

# Experience IoT through the use of AWS IoT Buttons

CETPA

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# How are you using IoT?

 Respond at [PollEv.com/sburt](https://PollEv.com/sburt)  Text **SBURT** to **37607** once to join, then **A, B, C, D, E...**

Facilities management	<b>A</b>
Classroom instruction	<b>B</b>
Transportation	<b>C</b>
Maintenance	<b>D</b>
Nothing (yet)	<b>E</b>
Other	<b>F</b>

# Welcome

1. Introductions
2. About AWS in K12 education
3. The Internet of Things
4. How IoT is being used in education
5. AWS IoT Button
  - a. Demo
  - b. Schema
  - c. Code snippets
6. How you can use AWS IoT Buttons
  - a. Ideas, opportunities, and cost

# Presentation resources

[www.k12blueprint.com/cetpa](http://www.k12blueprint.com/cetpa)

## About your presenters

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# Benefits of Cloud in Education

## Security

Highest levels of security developed for government & enterprise.



## Simplification

Stop guessing at capacity.



## Experimentation

Sandbox new services while minimizing risk.



## Efficiency

Benefit from massive economies of scale.



## Equity

Provide equal access to services for all.



## Analytics

Democratize data for all stakeholders.



## Agility

Increase speed and flexibility.

# AWS in K12 education

- ❑ **Lower costs** and reallocate resources so you can deliver more efficient and equitable solutions.
- ❑ **Innovate faster** and solidify your education services by merging agility with experience and resources.
- ❑ **Reduce risk** by focusing resources dedicated to security, compliance and availability to the most important areas of your district.
- ❑ **Customize services** by utilizing flexible offerings that provide just-in-time solutions for students, educators, and your community.
- ❑ **Improve equity** by leveraging data analytics, virtualization, and AI tools.

\* [aws.amazon.com/education/K12-primary-ed](https://aws.amazon.com/education/K12-primary-ed)

# The Internet of Things

“The interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.”



\* [wikipedia.org/wiki/Internet\\_of\\_things](http://wikipedia.org/wiki/Internet_of_things)



# How IoT is being used in education

- Monitor hardware and reduce operational costs
- Improve building safety
- Enhance access to information
- Develop smart lesson plans such as using sensor gloves to teach sign language



\* [businessinsider.com/internet-of-things-education-2016-9](http://businessinsider.com/internet-of-things-education-2016-9)

