

Workshop: Connecting IoT devices to the cloud with Amazon IoT and mbed Cloud

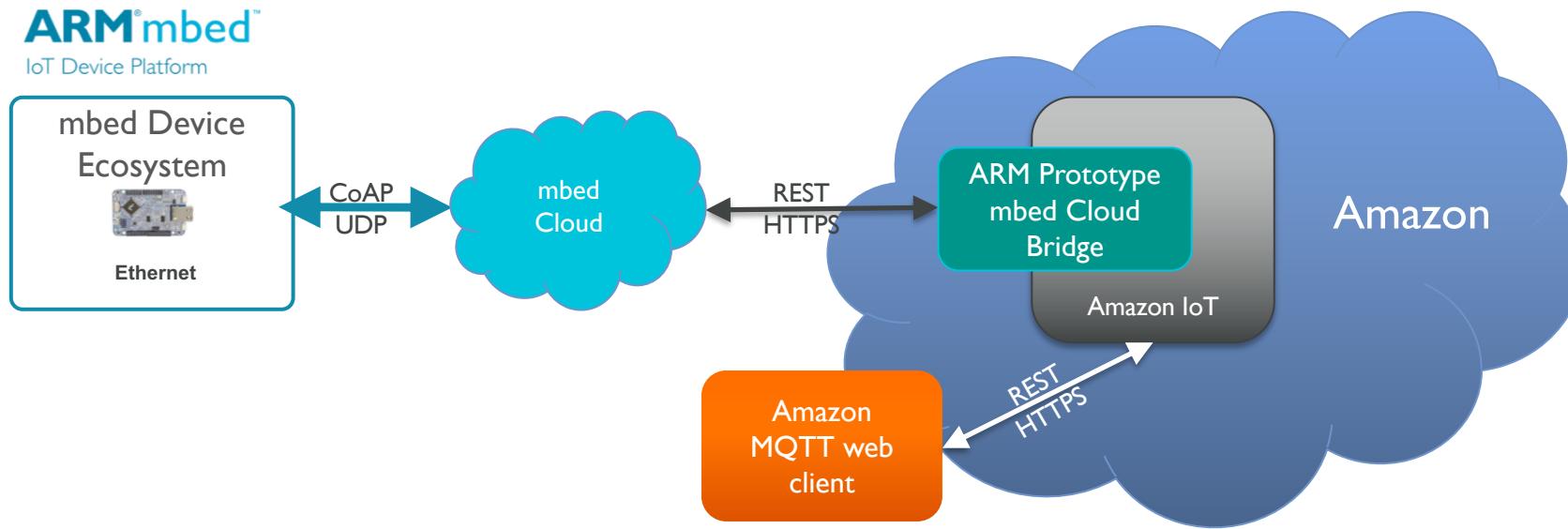


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What will we build in this Workshop?



- Connect your mbed device into Amazon IoT through mbed Cloud and ARMs Prototype AWS IoT Cloud Bridge
 - Create a simple mbed device and connect it to mbed Cloud
 - Create an instance of ARM's Prototype AWS IoT Cloud bridge and bind it to your Amazon and mbed Cloud accounts
 - Exploration of the device data telemetry using Amazon's web-based MQTT client

Workshop: Let's get started!

- Create and setup your Amazon account (should be completed prior to workshop)
- Install the necessary tools/drivers PC/Mac/Linux (should be completed prior to workshop)
- Create mbed developer and mbed Cloud accounts (should be completed prior to workshop)
- Retrieve a set of provisioning credentials (mbed_cloud_dev_credentials.c)
- Import our mbed sample project into the online IDE
- Update the sample project with the provisioning credentials (mbed_cloud_dev_credentials.c)
- Compile, Install, Download, and Copy into the mbed device
- Connect a Serial Terminal (115200,8NI, proper mbed COM port chosen for Windows users...)
- Send the “Break” command to reset the mbed device
- See the device output on our Serial Terminal (PTSOOI method...)

NOTE: During the workshop, be sure to double-check your copy/paste operations...

Quick Links: Visit https://github.com/ARMmbed/bridge_workshop_aws_iot_cloud

- README.md has all of the links in the workshop + this presentation in PDF format

Create our Amazon Account

- Navigate to the Amazon Management Console:

<https://aws.amazon.com/console/>

- Press "Create a Free Account"

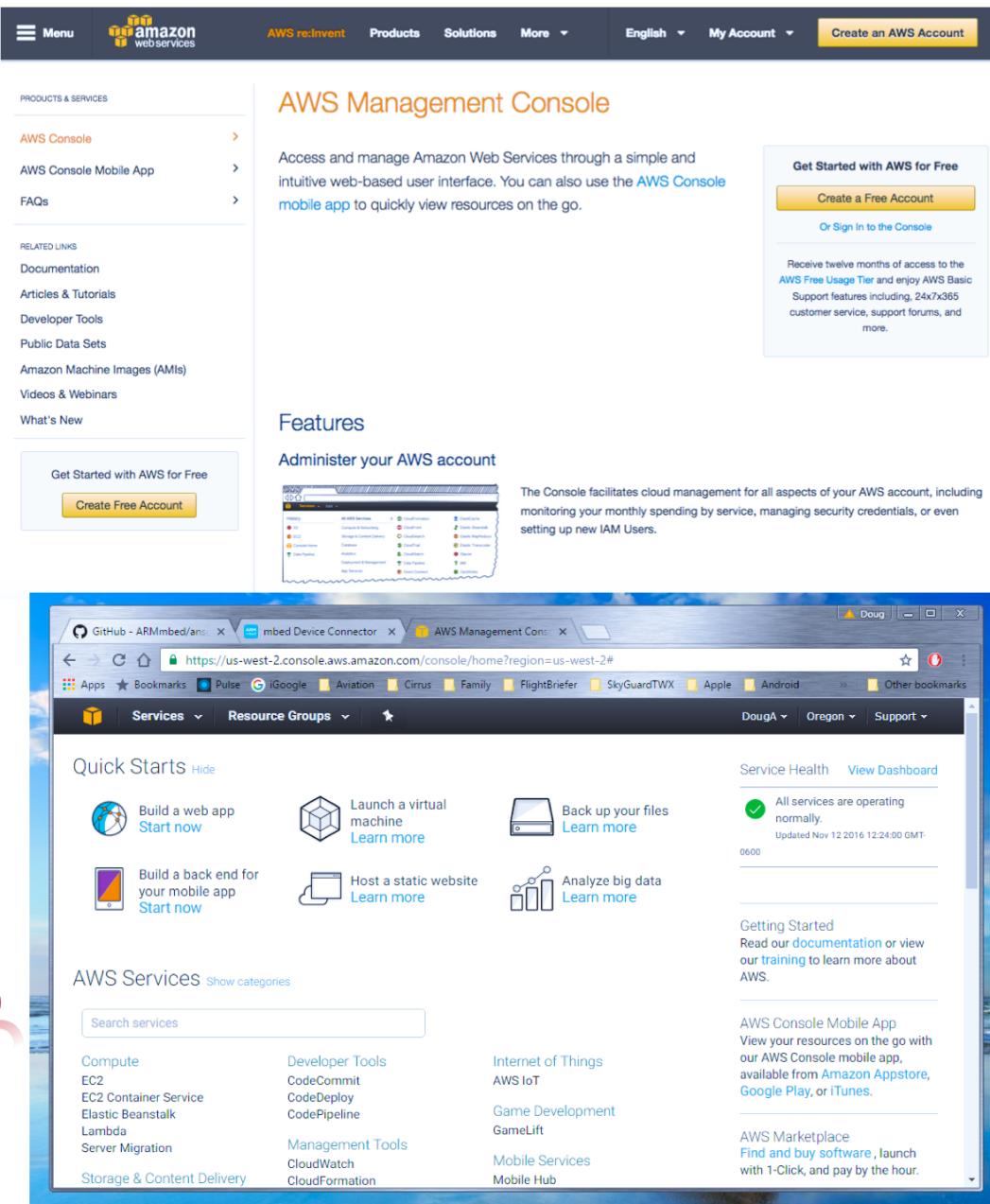
- Enter your email address that you can access
- Select "I am a new user"
- Press "Sign in using our secure server"
- You will need to provide a Credit Card
- You will be called on your cell phone to verify identity

- Complete the Account signup and validation

- You can choose the "Basic" support

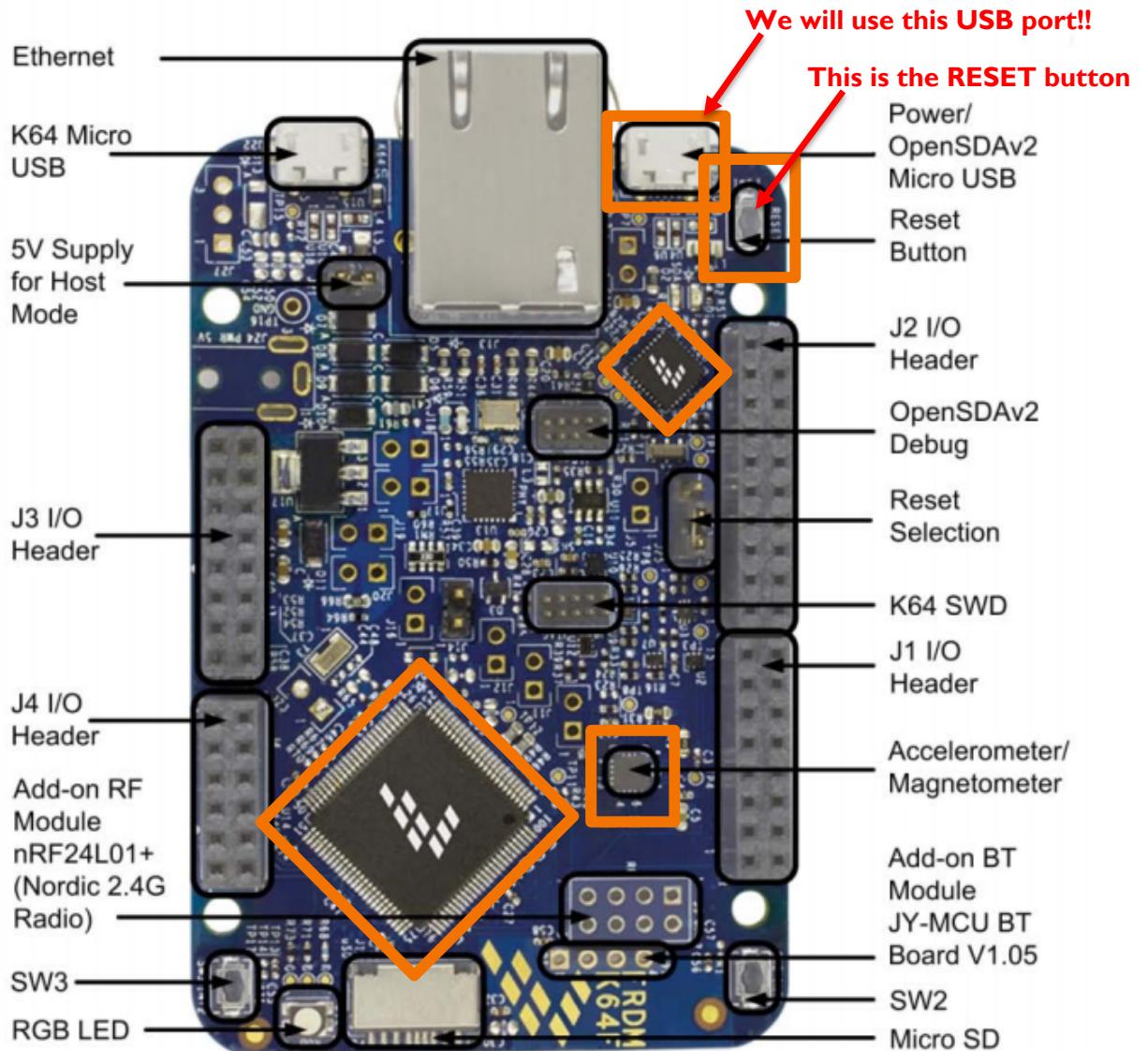
- Press "Sign into the Console"

