



# How to connect a LabVIEW device to AWS IoT cloud using WireQueue MQTT Toolkit

This guide assumes you already have created an account at Amazon AWS that has the policy *Administrator Access* attached to it.

We start by creating a *Thing* using AWS's web interface and download the necessary certificates and keys. Then we will fill in the appropriate URLs and point to the downloaded files in the LabVIEW example to be able to connect to the AWS IoT cloud.

## 1. Log in to AWS

A screenshot of the Amazon Web Services (AWS) Sign-In page. The browser address bar shows the URL: https://us-east-1.signin.aws.amazon.com/oauth?SignatureVersion=4&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-C... The page features the AWS logo at the top left. Below it are three input fields: 'Account ID or alias' (with a blacked-out value), 'IAM user name' (with the value 'Test-user'), and 'Password' (with masked characters). A blue 'Sign In' button is positioned below the password field. To the right of the input fields is a large promotional banner with a blue hexagonal pattern and the text 'Accelerate your Windows workloads migration with AWS' and a 'Learn more »' button. At the bottom of the page, there is a language dropdown menu set to 'English' and a small link for 'Terms of Use Privacy Policy © 1999-2019, Amazon Web Services, Inc. or its affiliates.'

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## 2. Go to AWS IoT Core

A screenshot of the AWS Management Console interface. The browser address bar shows the URL 'https://us-west-2.console.aws.amazon.com/console/home?region=us-west-2#'. The page title is 'AWS Management Console'. The main content area is divided into several sections. The 'AWS services' section includes a search bar for finding services and a 'Recently visited services' list. In this list, 'IoT Core' is highlighted with a red circle. Other services listed include IAM, Billing, and AWS Organizations. The 'Build a solution' section offers options to 'Launch a virtual machine' (with EC2) or 'Build a web app' (with Elastic Beanstalk). The right-hand side of the console features sections for 'Access resources on the go' (with a mobile app link), 'Explore AWS' (with a summit link), and 'Amazon RDS' (with a 'Learn more' link).

AWS Management Console

Find Services  
You can enter names, keywords or acronyms.  
Example: Relational Database Service, database, RDS

Recently visited services

- IAM
- Billing
- IoT Core**
- AWS Organizations

All services

Build a solution  
Get started with simple wizards and automated workflows.

- Launch a virtual machine  
With EC2
- Build a web app  
With Elastic Beanstalk

Access resources on the go  
Access the Management Console using the AWS Console Mobile App. [Learn more](#)

Explore AWS

Visit AWS around the world at a Summit  
AWS Global Summits bring the cloud computing community together to connect, collaborate, and learn about AWS. [Learn more](#)

Amazon RDS  
Set up, operate, and scale your relational database in the cloud. [Learn more](#)

Amazon SageMaker

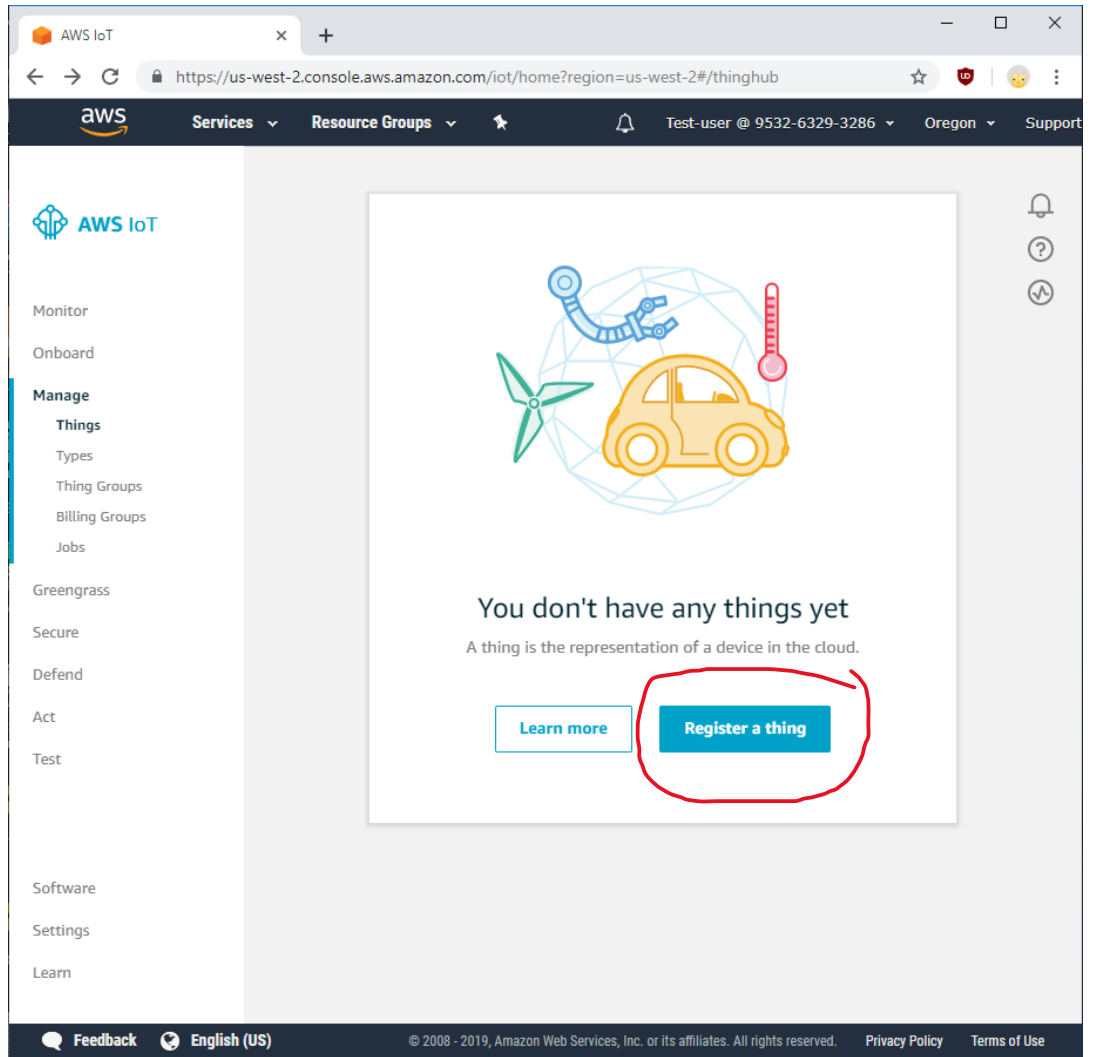
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- Now we must create a "Thing"; Navigate to *Manage* → *Things* and click on *Register a thing* or *Create* if you already have registered Things previously