# The AWS IoT Button

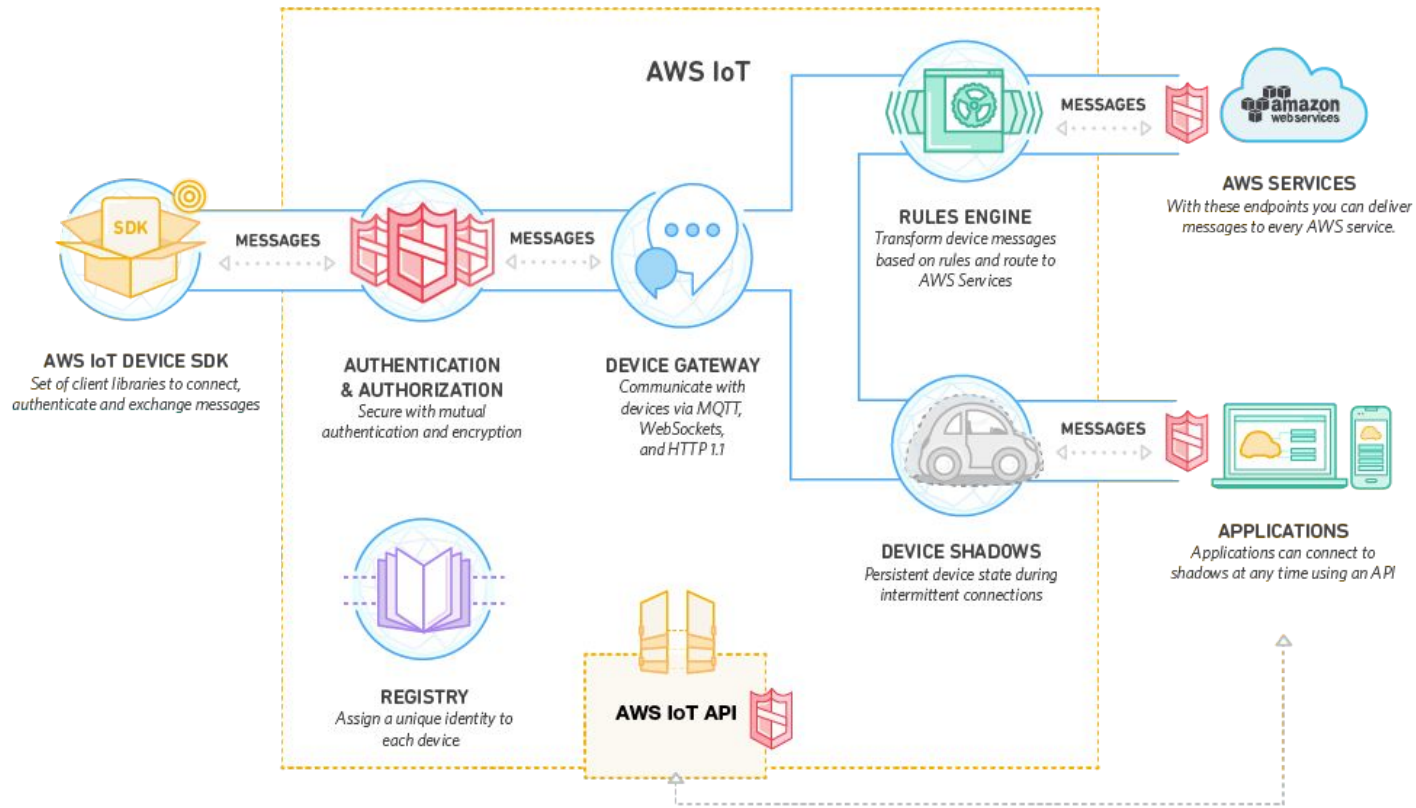


Programmable button  
based on the Amazon Dash Button

- Easy to configure Wi-Fi device
- Count or track items
- Notify someone (email or text)
- Remote control for other hardware
- Integrate third-party APIs

\* Learn more at [aws.amazon.com/iotbutton](https://aws.amazon.com/iotbutton)

# AWS IoT Platform



\* [aws.amazon.com/iot/](https://aws.amazon.com/iot/)

# DEMO: SEL data collection

**Social-Emotional skills education\*** is a growing trend, included in the ESSA act, and difficult to assess.

We developed a **data collection proof-of-concept** using the AWS IoT Button to demonstrate how SEL instruction can be measured.

\* Learn more about SEL at [casel.org/core-competencies/](https://casel.org/core-competencies/)

