

Operating System
X
Raspberry Pi OS (32-bit)
A port of Debian with the Raspberry Pi Desktop (Recommended)
Released: 2021-01-11
Online - 1.1 GB download
Raspberry Pi OS (other)
Other Raspberry Pi OS based images
Other general purpose OS
Other general purpose Operating Systems
Media player - Kodi OS
Kodi based Media player operating systems
Emulation and game OS

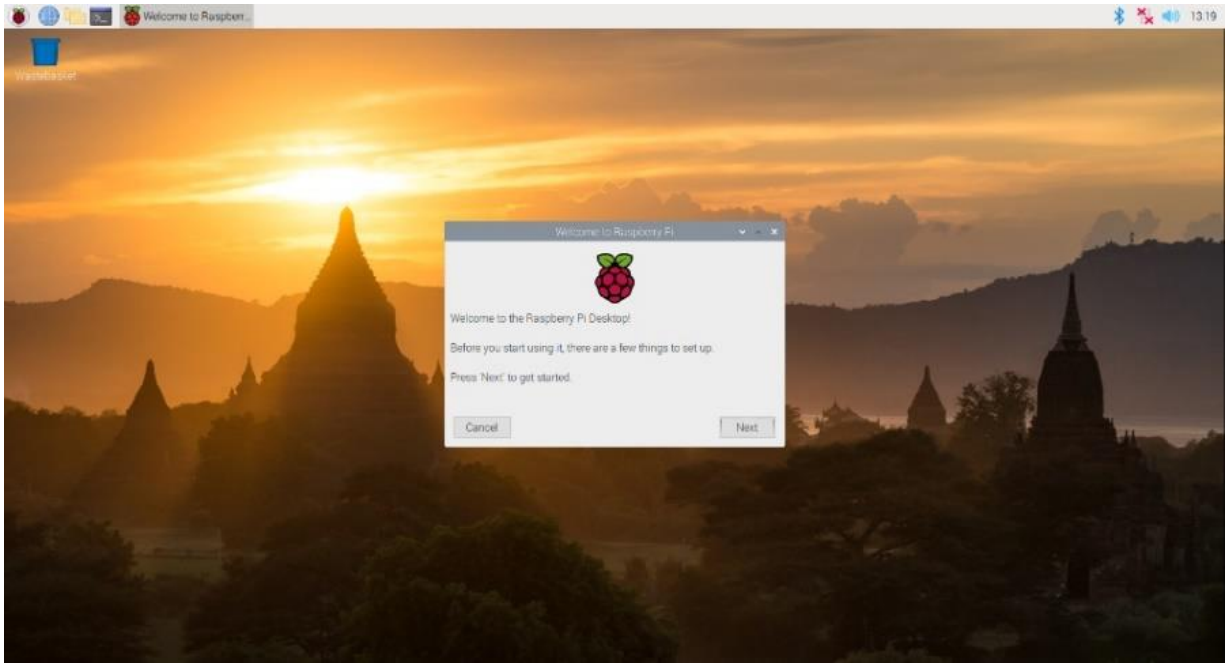

SD Card
X
USB Mass Storage Device USB Device - 15.9 GB
Mounted as F:\


Raspberry Pi
Operating System
SD Card
RASPBERRY PI OS (32-BIT)
USB MASS STORA...
WRITE


Raspberry Pi Imager v1.5
Raspberry Pi
Operating System
SD Card
RASPBERRY PI OS (32-BIT)
USB MASS STORA...
WRITE
Writing... 21%
CANCEL WRITE

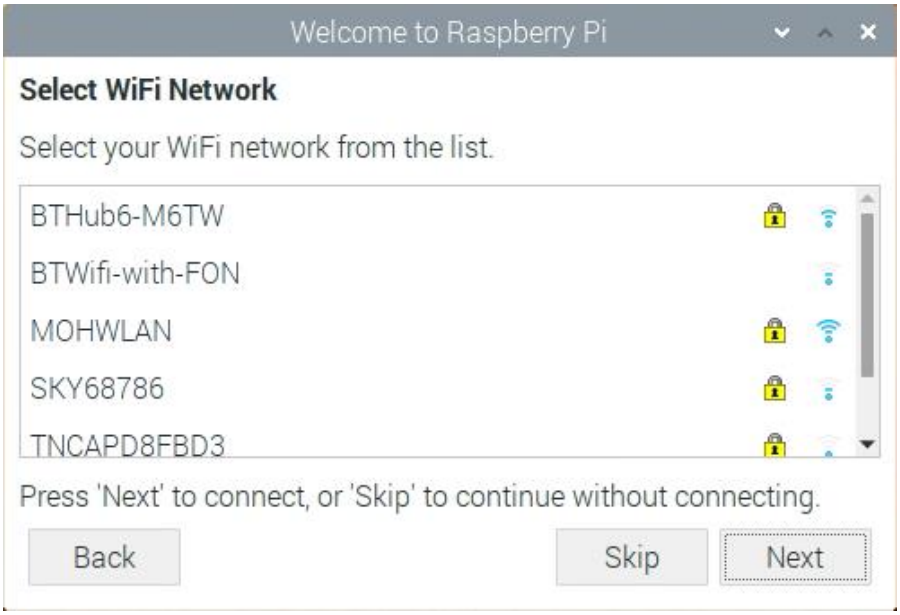


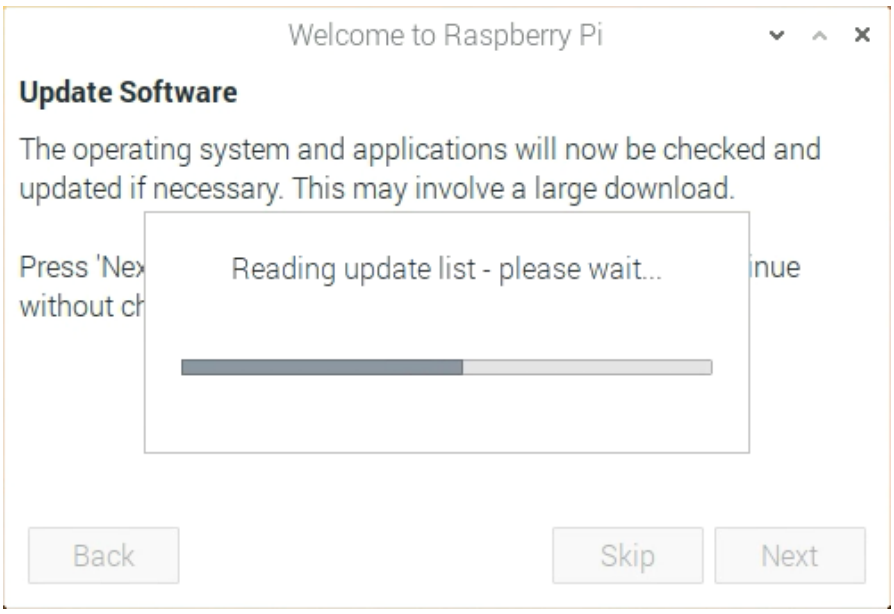



Welcome to Raspberry Pi
Welcome to the Raspberry Pi Desktop!
Before you start using it, there are a few things to set up.
Press 'Next' to get started.
Cancel
Next

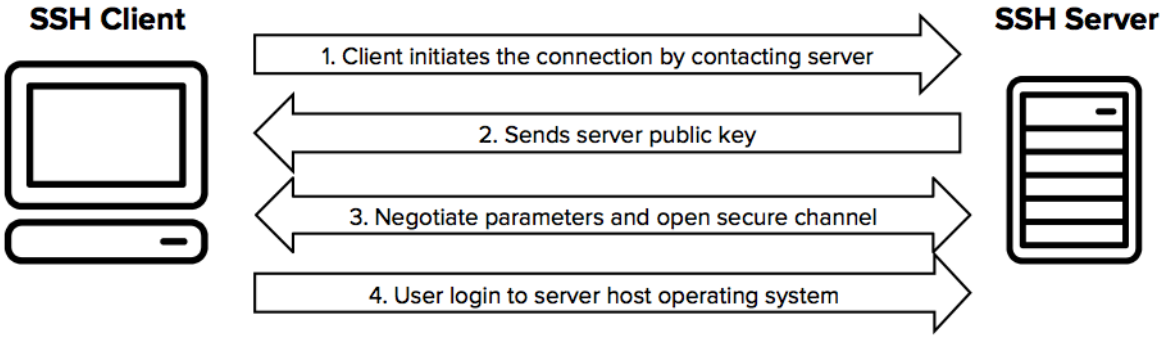
Welcome to Raspberry Pi
Set Country
Enter the details of your location. This is used to set the language, time zone, keyboard and other international settings.
Country:
United Kingdom
Language:
British English
Timezone:
London
Use English language
Use US keyboard
Press 'Next' when you have made your selection.
Back
Next

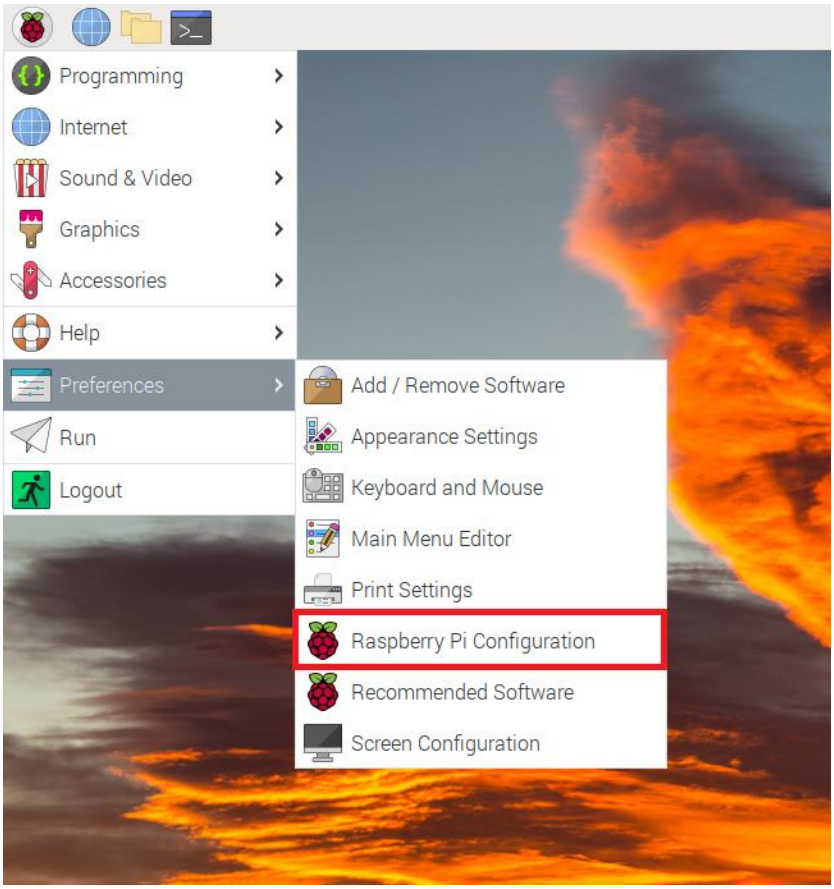
Welcome to Raspberry Pi
Change Password
The default 'pi' user account currently has the password 'raspberry'. It is strongly recommended that you change this to a different password that only you know.
Enter new password:
Confirm new password:
Hide characters
Press 'Next' to activate your new password.
Back
Next

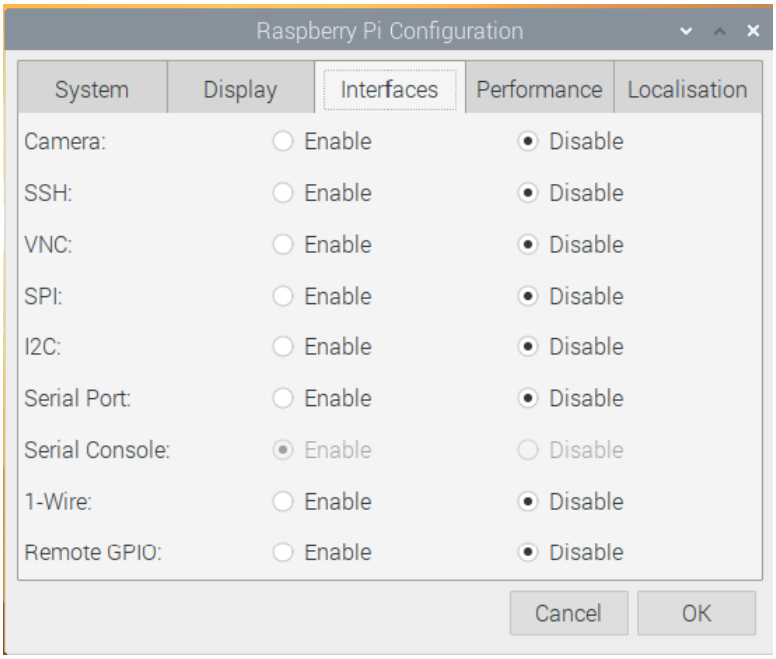

Welcome to Raspberry Pi
Select WiFi Network
Select your WiFi network from the list.
BTHub6-M6TW
BTWifi-with-FON
MOHWLAN
SKY68786
TNCAPD8FBD3
Press 'Next' to connect, or 'Skip' to continue without connecting.
Back
Skip
Next

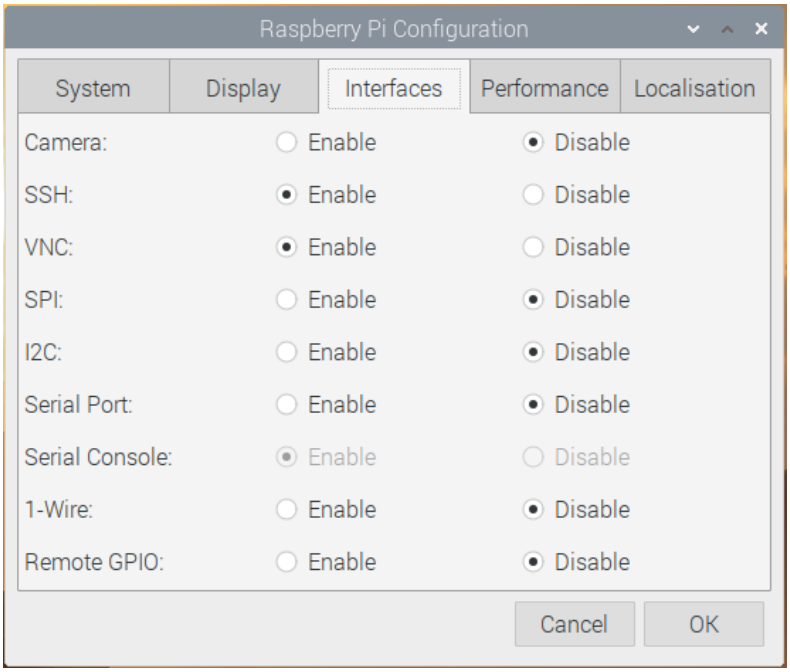

Welcome to Raspberry Pi
Update Software
The operating system and applications will now be checked and updated if necessary. This may involve a large download.
Reading update list - please wait...
Back
Skip
Next

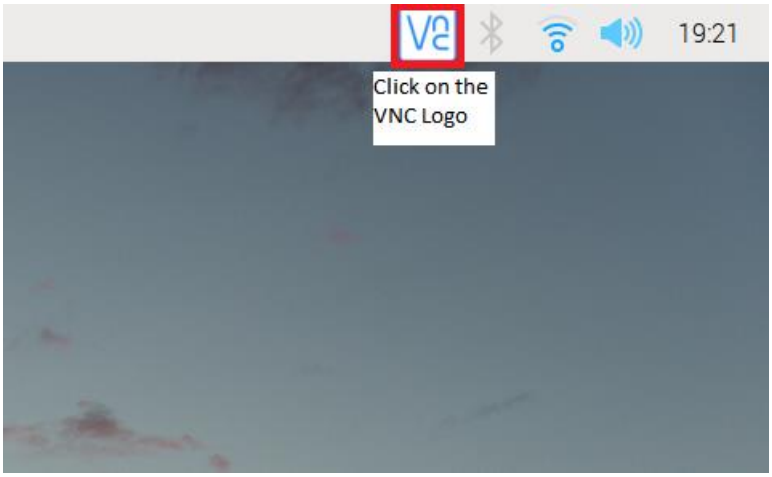
Welcome to Raspberry Pi
Setup Complete
Your Raspberry Pi is now set up and ready to go.
To run applications, click the raspberry icon in the top left corner of the screen to open the menu.
Press 'Restart' to restart your Raspberry Pi to load the new settings, or press 'Later' to close this window and restart manually later.
Back
Later
Restart

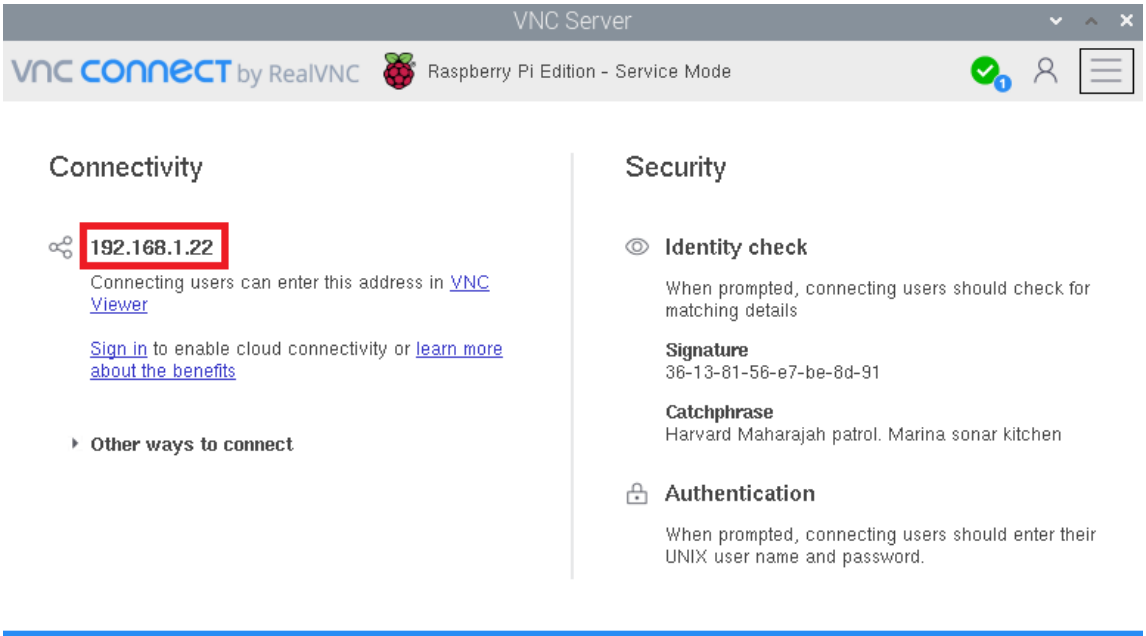

SSH Client
SSH Server
1. Client initiates the connection by contacting server
2. Sends server public key
3. Negotiate parameters and open secure channel
4. User login to server host operating system


Programming
Internet
Sound & Video
Graphics
Accessories
Help
Preferences
Run
Logout
Add / Remove Software
Appearance Settings
Keyboard and Mouse
Main Menu Editor
Print Settings
Raspberry Pi Configuration
Recommended Software
Screen Configuration

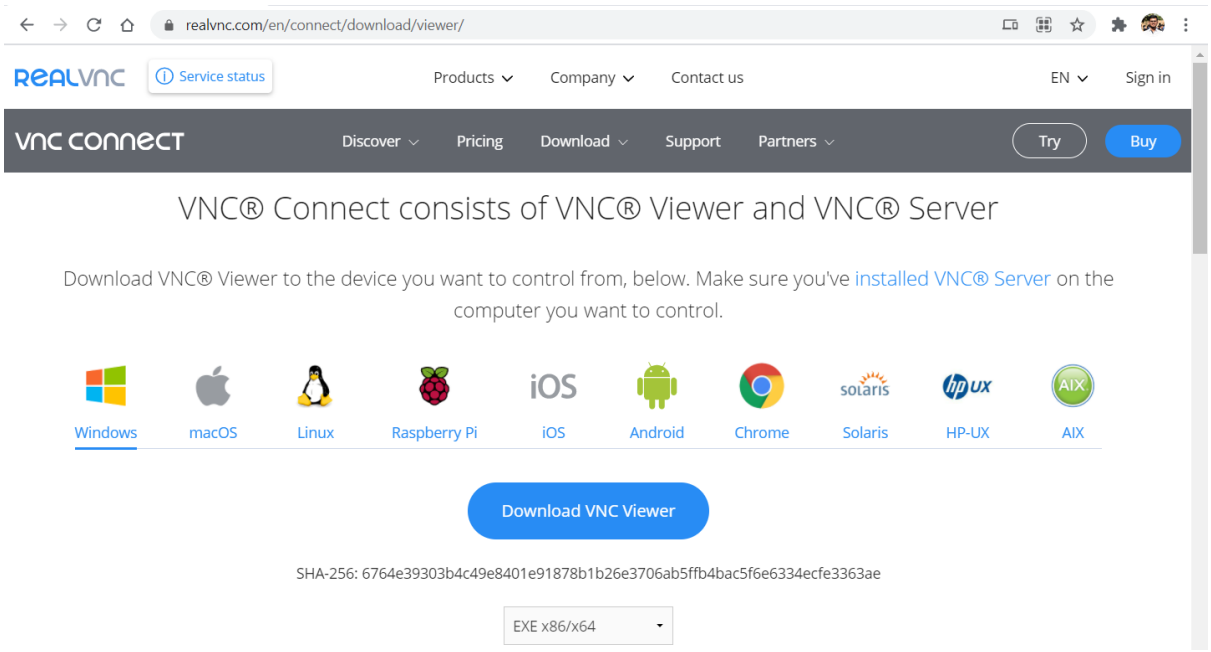

Raspberry Pi Configuration
System
Display
Interfaces
Performance
Localisation
Camera: Enable Disable
SSH: Enable Disable
VNC: Enable Disable
SPI: Enable Disable
I2C: Enable Disable
Serial Port: Enable Disable
Serial Console: Enable Disable
1-Wire: Enable Disable
Remote GPIO: Enable Disable
Cancel
OK

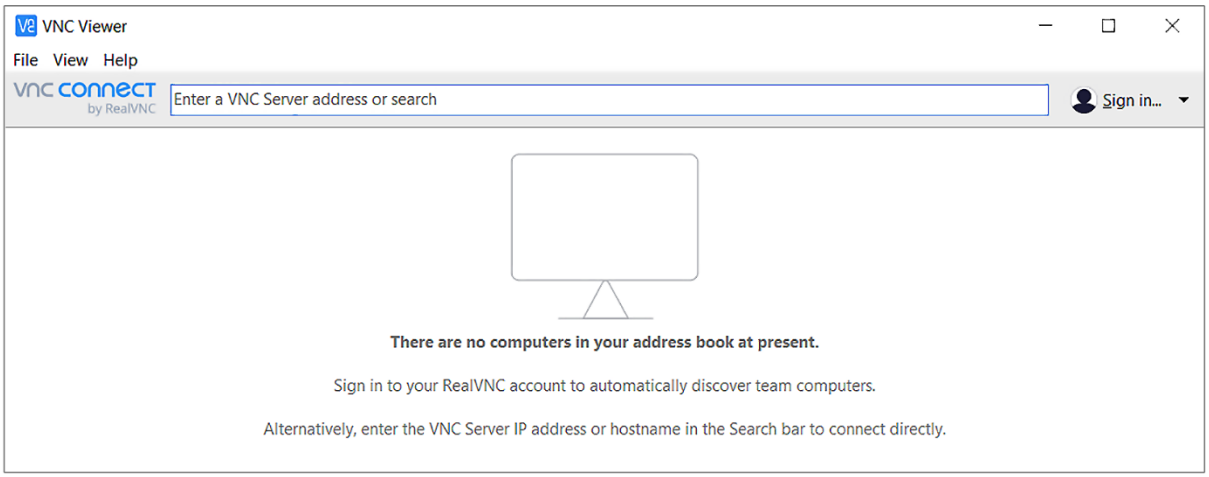

Raspberry Pi Configuration
System
Display
Interfaces
Performance
Localisation
Camera: Enable Disable
SSH: Enable Disable
VNC: Enable Disable
SPI: Enable Disable
I2C: Enable Disable
Serial Port: Enable Disable
Serial Console: Enable Disable
1-Wire: Enable Disable
Remote GPIO: Enable Disable
Cancel
OK

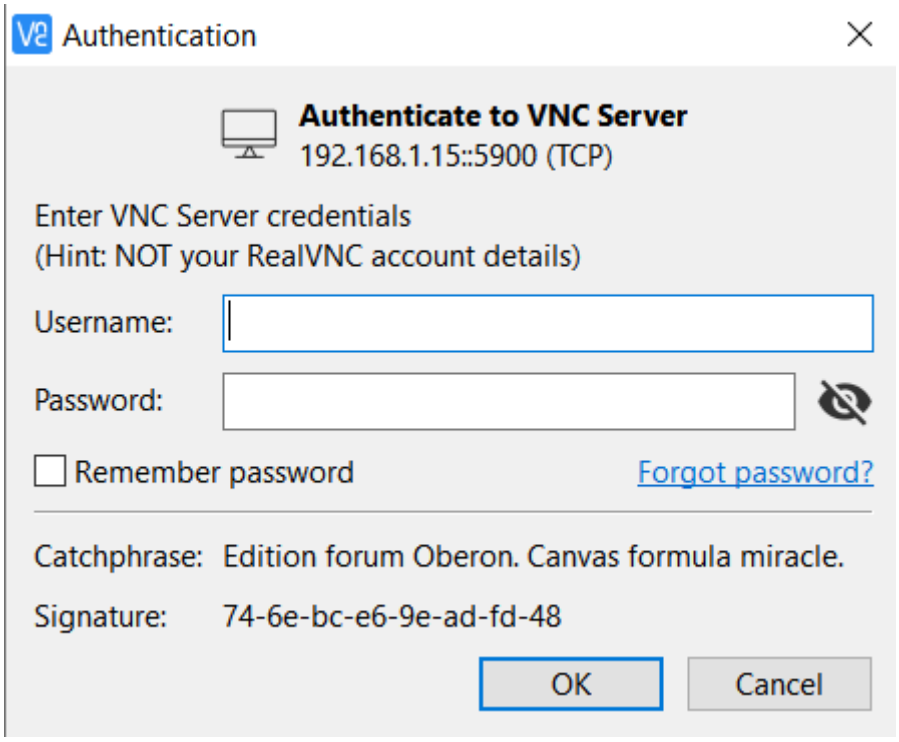

19:21
Click on the
VNC Logo

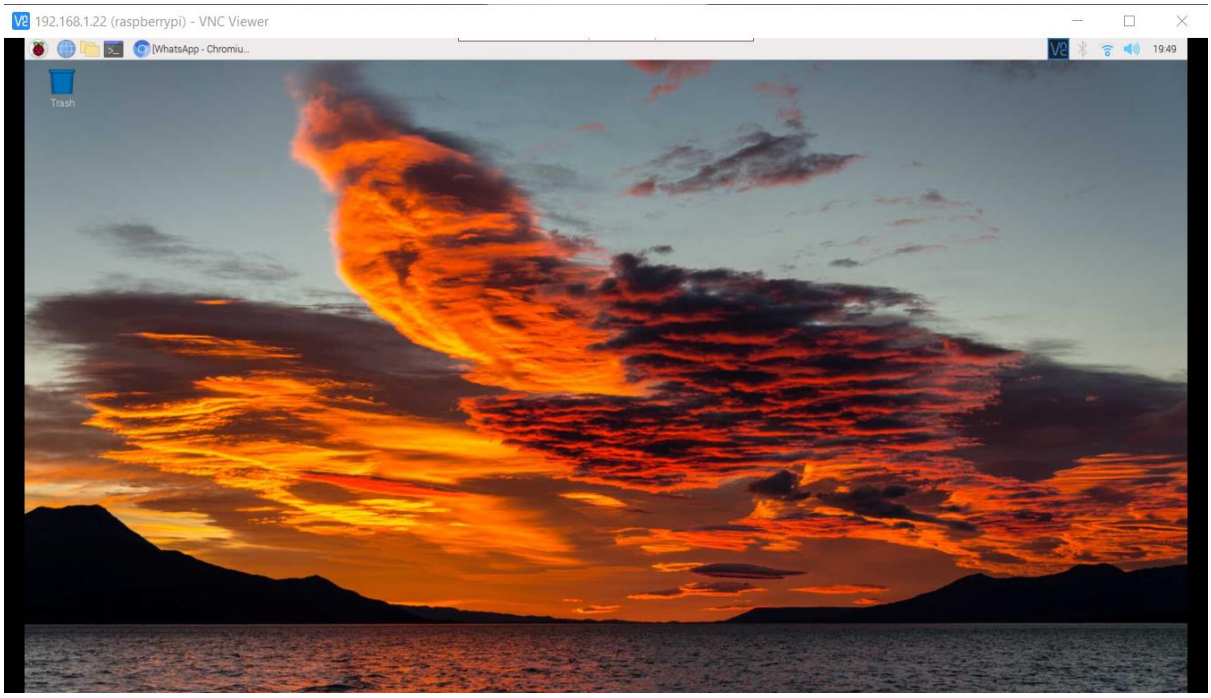

VNC Server
VNC Connect by RealVNC
Raspberry Pi Edition - Service Mode
Connectivity
192.168.1.22
Connecting users can enter this address in VNC Viewer
Sign in to enable cloud connectivity or learn more about the benefits
Other ways to connect
Security
Identity check
When prompted, connecting users should check for matching details
Signature
36-13-81-56-e7-be-8d-91
Catchphrase
Harvard Maharajah patrol. Marina sonar kitchen
Authentication
When prompted, connecting users should enter their UNIX user name and password.

Non-commercial use only. Download VNC Viewer and get connected.


realvnc.com/en/connect/download/viewer/
REALVNC
Service status
Products
Company
Contact us
EN
Sign in
VNC Connect
Discover
Pricing
Download
Support
Partners
Try
Buy
VNC® Connect consists of VNC® Viewer and VNC® Server
Download VNC® Viewer to the device you want to control from, below. Make sure you've installed VNC® Server on the computer you want to control.
Windows
macOS
Linux
Raspberry Pi
iOS
Android
Chrome
Solaris
HP-UX
AIX
Download VNC Viewer
SHA-256: 6764e39303b4c49e8401e91878b1b26e3706ab5ffb4bac5f6e6334ecfe3363ae
EXE x86/x64


VNC Viewer
File View Help
VNC Connect by RealVNC
Enter a VNC Server address or search
Sign in...
There are no computers in your address book at present.
Sign in to your RealVNC account to automatically discover team computers.
Alternatively, enter the VNC Server IP address or hostname in the Search bar to connect directly.


Authentication
Authenticate to VNC Server
192.168.1.15::5900 (TCP)
Enter VNC Server credentials
(Hint: NOT your RealVNC account details)
Username:
Password:
Remember password
Forgot password?
Catchphrase: Edition forum Oberon. Canvas formula miracle.
Signature: 74-6e-bc-e6-9e-ad-fd-48
OK
Cancel


192.168.1.22 (raspberrypi) - VNC Viewer
Trash

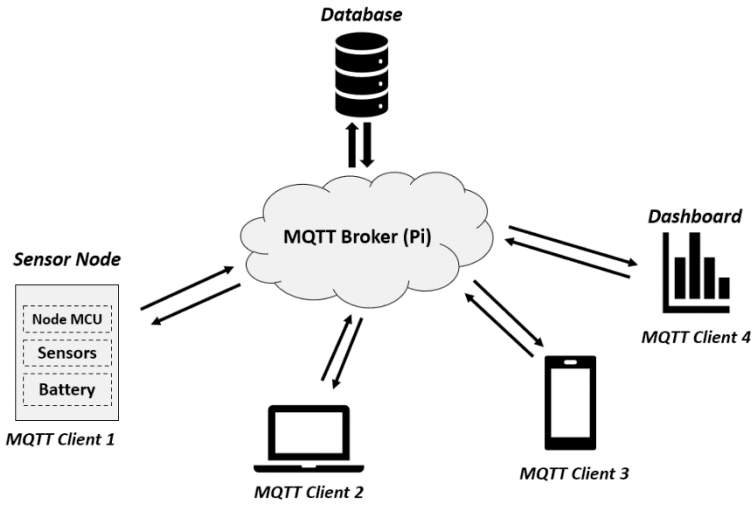
```
pi@raspberrypi:~ $ sudo apt install mosquitto mosquitto-clients
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Suggested packages:
  apparmor
The following NEW packages will be installed:
  mosquitto mosquitto-clients
0 upgraded, 2 newly installed, 0 to remove and 207 not upgraded.
Need to get 352 kB of archives.
After this operation, 885 kB of additional disk space will be used.
Get:1 http://raspbian.mirror.net.in/raspbian/raspbian bullseye/main armhf mosquitto armhf 2.0.11-1 [243 kB]
Get:2 http://raspbian.mirror.net.in/raspbian/raspbian bullseye/main armhf mosquitto-clients armhf 2.0.11-1 [110 kB]
Fetched 352 kB in 2s (173 kB/s)
Selecting previously unselected package mosquitto.
(Reading database ... 105998 files and directories currently installed.)
Preparing to unpack .../mosquitto_2.0.11-1_armhf.deb ...
Unpacking mosquitto (2.0.11-1) ...
Selecting previously unselected package mosquitto-clients.
Preparing to unpack .../mosquitto-clients_2.0.11-1_armhf.deb ...
Unpacking mosquitto-clients (2.0.11-1) ...
Setting up mosquitto-clients (2.0.11-1) ...
Setting up mosquitto (2.0.11-1) ...
Processing triggers for man-db (2.9.4-2) ...
Processing triggers for libc-bin (2.31-13+rpt2+rpi1+deb11u2) ...
pi@raspberrypi:~ $
```

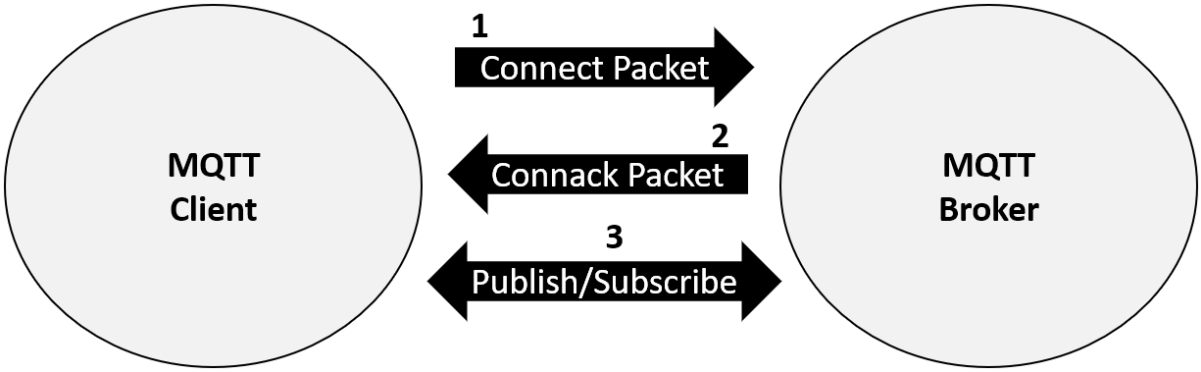
```
● mosquitto.service - Mosquitto MQTT v3.1/v3.1.1 Broker
   Loaded: loaded (/lib/systemd/system/mosquitto.service; enabled; vendor preset:
enabled)
   Active: active (running) since Tue 2021-03-16 16:33:30 IST; 3min 39s ago
     Docs: man:mosquitto.conf(5)
           man:mosquitto(8)
 Main PID: 2607 (mosquitto)
    Tasks: 1 (limit: 2062)
   CGroup: /system.slice/mosquitto.service
           └─2607 /usr/sbin/mosquitto -c /etc/mosquitto/mosquitto.conf

Mar 16 16:33:30 raspberrypi systemd[1]: Starting Mosquitto MQTT v3.1/v3.1.1 Broke
r...
Mar 16 16:33:30 raspberrypi systemd[1]: Started Mosquitto MQTT v3.1/v3.1.1 Broke
r.
```

```
pi@raspberrypi: ~
File  Edit  Tabs  Help
pi@raspberrypi:~ $ mosquitto_sub -v -t test/message
test/message Hello World!
```

```
pi@raspberrypi: ~
File  Edit  Tabs  Help
pi@raspberrypi:~ $ mosquitto_pub -t test/message -m "Hello World!"
pi@raspberrypi:~ $
```

Chapter 2: MQTT in Detail





Bit	7	6	5	4	3	2	1	0
byte 1	MQTT Control Packet type (1)				Reserved			
	0	0	0	1	0	0	0	0
byte 2…	Remaining Length							

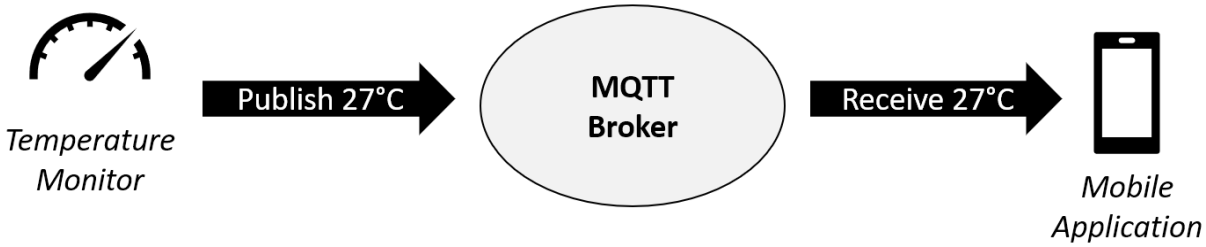
Bit	7	6	5	4	3	2	1	0
	User Name Flag	Password Flag	Will Retain	Will QoS		Will Flag	Clean Session	Reserved
byte 8	X	X	X	X	X	X	X	0

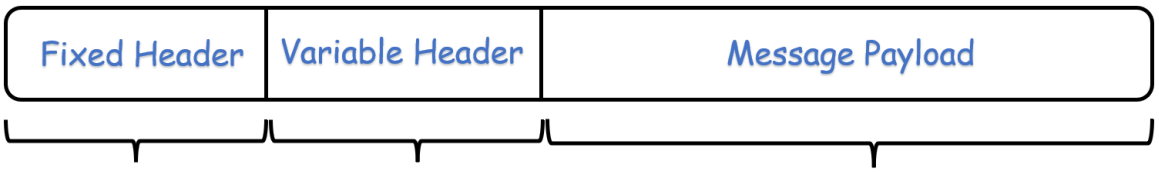
CONNECT

clientId:	"ExampleClient"
cleanSession:	true
username (optional):	"user1"
password (optional):	"password"
lastWillTopic (optional):	"/test/1"
lastWillQos (optional):	1
lastWillMessage (opt.):	"unexpected exit"
lastWillRetain (optional):	false
keepAlive:	60

CONNACK

sessionPresent:	true
returnCode:	0





MQTT Control Packet Type (4 bits)
DUP Flag (1 bit)
RETAIN Flag (1bit)
QoS Level (2 bits)

Topic Name
Packet Identifier

Example (JSON):
{ 'temperature' : 25 }

PUBLISH

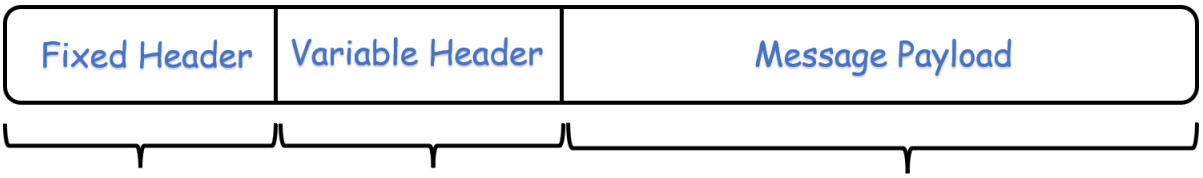
Topic : test/temperature

QoS Level: 0

Payload : {'temp' : 25}

Retain Flag : 0

DUP Flag : 0



MQTT Control Packet Type (4 bits)