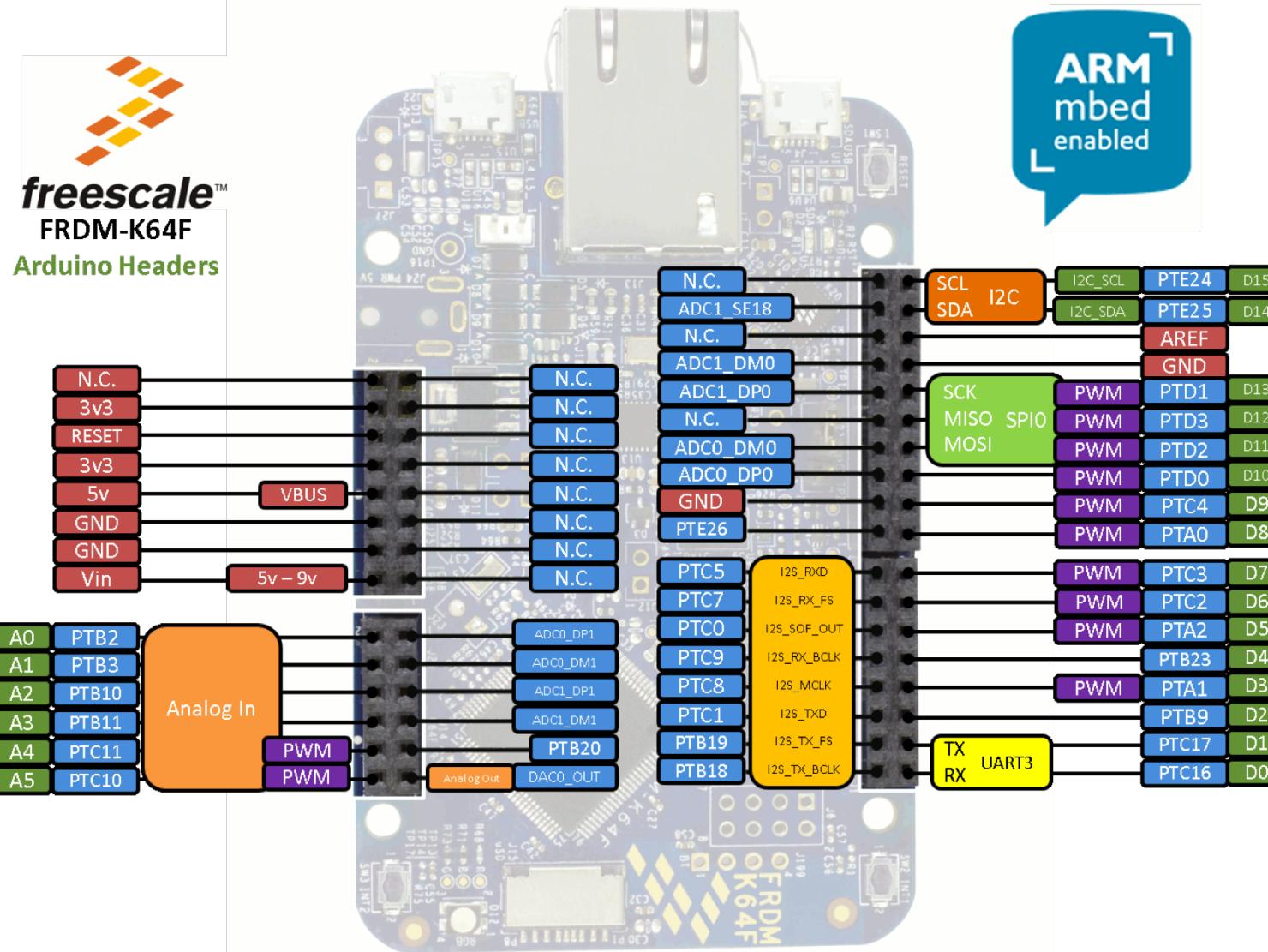
Prior to
Workshop



NXP- FRDM-K64F Overview

- **Freedom Development Platform**
 - Quick, simple development experience with rich features
 - Cortex-M4, 120MHz, 1MB Flash, 256KB SRAM
 - Easy access to MCU I/O
 - 3-axis **accelerometer**/3-axis **magnetometer**
 - RGB LED
 - Add-on **Bluetooth** Module
 - Built-in Ethernet/Add-on **Wireless** Module
 - Micro SD
- **Arduino shield compatible**
- Flash programming functionality
- Enabled by OpenSDA debug interface





Install the Necessary Tools

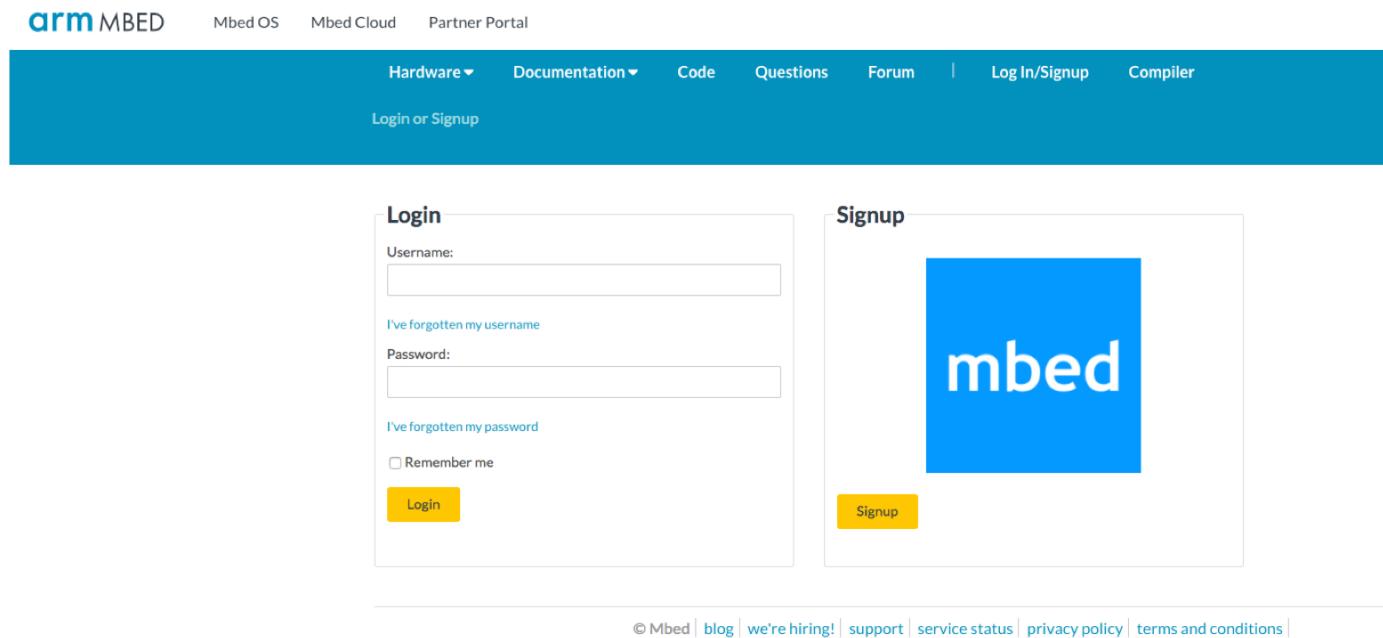
- **Windows IMPORTANT:** Install the mbed USB Serial driver -
https://os.mbed.com/media/downloads/drivers/mbedWinSerial_16466.exe
 - Insert the USB cable and mbed device BEFORE running the Serial Driver installation...
 - the installer MUST see the device *first*
 - You will need administrator access to your Windows PC to install this driver
- Serial Terminal: Putty - <http://www.putty.org/>
- Chrome and Firefox Browsers may also be used
- Docker Toolbox installed on your Windows PC: <https://github.com/docker/toolbox/releases/tag/v1.12.2>
- Docker Engine installed on your Mac - <https://docs.docker.com/engine/installation/mac/> (*not* Toolbox)
- Docker Engine installed on your Linux - <https://docs.docker.com/engine/installation/linux/>
- Mac/Linux: install "git" (mac: <https://git-scm.com/download/mac>, Ubuntu: use "apt-get install git")
- Mac Serial Terminal - http://freeware.the-meiers.org/CoolTerm_Mac.zip
- Linux Serial Terminal - http://freeware.the-meiers.org/CoolTerm_Linux.zip

Prior to
Workshop
Day 1/2/3

Connect both your USB cable and Ethernet cable to the K64F and leave it there for now

