

**EXCLUSIVE NODE-RED ON IBM I
TRAINING DAY**

£50 per student or £100 per company (5 seats)

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Invest in your professional development & take your Node-RED expertise to new heights.
Join us virtually on **19 July 2023** & be part of this exciting training event!

- Gain in-depth knowledge of Node-RED & its capabilities
- Learn how to create powerful automation workflows & streamline your processes
- Learn how to integrate Node-RED & IBM i
- Get hands-on experience through practical exercises & real-world examples

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Raspberry Pi
Meets
IBM i

Andy Youens
FormaServe Systems Ltd
IBM Champion 2021, 2022 & 2023



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Presenter - Andy Youens



IBM i
Consultant/Instructor
at FormaServe for
over 33 years

Over 40 years IT
experience working
with S/34, S/36,
AS400, iSeries & IBM i

Specialties IBM i RPG
PHP DB2 & Open
Source on IBM i

Instructor & article
writer

IBM Champion 2021,
2022 & 2023
Certified IBM
Developer

Prior to IT, Andy is
proud to have served
10 years in the Royal
Navy



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FormaServe Systems Ltd



- We are proud to be a leading IBM i software vendor with a remarkable track record of over 33 years
- Our company offers comprehensive IBM i training courses, both remotely & on-site, to equip individuals & teams with the necessary skills & knowledge
- As open-source on IBM i specialists, we possess deep expertise in leveraging open-source technologies to enhance & optimize IBM i environments
- Our team comprises modernisation experts who can guide you in transforming your IBM i systems to embrace modern practices and technologies

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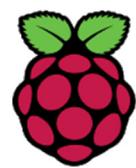
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Raspberry Pi & Pico



Raspberry Pi®



Don't let its size fool you!

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What is the Raspberry Pi?



- Raspberry Pi is the worlds most popular SBC (Single Board Computer)
- Can do pretty much everything a desktop can do
- Suitable for all ages
- Comes with all the software you require
- Great for developers

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Raspberry Pi Operating Systems

Raspberry Pi OS

- a Linux distro
- Was Raspbian

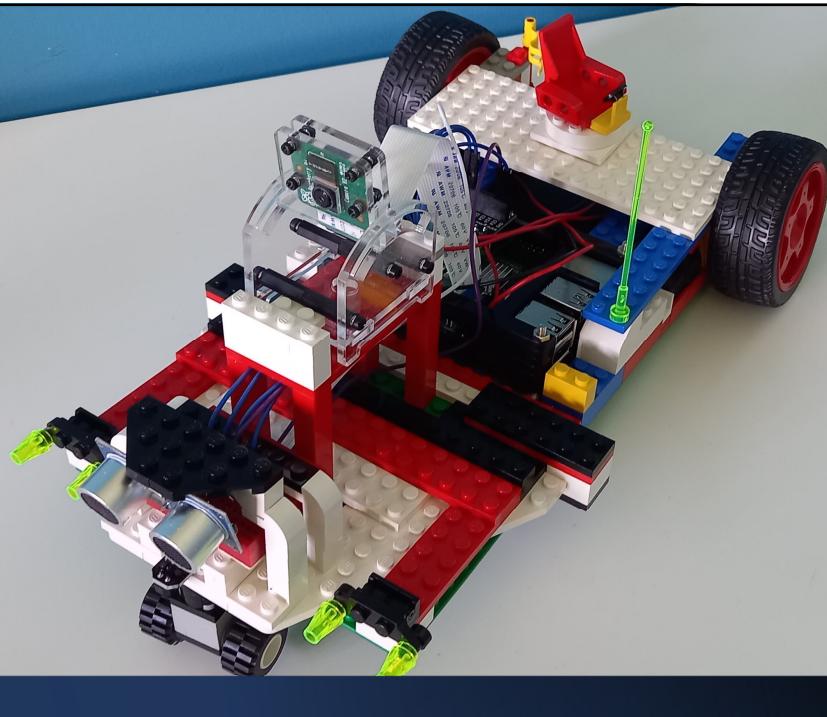
Ubuntu

Windows 10 IoT Core

Other Linux distro's can be installed

- Ubuntu Mate
- Arch Linux ARM
- Fedora

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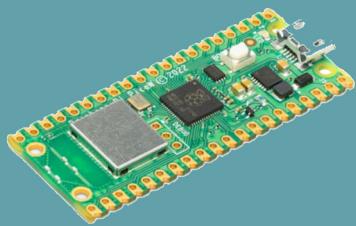


Raspberry Pi Projects

- Fun project with grandkids!
- Uses sensors for avoidance & following lines
- Camera sends photo's back to IFS on IBM i

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What is the PICO W?