Packet Identifier MSB
Packet Identifier LSB

Topic Filter
Requested QoS

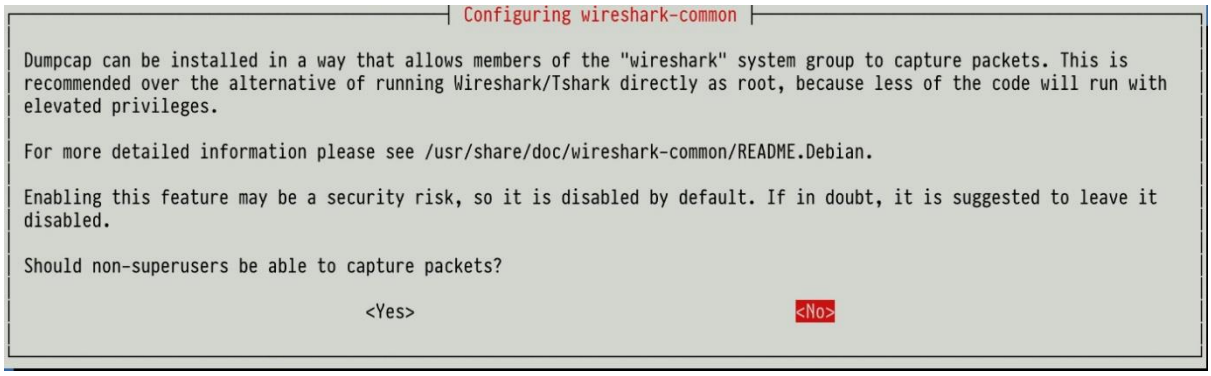
Subscribe

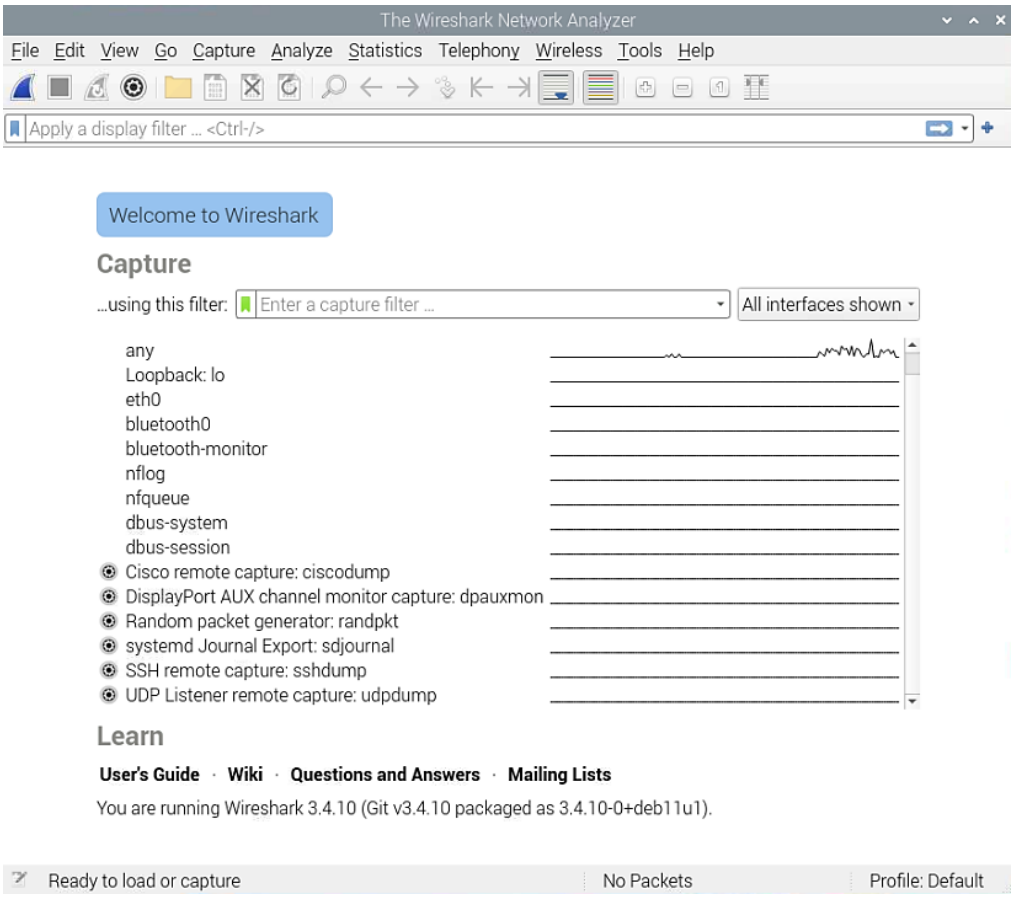
Topic : test/temperature

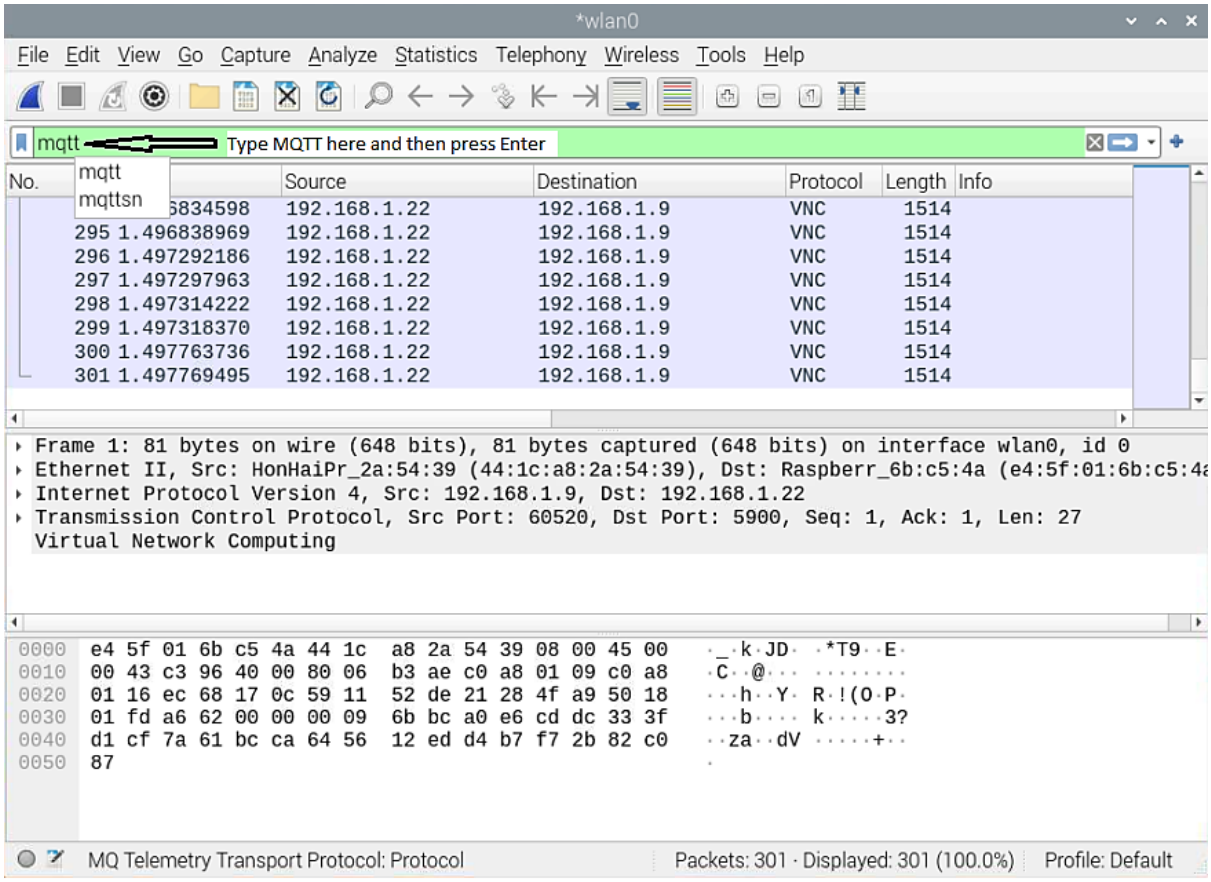
QoS Level: 0

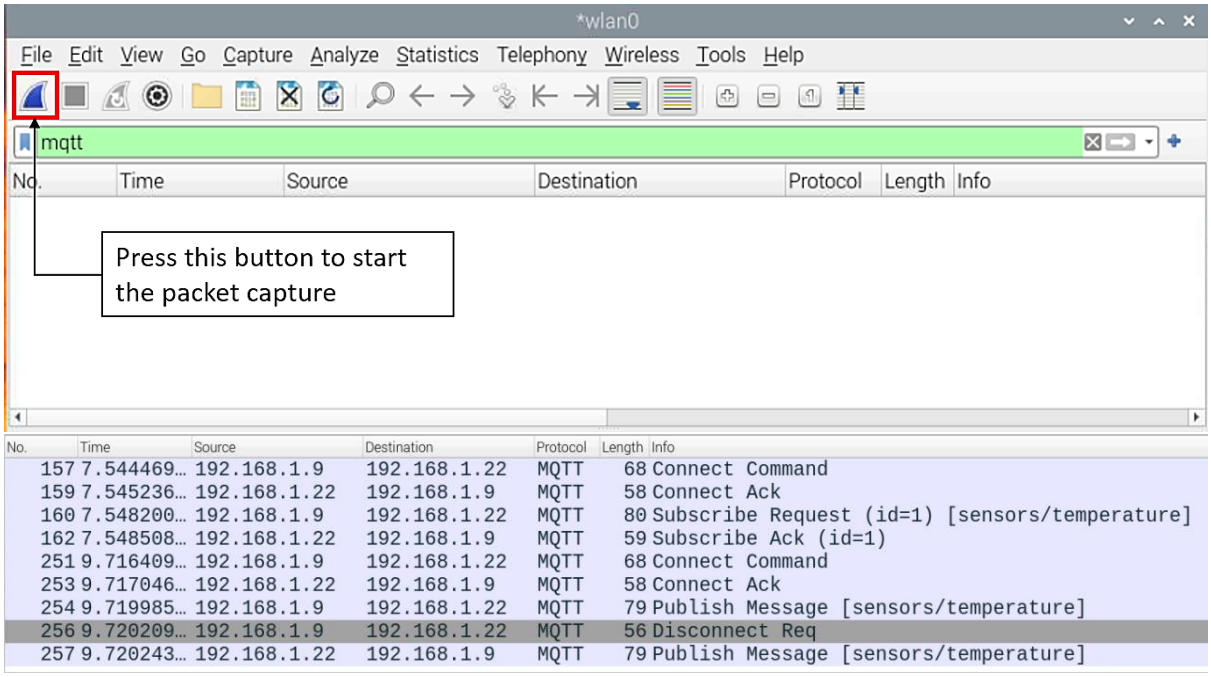
Topic: test/humidity

QoS Level: 1



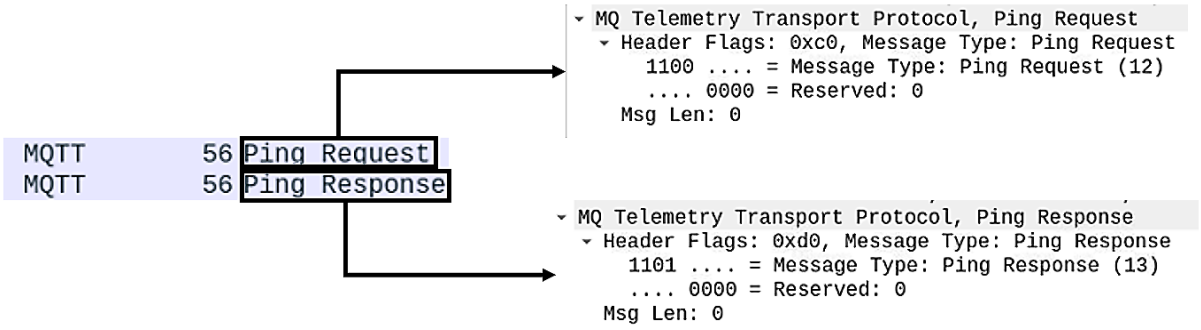







```
MQTT        68 Connect Command
MQTT        58 Connect Ack
MQTT        80 Subscribe Request (id=1) [sensors/temperature]
MQTT        59 Subscribe Ack (id=1)
```

```
MQ Telemetry Transport Protocol, Connect Command
  Header Flags: 0x10, Message Type: Connect Command
    Msg Len: 12
    Protocol Name Length: 4
    Protocol Name: MQTT
    Version: MQTT v3.1.1 (4)
  Connect Flags: 0x02, QoS Level: At most once delivery (Fire and Forget), Clean Session Flag
      0... .... = User Name Flag: Not set
      .0.. .... = Password Flag: Not set
      ..0. .... = Will Retain: Not set
      ...0 0... = QoS Level: At most once delivery (Fire and Forget) (0)
      .... .0.. = Will Flag: Not set
      .... ..1. = Clean Session Flag: Set
      .... ...0 = (Reserved): Not set
    Keep Alive: 60
    Client ID Length: 0
    Client ID:
```




```
MQ Telemetry Transport Protocol, Connect Ack
  Header Flags: 0x20, Message Type: Connect Ack
      0010 .... = Message Type: Connect Ack (2)
      .... 0000 = Reserved: 0
    Msg Len: 2
  Acknowledge Flags: 0x00
      0000 000. = Reserved: Not set
      .... ...0 = Session Present: Not set
    Return Code: Connection Accepted (0)
```

```
MQ Telemetry Transport Protocol, Subscribe Request
  Header Flags: 0x82, Message Type: Subscribe Request
      1000 .... = Message Type: Subscribe Request (8)
      .... 0010 = Reserved: 2
    Msg Len: 24
    Message Identifier: 1
    Topic Length: 19
    Topic: sensors/temperature
    Requested QoS: At most once delivery (Fire and Forget) (0)
```

```
MQ Telemetry Transport Protocol, Subscribe Ack
  Header Flags: 0x90, Message Type: Subscribe Ack
      1001 .... = Message Type: Subscribe Ack (9)
      .... 0000 = Reserved: 0
    Msg Len: 3
    Message Identifier: 1
    Granted QoS: At most once delivery (Fire and Forget) (0)
```

```
MQTT        68 Connect Command
MQTT        58 Connect Ack
MQTT        79 Publish Message [sensors/temperature]
MQTT        56 Disconnect Req
```

CONNECT Packet

```
MQ Telemetry Transport Protocol, Connect Command
  Header Flags: 0x10, Message Type: Connect Command
    0001 .... = Message Type: Connect Command (1)
    .... 0000 = Reserved: 0
  Msg Len: 12
  Protocol Name Length: 4
  Protocol Name: MQTT
  Version: MQTT v3.1.1 (4)
  Connect Flags: 0x02, QoS Level: At most once delivery (Fire and Forget), Clean Session Flag
  Keep Alive: 60
  Client ID Length: 0
  Client ID:
```

CONNACK Packet

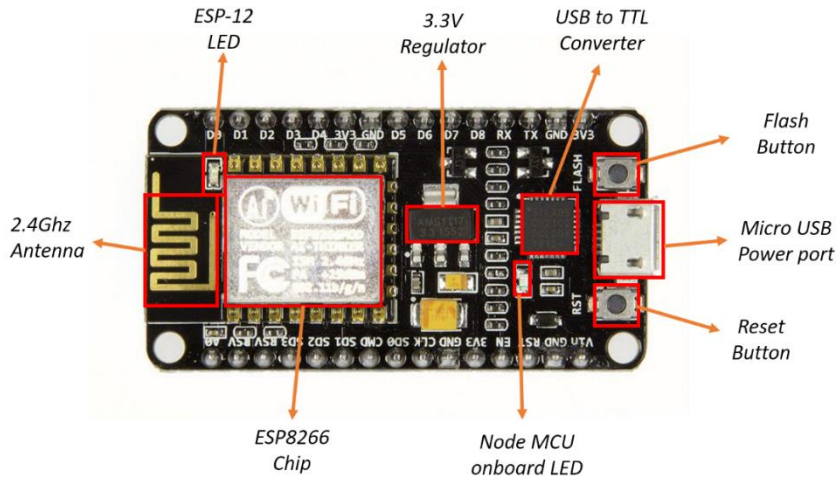
```
MQ Telemetry Transport Protocol, Connect Ack
  Header Flags: 0x20, Message Type: Connect Ack
    0010 .... = Message Type: Connect Ack (2)
    .... 0000 = Reserved: 0
  Msg Len: 2
  Acknowledge Flags: 0x00
    0000 000. = Reserved: Not set
    .... ...0 = Session Present: Not set
  Return Code: Connection Accepted (0)
```

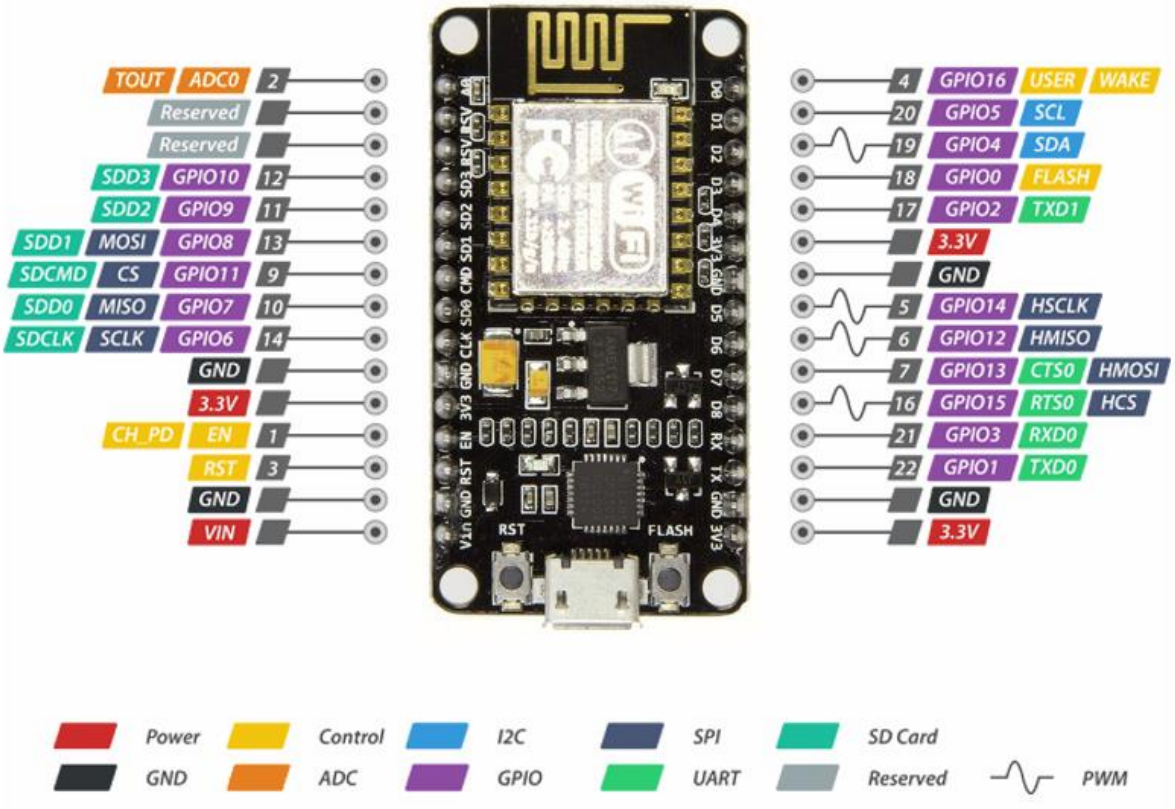
```
MQ Telemetry Transport Protocol, Publish Message
  Header Flags: 0x30, Message Type: Publish Message
    0011 .... = Message Type: Publish Message (3)
    .... 0... = DUP Flag: Not set
    .... .00. = QoS Level: At most once delivery (Fire and Forget) (0)
    .... ...0 = Retain: Not set
  Msg Len: 23
  Topic Length: 19
  Topic: sensors/temperature
  Message: 3237
```

1	31	DIGIT ONE
2	32	DIGIT TWO
3	33	DIGIT THREE
4	34	DIGIT FOUR
5	35	DIGIT FIVE
6	36	DIGIT SIX
7	37	DIGIT SEVEN
8	38	DIGIT EIGHT

```
MQ Telemetry Transport Protocol, Disconnect Req
  Header Flags: 0xe0, Message Type: Disconnect Req
    1110 .... = Message Type: Disconnect Req (14)
    .... 0000 = Reserved: 0
  Msg Len: 0
```

Chapter 3: Introduction to ESP Development Boards





Arduino IDE 1.8.19

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

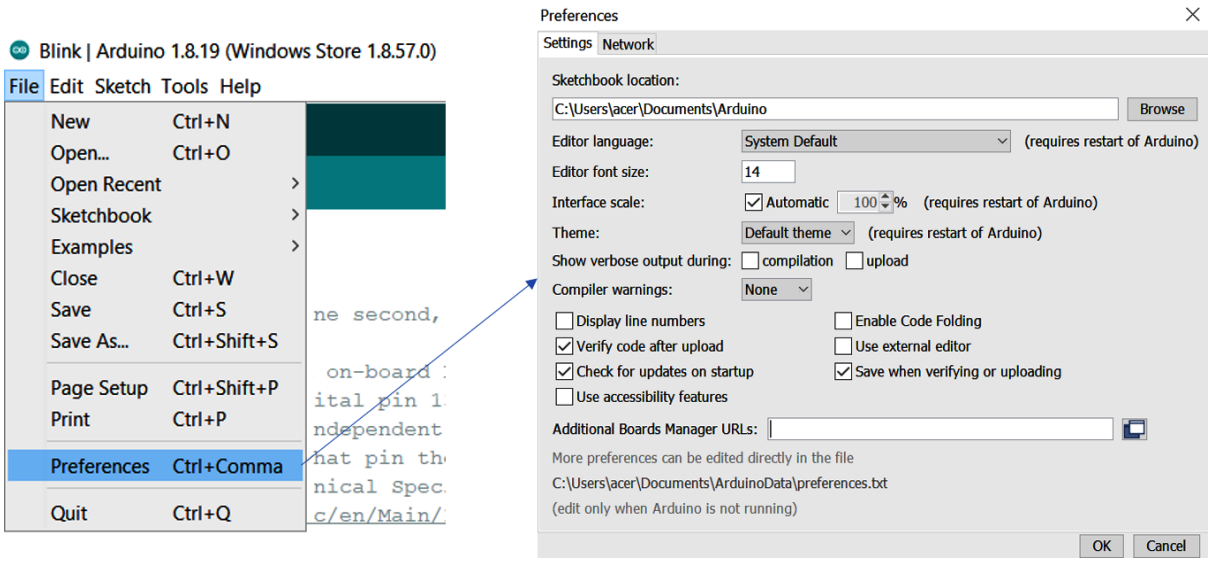
Refer to the **Getting Started** page for Installation instructions.

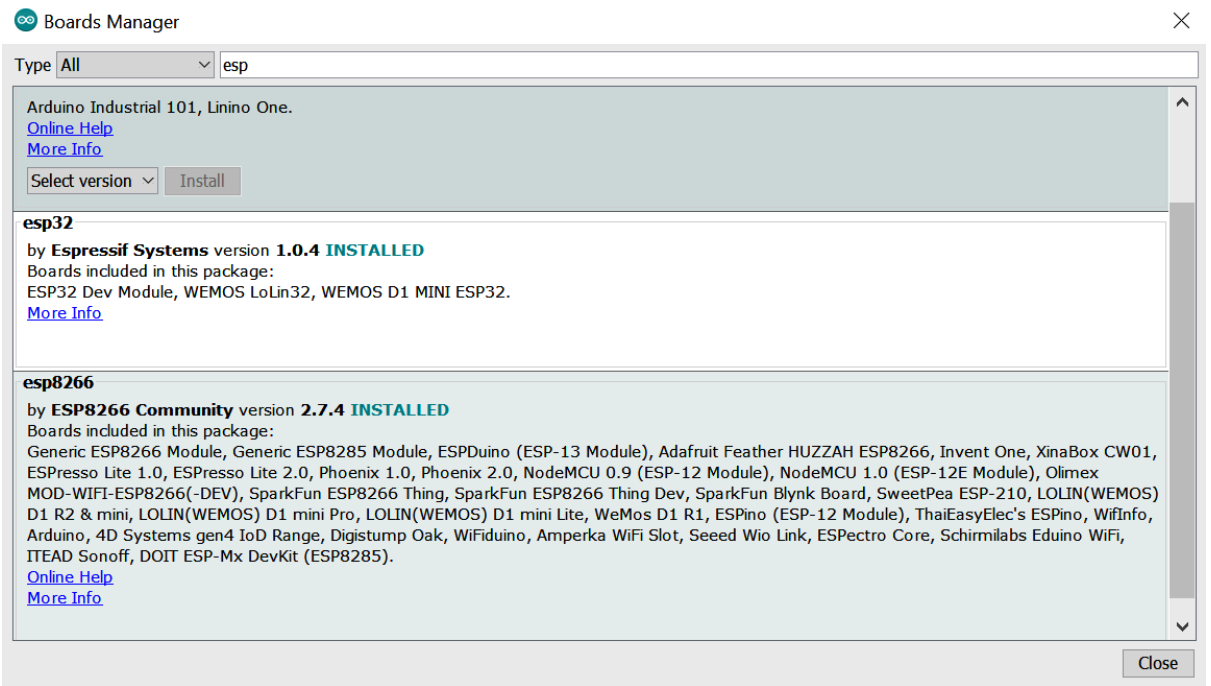
SOURCE CODE

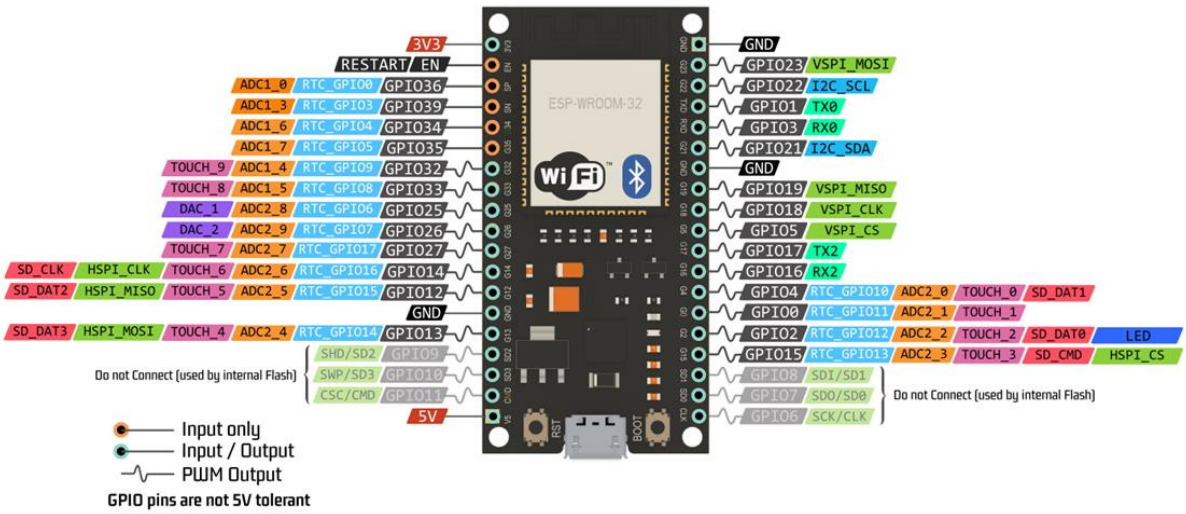
Active development of the Arduino software is **hosted by GitHub**. See the instructions for **building the code**. Latest release source code archives are available **here**. The archives are PGP-signed so they can be verified using **this** gpg key.

DOWNLOAD OPTIONS

Windows Win 7 and newer
Windows ZIP file
Windows app Win 8.1 or 10 Get
Linux 32 bits
Linux 64 bits
Linux ARM 32 bits
Linux ARM 64 bits
Mac OS X 10.10 or newer
Release Notes
Checksums (sha512)







boolean **connect** (clientID, [username, password], [willTopic, willQoS, willRetain, willMessage], [cleanSession])

Connects the client.

Parameters

- clientID `const char[]` - the client ID to use when connecting to the server
- Credentials - *(optional)*
  - username `const char[]` - the username to use. If `NULL`, no username or password is used
  - password `const char[]` - the password to use. If `NULL`, no password is used
- Will - *(optional)*
  - willTopic `const char[]` - the topic to be used by the will message
  - willQoS `int: 0,1 or 2` - the quality of service to be used by the will message
  - willRetain `boolean` - whether the will should be published with the retain flag
  - willMessage `const char[]` - the payload of the will message
- cleanSession `boolean` *(optional)* - whether to connect clean-session or not

Returns

- `false` - connection failed
- `true` - connection succeeded

boolean **publish** (topic, payload, [length], [retained])

Publishes a message to the specified topic.

Parameters

- topic `const char[]` - the topic to publish to
- payload `const char[], byte[]` - the message to publish
- length `unsigned int` *(optional)* - the length of the payload. Required if payload is a `byte[]`
- retained `boolean` *(optional)* - whether the message should be retained
  - false - not retained
  - true - retained

Returns

- `false` - publish failed, either connection lost or message too large
- `true` - publish succeeded

boolean **subscribe** (topic, [qos])

Subscribes to messages published to the specified topic.

Parameters

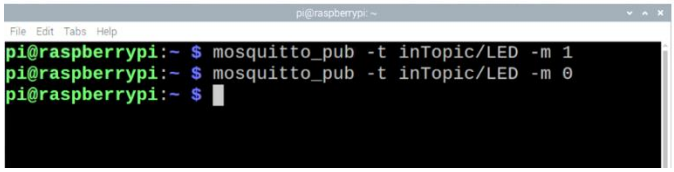
- topic `const char[]` - the topic to subscribe to
- qos `int: 0 or 1 only` *(optional)* - the qos to subscribe at

Returns

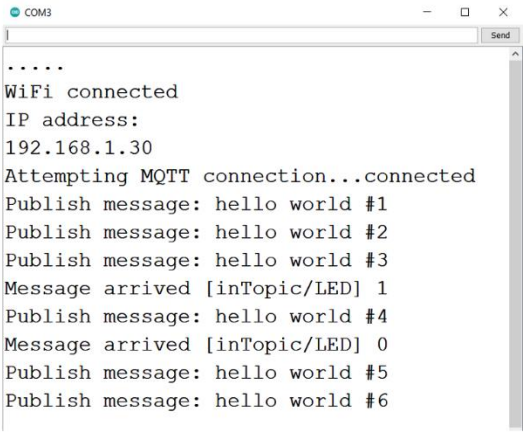
- `false` - sending the subscribe failed, either connection lost or message too large
- `true` - sending the subscribe succeeded

Pi MQTT Subscriber Terminal

Pi MQTT Publisher Terminal



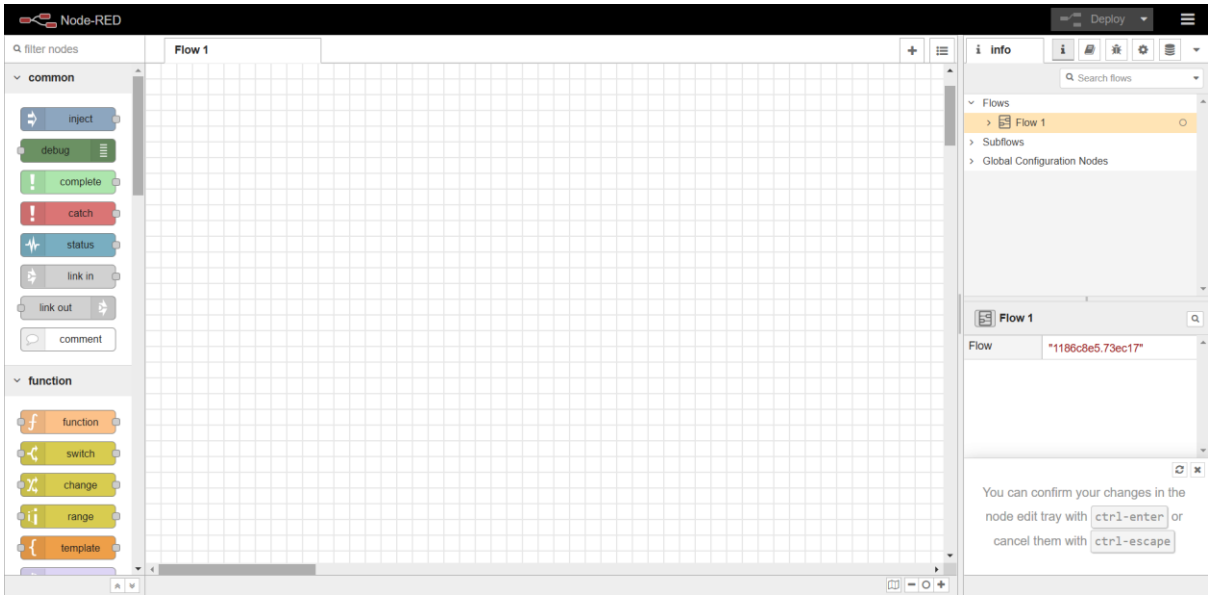
NodeMCU Output

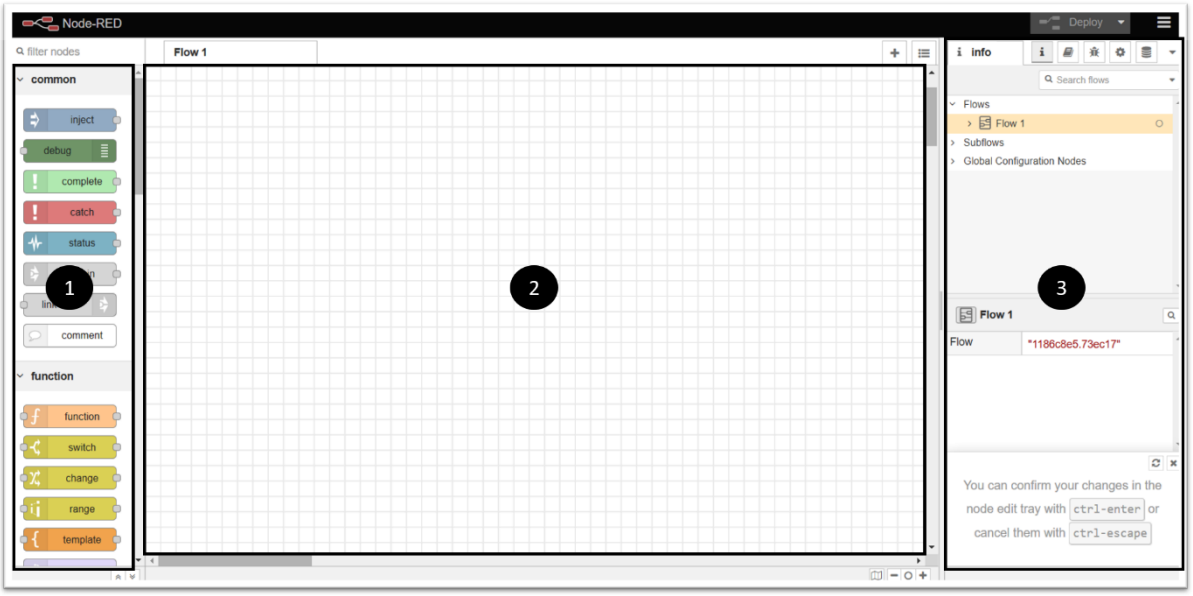


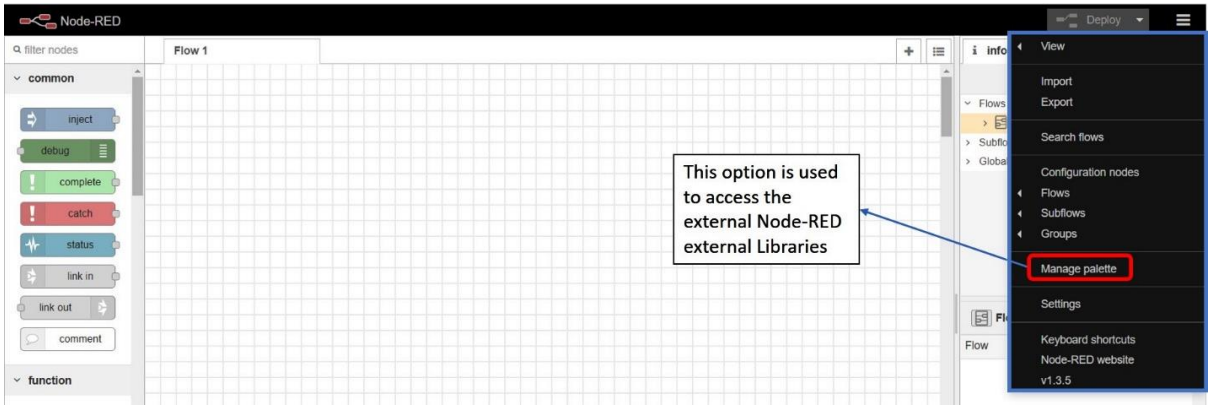
Chapter 4: Node-RED on Raspberry Pi

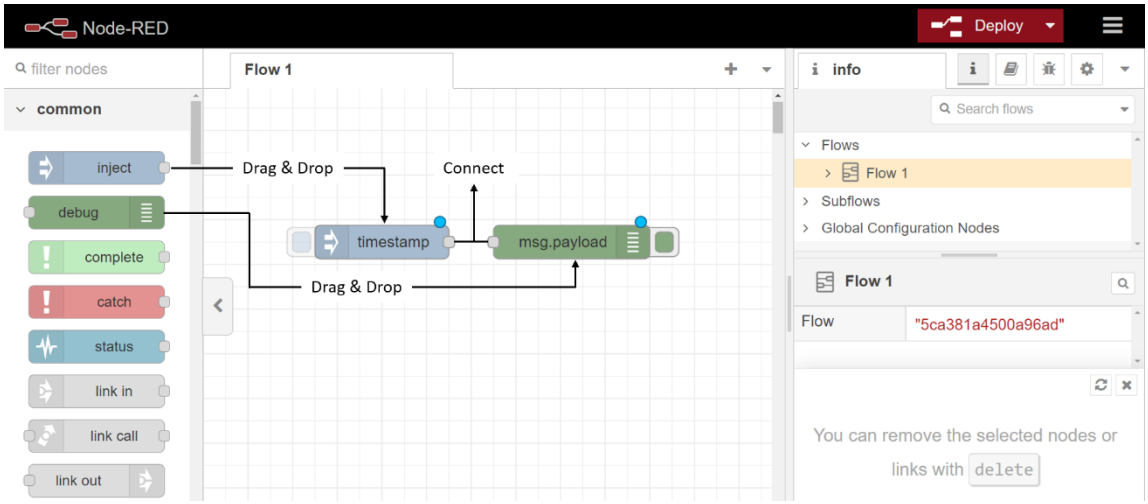
```
login as: pi
pi@192.168.1.15's password:
Linux raspberrypi 5.10.17-v7+ #1403 SMP Mon Feb 22 11:29:51 GMT 2021 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Mar 31 19:02:04 2021

SSH is enabled and the default password for the 'pi' user has not been changed.
This is a security risk - please login as the 'pi' user and type 'passwd' to set
 a new password.

pi@raspberrypi:~ $
```

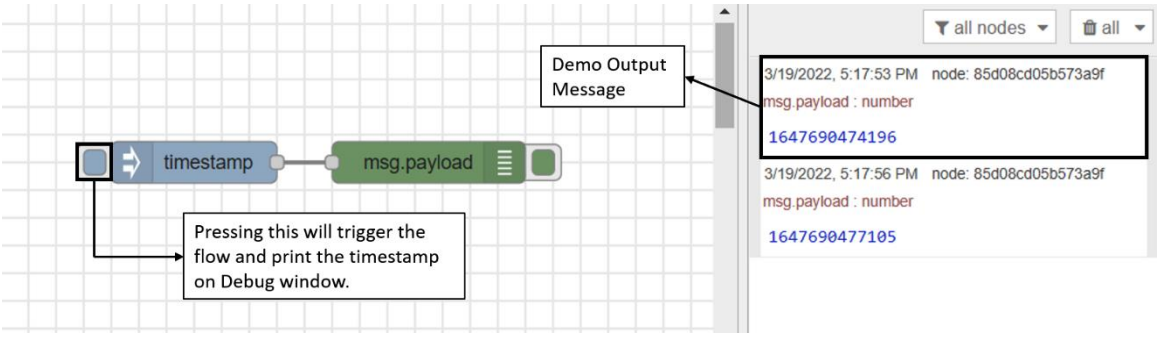
```
Running Node-RED install for user pi at /home/pi on raspbian


This can take 20-30 minutes on the slower Pi versions - please wait.

  Stop Node-RED                       ✔
  Remove old version of Node-RED      ✔
  Remove old version of Node.js       ✔
  Install Node.js 14 LTS              ✔   v14.17.0   Npm 6.14.13
  Clean npm cache                     ✔
  Install Node-RED core               ✔   1.3.5
  Move global nodes to local          -
  Npm rebuild existing nodes          ✔
  Install extra Pi nodes              ✔
  Add shortcut commands               ✔
  Update systemd script               ✔


Any errors will be logged to   /var/log/nodered-install.log
All done.
You can now start Node-RED with the command  node-red-start
  or using the icon under   Menu / Programming / Node-RED
Then point your browser to localhost:1880 or http://{your_pi_ip-address}:1880

Started :  Sun 13 Jun 2021 04:45:00 PM IST
Finished:  Sun 13 Jun 2021 04:50:09 PM IST
pi@raspberrypi:~ $
```

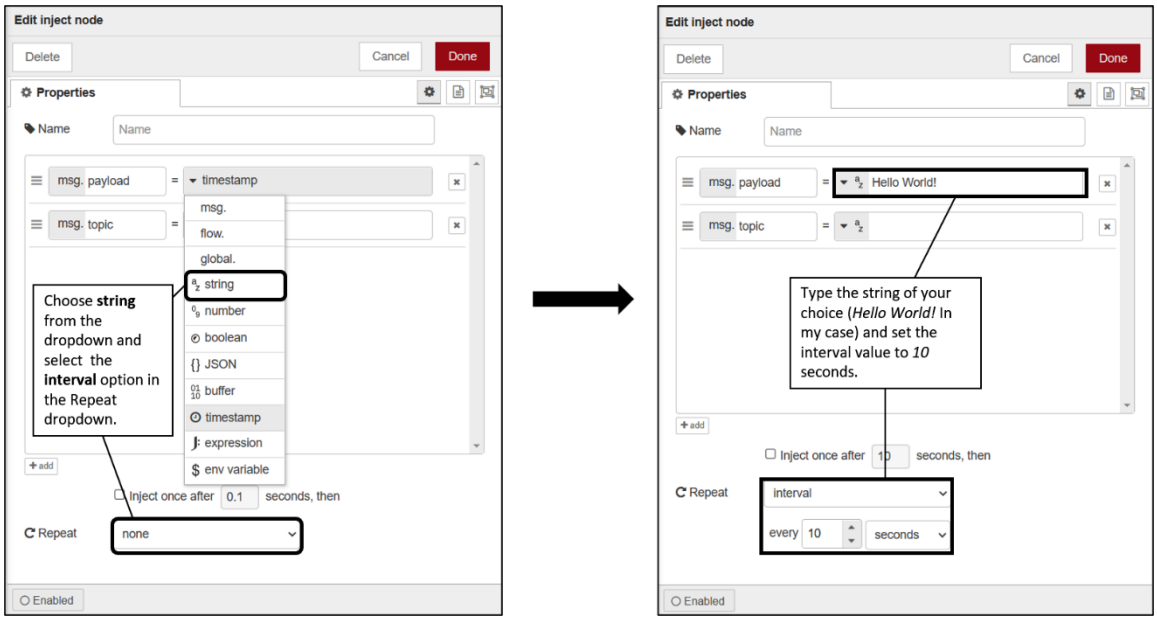

Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link out
comment
function
function
switch
change
range
template
info
Search flows
Flows
Flow 1
Subflows
Global Configuration Nodes
Flow 1
Flow
"1186c8e5.73ec17"
You can confirm your changes in the node edit tray with ctrl-enter or cancel them with ctrl-escape