Create Your mbed Account

- Navigate to: <https://os.mbed.com/account/login/?next=/>
- Create an Account

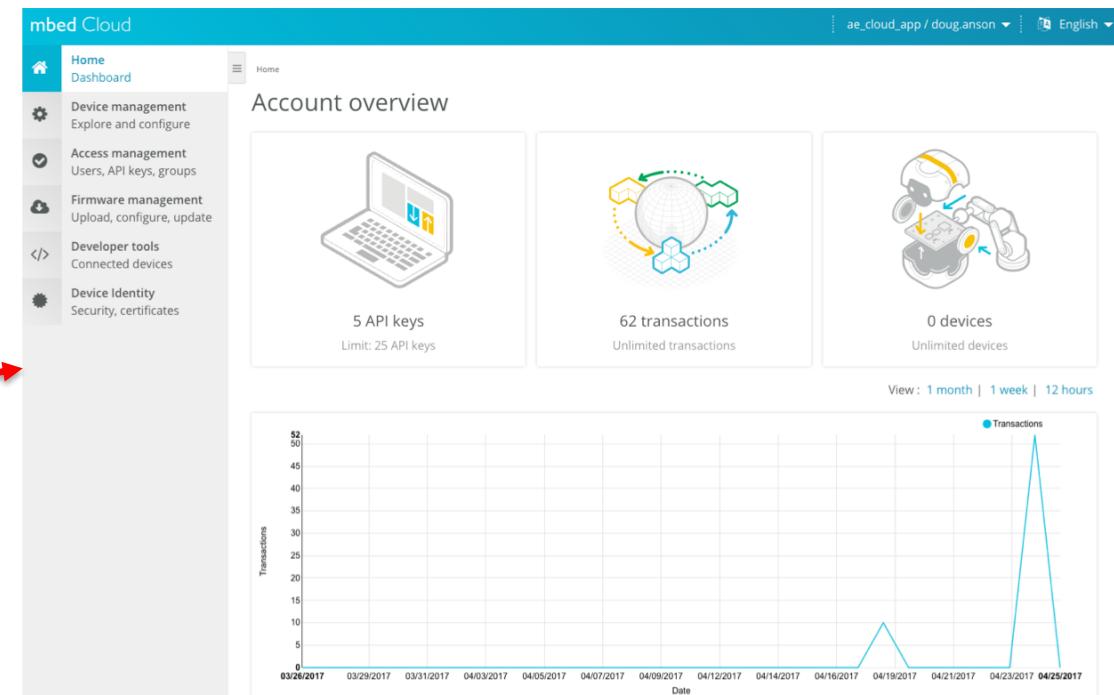
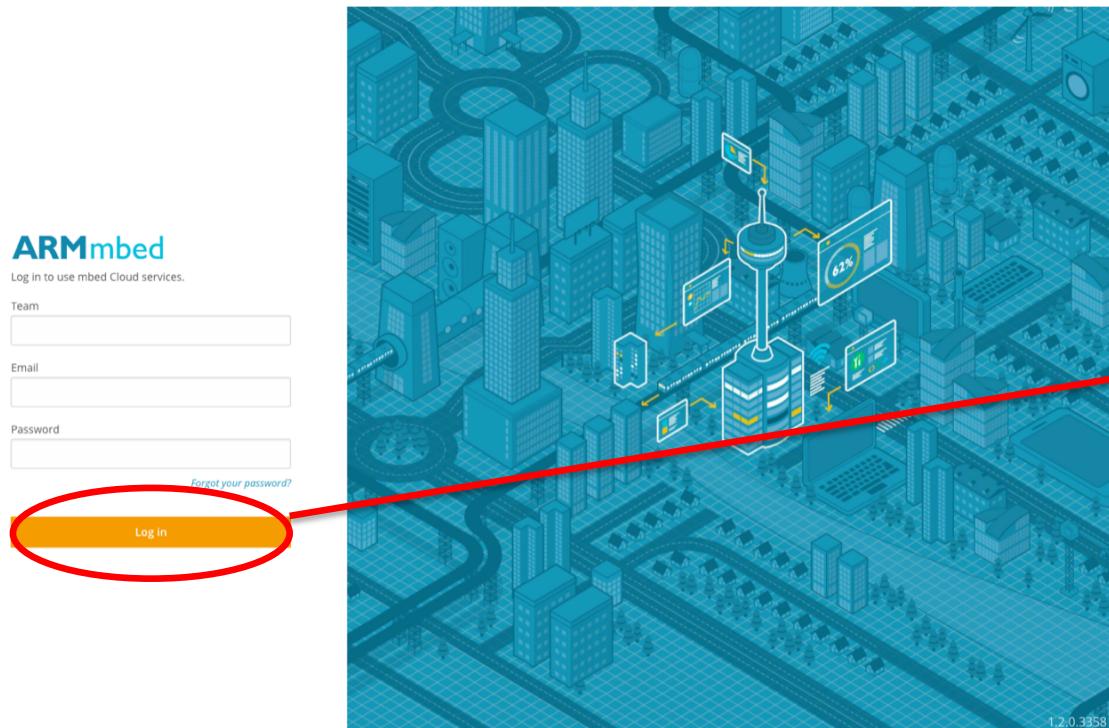


Prior to
Workshop

Create Your mbed Cloud Account...

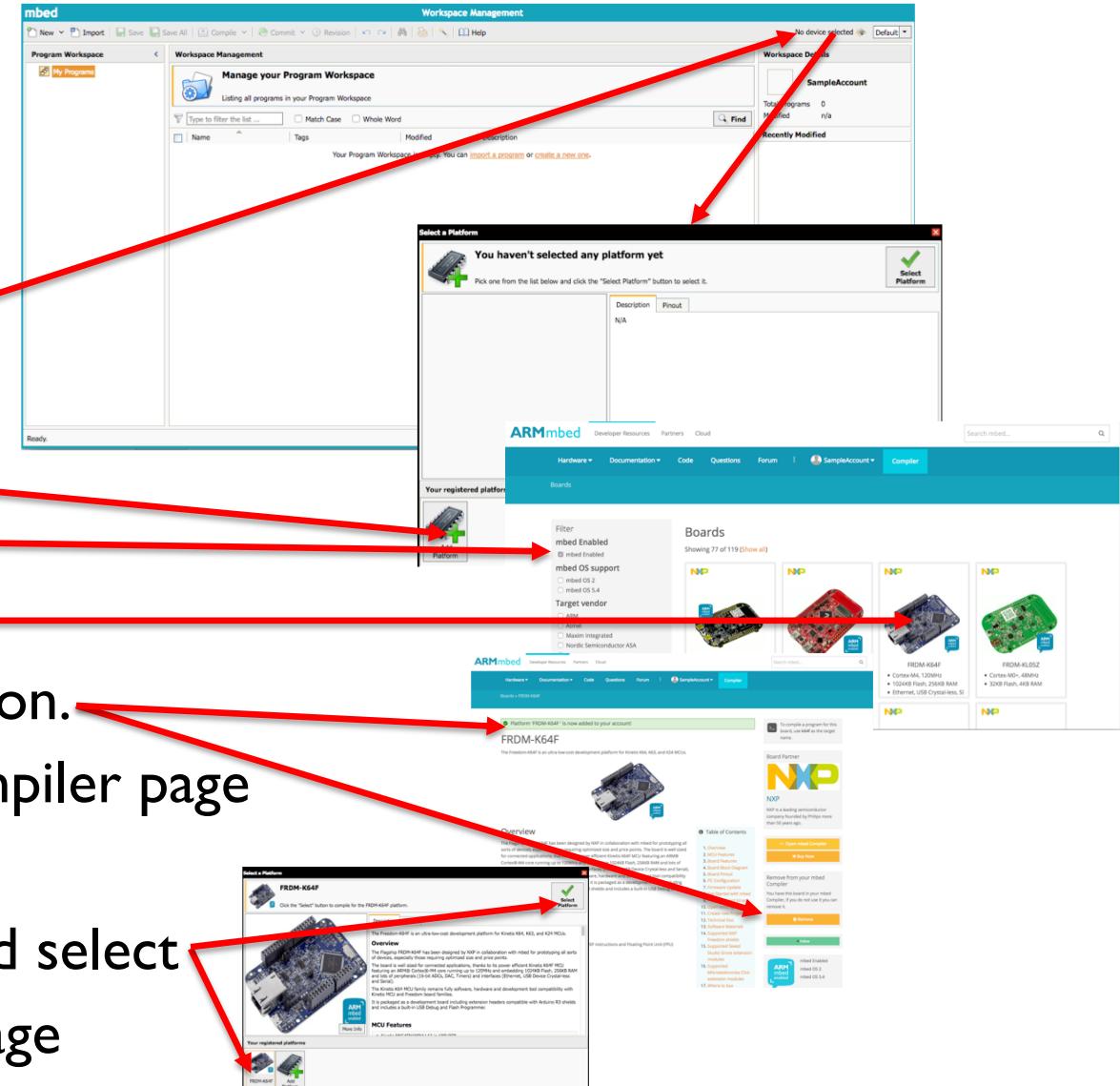
Prior to
Workshop

- Navigate to the mbed Cloud Dashboard: <https://portal.mbedcloud.com>
- Confirm that you can log into your mbed device mbed Cloud dashboard



Log into the Online IDE – Add the K64F Compile Target

- Go to <https://os.mbed.com/>



Import our K64F Endpoint Project

- Go to <https://os.mbed.com/>

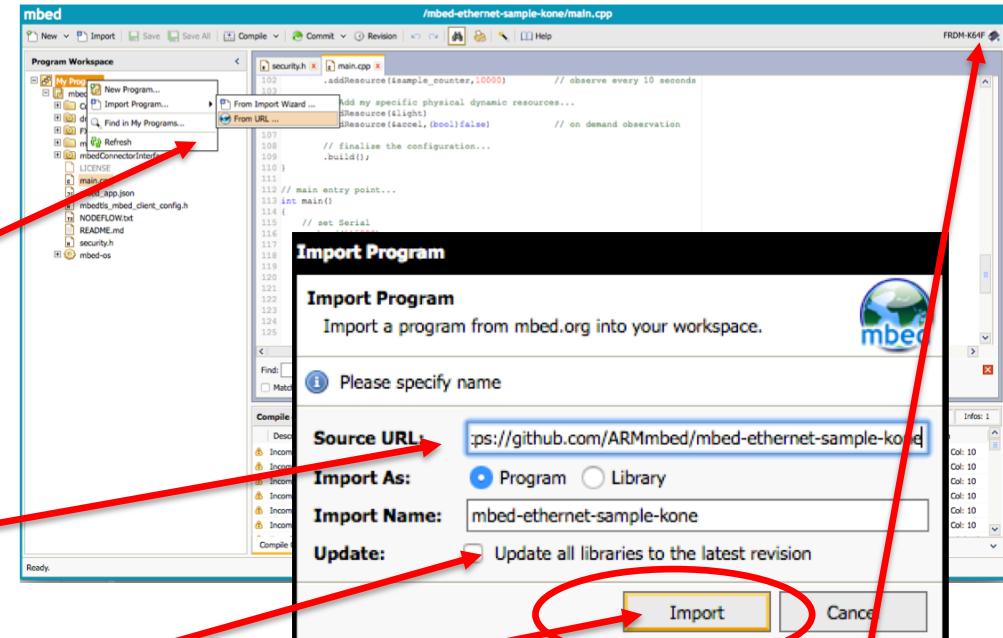
- Select the “Compiler” page

- Right-click on “My Programs” → “Import Program”

- Choose Select “from URL...”

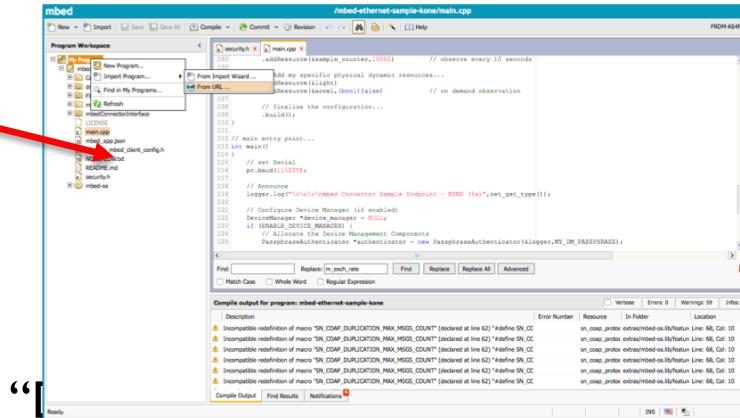
- Enter this URL (Leave the “Update all libraries...” **unchecked**)
<https://github.com/ARMmbed/mbed-cloud-sample/>