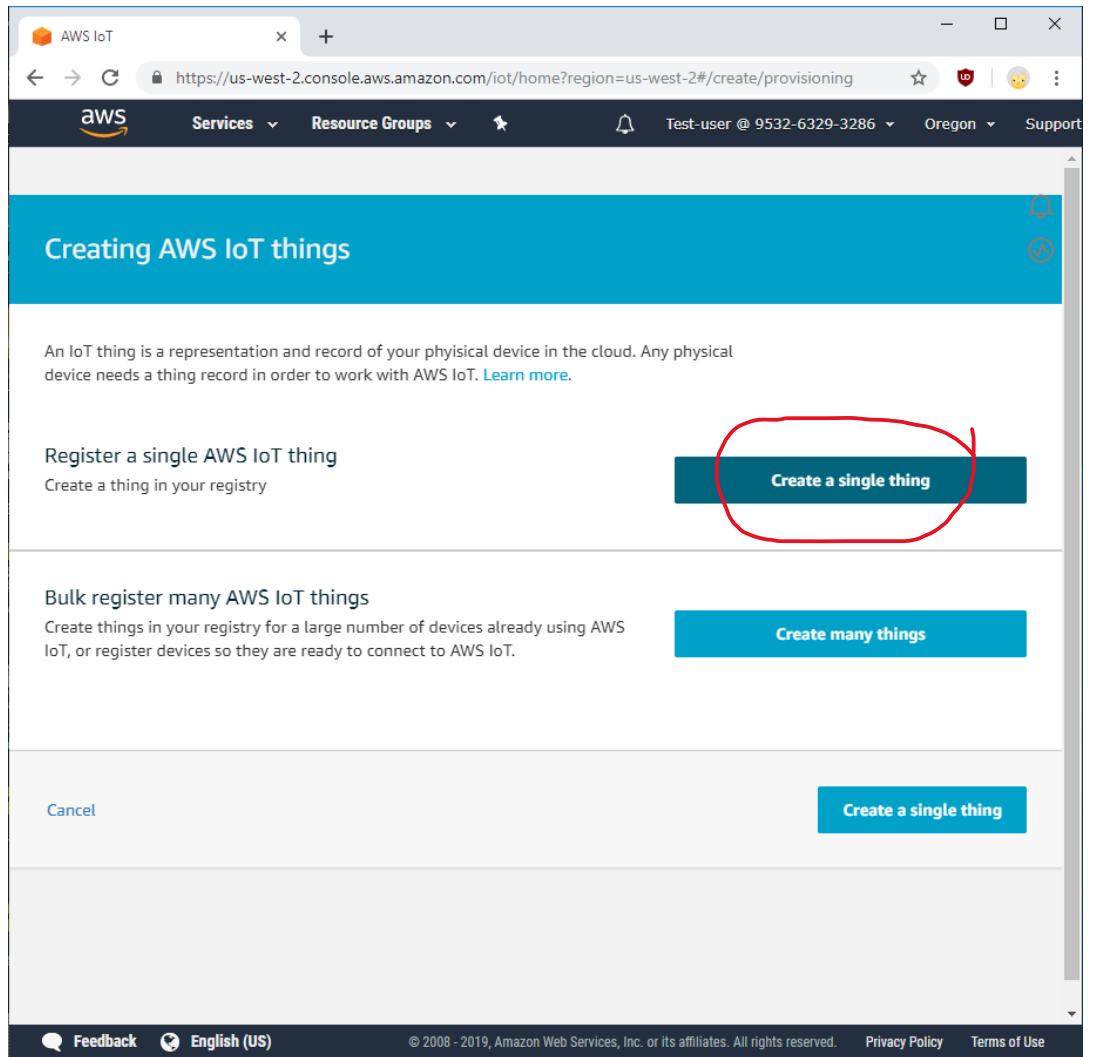
The screenshot shows the AWS IoT console interface. The browser address bar displays the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/thinghub`. The console header includes the AWS logo, navigation menus for Services and Resource Groups, and user information for 'Test-user @ 9532-6329-3286' in the 'Oregon' region. The left sidebar contains a navigation menu with categories: Monitor, Onboard, Manage, Greengrass, Secure, Defend, Act, Test, Software, Settings, and Learn. Under the 'Manage' category, the 'Things' option is selected. The main content area features a central graphic with a car, a wind turbine, and a thermometer, with the text: 'You don't have any things yet' and 'A thing is the representation of a device in the cloud.' Below this text are two buttons: 'Learn more' and 'Register a thing'. The 'Register a thing' button is circled in red. The footer of the console includes a Feedback button, language selection (English (US)), and copyright information: '© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved.' along with links for Privacy Policy and Terms of Use.

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4. Click *Create a single thing*

The screenshot shows the AWS IoT console interface. The browser address bar displays the URL: <https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/create/provisioning>. The page title is "Creating AWS IoT things". Below the title, there is a descriptive paragraph: "An IoT thing is a representation and record of your physical device in the cloud. Any physical device needs a thing record in order to work with AWS IoT. [Learn more.](#)".

There are three main sections with buttons:

- Register a single AWS IoT thing**: "Create a thing in your registry" with a button labeled "Create a single thing". This button is circled in red.
- Bulk register many AWS IoT things**: "Create things in your registry for a large number of devices already using AWS IoT, or register devices so they are ready to connect to AWS IoT." with a button labeled "Create many things".
- Cancel**: A button labeled "Cancel" and another button labeled "Create a single thing".

The footer contains: "Feedback", "English (US)", "© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved.", "Privacy Policy", and "Terms of Use".