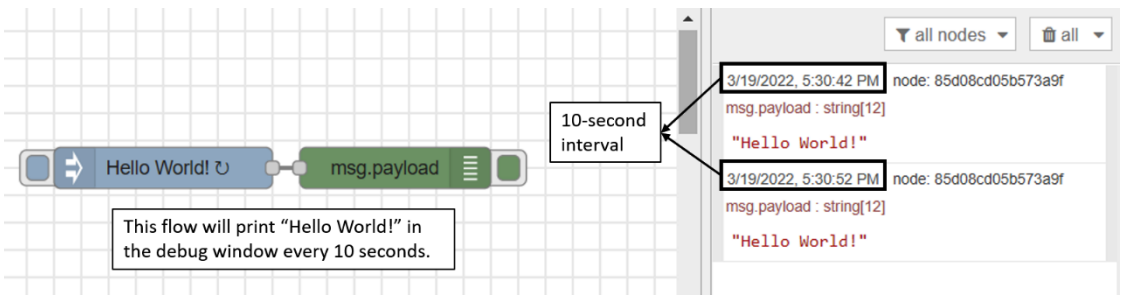

Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
comment
function
function
switch
change
range
template
1
2
3
info
Search flows
Flows
Flow 1
Subflows
Global Configuration Nodes
Flow 1
Flow
"1186c8e5.73ec17"
You can confirm your changes in the node edit tray with ctrl-enter or cancel them with ctrl-escape

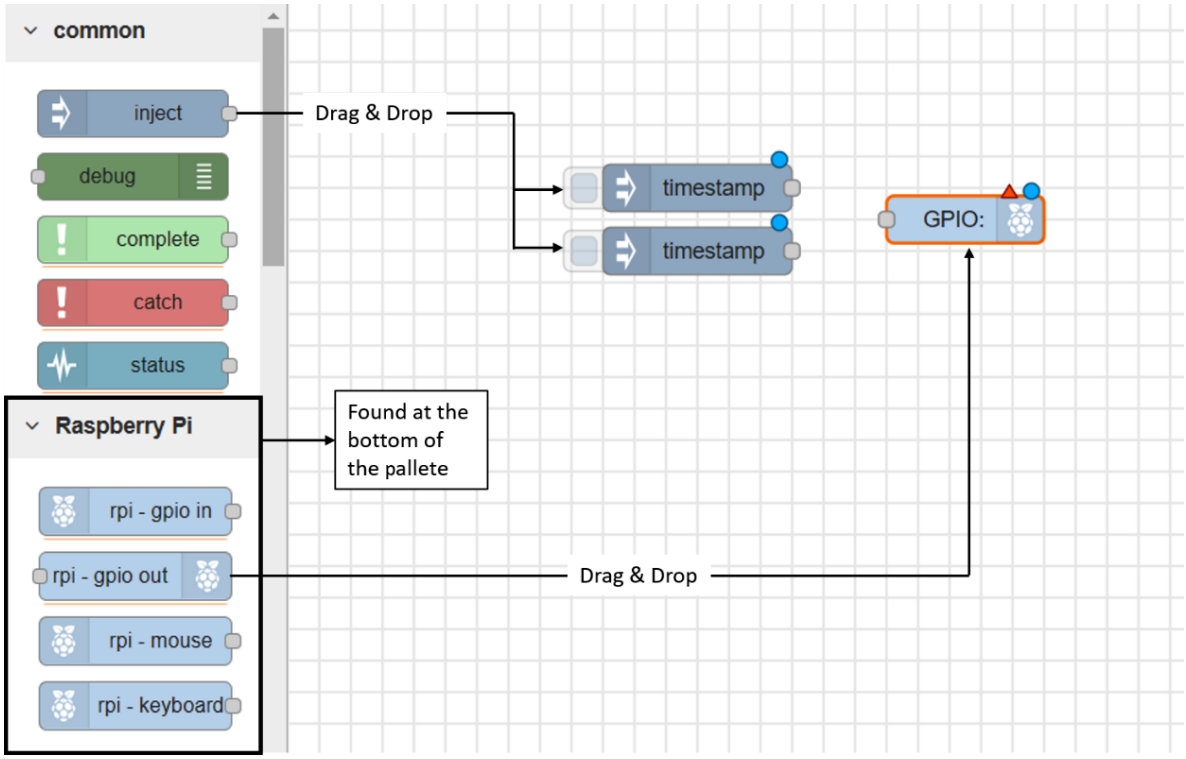

Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link out
comment
function
This option is used to access the external Node-RED external Libraries
View
Import
Export
Search flows
Configuration nodes
Flows
Subflows
Groups
Manage palette
Settings
Keyboard shortcuts
Node-RED website
v1.3.5

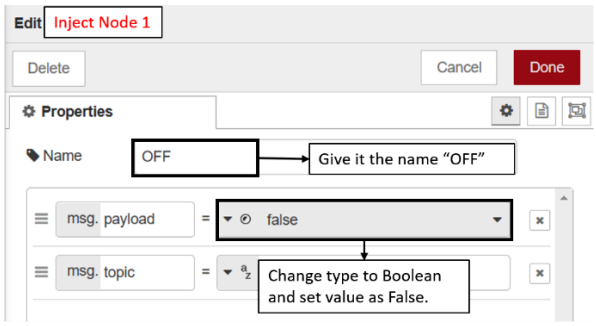

Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link call
link out
Drag & Drop
Connect
timestamp
msg.payload
Drag & Drop
info
Search flows
Flows
Flow 1
Subflows
Global Configuration Nodes
Flow 1
Flow
"5ca381a4500a96ad"
You can remove the selected nodes or links with delete

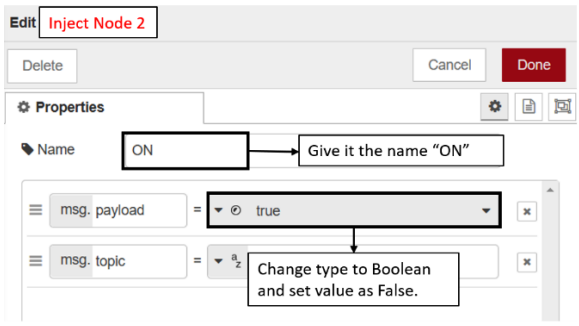

timestamp
msg.payload
Pressing this will trigger the flow and print the timestamp on Debug window.
Demo Output Message
all nodes
all
3/19/2022, 5:17:53 PM node: 85d08cd05b573a9f
msg.payload : number
1647690474196
3/19/2022, 5:17:56 PM node: 85d08cd05b573a9f
msg.payload : number
1647690477105

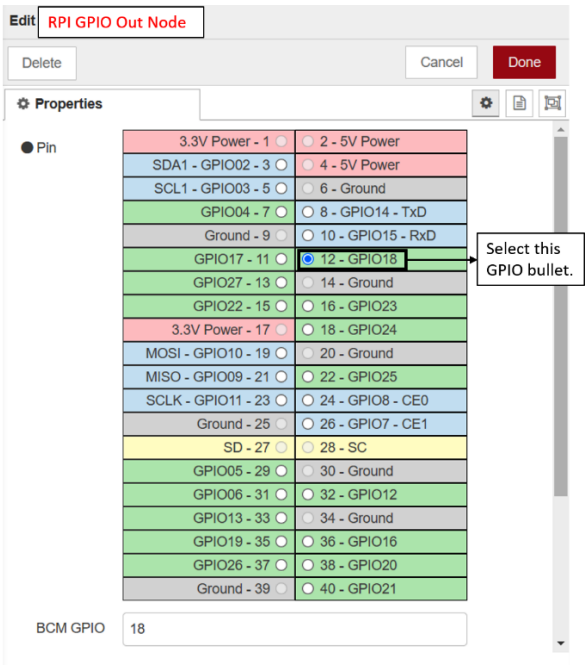

Edit inject node
Delete
Cancel
Done
Properties
Name
msg. payload
timestamp
msg. topic
msg.
flow.
global.
string
number
boolean
JSON
buffer
timestamp
expression
env variable
Choose string from the dropdown and select the interval option in the Repeat dropdown.
Inject once after 0.1 seconds, then
Repeat
none
Enabled
Edit inject node
Delete
Cancel
Done
Properties
Name
msg. payload
Hello World!
msg. topic
Type the string of your choice (Hello World! In my case) and set the interval value to 10 seconds.
Inject once after 10 seconds, then
Repeat
interval
every 10
seconds
Enabled

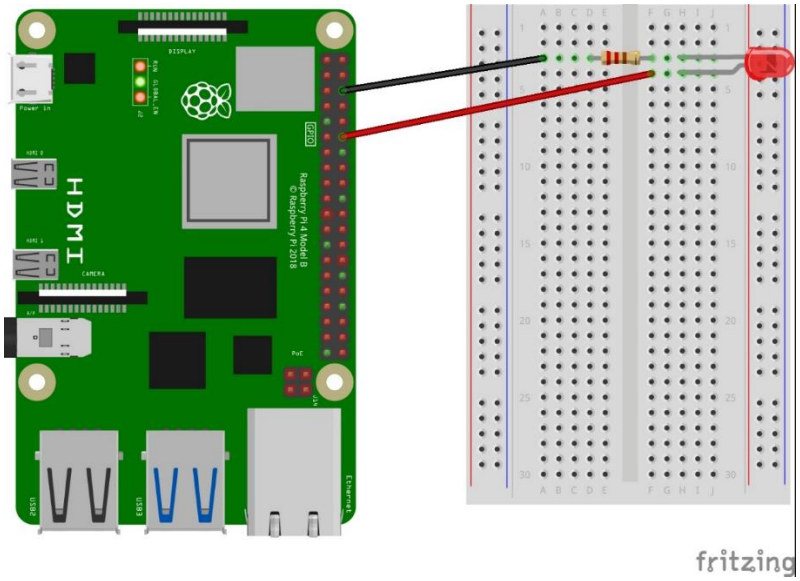

Hello World!
msg.payload
This flow will print "Hello World!" in the debug window every 10 seconds.
10-second interval
all nodes
all
3/19/2022, 5:30:42 PM node: 85d08cd05b573a9f
msg.payload : string[12]
"Hello World!"
3/19/2022, 5:30:52 PM node: 85d08cd05b573a9f
msg.payload : string[12]
"Hello World!"

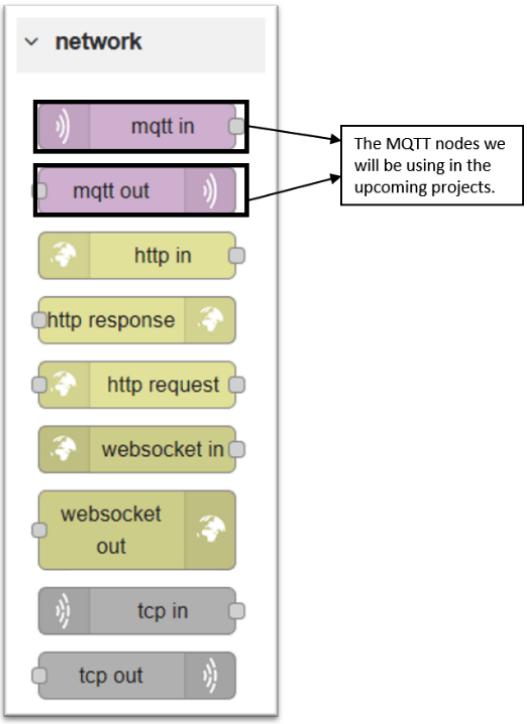

common
inject
debug
complete
catch
status
Raspberry Pi
rpi - gpio in
rpi - gpio out
rpi - mouse
rpi - keyboard
Drag & Drop
timestamp
timestamp
GPIO:
Found at the bottom of the pallete
Drag & Drop

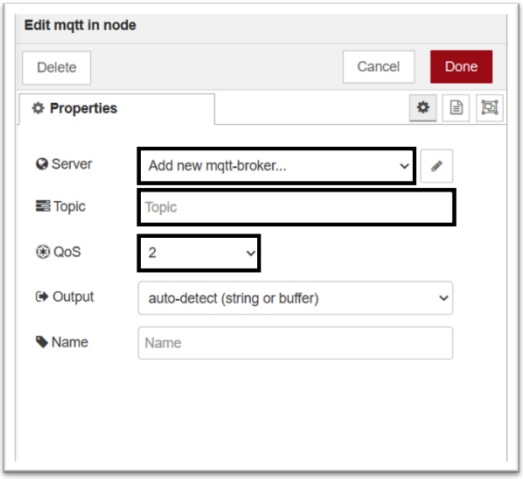

Edit
Inject Node 1
Delete
Cancel
Done
Properties
Name
OFF
Give it the name “OFF”
msg. payload
false
msg. topic
Change type to Boolean and set value as False.

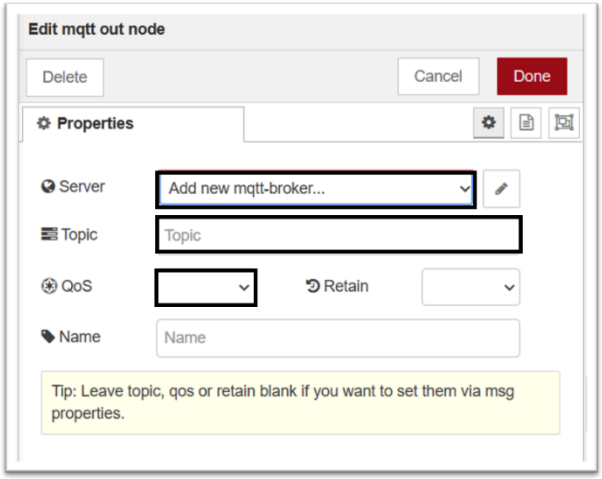

Edit
Inject Node 2
Delete
Cancel
Done
Properties
Name
ON
Give it the name “ON”
msg. payload
true
msg. topic
Change type to Boolean and set value as False.

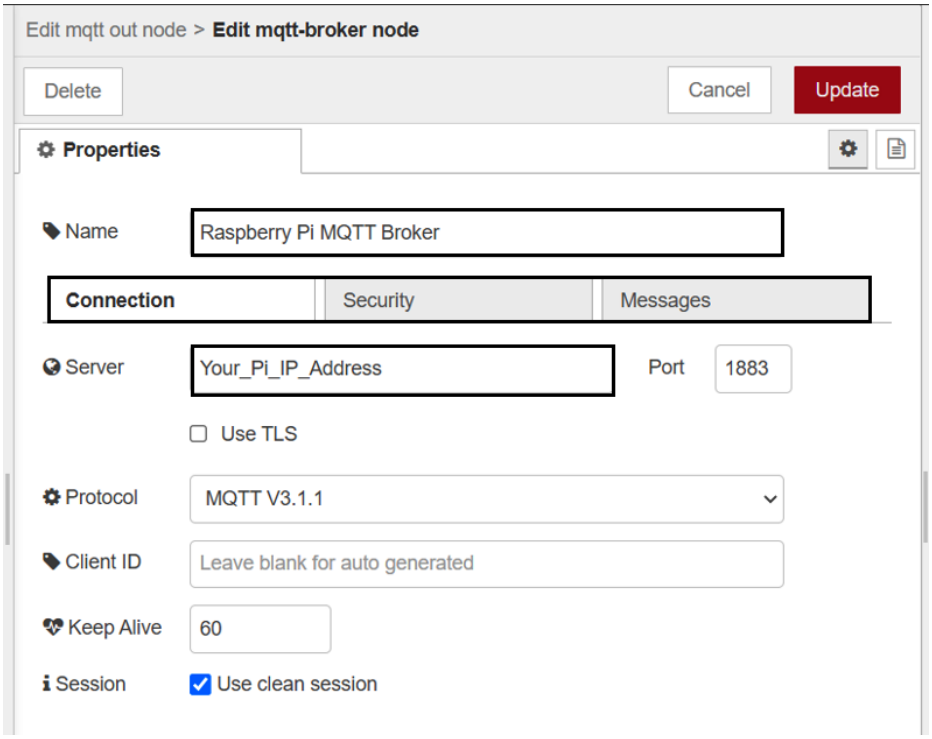

Edit
RPI GPIO Out Node
Delete
Cancel
Done
Properties
Pin
3.3V Power - 1
2 - 5V Power
SDA1 - GPIO02 - 3
4 - 5V Power
SCL1 - GPIO03 - 5
6 - Ground
GPIO04 - 7
8 - GPIO14 - TxD
Ground - 9
10 - GPIO15 - RxD
GPIO17 - 11
12 - GPIO18
GPIO27 - 13
14 - Ground
GPIO22 - 15
16 - GPIO23
3.3V Power - 17
18 - GPIO24
MOSI - GPIO10 - 19
20 - Ground
MISO - GPIO09 - 21
22 - GPIO25
SCLK - GPIO11 - 23
24 - GPIO8 - CE0
Ground - 25
26 - GPIO7 - CE1
SD - 27
28 - SC
GPIO05 - 29
30 - Ground
GPIO06 - 31
32 - GPIO12
GPIO13 - 33
34 - Ground
GPIO19 - 35
36 - GPIO16
GPIO26 - 37
38 - GPIO20
Ground - 39
40 - GPIO21
Select this GPIO bullet.
BCM GPIO
18

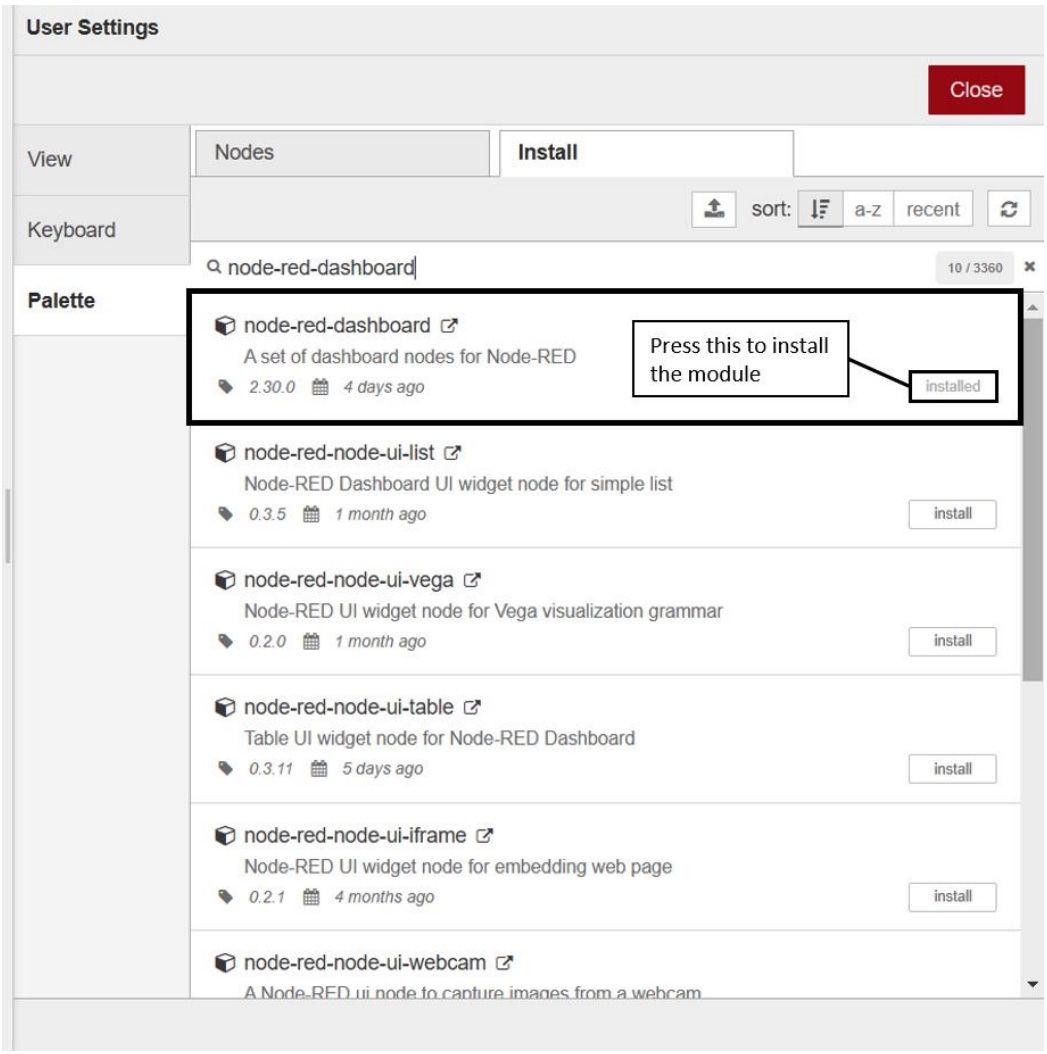

HDMI
fritzing


network
mqtt in
mqtt out
http in
http response
http request
websocket in
websocket out
tcp in
tcp out
The MQTT nodes we will be using in the upcoming projects.

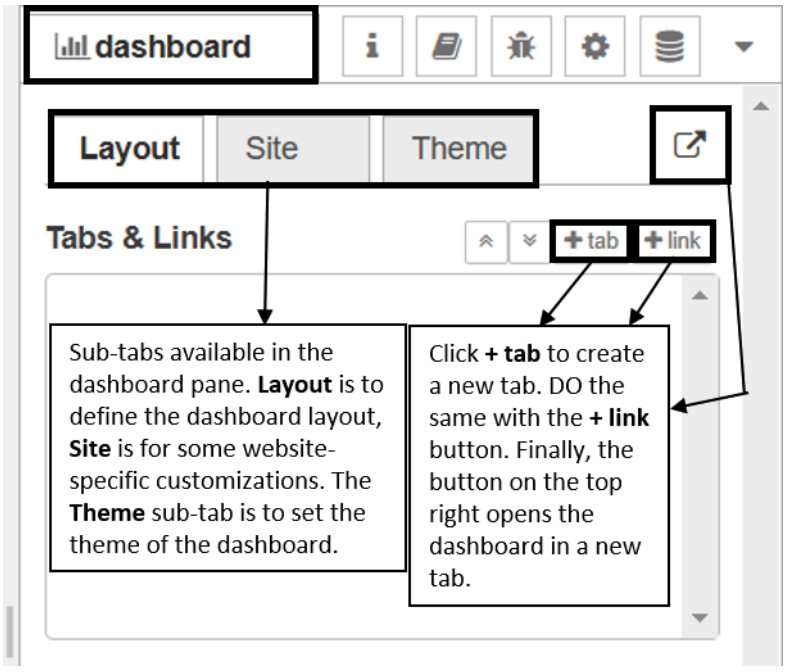

Edit mqtt in node
Delete
Cancel
Done
Properties
Server
Add new mqtt-broker...
Topic
Topic
QoS
2
Output
auto-detect (string or buffer)
Name
Name

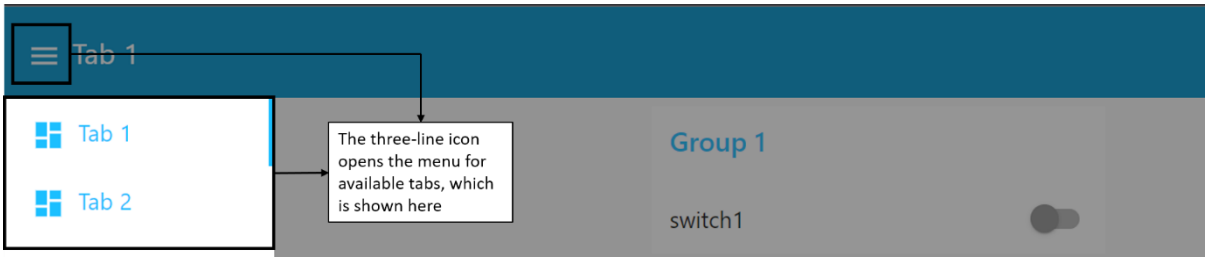

Edit mqtt out node
Delete
Cancel
Done
Properties
Server
Add new mqtt-broker...
Topic
Topic
QoS
Retain
Name
Name
Tip: Leave topic, qos or retain blank if you want to set them via msg properties.

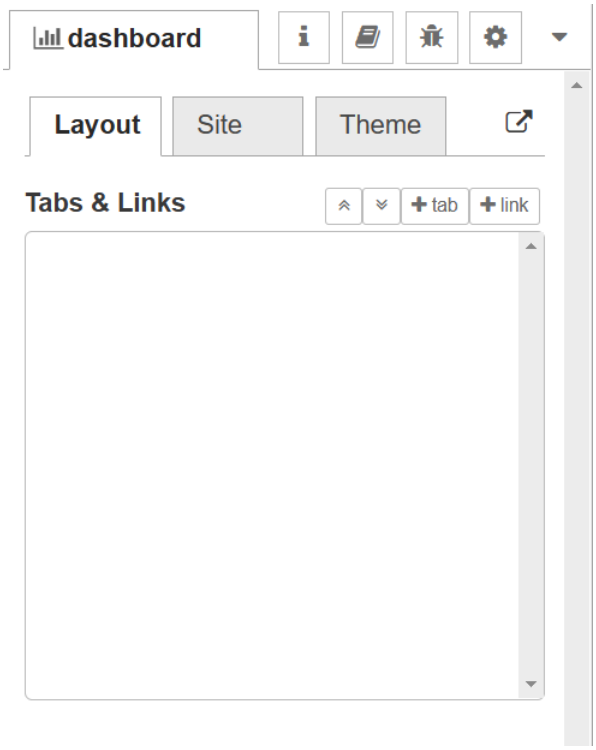

Edit mqtt out node > Edit mqtt-broker node
Delete
Cancel
Update
Properties
Name
Raspberry Pi MQTT Broker
Connection
Security
Messages
Server
Your_Pi_IP_Address
Port
1883
Use TLS
Protocol
MQTT V3.1.1
Client ID
Leave blank for auto generated
Keep Alive
60
Session
Use clean session

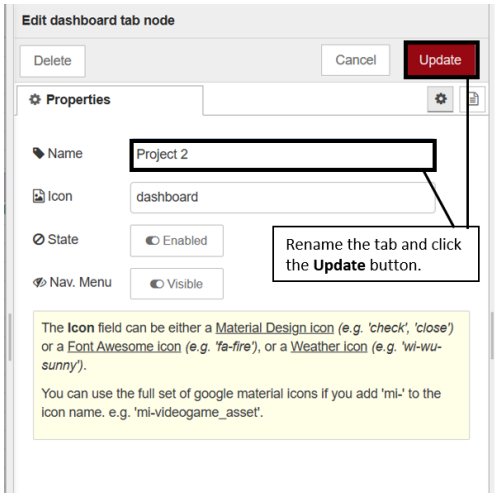

User Settings
Close
View
Keyboard
Palette
Nodes
Install
sort:
a-z
recent
node-red-dashboard
10 / 3360
node-red-dashboard
A set of dashboard nodes for Node-RED
2.30.0
4 days ago
Press this to install the module
installed
node-red-node-ui-list
Node-RED Dashboard UI widget node for simple list
0.3.5
1 month ago
install
node-red-node-ui-vega
Node-RED UI widget node for Vega visualization grammar
0.2.0
1 month ago
install
node-red-node-ui-table
Table UI widget node for Node-RED Dashboard
0.3.11
5 days ago
install
node-red-node-ui-iframe
Node-RED UI widget node for embedding web page
0.2.1
4 months ago
install
node-red-node-ui-webcam

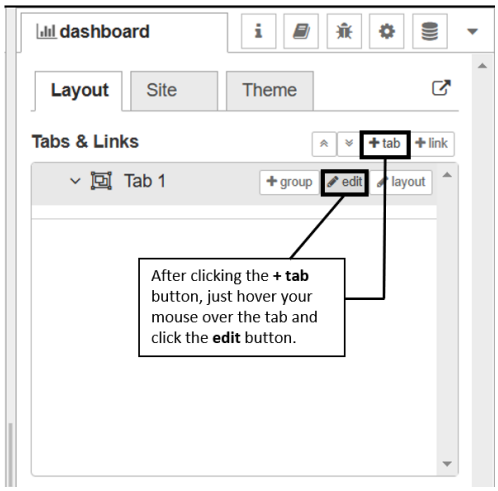
dashboard
button
form
dropdown
gauge
slider
text
switch
audio out
numeric
chart
text input
notification
date picker
ui control
colour picker
template

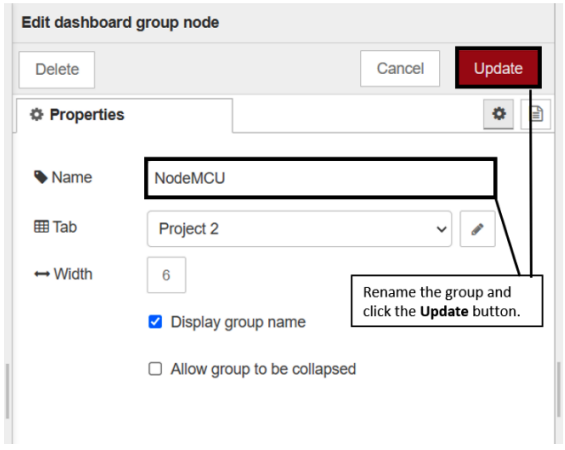

dashboard
Layout
Site
Theme
Tabs & Links
+ tab
+ link
Sub-tabs available in the dashboard pane. **Layout** is to define the dashboard layout, **Site** is for some website-specific customizations. The **Theme** sub-tab is to set the theme of the dashboard.
Click **+ tab** to create a new tab. DO the same with the **+ link** button. Finally, the button on the top right opens the dashboard in a new tab.

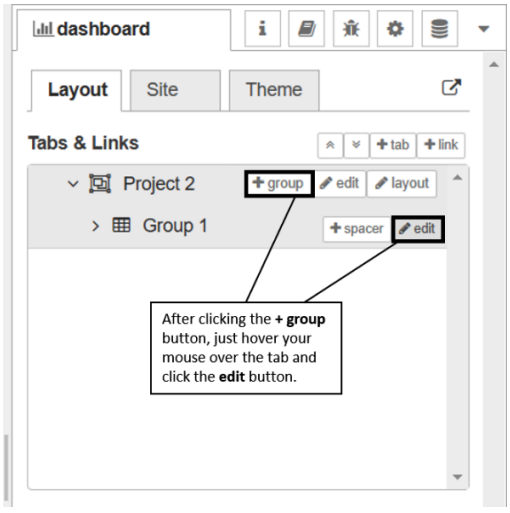

Tab 1
Tab 1
Tab 2
The three-line icon opens the menu for available tabs, which is shown here
Group 1
switch1

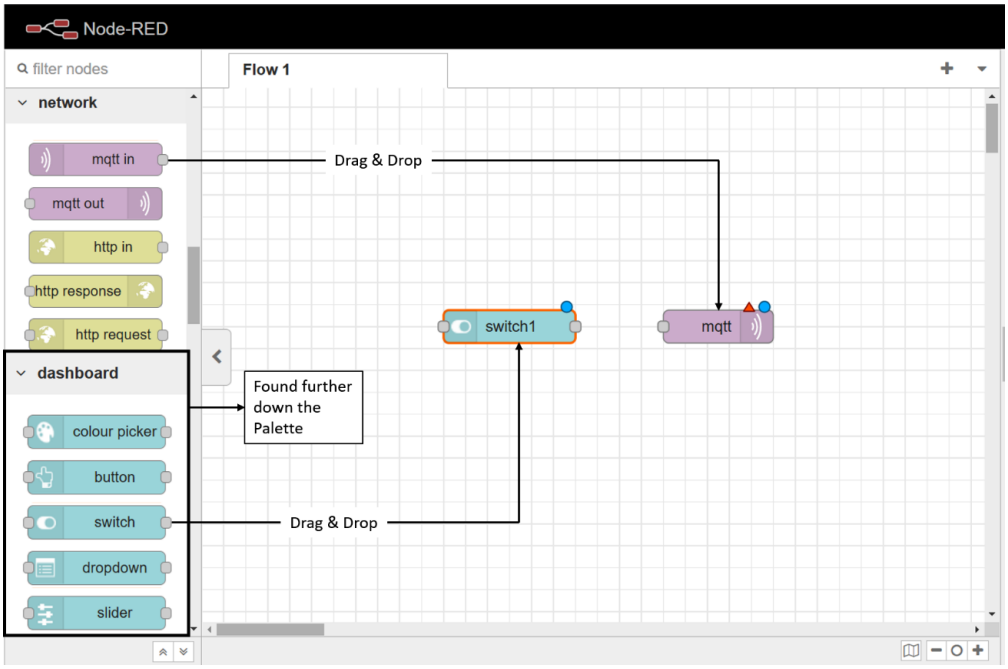

dashboard
Layout
Site
Theme
Tabs & Links
+ tab
+ link

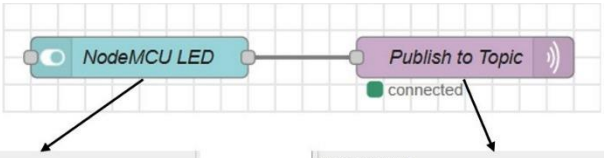

Edit dashboard tab node
Delete
Cancel
Update
Properties
Name
Project 2
Icon
dashboard
State
Enabled
Nav. Menu
Visible
Rename the tab and click the **Update** button.
The **Icon** field can be either a Material Design icon *(e.g. 'check', 'close')* or a Font Awesome icon *(e.g. 'fa-fire')*, or a Weather icon *(e.g. 'wi-wu-sunny')*.
You can use the full set of google material icons if you add 'mi-' to the icon name. e.g. 'mi-videogame_asset'.


dashboard
Layout
Site
Theme
Tabs & Links
+ tab
+ link
Tab 1
+ group
edit
layout
After clicking the **+ tab** button, just hover your mouse over the tab and click the **edit** button.

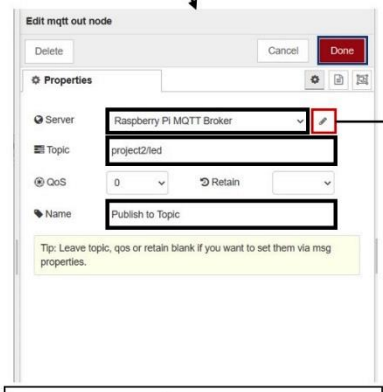

Edit dashboard group node
Delete
Cancel
Update
Properties
Name
NodeMCU
Tab
Project 2
Width
6
Display group name
Allow group to be collapsed
Rename the group and click the **Update** button.


dashboard
Layout
Site
Theme
Tabs & Links
+ tab
+ link
Project 2
+ group
edit
layout
Group 1
+ spacer
edit
After clicking the **+ group** button, just hover your mouse over the tab and click the **edit** button.



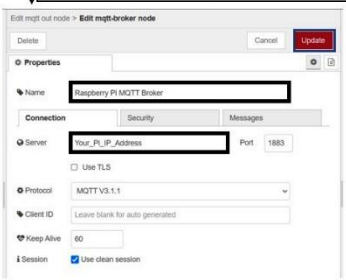


Select the **Group** we created and change the **Label** and **Name** text to "*NodeMCU LED*". For **On Payload**, select string "*1*" and for **Off Payload**, select string "*0*". Then click **Done.**



One-time setup for MQTT server is required. Please refer to the screenshot beside this box for reference. Change **Name** to anything of your choice. After that, just change **Topic** to "*project2/led*" and click **Done.**

For the server address, just add the static IP address of your PI (you can get it through the **ipconfig** command). Then add a **Name** of your choice and click the **Update** button.

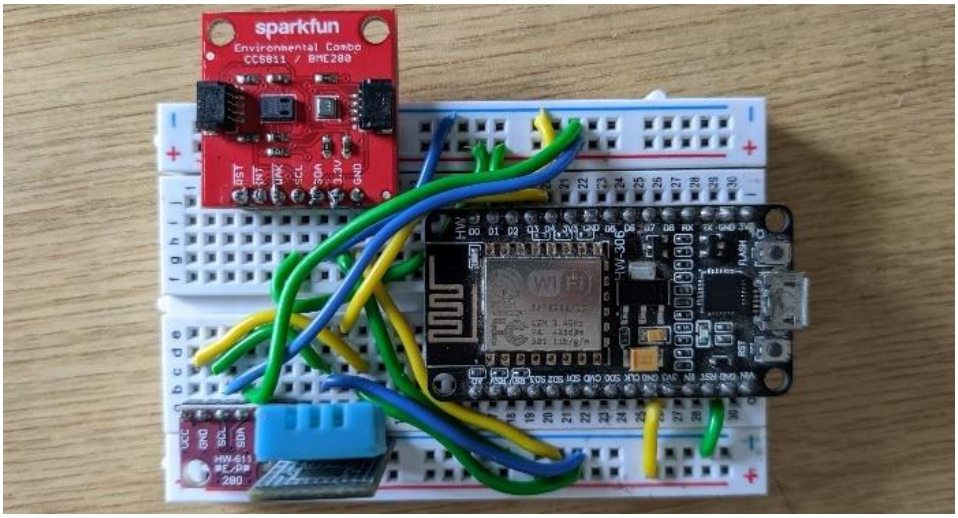


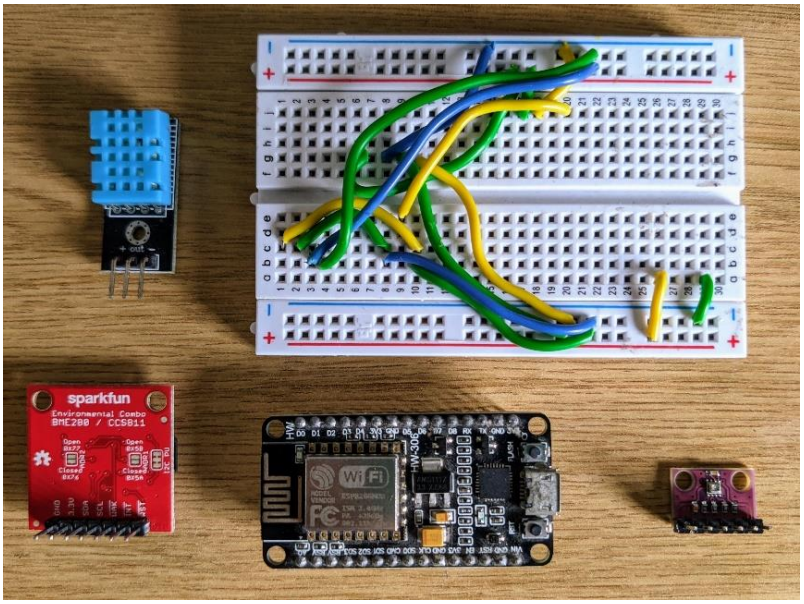
Project 2

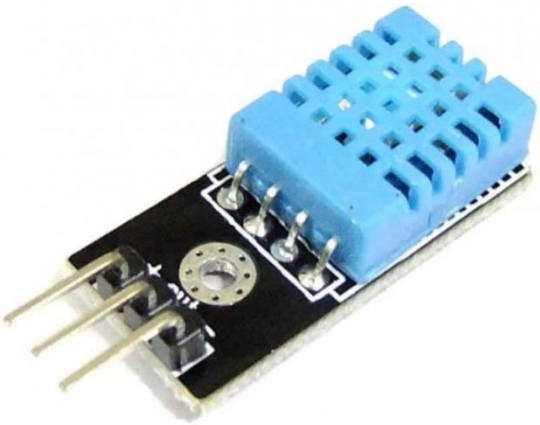
NodeMCU

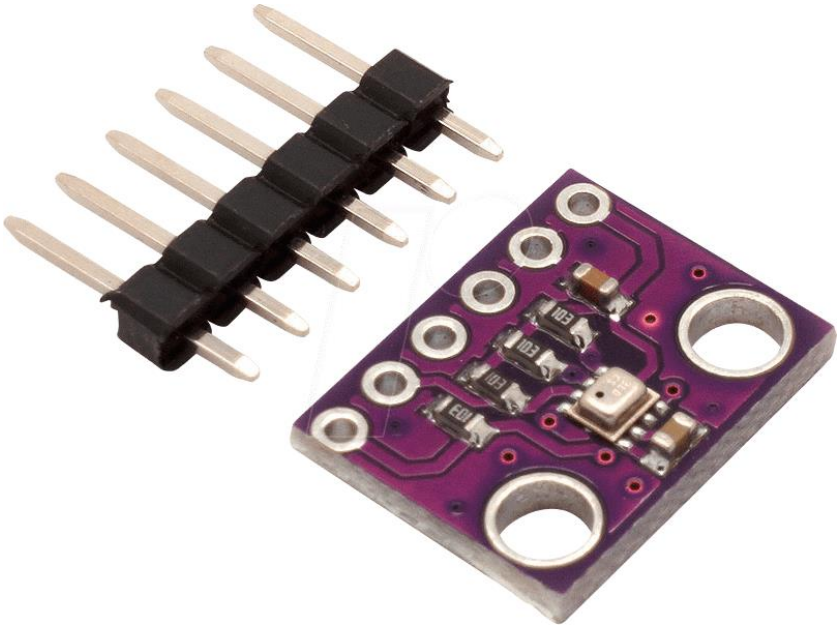
NodeMCU LED

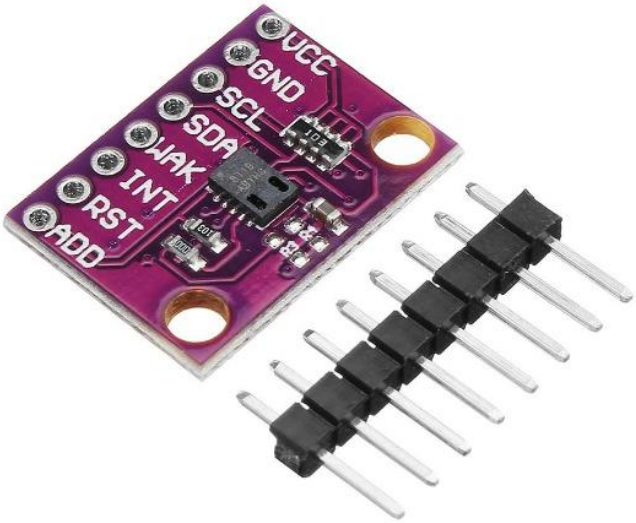
Chapter 5: Major Project 1: IoT Weather Station

