
AWS
re:Invent

IOT307

How to efficiently architect IoT applications to optimize ROI

Aditi Gupta
Senior IoT Specialist Architect
AWS

AWS re:Invent

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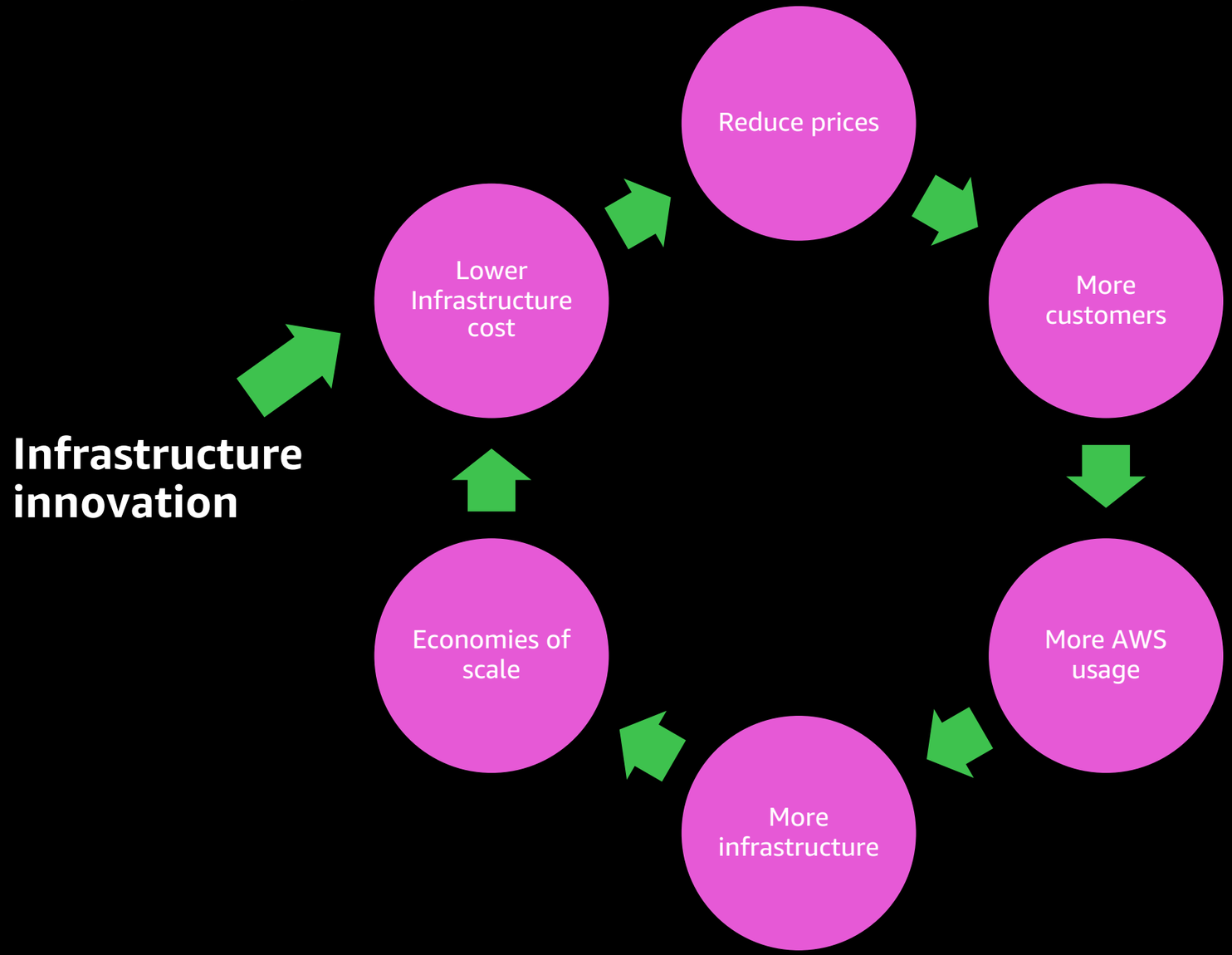
What you'll get out of this session

- Best practices on how to lower your AWS bill
- A more scalable, robust, dynamic architecture
- More time to innovate
- Real-world customer examples
- Strategies that are easy to implement



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AWS Flywheel



80+ price reductions since 2006

Community

Global footprint

New features

New services

Recent IoT price reductions

80+ PRICE REDUCTIONS SINCE 2006 ACROSS AWS SERVICES

- 90%+ price reduction for AWS IoT Device Management jobs
- 86%+ price reduction for AWS IoT Events
- 15% in Tokyo Region and over 20% in Singapore and Sydney Regions for AWS IoT Core