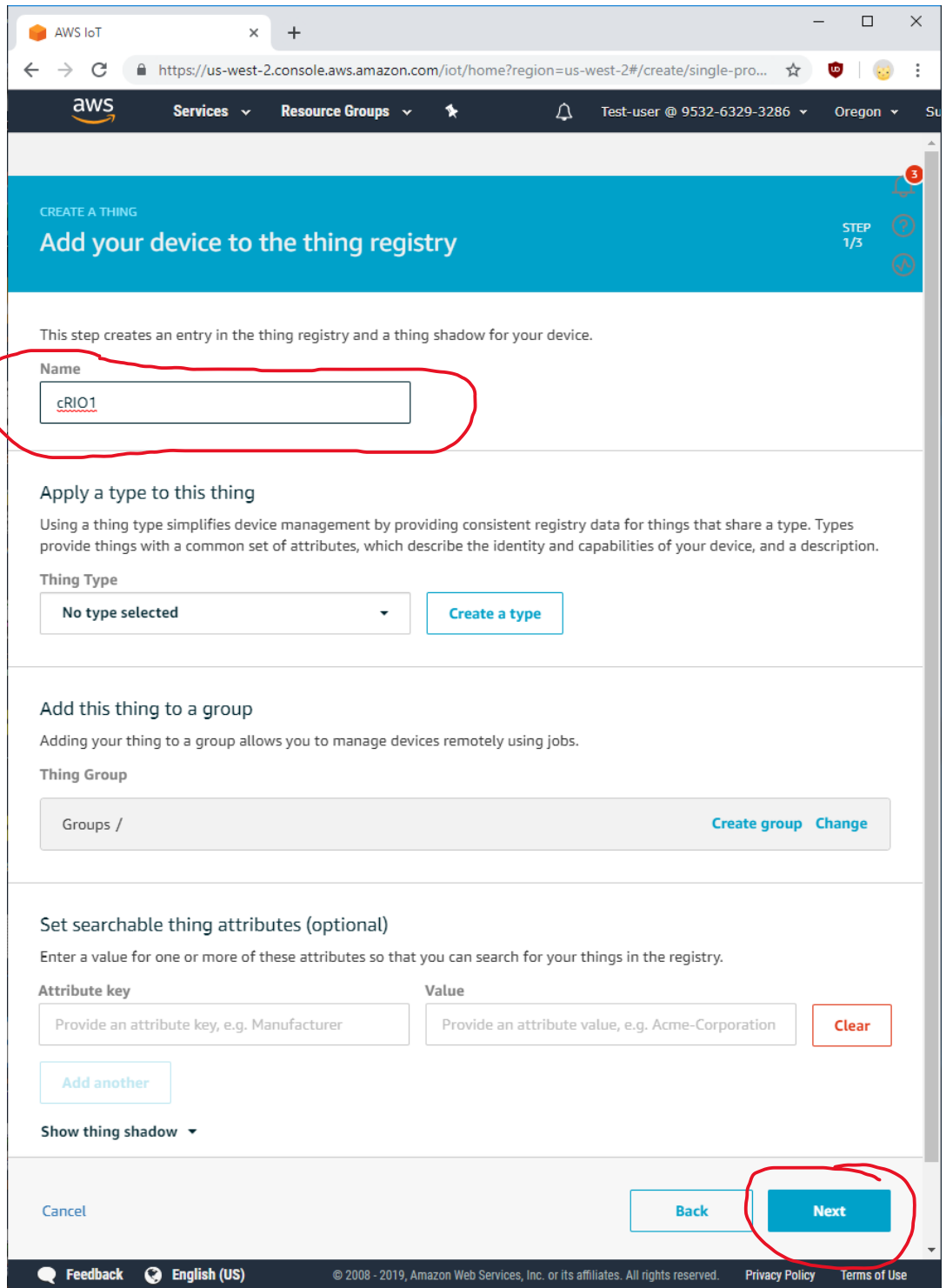
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- a. Give the thing a name (e.g. "cRIO1") and click *Next*



AWS IoT

Services Resource Groups Test-user @ 9532-6329-3286 Oregon

### CREATE A THING

## Add your device to the thing registry

STEP 1/3

This step creates an entry in the thing registry and a thing shadow for your device.

**Name**

**Apply a type to this thing**

Using a thing type simplifies device management by providing consistent registry data for things that share a type. Types provide things with a common set of attributes, which describe the identity and capabilities of your device, and a description.

**Thing Type**

No type selected [Create a type](#)

**Add this thing to a group**

Adding your thing to a group allows you to manage devices remotely using jobs.

**Thing Group**

Groups / [Create group](#) [Change](#)

**Set searchable thing attributes (optional)**

Enter a value for one or more of these attributes so that you can search for your things in the registry.

Attribute key	Value	
<input type="text" value="Provide an attribute key, e.g. Manufacturer"/>	<input type="text" value="Provide an attribute value, e.g. Acme-Corporation"/>	<a href="#">Clear</a>
<a href="#">Add another</a>		

**Show thing shadow** ▾

[Cancel](#) [Back](#) [Next](#)

[Feedback](#) [English \(US\)](#) © 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved. [Privacy Policy](#) [Terms of Use](#)



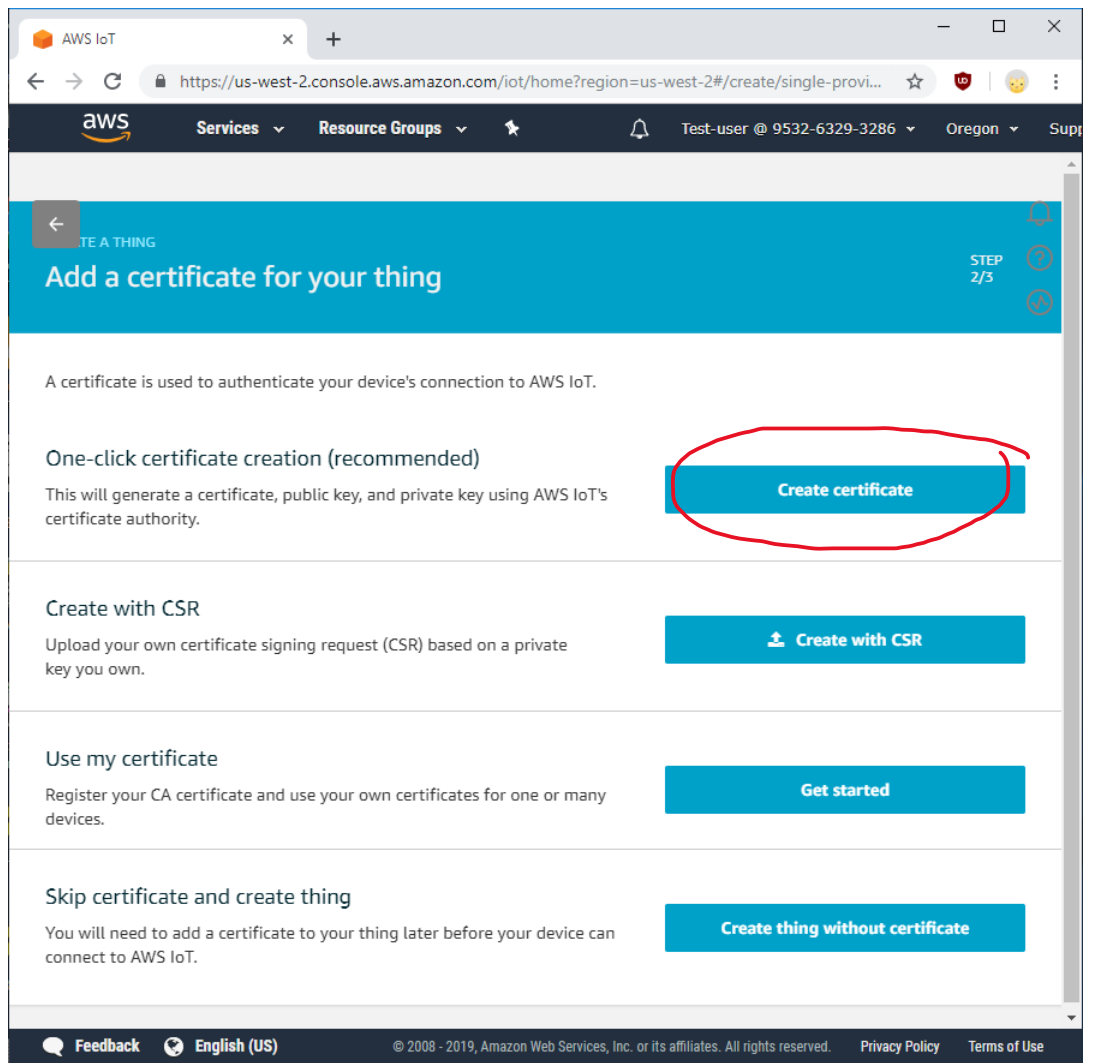
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## 5. Create a certificate and keys using One-click certificate creation