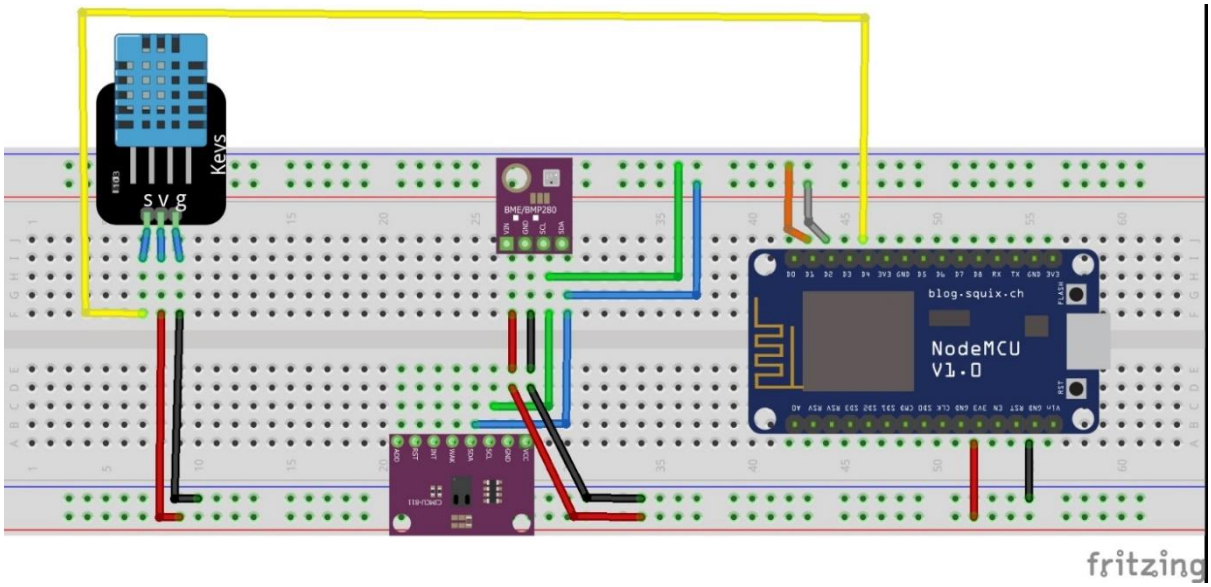




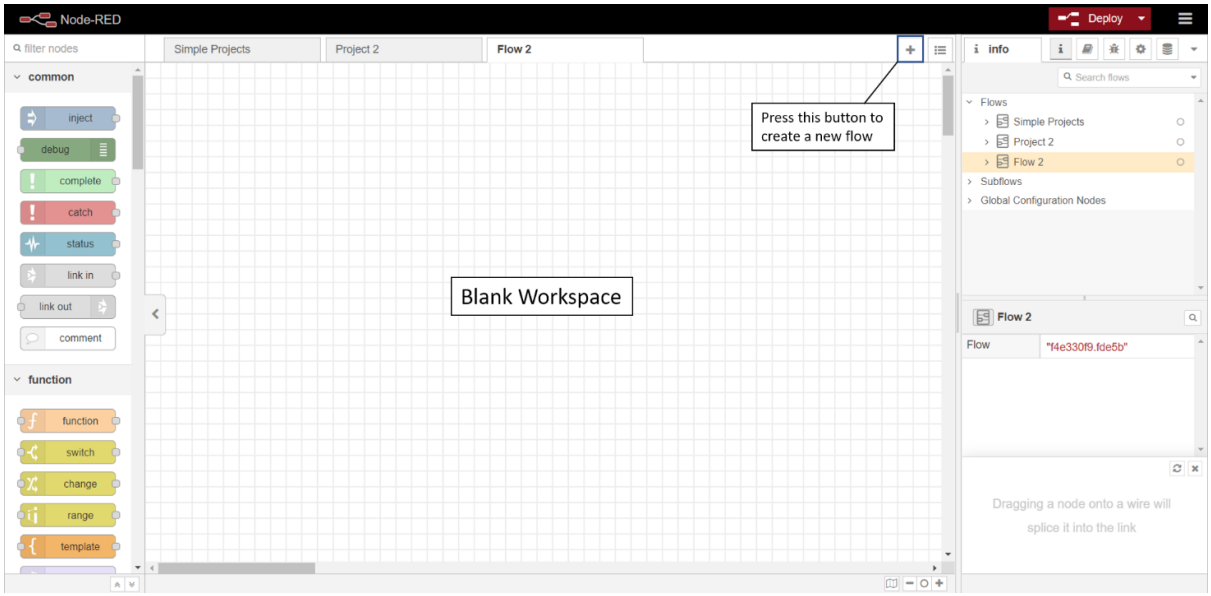


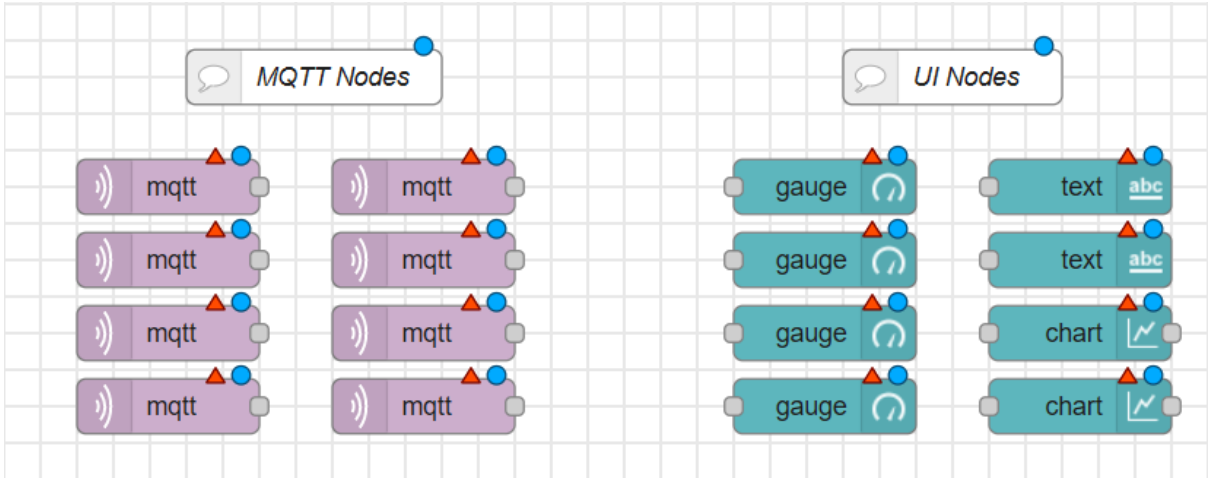



VCC
GND
SCL
SDA
WAK
INT
RST
ADD



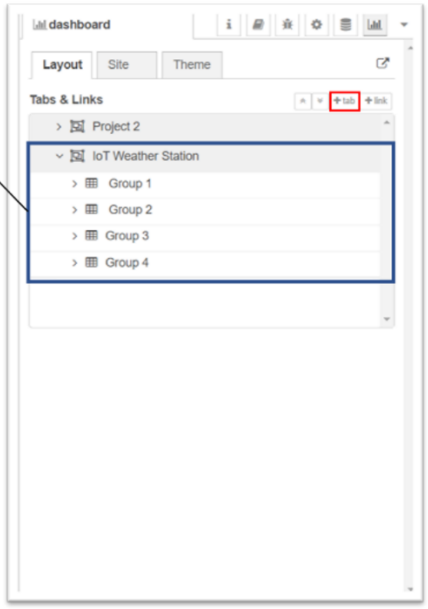

```
pi@raspberrypi:~ $ node-red-start

Start Node-RED

Once Node-RED has started, point a browser at http://192.168.1.22:1880
On Pi Node-RED works better with the Firefox or Chrome browser

Use   node-red-stop                          to stop Node-RED
Use   node-red-start                         to start Node-RED again
Use   node-red-log                           to view the recent log output
Use   sudo systemctl enable nodered.service  to autostart Node-RED at every boot
Use   sudo systemctl disable nodered.service to disable autostart on boot

To find more nodes and example flows - go to http://flows.nodered.org

Starting as a systemd service.
6 Apr 15:36:26 - [info]
Welcome to Node-RED
===================
6 Apr 15:36:26 - [info] Node-RED version: v2.2.2
6 Apr 15:36:26 - [info] Node.js  version: v14.19.1
6 Apr 15:36:26 - [info] Linux 5.10.92-v7l+ arm LE
6 Apr 15:36:27 - [info] Loading palette nodes
6 Apr 15:36:29 - [info] Dashboard version 3.1.6 started at /ui
6 Apr 15:36:29 - [info] Settings file  : /home/pi/.node-red/settings.js
6 Apr 15:36:29 - [info] Context store  : 'default' [module=memory]
6 Apr 15:36:29 - [info] User directory : /home/pi/.node-red
6 Apr 15:36:29 - [warn] Projects disabled : editorTheme.projects.enabled=false
6 Apr 15:36:29 - [info] Flows file     : /home/pi/.node-red/flows.json
6 Apr 15:36:29 - [info] Server now running at http://127.0.0.1:1880/
6 Apr 15:36:29 - [warn]
---------------------------------------------------------------------
Your flow credentials file is encrypted using a system-generated key.
If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.
You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
```



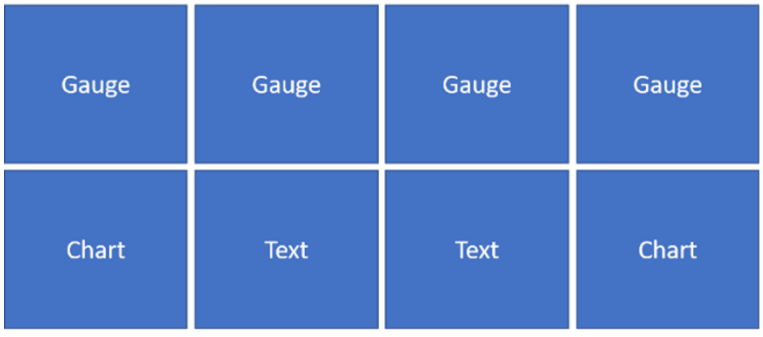


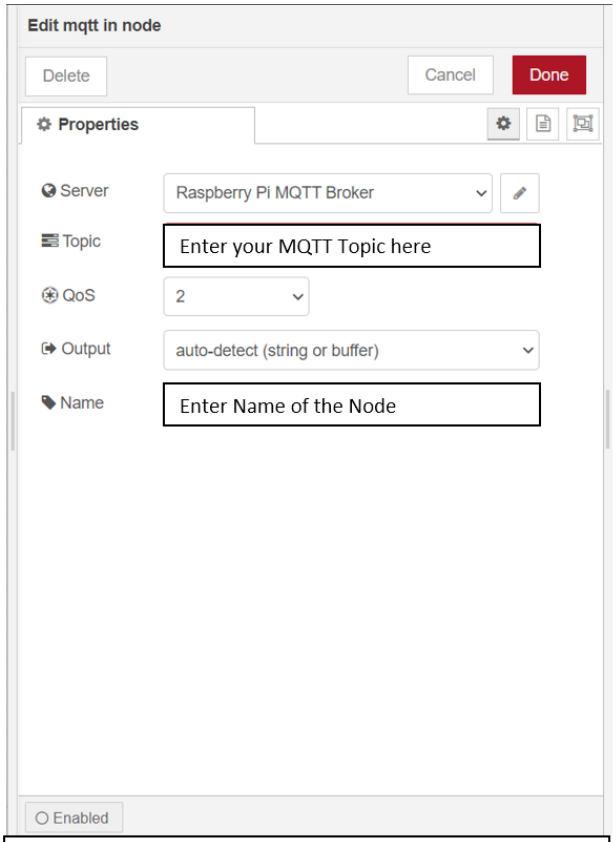
Dashboard Layout Setup

- First, create a new Tab using the +**tab** button and rename to *"IoT Weather Station"*.
- Then using the **+group** button on the tab, create four groups as shown in the figure.
- Now, all you have to do is add your widgets to individual groups. For this project, we will follow the layout shown below. Hence, we will be adding a *Gauge* and any of the other two widgets in each group.



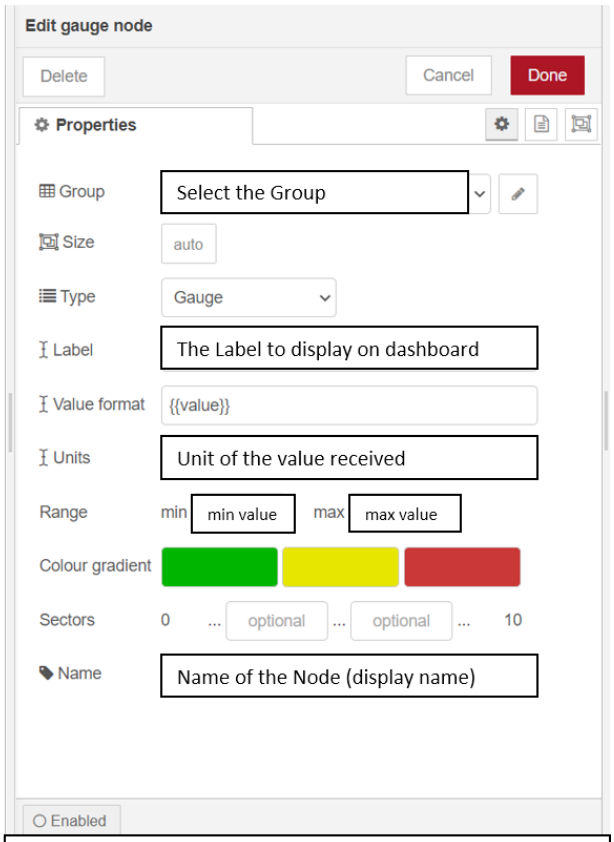
IoT Weather Station Dashboard Layout





MQTT In Node

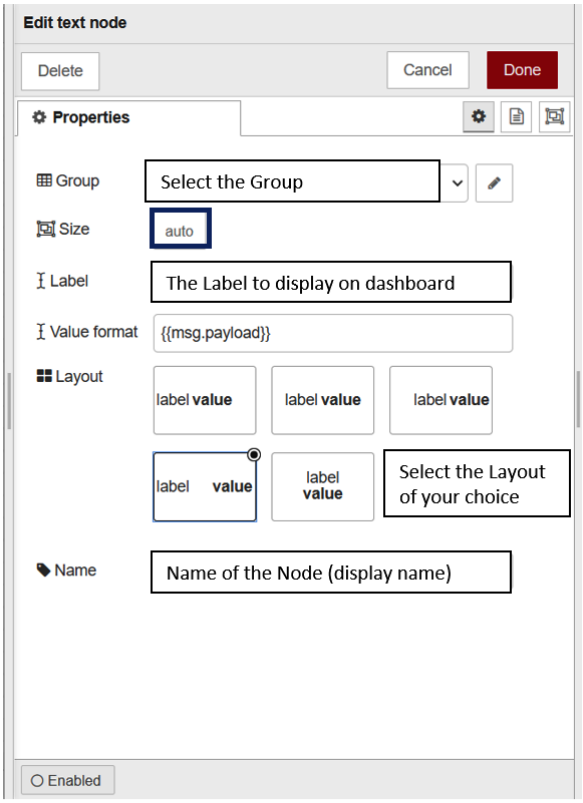
For each sensor value, just add the corresponding MQTT topic (as configured in code) and name the node accordingly).
For example: For Humidity values, input the topic as "**IoTWeatherStation/humidity**" and Name as "**Humidity**".

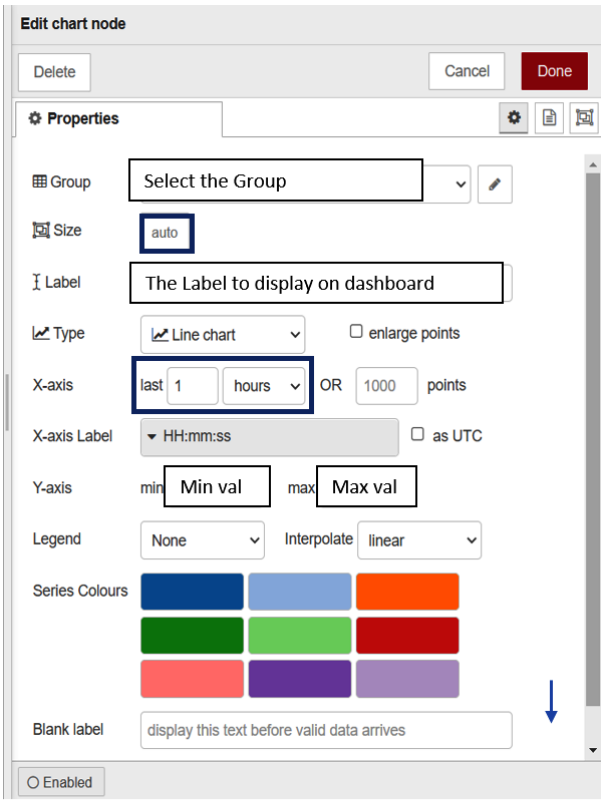


Gauge Node

Please input the marked values according to the information provided.

For example: For Humidity values, input the Label as "**Humidity**", Unit as "**%**", range between **0 and 100** and the Name as **Humidity.**





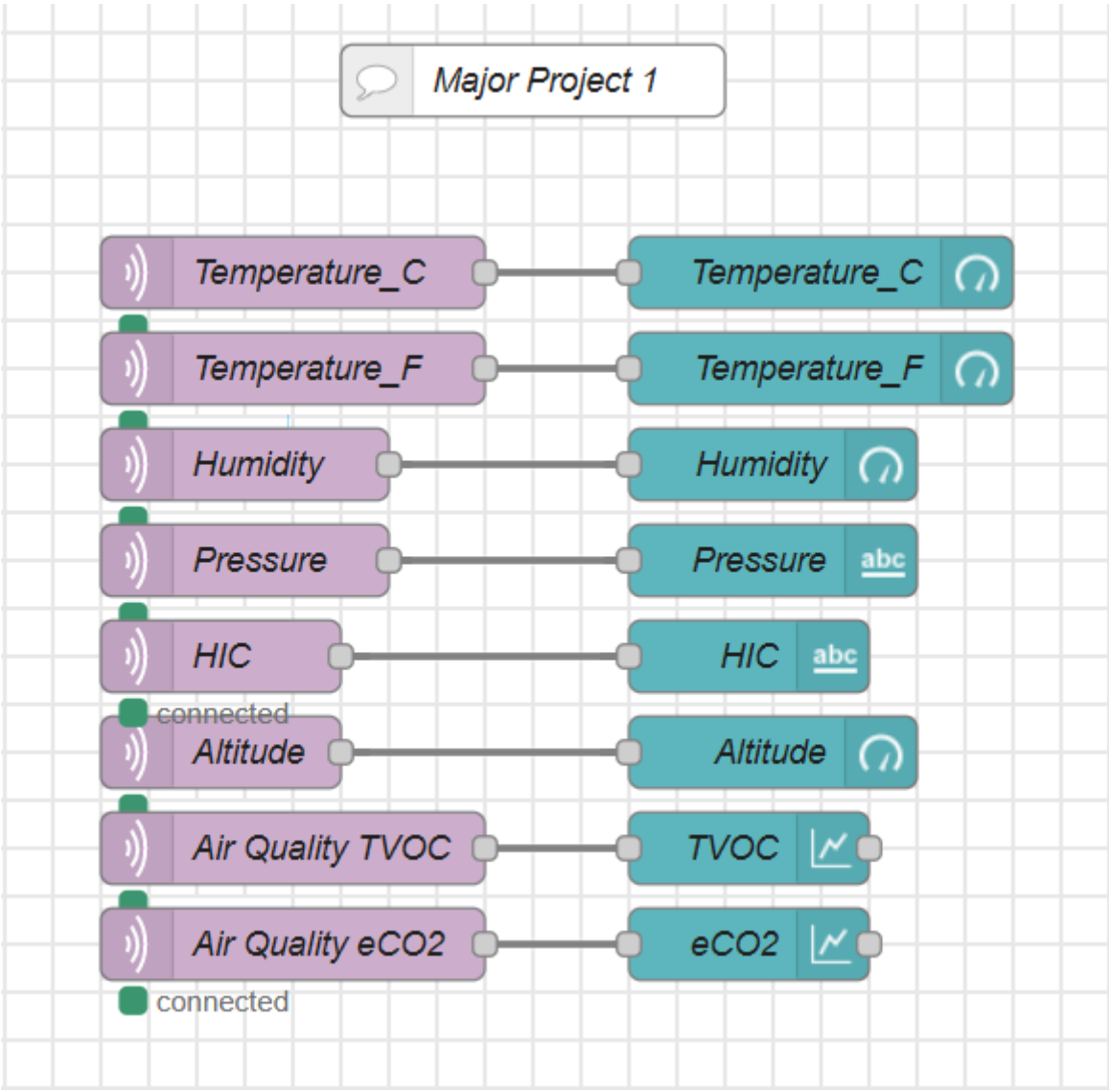
Text Node

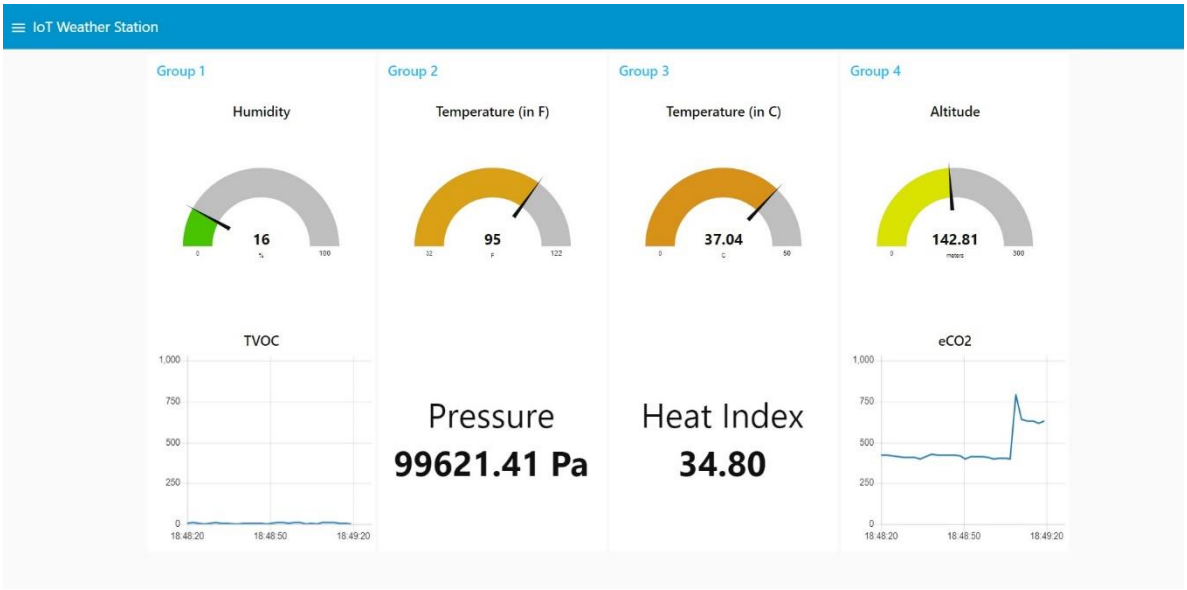
Please fill in the marked values according to the information provided. Set size to **6x6.**

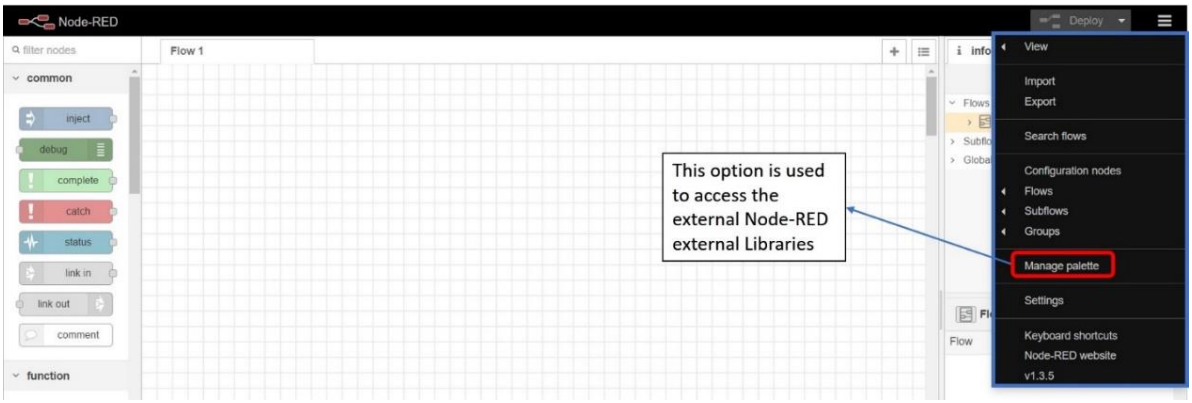
For example: For Pressure values, input *Label* as "**Pressure**", add the unit in *Value format* as "**{{msg.payload}} Pa**" and input "**Pressure**" in *Name*.

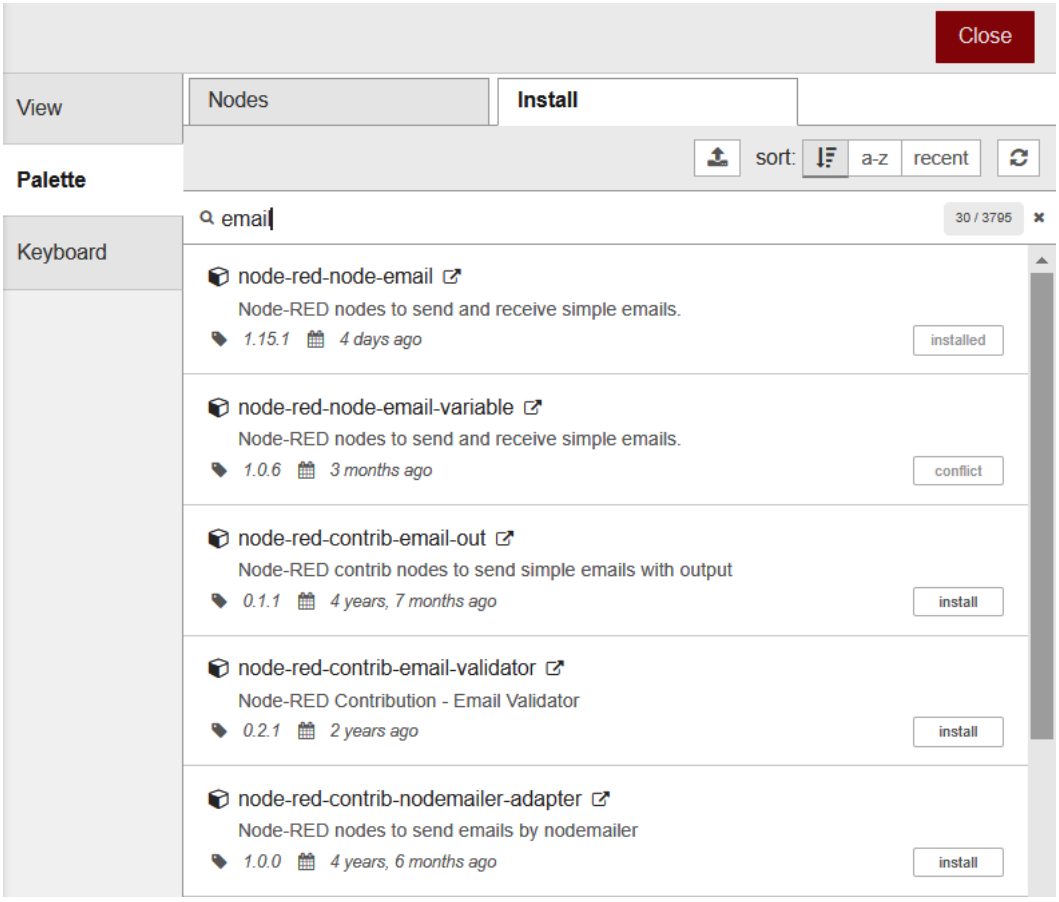
Chart Node

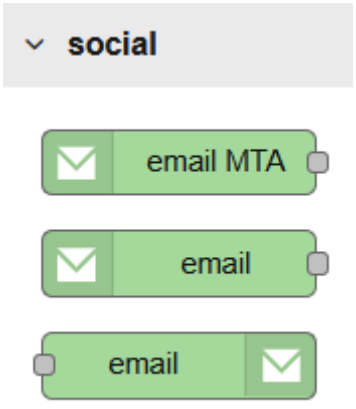
We will create line charts. Fill in the text box info, set size to **6x6,** and for x-axis, just enter a **time range** (2 minutes). Then add the **range** of sensor values (Eg: 0 - 50°C). Lastly, the down arrow indicates that the screen needs to scrolled. The last thing to input is the *Name* of the node.

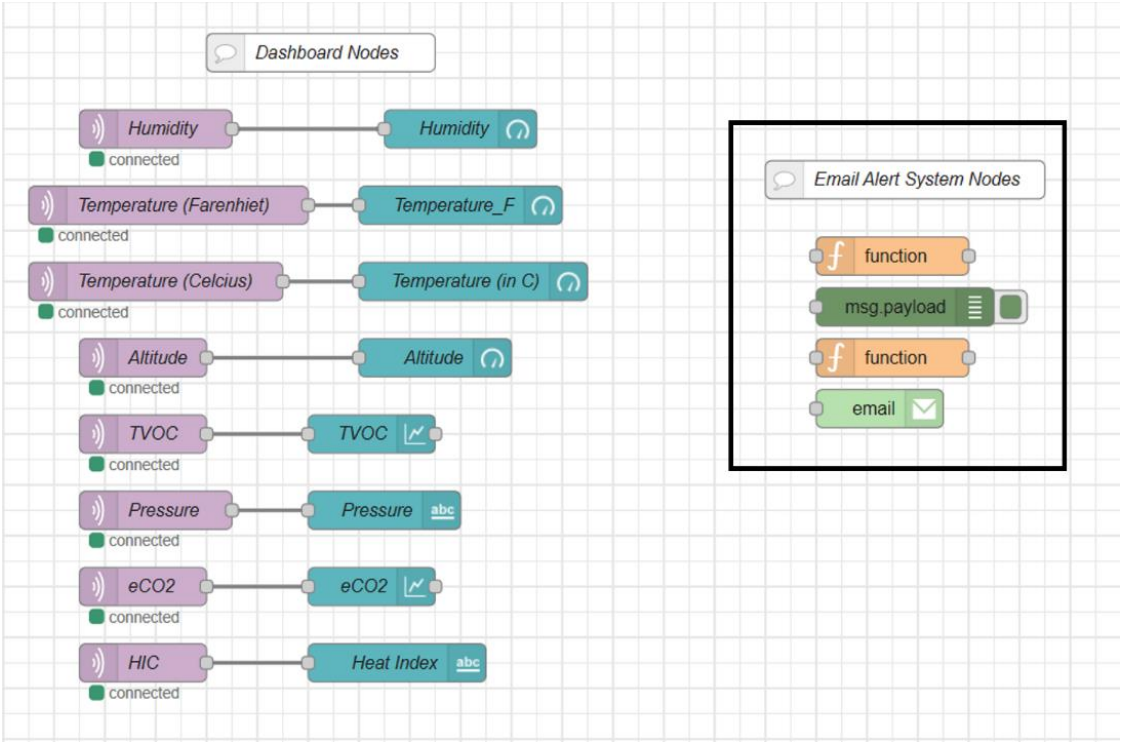

Major Project 1
Temperature_C
Temperature_C
Temperature_F
Temperature_F
Humidity
Humidity
Pressure
Pressure
abc
HIC
HIC
abc
connected
Altitude
Altitude
Air Quality TVOC
TVOC
Air Quality eCO2
eCO2
connected

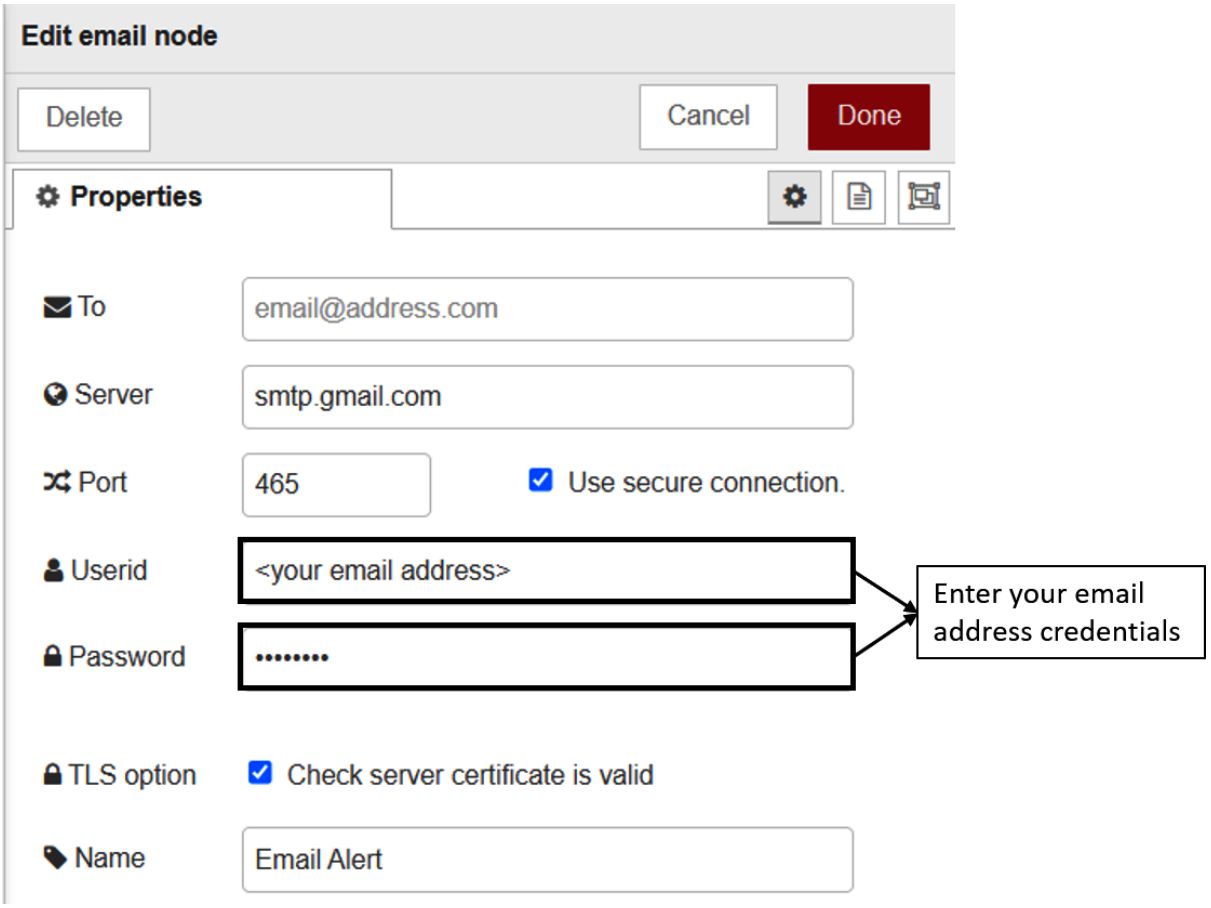

IoT Weather Station
Group 1
Humidity
16
Group 2
Temperature (in F)
95
Group 3
Temperature (in C)
37.04
Group 4
Altitude
142.81
TVOC
1,000
750
500
250
0
18:48:20
18:48:50
18:49:20
Pressure
99621.41 Pa
Heat Index
34.80
eCO2
1,000
750
500
250
0
18:48:20
18:48:50
18:49:20

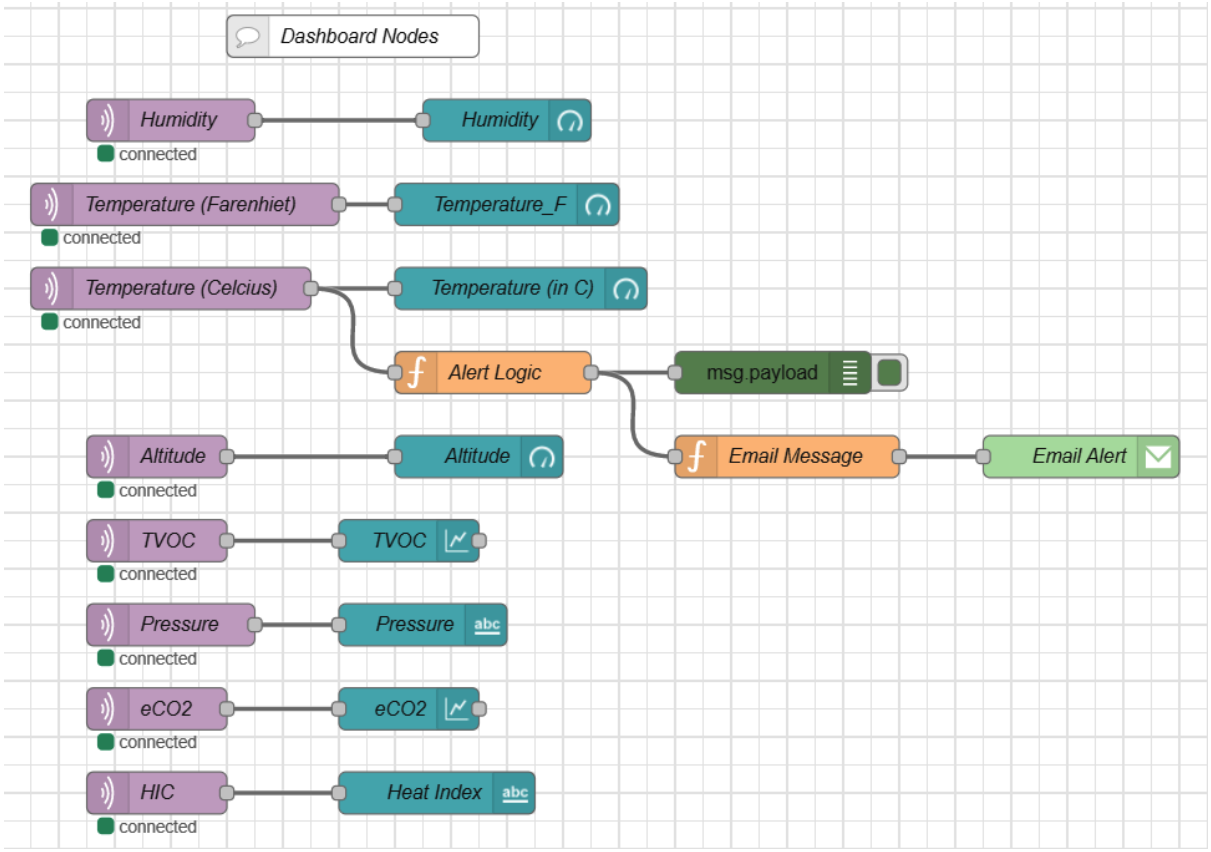

Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link out
comment
function
This option is used to access the external Node-RED external Libraries
View
Import
Export
Search flows
Configuration nodes
Flows
Subflows
Groups
Manage palette
Settings
Keyboard shortcuts
Node-RED website
v1.3.5

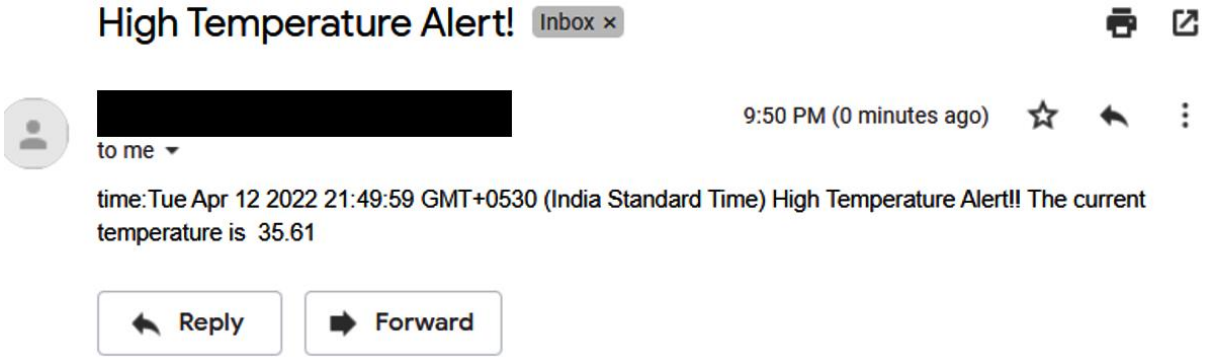

Close
View
Palette
Keyboard
Nodes
Install
sort:
a-z
recent
email
30 / 3795
node-red-node-email
Node-RED nodes to send and receive simple emails.
1.15.1
4 days ago
installed
node-red-node-email-variable
Node-RED nodes to send and receive simple emails.
1.0.6
3 months ago
conflict
node-red-contrib-email-out
Node-RED contrib nodes to send simple emails with output
0.1.1
4 years, 7 months ago
install
node-red-contrib-email-validator
Node-RED Contribution - Email Validator
0.2.1
2 years ago
install
node-red-contrib-nodemailer-adapter
Node-RED nodes to send emails by nodemailer
1.0.0
4 years, 6 months ago
install


social
email MTA
email
email

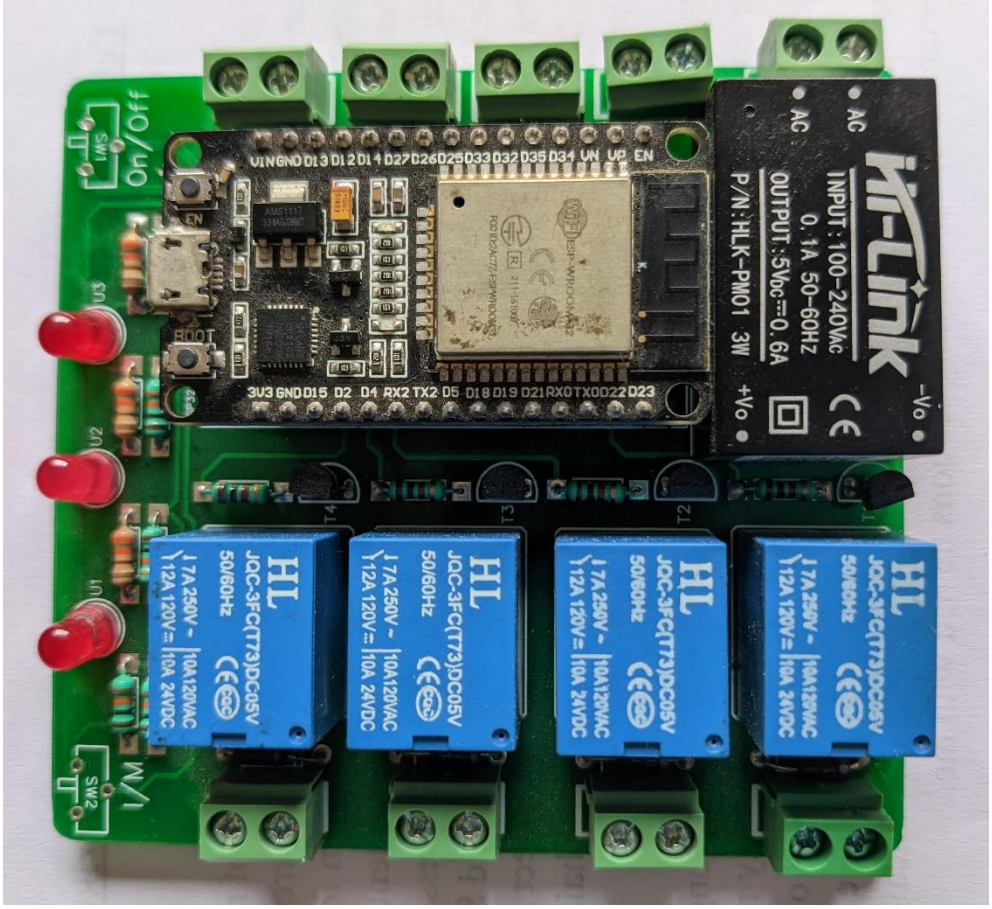

Dashboard Nodes
Humidity
connected
Humidity
Temperature (Farenhiet)
connected
Temperature_F
Temperature (Celcius)
connected
Temperature (in C)
Altitude
connected
Altitude
TVOC
connected
TVOC
Pressure
connected
Pressure
eCO2
connected
eCO2
HIC
connected
Heat Index
Email Alert System Nodes
function
msg.payload
function
email

