

IOT and Edge
Compute at



What to Expect from the Session



- Why IOT?
- Design Principles
- Chick-fil-A Architecture
 - Security
 - Edge
- Key Takeaways
- QA



**What is a “thing”
anyway?**

A photograph of a Chick-fil-A restaurant at night. The building is brick with large glass windows. The Chick-fil-A logo is illuminated in red and pink neon above the entrance. A large crowd of people is gathered outside, some standing in line. A sign on the left reads "RIGHT LANE MUST TURN RIGHT". A sign on the right reads "NO CURB CUTTING". The text "Why IOT?" is overlaid in white on the right side of the image.

Chick-fil-A

RIGHT LANE
MUST
TURN RIGHT

NO CURB CUTTING
←

Why IOT?

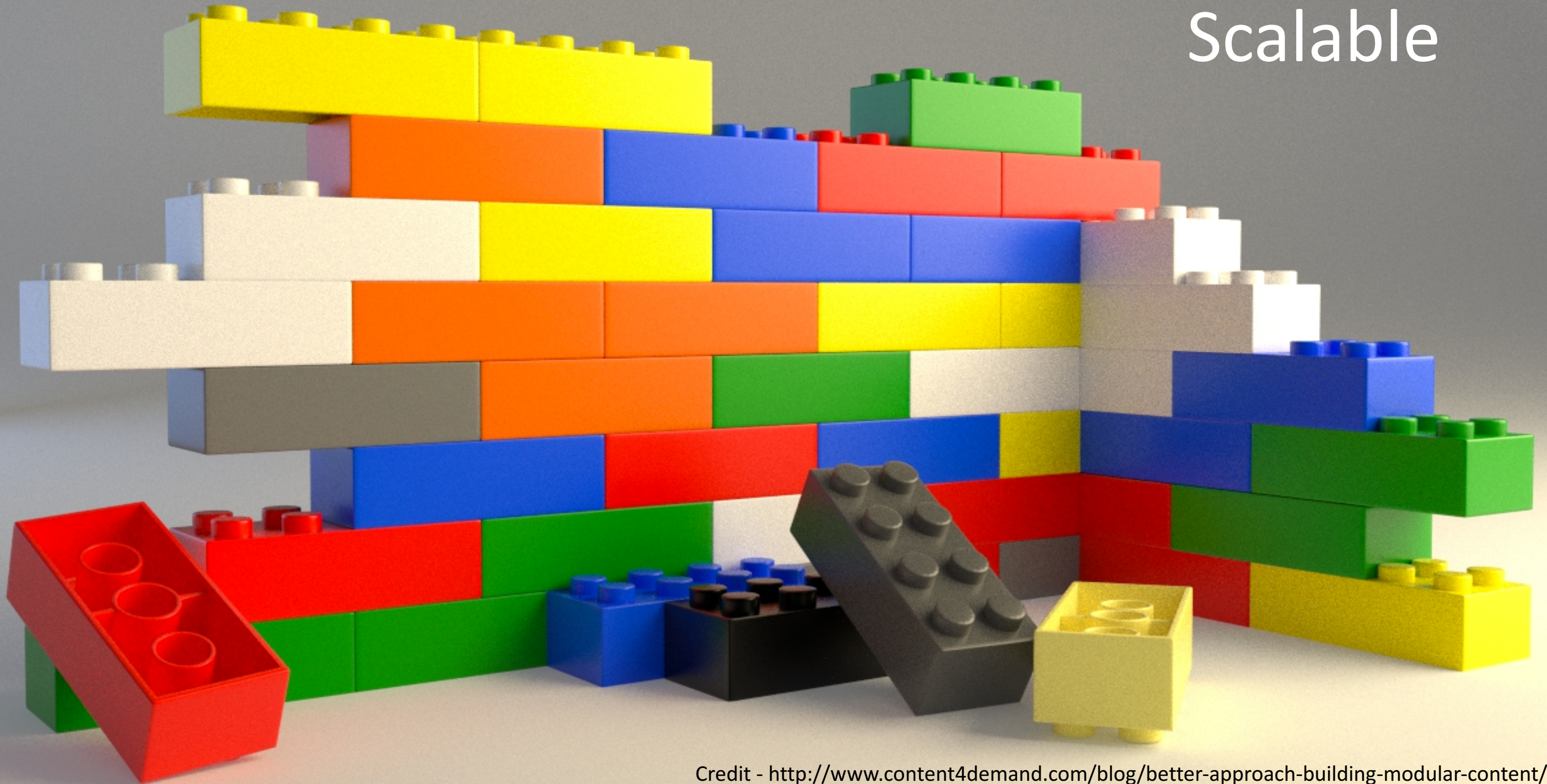


Secure

A row of white hurdles on a red running track. The hurdles are arranged in a line, receding into the distance. The track is red with yellow lane markings. The word "Open" is written in white text on the left side of the image.