- Aka Pi Cow 😎
- A microcontroller board
- Released in 2022
- Has a WIFI module, allows it to communicate with Wi-Fi & Bluetooth
- Pico W is built around the RP2040 microcontroller chip
- Has 40 GPIO pins for sensors & IOT devices
- Onboard LED & temperature sensor
- Runs Micro-Python

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Pico Projects

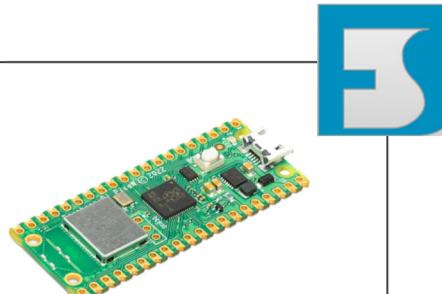
• Garage Doors

- Is my garage door open?
- Opening/closing a garage door from mobile

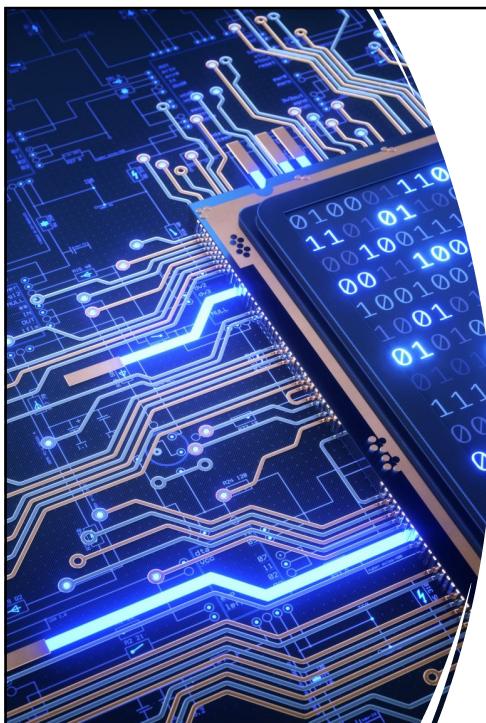
• Soil Moisture Monitor

• Weather Station Monitor

• Provide Web Services & Web Pages



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Communicating with the IBM i - How?

• **Remote Shells**

- SSH/SFTP/Telnet/FTP/RSync

• **Database Connectivity**

- ODBC/JDBC

• **Web Services**

- REST/SOAP interfaces

• **IBM MQ**

• **Node-RED**

• **MQTT**

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What is MQTT?

■ A messaging protocol designed for efficient communication between devices

■ Clients publish messages to topics & clients subscribe to topics to receive messages

■ Known for its simplicity, low bandwidth usage & support for unreliable networks

■ Widely adopted for IoT applications due to its efficiency & scalability

■ Developed by IBM in 1999

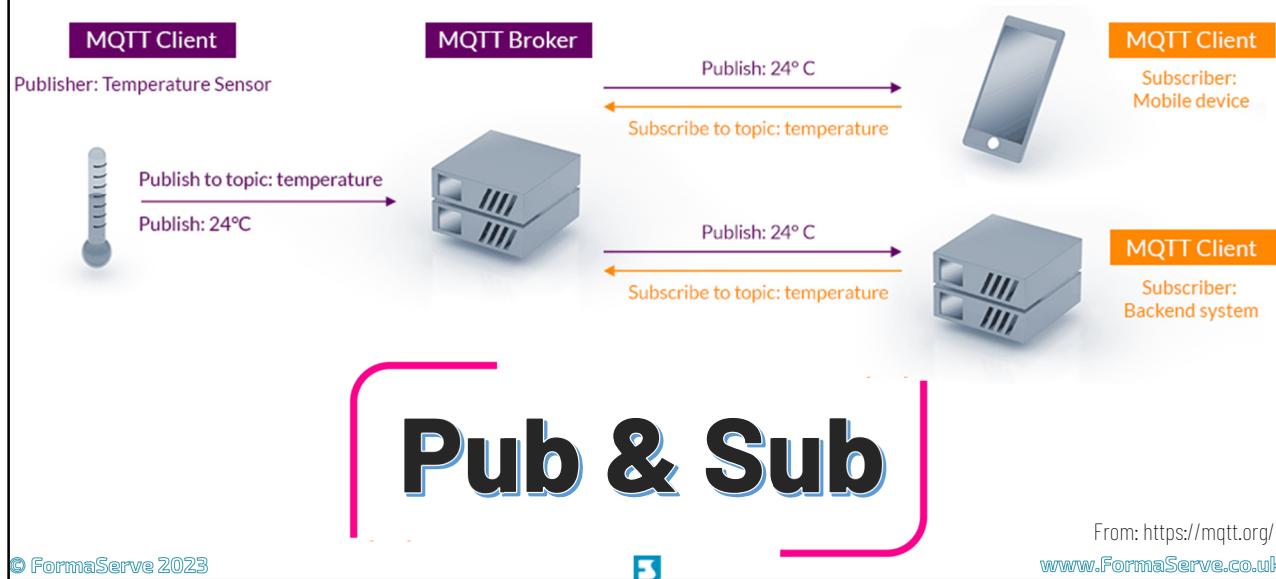
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Who Uses MQTT?