The screenshot shows the AWS IoT console interface for creating a certificate. The page title is "Add a certificate for your thing" and it is part of a 3-step process (STEP 2/3). The main heading is "Add a certificate for your thing". Below this, there is a description: "A certificate is used to authenticate your device's connection to AWS IoT." There are four options for creating a certificate:

- One-click certificate creation (recommended)**: This will generate a certificate, public key, and private key using AWS IoT's certificate authority. The **Create certificate** button is circled in red.
- Create with CSR**: Upload your own certificate signing request (CSR) based on a private key you own. The **Create with CSR** button is visible.
- Use my certificate**: Register your CA certificate and use your own certificates for one or many devices. The **Get started** button is visible.
- Skip certificate and create thing**: You will need to add a certificate to your thing later before your device can connect to AWS IoT. The **Create thing without certificate** button is visible.

The footer of the console shows "Feedback", "English (US)", "© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved.", "Privacy Policy", and "Terms of Use".



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6. Download Certificate files and key files (4 in total). The root CA cert for AWS IoT file is called AmazonRootCA1.pem on disk
7. Click Activate to activate the certificate
8. Click *Attach a policy*

**Certificate created!**

Download these files and save them in a safe place. Certificates can be retrieved at any time, but the private and public keys cannot be retrieved after you close this page.

In order to connect a device, you need to download the following:

A certificate for this thing	ff56758eb7.cert.pem	<a href="#">Download</a>
A public key	ff56758eb7.public.key	<a href="#">Download</a>
A private key	ff56758eb7.private.key	<a href="#">Download</a>

You also need to download a root CA for AWS IoT:  
 A root CA for AWS IoT [Download](#)

[Activate](#)

Cancel [Done](#) [Attach a policy](#)

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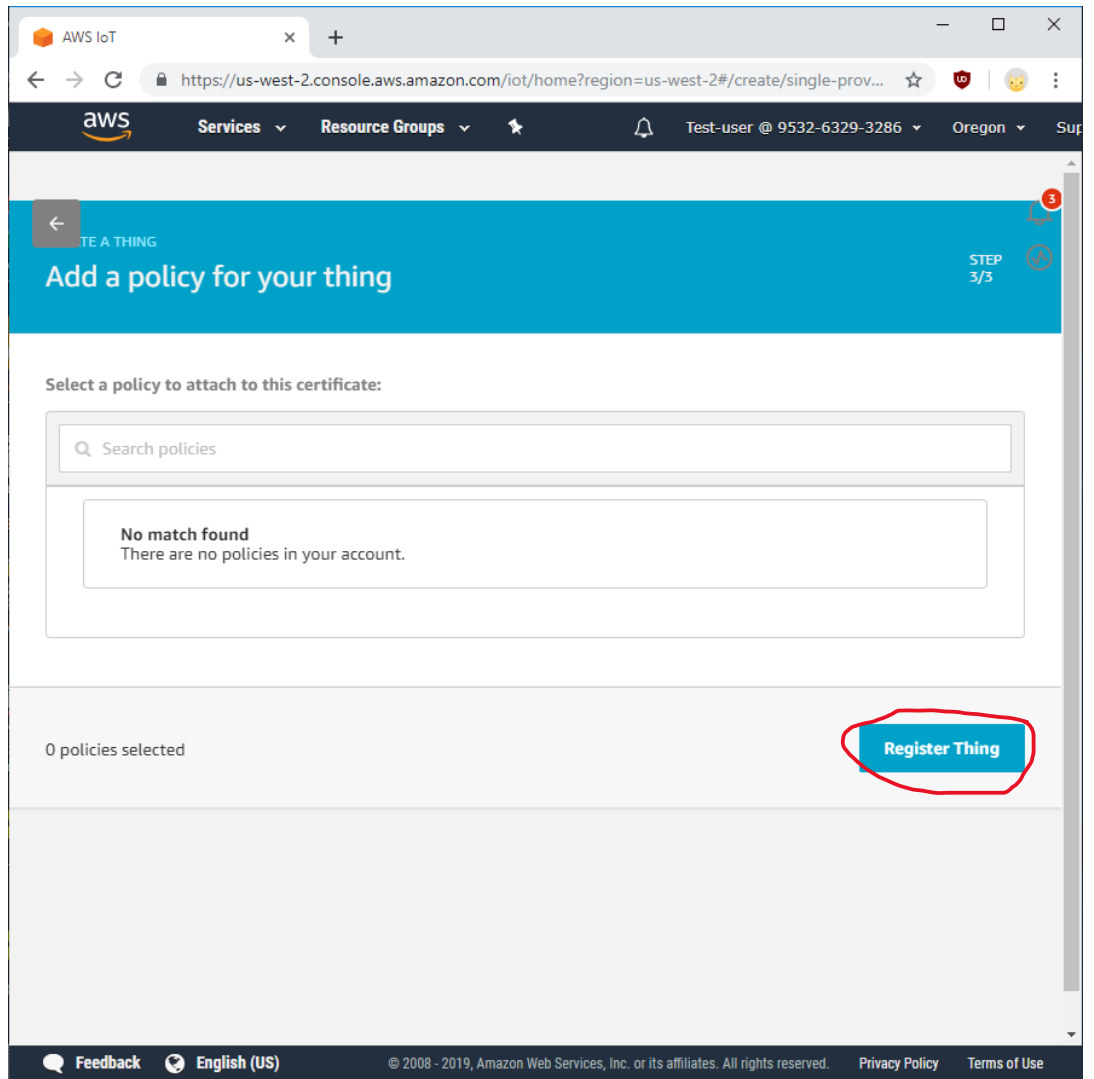
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9. We don't have any policies to attach just yet, so click *Register Thing* at this point.