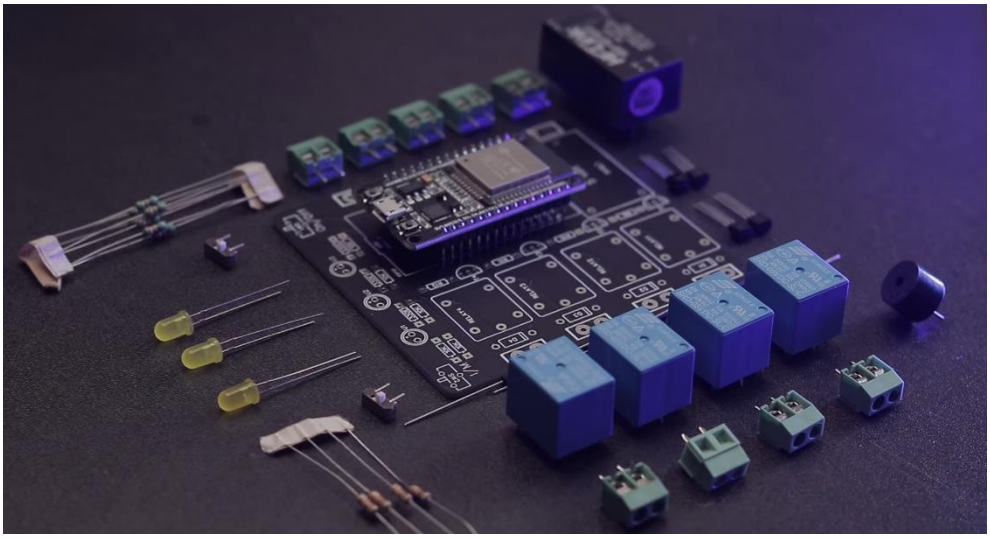

Edit email node
Delete
Cancel
Done
Properties
To
email@address.com
Server
smtp.gmail.com
Port
465
Use secure connection.
Userid
<your email address>
Password
••••••••
Enter your email address credentials
TLS option
Check server certificate is valid
Name
Email Alert

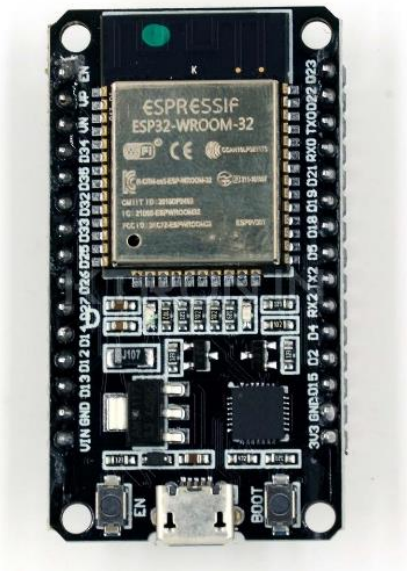

Dashboard Nodes
Humidity
connected
Humidity
Temperature (Farenhiet)
connected
Temperature_F
Temperature (Celcius)
connected
Temperature (in C)
Alert Logic
msg.payload
Email Message
Email Alert
Altitude
connected
Altitude
TVOC
connected
TVOC
Pressure
connected
Pressure
abc
eCO2
connected
eCO2
HIC
connected
Heat Index
abc

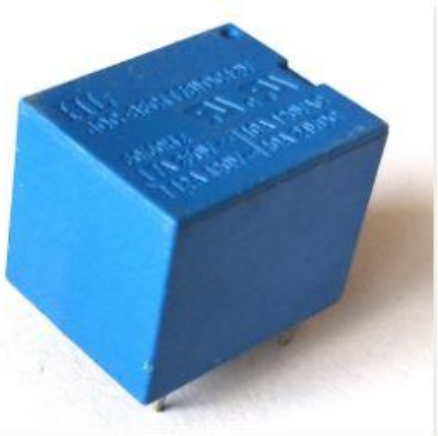

High Temperature Alert!
Inbox ×
[redacted]
9:50 PM (0 minutes ago)
to me
time:Tue Apr 12 2022 21:49:59 GMT+0530 (India Standard Time) High Temperature Alert!! The current temperature is 35.61
Reply
Forward

Chapter 6: Major Project 2: Smart Home Control Relay System

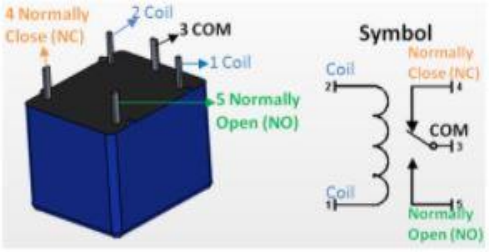






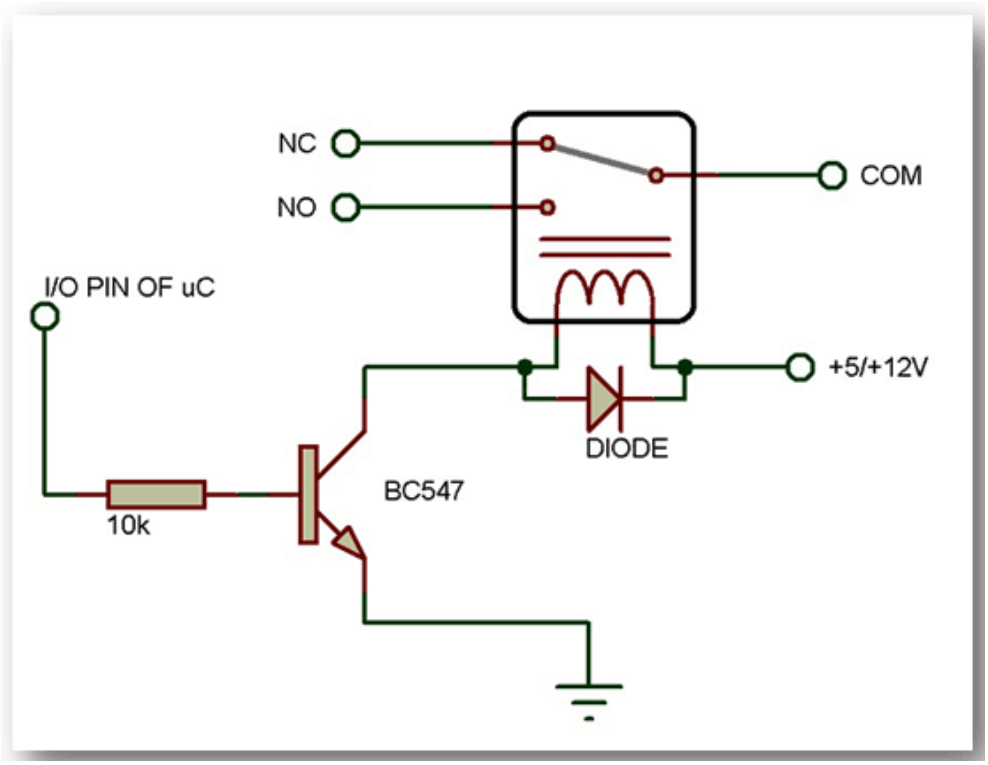


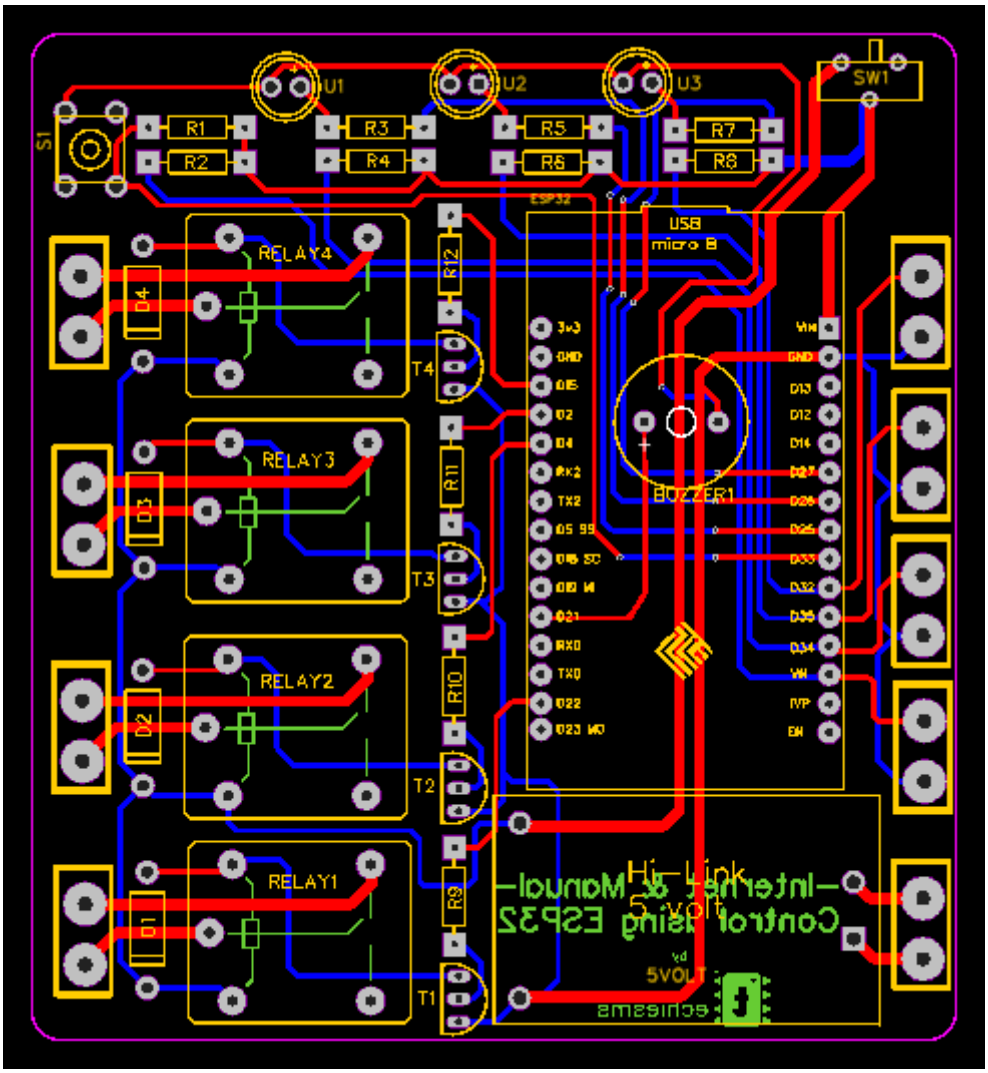
5V 5-Pin Relay Module

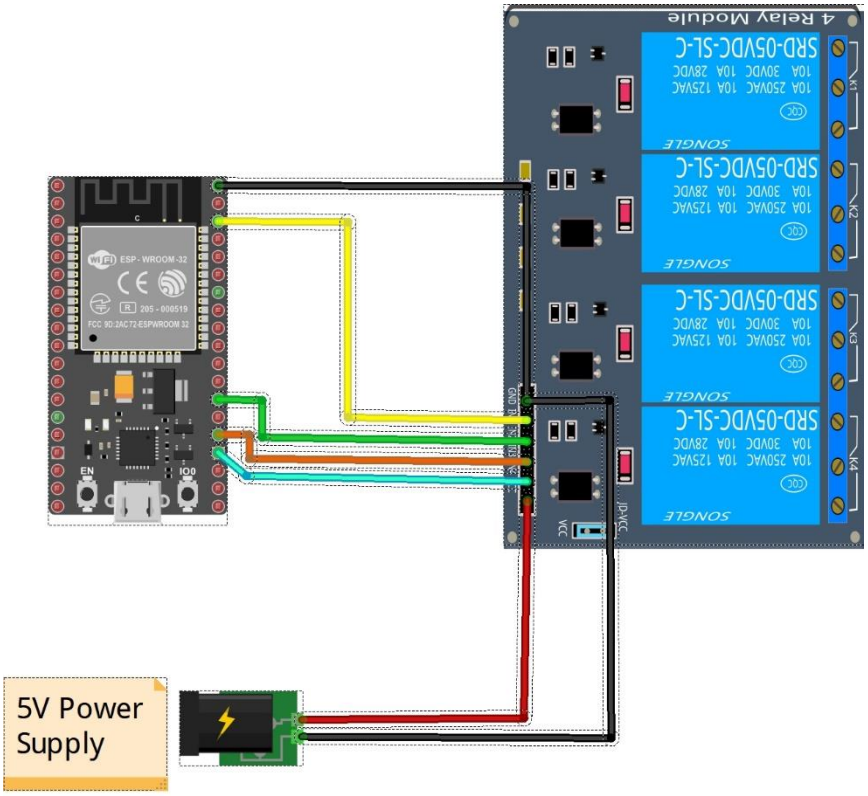


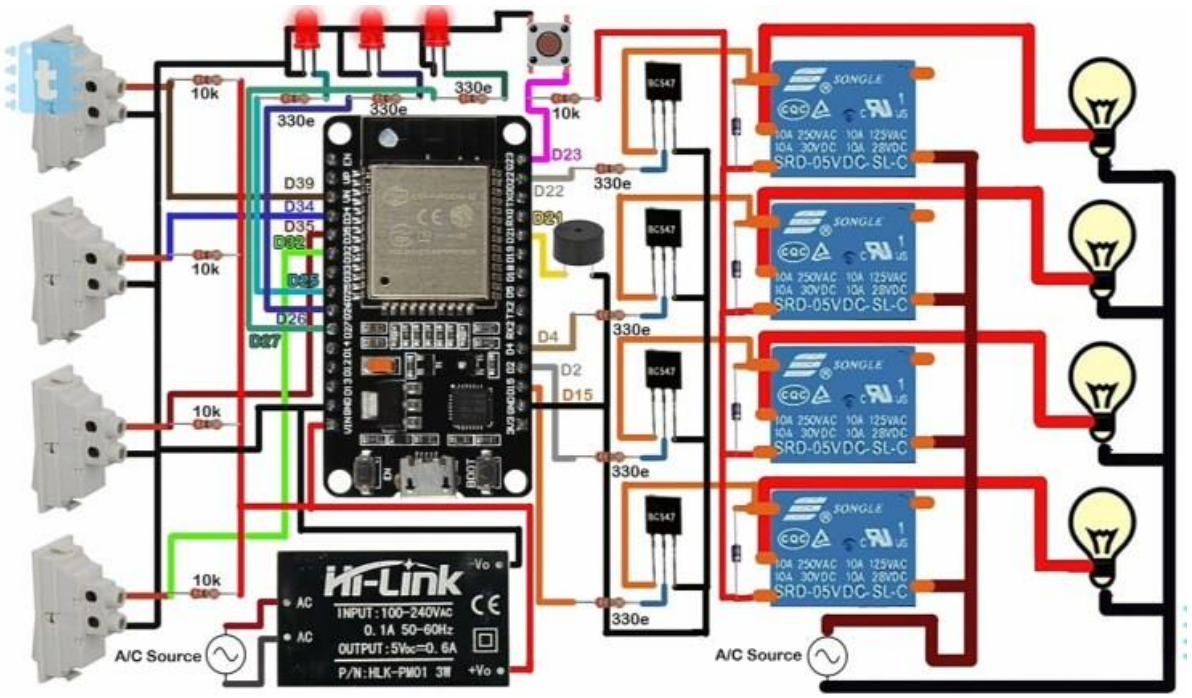
5V Relay Pin Diagram

Trigger Voltage	5V DC
Trigger Current	70mA
Maximum AC load current	10A @ 250/125V AC
Maximum DC load current	10A @ 30/28V DC
Operating time	10msec
Release time	5msec
Maximum switching	300 operating/minute

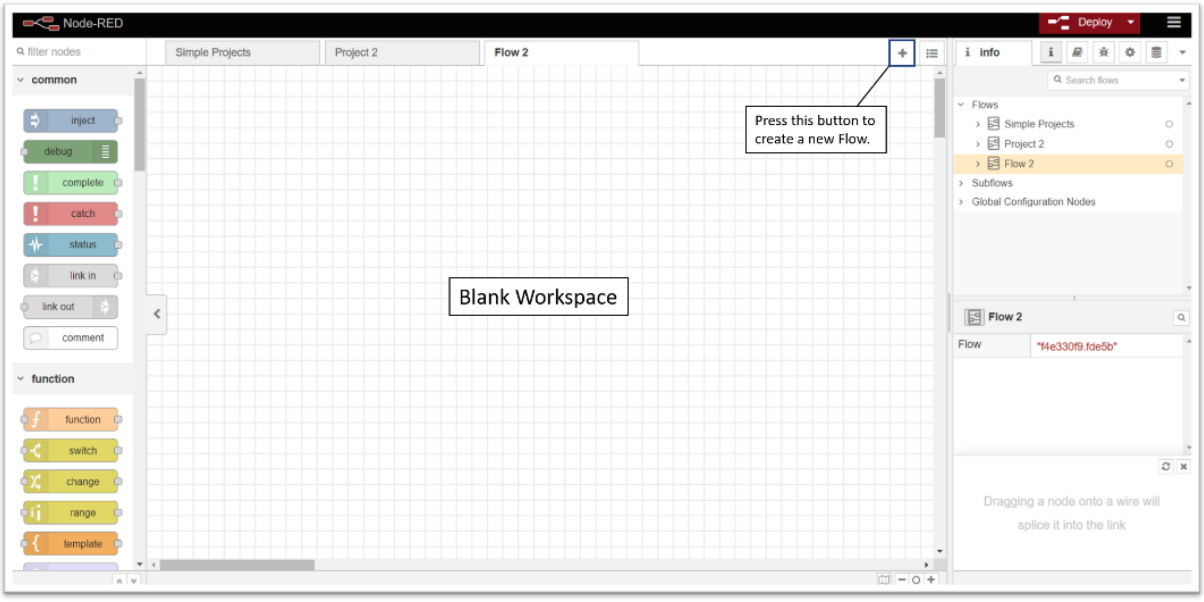

NC
NO
COM
I/O PIN OF uC
+5/+12V
DIODE
BC547
10k

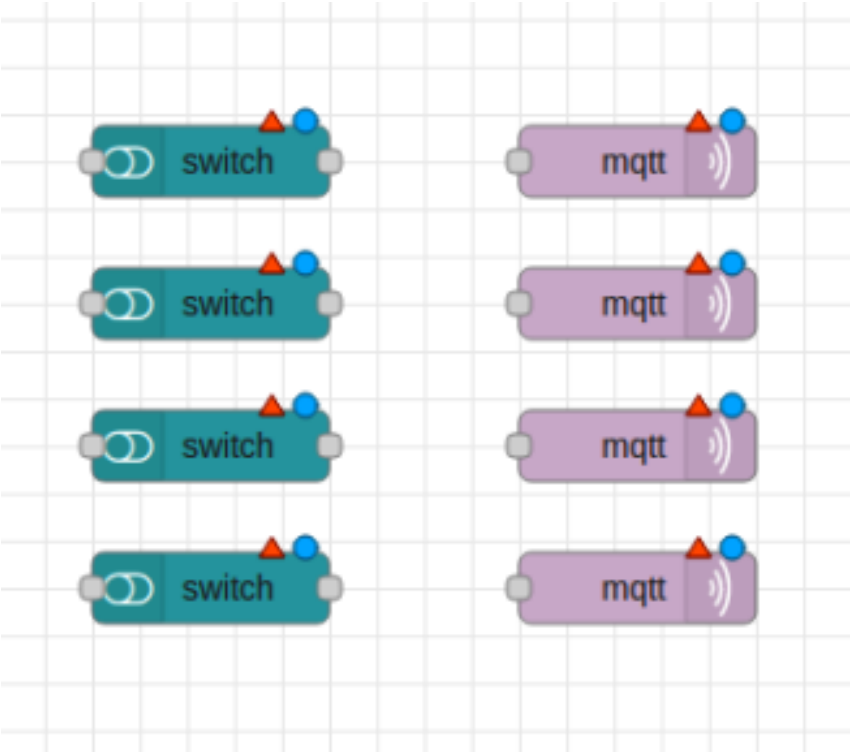

U1
U2
U3
SW1
S1
R1
R2
R3
R4
R5
R6
R7
R8
RELAY4
RELAY3
RELAY2
RELAY1
D4
D3
D2
D1
R12
R11
R10
R9
T4
T3
T2
T1
USB
micro B
BUZZER1
Hi-Link
5 volt
5VOLT


4 Relay Module
SRD-05VDC-SL-C
ESP-WROOM-32
5V Power Supply
fritzing


10k
330e
D39
D34
D35
D32
D33
D25
D26
D27
D23
D22
D21
D4
D2
D15
BC547
SRD-05VDC-SL-C
Hi-Link
INPUT:100-240VAC
0.1A 50-60Hz
OUTPUT:5Vdc=0.6A
P/N:HLK-PM01 3W
A/C Source

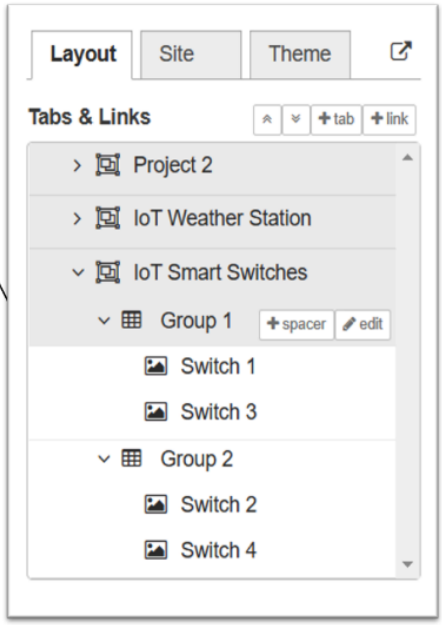
```
pi@raspberrypi:~ $ node-red-start

Start Node-RED

Once Node-RED has started, point a browser at http://192.168.1.22:1880
On Pi Node-RED works better with the Firefox or Chrome browser

Use   node-red-stop                          to stop Node-RED
Use   node-red-start                         to start Node-RED again
Use   node-red-log                           to view the recent log output
Use   sudo systemctl enable nodered.service  to autostart Node-RED at every boot
Use   sudo systemctl disable nodered.service to disable autostart on boot

To find more nodes and example flows - go to http://flows.nodered.org

Starting as a systemd service.
6 Apr 15:36:26 - [info]
Welcome to Node-RED
===================
6 Apr 15:36:26 - [info] Node-RED version: v2.2.2
6 Apr 15:36:26 - [info] Node.js  version: v14.19.1
6 Apr 15:36:26 - [info] Linux 5.10.92-v7l+ arm LE
6 Apr 15:36:27 - [info] Loading palette nodes
6 Apr 15:36:29 - [info] Dashboard version 3.1.6 started at /ui
6 Apr 15:36:29 - [info] Settings file  : /home/pi/.node-red/settings.js
6 Apr 15:36:29 - [info] Context store  : 'default' [module=memory]
6 Apr 15:36:29 - [info] User directory : /home/pi/.node-red
6 Apr 15:36:29 - [warn] Projects disabled : editorTheme.projects.enabled=false
6 Apr 15:36:29 - [info] Flows file     : /home/pi/.node-red/flows.json
6 Apr 15:36:29 - [info] Server now running at http://127.0.0.1:1880/
6 Apr 15:36:29 - [warn]
---------------------------------------------------------------------
Your flow credentials file is encrypted using a system-generated key.
If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.
You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
```



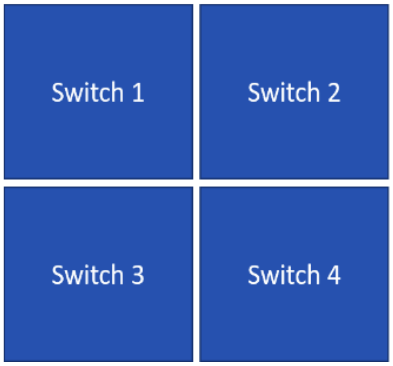


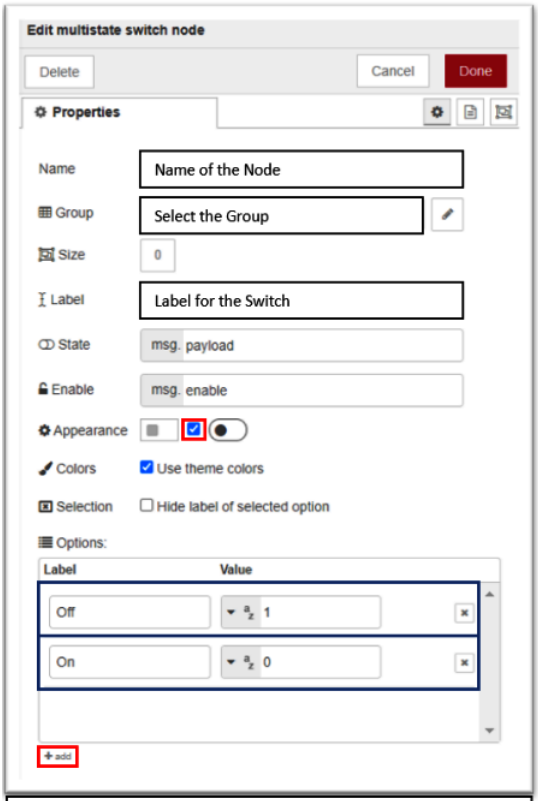
Dashboard Layout Setup

- First, create a new Tab using the **+tab** button and rename it to "*IoT Smart Switches*".
- Then using the **+group** button on the tab, create 2 groups as shown in the figure.
- Now, all you have to do is add your widgets to individual groups. For this project, we will follow the layout shown below. Just add **Switch 1 & 3** to *Group 1* and **Switch 2 & 4** to *Group 2*.



IoT Smart Switches Dashboard Layout

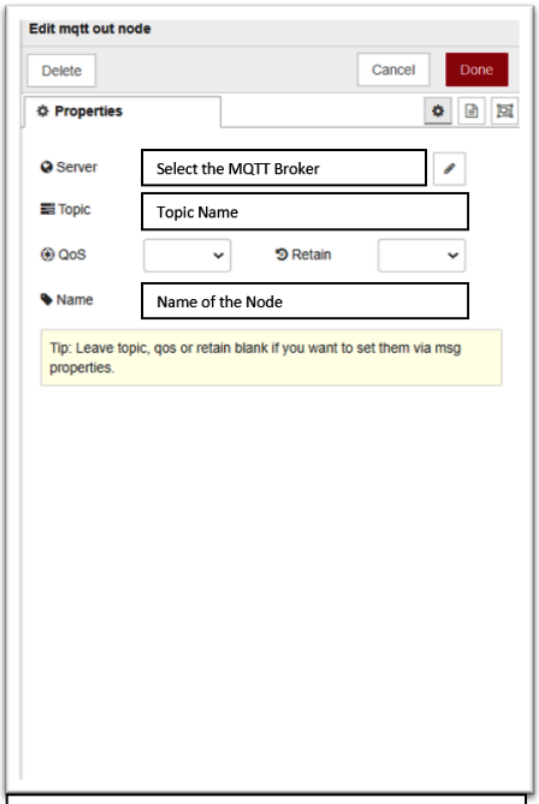




Multistate Switch Node

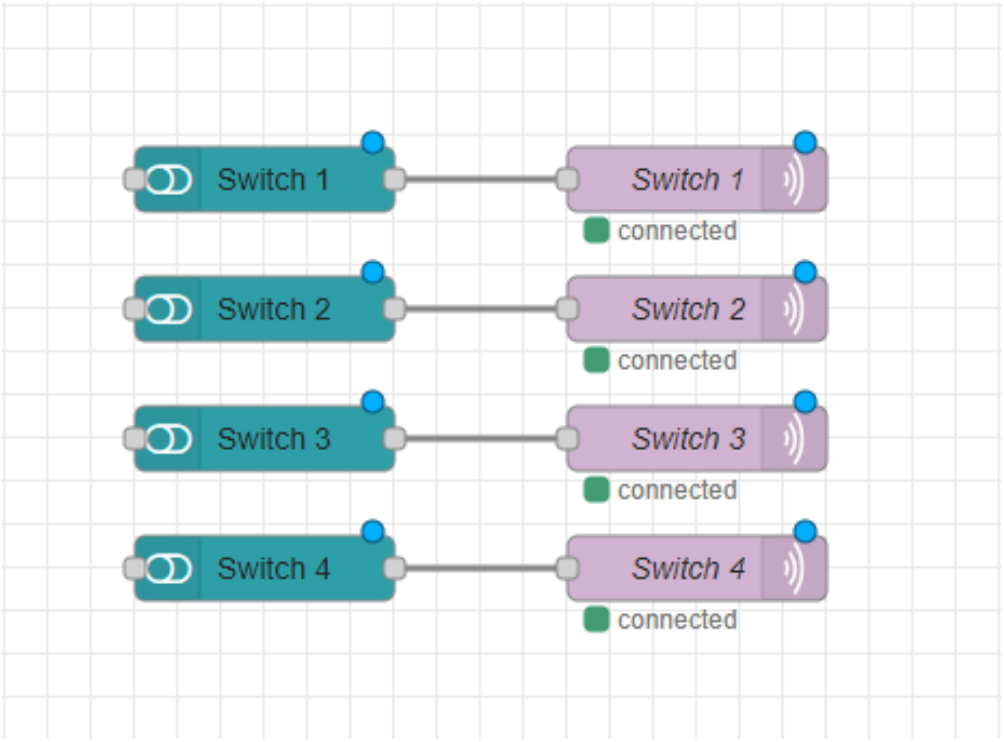
Name your node and select the group to which the switch needs to be added (according to the dashboard layout). Then, add the Label (name which shows up on the dashboard).

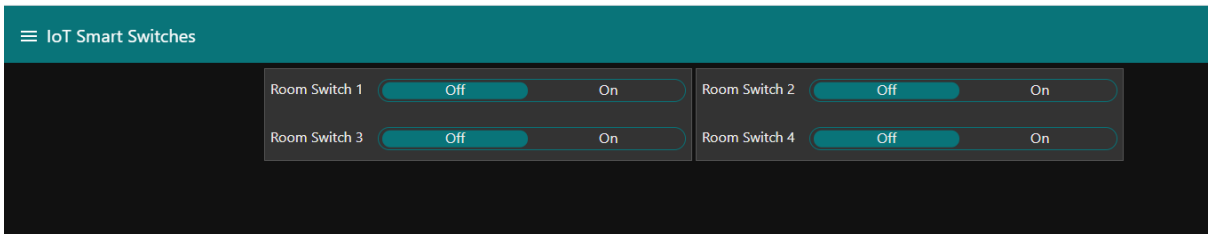
Then, click the **+add** button and add the labels as shown in the figure.

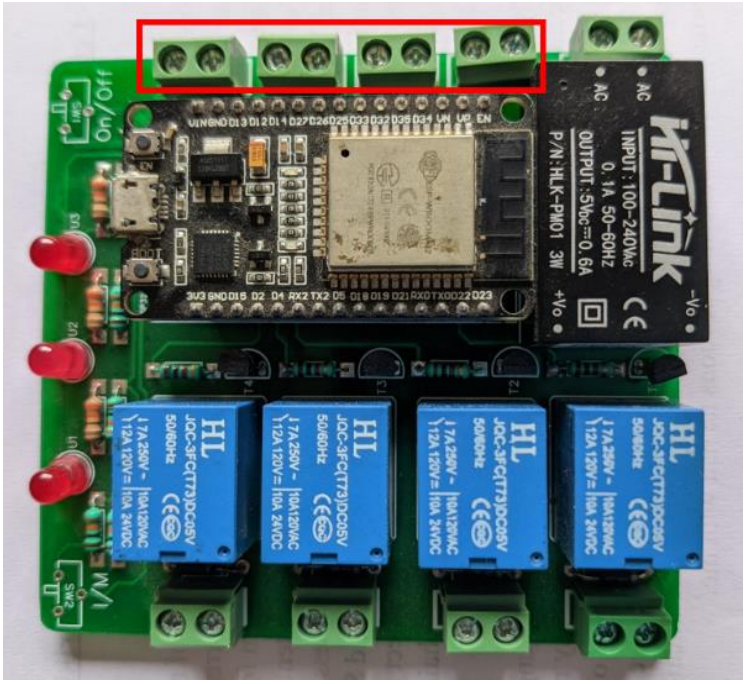


MQTT Out Node

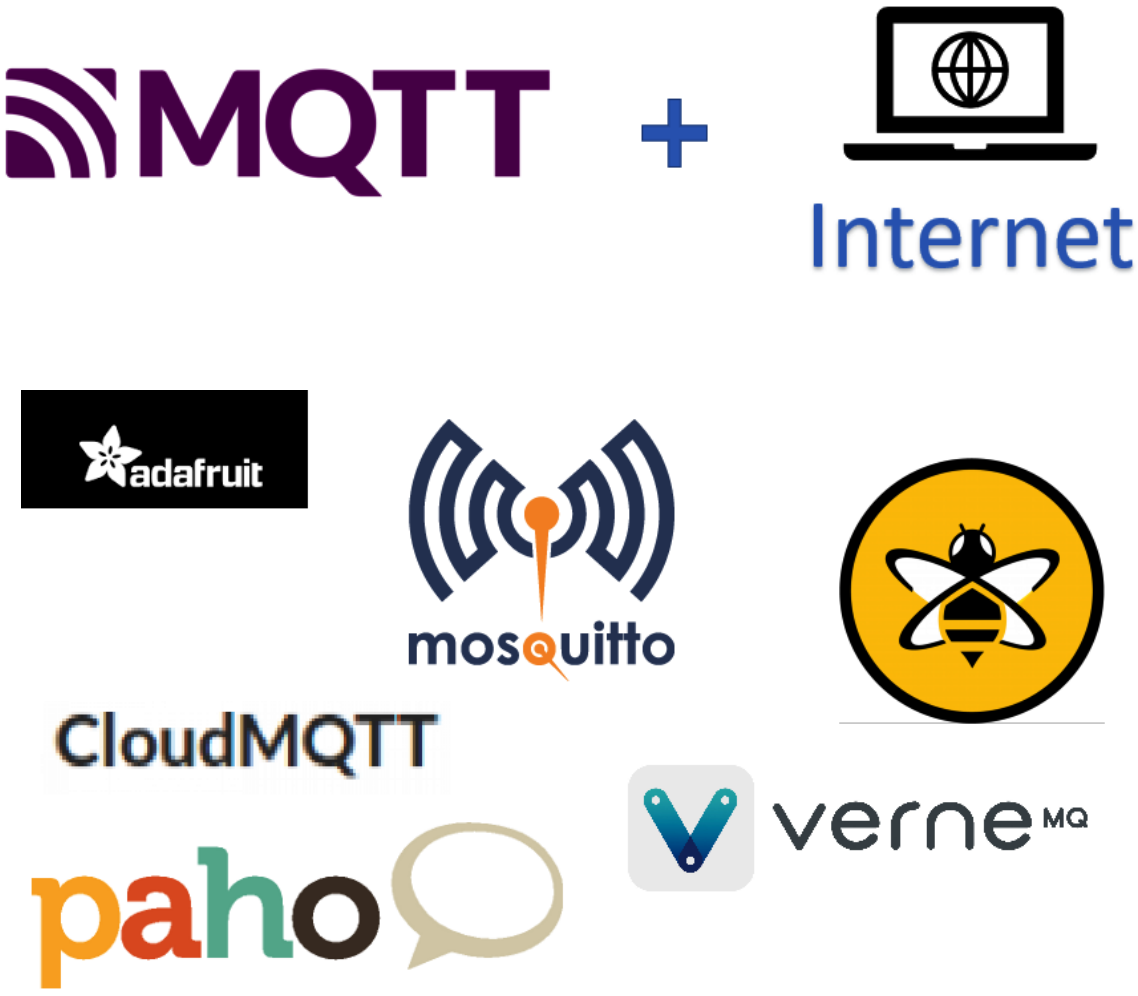
Select the MQTT Broker (Pi's in our case). Then, type in the topic name corresponding to the **switch.** Finally, give a name to the node and press **Done.**




IoT Smart Switches
Room Switch 1
Off
On
Room Switch 2
Off
On
Room Switch 3
Off
On
Room Switch 4
Off
On


Hi-Link
INPUT:100-240Vac
0.1A 50-60Hz
OUTPUT:5Vdc=0.6A
P/N:HLK-PM01 3W
HL
JQC-3FC(T73)DC05V
10A 120VAC
10A 24VDC

Chapter 7: Take Your MQTT Broker Global

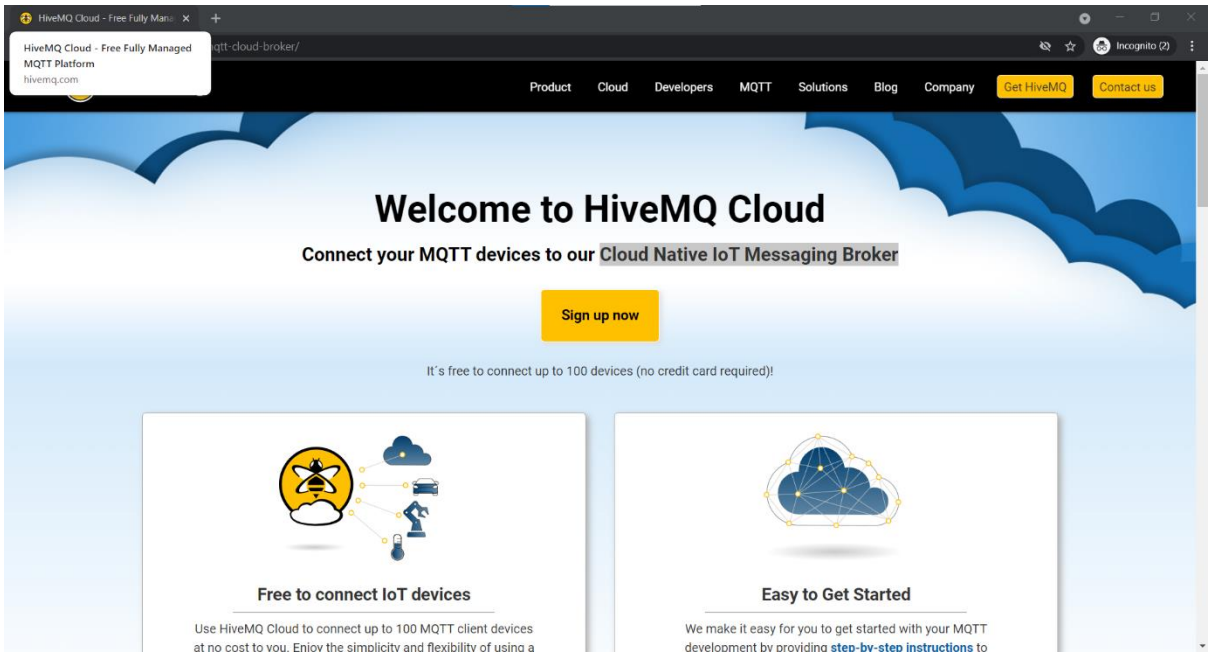


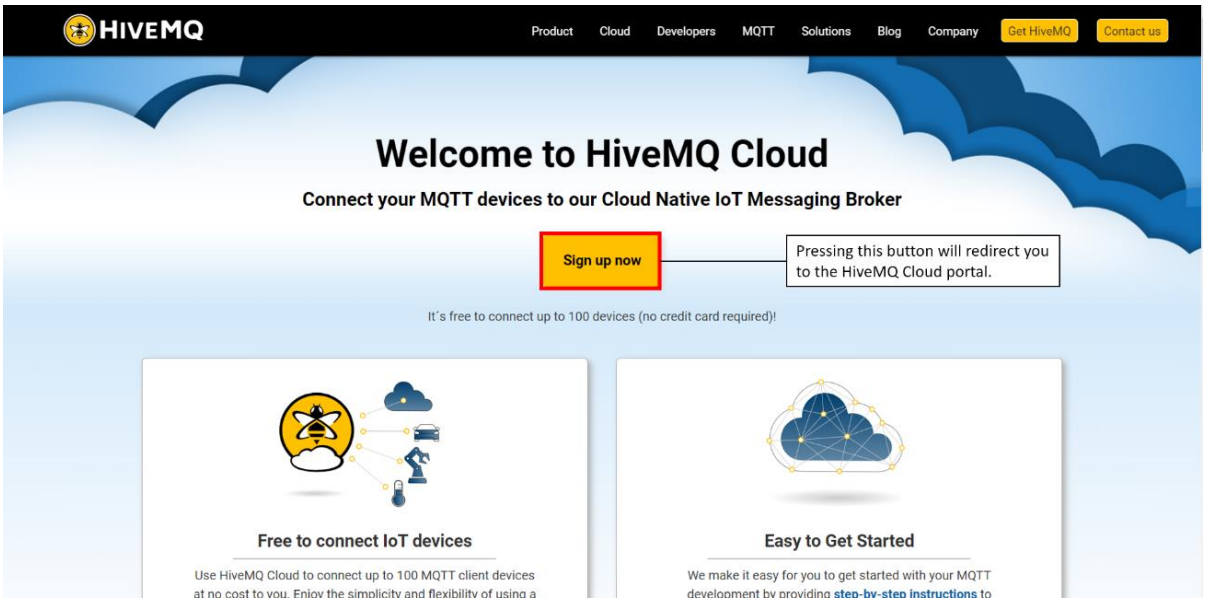
Capacity

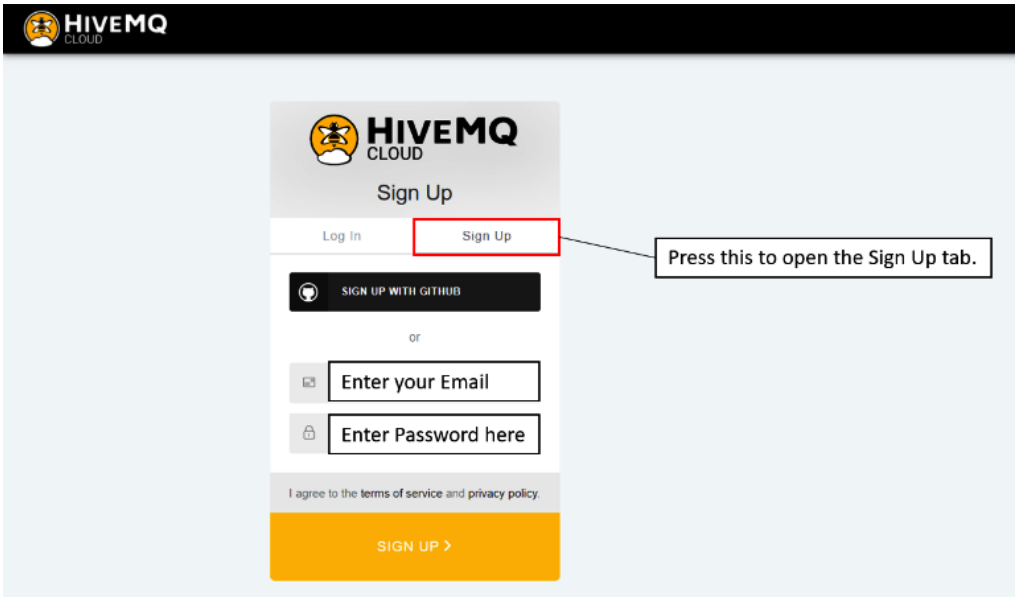
MQTT Client Sessions:	100
Data Traffic:	10 GB
Data Retention Time:	3 Days
Max Message Size:	5 MB