# SEL and the AWS IoT Button

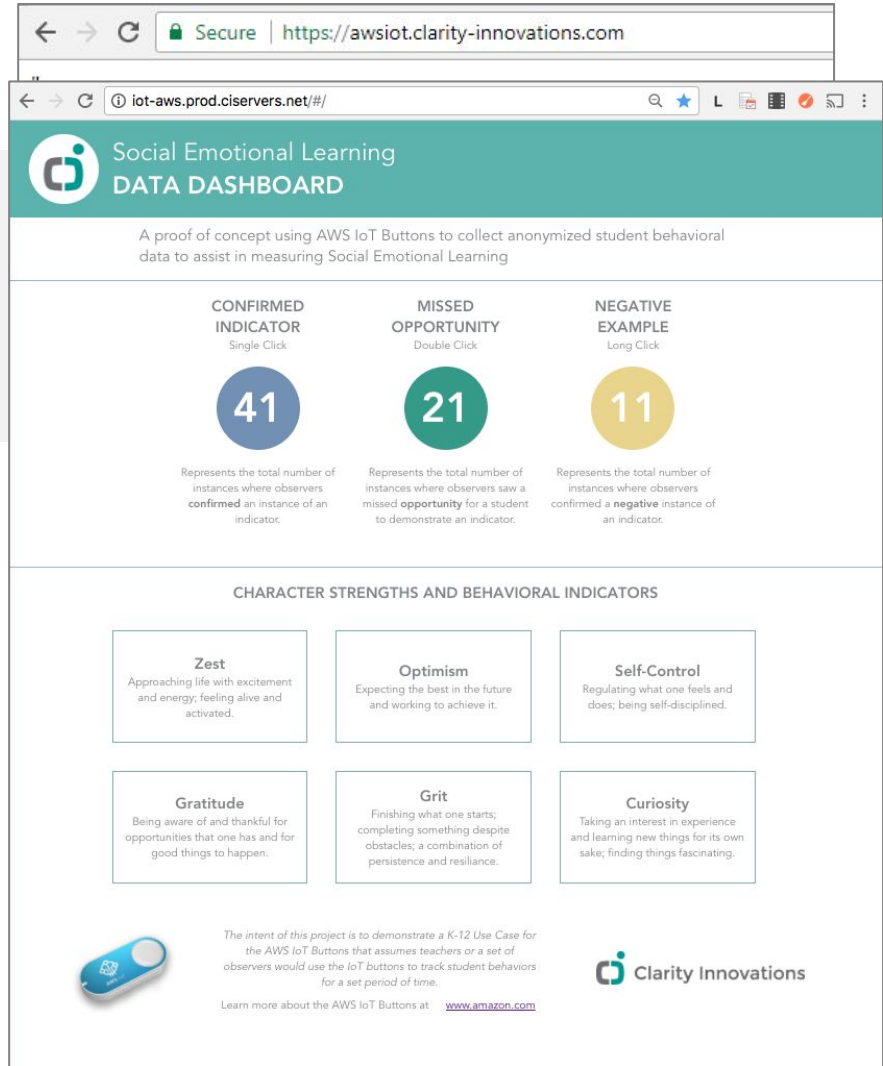
Raw data collected from AWS IoT buttons

- Single click
- Double click
- Long click

```

← → ↻ | Secure | https://awsiot.clarity-innovations.com
ID: 864d4828-241a-11e7-8343-e8716d94323 With Message: Long click event
ID: 262b644-3960-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: 06e4348c-1977-11e7-8a2b-e9946d0e068 With Message: Double click event
ID: 0998a8c0-099e-11e7-83aa-c55037d6681 With Message: Single click event
ID: 85ec9402-2111-11e7-8a58-d6d594c18630 With Message: Single click event
ID: 05122848-3106-11e7-8a58-d6d594c18630 With Message: Single click event
ID: 8718424-1976-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: a156846-099e-11e7-83aa-c55037d6681 With Message: Single click event
ID: 50851a-3112-11e7-8a58-d6d594c18630 With Message: Double click event
ID: 13c78474-3106-11e7-8a58-d6d594c18630 With Message: Single click event
ID: 688a8a8-099e-11e7-83aa-c55037d6681 With Message: Single click event
ID: 806a83c-341a-11e7-8504-e8716d94323 With Message: Single click event
ID: 66c63e-099a-11e7-83aa-c55037d6681 With Message: Single click event
ID: 7177446-1977-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: a80ea69-3106-11e7-8a58-d6d594c18630 With Message: Long click event
ID: 7094736-3112-11e7-8a58-d6d594c18630 With Message: Double click event
ID: 41839a6-2c06-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: 7d6d69-099e-11e7-83aa-c55037d6681 With Message: Single click event
ID: a4ac586-341a-11e7-8504-e8716d94323 With Message: Double click event
ID: 178c7c3-1977-11e7-8a2b-e9946d0e068 With Message: Double click event
ID: b79a270-099e-11e7-83aa-c55037d6681 With Message: Single click event
ID: 9a28a6c-3106-11e7-8a58-d6d594c18630 With Message: Single click event
ID: 2324a6d-3106-11e7-8a58-d6d594c18630 With Message: Long click event
ID: 9687d7e-341a-11e7-8504-e8716d94323 With Message: Double click event
ID: 681965c-341a-11e7-8504-e8716d94323 With Message: Single click event
ID: 8155968-3112-11e7-8504-e8716d94323 With Message: Double click event
ID: 6a6a948-1977-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: 6a6a948-1977-11e7-8a2b-e9946d0e068 With Message: Long click event
ID: 6a6a948-1977-11e7-8a2b-e9946d0e068 With Message: Single click event
ID: e8d4c56-2a6c-11e7-a717-d677bd4d434 With Message: Double click event
ID: 1508a0c-354d-11e7-8343-e8a80b157968 With Message: Single click event
ID: be9f9cc4-35cc-11e7-8343-e8a80b157968 With Message: Single click event
    
```