- Press “Import”, the ensure that “FRDM-K64F” is selected



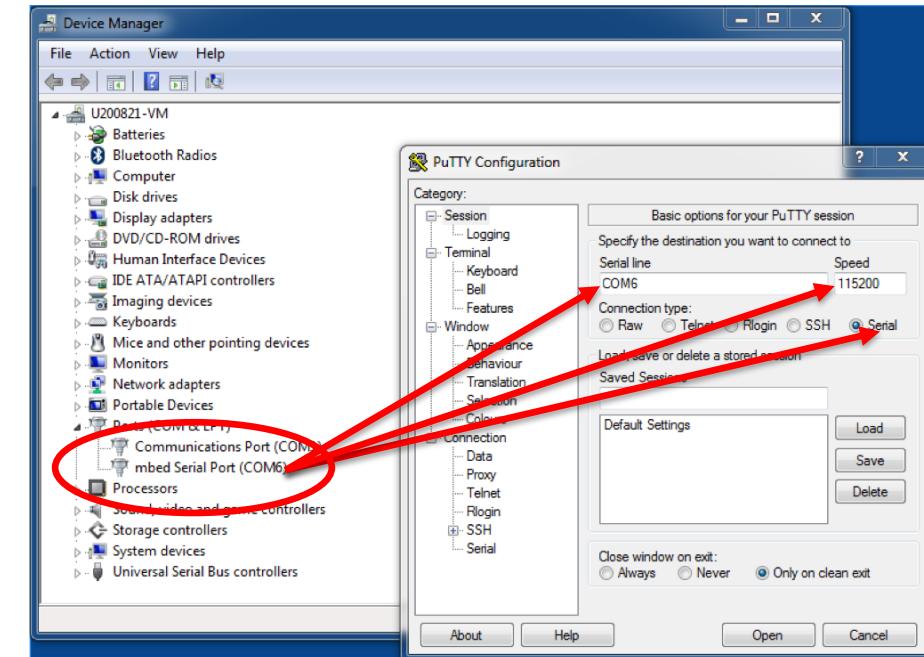
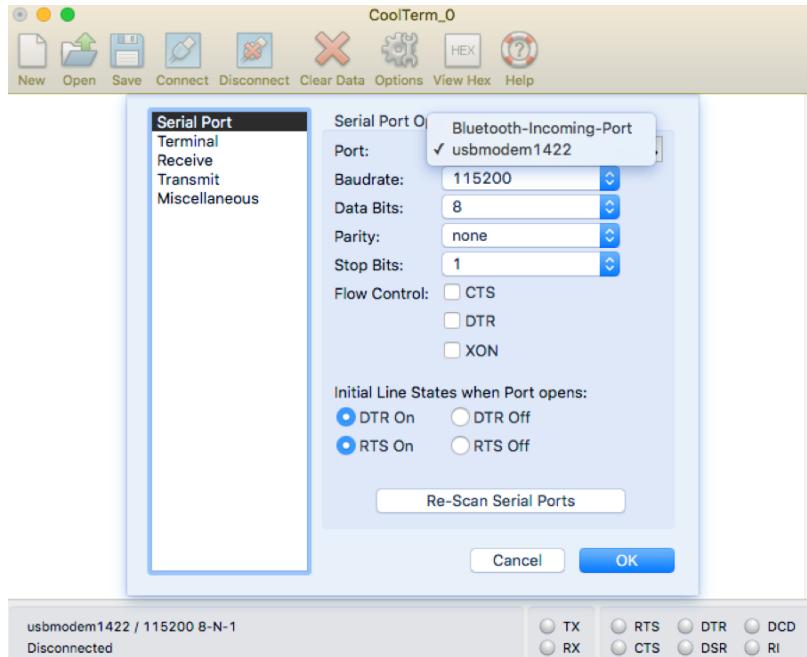
Set Provisioning Credentials in Your Endpoint Code

- Go back to the mbed Device mbed Cloud dashboard: <https://portal.mbedcloud.com>
 - In the left sidebar, select “Device Identity” → “Certificates”
 - Under “Actions”, select “create a developer certificate”
 - Give your developer certificate a name and description... press “create certificate”
 - Press “Download Developer C file” – this will deposit “mbed_cloud_dev_credentials.c” in your downloads directory
- Now, go back to the Compiler page of your online IDE
- Replace `mbed_cloud_dev_credentials.c` with newly downloaded one from the dashboard
- Save
 - Glance at `main.cpp`... a clean and simple mbed endpoint example
 - Exposes two CoAP resources: accelerometer and LED
- Select the project name and press the “Compile” button
- The endpoint code should compile up successfully
- The online IDE will deposit a “bin” file into your downloads directory
- Drag-n-Drop this bin file to your “MBED” flash drive (may also be called “L
- K64F green LED will flicker for a bit, then stop, and dismount/remount...



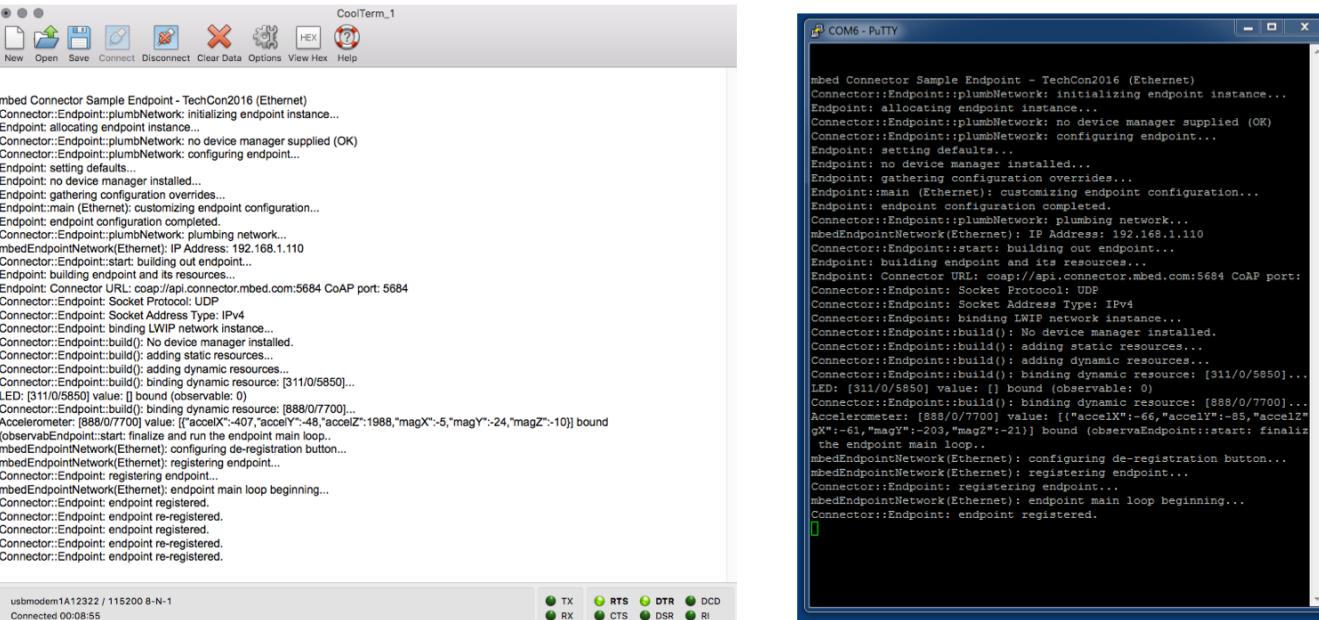
Running your Endpoint Code

- Bring up your Serial Terminal
 - CoolTerm for Windows, Mac, Linux: Select: “Options→”Re-scan serial ports”. Select the mbed one found.
 - For MAC, you may need to “authorize” the CoolTerm Application under your “System Preferences”-> “Security & Privacy”... you may have to allow apps to run from “any developer”, then authorize the launch of CoolTerm.
 - PuTTY for Windows : You must determine what COM port your mbed device is. Look in the Windows Device Manager FYI
- For the endpoint serial configuration, set the baud rate to 115200 baud, defaults for everything else: (8, N, one)
 - PuTTY for Windows: Ensure that you have “Serial” radio button selected...



Running your Endpoint Code...

- Connect your Serial Terminal to the K64F:
 - CoolTerm for Windows, Mac, Linux: Simply press the “Connect” button on the top part of the CoolTerm GUI
 - PuTTY for Windows: Press the “Open” button
- Send a “Break” command from the serial terminal (or press the RESET button on the K64F)
 - CoolTerm for Windows, Mac, Linux: “Connection” → “Send Break”
 - PuTTY for Windows: Right-click on top of Window, Select “Special Command” → “Break”
- Look at the output – you need to confirm that you see “endpoint registered” in the output:



The image displays two terminal windows side-by-side, both showing the output of the mbed Connector Sample Endpoint application running on a K64F. The left window is titled "CoolTerm_1" and the right window is titled "COM6 - PUTTY". Both windows show the same text output, which includes logs from the mbed endpoint configuration process, such as "plumbNetwork", "allocating endpoint instance", "configuring endpoint", and "endpoint registered". The output also includes details about the CoAP port (5684), UDP socket protocol, and various sensor and LED configurations. The text ends with "Connector::Endpoint::endPoint registered".

```
mbed Connector Sample Endpoint - TechCon2016 (Ethernet)
Connector::Endpoint::plumbNetwork: initializing endpoint instance...
Endpoint: allocating endpoint instance...
Connector::Endpoint::plumbNetwork: no device manager supplied (OK)
Connector::Endpoint::plumbNetwork: configuring endpoint...
Endpoint: setting defaults...
Endpoint: no device manager installed...
Endpoint: gathering configuration overrides...
Endpoint: main (Ethernet): customizing endpoint configuration...
Endpoint: endpoint configuration completed.
Connector::Endpoint::plumbNetwork: plumbing network...
mbedEndpointNetwork(Ethernet): IP Address: 192.168.1.110
Connector::Endpoint::start: building core endpoint...
Endpoint: building endpoint and its resources...
Endpoint: Connector URL: coap://api.connector.mbed.com:5684 CoAP port: 5684
Connector::Endpoint::Socket Protocol: UDP
Connector::Endpoint::Socket Address Type: IPv4
Connector::Endpoint::binding LWIP network instance...
Connector::Endpoint::build(): No device manager installed.
Connector::Endpoint::build(): adding static resources...
Connector::Endpoint::build(): adding dynamic resources...
Connector::Endpoint::bind dynamic resource: [311/0/5850]...
LED: [311/0/5850] value: [] bound (observable: 0)
Connector::Endpoint::bind dynamic resource: [888/0/7700]...
Accelerometer: [888/0/7700] value: [{"accelX": -407, "accelY": -48, "accelZ": 1988, "magX": -5, "magY": -24, "magZ": -10}] bound
(observable)Endpoint::start: finalize and run the endpoint main loop.
mbedEndpointNetwork(Ethernet): configuring de-registration button...
mbedEndpointNetwork(Ethernet): registering endpoint...
Connector::Endpoint::endPoint registered.
Connector::Endpoint::endPoint re-registered.
Connector::Endpoint::endPoint registered.
Connector::Endpoint::endPoint re-registered.
Connector::Endpoint::endPoint registered.
```

Status Check

So far we've completed the following

- Setup our accounts and PC with appropriate tools (prior to workshop)...
- Retrieved a set of provisioning credentials (mbed_cloud_dev_credentials.c)
- Imported our mbed sample project into the online IDE
- Updated the sample project with the provisioning credentials (mbed_cloud_dev_credentials.c)
- Compiled, Installed, Downloaded, and Copied into the mbed device
- Connected a Serial Terminal (115200,8NI, proper mbed COM port chosen for Windows users...)
- Sent the “Break” command to reset the mbed device
- Saw the device output on our Serial Terminal (PTSOOI method...)

Next, we will import and configure the ARM AWS IoT Prototype mbed Cloud Bridge...

ARM AWS IoT mbed Cloud Bridge Setup

What we will do next...

- Ensure that we have the necessary pre-requisites setup on our PC
- Create our mbed Cloud API Key/Token
- Create our AWS IoT Instance
- Create our AWS Access Key and ID
- Import our Prototype mbed Cloud Bridge instance as a Docker image into our Docker runtime
- Configure our Prototype mbed Cloud Bridge for AWS IoT

Double check (Windows) :All our needed tools are installed

- Latest Docker Toolbox runtime installed

- Ensure that “Git for Windows” is checked!
 - <https://github.com/docker/toolbox/releases/tag/v1.12.2>



- Windows mbed USB driver installed and functioning properly.