Open

Scalable



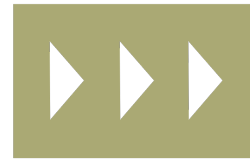
Credit - <http://www.content4demand.com/blog/better-approach-building-modular-content/>

Chick-fil-A Architecture

Cloud



OAuth Server



MQTT

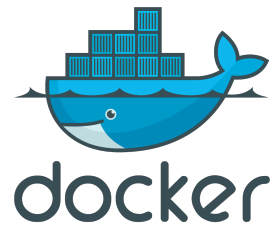


Analytics



Management

Edge



Edge Tools

Local
Auth



MSGing

Web
Server

Event
Fwding

Apps
...

Local Persistence/Storage - Redis

Connectivity



Bluetooth

Things



Chick-fil-A Architecture

Cloud



Edge

Connectivity

Things

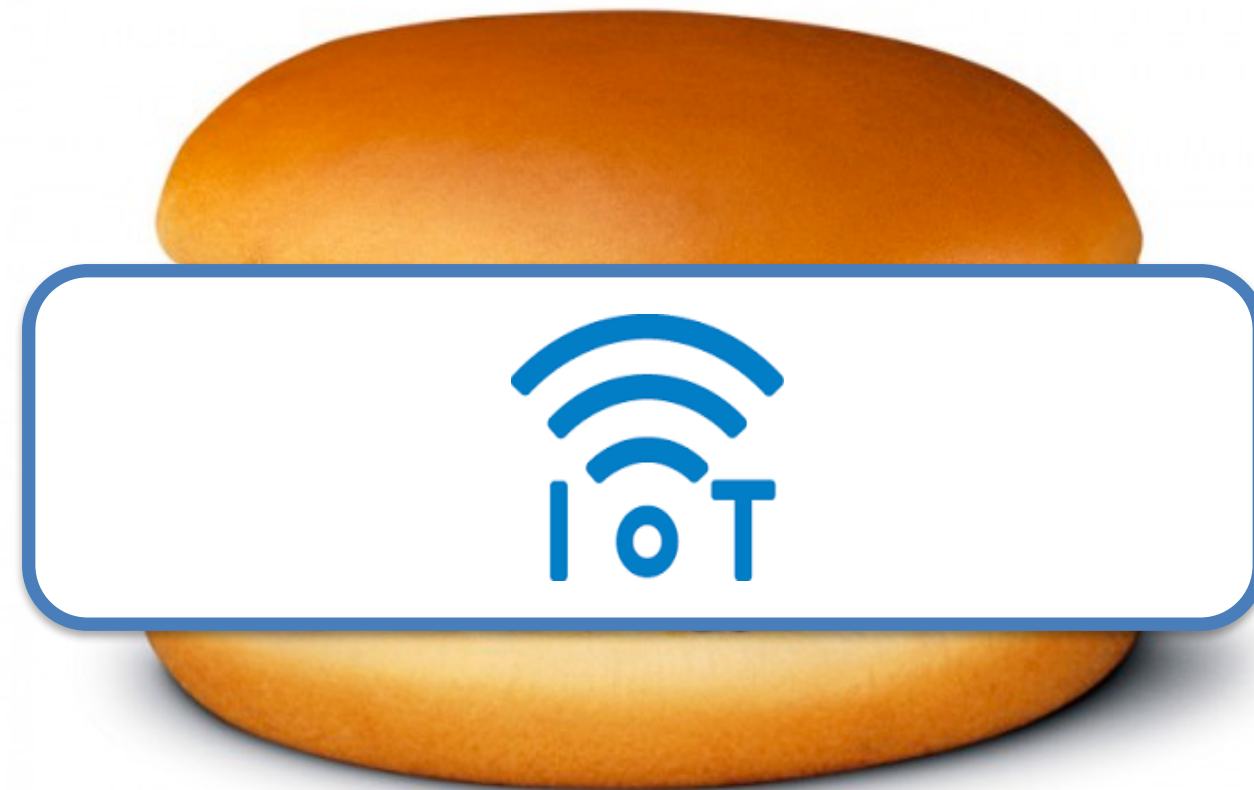


Let's create a new product...