- **Automotive** - Used by car manufacturers like BMW to manage their car-sharing service that operates a fleet of over 14,000 vehicles across 18 cities. Also used for predictive maintenance, driver assistance & autonomous driving features.
- **Logistics** - Used by companies like Matternet to enable real-time monitoring of their autonomous drones that deliver medical supplies
- **Manufacturing** - Used by companies like Celikler Holding to monitor their power plant operations. Enables easy data transfer from the factory floor to the cloud.
- **Smart Home** - Used by many consumer IoT devices like thermostats, appliances, security systems, smart watches, fitness trackers, etc.

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MQTT Architecture



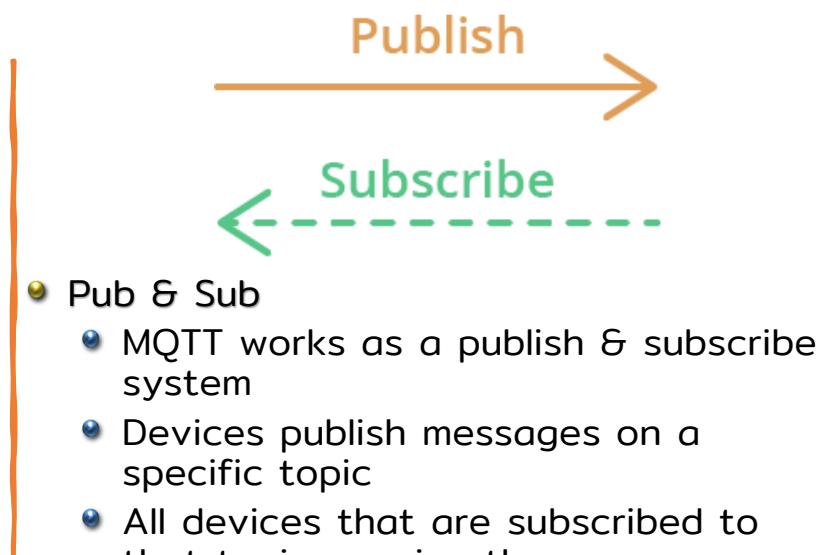
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MQTT Terms

- Pub & Sub
- Messages
- Topics
- Broker

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MQTT Basic Concepts



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MQTT Basic Concepts

Messages

- Messages are the information that you want to exchange between your devices
- It can be a message or data from sensor readings
- They do not have a fixed format

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MQTT Basic Concepts

Topics

- The way you register interest for incoming messages or how you specify where you want to publish the message
- Topics are represented with strings separated by a forward slash
 - company/office1/temperature
- Case sensitive!

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MQTT Basic Concepts

- Broker

- A central hub, allows clients to talk to each other
- Can be managed or self-hosted
- Receives all messages
- Publishes the message to all clients
- There are many Internet MQTT brokers you can use
 - Mosquitto - Most popular
 - Adafruit.io - Great dashboard

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IBM i as MQTT Broker?

 Apache **ACTIVE MQ**

Open Source Package Management

Package	Version
activemq	5.15.12-1
ansible	2.9.10-2
bash	5.1-3
bash-completion	2.10-0
bash-completion-devel	2.10-0
bob	2.4.6-1
ca-certificates	2_git20170807.10b2785-3
ca-certificates-mozilla	2021.2.46-1
curl	1.14-5

SSH Galatea

```

Set weather API Key
andy@GALATEA:~$ activemq start
INFO: Loading '/QOpenSys/pkg/lib/activemq//bin/env'
INFO: Using java '/QOpenSys/QIBM/ProdData/JavaVM/jdk80/64bit/bin/java'
INFO: Process with pid '271199' is already running
andy@GALATEA:~$ activemq status
INFO: Loading '/QOpenSys/pkg/lib/activemq//bin/env'
INFO: Using java '/QOpenSys/QIBM/ProdData/JavaVM/jdk80/64bit/bin/java'
ActiveMQ is running (pid '271199')
andy@GALATEA:~$ 
```



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IBM i as MQTT Broker?