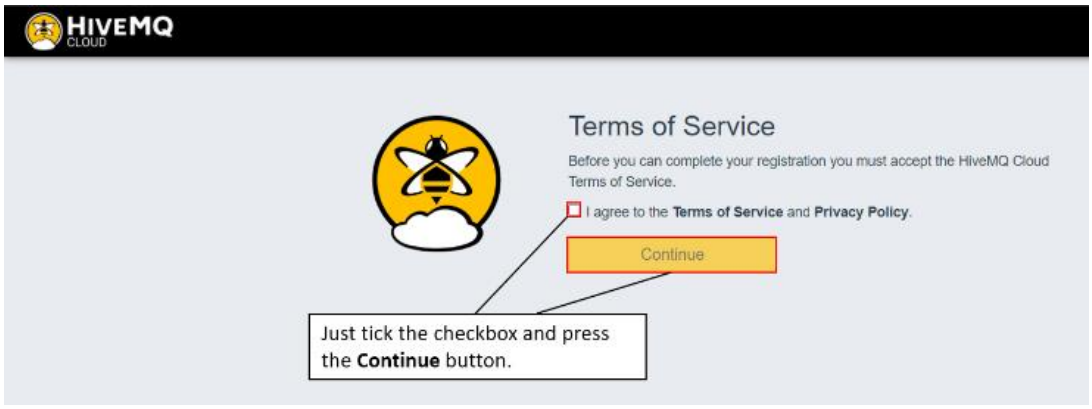
UPGRADE CLUSTER

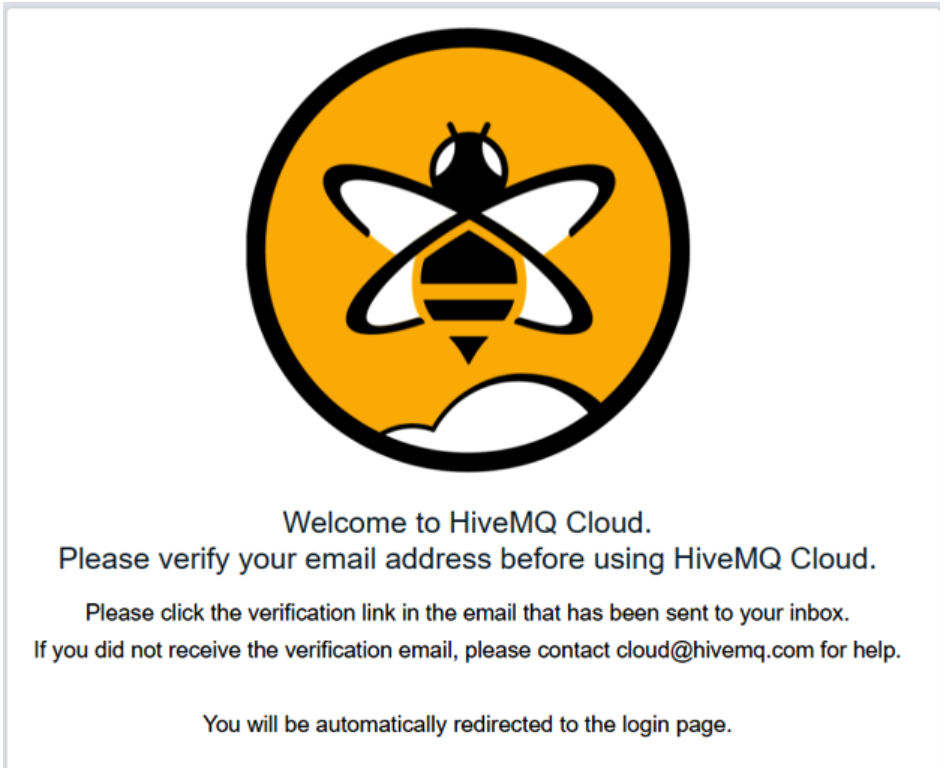
HIVEMQ
CLOUD

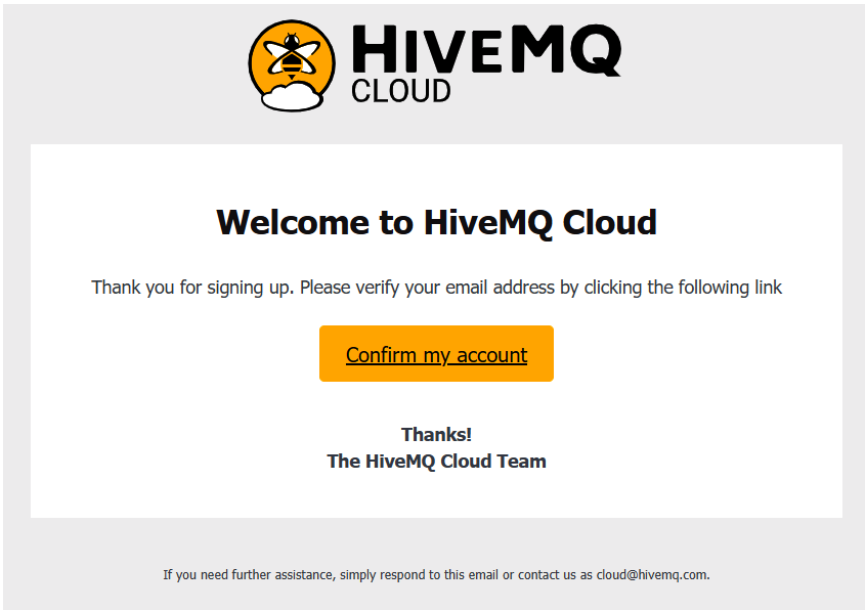


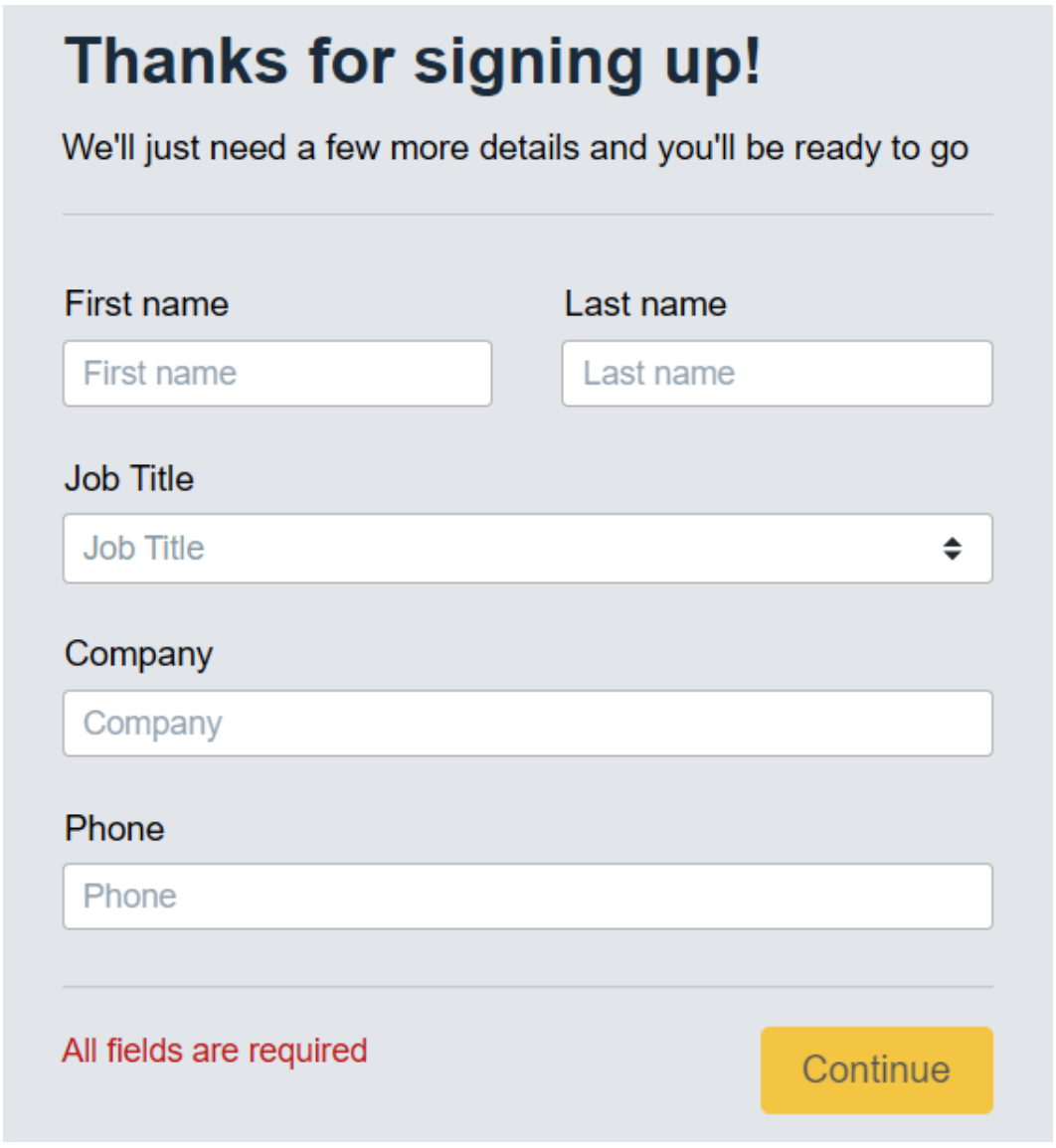


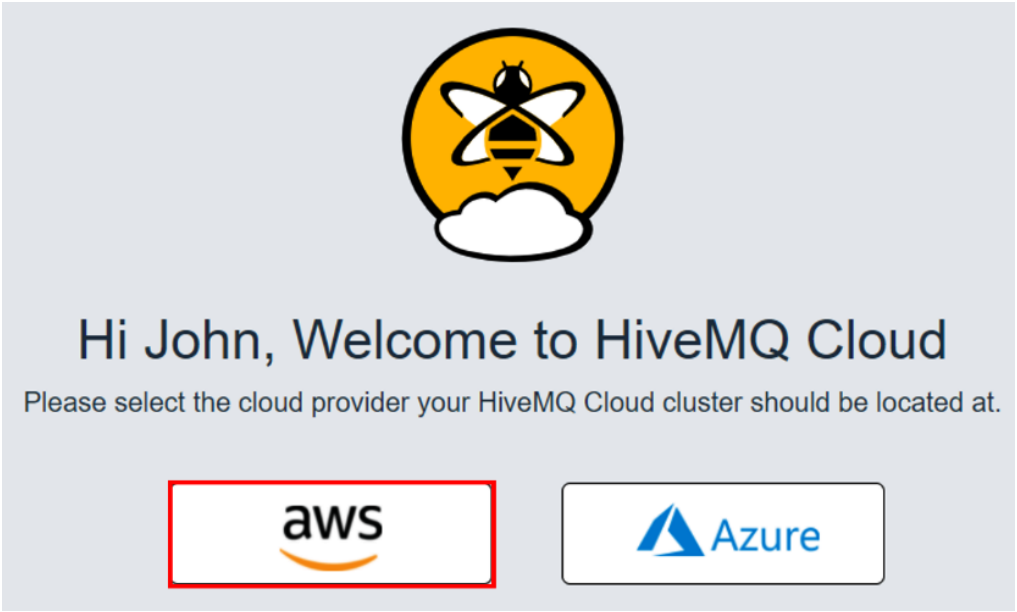

HIVEMQ
CLOUD
Sign Up
Log In
Sign Up
Press this to open the Sign Up tab.
SIGN UP WITH GITHUB
or
Enter your Email
Enter Password here
I agree to the terms of service and privacy policy.
SIGN UP >

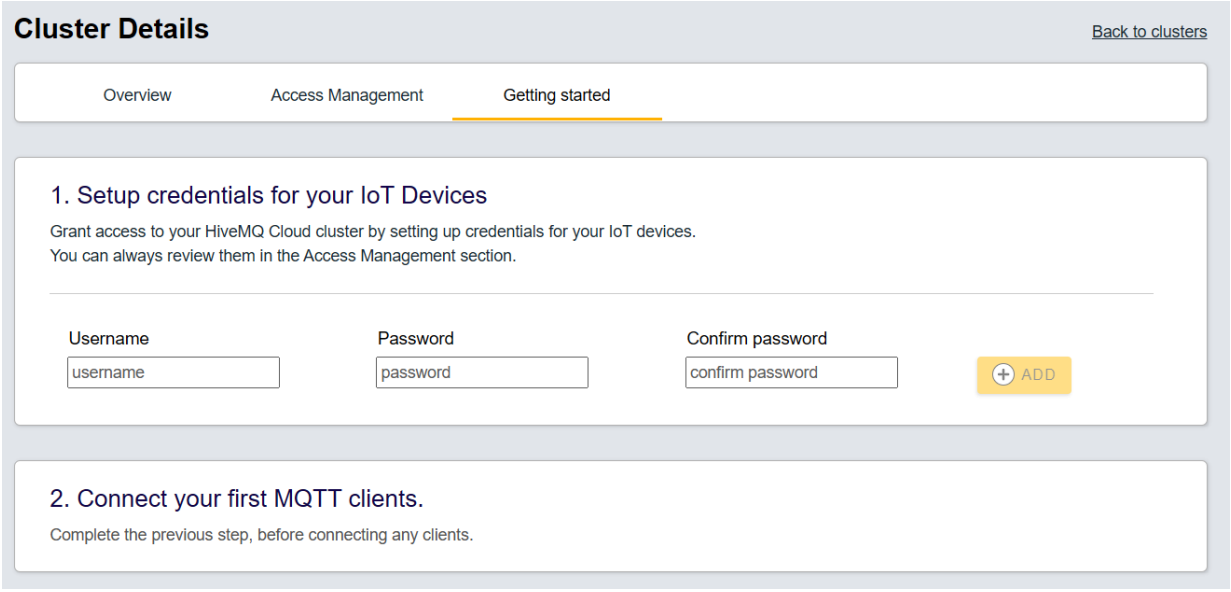

HIVEMQ
CLOUD
Terms of Service
Before you can complete your registration you must accept the HiveMQ Cloud Terms of Service.
I agree to the Terms of Service and Privacy Policy.
Continue
Just tick the checkbox and press the Continue button.

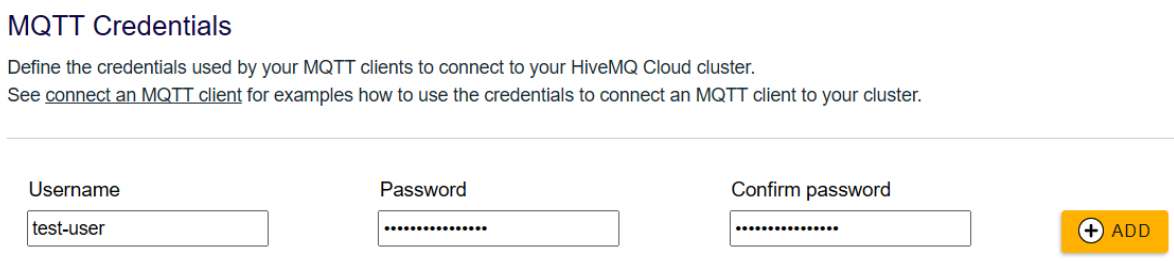

Welcome to HiveMQ Cloud.
Please verify your email address before using HiveMQ Cloud.
Please click the verification link in the email that has been sent to your inbox.
If you did not receive the verification email, please contact cloud@hivemq.com for help.
You will be automatically redirected to the login page.


HIVEMQ
CLOUD
Welcome to HiveMQ Cloud
Thank you for signing up. Please verify your email address by clicking the following link
Confirm my account
Thanks!
The HiveMQ Cloud Team
If you need further assistance, simply respond to this email or contact us as cloud@hivemq.com.


Thanks for signing up!
We'll just need a few more details and you'll be ready to go
First name
First name
Last name
Last name
Job Title
Job Title
Company
Company
Phone
Phone
All fields are required
Continue


Hi John, Welcome to HiveMQ Cloud
Please select the cloud provider your HiveMQ Cloud cluster should be located at.
aws
Azure


Cluster Details
Back to clusters
Overview
Access Management
Getting started
1. Setup credentials for your IoT Devices
Grant access to your HiveMQ Cloud cluster by setting up credentials for your IoT devices.
You can always review them in the Access Management section.
Username
username
Password
password
Confirm password
confirm password
ADD
2. Connect your first MQTT clients.
Complete the previous step, before connecting any clients.


MQTT Credentials
Define the credentials used by your MQTT clients to connect to your HiveMQ Cloud cluster.
See connect an MQTT client for examples how to use the credentials to connect an MQTT client to your cluster.
Username
test-user
Password
Confirm password
ADD

2. Connect your first MQTT clients.

Choose your preferred tool or programming language.

Tools

mqtt-cli
command-line tool

MQTT.fx
GUI tool

mosquitto_pub/sub
command-line tool

HiveMQ Websocket Client
browser tool

Programming Languages

Java
hivemq-mqtt-client

Python
Paho Python

JavaScript
mqtt.js

Java (Websocket)
hivemq-mqtt-client

C
Paho C

Cluster Details

Back to clusters

Overview | Access Management | Getting started

Details

Hostname: Your Host IP Address
Port (TLS): 8883
Port (Websocket + TLS): 8884

Cluster Information

Cluster Type: Free
Cloud Provider: Microsoft Azure

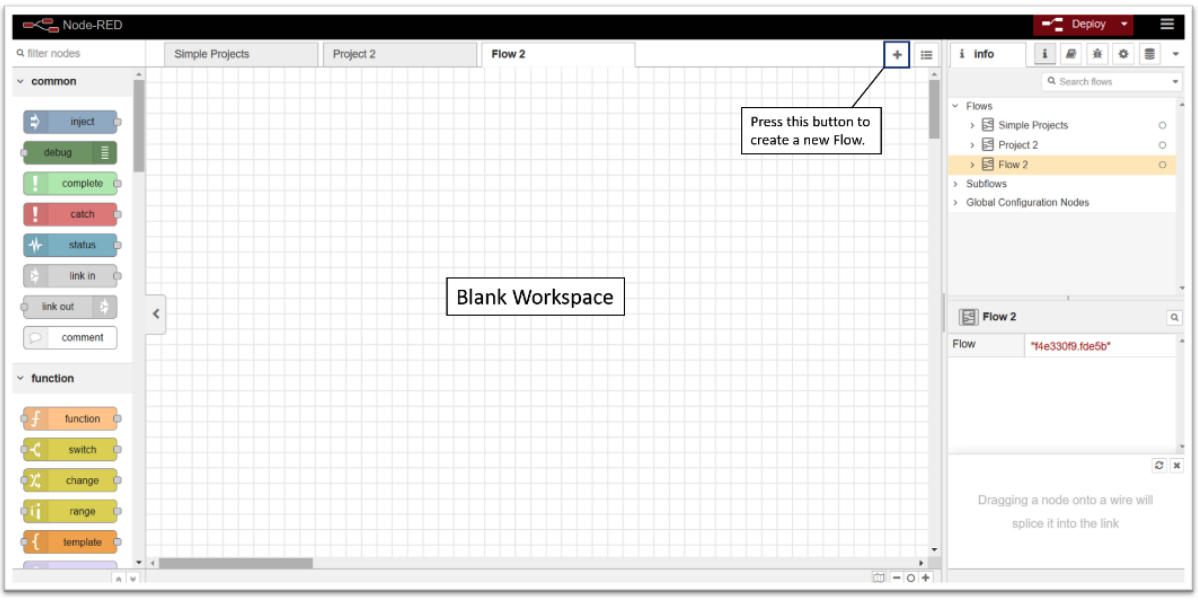
Capacity

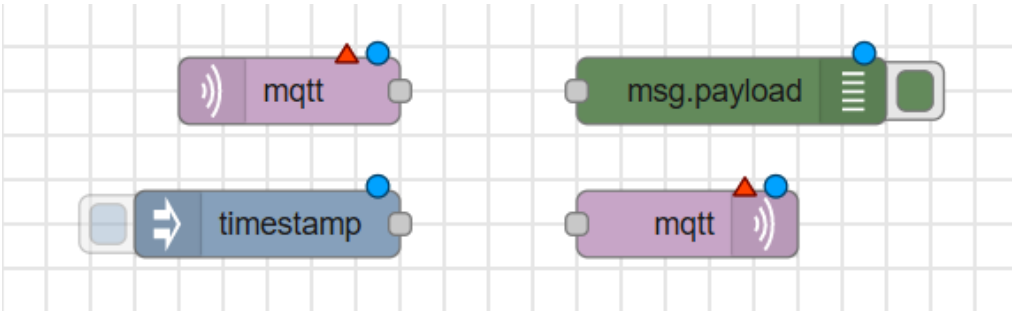
MQTT Client Sessions: 100
Data Traffic: 10 GB
Data Retention Time: 3 Days
Max Message Size: 5 MB

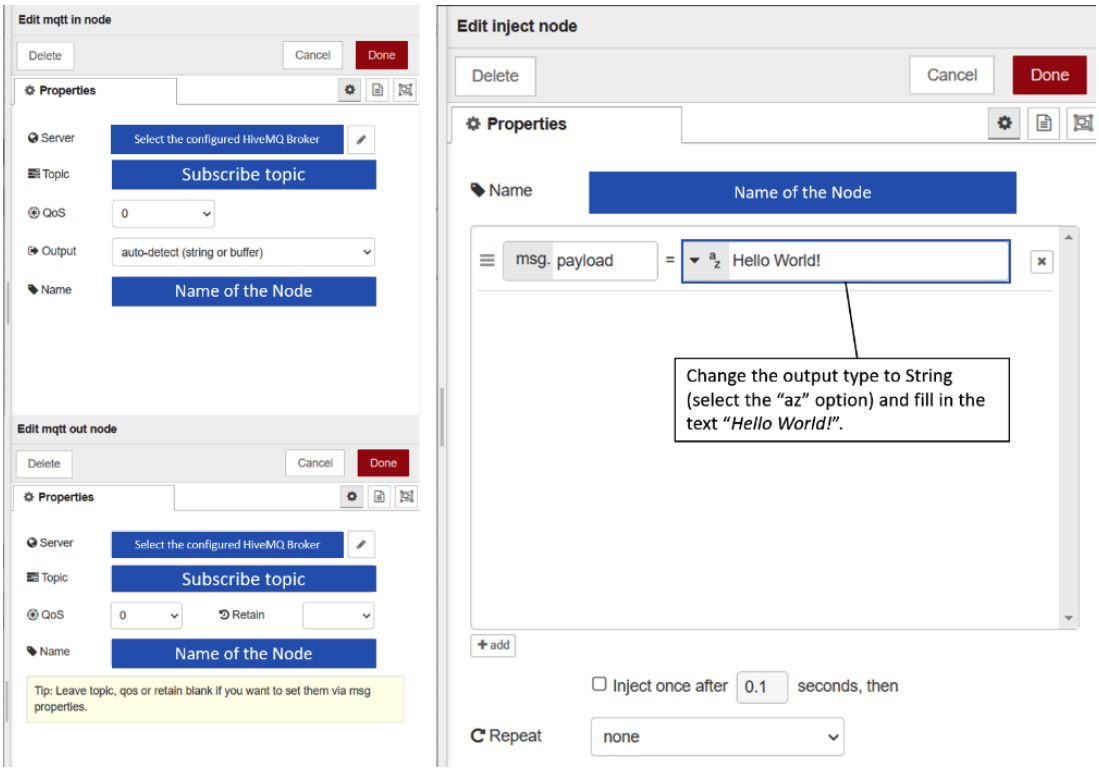
UPGRADE CLUSTER

DELETE CLUSTER

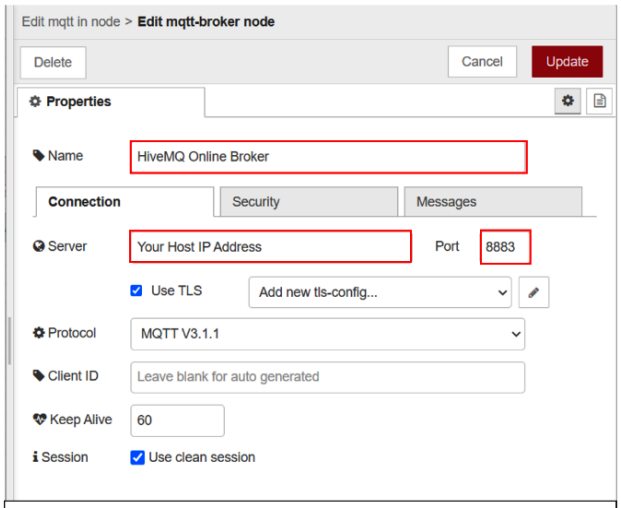
```
pi@raspberrypi:~ $ node-red-start

Start Node-RED

Once Node-RED has started, point a browser at http://192.168.1.22:1880
On Pi Node-RED works better with the Firefox or Chrome browser

Use   node-red-stop                          to stop Node-RED
Use   node-red-start                         to start Node-RED again
Use   node-red-log                           to view the recent log output
Use   sudo systemctl enable nodered.service  to autostart Node-RED at every boot
Use   sudo systemctl disable nodered.service to disable autostart on boot

To find more nodes and example flows - go to http://flows.nodered.org

Starting as a systemd service.
6 Apr 15:36:26 - [info]
Welcome to Node-RED
===================
6 Apr 15:36:26 - [info] Node-RED version: v2.2.2
6 Apr 15:36:26 - [info] Node.js  version: v14.19.1
6 Apr 15:36:26 - [info] Linux 5.10.92-v7l+ arm LE
6 Apr 15:36:27 - [info] Loading palette nodes
6 Apr 15:36:29 - [info] Dashboard version 3.1.6 started at /ui
6 Apr 15:36:29 - [info] Settings file  : /home/pi/.node-red/settings.js
6 Apr 15:36:29 - [info] Context store  : 'default' [module=memory]
6 Apr 15:36:29 - [info] User directory : /home/pi/.node-red
6 Apr 15:36:29 - [warn] Projects disabled : editorTheme.projects.enabled=false
6 Apr 15:36:29 - [info] Flows file     : /home/pi/.node-red/flows.json
6 Apr 15:36:29 - [info] Server now running at http://127.0.0.1:1880/
6 Apr 15:36:29 - [warn]
---------------------------------------------------------------------
Your flow credentials file is encrypted using a system-generated key.
If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.
You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
```



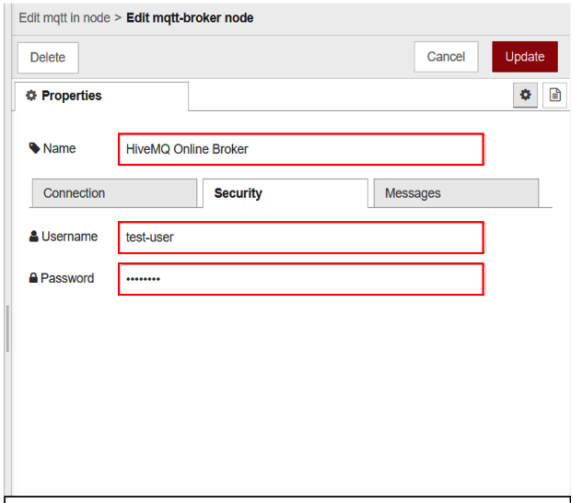




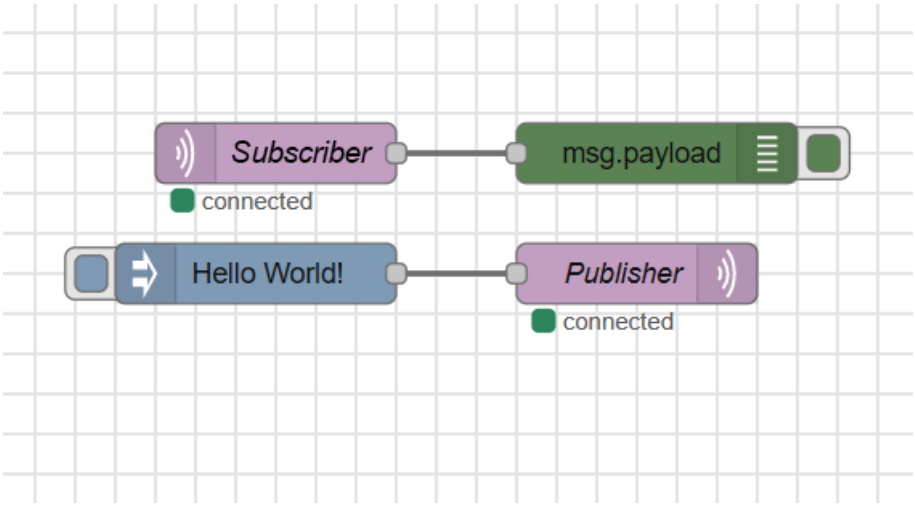
MQTT Broker Setup

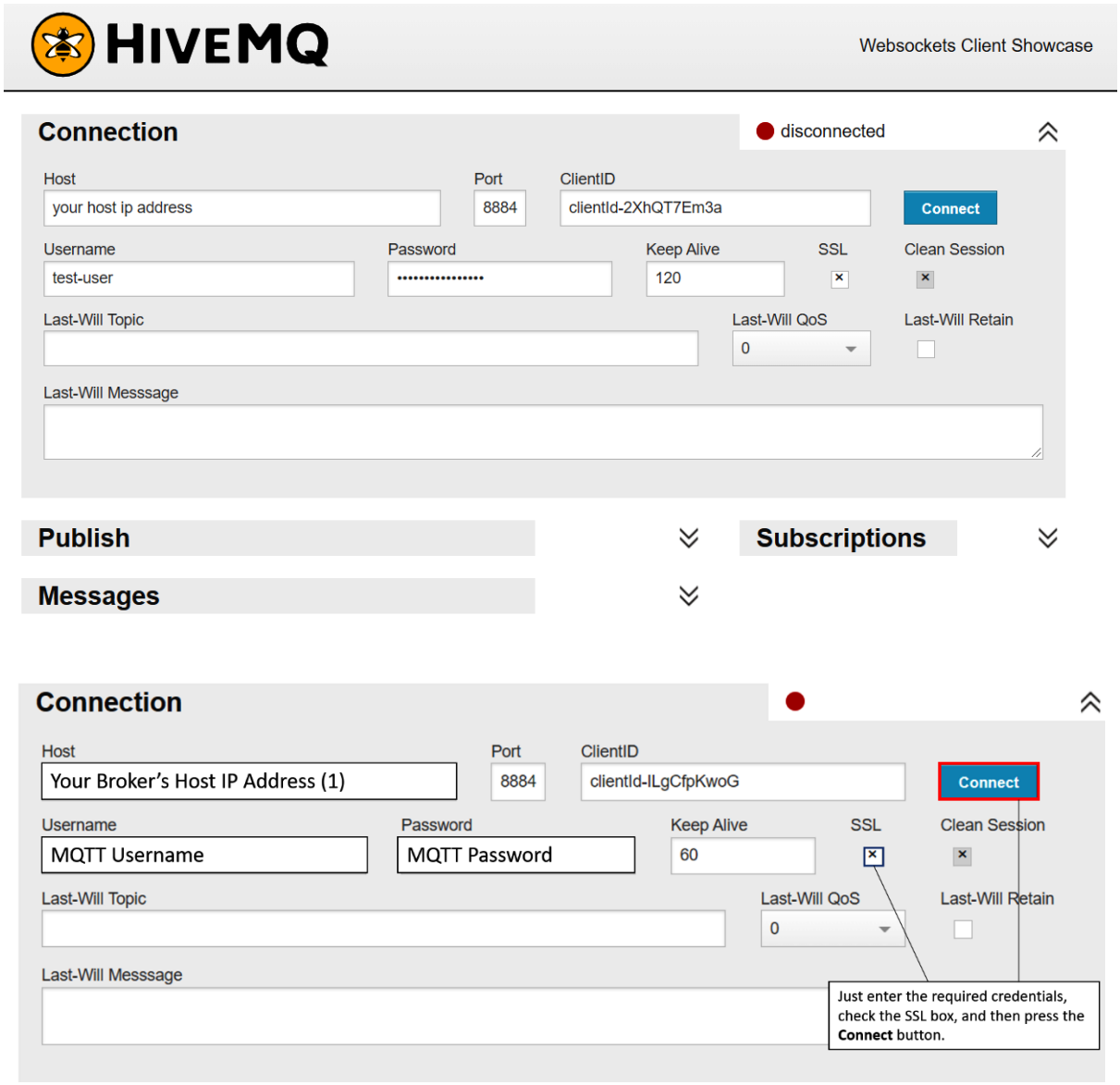


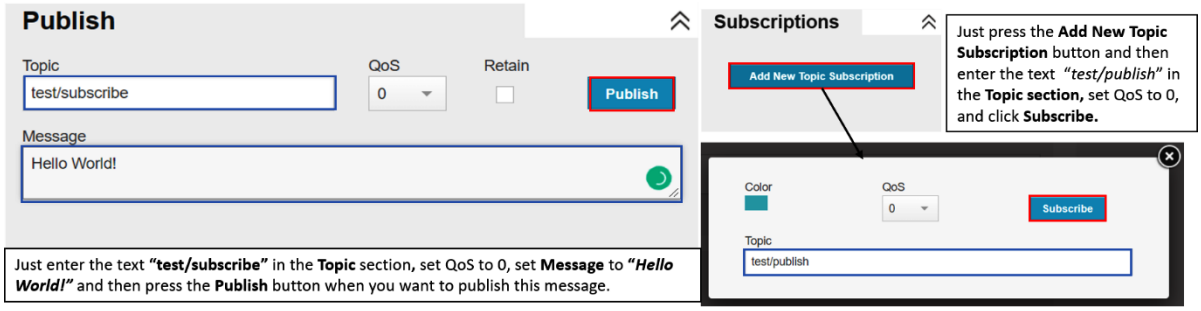
Connection Tab
The marked boxes need to be filled. That includes the **Name** of the node; the **Server** box needs the HiveMQ host IP Address and the **Port** box must contain 8883.



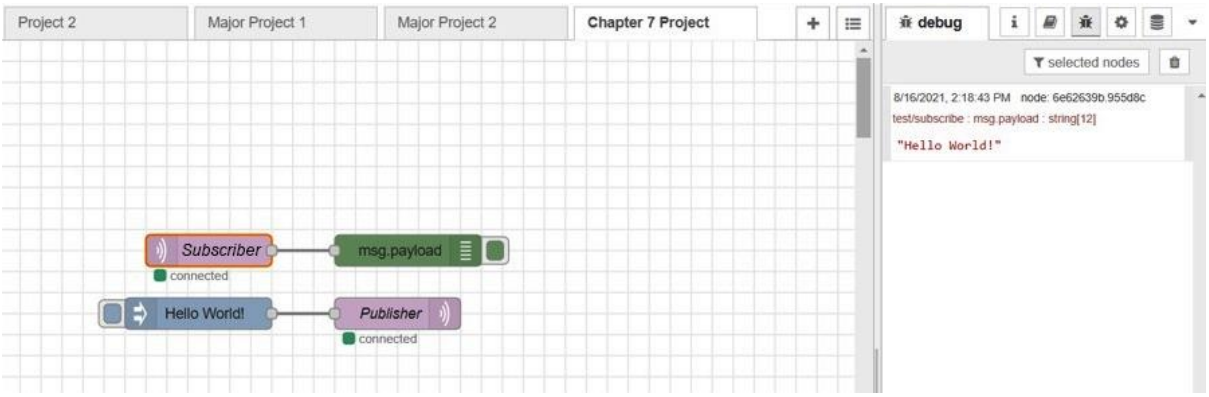
Security Tab
We need to fill in the **Username** and **Password** boxes with the MQTT credentials we have set up.

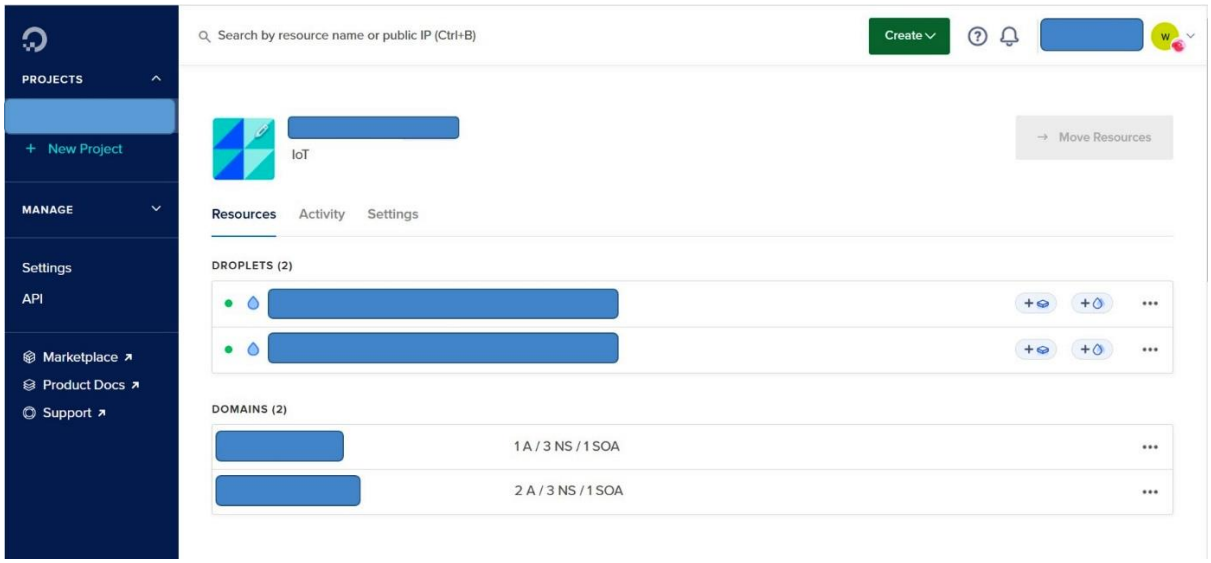

Subscriber
connected
msg.payload
Hello World!
Publisher
connected


HIVEMQ
Websockets Client Showcase
Connection
disconnected
Host
your host ip address
Port
8884
ClientID
clientId-2XhQT7Em3a
Connect
Username
test-user
Password
Keep Alive
120
SSL
Clean Session
Last-Will Topic
Last-Will QoS
0
Last-Will Retain
Last-Will Messsage
Publish
Subscriptions
Messages
Connection
Host
Your Broker's Host IP Address (1)
Port
8884
ClientID
clientId-ILgCfpKwoG
Connect
Username
MQTT Username
Password
MQTT Password
Keep Alive
60
SSL
Clean Session
Last-Will Topic
Last-Will QoS
0
Last-Will Retain
Last-Will Messsage
Just enter the required credentials, check the SSL box, and then press the Connect button.


Publish
Topic
test/subscribe
QoS
0
Retain
Publish
Message
Hello World!
Subscriptions
Add New Topic Subscription
Color
QoS
0
Subscribe
Topic
test/publish
Just press the **Add New Topic Subscription** button and then enter the text *"test/publish"* in the **Topic section,** set QoS to 0, and click **Subscribe.**
Just enter the text **"test/subscribe"** in the **Topic** section, set QoS to 0, set **Message** to ***"Hello World!"*** and then press the **Publish** button when you want to publish this message.