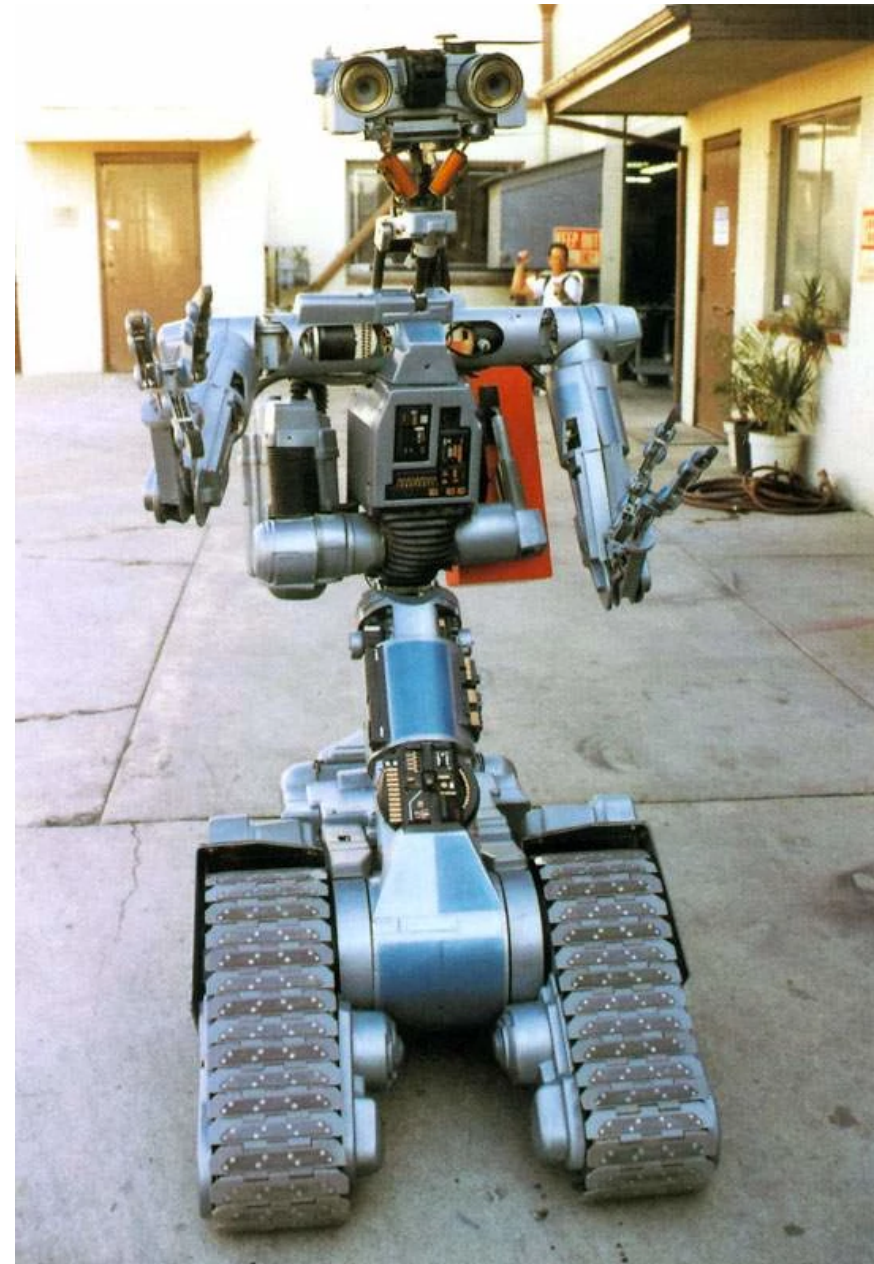
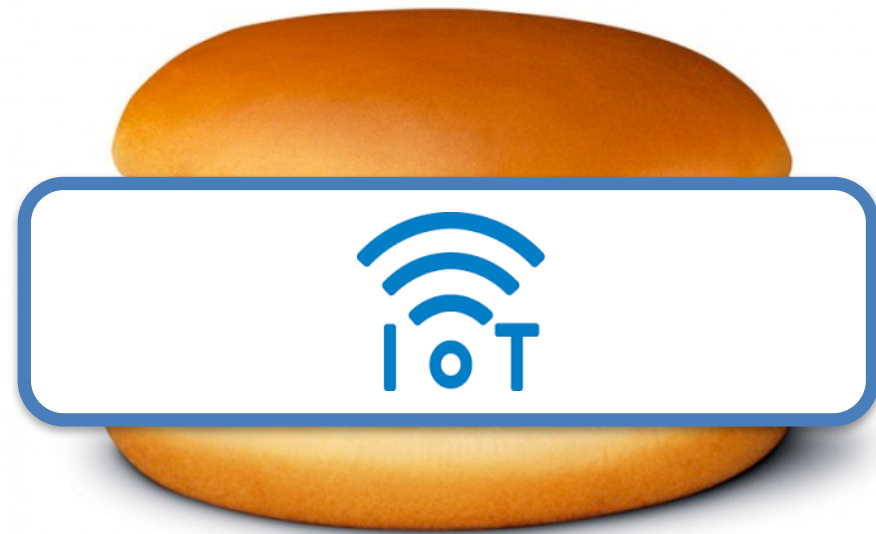
Requirements