Your biggest strength in AWS

Architectural flexibility

You build it,
You run it,
You **optimize** it

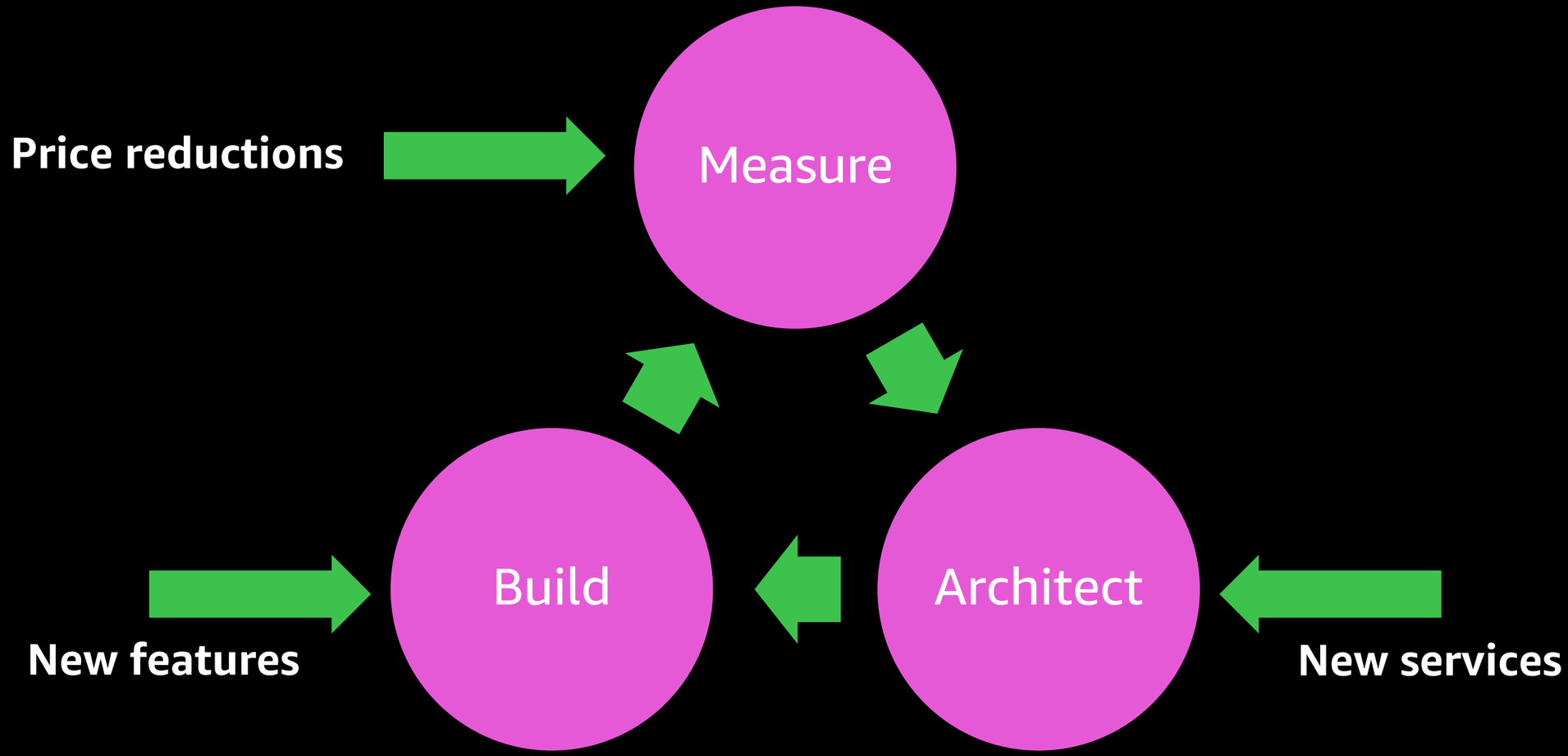


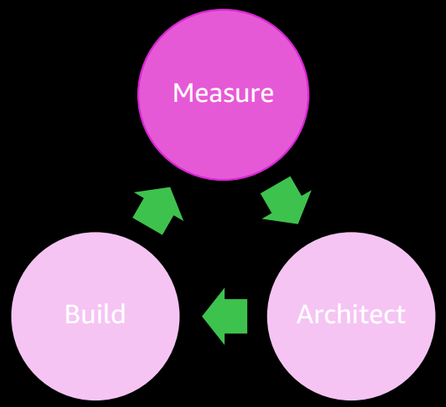
Cost-optimization process



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Cost-optimization process

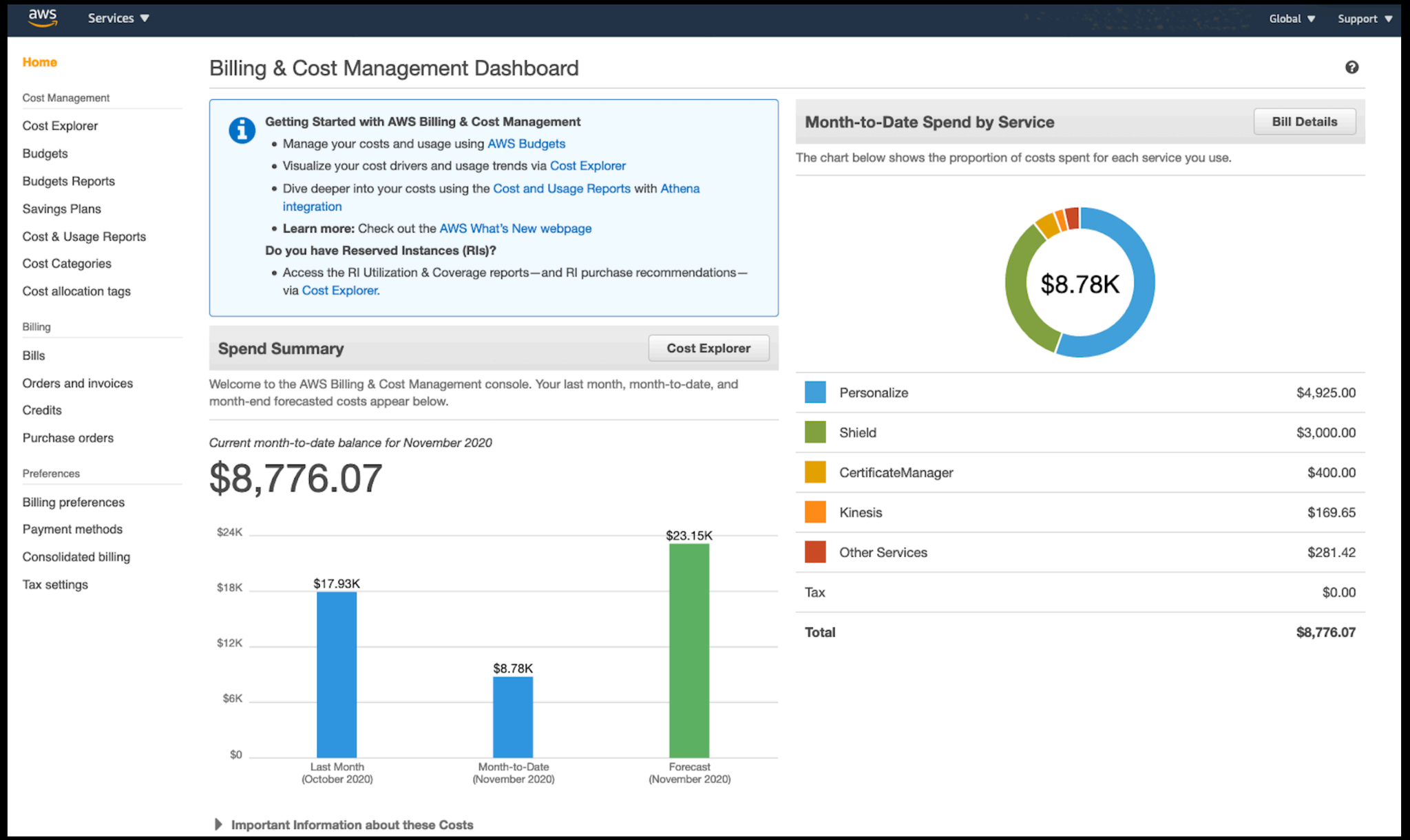




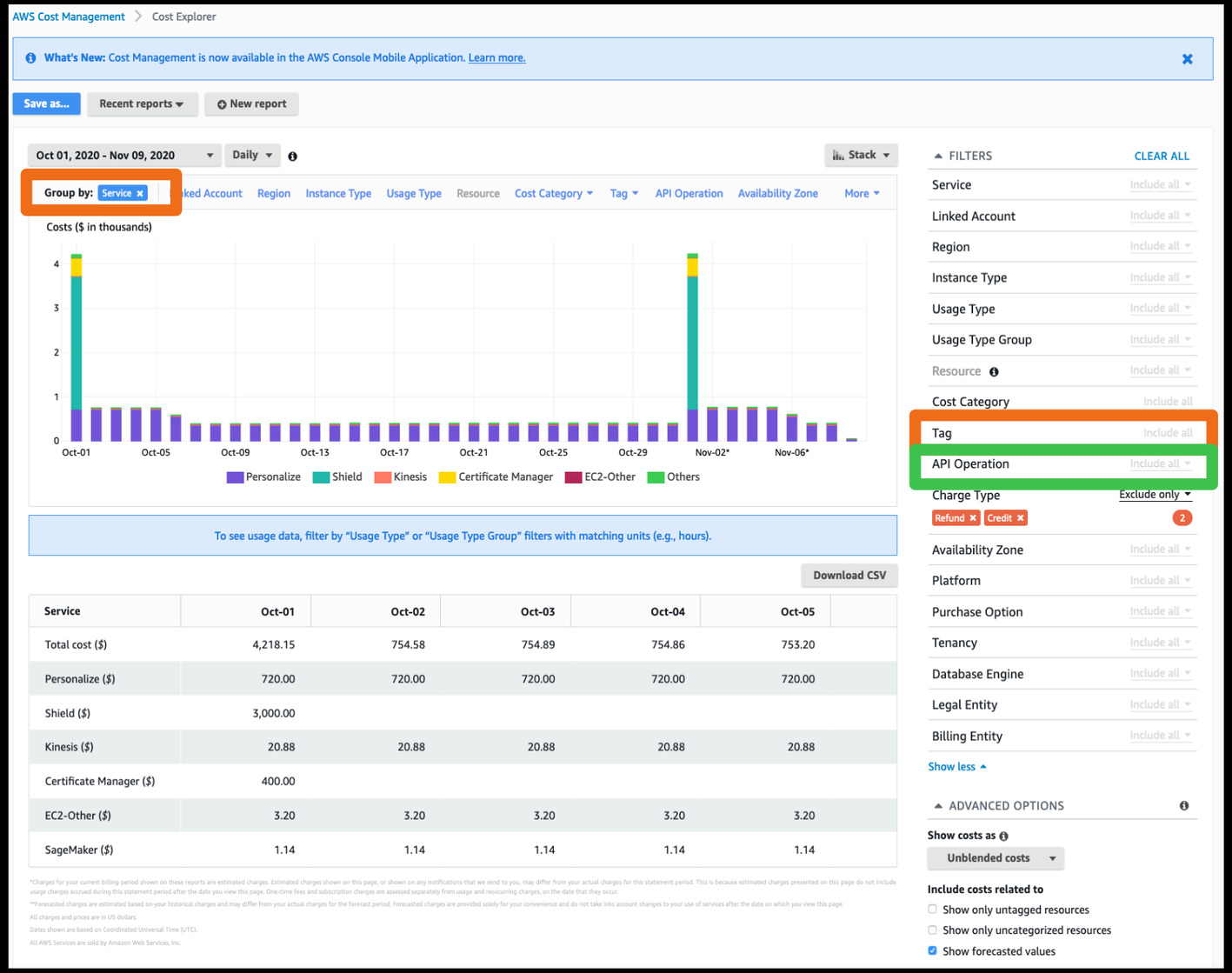
Measure the cost in the cloud

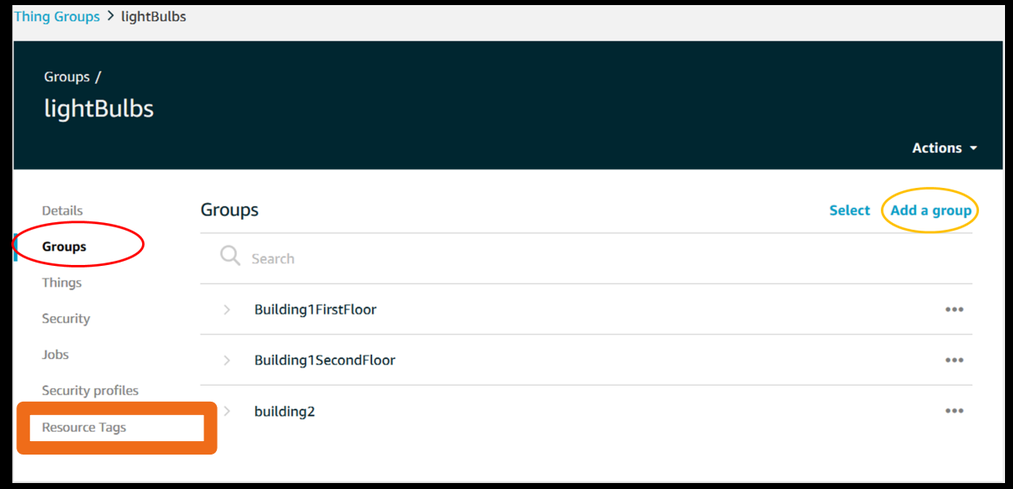
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Use AWS Billing & Cost Management Dashboard