HIVEMQ
Websockets Client Showcase
Connection
connected
Publish
Subscriptions
Messages
Add New Topic Subscription
2021-08-15 21:05:47
Topic: test/publish
Qos: 0
Hello World!
Qos: 0
test/publish
Add the **test/publish** topic to Subscriptions and then trigger the Inject node to get the *"Hello World!"* message under the **Messages** section.


Project 2
Major Project 1
Major Project 2
Chapter 7 Project
debug
selected nodes
8/16/2021, 2:18:43 PM node: 6e62639b.955d8c
test/subscribe : msg.payload : string[12]
"Hello World!"
Subscriber
connected
msg.payload
Hello World!
Publisher
connected



Create Droplets

Choose an image

Distributions | Container distributions | Marketplace | Custom images

Ubuntu	FreeBSD	Fedora	Debian	CentOS	Rocky Linux
20.04 (LTS) x64	Select version	Select version	Select version	Select version	Select version

Choose a plan

Help me choose

SHARED CPU	DEDICATED CPU			
Basic	General Purpose	CPU-Optimized	Memory-Optimized	Storage-Optimized NEW

Basic virtual machines with a mix of memory and compute resources. Best for small projects that can handle variable levels of CPU performance, like blogs, web apps and dev/test environments.

CPU options: (•) Regular Intel with SSD ( ) Premium Intel with NVMe SSD NEW ( ) Premium AMD with NVMe SSD NEW

$5/mo $0.007/hour	$10/mo $0.015/hour	$15/mo $0.022/hour	$20/mo $0.030/hour	$40/mo $0.060/hour	$80/mo $0.119/hour
1 GB / 1 CPU 25 GB SSD Disk 1000 GB transfer	2 GB / 1 CPU 50 GB SSD Disk 2 TB transfer	2 GB / 2 CPUs 60 GB SSD Disk 3 TB transfer	4 GB / 2 CPUs 80 GB SSD Disk 4 TB transfer	8 GB / 4 CPUs 160 GB SSD Disk 5 TB transfer	16 GB / 8 CPUs 320 GB SSD Disk 6 TB transfer

Choose a datacenter region

New York	San Francisco	Amsterdam	Singapore	London	Frankfurt
1 2 3	1 2 3	2 3	1	1	1

Toronto	Bangalore
1	1

Authentication ?

( ) **SSH keys**
A more secure authentication method

(•) **Password**
Create a root password to access Droplet (less secure)

Create root password *

Type your password...

PASSWORD REQUIREMENTS

- Must be at least 8 characters long
- Must contain 1 uppercase letter (cannot be first or last character)
- Must contain 1 number
- Cannot end in a number or special character

⚠ Please store your password securely. You will not be sent an email containing the Droplet's details or password.

Finalize and create

How many Droplets?

Deploy multiple Droplets with the same configuration.

1 Droplet

Choose a hostname

Give your Droplets an identifying name you will remember them by. Your Droplet name can only contain alphanumeric characters, dashes, and periods.

example-hostname

Add tags

Use tags to organize and relate resources. Tags may contain letters, numbers, colons, dashes, and underscores.

Type tags here

Select Project

Assign Droplets to a project

Default Project

Create Droplet

DROPLETS (1)

ubuntu-s-1vcpu-1gb-sfo2-01

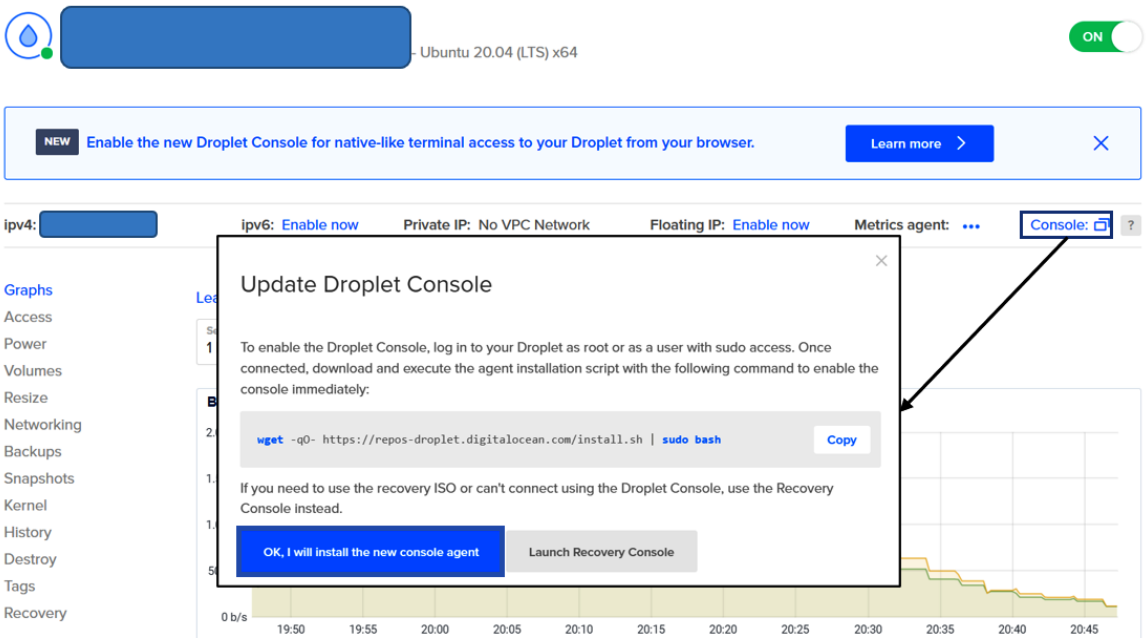
Resources Activity Settings

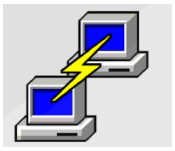
DROPLETS (1)

ubuntu-s-1vcpu-1gb-sfo2-01
SFO2 / 1GB / 25GB Disk

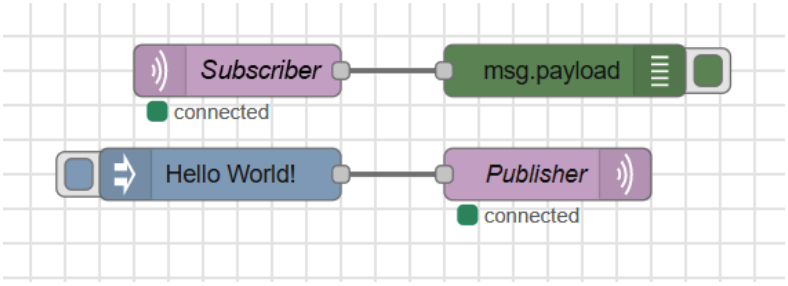
203.0.113.0

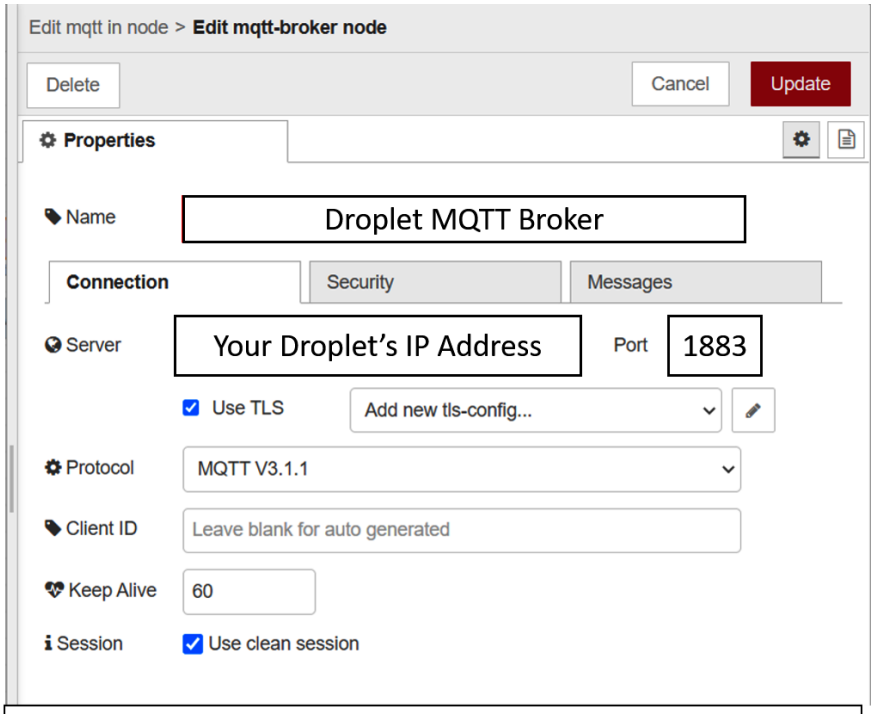
Add tags





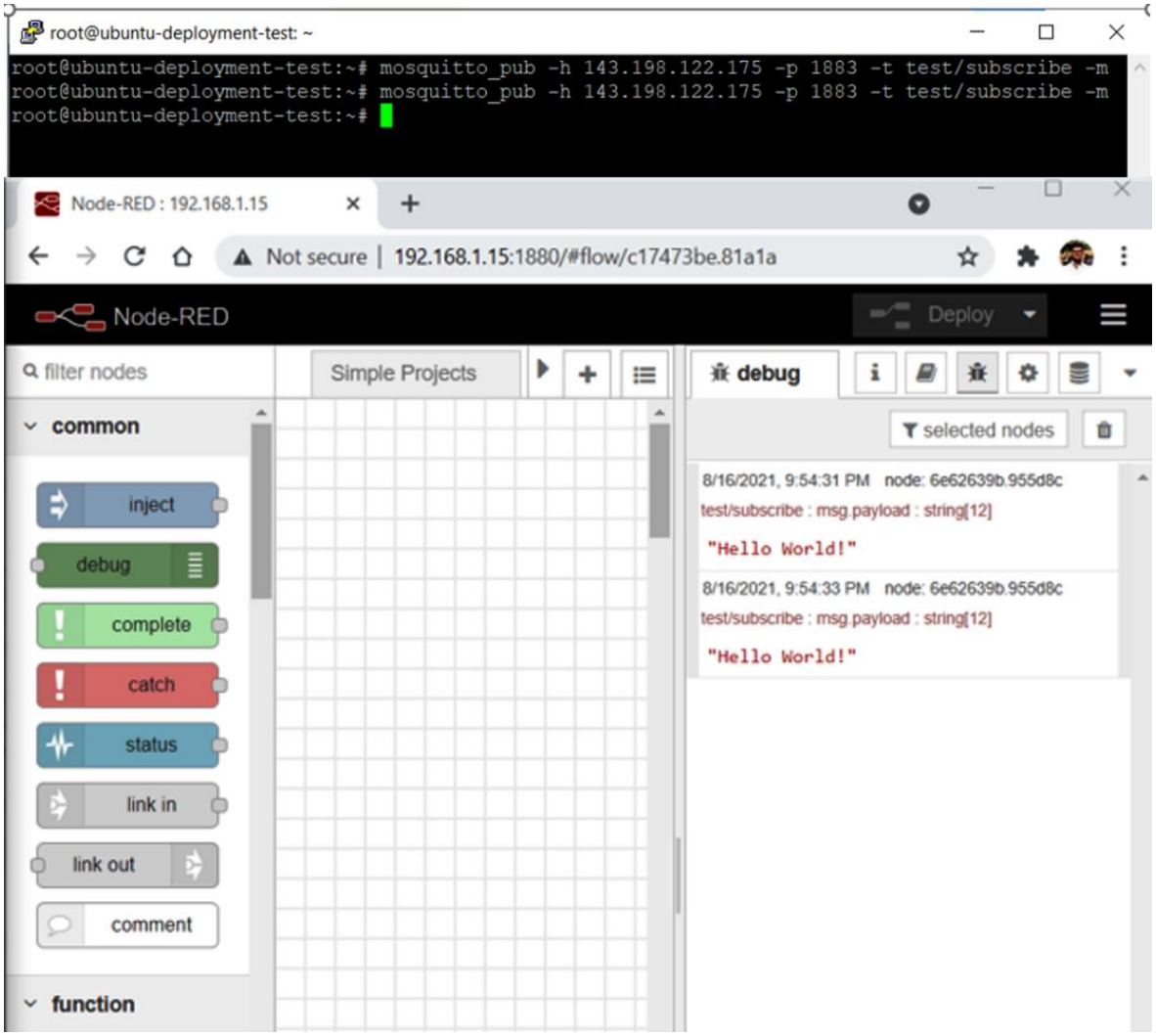
```
● mosquitto.service - Mosquitto MQTT v3.1/v3.1.1 Broker
   Loaded: loaded (/lib/systemd/system/mosquitto.service; enabled; vendor preset:
enabled)
   Active: active (running) since Tue 2021-03-16 16:33:30 IST; 3min 39s ago
     Docs: man:mosquitto.conf(5)
           man:mosquitto(8)
 Main PID: 2607 (mosquitto)
    Tasks: 1 (limit: 2062)
   CGroup: /system.slice/mosquitto.service
           └─2607 /usr/sbin/mosquitto -c /etc/mosquitto/mosquitto.conf

Mar 16 16:33:30 raspberrypi systemd[1]: Starting Mosquitto MQTT v3.1/v3.1.1 Broke
r...
Mar 16 16:33:30 raspberrypi systemd[1]: Started Mosquitto MQTT v3.1/v3.1.1 Broke
r.
```





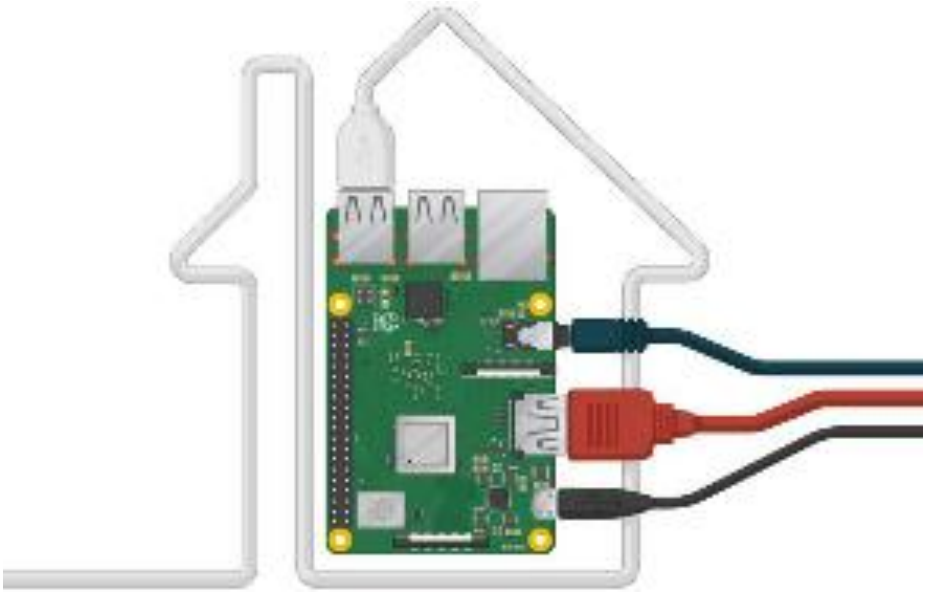
Connection Tab

The marked boxes need to be filled. You need to **Name** of the node, the **Server** box needs the Droplet's IP address, and the **Port** box needs to be set to 1883.

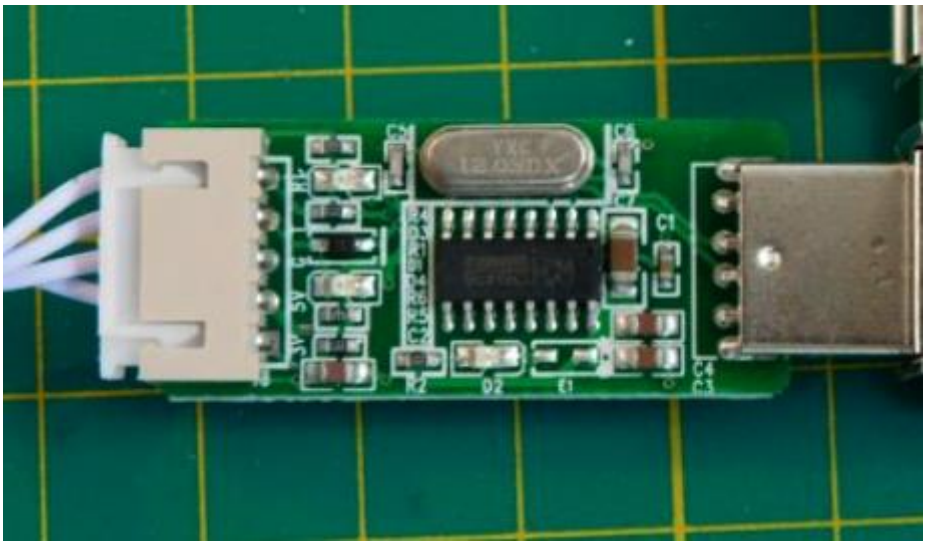


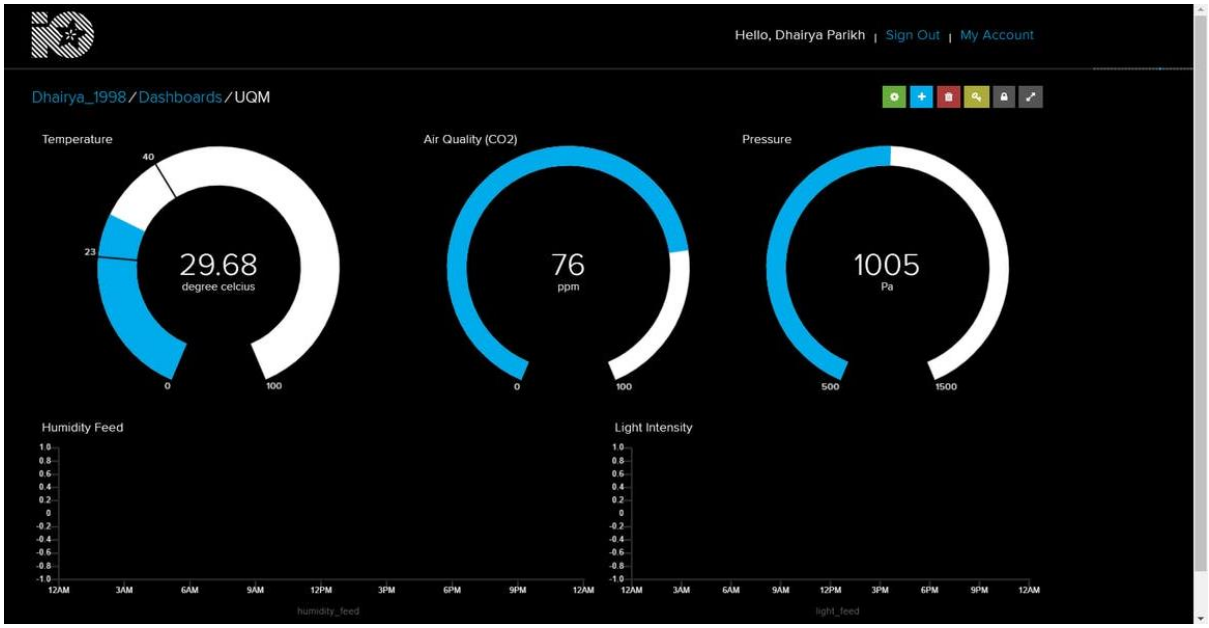

```
root@ubuntu-deployment-test:~#
root@ubuntu-deployment-test:~# mosquitto_sub -h 143.198.122.175 -p 1883 -t test/publish
Hello World!
Hello World!
```

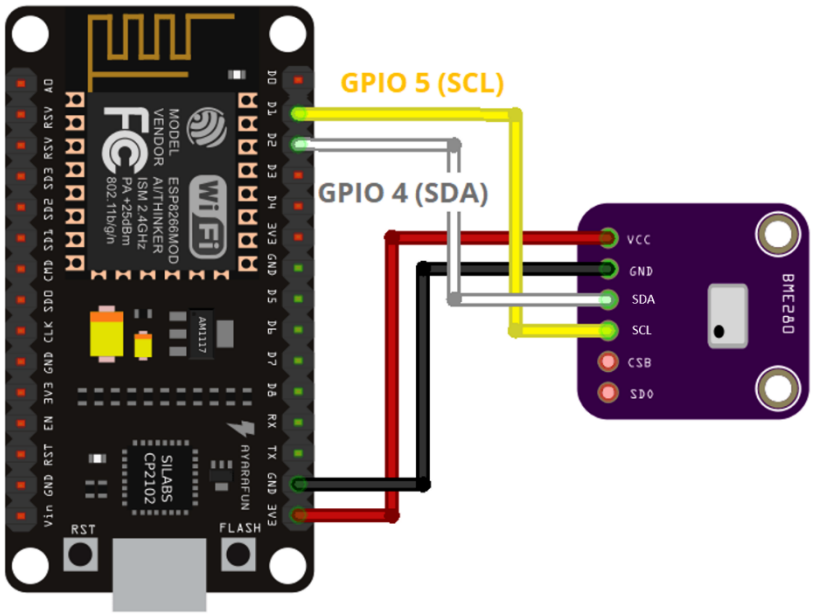
Chapter 8: Project Prototype to Product – How?

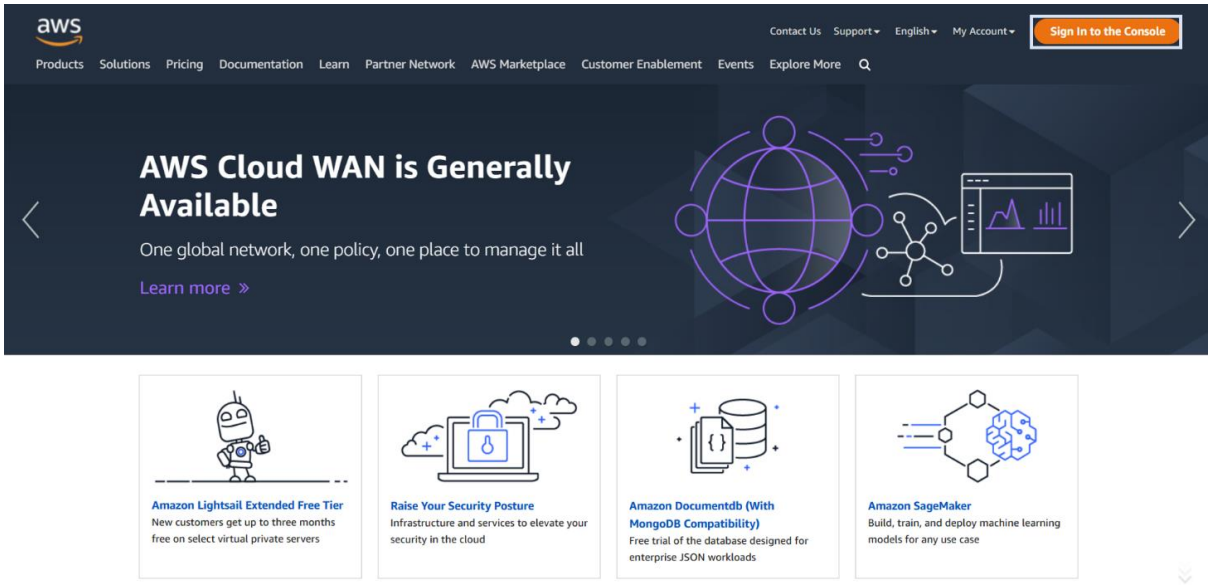


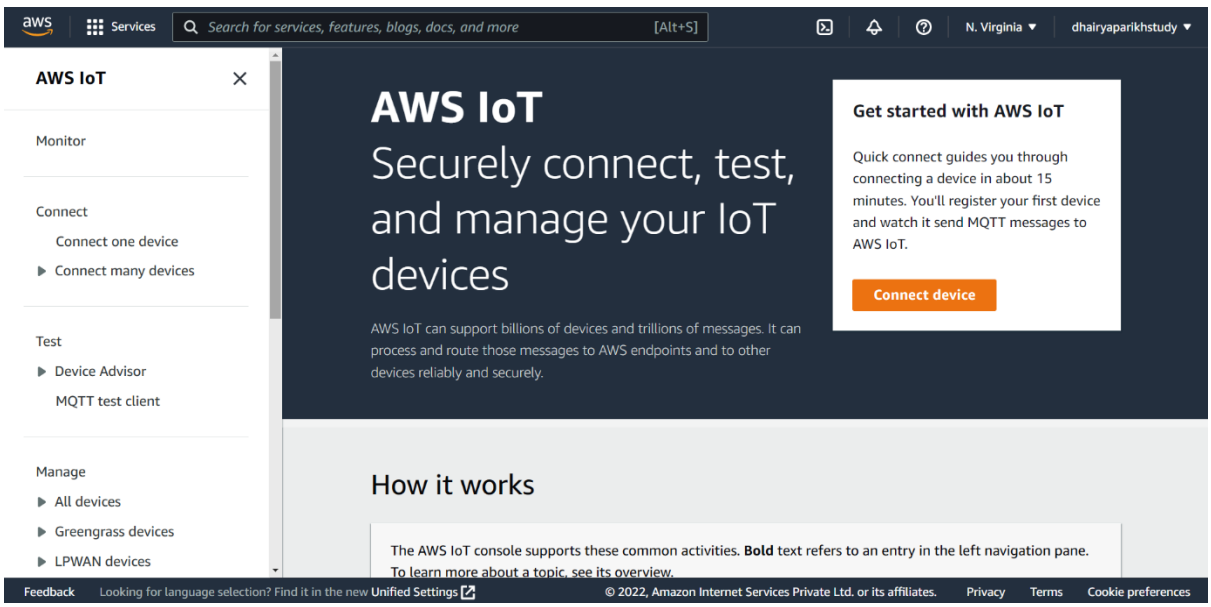
nova PM sensor

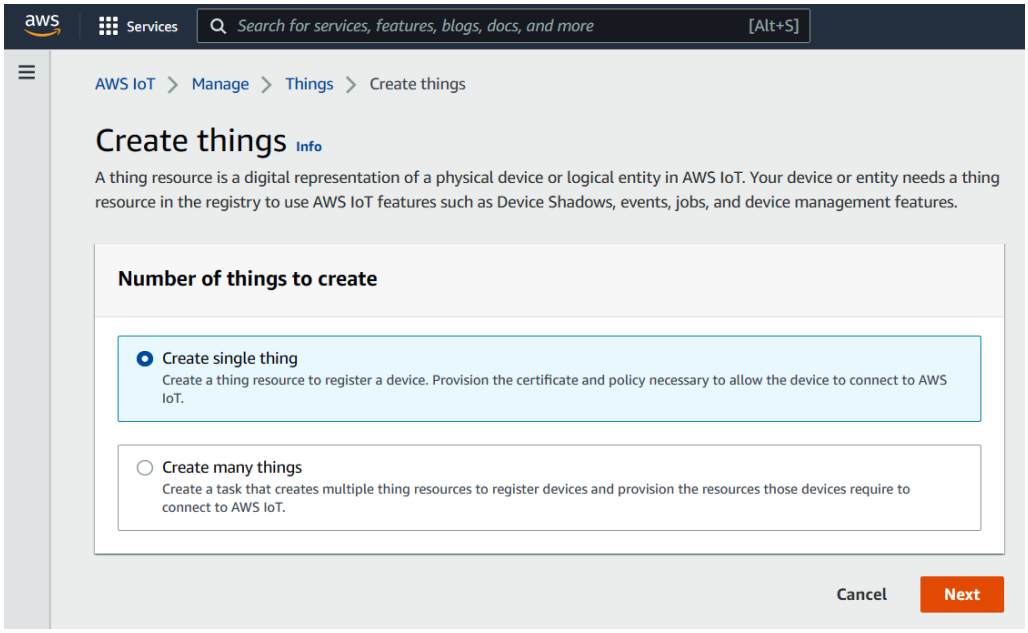


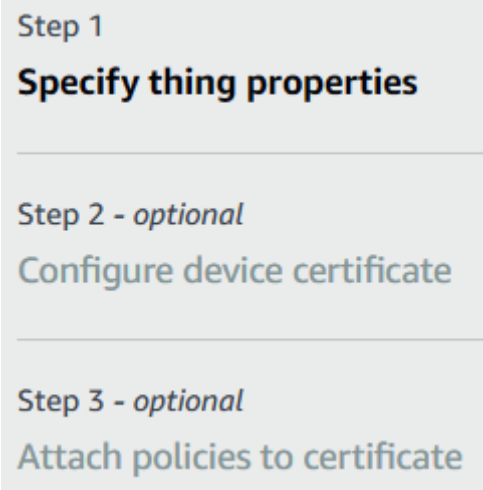

Hello, Dhairya Parikh | Sign Out | My Account
Dhairya_1998 / Dashboards / UQM
Temperature
40
23
29.68
degree celcius
0
100
Air Quality (CO2)
76
ppm
0
100
Pressure
1005
Pa
500
1500
Humidity Feed
1.0
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1.0
12AM
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12AM
humidity_feed
Light Intensity
1.0
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1.0
12AM
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12AM
light_feed

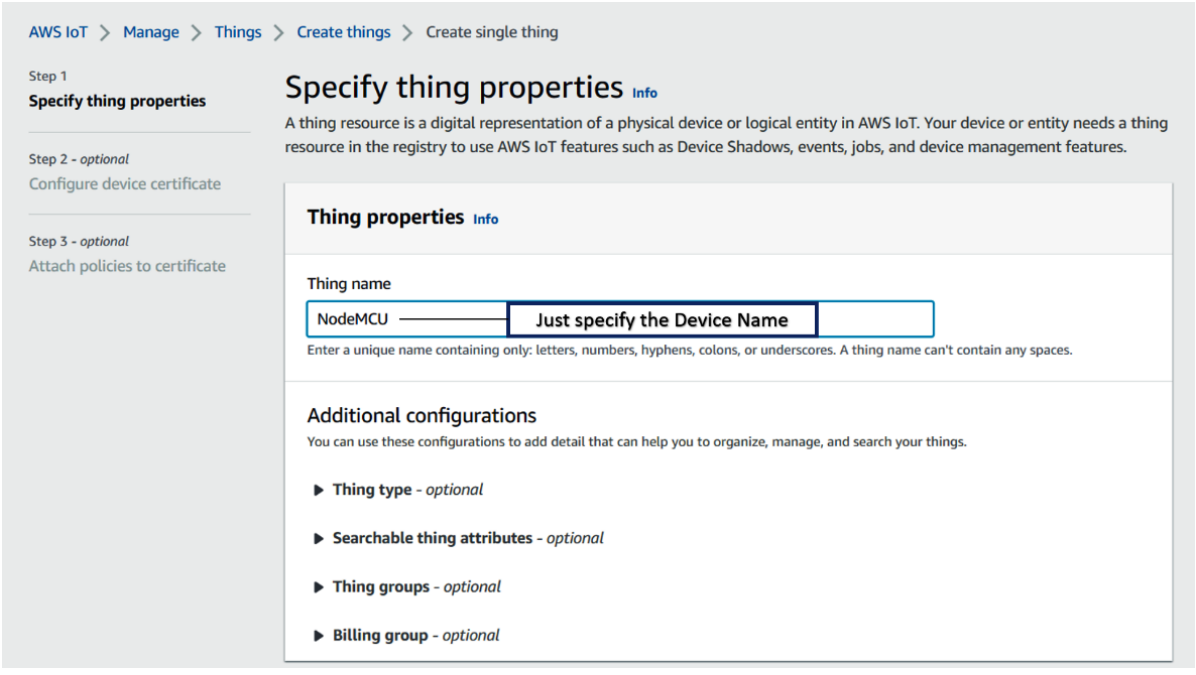

GPIO 5 (SCL)
GPIO 4 (SDA)
VCC
GND
SDA
SCL
CSB
SDO
BME280

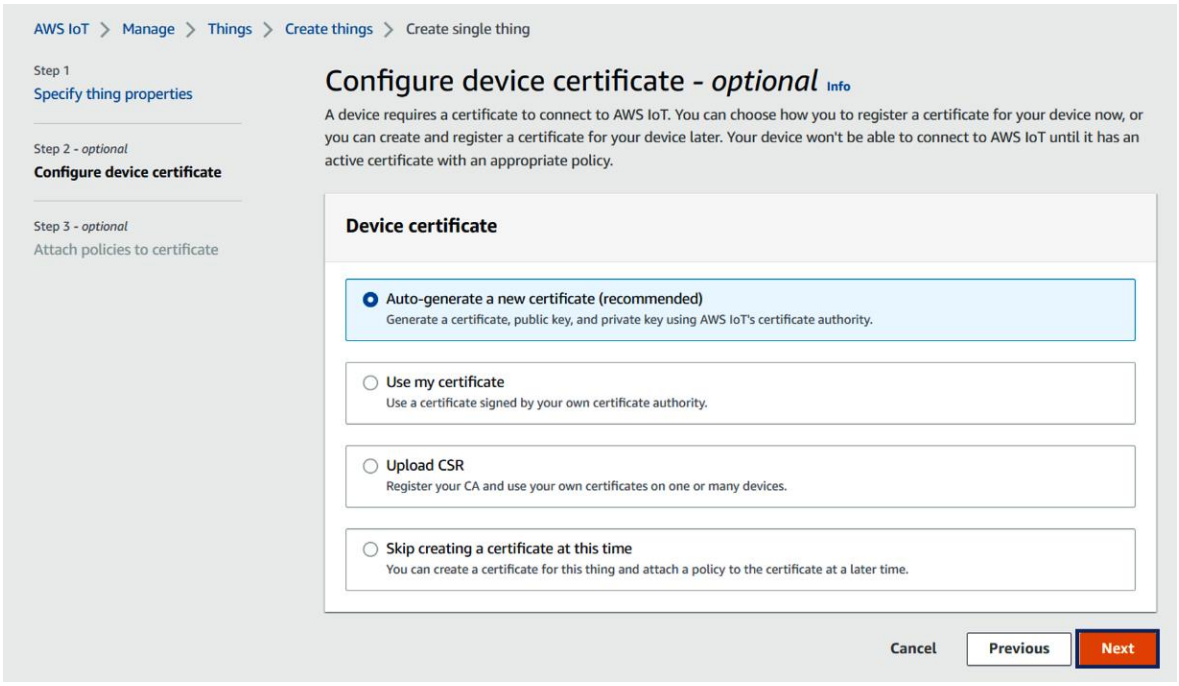

aws
Contact Us
Support
English
My Account
Sign In to the Console
Products
Solutions
Pricing
Documentation
Learn
Partner Network
AWS Marketplace
Customer Enablement
Events
Explore More
AWS Cloud WAN is Generally Available
One global network, one policy, one place to manage it all
Learn more »
Amazon Lightsail Extended Free Tier
New customers get up to three months free on select virtual private servers
Raise Your Security Posture
Infrastructure and services to elevate your security in the cloud
Amazon Documentdb (With MongoDB Compatibility)
Free trial of the database designed for enterprise JSON workloads
Amazon SageMaker
Build, train, and deploy machine learning models for any use case

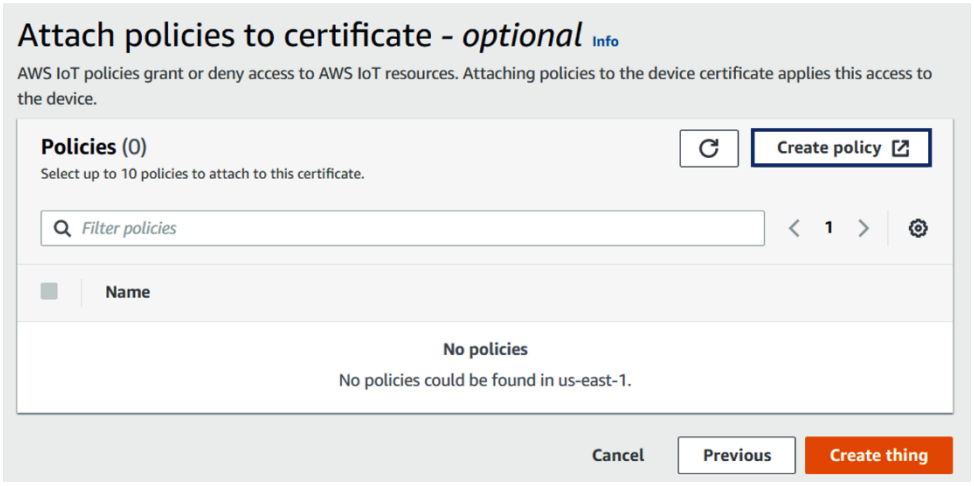

aws
Services
Search for services, features, blogs, docs, and more
[Alt+S]
N. Virginia
dhairyaparikhstudy
AWS IoT
Monitor
Connect
Connect one device
Connect many devices
Test
Device Advisor
MQTT test client
Manage
All devices
Greengrass devices
LPWAN devices
AWS IoT
Securely connect, test, and manage your IoT devices
AWS IoT can support billions of devices and trillions of messages. It can process and route those messages to AWS endpoints and to other devices reliably and securely.
Get started with AWS IoT
Quick connect guides you through connecting a device in about 15 minutes. You'll register your first device and watch it send MQTT messages to AWS IoT.
Connect device
How it works
The AWS IoT console supports these common activities. Bold text refers to an entry in the left navigation pane. To learn more about a topic, see its overview.
Feedback
Looking for language selection? Find it in the new Unified Settings
© 2022, Amazon Internet Services Private Ltd. or its affiliates.
Privacy
Terms
Cookie preferences

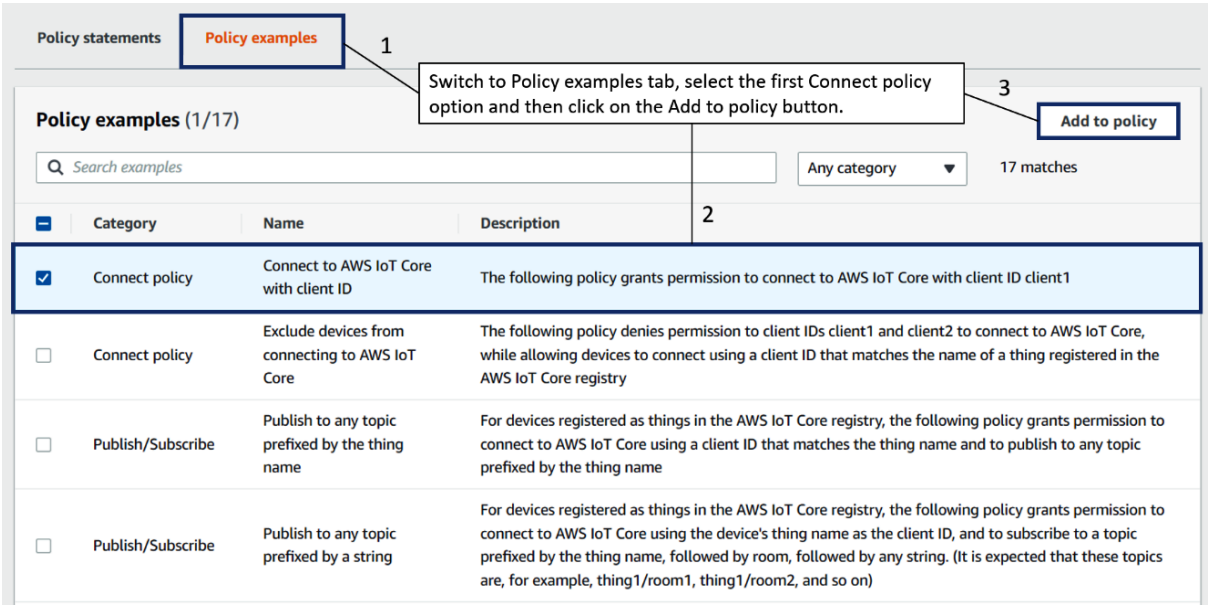

aws
Services
Search for services, features, blogs, docs, and more
[Alt+S]
AWS IoT > Manage > Things > Create things
Create things Info
A thing resource is a digital representation of a physical device or logical entity in AWS IoT. Your device or entity needs a thing resource in the registry to use AWS IoT features such as Device Shadows, events, jobs, and device management features.
Number of things to create
Create single thing
Create a thing resource to register a device. Provision the certificate and policy necessary to allow the device to connect to AWS IoT.
Create many things
Create a task that creates multiple thing resources to register devices and provision the resources those devices require to connect to AWS IoT.
Cancel
Next

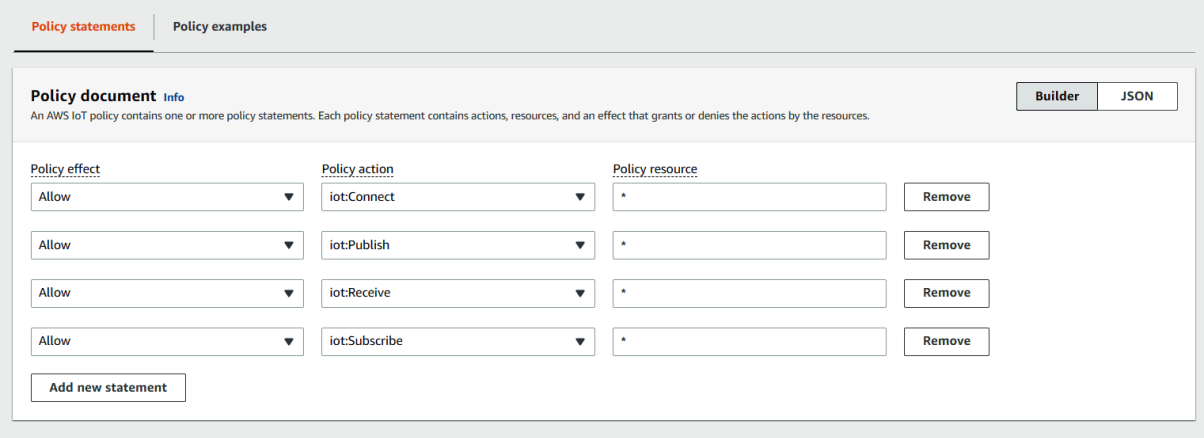

Step 1
Specify thing properties
Step 2 - optional
Configure device certificate
Step 3 - optional
Attach policies to certificate