The screenshot shows the ActiveMQ administration interface with the URL `galatea:8161/admin/topics.jsp;sessionid=node0wqyhc9tnz3847ajnfdvt1j5.node0`. The main page displays a list of topics with columns: Name, Number Of Consumers, Messages Enqueued, Messages Dequeued, and Operations. The 'Hackaday.nodered.test' topic is highlighted with a blue box. The 'iot' and 'test' topics are also visible.

Name	Number Of Consumers	Messages Enqueued	Messages Dequeued	Operations
ActiveMQ.Advisory.Connection	0	42	0	Send To Active Subscribers Active Producers Delete
ActiveMQ.Advisory.Consumer.Topic.Hackaday.noder...	0	24	0	Send To Active Subscribers Active Producers Delete
ActiveMQ.Advisory.Consumer.Topic.1ot	0	26	0	Send To Active Subscribers Active Producers Delete
ActiveMQ.Advisory.MasterBroker	0	1	0	Send To Active Subscribers Active Producers Delete
Hackaday.nodered.test	0	8	0	To Active Subscribers Producers
iot	0	563	527	To Active Subscribers Producers
test	0	95	0	To Active Subscribers Producers

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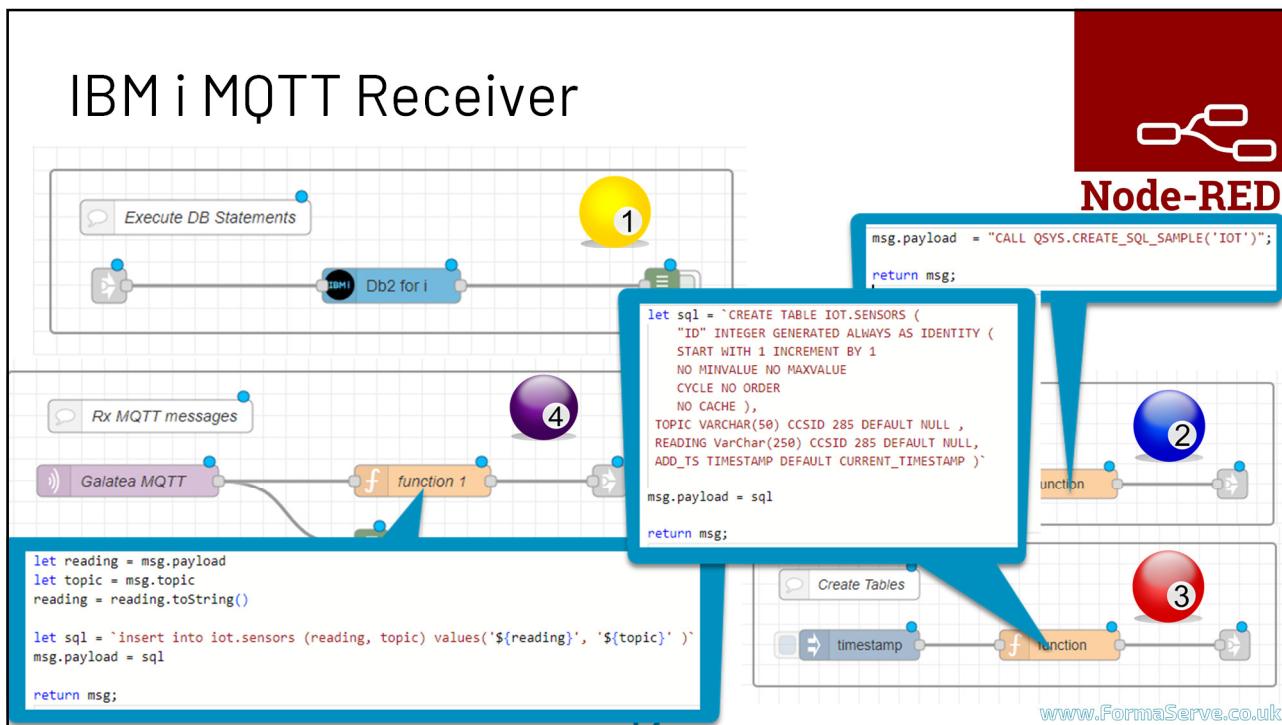
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IBM i Client Example