The screenshot shows the AWS IoT console interface. At the top, the browser address bar displays the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/create/single-prov...`. The AWS logo and navigation menu are visible. The main heading is "Add a policy for your thing" with a sub-heading "STEP 3/3". Below this, there is a section titled "Select a policy to attach to this certificate:" containing a search box labeled "Search policies". A message box below the search box states: "No match found. There are no policies in your account." At the bottom right of the main content area, a blue button labeled "Register Thing" is circled in red. The footer contains "Feedback", "English (US)", and copyright information: "© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use".



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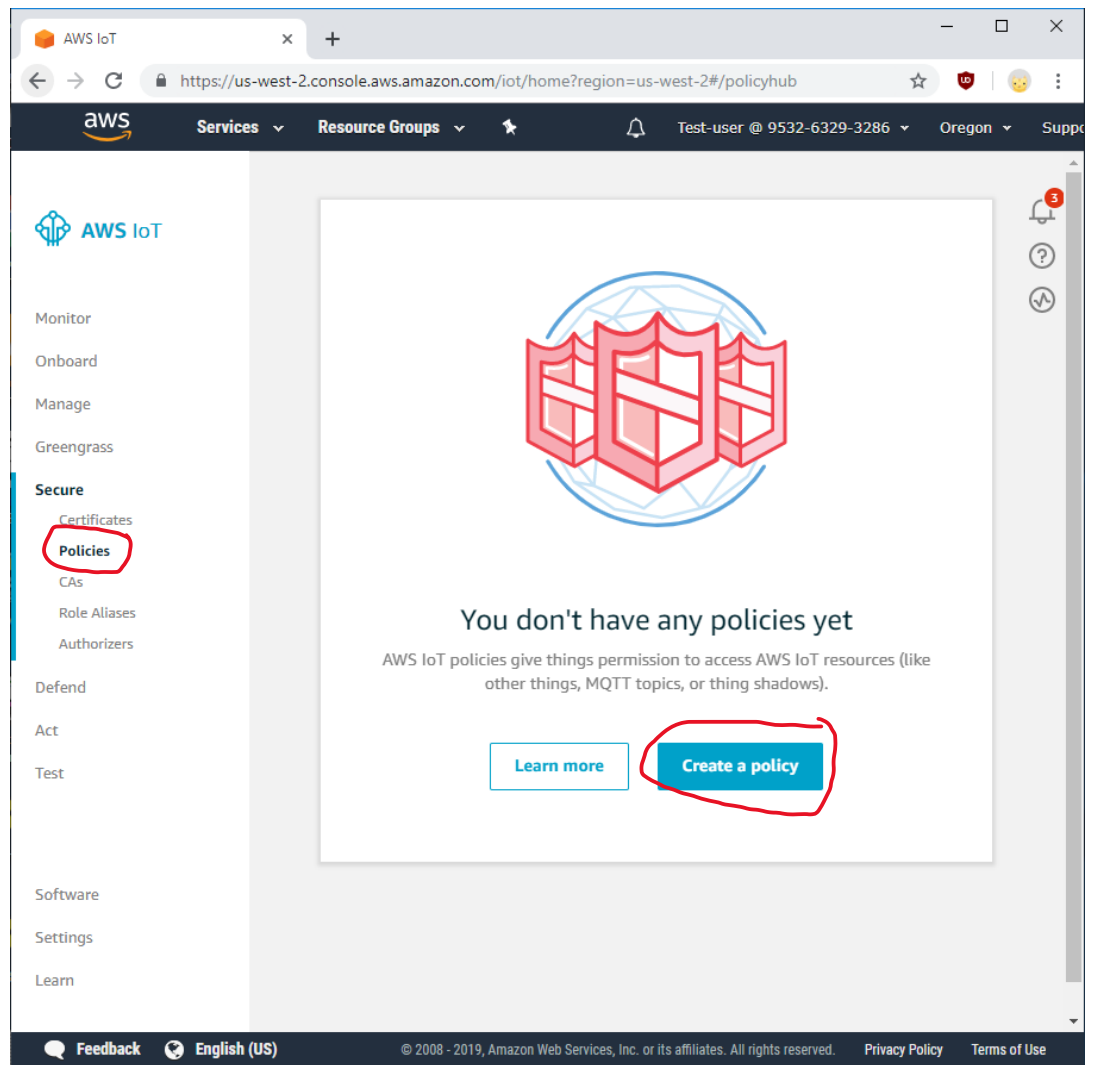
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10. Navigate to *Secure* → *Policies* and then click *Create a policy*



The screenshot shows the AWS IoT console interface. The left sidebar contains a navigation menu with the following items: Monitor, Onboard, Manage, Greengrass, **Secure**, Certificates, **Policies** (circled in red), CAs, Role Aliases, Authorizers, Defend, Act, Test, Software, Settings, and Learn. The main content area features a large shield icon and the text: "You don't have any policies yet". Below this, it states: "AWS IoT policies give things permission to access AWS IoT resources (like other things, MQTT topics, or thing shadows)." At the bottom of the main content area, there are two buttons: "Learn more" and "Create a policy" (circled in red). The top of the browser window shows the URL: "https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/policyhub".

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11. Fill in the form (name below is just an example):

- *Name* = "AllowAll"
- *Action* = "iot:\*"
- *Resource ARN* = "\*"

12. Check *Allow* and click *Create*

The screenshot shows the AWS IoT console interface for creating a policy. The browser address bar indicates the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/create/policy`. The page title is "Create a policy". Below the title, there is a brief instruction: "Create a policy to define a set of authorized actions. You can authorize actions on one or more resources (things, topics, topic filters). To learn more about IoT policies go to the [AWS IoT Policies documentation page](#)." The form contains the following fields and options:

- Name:** A text input field containing "AllowAll".
- Add statements:** A section titled "Add statements" with the subtitle "Policy statements define the types of actions that can be performed by a resource." and a toggle for "Advanced mode".
- Action:** A text input field containing "iot:\*".
- Resource ARN:** A text input field containing "\*".
- Effect:** Radio buttons for "Allow" (selected) and "Deny".
- Buttons:** "Add statement" and "Remove" (next to the statement).
- Create:** A large blue button at the bottom right of the form.