Dive deep with AWS Cost Explorer: Now with API

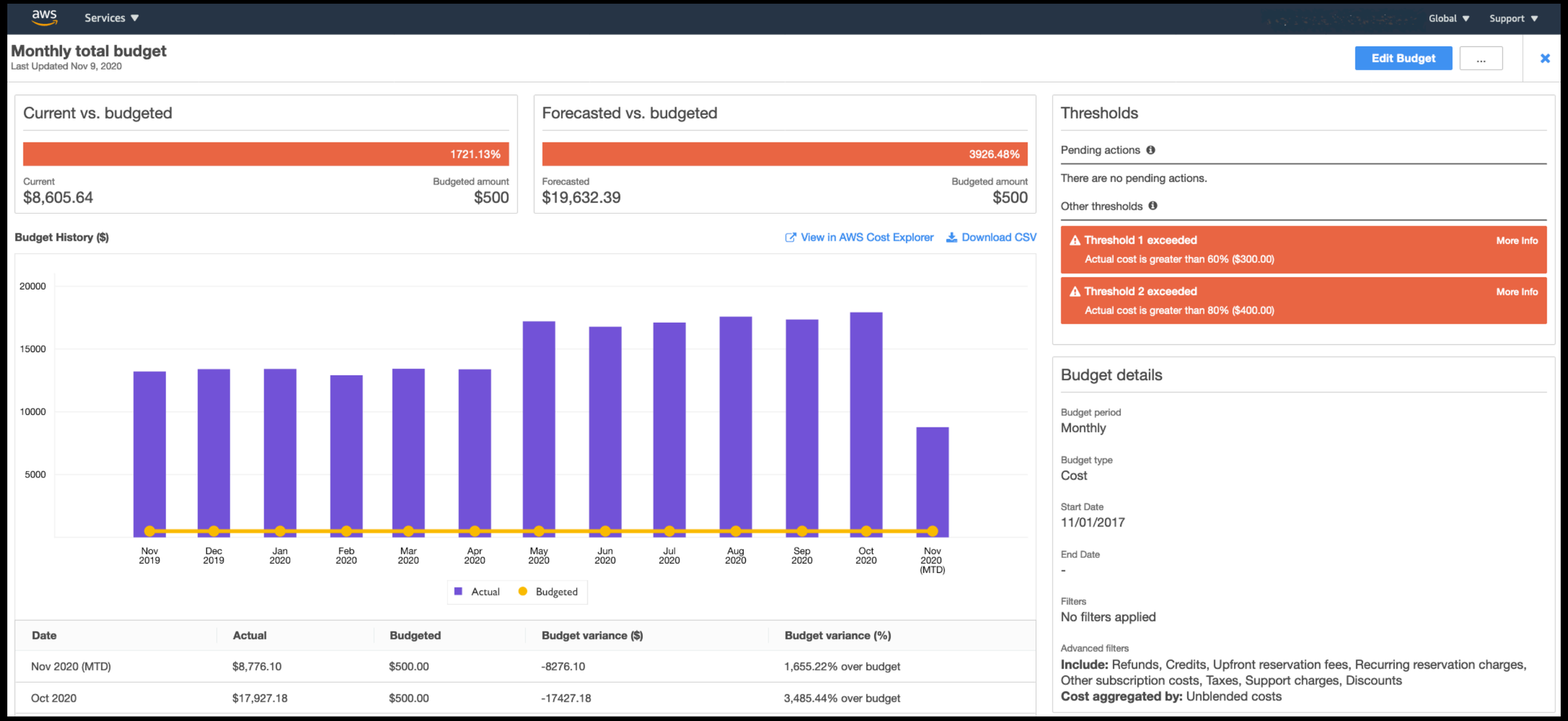




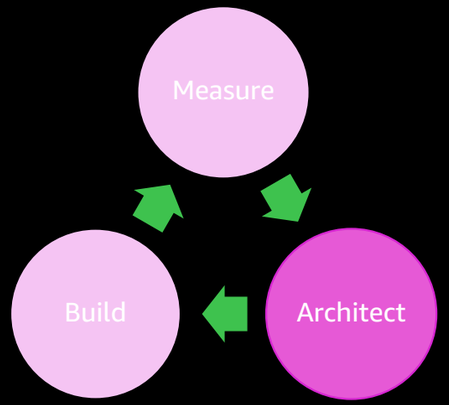

```
aws iot create-billing-group
  --billing-group-name Building2FirstFloorLights
  --tags Key="Location",Value="Building2-FirstFloor"
  {
        "billingGroupArn": "arn:aws:iot:us-east-1
        :xxxx:billinggroup/Building2FirstFloorLights",
        "billingGroupId": "af885c88-15b2-4f3d-8809-287e07c56338",
        "billingGroupName": "Building2FirstFloorLights
  }

#add one thing to billing group []
aws iot add-thing-to-billing-group
  --billing-group-name Building2FirstFloorLights
  --thing-name lightBulbs53
```

Set monthly AWS budget



Date	Actual	Budgeted	Budget variance ($)	Budget variance (%)
Nov 2020 (MTD)	$8,776.10	$500.00	-8276.10	1,655.22% over budget
Oct 2020	$17,927.18	$500.00	-17427.18	3,485.44% over budget



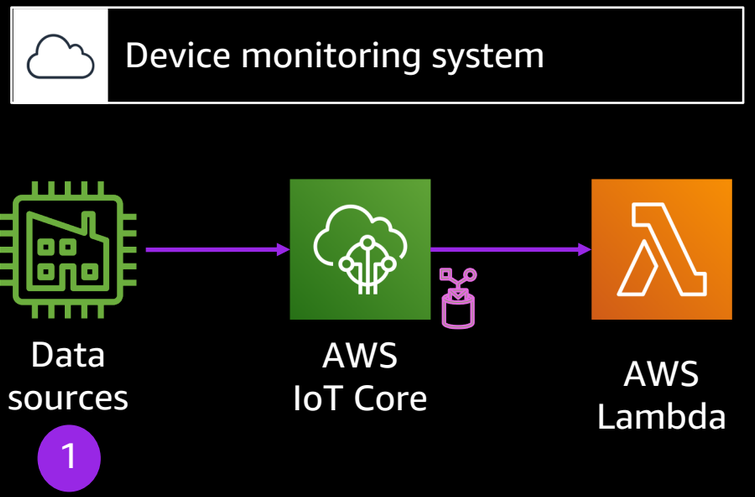
Architect using cost-optimization patterns

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Use case: Device monitoring system

MONITOR THE STATE OF DEVICES, EACH DEVICE HAVING MULTIPLE SENSORS



1

Payload sample

```
{"temp":55,"x":50,"y":75,"z":65","fall-detect":false}
```

Number of devices: 100

Each device sends:

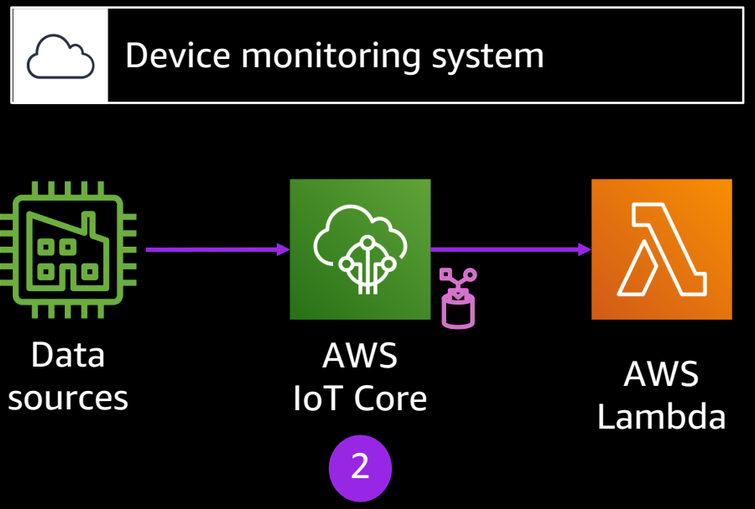
Frequency: 10 messages/sec

Payload size: 150 bytes

```
{"temp":55, "x":50, "y":75, "z":65", "fall-detect":false}
```