Presented using a custom user interface at [iot-aws.prod.ciservers.net](https://iot-aws.prod.ciservers.net)



Secure | <https://awsiot.clarity-innovations.com>

iot-aws.prod.ciservers.net/#/

## Social Emotional Learning DATA DASHBOARD

A proof of concept using AWS IoT Buttons to collect anonymized student behavioral data to assist in measuring Social Emotional Learning


CONFIRMED INDICATOR	MISSED OPPORTUNITY	NEGATIVE EXAMPLE
Single Click	Double Click	Long Click
41	21	11
Represents the total number of instances where observers confirmed an instance of an indicator.	Represents the total number of instances where observers saw a missed opportunity for a student to demonstrate an indicator.	Represents the total number of instances where observers confirmed a negative instance of an indicator.

### CHARACTER STRENGTHS AND BEHAVIORAL INDICATORS

<b>Zest</b> Approaching life with excitement and energy; feeling alive and activated.	<b>Optimism</b> Expecting the best in the future and working to achieve it.	<b>Self-Control</b> Regulating what one feels and does; being self-disciplined.
<b>Gratitude</b> Being aware of and thankful for opportunities that one has and for good things to happen.	<b>Grit</b> Finishing what one starts; completing something despite obstacles; a combination of persistence and resilience.	<b>Curiosity</b> Taking an interest in experience and learning new things for its own sake; finding things fascinating.

The intent of this project is to demonstrate a K-12 Use Case for the AWS IoT Buttons that assumes teachers or a set of observers would use the IoT buttons to track student behaviors for a set period of time.

Learn more about the AWS IoT Buttons at [www.amazon.com](http://www.amazon.com)