- “DAPLINK” flash drive present
 - “mbed Serial Port” seen in Windows Device Manager when K64F USB is connected

- Putty installed and operational

- Chrome and/or Firefox installed

Double check (Mac/Linux) :All our needed tools are installed

- Docker Engine installed (do not install the "Toolbox" version on Mac... use the native engine)
 - Docker Engine for Mac (do not install the "Toolbox" version on the mac):
 - <https://docs.docker.com/engine/installation/mac/>
 - Docker Engine for Linux:
 - <https://docs.docker.com/engine/installation/linux/>
- Suitable serial terminal installed and operational
- Chrome and/or Firefox installed
- "git" installed
- Access to a command line terminal

Create our mbed Cloud Access/API Token

- Navigate to the mbed Cloud Dashboard: <https://portal.mbedcloud.com>
- Log in, Select “Access Management”, then “API keys”
- Press “Create new API Key ”... you will create a key
- Give the new API Key a name
- Select “Developers” group
- Create the API Key

Create new API key

API key name: My New API Key

Groups: Developers

Create API Key Cancel

Key name	Groups	Date last connected	Date created
AWS IoT	1	-	April 19, 2017 4:51 PM
Home	1	-	April 19, 2017 4:51 PM
IBM Watson	1	-	April 19, 2017 4:49 PM
MS IoTHub	1	-	April 19, 2017 4:50 PM
Test	1	-	April 19, 2017 4:51 PM

The API key has been created

This will be the last time the API key is available to you, but you can generate a new one from the API Key Details page.

Security credentials

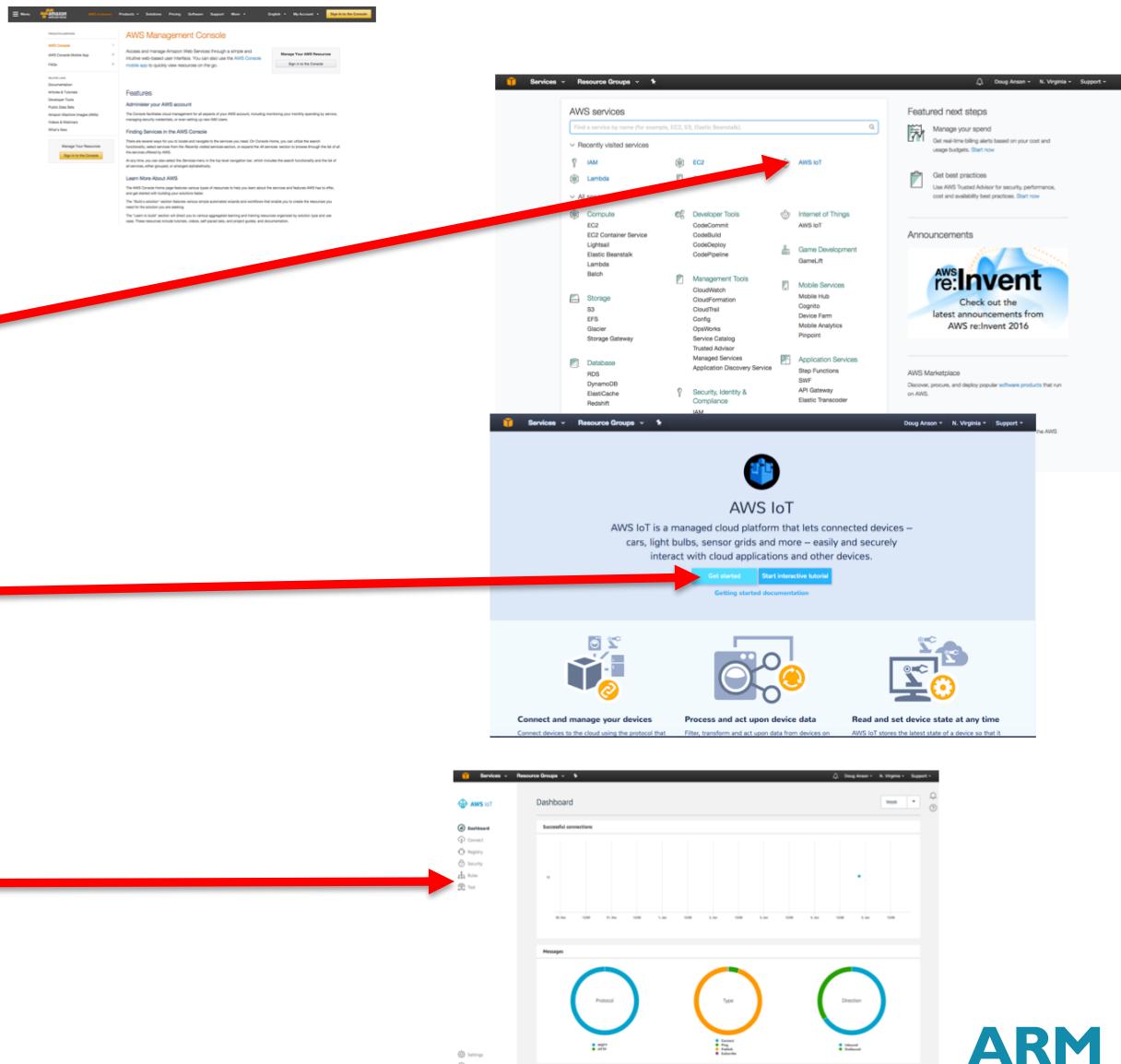
Key name: My New API Key

API key: a... (long hex string)

Copy to clipboard Add another key

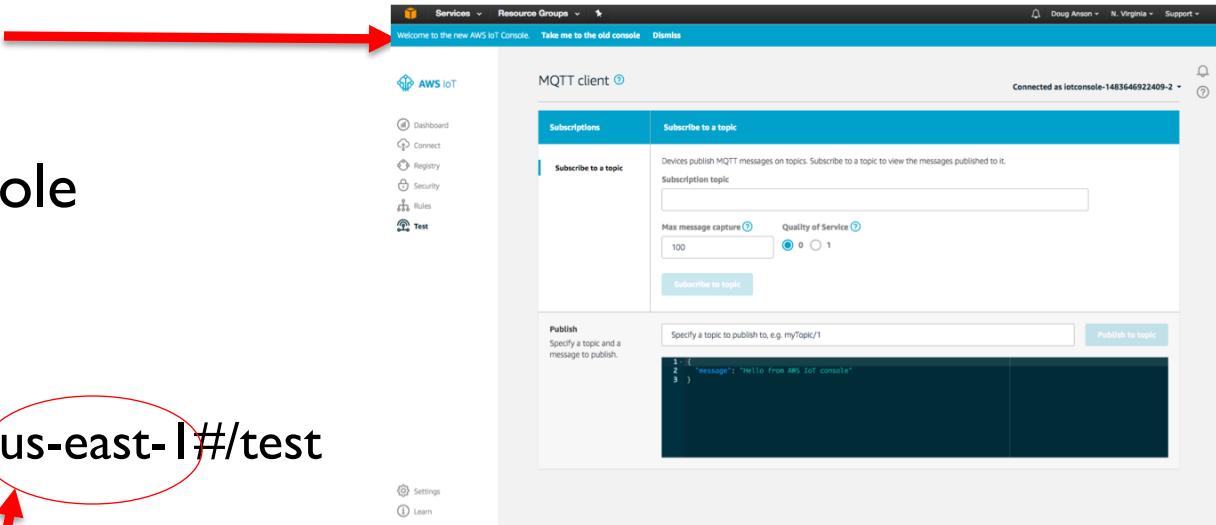
Create our Amazon AWS IoT Instance

- log into your AWS Management Console
 - <https://aws.amazon.com/console/>
 - Sign In...
- Select "AWS IoT"
- Create an instance if you don't have one
 - Complete steps to create your instance
- Once created, go to your AWS IoT
 - Dashboard... Select "Test"



Determine our AWS Region

- Continuing with the "Test" AWS IoT Console
- Look at the URL for **your** AWS IoT Test Console
- You should see something like this:
 - <https://console.aws.amazon.com/iotv2/home?region=us-east-1#/test>
- Make a note of your "region" parameter value
 - In the above example, my **AWS Region** is "**us-east-1**". Yours may be different.
 - Note what yours is.. we will use that value later

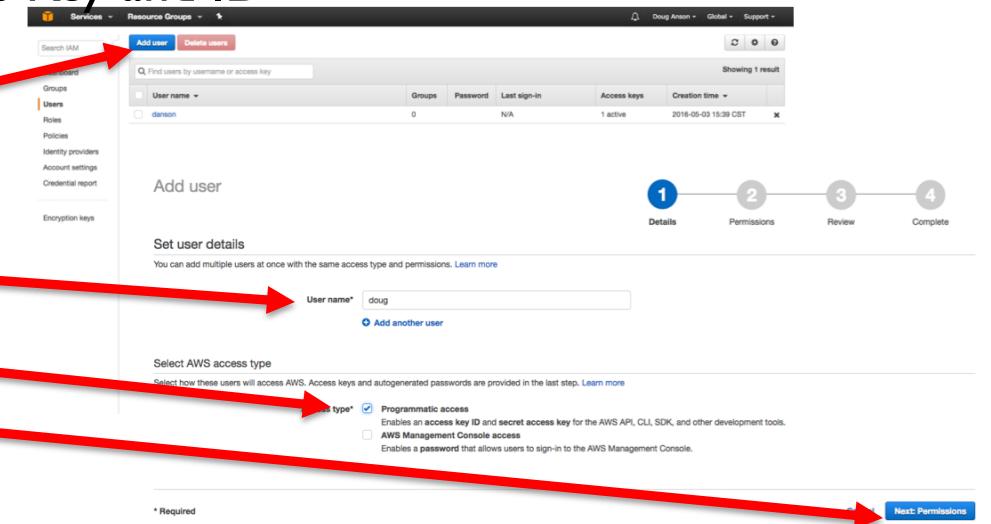


Create our AWS Access Key and ID (New IAM User)

- Using Chrome, navigate to:
 - <http://docs.aws.amazon.com/AWSSimpleQueueService/latest/SQSGettingStartedGuide/AWSCredentials.html>
 - Complete the steps in Amazon's HOWTO to create the Access Key and ID

- If you do not have an IAM User... create one

- Create a new user
- Select "Programmatic Access"
- Press "Next Permissions"