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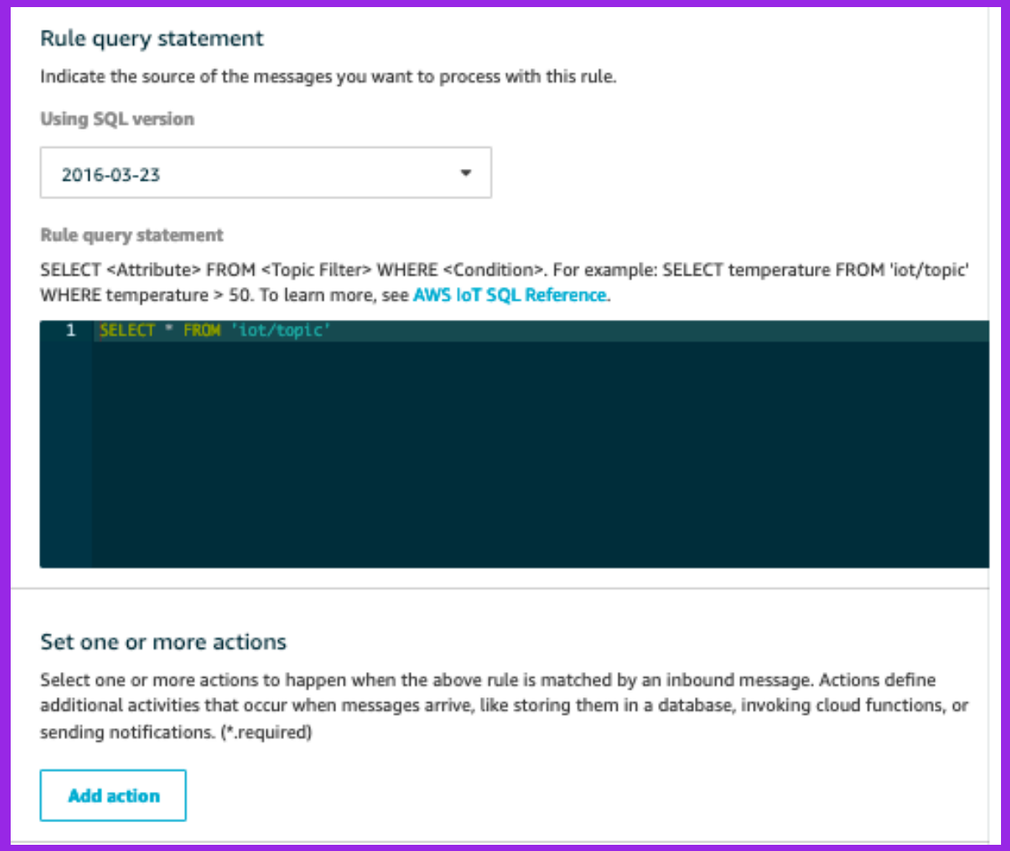
```
{"temp":55, "x":50, "y":75, "z":65", "fall-detect":false}
```

Number of rules: 1 per message

```
SELECT * FROM 'iot/topic'
```

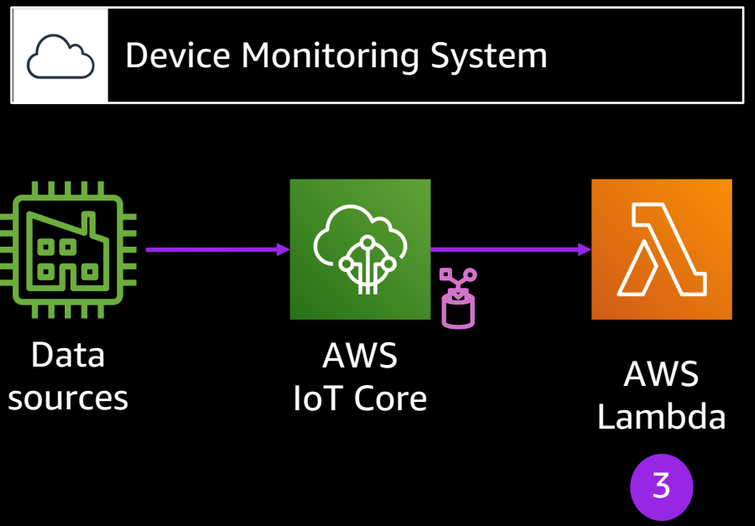
2

Rule query : `SELECT * FROM 'iot/topic'`



Use case: Device monitoring system

MONITOR THE STATE OF DEVICES, EACH DEVICE HAVING MULTIPLE SENSORS



Number of devices: 100

Each device sends:

Frequency: 10 messages/sec

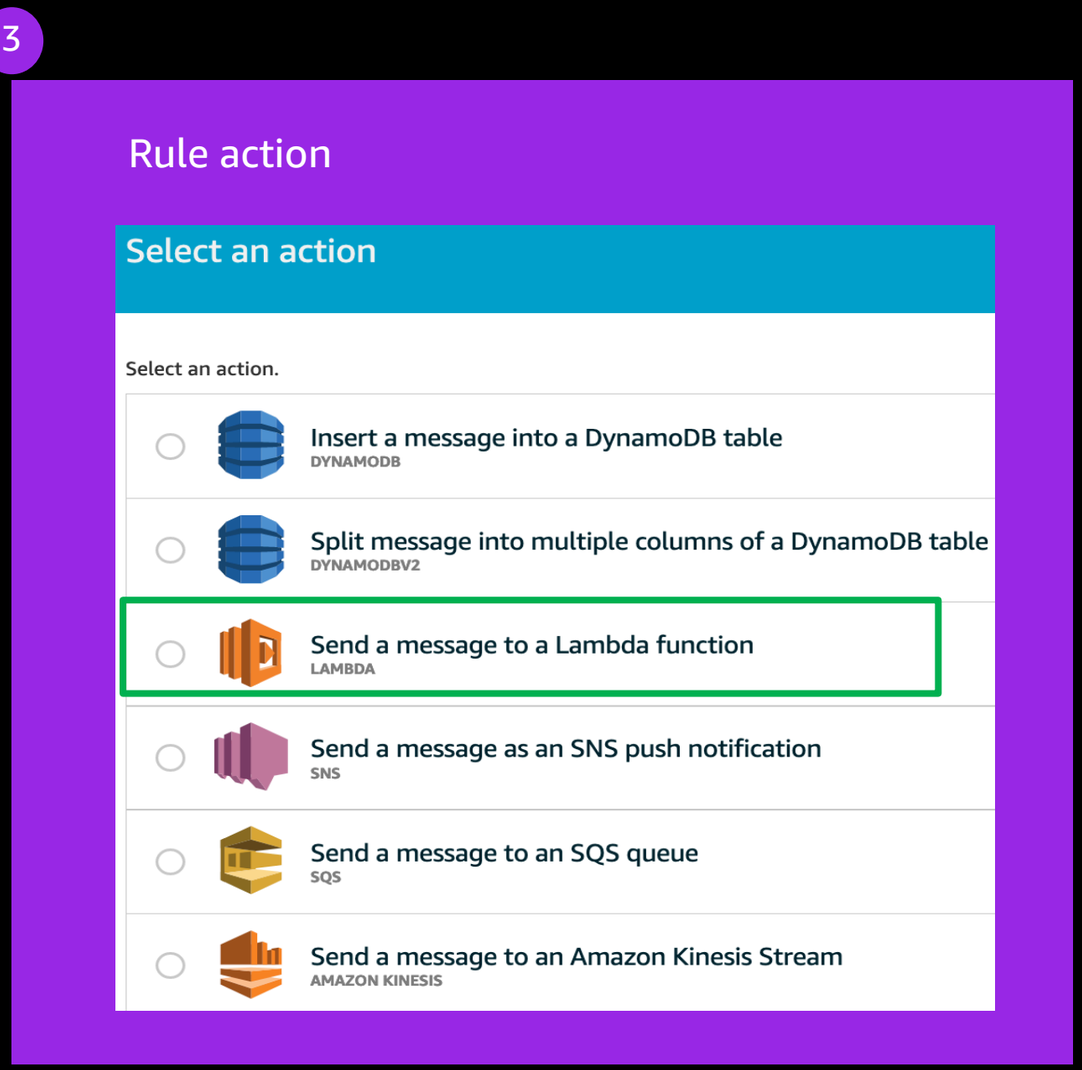
Payload size: 150 bytes

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```

Number of rules: 1 per message

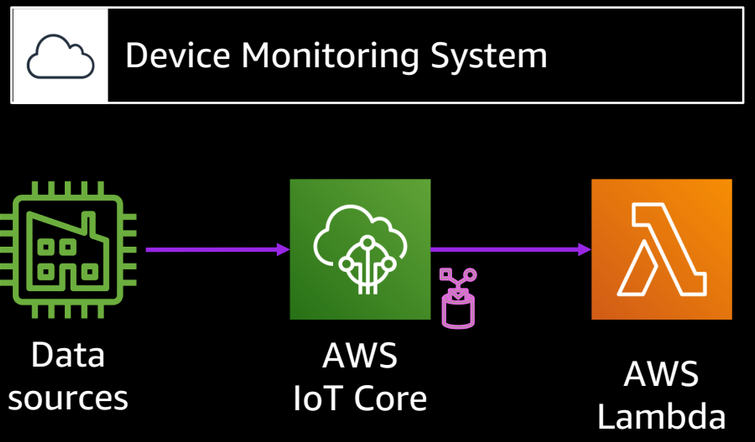
```
SELECT * FROM 'iot/topic'
```

Number of Lambda calls: 1 per message



Use case: Device monitoring system

MONITOR THE STATE OF DEVICES, EACH DEVICE HAVING MULTIPLE SENSORS



Number of devices: 100
Each device sends:
Frequency: 10 messages/sec
Payload size: 150 bytes

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{"temp":55, "x":50, "y":75, "z":65", "fall-detect":false}
```

Number of rules: 1 per message