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13. Navigate to *Secure* → *Certificates* and click on the certificate you just created

The screenshot displays the AWS IoT console interface. The browser address bar shows the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/certifi...`. The console header includes the AWS logo, 'Services', 'Resource Groups', and user information 'Test-user @ 9532-6329-3286'. The left sidebar lists navigation categories: Monitor, Onboard, Manage, Greengrass, **Secure** (with sub-items: Certificates, Policies, CAs, Role Aliases, Authorizers), Defend, Act, Test, Software, Settings, and Learn. The main content area is titled 'Certificates' and features a 'Create' button, a search bar labeled 'Search certificates', and a 'Card' dropdown menu. A single certificate entry is visible, with its ID 'ff56758eb75a6c8122...' and status 'ACTIVE' circled in red. The bottom of the page contains a footer with 'Feedback', 'English (US)', 'Privacy Policy', and 'Terms of Use', along with a copyright notice: '© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved.' The browser's taskbar at the bottom shows three open files: 'ff56758eb7-privat....key', 'ff56758eb7-public.....key', and 'ff56758eb7-certific....crt', with a 'Show all' button.

14. Navigate to *Policies* and in the drop-down menu called *Action* on the right, choose *Attach policy*

The screenshot shows the AWS IoT console interface. The browser address bar displays the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/certifi...`. The page title is "CERTIFICATE" and the certificate ID is `ff56758eb75a6c81222df9207de3ae4ec53d8c9b4dca7160bd2ffe4...`. The status is "ACTIVE".

The left sidebar contains a navigation menu with the following items: "Details", "Policies", "Things", and "Non-compliance". The "Policies" item is circled in red.

The main content area is titled "Policies" and displays the message: "There are no policies attached to this certificate."

An "Actions" dropdown menu is open on the right side of the page. The menu items are: "Activate", "Deactivate", "Revoke", "Accept transfer", "Reject transfer", "Revoke transfer", "Start transfer", "Attach policy", "Attach thing", "Download", and "Delete". The "Attach policy" option is circled in red.

The footer of the console includes "Feedback", "English (US)", "Privacy Policy", and "Terms of Use". The copyright notice is "© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved." The taskbar at the bottom shows three open files: `ff56758eb7-privat....key`, `ff56758eb7-public....key`, and `ff56758eb7-certific....crt`, along with a "Show all" button.



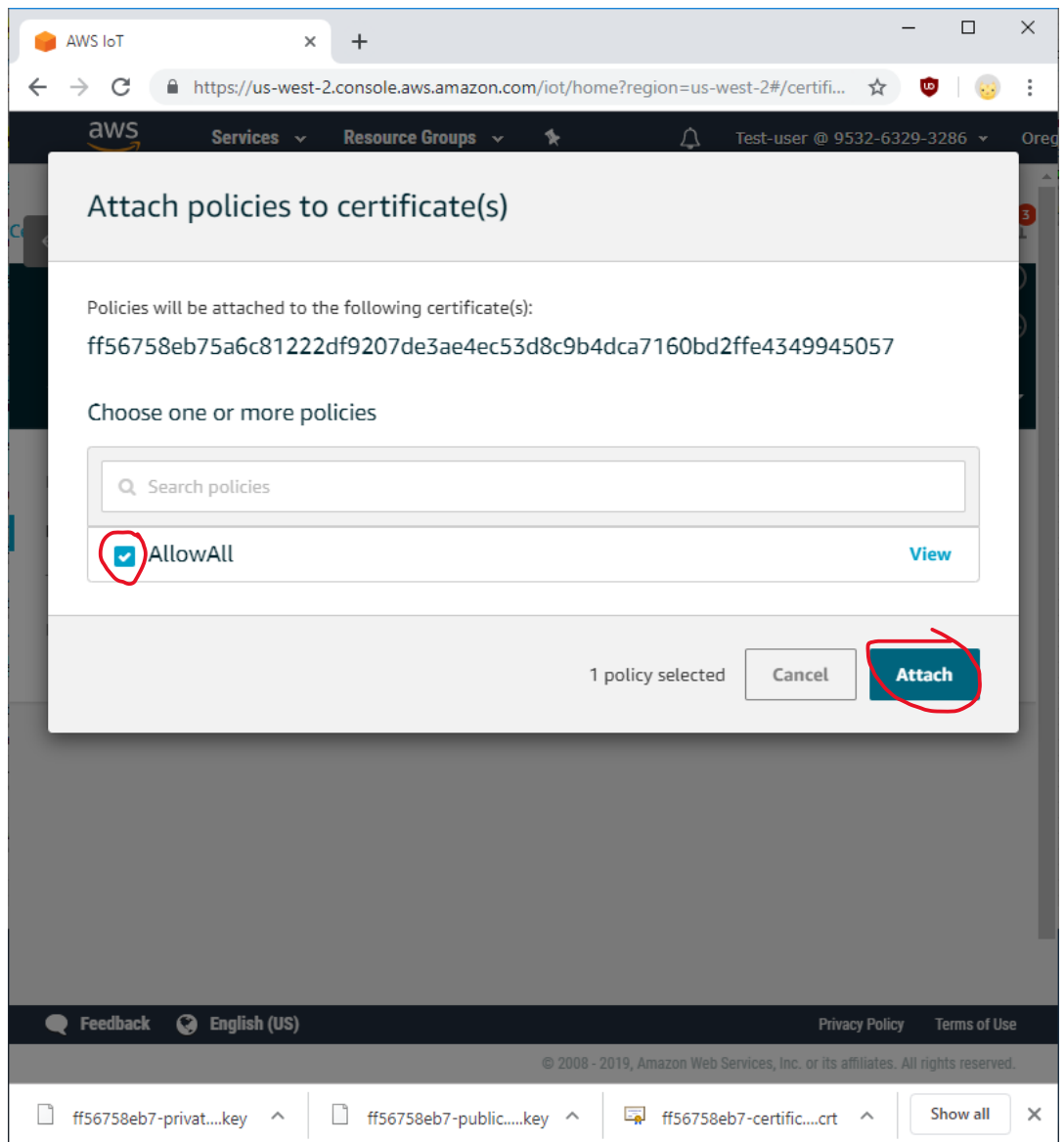
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15. Check the newly created policy *AllowAll* and click *Attach*