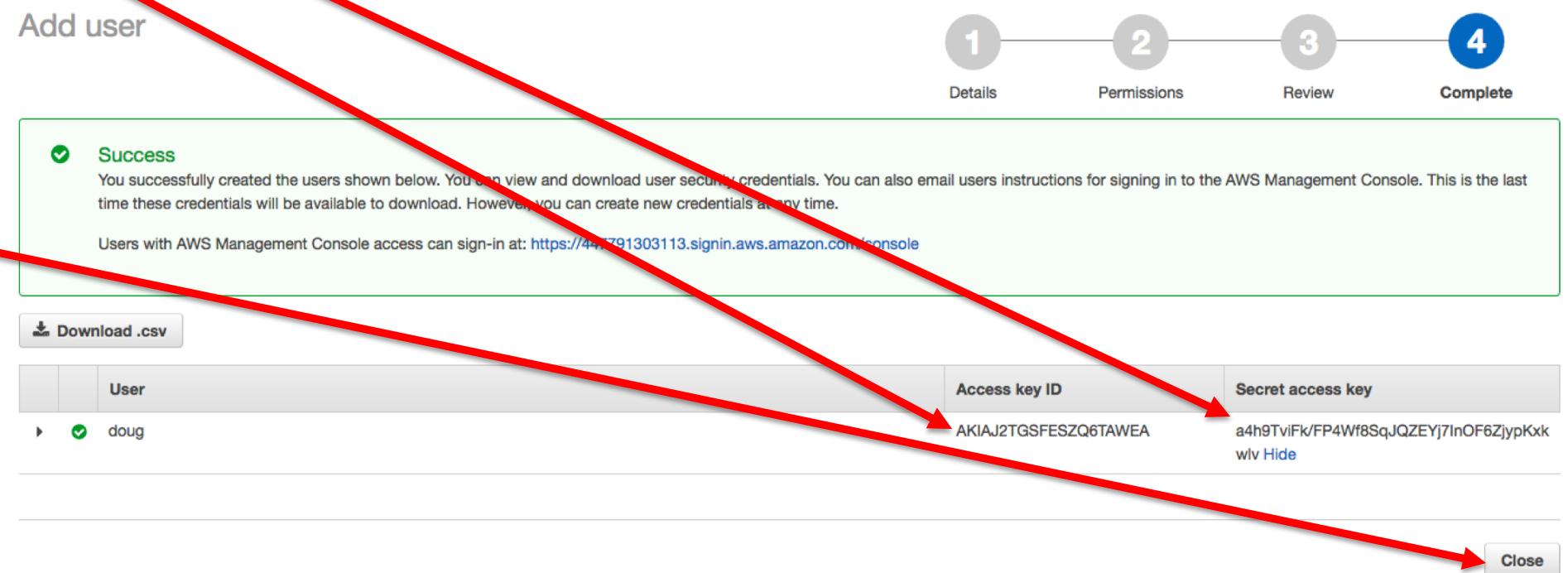
- Create a Permissions Group

- Name the Group
- Search for and select "AdministratorAccess" permission...
- Create the Group
- Complete creating the user!



Create our AWS Access Key and ID(New IAM User)...

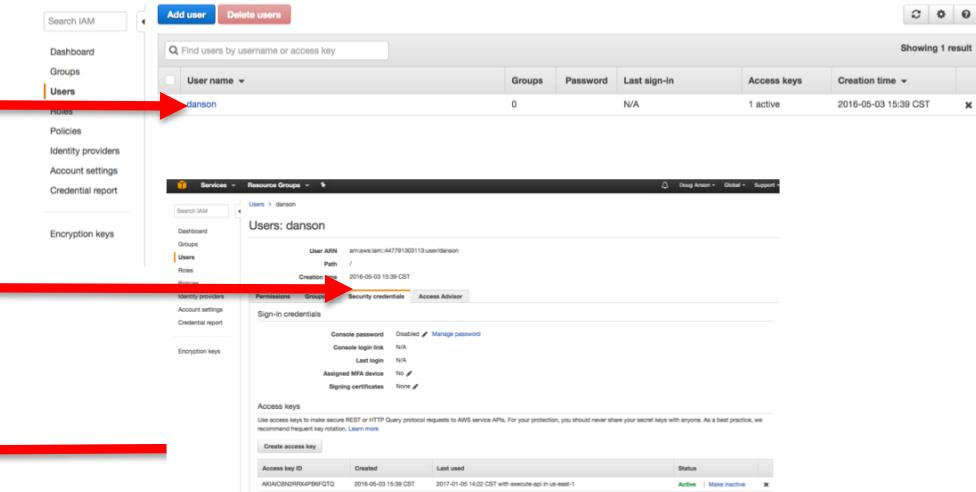
- Finally, after the new IAM User is created, you will be shown your keys
 - "Show" your Secret Access Key – save off both for later
 - AWS IoT Secret Access Key
 - AWS IoT Access Key ID



Create our AWS Access Key and ID (Existing IAM user)...

- If you have an existing IAM User, then you can simply create a new AccessKey for that user

- Select your IAM User



- Select "Security Credentials"

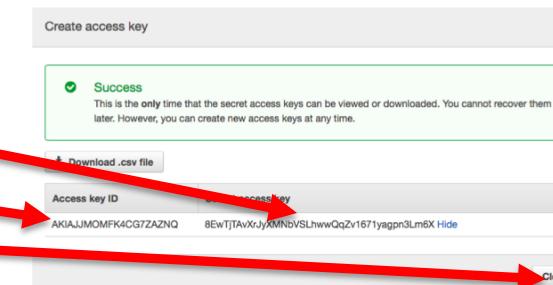
- Press "Create Access Key"

- Show & Save off the values you acquired ("Show" the secret access key)

- AWS IoT Secret Access Key

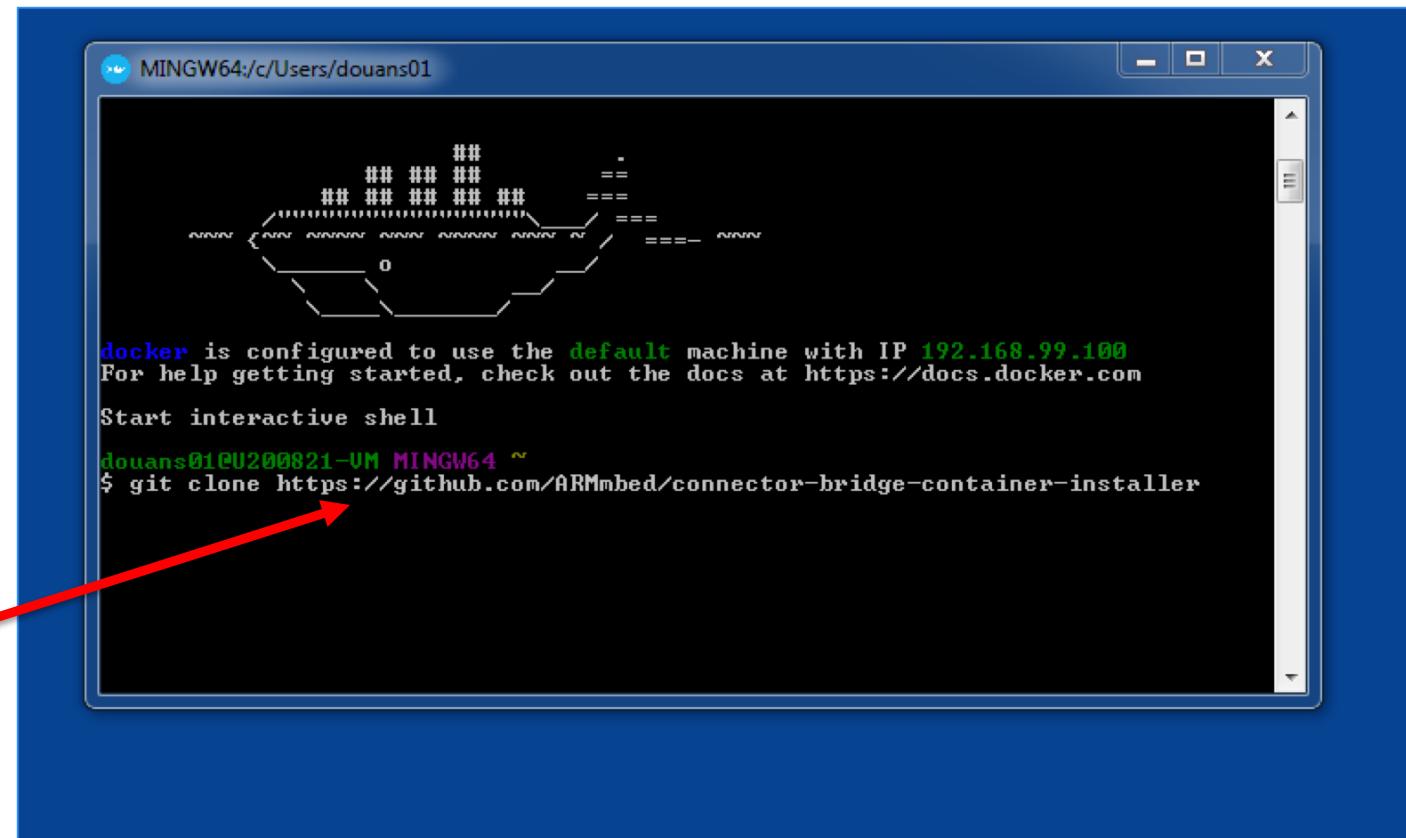
- AWS IoT Access Key ID

- Press Close



Import our mbed Cloud AWS IoT Bridge Installer

- Windows: Launch the Docker QuickStart Terminal
 - It may take a few minutes to initialize if launched the first time... it will have to download additional stuff
 - Allow VirtualBox to make changes to your network interface
- Mac/Linux: Open a terminal
- Type the following “git” command (below)
- For all platforms (Windows/Mac/Linux), this is the "git" command to run:
\$ git clone <https://github.com/ARMmbed/connector-bridge-container-installer>



The screenshot shows a terminal window titled 'MINGW64:/c/Users/douans01'. It displays the Docker configuration message: 'docker is configured to use the default machine with IP 192.168.99.100. For help getting started, check out the docs at https://docs.docker.com'. Below this, it says 'Start interactive shell' and shows the user prompt 'douans01@U200821-UM MINGW64 ~'. A red arrow points from the text 'Type the following “git” command (below)' in the previous slide to the '\$ git clone' command in the terminal window.

```
MINGW64:/c/Users/douans01
docker is configured to use the default machine with IP 192.168.99.100
For help getting started, check out the docs at https://docs.docker.com
Start interactive shell
douans01@U200821-UM MINGW64 ~
$ git clone https://github.com/ARMmbed/connector-bridge-container-installer
```

Import our mbed Cloud AWS IoT Bridge Container

- cd into the installer repo
% cd connector-bridge-container-installer
- Run the installer script (look at options)
% ./get_bridge.sh
- Run the installer script with options
% ./get_bridge.sh aws use-long-polling
- Bridge container will import from DockerHub

```
MINGW64:/c/Users/douans01/connector-bridge-container-installer
douans01@EU200821-VM MINGW64 ~/connector-bridge-container-installer <master>
$ ./get_bridge.sh
IP Address: 192.168.99.100
Usage: ./get_bridge.sh [iothub] [aws] [generic-mqtt] [generic-mqtt-gets]
[started] [Connector API Token] [use-long-polling]

douans01@EU200821-VM MINGW64 ~/connector-bridge-container-installer <master>
$ ./get_bridge.sh iothub use-long-polling
IP Address: 192.168.99.100
No running bridge container found... OK
Looking for existing container image...
No container image found... OK

mbed Connector bridge Image: danson/connector-bridge-container-iothub
Pulling mbed Connector bridge image from DockerHub<tm>...
Using default tag: latest
latest: Pulling from danson/connector-bridge-container-iothub

bf5d46315322: Pull complete
9f13e0ac480c: Pull complete
e89885b3097: Pull complete
40af181810e7: Pull complete
e6f7c7e5c03e: Pull complete
7d758f855913: Pull complete
043cfde3f155: Pull complete
dc88d7b95bd9: Pull complete
72096a7f3077: Pull complete
5745588ff43: Pull complete
da73ba87a653: Pull complete
992c2f7851e8: Pull complete
2ecc63963f93: Pull complete
d6839695820e: Pull complete
529e0a634b56: Pull complete
1e0fdb880b74: Pull complete
b67f6460ea71: Pull complete
14db618659de: Pull complete
15059c29602e: Pull complete
16a2e20fbde0: Pull complete
171c88088ad4: Pull complete
9b1fb05ff4a2: Pull complete
6e29bde661ee: Pull complete
a5bb145bala3: Pull complete
Digest: sha256:75d1524b0708ede49c20a837aab4aef009ffd683d6d6f177e3cd3ba05512eb
Status: Downloaded newer image for danson/connector-bridge-container-iothub:latest

Starting mbed Connector bridge image...
docker run -d -p 192.168.99.100:28519 -p 192.168.99.100:28520 -p 192.168.99.100:2222:22 -p 192.168.99.100:8234:8234 -t danson/connector-bridge-container-iothub /home/arm/start_instance.sh use-long-polling
a126e83b594c31336cc6d2051bc9e153c8d29365cc3b1b7e1a3d952e226d6422
mbed Connector bridge started! SSH is available to log into the bridge runtime

douans01@EU200821-VM MINGW64 ~/connector-bridge-container-installer <master>
$
```