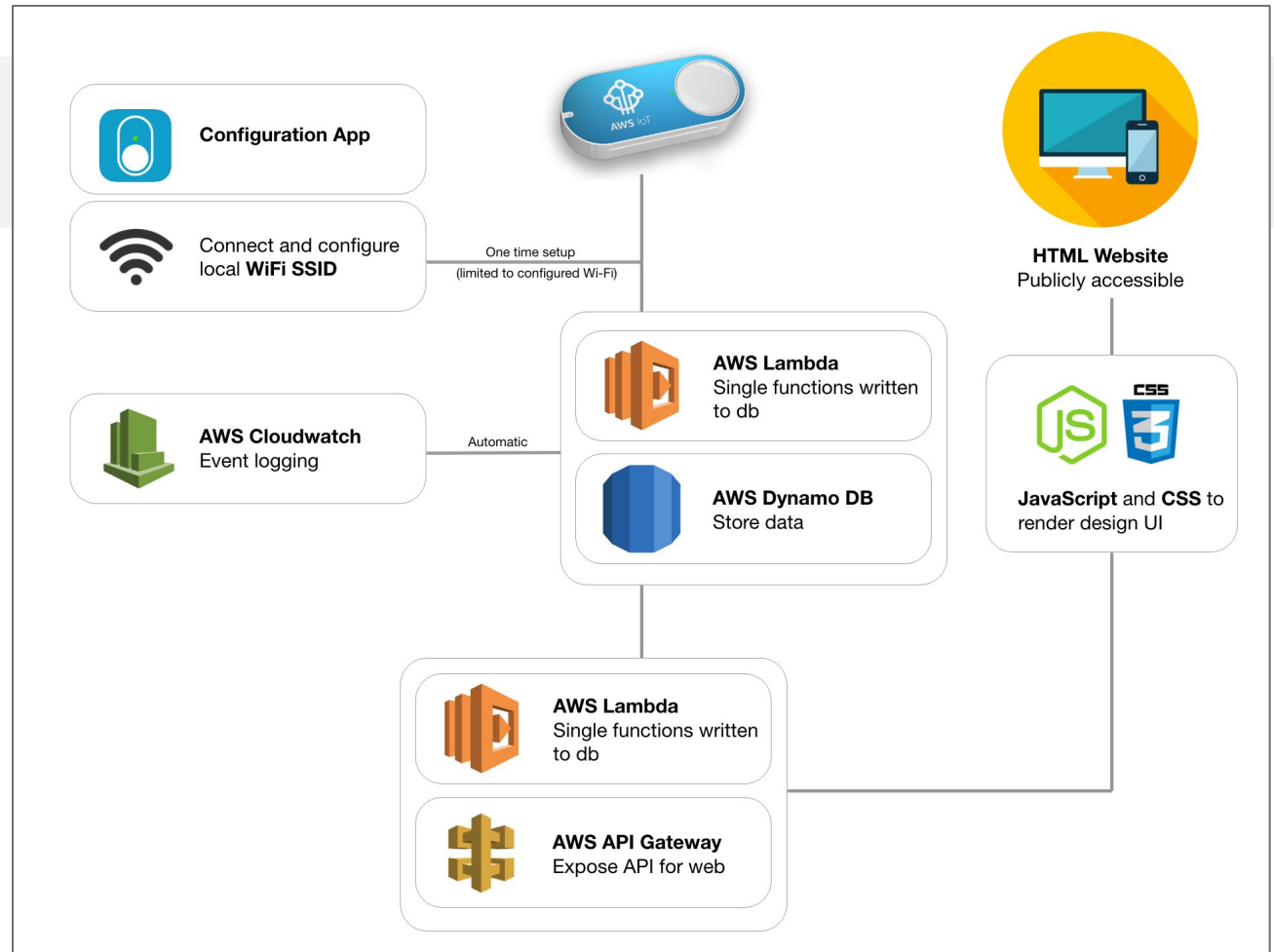
Clarity Innovations

ID: 830bdb36-35cd-11e7-8343-8aa80b157968 With Message: Single click event  
 ID: be9f9cc4-35cc-11e7-8343-8aa80b157968 With Message: Single click event

# Schema

## Services

- Lambda
- Dynamo DB
- API Gateway
  
- JavaScript
- CSS



# Architecture and Setup

- About AWS services and dev-op tool
- About our app architecture

# AWS Services

- Rule Engine
- Lambda
  - Dash
  - UI
  - Cleanup
- DynamoDB
- API Gateway
- Chalice



# Rule Engine

RULE  
**iotbutton\_G030MD028416G7V1**  
ENABLED Actions ▾

---

**Overview** Description Edit

Event source for your IoT Button to Lambda

**Rule query statement** Edit


The source of the messages you want to process with this rule.

```
SELECT clickType FROM 'iotbutton/G030MD028416G7V1'
```













Using SQL version 2016-03-23

**Actions**

Actions are what happens when a rule is triggered. [Learn more](#)

 **Invoke a Lambda function passing the message...** Remove Edit

[Add action](#)