```
SELECT * FROM 'iot/topic'
```

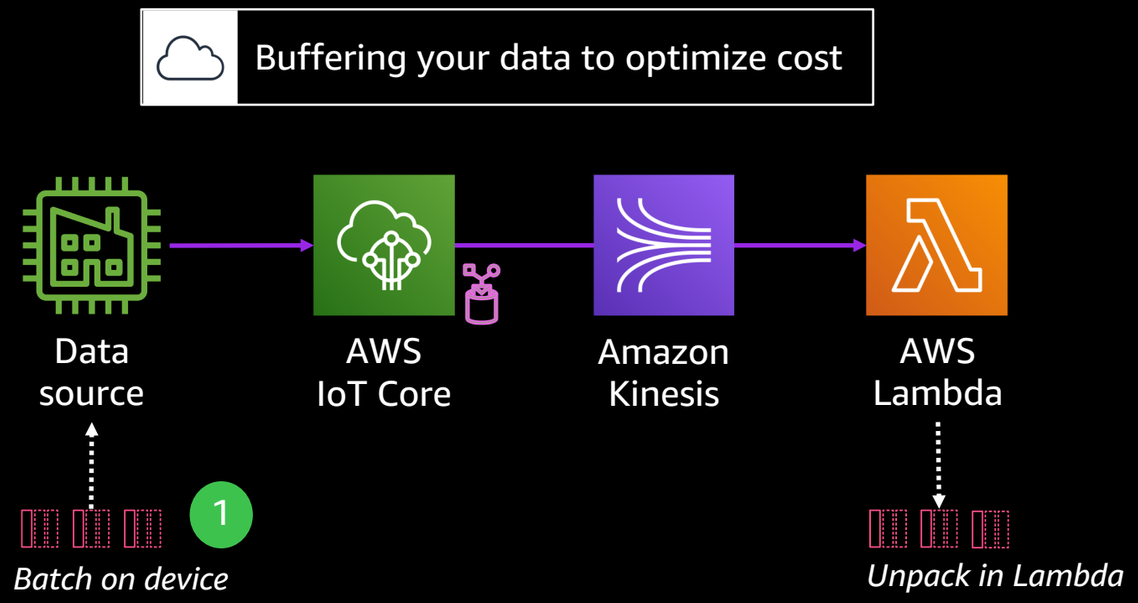
Number of Lambda calls: 1 per message

Un-Optimized Architecture Cost

Number of devices		100
Avg. Msg Size (Bytes)		150
Messages per day/device (600 msg/min/device)		864000
Lambda Calls per month		2592000000
	Cost Per Month	
MQTT Messages Broker	$	2,274.00
Rule Engine (1 rule, 1 action per message)	$	778.00
Lambda Calls	$	2,138.72
Total (per month)	$	5,190.72
Total (per year)	$	62,288.64

Use case: Device monitoring system

IOT MESSAGE IS BILLED IN 5 KB INCREMENTS, UP TO 128 KB



Number of devices: 100

Each device sends:

Frequency: 0.5 message/sec ~ 1 message/2 sec

Payload size: 3,000 bytes ~ 3 KB

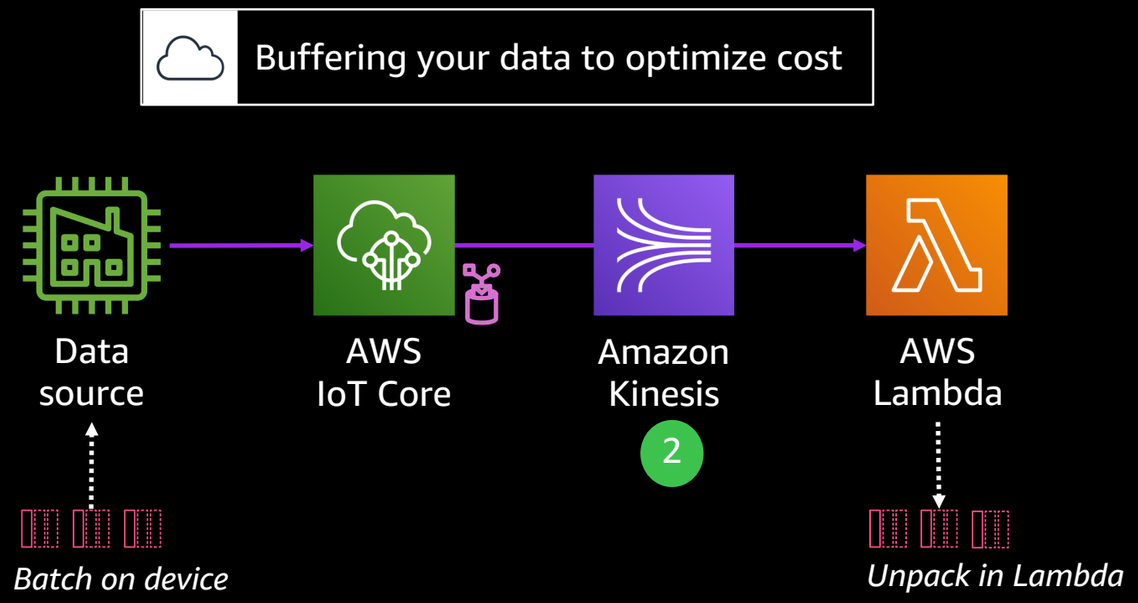
1

Payload sample: Devices

```
{"packed-data":[
{"temp":55,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":58,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":59,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":61,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false}
]}
```

Use case: Device monitoring system

SERVICES LIKE AMAZON KINESIS WILL BATCH FOR YOU



Number of devices: 100
Each device sends:
- Frequency: 0.5 times/sec ~ 1 message/2 sec
- Payload size: 3,000 bytes ~ 3 KB

Number of rules: 1 per packed message
Number of Lambda calls: 1 per packed Kinesis message

2

Sample output: Kinesis Data Streams


