Cloud Tutorial: AWS IoT

TA for class CSE 521S, Fall, Jan/18/2018
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Pointers

- **Amazon IoT**
  - [http://docs.aws.amazon.com/iot/latest/developerguide/what-is-aws-iot.html](http://docs.aws.amazon.com/iot/latest/developerguide/what-is-aws-iot.html)

- **Amazon EC2**

- **Resource list** for course projects

- **Apply for $40 credits for Amazon AWS**
  - [https://aws.amazon.com/education/awseducate/apply/](https://aws.amazon.com/education/awseducate/apply/)
XaaS: Basics in Cloud Computing
Cloud Computing

- Cloud computing provides shared pool of configurable computing resource to end users on demand

- Three service models
  - IaaS (Infrastructure as a Service): virtual machines, storage, network …
  - PaaS (Platform as a Service): execution runtime, middleware, web server, database, development tool …
  - SaaS (Software as a Service): email, virtual desktop, games …
Cloud Services: On-premise Software

- Traditional
  - installed and runs on personal computer

- You Manage and Deploy
  - Hardware
  - OS
  - Software

- Example
  - This presentation
Infrastructure as a Service (IaaS)

- IaaS
  - "physical server box"
  - Virtual Machine
    - Memory
    - Storage
    - CPU
    - Network

- Example
  - AWS EC2
  - AWS HPC

- Use case
  - Build up your VM cluster
Platform as a Service (PaaS)

- **PaaS**
  - You get a framework
  - Host Application
  - Tools

- **Example**
  - AWS IoT

- **Use case**
  - Build up you’re smart A/C controller
PaaS Example: Amazon IoT

Tools

Framework
Software as a Service (SaaS)

- SaaS
  - You get a whole solution

- Example
  - Gmail
  - Dropbox
  - Office365
XaaS: A Recap

On-Premise
- APP
- Data
- Runtime
- Middleware
- OS
- Virtualization
- Server
- Storage
- Network

IaaS
- APP
- Data
- Runtime
- Middleware
- OS
- Virtualization
- Server
- Storage
- Network

You Manage

PaaS
- APP
- Data
- Runtime
- Middleware
- OS
- Virtualization
- Server
- Storage
- Network

Service Provider Manages

SaaS
- APP
- Data
- Runtime
- Middleware
- OS
- Virtualization
- Server
- Storage
- Network

Service Provider Manages
Tutorial: Hello! AWS IoT!!
Internet-of-Things

Things (Devices)
- Many of them
  - Different Types
  - Isolated Systems

Data and Command
- Sensing the world
- Give Response

Challenge
- United: Connected + Communication
- Smart: Data Analytics + Strategy

Source: https://aws.amazon.com/iot-platform/
http://www.brain-smart.net/smart-brain-health-blog/page/2/#axzz4W4oSp8a6
Solution: AWS IoT

United: Connect + Communication
Stated: “Thing Shadow”

Smart: Other Cloud Service
Data Storage
Machine Learning

Source: https://aws.amazon.com/iot-platform/
Tutorial: Hello AWS IoT!

1. Generate a random integer between 1 and 100.
2. Publish the random integer to AWS IoT using an EC2 t2.micro instance.
3. Forward the message to Amazon SNS.
4. Subscribe to Amazon SNS to receive the published message.

Source: https://aws.amazon.com/iot-platform/
Step 1: Create a Virtual "Thing"
Get into AWS Manage Console

- Create your own AWS account
- Sign In IoT Manage Console
  - [https://aws.amazon.com/iot/](https://aws.amazon.com/iot/)
Create a thing

1. AWS IoT Menu
   - Registry
     - Things ➔ Create

2. Give a name
Basic Interact: Publish

➢ Using Embedded **MQTT Client** to Test

➢ Check the Things Shadow
Basic Interact: Subscribe

Devices publish MQTT messages on topics. Subscribe to a topic to view the messages published to it.