AWS IoT

https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/certifi...

aws Services Resource Groups Test-user @ 9532-6329-3286

### Attach policies to certificate(s)

Policies will be attached to the following certificate(s):  
ff56758eb75a6c81222df9207de3ae4ec53d8c9b4dca7160bd2ffe4349945057

Choose one or more policies

Search policies

AllowAll [View](#)

1 policy selected

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ff56758eb7-privat....key ff56758eb7-public....key ff56758eb7-certific....crt Show all



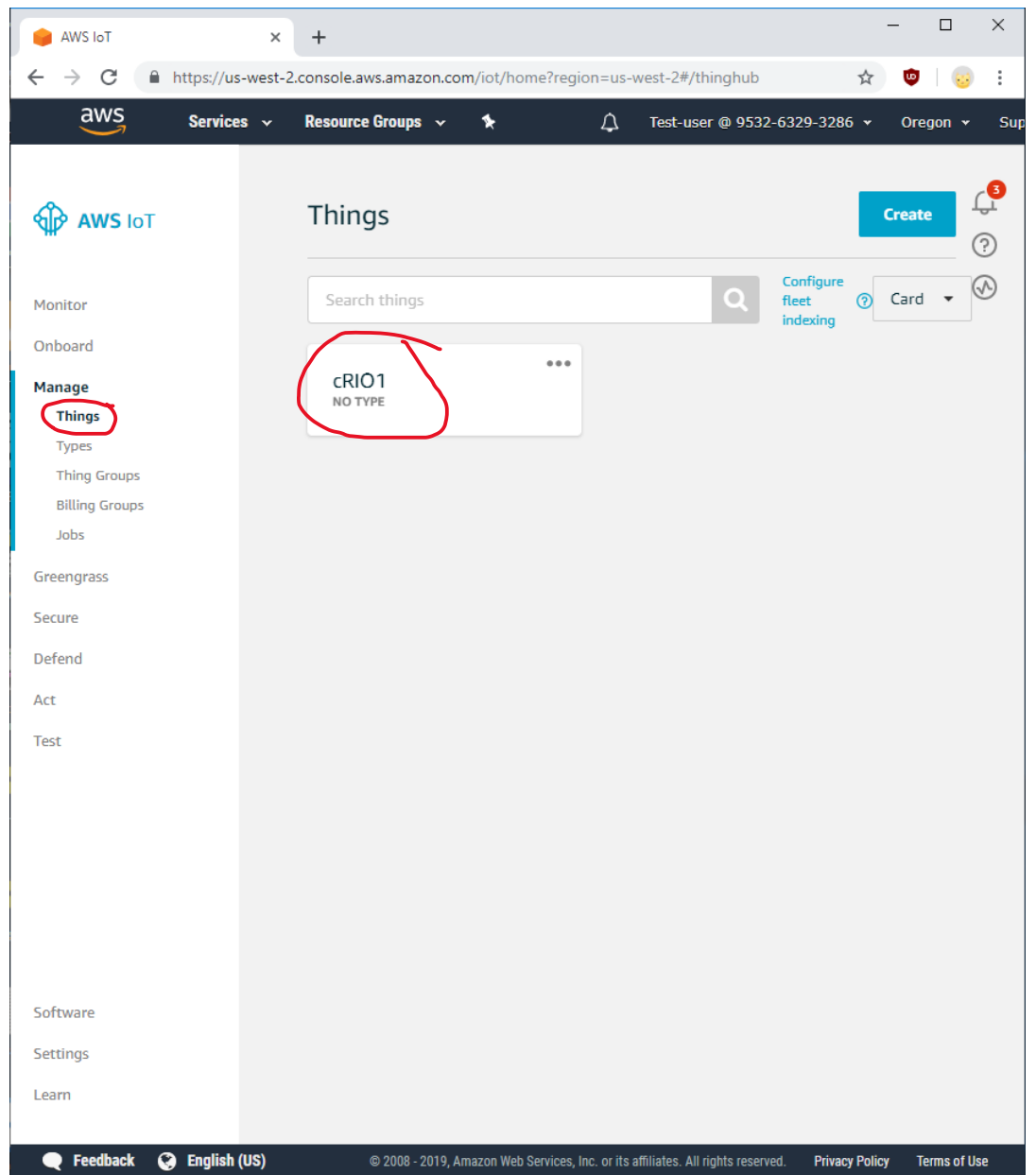
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16. Navigate to *Manage* → *Things* and click on the Thing you just created



The screenshot shows the AWS IoT console interface. The left sidebar contains a navigation menu with the following items: Monitor, Onboard, Manage, Things, Types, Thing Groups, Billing Groups, Jobs, Greengrass, Secure, Defend, Act, Test, Software, Settings, and Learn. The 'Manage' section is expanded, and the 'Things' sub-menu item is circled in red. The main content area is titled 'Things' and features a search bar labeled 'Search things', a 'Create' button, and a 'Configure fleet indexing' link. A card for a thing named 'cRIO1' with the type 'NO TYPE' is displayed and circled in red. The footer of the console includes a 'Feedback' button, the language 'English (US)', and copyright information: '© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use'.