- Want to receive the temperature MQTT messages from the broker
- Prior to receiving them, we need to
 - Create a schema/library
 - Create a table/file to store the temperatures
- Our IBM client will do all this for us
- IBM i client could be written in any open-source language
 - Node.js
 - Python
 - PHP

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IBM i MQTT Receiver - Table Example

ID	TOPIC	READING	ADD_TS
35	iot	31.2577	2023-04-16-17.10.11.236596
34	iot	31.2577	2023-04-16-17.09.10.739818
33	iot	31.2577	2023-04-16-17.08.10.837468
32	iot	31.72584	2023-04-16-17.07.10.930743
31	iot	31.72584	2023-04-16-17.06.11.030084
30	iot	31.2577	2023-04-16-17.05.11.111393
29	iot	30.78955	2023-04-16-17.04.10.687442
28	iot	31.2577	2023-04-16-17.03.10.782778
27	iot	31.72584	2023-04-16-17.02.10.871956
26	iot	31.72584	2023-04-16-17.01.10.964449
25	iot	31.72584	2023-04-16-17.00.11.056056
24	iot	31.72584	2023-04-16-16.59.10.891391
23	iot	32.19402	2023-04-16-16.58.32.155232
22	iot	32.19402	2023-04-16-16.57.32.253662
21	iot	32.19402	2023-04-16-16.56.31.833711
20	iot	32.19402	2023-04-16-16.55.31.922931
19	iot	32.19402	2023-04-16-16.54.32.011407
18	iot	32.19402	2023-04-16-16.53.32.103465
17	iot	32.66213	2023-04-16-16.52.32.195194

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From Pico to IBM i - Working Example



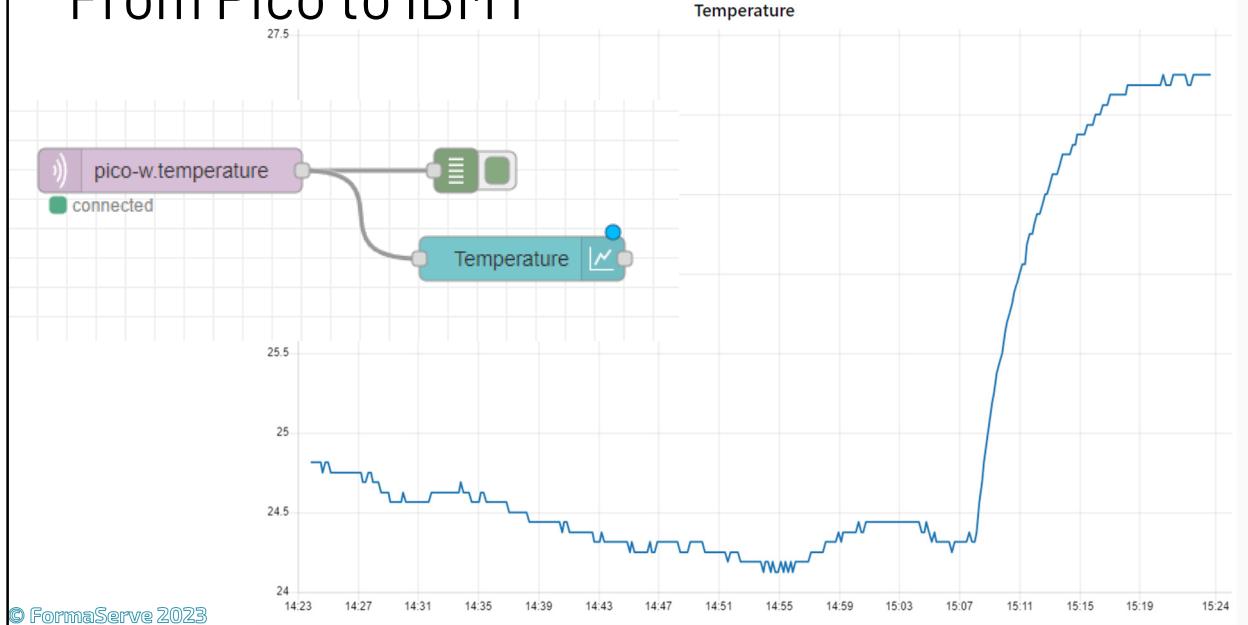
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From Pico to IBM i