Subscription topic:

$aws/things/Test/shadow/update/accepted

Max message capture: 100

Quality of Service: 0

Subscribe to topic

MQTT client

Connected as iotconsole-1484713476597-4

Subscriptions

$aws/things/Test/shadow/update/accepted

Clear

Pause

Jan 17, 2017 10:27:34 PM

Hide

{  "state":  [    "reported":  [      "Info":  "Hello AWS IoT!"    ]  ]}
Step 2: Connect a “Physical” Device
Create and get Certificates

- Create Certificates
  - Security ➔ Certificates ➔ Create

- Download Cert Files
  - 1. public & private key
  - 2. thing cert
  - 3. Root CA for AWS

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

<table>
<thead>
<tr>
<th>Item</th>
<th>File Name</th>
<th>Download</th>
</tr>
</thead>
<tbody>
<tr>
<td>A certificate for this thing</td>
<td>f32c514adc.cert.pem</td>
<td></td>
</tr>
<tr>
<td>A public key</td>
<td>f32c514adc.public.key</td>
<td></td>
</tr>
<tr>
<td>A private key</td>
<td>f32c514adc.private.key</td>
<td></td>
</tr>
</tbody>
</table>

You also need to download a root CA for AWS IoT from Symantec:
A root CA for AWS IoT [Download]
Create Policy and attach it to cert

- Create Policy
  - Security
    - Certificates
    - Policies
    - CAs

- Attach Policy to Certificates
  Set your policy to allow pub/sub!

CPSL
Cyber-Physical Systems Laboratory
Connect your Device

- Copy certificates to your EC2 Instance
  - Note: through `scp` utility

- Choose your AWS SDK (support MQTT)
  - Node JS
  - Python
  - Java

- You can also use third party MQTT tools
  - Python (paho-mqtt library)
Some Notes

1. You will need these certification when setting up the TLS 1.2 verification

2. You will need the endpoint and port (8883) when connect to AWS IoT Gateway

HTTPS

Update your Thing Shadow using this Rest API Endpoint. Learn more

a351pfzlksv6kq.iot.us-west-2.amazonaws.com
More: Rule Engine, Link with SNS services

- Simple Notification Service
  - Publish from EC2 t2.micro to AWS
  - Subscribe to Amazon SNS
  - Forward to Virtual "Thing"/Shadow
  - Topic: CSE521_Tutorial

AWS IoT
Amazon SNS

Create a Topic

- ARN will be used later

Topic details: LED_Litup

- Topic owner: 401317363811
- Region: us-west-2
- Display name: LED_Litup

Subscriptions

- Create subscription
- Request confirmations
- Confirm subscription
- Other subscription actions

Filter

<table>
<thead>
<tr>
<th>Subscription ID</th>
<th>Protocol</th>
<th>Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>arn:aws:sns:us-west-2:401317363811:LED_Litup:9d1e4c16-4316-47c3-a8f1-763c72152...</td>
<td>sms</td>
<td>+1929...</td>
</tr>
<tr>
<td>arn:aws:sns:us-west-2:401317363811:LED_Litup:975dbe42-cde3-4b3a-80fc-a404e6930...</td>
<td>email</td>
<td>@gmail.com</td>
</tr>
</tbody>
</table>
Create a Rule in Amazon IoT

- Add a query to filter your interesting topic (event)

  Rule query statement
  ```sql
  SELECT * FROM '$aws/things/RaspberryPi/shadow/update/accepted'
  ```

- Add an Action:
  - Forward this message to SNS
  - Specify Dest ARN
  - Enable Rule
Notification on SMS & Email

AWS Notification Message

520Tutor no-reply@sns.amazonas.com
3:11 PM (28 minutes ago)

447-79
520Tutor> {"state":{"reported":{"Value":45}},"metadata":{"reported":{"Value":{"timestamp":1503951070}}},"version":134,"timestamp":1503951070}

If you wish to stop receiving notifications from this topic, please click or visit the link below to unsubscribe:
https://sns.us-west-2.amazonaws.com/unsubscribe.html?
SubscriptionArn=arn:aws:sns:us-west-2:401317363811:
CSE520S_Tutorial:00c54352-7d1a-4c09-9cc1-15aed3c395e3&
Endpoint=naroahlee@gmail.com

Please do not reply directly to this email. If you have any questions or comments regarding this email, please contact us at
https://aws.amazon.com/support
One More Thing: Account Security

➢ DON’T UPLOAD YOUR KEY PUBLICLY!!!

Time to Open Source!
My AWS account was hacked and I have a $50,000 bill, how can I reduce the amount I need to pay?

For years, my bill was never above $350/month on my single AWS instance. Then over the weekend someone got hold of my private key and launched hundreds of instances and racked up a $50,000 bill before I found out about it on Tuesday. Amazon had sent a warning by email at $15,000 saying they had found our key posted publicly, but I didn't see it. Naturally, this is a devastating amount of money to pay. I'm not saying I shouldn't pay anything, but this just a crazy amount in context. Amazon knew the account was compromised, that is why they sent an email, they knew the account history and I had only spent $213 the previous month. I almost feel they deliberately let it ride to try to earn more money. Does anyone have any experience with this sort of problem?
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Thanks!

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