Configure our AWS IoT Bridge (Windows)

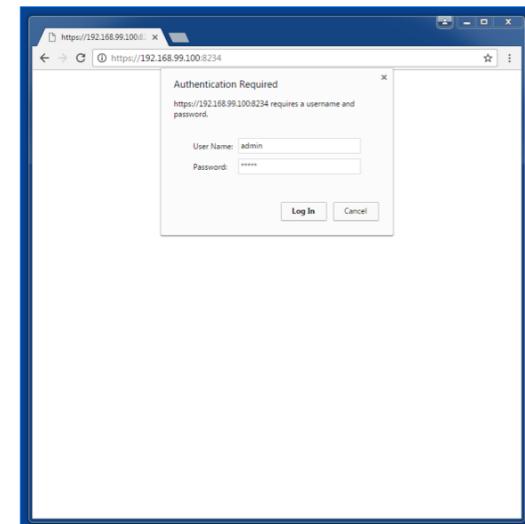
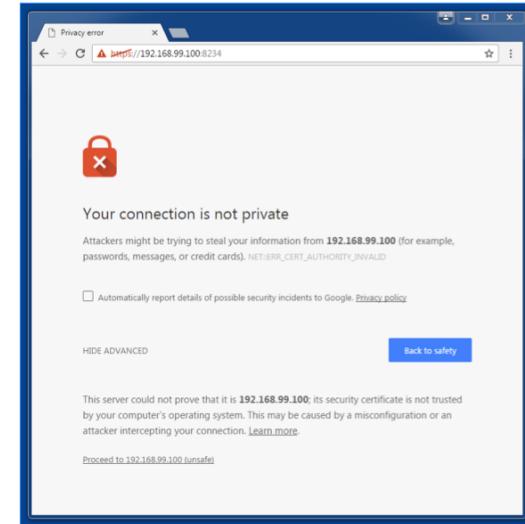
- Your Container IP address will be:

192.168.99.100

- Bring up Firefox/Chrome and go to:

<https://192.168.99.100:8234>

- Accept the self signed certificate
- Username: admin PW: admin



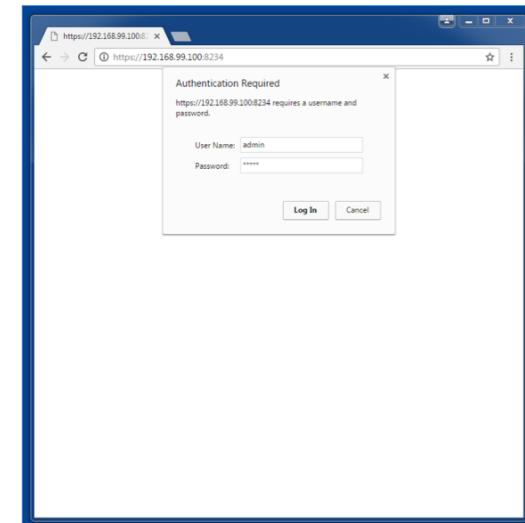
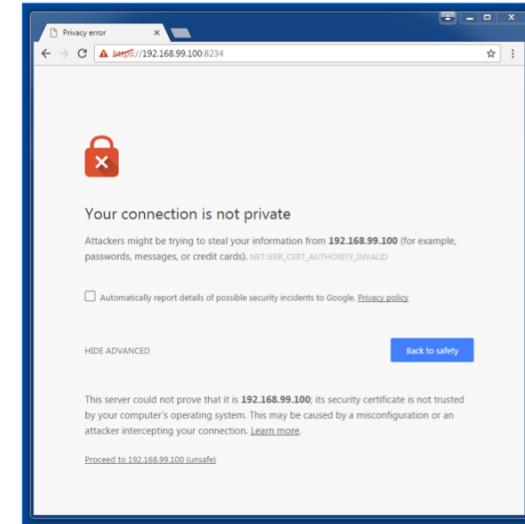
Configure our AWS IoT Bridge (Mac/Linux)

- Your Container IP address be "localhost" if installed on your local box, otherwise, make note of it if installed remotely

- Bring up Firefox/Chrome and go to:

<https://<your container IP address>:8234>
(typically: <https://localhost:8234>)

- Accept the self signed certificate
- Username: admin PW: admin



Configure the mbed Cloud Bridge for AWS IoT...

- Enter the mbed Cloud API Key/Token, THEN Press “Save”

- Enter your AWS Region, Press "Save"

- Enter your AWS Access Key ID, Press "Save"

- Enter your AWS Secret Key, Press "Save"

- Ensure you have the right API endpoint

- Cloud: api.us-east-1.mbedcloud.com

- Connector: api.connector.mbed.com

- Press “RESTART”

- Your mbed Cloud Bridge is now configured for AWSIoT

The screenshot shows the 'mbed Connector Bridge Configuration' interface. It includes sections for 'Connector Bridge Control' (with a 'RESTART' button) and 'Connector Bridge Configuration'. The configuration fields are:

- mds_api_token → mbed_connector_api_token_goes_here
- aws_iot_region → AWS_region_goes_here
- aws_iot_access_key_ → AWS_Access_Key_ID_goes_here
- aws_iot_secret_access_ → AWS_Secret_Access_Key_goes_here
- mds_address → api.us-east-1.mbedcloud.com
- mds_enable_long_poll → true

Each field has a corresponding 'SAVE' button to its right.

Configurator Admin Settings

admin_username	admin	SAVE
admin_password	admin	SAVE
default_port	8234	SAVE
keystore_password	arm1234	SAVE

Status Check

So far we've completed the following

- Ensure that we have the necessary pre-requisites setup on our PC
- Create our mbed Cloud API Key/Token
- Create our AWS IoT Instance
- Create our AWS Access Key and ID
- Import our bridge instance: a Docker image into our Docker runtime
- Configure our mbed Cloud Bridge for AWS IoT

With our bridge now operational, we should be able to restart our endpoint and see messages coming into our AWS IoT via Amazon's MQTT Client/explorer

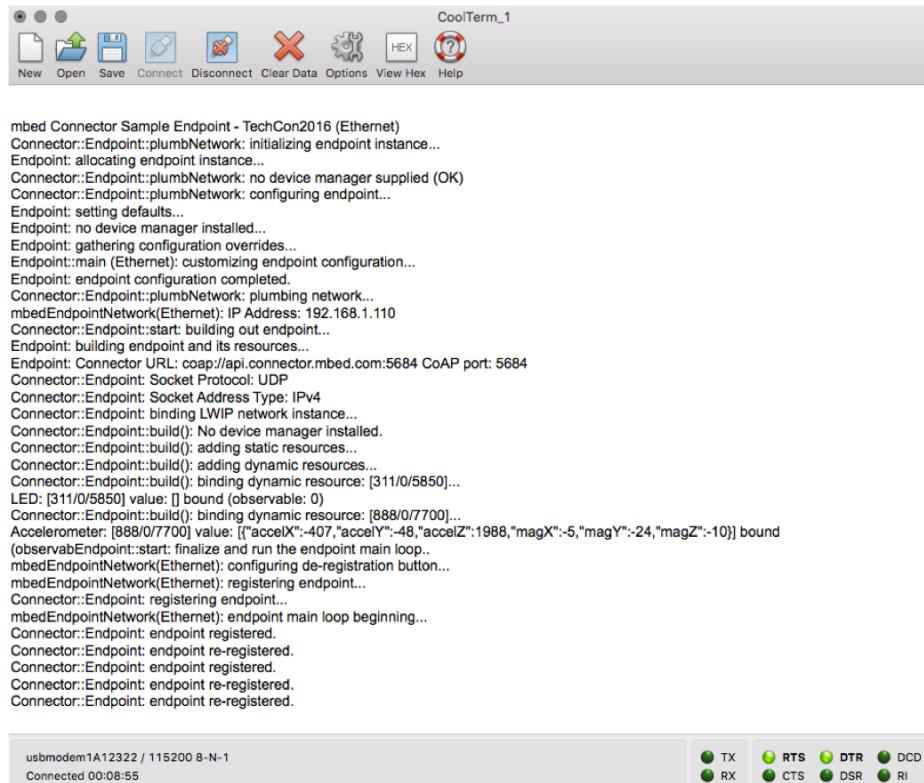
Putting it all Together

- Press the “reset” button on your mbed device (next to the USB port)
- Ensure that you see “endpoint registered” in the serial terminal
- Go to your AWS IoT Dashboard
 - URL should look something like this:
 - <https://console.aws.amazon.com/iotv2/home?region=us-east-1#/dashboard>
 - Your AWS Region ("us-east-1") may be different though...

Lets check how things are working...

Putting it all Together: Check the Serial Terminal

- You should see output that looks something like this:
 - Make sure that you see a message like “endpoint registered”