```
{"kinesis-data":[
{"packed-data":[
{"temp":55,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":58,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":59,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":61,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false}
]},
{"packed-data":[
{"temp":55,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":58,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":59,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":61,"x":50,"y":75,"z":65","fall-detect":false},
{"temp":60,"x":50,"y":75,"z":65","fall-detect":false}
]}
]}
```

Optimize MQTT payload size and buffer data

MONITOR THE STATE OF DEVICES, EACH DEVICE HAVING MULTIPLE SENSORS

Un-Optimized Architecture Cost

Number of devices		100
Avg. Msg Size (Bytes)		150
Messages per day/device (600 msg/min/device)		864000
Lambda Calls per month		2592000000
	Cost Per Month	
MQTT Messages Broker	$	2,274.00
Rule Engine (1 rule, 1 action per message)	$	778.00
Lambda Calls	$	2,138.72
Total (per month)	$	5,190.72
Total (per year)	$	62,288.64

Optimized Architecture Cost

Number of devices		100
Avg. Msg Size (Bytes)		3000
Messages per day/device (30 msg/min/device)		43200
Kinesis batching (20)		20
Lambda Calls per month		6480000
	Cost Per Month	
MQTT Messages Broker	$	130.00
Rule Engine (1 rule, 1 action per message)	$	39.00
Kinesis	$	16.00
Lambda Calls	$	4.05
Total (per month)	$	189.05
Total (per year)	$	2,268.60

AWS IoT Core batch function

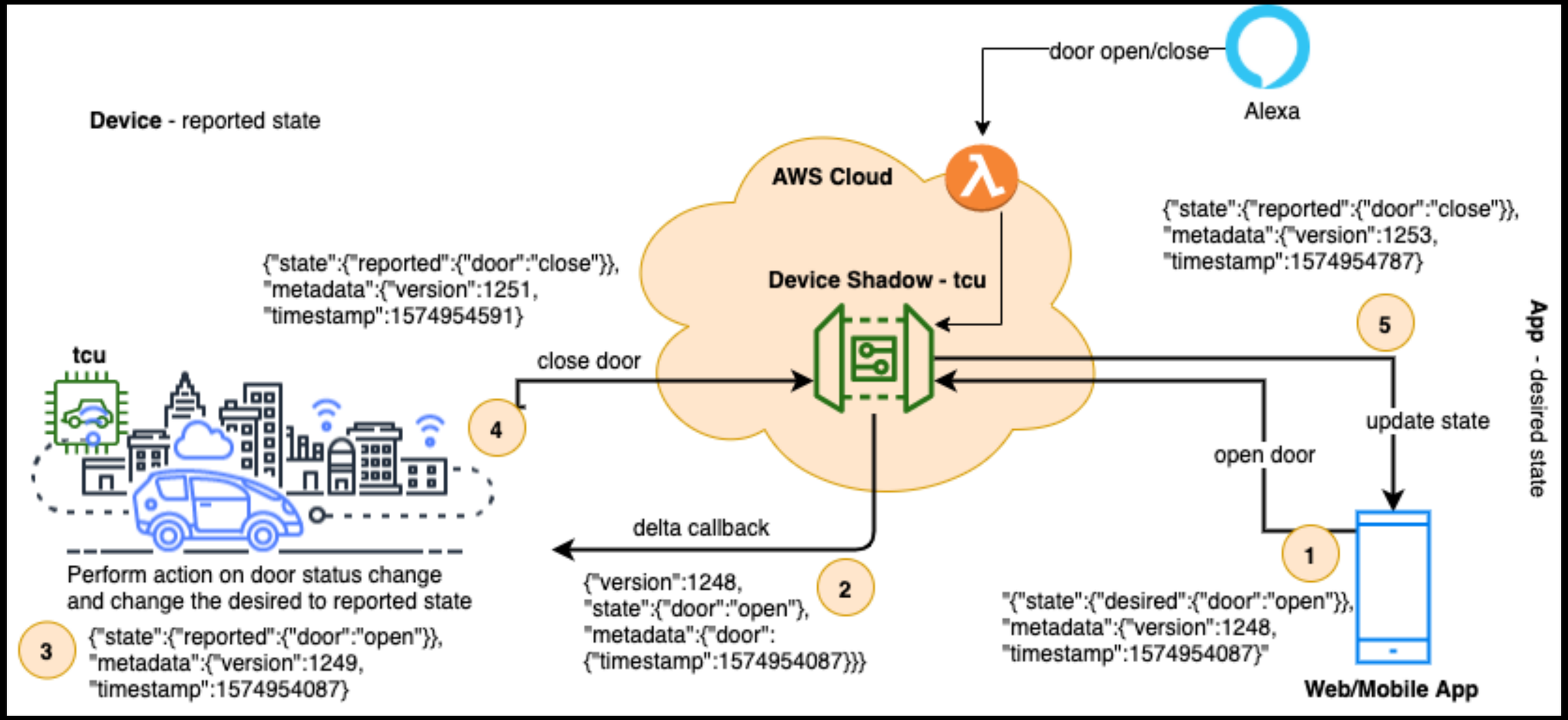


NEW FEATURES IN AWS IOT RULES

- Inline **transform()** function
  - Transform AWS IoT SiteWise batched payload to the format that downstream services accept
    - https://docs.aws.amazon.com/iot/latest/developerguide/iot-sql-functions.html#iot-func-transform
- **Batch mode** for
  - Amazon Kinesis Data Firehose action