-  **Insert a message into a DynamoDB table**  
DYNAMODB
-  **Split message into multiple columns of a database table (DynamoDBv2)**  
DYNAMODBV2
-  **Invoke a Lambda function passing the message data**  
LAMBDA
-  **Send a message as an SNS push notification**  
SNS
-  **Send a message to an SQS queue**  
SQS
-  **Sends messages to an Amazon Kinesis Stream**  
AMAZON KINESIS
-  **Republish messages to an AWS IoT topic**  
AWS IoT REPUBLISH
-  **Store messages in an Amazon S3 bucket**  
S3
-  **Send messages to an Amazon Kinesis Firehose stream**  
AMAZON KINESIS FIREHOSE
-  **Sends message data to CloudWatch**  
CLOUDWATCH METRICS
-  **Change the state of a CloudWatch alarm**  
CLOUDWATCH ALARMS
-  **Send messages to the Amazon Elasticsearch Service**

# Lambda

```
22 def main(event, context = None):
23
24     # This is the python version of a switch case statement.
25     result = {
26         'SINGLE': lambda e: single_click(e),
27         'DOUBLE': lambda e: double_click(e),
28         'LONG': lambda e: long_click(e)
29     }.get(event['clickType'], lambda e: print('no click event was called'))(event)
30
31     return ''
32
33 if __name__ == '__main__':
34     main({'clickType': 'null'}, 'null')
35
36 # It would be good to replace this with a class that does this stuff.
37 def single_click(e):
38     now = decimal.Decimal(str(time.time()))
39     print(EventType[0])
40
41     dashpocdb.put_item(
42         Item = {
43             'id': str(uuid.uuid1()),
44             'date': now,
45             'eventType': EventType.single,
46             'created': now,
47             'updated': now,
48             'message': 'Single click event'
```

# DynamoDB



<input type="checkbox"/>	id	date	created	eventType	message
<input type="checkbox"/>	<a href="#">9ebd4d38-341a</a>	1494267459.51	1494267459.51	2	Long click event
<input type="checkbox"/>	<a href="#">2fa2bc44-39b0-</a>	1494881453.43	1494881453.43	0	Single click event
<input type="checkbox"/>	<a href="#">0de43dfc-1977-</a>	1491338478.3	1491338478.3	1	Double click event
<input type="checkbox"/>	<a href="#">c998ee3c-099e-</a>	1489596324.98	1489596324.98	0	Single click event
<input type="checkbox"/>	<a href="#">b5ec94f2-3111-</a>	1493933779.45	1493933779.45	0	Single click event
<input type="checkbox"/>	<a href="#">075129c8-310f-</a>	1493932627.51	1493932627.51	0	Single click event
<input type="checkbox"/>	<a href="#">f671b924-1976-</a>	1491338438.96	1491338438.96	0	Single click event
<input type="checkbox"/>	<a href="#">a15684fc-099e-</a>	1489596257.44	1489596257.44	0	Single click event
<input type="checkbox"/>	<a href="#">5e08351a-3112-</a>	1493934061.49	1493934061.49	1	Double click event
<input type="checkbox"/>	<a href="#">12678474-310f-</a>	1493932646.1	1493932646.1	0	Single click event
<input type="checkbox"/>	<a href="#">8ef682f0-a933-</a>	1507142456.5	1507142456.5	0	Single click event
<input type="checkbox"/>	<a href="#">d77af266-b42f-</a>	1508350322.97	1508350322.97	0	Single click event
<input type="checkbox"/>	<a href="#">d68a8ad8-099e-</a>	1489596346.7	1489596346.7	0	Single click event