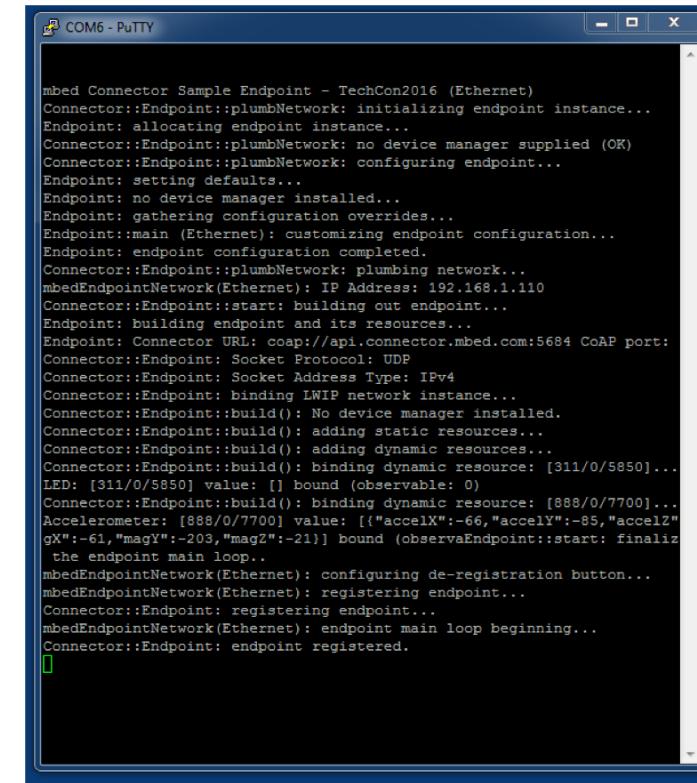
CoolTerm_1

New Open Save Connect Disconnect Clear Data Options View Hex Help

```
mbed Connector Sample Endpoint - TechCon2016 (Ethernet)
Connector::Endpoint::plumbNetwork: initializing endpoint instance...
Endpoint: allocating endpoint instance...
Connector::Endpoint::plumbNetwork: no device manager supplied (OK)
Connector::Endpoint::plumbNetwork: configuring endpoint...
Endpoint: setting defaults...
Endpoint: no device manager installed...
Endpoint: gathering configuration overrides...
Endpoint::main (Ethernet): customizing endpoint configuration...
Endpoint: endpoint configuration completed.
Connector::Endpoint::plumbNetwork: plumbing network...
mbedEndpointNetwork(Ethernet): IP Address: 192.168.1.110
Connector::Endpoint::start: building out endpoint...
Endpoint: building endpoint and its resources...
Endpoint: Connector URL: coap://api.connector.mbed.com:5684 CoAP port: 5684
Connector::Endpoint: Socket Protocol: UDP
Connector::Endpoint: Socket Address Type: IPv4
Connector::Endpoint: binding LWIP network instance...
Connector::Endpoint::build(): No device manager installed.
Connector::Endpoint::build(): adding static resources...
Connector::Endpoint::build(): adding dynamic resources...
Connector::Endpoint::build(): binding dynamic resource: [311/0/5850]...
LED: [311/0/5850] value: [] bound (observable: 0)
Connector::Endpoint::build(): binding dynamic resource: [888/0/7700]...
Accelerometer: [888/0/7700] value: [{"accelX": -407, "accelY": -48, "accelZ": 1988, "magX": -5, "magY": -24, "magZ": -10}] bound
(observabEndpoint::start: finalize and run the endpoint main loop...
mbedEndpointNetwork(Ethernet): configuring de-registration button...
mbedEndpointNetwork(Ethernet): registering endpoint...
Connector::Endpoint: registering endpoint...
mbedEndpointNetwork(Ethernet): endpoint main loop beginning...
Connector::Endpoint: endpoint registered.
Connector::Endpoint: endpoint re-registered.
Connector::Endpoint: endpoint registered.
Connector::Endpoint: endpoint re-registered.
Connector::Endpoint: endpoint re-registered.
```

usbmodem1A12322 / 115200 8-N-1
Connected 00:08:55

TX	RTS	DTR	DCD
RX	CTS	DSR	RI



COM6 - PuTTY

```
mbed Connector Sample Endpoint - TechCon2016 (Ethernet)
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Connector::Endpoint: binding LWIP network instance...
Connector::Endpoint::build(): No device manager installed.
Connector::Endpoint::build(): adding static resources...
Connector::Endpoint::build(): adding dynamic resources...
Connector::Endpoint::build(): binding dynamic resource: [311/0/5850]...
LED: [311/0/5850] value: [] bound (observable: 0)
Connector::Endpoint::build(): binding dynamic resource: [888/0/7700]...
Accelerometer: [888/0/7700] value: [{"accelX": -66, "accelY": -85, "accelZ": 1988, "magX": -61, "magY": -203, "magZ": -21}] bound
(observabEndpoint::start: finalize and run the endpoint main loop...
mbedEndpointNetwork(Ethernet): configuring de-registration button...
mbedEndpointNetwork(Ethernet): registering endpoint...
Connector::Endpoint: registering endpoint...
mbedEndpointNetwork(Ethernet): endpoint main loop beginning...
Connector::Endpoint: endpoint registered.
```

View your device telemetry in AWS IoT MQTT Client

- Look at your AWS IoT Dashboard

- Under the “Registry/Things” tab, you should see your device listed as a “Thing”

- Next lets bring up the "Test" dashboard to interact with the device

The image shows two screenshots of the AWS IoT Console. The top screenshot displays the 'Things' page under the 'Registry' tab, where a device named '77497059-f1ba-4260...' is listed. A red arrow points from the text 'Under the “Registry/Things” tab, you should see your device listed as a “Thing”' to this device entry. The bottom screenshot shows the 'Test' dashboard under the 'MQTT client' tab. It features a 'Subscriptions' section with a topic 'mbed/notify/mbed-endpoint/#' and a 'Publish' section where a message is being constructed: '1 { "path": "/s1/r/4500", "ep": "77497059-f1ba-4260-uuid-833fc1540d9", "new_value": "1", "Coap_ver": "1", "put": "1" }'. A red arrow points from the text 'Next lets bring up the "Test" dashboard to interact with the device' to the 'Test' button in the MQTT client interface.

View your device telemetry in AWS IoT MQTT Client...

- Now, "subscribe" to the observation channel:
 - Client ID: "mbed/notify/#"
- Also, subscribe to the command response channel:
 - Client ID: "mbed/cmd-response/#"
- Click on one of these subscriptions...
- You should start seeing output from your devices' observations

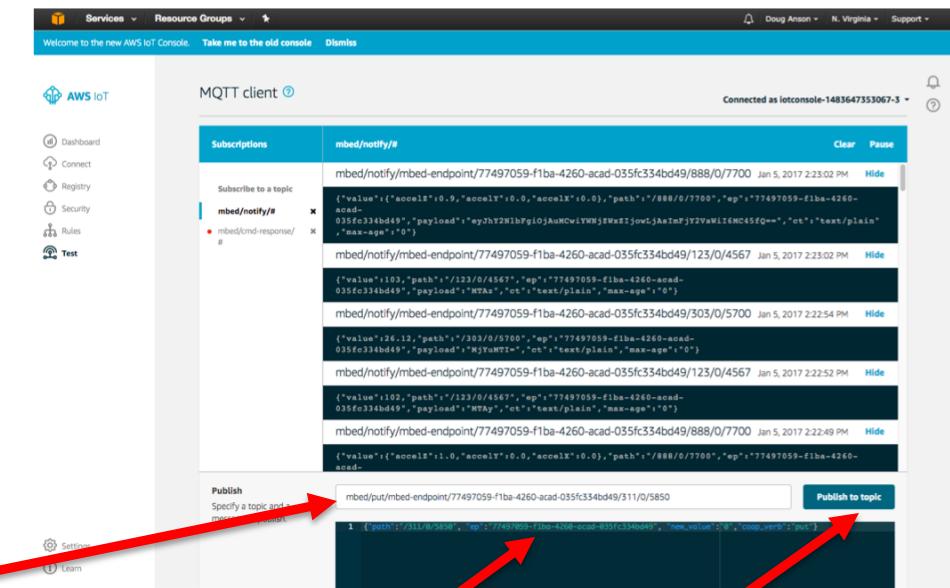
The screenshot shows the AWS IoT MQTT client interface. In the top navigation bar, 'AWS IoT' is selected. On the left sidebar, 'Subscriptions' is highlighted. The main area displays a 'Subscriptions' table with one entry: 'mbed/notify/#'. A red arrow points to this entry. Below the table, there's a 'Subscribe to topic' button, which also has a red arrow pointing to it. To the right of the table, there's a section titled 'Publish' with a message editor containing JSON: { "message": "Hello from AWS IoT console" } and a 'Publish to topic' button.

The screenshot shows the AWS IoT MQTT client interface after subscriptions have been made. The left sidebar shows 'Subscriptions' and 'mbed/notify/#' is listed. A red arrow points to this entry. Another red arrow points to the 'Publish' section below, which contains a message editor with the same JSON as before and a 'Publish to topic' button. The main area now displays a list of received messages under the 'Subscriptions' table. The first message is: 'mbed/notify/mbed-endpoint/77497059-f1ba-4260-acad-035fc334bd49/123/0/4567' with a timestamp 'Jan 5, 2017 2:21:52 PM'. The message payload is: { "value": 94, "path": "/123/0/4567", "ep": "77497059-f1ba-4260-acad-035fc334bd49", "payload": "0000", "ct": "text/plain", "max-age": "0" }. There are several other messages listed below it, all with similar timestamps and payloads.

Interacting with your device in AWS MQTT Client

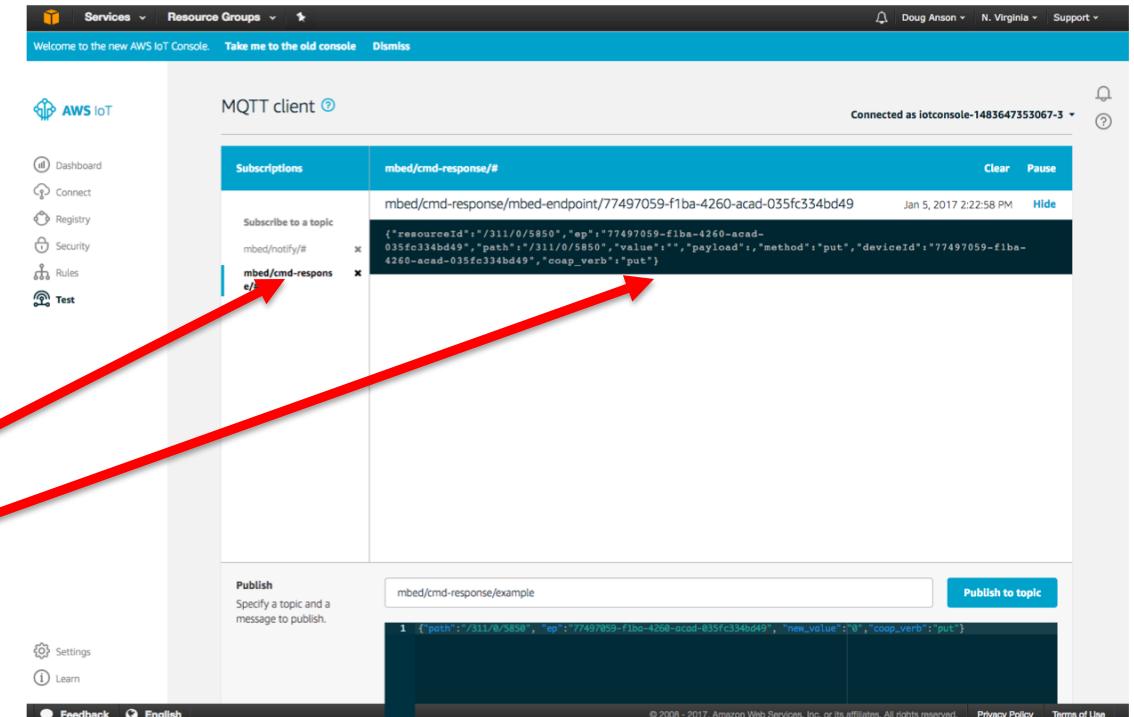
- Next, we will send a CoAP "put" command to the device to toggle the LED on ("1") or off ("0")

- Enter the topic:
mbed/put/<endpoint_type>/<endpoint_name>/311/0/5850
(<endpoint_type> and <endpoint_name> can be seen in the observations...)
- Enter the Payload (make "new_value": "0" – this will turn the blue LED off):
{"path": "/311/0/5850", "ep": "ENDPOINT_NAME_Goes_Here", "new_value": "0", "coap_verb": "put"}
NOTE: Make ENDPOINT_NAME_Goes_Here your actual endpoint name
- Press "Publish to Topic"



View your device telemetry in AWS MQTT Client...

- Your blue LED should turn off
(or on if you used "I")



- You will get a notification
response in the "cmd-response" window – that indicates
that the CoAP "put" completed successfully!

Summary

We have completed the following – congratulations!

- Created our Amazon AWS IoT and mbed environments and PC tool setup
- Imported our mbed endpoint, customized, installed, and ran it
- Created our own Amazon AWS IoT instance
- Imported and configured our ARM AWS IoT Prototype mbed Cloud Bridge
- Examined live telemetry from within Amazon's MQTT Client
- Interacted with our device through Amazon's MQTT Client

Great JOB! Thanks for your time.