    - https://docs.aws.amazon.com/iot/latest/developerguide/kinesis-firehose-rule-action.html
  - AWS IoT Events action
    - https://docs.aws.amazon.com/iot/latest/developerguide/iotevents-rule-action.html
  - AWS IoT Analytics action
    - https://docs.aws.amazon.com/iot/latest/developerguide/iotanalytics-rule-action.html

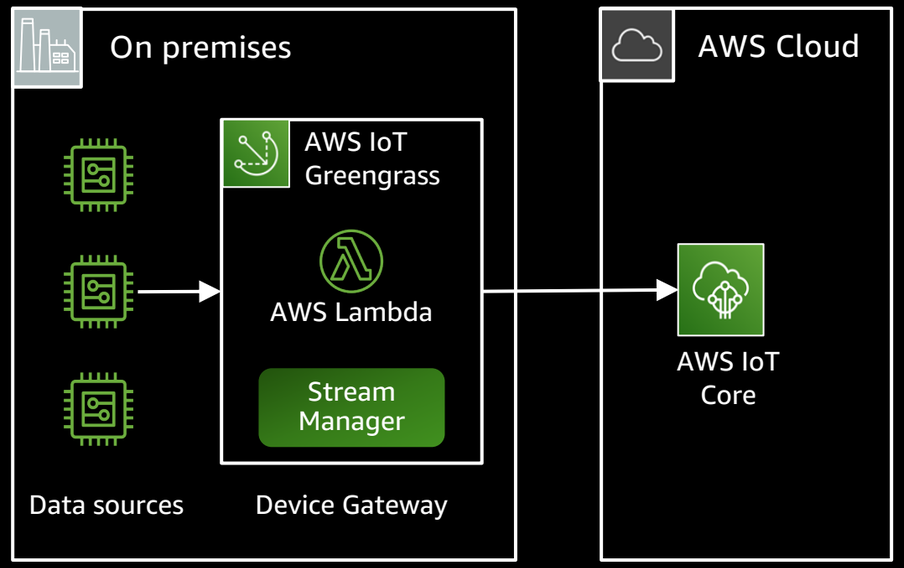
Working with Shadows and Named Shadow

DEVICE SHADOWS ARE METERED IN 1 KB INCREMENTS



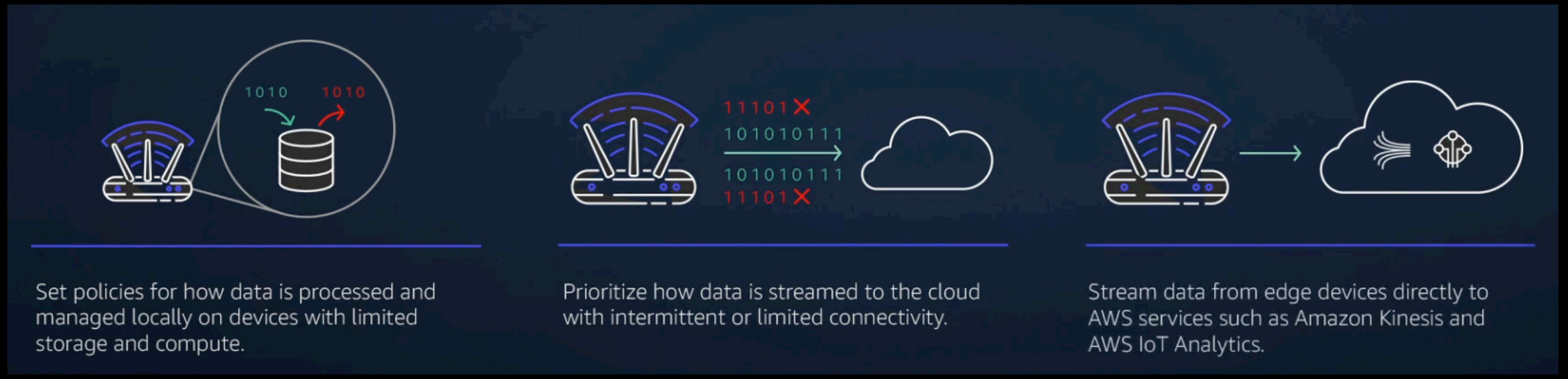
Optimizing edge performance for cost

MANAGE DIFFERENT VELOCITY AND PRIORITY OF DATA WITH STREAM MANAGER



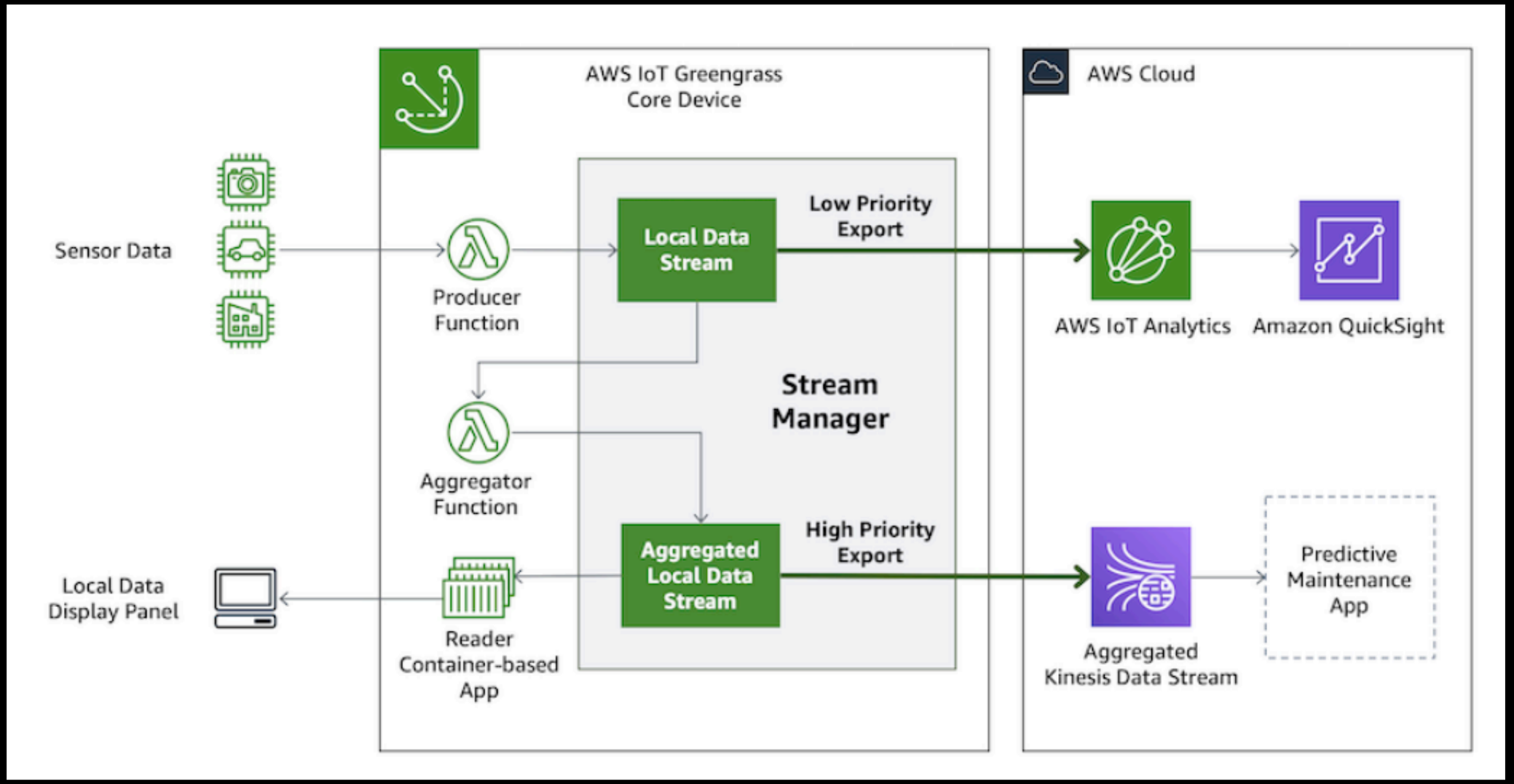
Benefits of pre-processing

- Simplification of data streams involving large numbers of devices
- Increased system state accuracy
- Reduced network traffic
- Reduced compute costs



Optimizing edge performance

MANAGE DIFFERENT VELOCITY AND PRIORITY OF DATA WITH STREAM MANAGER



Ingest options

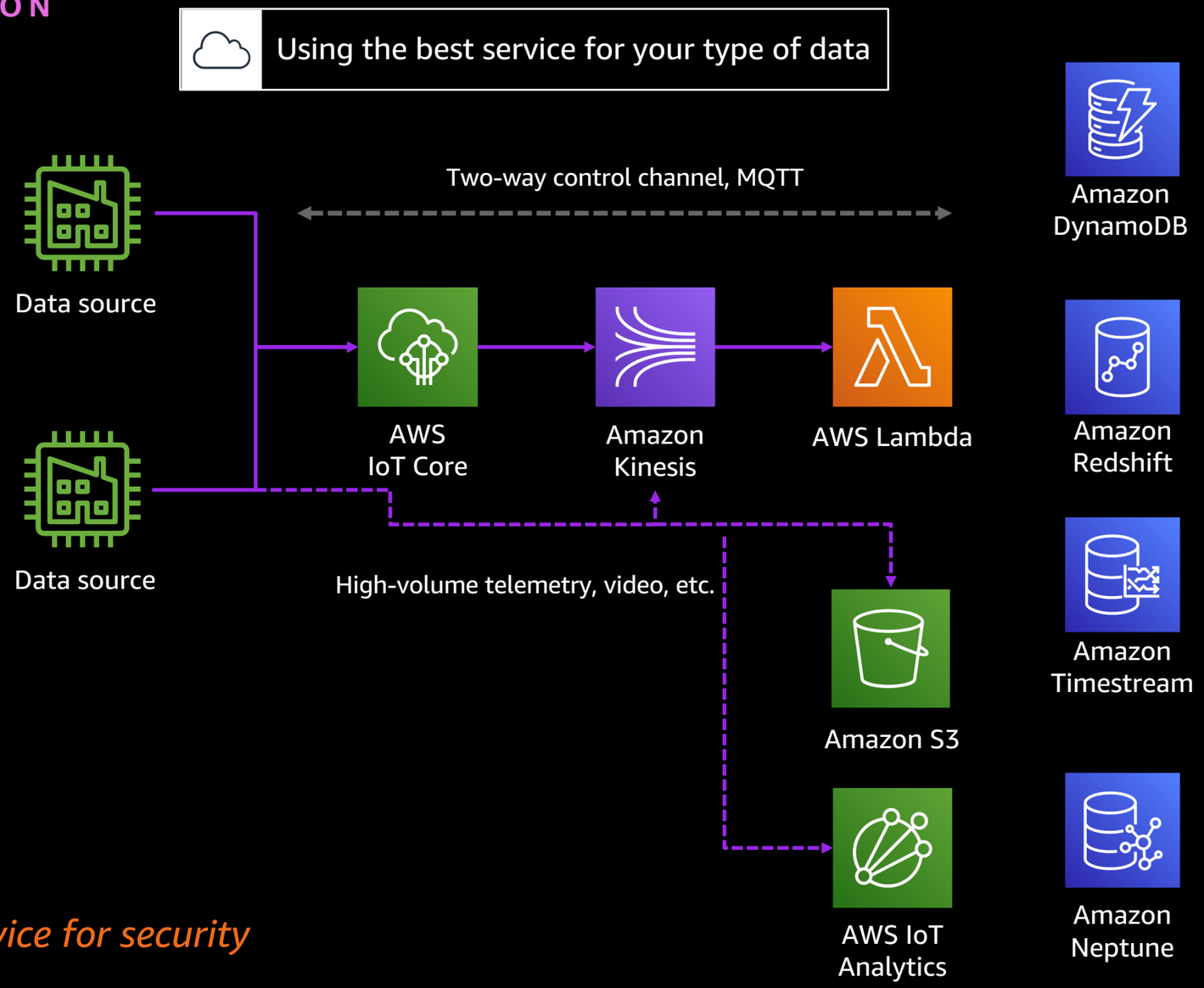
USE THE CORRECT SERVICE FOR INGESTION

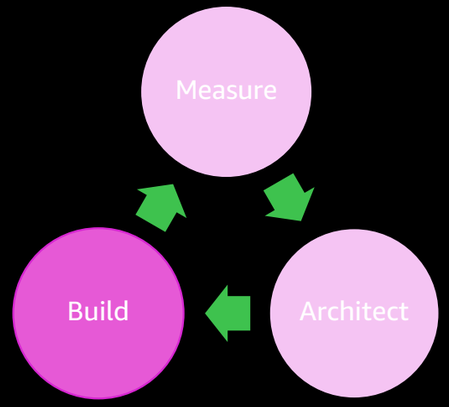
- **Data stream and messages**
  - AWS IoT Core Basic Ingest
  - AWS IoT Core
  - Amazon Kinesis Data Streams
  - Amazon Kinesis Data Firehose
- **Log and binary files**
  - Amazon S3

    e.g., Log file of 128 KB
    - 26 MQTT IoT messages vs. 1 S3 put call
- **Streaming video**
  - Amazon Kinesis Video Streams

    e.g., Gas turbine video monitoring
    - Kinesis Video Stream to ingest camera feed
    - AWS IoT Core for control plane

Use credentials provider or Token Exchange Service for security





Build taking advantage of AWS Managed Services

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The dilemma: Build vs. AWS Managed Services

AWS MANAGED SERVICES HELP TO FUTURE-PROOF WORKLOADS

Self-managed vs. AWS Managed Services

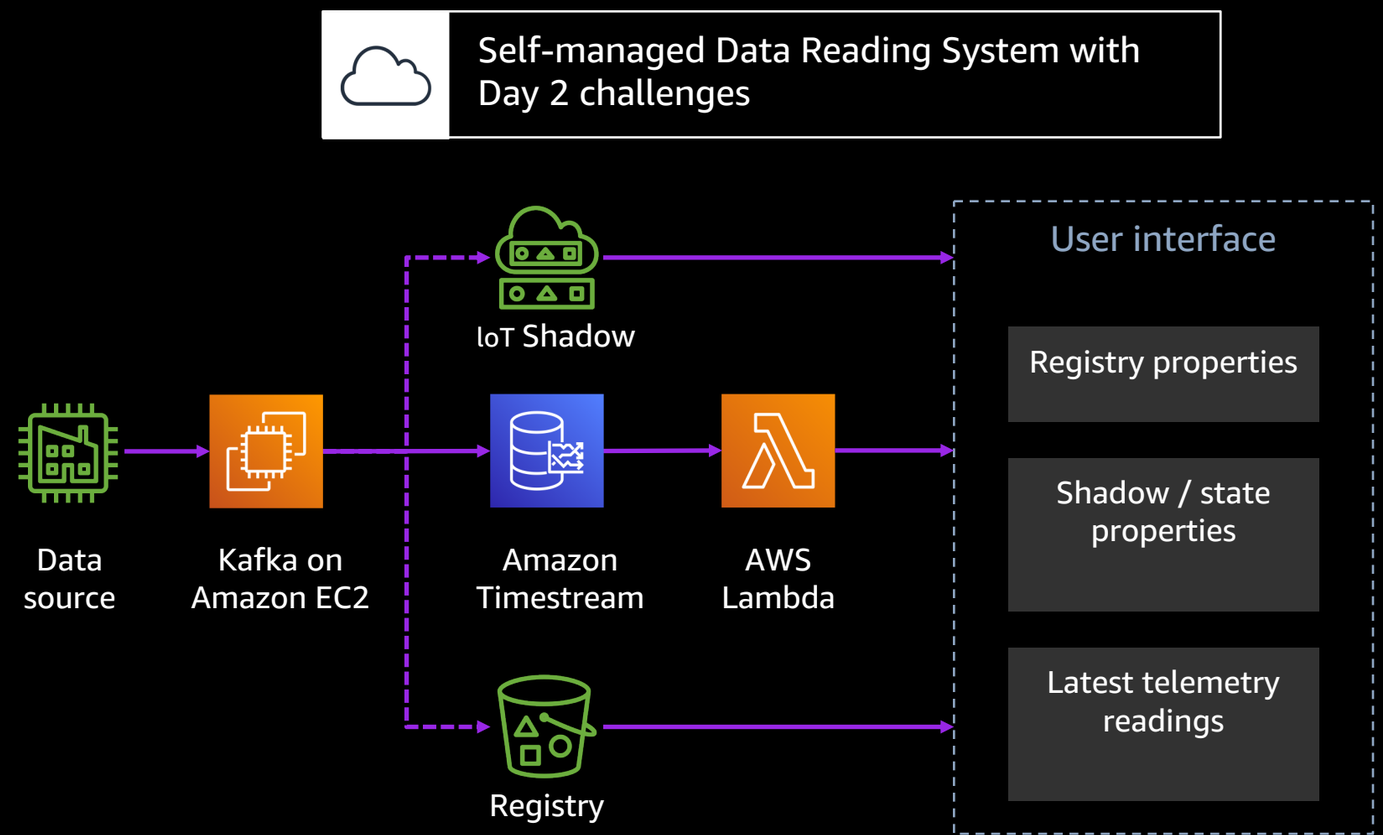