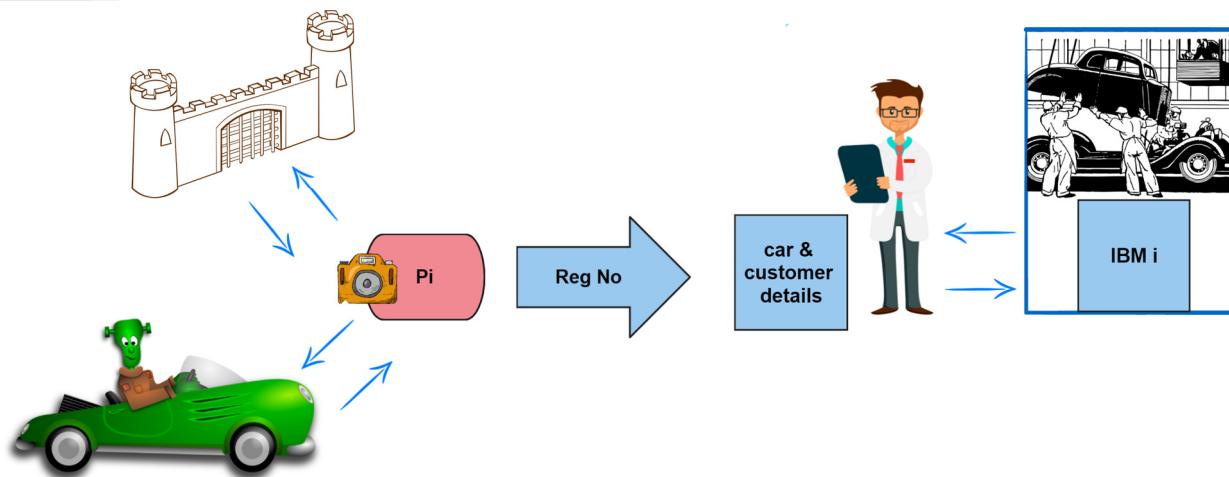


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FormaServe Current Project



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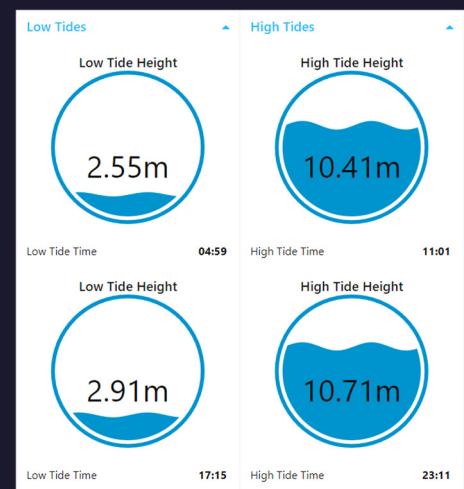
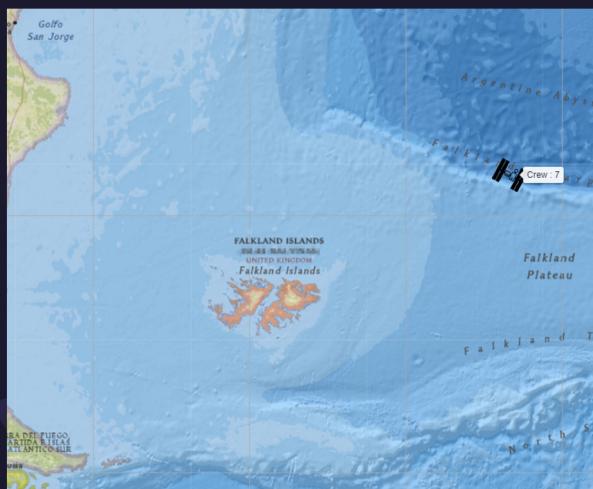


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A Couple of Extras - Don't tell Mike!

- International Space Station
- High & Low Tide Times



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This repo contains information that we hope you will find helpful when completing our f_Learning training videos.

You will also find examples & information that we have used when giving presentations/workshops at IBM i User Groups around the world.

We are still providing IBM i training in these strange times. [Get in contact here.](#)

If you have any questions or comments, we will be happy to help you.

Examples

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Grunt Configure
Automatically convert CI/CD files to YAML for GitHub Actions.

Publish Node.js Package to GitHub Packages Configure
Publishes a Node.js package to GitHub Packages.

[More workflows](#) [Dismiss suggestion](#)

github.com/FormaServe/f_learning

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Thank You!

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Buy Me a Coffee

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