- Should be amazing!
- Produced with a new machine we'll develop
- Should be able to collect data from our machine
- Should be able to command our machine to cook what we want on demand

Presenting the IoT Sandwich



Our Machine



How do I connect my device?

Securing the IoT

- Network Access
- Credential Management
- Transport Layer Security
- Brokered Communications
- **Device Registration**
- **Authentication / Authorization**

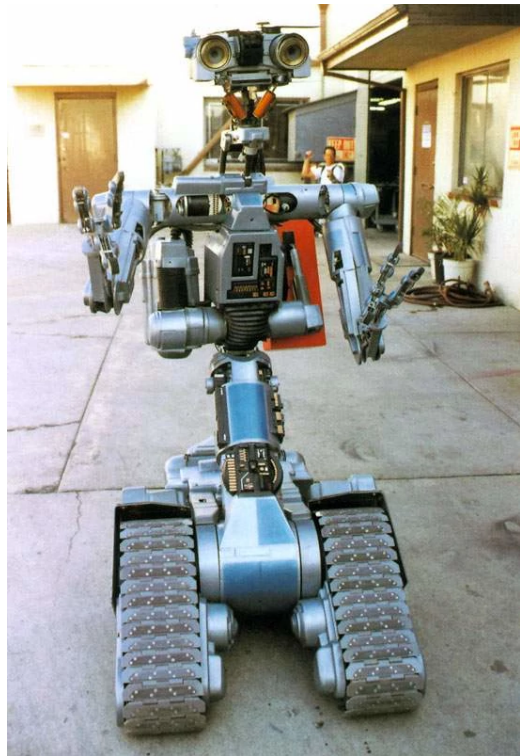


Registration & AuthN/AuthZ

- Dynamic Client Registration for OAuth Clients
- Authorization – Human authorization
 - Auth Code Flow / Device Code Flow
- Stateless Tokens – JWT
- No degradation when WAN offline
- Software Development Kit (SDK) to make it easy



Security: Demo



What happens with a new device?

1. Connect (Wi-Fi in our case)
2. Discover endpoints via .wellknown
3. Register with Auth Server
4. Request authorization as Johnny 5
5. Approve the request (SSO / MFA)
6. Return a JWT
7. Switch Wi-Fi Networks

Chick-fil-A Architecture

Cloud



OAuth Server

Edge

Connectivity



Bluetooth

Things



Security Recommendations

1. Don't hardcode **permanent, powerful** credentials at manufacture time, and then never change them
2. Require **human authorization** for devices whenever possible
3. **Monitor** device **traffic profiles** to ensure they are behaving normally
4. Don't allow **inbound connectivity** if possible

How do I collect data from the device?

Collecting Data from Things



- Lightweight messaging protocol
- Pub / Sub functionality
- Collect events
- Brokers “thing” interactions
- Mosca Broker backed by Redis

MQTT: Demo

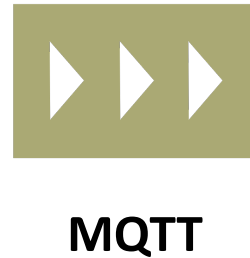


Picking up where we left of...