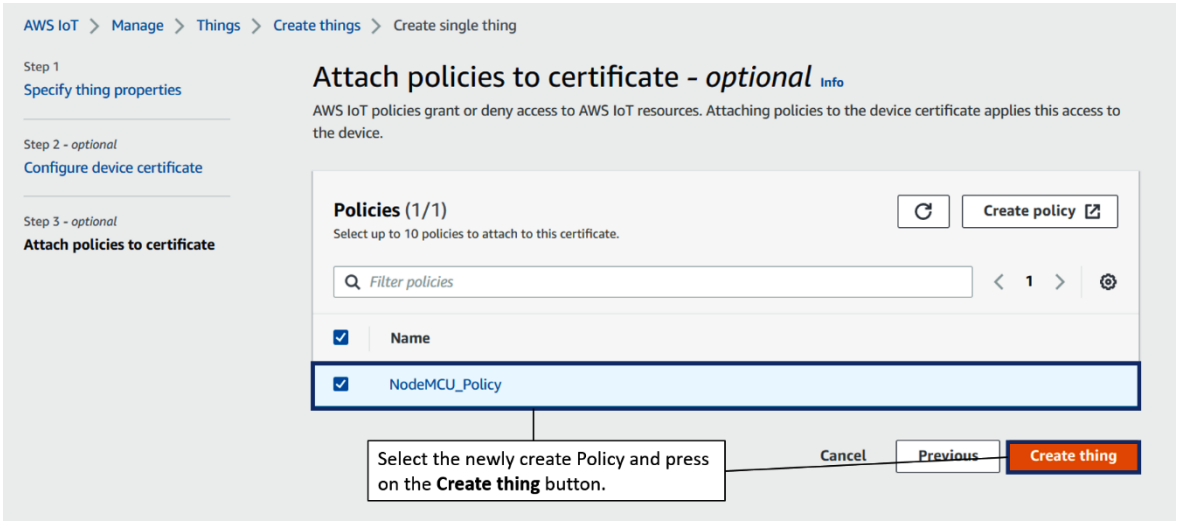

AWS IoT > Manage > Things > Create things > Create single thing
Step 1
Specify thing properties
Step 2 - optional
Configure device certificate
Step 3 - optional
Attach policies to certificate
Specify thing properties Info
A thing resource is a digital representation of a physical device or logical entity in AWS IoT. Your device or entity needs a thing resource in the registry to use AWS IoT features such as Device Shadows, events, jobs, and device management features.
Thing properties Info
Thing name
NodeMCU
Just specify the Device Name
Enter a unique name containing only: letters, numbers, hyphens, colons, or underscores. A thing name can't contain any spaces.
Additional configurations
You can use these configurations to add detail that can help you to organize, manage, and search your things.
Thing type - optional
Searchable thing attributes - optional
Thing groups - optional
Billing group - optional

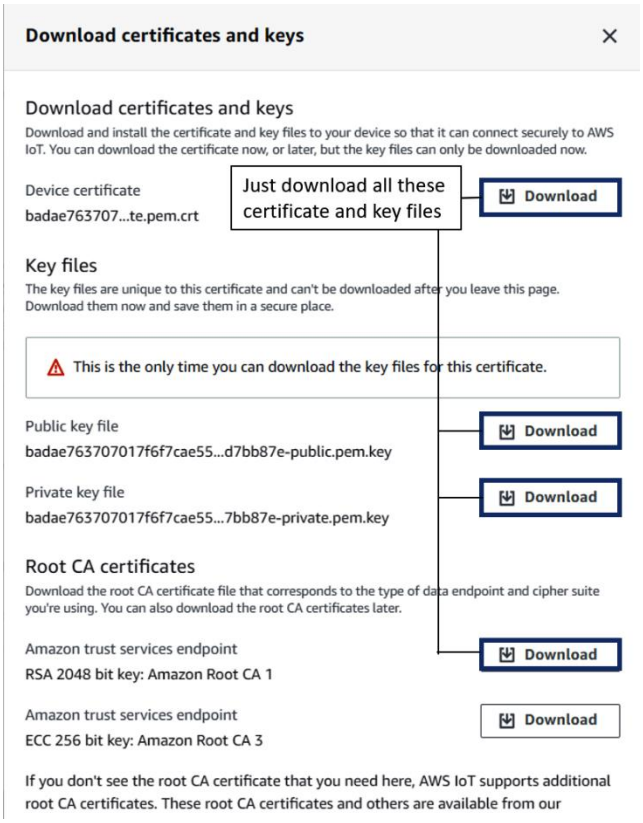

AWS IoT > Manage > Things > Create things > Create single thing
Step 1
Specify thing properties
Step 2 - optional
Configure device certificate
Step 3 - optional
Attach policies to certificate
Configure device certificate - optional Info
A device requires a certificate to connect to AWS IoT. You can choose how you to register a certificate for your device now, or you can create and register a certificate for your device later. Your device won't be able to connect to AWS IoT until it has an active certificate with an appropriate policy.
Device certificate
Auto-generate a new certificate (recommended)
Generate a certificate, public key, and private key using AWS IoT's certificate authority.
Use my certificate
Use a certificate signed by your own certificate authority.
Upload CSR
Register your CA and use your own certificates on one or many devices.
Skip creating a certificate at this time
You can create a certificate for this thing and attach a policy to the certificate at a later time.
Cancel
Previous
Next

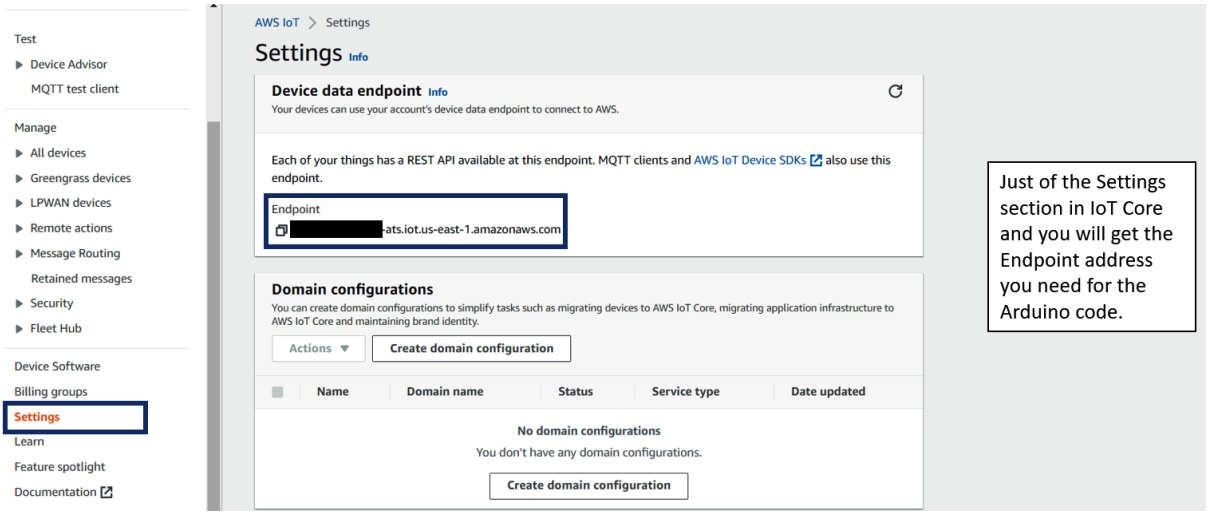

Attach policies to certificate - optional Info
AWS IoT policies grant or deny access to AWS IoT resources. Attaching policies to the device certificate applies this access to the device.
Policies (0)
Select up to 10 policies to attach to this certificate.
Create policy
Filter policies
1
Name
No policies
No policies could be found in us-east-1.
Cancel
Previous
Create thing


Policy statements
Policy examples
1
Switch to Policy examples tab, select the first Connect policy option and then click on the Add to policy button.
3
Add to policy
Policy examples (1/17)
Search examples
Any category
17 matches
2
Category
Name
Description
Connect policy
Connect to AWS IoT Core with client ID
The following policy grants permission to connect to AWS IoT Core with client ID client1
Connect policy
Exclude devices from connecting to AWS IoT Core
The following policy denies permission to client IDs client1 and client2 to connect to AWS IoT Core, while allowing devices to connect using a client ID that matches the name of a thing registered in the AWS IoT Core registry
Publish/Subscribe
Publish to any topic prefixed by the thing name
For devices registered as things in the AWS IoT Core registry, the following policy grants permission to connect to AWS IoT Core using a client ID that matches the thing name and to publish to any topic prefixed by the thing name
Publish/Subscribe
Publish to any topic prefixed by a string
For devices registered as things in the AWS IoT Core registry, the following policy grants permission to connect to AWS IoT Core using the device's thing name as the client ID, and to subscribe to a topic prefixed by the thing name, followed by room, followed by any string. (It is expected that these topics are, for example, thing1/room1, thing1/room2, and so on)

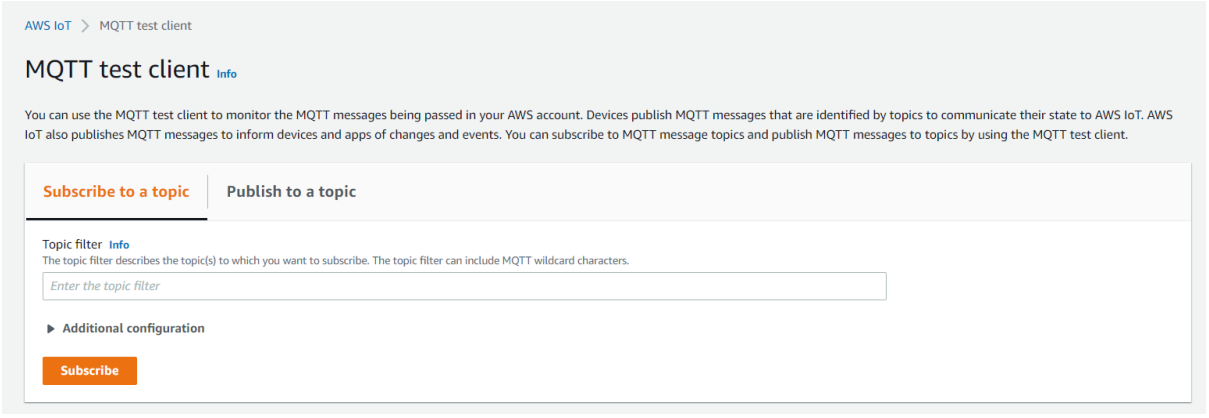

Policy statements
Policy examples
Policy document Info
An AWS IoT policy contains one or more policy statements. Each policy statement contains actions, resources, and an effect that grants or denies the actions by the resources.
Builder
JSON
Policy effect
Policy action
Policy resource
Allow
iot:Connect
*
Remove
Allow
iot:Publish
*
Remove
Allow
iot:Receive
*
Remove
Allow
iot:Subscribe
*
Remove
Add new statement


AWS IoT > Manage > Things > Create things > Create single thing
Step 1
Specify thing properties
Step 2 - optional
Configure device certificate
Step 3 - optional
Attach policies to certificate
Attach policies to certificate - optional Info
AWS IoT policies grant or deny access to AWS IoT resources. Attaching policies to the device certificate applies this access to the device.
Policies (1/1)
Select up to 10 policies to attach to this certificate.
Create policy
Filter policies
1
Name
NodeMCU_Policy
Select the newly create Policy and press on the Create thing button.
Cancel
Previous
Create thing

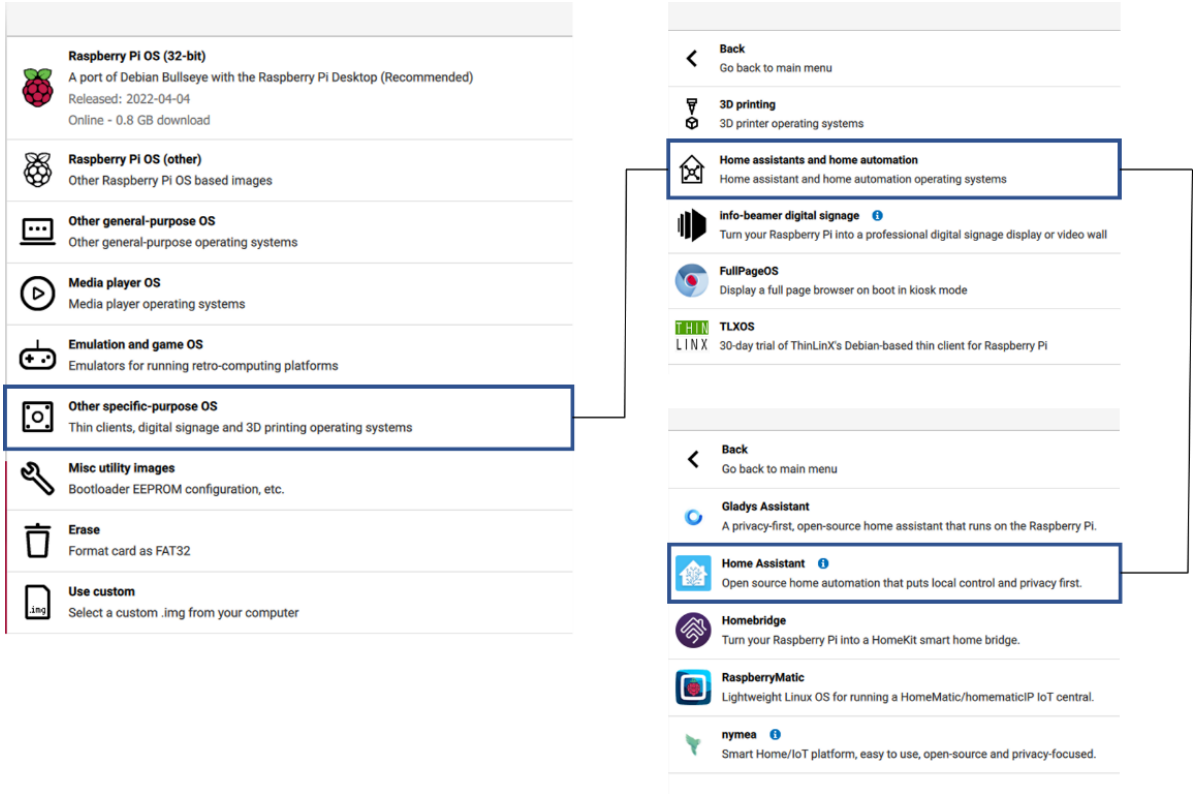

Download certificates and keys
Download certificates and keys
Download and install the certificate and key files to your device so that it can connect securely to AWS IoT. You can download the certificate now, or later, but the key files can only be downloaded now.
Device certificate
badae763707...te.pem.crt
Just download all these certificate and key files
Download
Key files
The key files are unique to this certificate and can't be downloaded after you leave this page. Download them now and save them in a secure place.
This is the only time you can download the key files for this certificate.
Public key file
badae763707017f6f7cae55...d7bb87e-public.pem.key
Download
Private key file
badae763707017f6f7cae55...7bb87e-private.pem.key
Download
Root CA certificates
Download the root CA certificate file that corresponds to the type of data endpoint and cipher suite you're using. You can also download the root CA certificates later.
Amazon trust services endpoint
RSA 2048 bit key: Amazon Root CA 1
Download
Amazon trust services endpoint
ECC 256 bit key: Amazon Root CA 3
Download
If you don't see the root CA certificate that you need here, AWS IoT supports additional root CA certificates. These root CA certificates and others are available from our

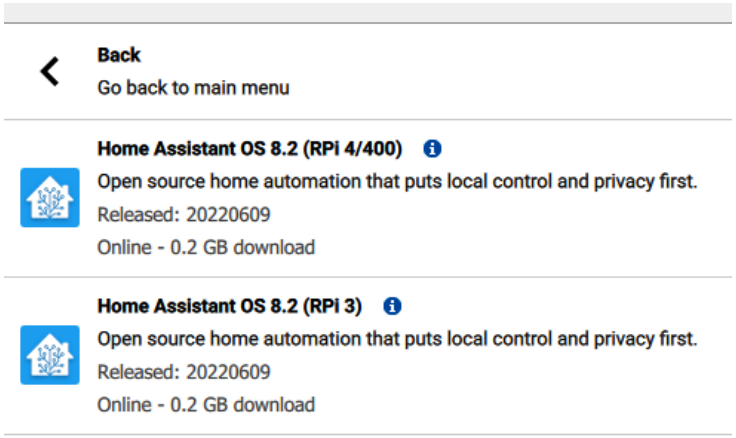


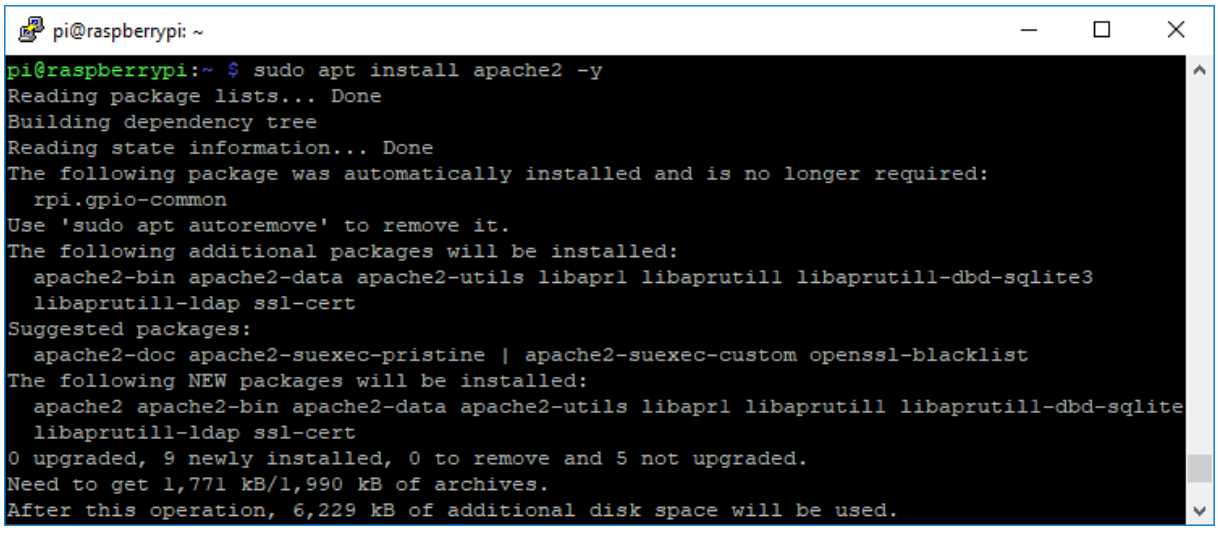
Just of the Settings section in IoT Core and you will get the Endpoint address you need for the Arduino code.

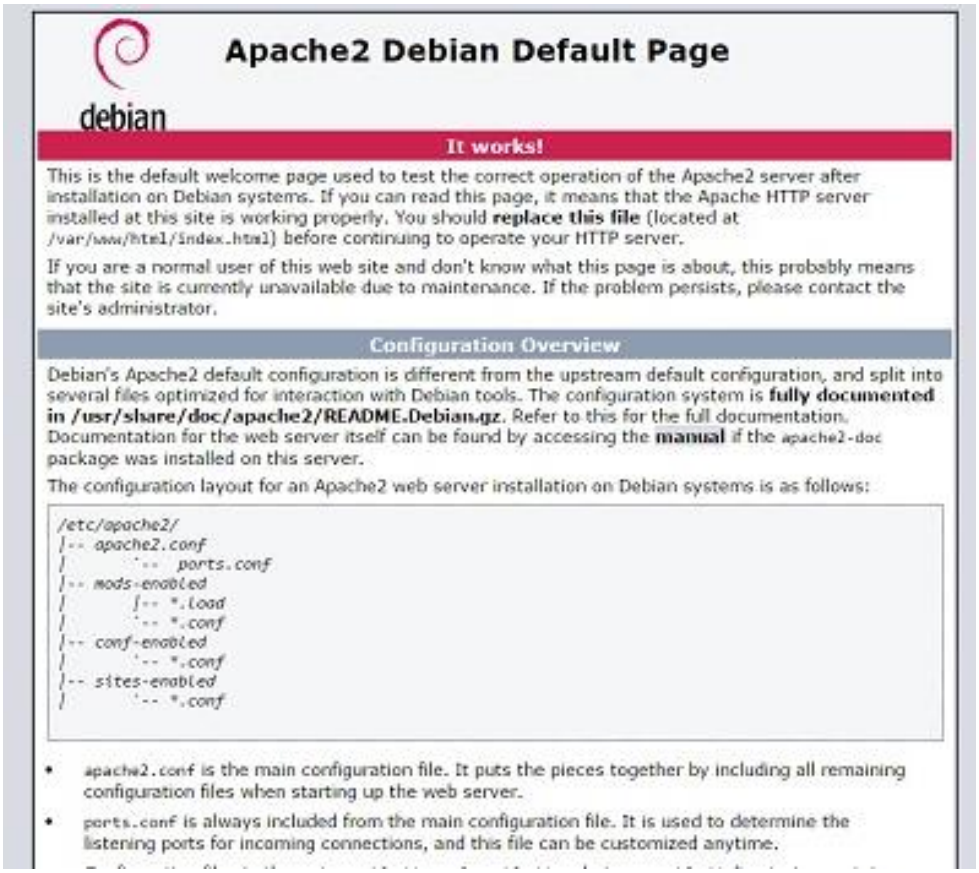


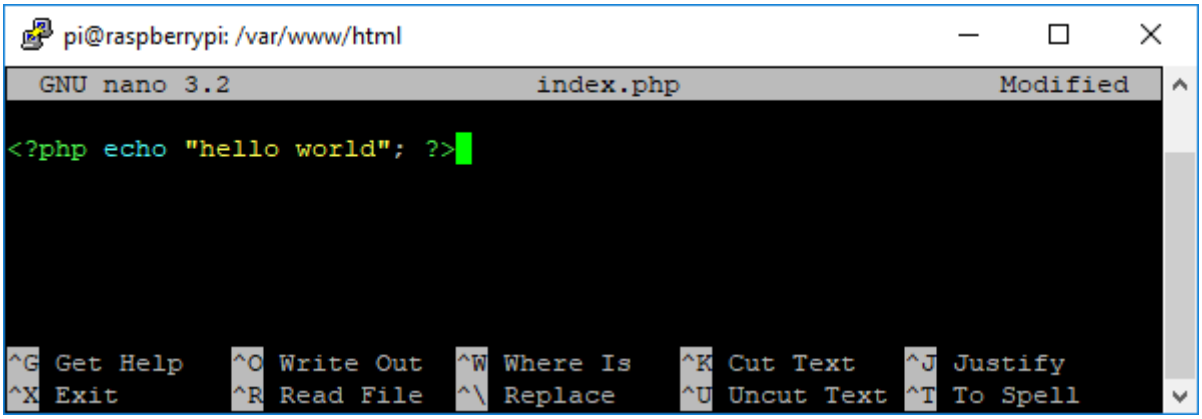
```
Temperature : 33.68%  Pressure : 99475.84   Altitude : 155.11
Temperature : 33.68%  Pressure : 99475.66   Altitude : 155.12
Temperature : 33.67%  Pressure : 99474.95   Altitude : 155.18
Received [ESP8266/subscribe]: {
  "message": "Hello from AWS IoT console"
}
Temperature : 33.67%  Pressure : 99474.60   Altitude : 155.21
Temperature : 33.67%  Pressure : 99474.25   Altitude : 155.24
Temperature : 33.68%  Pressure : 99474.44   Altitude : 155.22
```

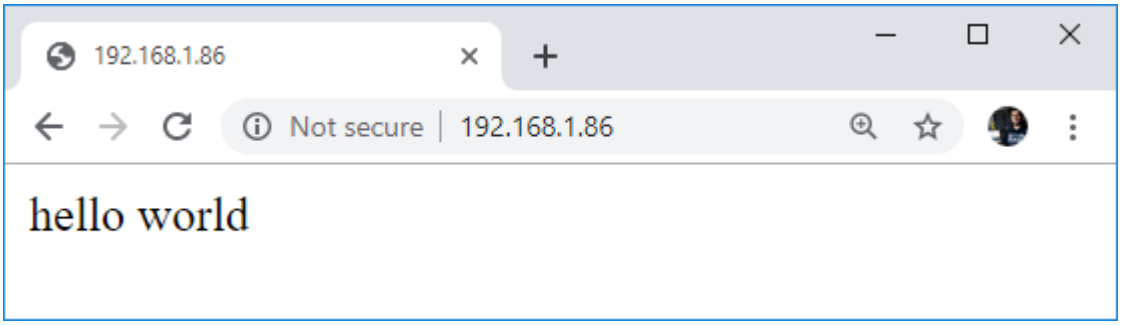

Raspberry Pi OS (32-bit)
A port of Debian Bullseye with the Raspberry Pi Desktop (Recommended)
Released: 2022-04-04
Online - 0.8 GB download
Raspberry Pi OS (other)
Other Raspberry Pi OS based images
Other general-purpose OS
Other general-purpose operating systems
Media player OS
Media player operating systems
Emulation and game OS
Emulators for running retro-computing platforms
Other specific-purpose OS
Thin clients, digital signage and 3D printing operating systems
Misc utility images
Bootloader EEPROM configuration, etc.
Erase
Format card as FAT32
Use custom
Select a custom .img from your computer
Back
Go back to main menu
3D printing
3D printer operating systems
Home assistants and home automation
Home assistant and home automation operating systems
info-beamer digital signage
Turn your Raspberry Pi into a professional digital signage display or video wall
FullPageOS
Display a full page browser on boot in kiosk mode
TLXOS
30-day trial of ThinLinX's Debian-based thin client for Raspberry Pi
Back
Go back to main menu
Gladys Assistant
A privacy-first, open-source home assistant that runs on the Raspberry Pi.
Home Assistant
Open source home automation that puts local control and privacy first.
Homebridge
Turn your Raspberry Pi into a HomeKit smart home bridge.
RaspberryMatic
Lightweight Linux OS for running a HomeMatic/homematicIP IoT central.
nymea
Smart Home/IoT platform, easy to use, open-source and privacy-focused.

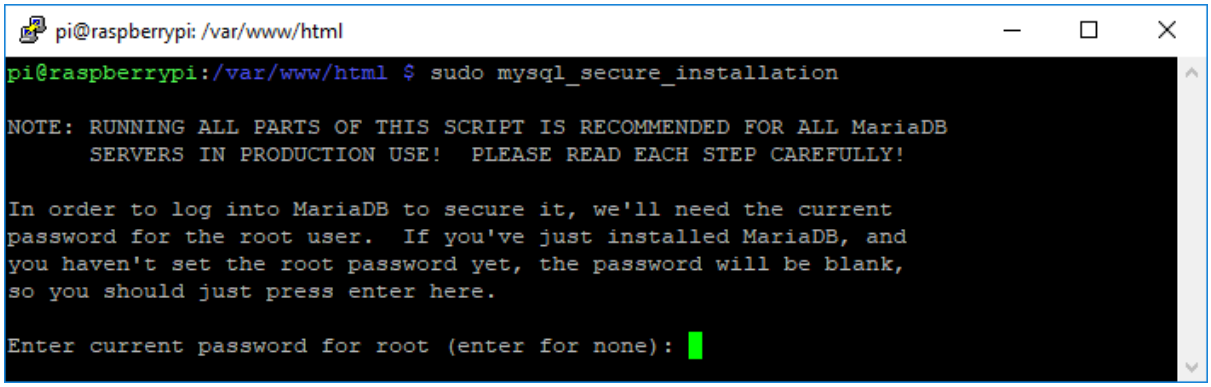

Back
Go back to main menu
Home Assistant OS 8.2 (RPi 4/400)
Open source home automation that puts local control and privacy first.
Released: 20220609
Online - 0.2 GB download
Home Assistant OS 8.2 (RPi 3)
Open source home automation that puts local control and privacy first.
Released: 20220609
Online - 0.2 GB download

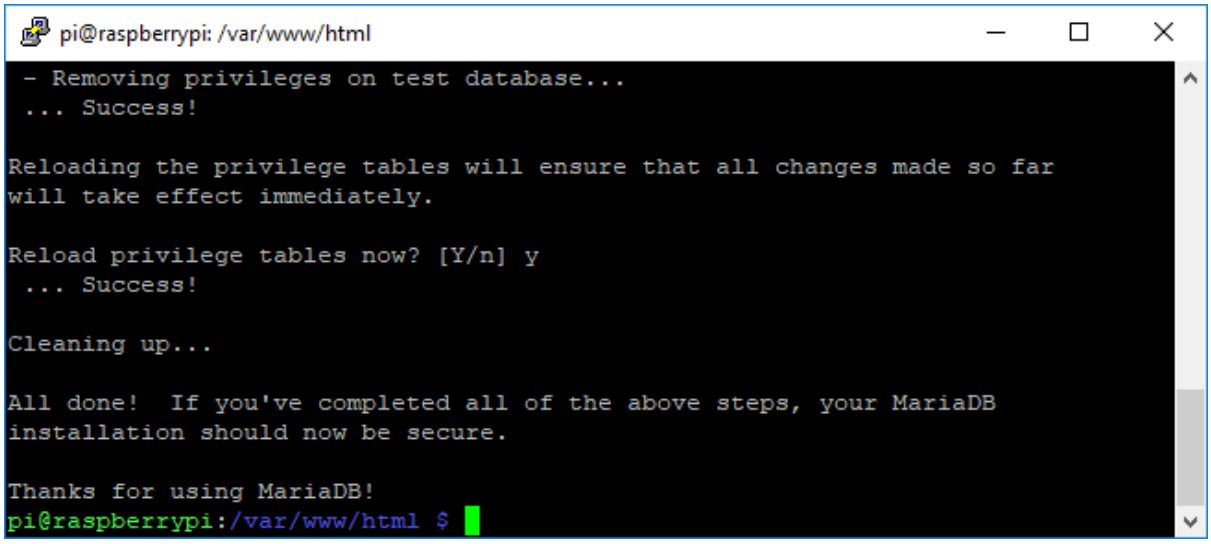

pi@raspberrypi: ~
pi@raspberrypi:~ $ sudo apt install apache2 -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
rpi.gpio-common
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
apache2-bin apache2-data apache2-utils libaprl libaprutill libaprutill-dbd-sqlite3
libaprutill-ldap ssl-cert
Suggested packages:
apache2-doc apache2-suexec-pristine | apache2-suexec-custom openssl-blacklist
The following NEW packages will be installed:
apache2 apache2-bin apache2-data apache2-utils libaprl libaprutill libaprutill-dbd-sqlite
libaprutill-ldap ssl-cert
0 upgraded, 9 newly installed, 0 to remove and 5 not upgraded.
Need to get 1,771 kB/1,990 kB of archives.
After this operation, 6,229 kB of additional disk space will be used.

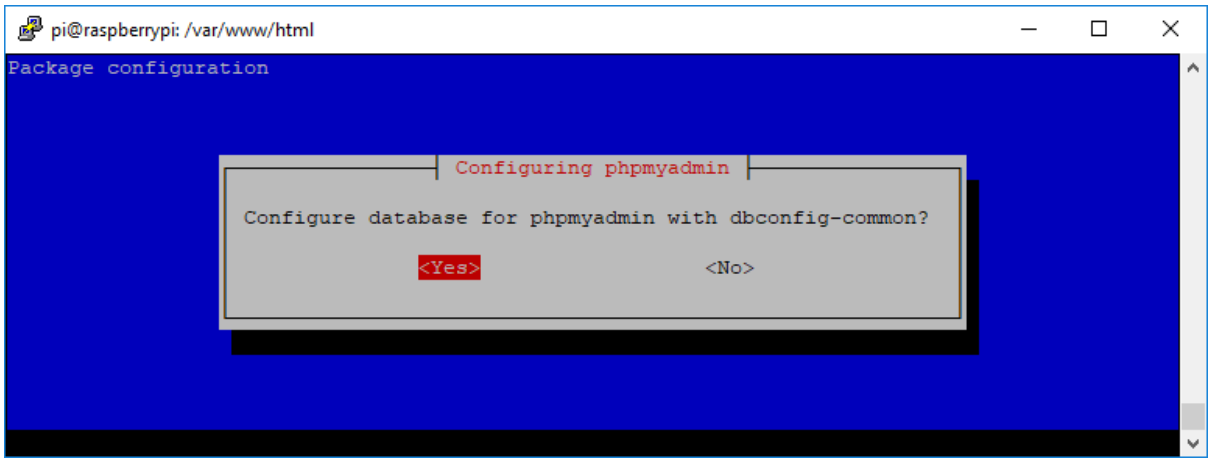

Apache2 Debian Default Page
debian
It works!
This is the default welcome page used to test the correct operation of the Apache2 server after installation on Debian systems. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should replace this file (located at /var/www/html/index.html) before continuing to operate your HTTP server.
If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.
Configuration Overview
Debian's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Debian tools. The configuration system is fully documented in /usr/share/doc/apache2/README.Debian.gz. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the manual if the apache2-doc package was installed on this server.
The configuration layout for an Apache2 web server installation on Debian systems is as follows:
/etc/apache2/
|-- apache2.conf
| `-- ports.conf
|-- mods-enabled
| |-- *.load
| `-- *.conf
|-- conf-enabled
| `-- *.conf
|-- sites-enabled
| `-- *.conf
apache2.conf is the main configuration file. It puts the pieces together by including all remaining configuration files when starting up the web server.
ports.conf is always included from the main configuration file. It is used to determine the listening ports for incoming connections, and this file can be customized anytime.

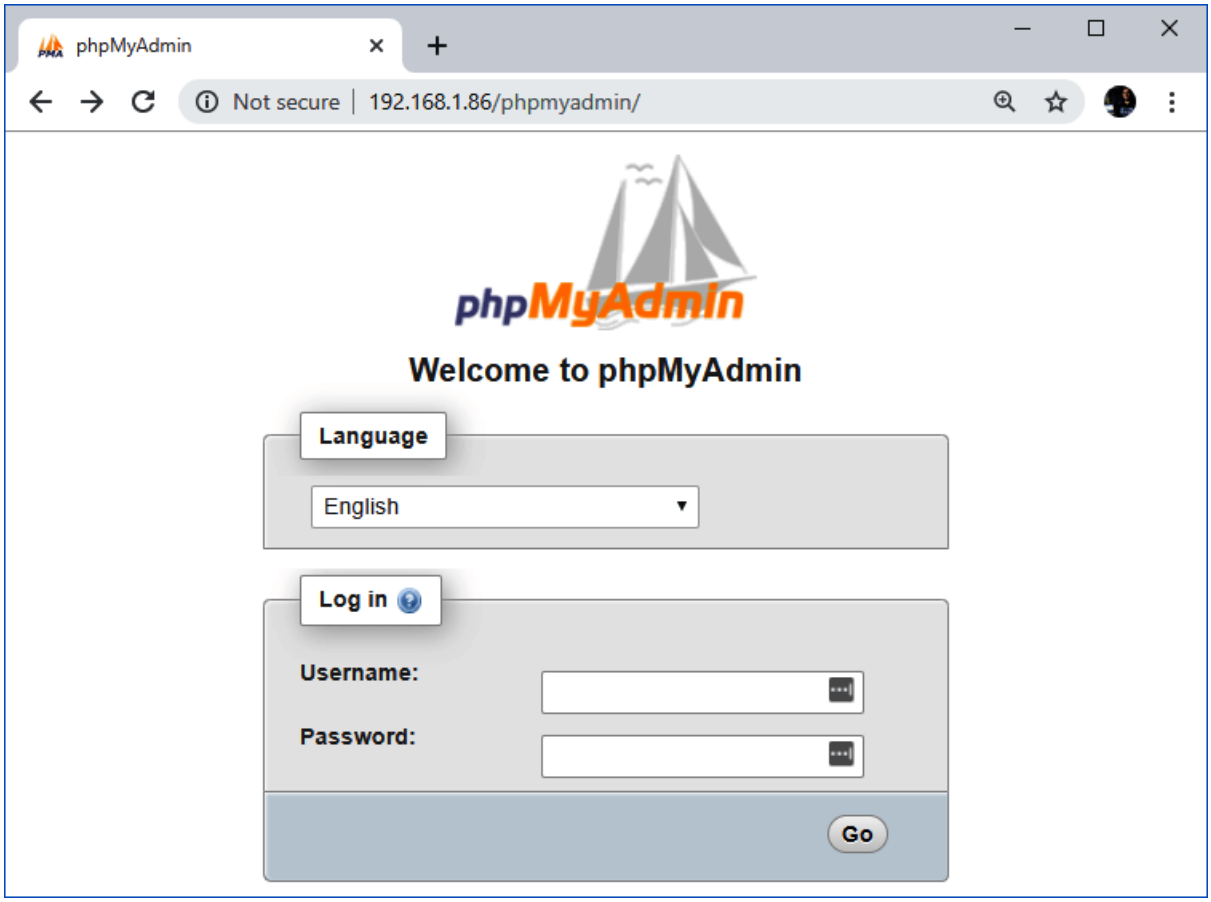

pi@raspberrypi: /var/www/html
GNU nano 3.2 index.php Modified
<?php echo "hello world"; ?>
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell

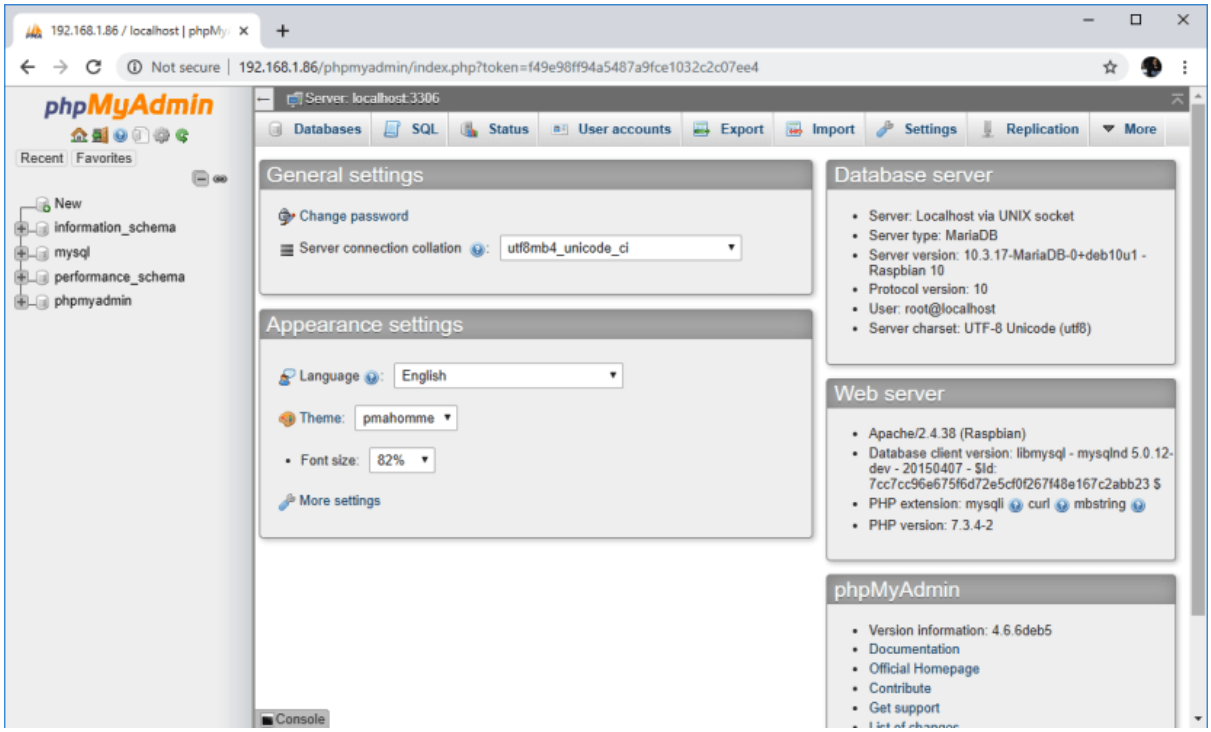

192.168.1.86
Not secure | 192.168.1.86
hello world


pi@raspberrypi: /var/www/html
pi@raspberrypi:/var/www/html $ sudo mysql_secure_installation
NOTE: RUNNING ALL PARTS OF THIS SCRIPT IS RECOMMENDED FOR ALL MariaDB
SERVERS IN PRODUCTION USE! PLEASE READ EACH STEP CAREFULLY!
In order to log into MariaDB to secure it, we'll need the current
password for the root user. If you've just installed MariaDB, and
you haven't set the root password yet, the password will be blank,
so you should just press enter here.
Enter current password for root (enter for none):


pi@raspberrypi: /var/www/html
- Removing privileges on test database...
... Success!
Reloading the privilege tables will ensure that all changes made so far
will take effect immediately.
Reload privilege tables now? [Y/n] y
... Success!
Cleaning up...
All done! If you've completed all of the above steps, your MariaDB
installation should now be secure.
Thanks for using MariaDB!
pi@raspberrypi:/var/www/html $


pi@raspberrypi: /var/www/html
Package configuration
Configuring phpmyadmin
Configure database for phpmyadmin with dbconfig-common?
<Yes>
<No>


phpMyAdmin
Not secure | 192.168.1.86/phpmyadmin/
phpMyAdmin
Welcome to phpMyAdmin
Language
English
Log in
Username:
Password:
Go


192.168.1.86 / localhost | phpMy
Not secure | 192.168.1.86/phpmyadmin/index.php?token=f49e98ff94a5487a9fce1032c2c07ee4
phpMyAdmin
Recent Favorites
New
information_schema
mysql
performance_schema
phpmyadmin
Server: localhost:3306
Databases SQL Status User accounts Export Import Settings Replication More
General settings
Change password
Server connection collation: utf8mb4_unicode_ci
Appearance settings
Language: English
Theme: pmahomme
Font size: 82%
More settings
Database server
Server: Localhost via UNIX socket
Server type: MariaDB
Server version: 10.3.17-MariaDB-0+deb10u1 - Raspbian 10
Protocol version: 10
User: root@localhost
Server charset: UTF-8 Unicode (utf8)
Web server
Apache/2.4.38 (Raspbian)
Database client version: libmysql - mysqlnd 5.0.12-dev - 20150407 - $Id: 7cc7cc96e675f6d72e5cf0f267f48e167c2abb23 $
PHP extension: mysqli curl mbstring
PHP version: 7.3.4-2
phpMyAdmin
Version information: 4.6.6deb5
Documentation
Official Homepage
Contribute
Get support
Console