# API Gateway



# API Gateway

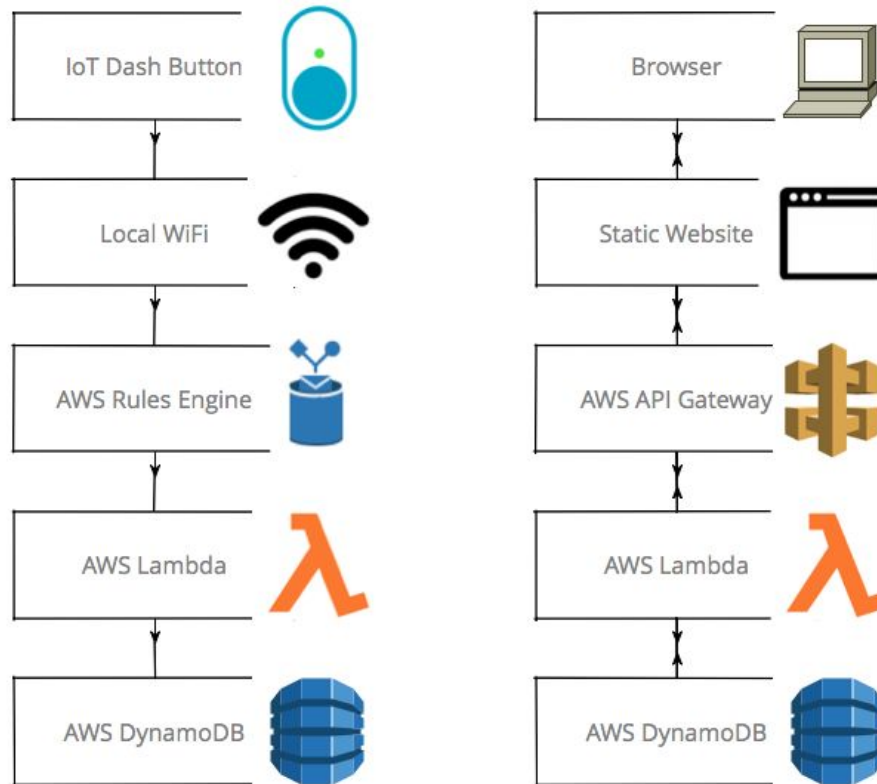


- Data Pipeline
- DeviceFarm
- DevPay
- Direct Connect
- Directory Service
- DynamoDB
- DynamoDB Streams
- Elastic Cloud Compute (EC2)
- EC2 Container Registry (ECR)
- EC2 Container Service (ECS)
- Elastic Beanstalk
- Elastic Transcoder
- ElastiCache
- Elastic File System (EFS)
- Elastic Load Balancing (ELB)
- Elastic MapReduce (EMR)
- Firehose
- GameLift
- Glacier
- Health
- Identity and Access Management (IAM)
- Import/Export
- Inspector
- Internet of Things (IoT)
- IoT Data
- Kinesis
- Kinesis Analytics
- Key Management Service (KMS)
- Lambda
- Lightsail
- Machine Learning
- Mobile Analytics
- OpsWorks
- Pinpoint
- Polly
- Relational Database Service (RDS)
- Redshift
- Rekognition
- Route 53
- Route 53 Domains
- Service Catalog
- Simple Storage Service (S3)
- SimpleDB (SDB)
- Simple Email Service (SES)
- Snowball
- Simple Notification Service (SNS)
- Simple Queue Service (SQS)**
- Simple Systems Management (SSM)
- Step Functions
- Storage Gateway
- Security Token Service (STS)
- Support
- Simple Workflow Service (SWF)

# Chalice



# Architecture



# Other AWS IoT Button ideas

## Cafeteria

At the return station

- (1) Trays and utensils returned
- (2) Partially returned

## Facilities

In a custodial closet

- (1) Supplies running low
- (2) Re-order supplies
- (3) Equipment damaged

## Transportation

On board a bus

- (1) Poor student behavior
- (2) Discipline referral
- (3) Send assistance immediately



## Discussion

- How do you think you could use an AWS IoT Button?
- What IoT implementations are you considering?
- What concerns or questions do you have?

# Thank you



## About your presenters

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