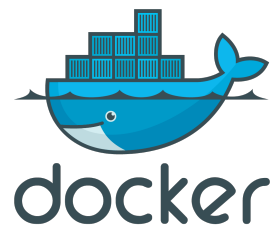
- Already have a JWT
- Connect to MQTT broker
- Publish some “state” messages

Chick-fil-A Architecture

Cloud



Edge



Edge Tools



Connectivity



Things



What if we lose connectivity?

What if the network is too slow?

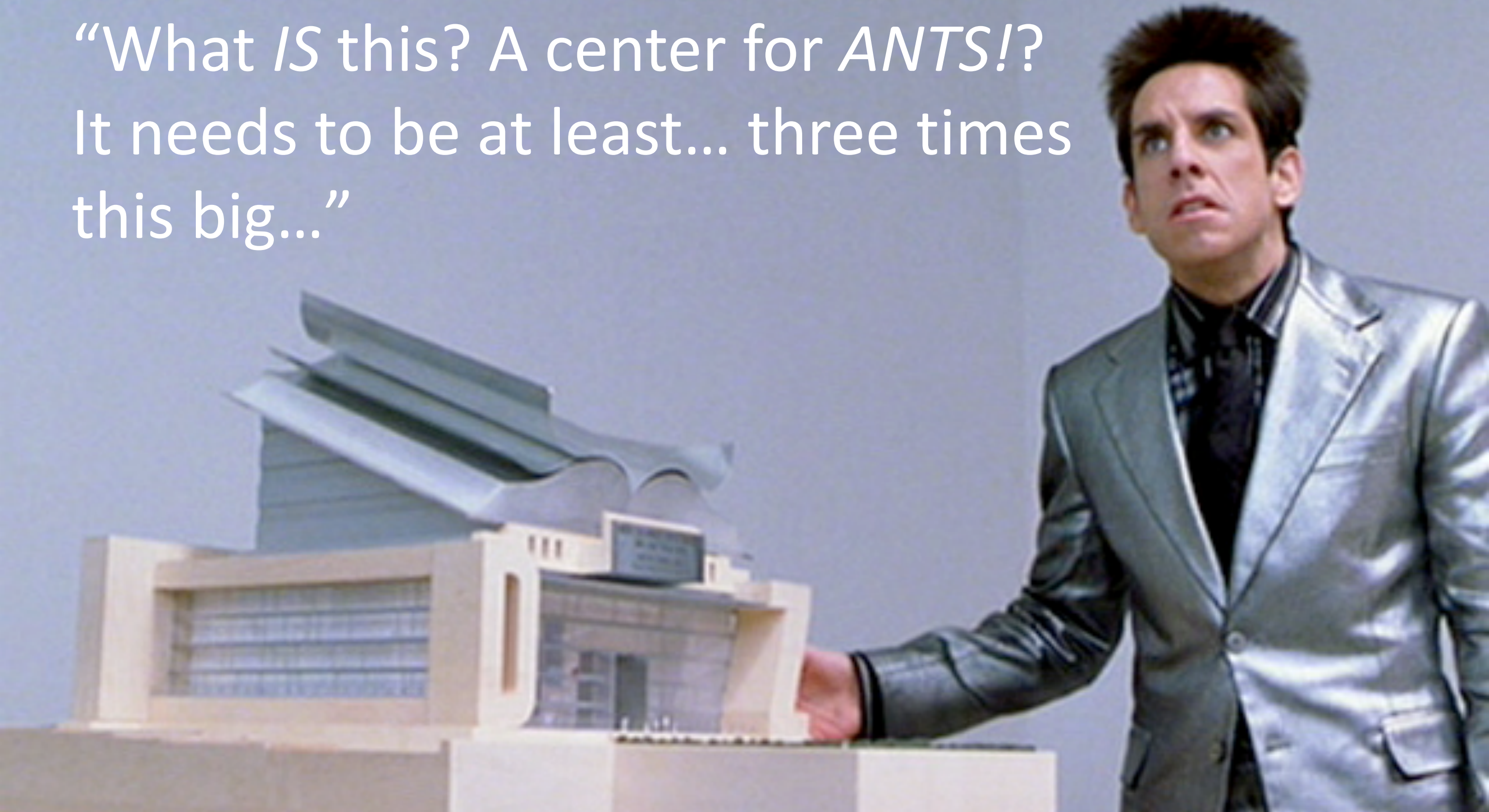
Edge Architecture



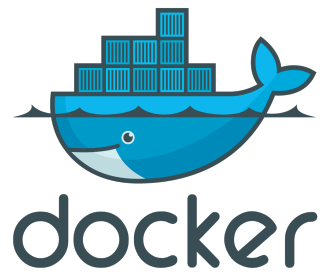
Why Edge Compute?