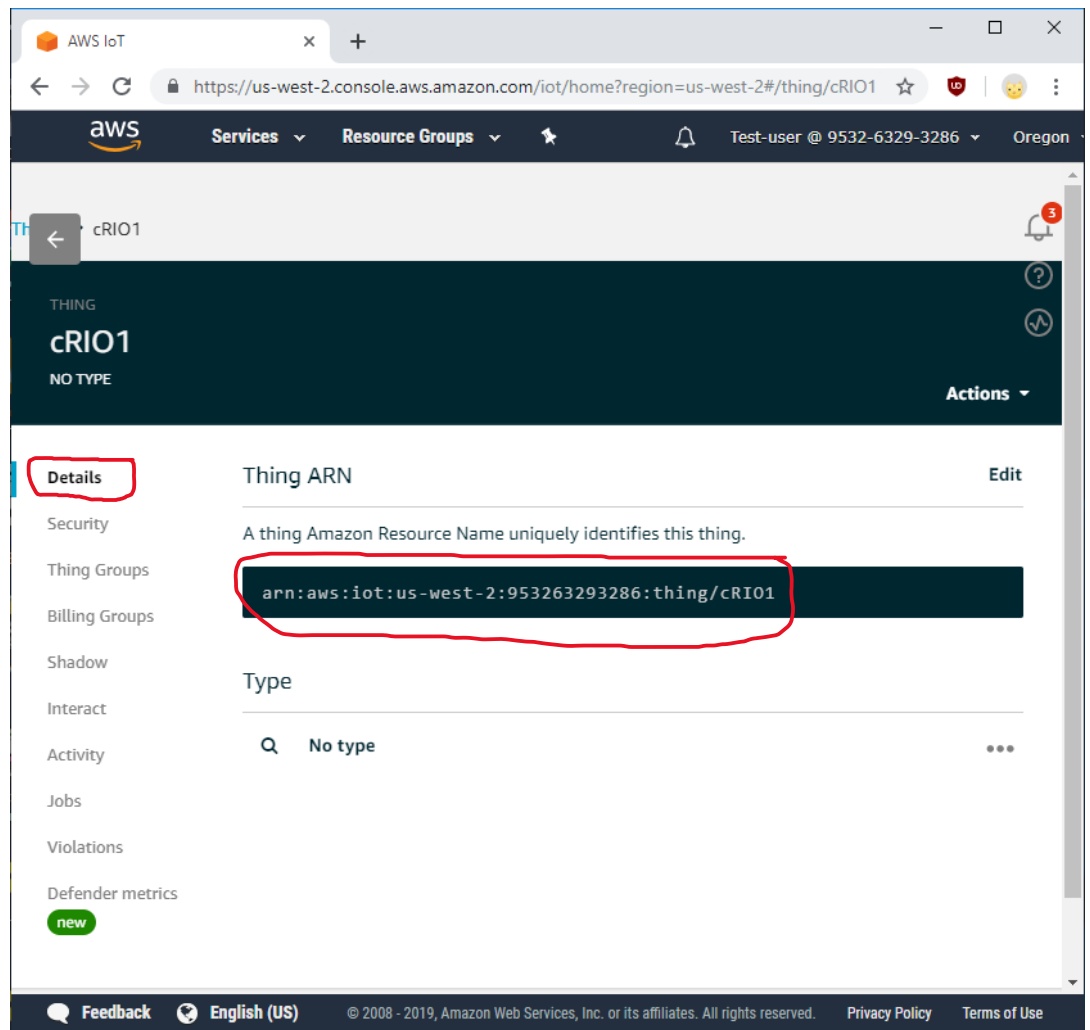
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17. Navigate to *Details* and take note of its Amazon Resource Name (ARN)



The screenshot shows the AWS IoT console interface. The browser address bar displays the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/thing/cRIO1`. The page title is "cRIO1" and it is identified as a "THING" with "NO TYPE". The "Details" tab is selected and highlighted with a red box. The "Thing ARN" section is also highlighted with a red box, showing the value: `arn:aws:iot:us-west-2:953263293286:thing/cRIO1`. The "Type" section shows "No type". The footer includes "Feedback", "English (US)", and copyright information for Amazon Web Services, Inc. (2008-2019).



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18. Navigate to *Interact* and take note of its Rest API Endpoint that is to be used as Server Name

The screenshot shows the AWS IoT console interface. The browser address bar displays the URL: `https://us-west-2.console.aws.amazon.com/iot/home?region=us-west-2#/thing/cRIO1`. The page title is 'cRIO1' and the breadcrumb is 'THING cRIO1 NO TYPE'. The 'Interact' tab is selected in the left sidebar. The main content area shows the 'Shadow' section with the Rest API Endpoint: `agchprjh9ak9t-ats.iot.us-west-2.amazonaws.com`. Below this, the 'MQTT' section is visible with the endpoint: `$aws/things/cRIO1/shadow/update`.

Now we have performed all actions and gathered all information we need to connect to the AWS IoT. Verify functionality by running the `MQTT_BasicExample.vi` installed with the `WF WireQueue-MQTT vipm-packet`. Fill in the following parameters in the front panel:

- Configuration = *Manual Configuration*
- Server IP = *<Rest API Endpoint name>*  
(e.g. `agchprjh9ak9t-ats.iot.us-west-2.amazonaws.com`)
- Port = `8883`
- Communication type = *TCP/IP (TLS)*
- CA-bundle.crt = *<Amazon root CA>* (e.g. `AmazonRootCA1.pem`)
- Client.crt = *<client certificate>* (e.g. `ff56758eb7-certificate.pem.crt`)
- Client.key = *<client private key>* (e.g. `ff56758eb7-private.pem.key`)
- Client ID = *<Amazon ARN>* (e.g. `arn:aws:iot:us-west-2:953263293286:thing/cRIO1`)





MQTT\_BasicExample.vi Front Panel

File Edit View Project Operate Tools Window Help

15pt Application Font

Search

1. Select a preconfigured test session or select manual to enter your own details

Configuration  
Manual configuration

The following steps are only needed to configure the settings manually

2. Specify Server IP and port

Server IP: agchprjh9ak9t-ats.iot.us-west-2.amazonaws.com Port: 8883

3. Specify Type of communication

Communication type: TCP/IP (TLS) TLS level (Full TLS): Full TLS check

4. If TLS encryption is used, specify CA-bundle (to identify the server), and optionally the Client certificate and private key

Generate your own mosquitto client certificate at <http://test.mosquitto.org/ssl/>

CA-bundle.crt ("=" = default): C:\\_svn\AC0075 IoT LabVIEW-driver\source\API\Examples\aws\AmazonRootCA1.pem

Client.crt ("=" = not used): C:\\_svn\AC0075 IoT LabVIEW-driver\source\API\Examples\aws\ff56758eb7-certificate.pem.crt

Client.key ("=" = next to Client.crt): C:\\_svn\AC0075 IoT LabVIEW-driver\source\API\Examples\aws\ff56758eb7-private.pem.key

5. Specify Client ID, user name and password

Client ID (Cannot be empty): am:aws:iot:us-west-2:953263293286:thing/cRIO1

User name: Password:

Select a example configuration or specify connection settings manually. Run the VI and see the timestamps for the messages

QoS (At most once): At most once

error out: status: 0 code: 0 source:

Received topics:

Received	value
16:11:38.432	16:11:38.213
16:11:38.642	16:11:38.432
16:11:38.864	16:11:38.642
16:11:39.078	16:11:38.864
16:11:39.291	16:11:39.078
16:11:39.517	16:11:39.291
16:11:40.178	16:11:39.517
16:11:40.411	16:11:40.178
16:11:40.618	16:11:40.411
16:11:40.826	16:11:40.619

That's all! Now you are connected to the AWS IoT cloud from your LabVIEW client!

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