- Ingestion – Open-source Kafka / HiveMQ on EC2
- vs. AWS IoT Core

Day 2 operational challenges

- Low touch self-healing gracefully upgradeable system

AWS Managed Services benefits

- Pace of innovation at Amazon
- AWS IoT services encompass far more features than HiveMQ or Kafka on their own

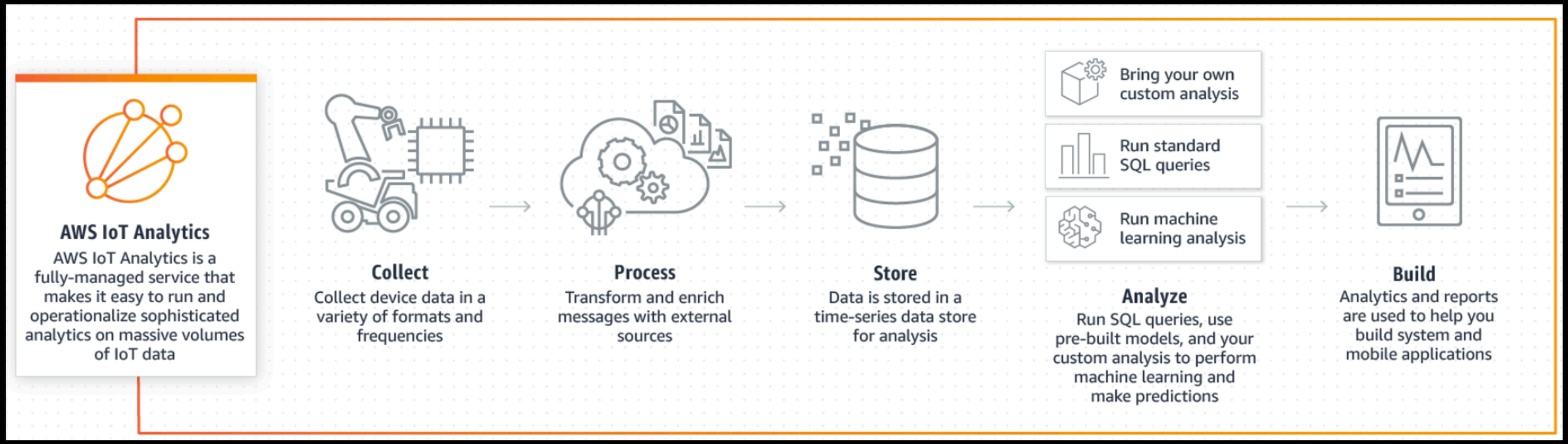


Total cost of ownership

- Self-implemented – Professional Services + license and support + AWS services + staff
- AWS Managed Services – AWS services + less staff + future-proof system with future benefits

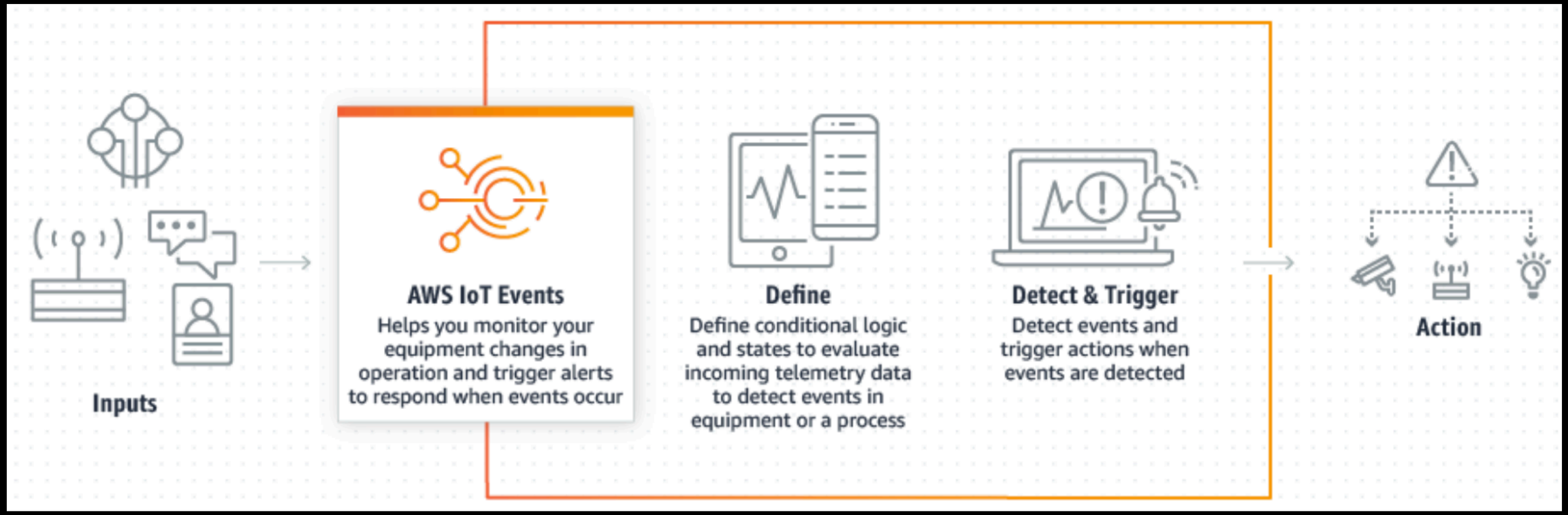
Leverage AWS Managed Services and features

1. AWS IoT Analytics
2. AWS IoT Events
3. AWS IoT Core Device Advisor



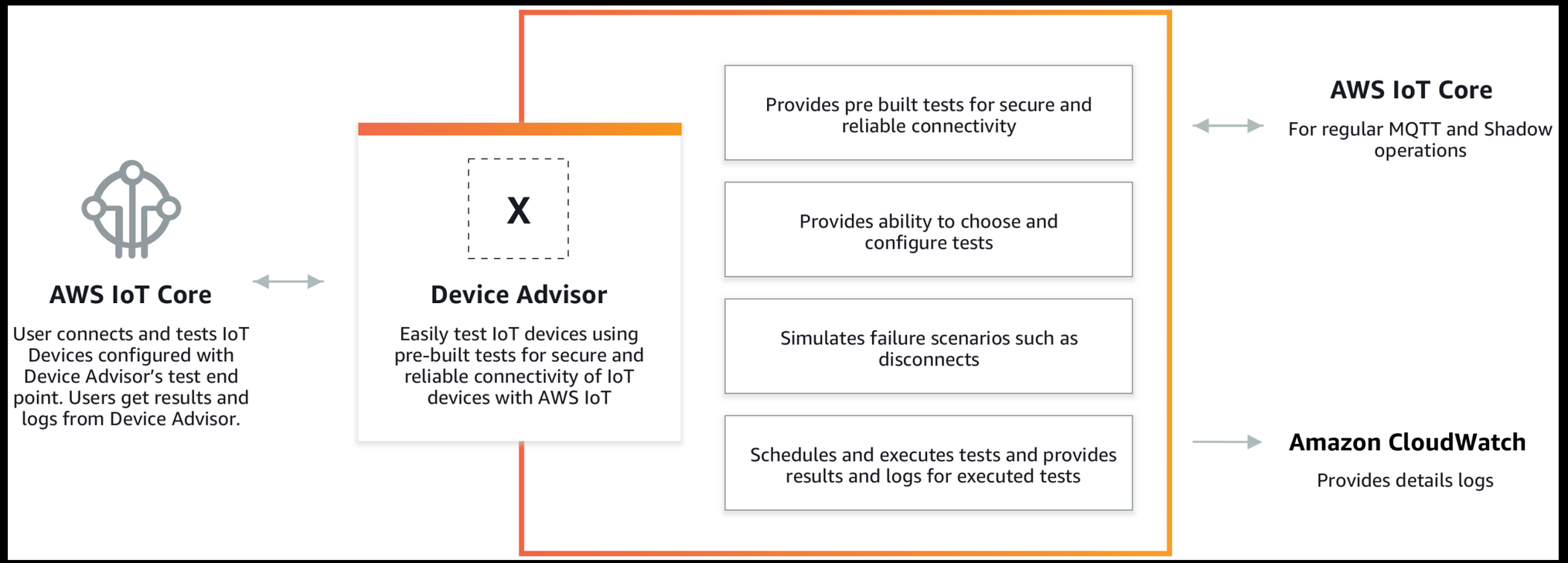
Leverage AWS Managed Services and features

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Leverage AWS Managed Services and features

1. AWS IoT Analytics
2. AWS IoT Events
3. AWS IoT Core Device Advisor



Call to action



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Calculator links

- AWS IoT Core calculator – https://aws.amazon.com/iot-core/pricing/

  This is an adjustable spreadsheet you can download
- AWS Lambda calculator – https://s3.amazonaws.com/lambda-tools/pricing-calculator.html
- AWS Pricing calculator – https://calculator.s3.amazonaws.com/index.html
- AWS calculator – https://calculator.aws
- TCO calculator template – https://iotcalculator.s3.amazonaws.com/iottco.xlsx

IOT204 – The ROI of IoT: Understanding and driving strategic business value

AWS Well-Architected Tool

HTTPS://AWS.AMAZON.COM/WELL-ARCHITECTED-TOOL/
HTTPS://DOCS.AWS.AMAZON.COM/WELLARCHITECTED/LATEST/IOT-LENS/




Go explore...

Thank you!

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Amazon Web Services
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