- Support critical businesses when network is down
- Reduce latency for “thing” interactions
- Data aggregation before shipping to cloud

“What *IS* this? A center for *ANTS!*?
It needs to be at least... three times
this big...”



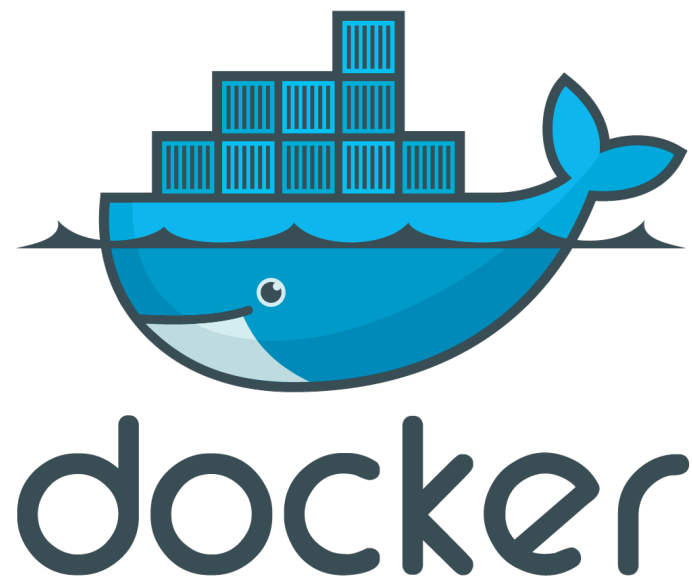
Edge Architecture



Edge Tools



Edge Architecture



Docker Swarm

- Separation / Microservices at Edge
- Self-healing architecture
- Discovery
- Portability of apps b/w Edge and Cloud

Edge Architecture

The NGINX logo is displayed in a bold, green, sans-serif font. The letters are stylized, with the 'G' and 'I' having unique shapes. The 'X' is composed of two intersecting lines.

Local Web Server

- Internal Content Delivery
- Reverse Proxy for Edge Microservices

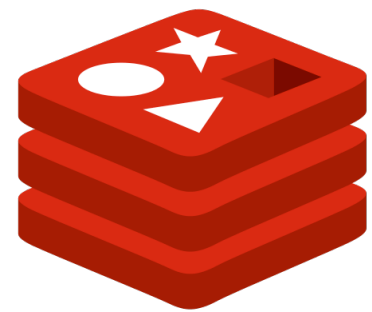
Edge Architecture



Event & Log Forwarding

- MQTT forwarding
- Docker log forwarding

Edge Architecture




redis

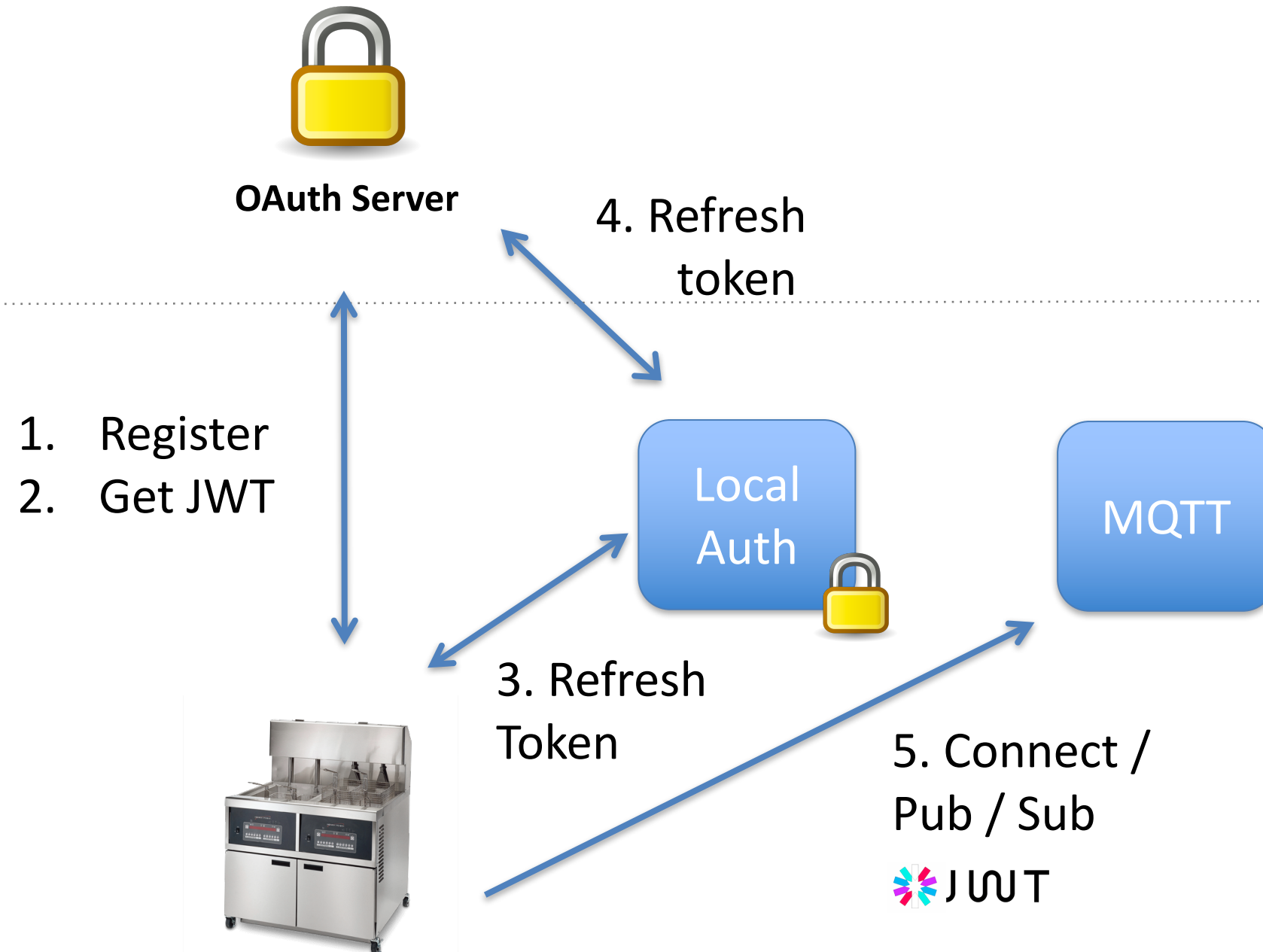
Persistence

- Distributed across all Edge nodes using clustering
- Supports Edge application persistence

Edge Architecture

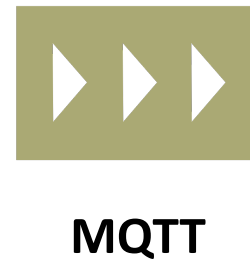
Cloud 

Edge 

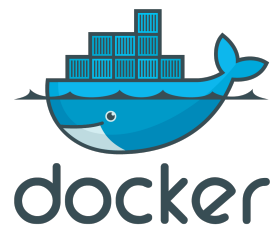


Chick-fil-A Architecture

Cloud



Edge



Edge Tools



Connectivity



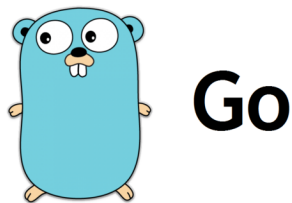
Bluetooth

Things

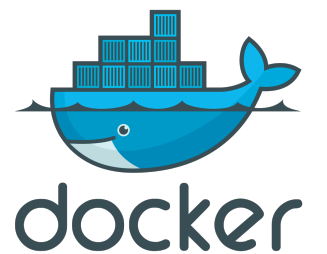


How do I build an application to control my device?

Edge Applications



- Run in Docker containers
- On-board as a **software** “thing”
- Interact with local and cloud services
- Short-lived vs Long-lived
- Service Limits



CI /CD for IOT

Commit



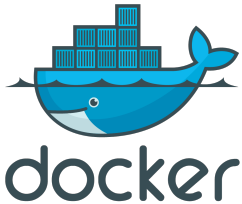
Build



Deploy



Virtual Edge



Validate

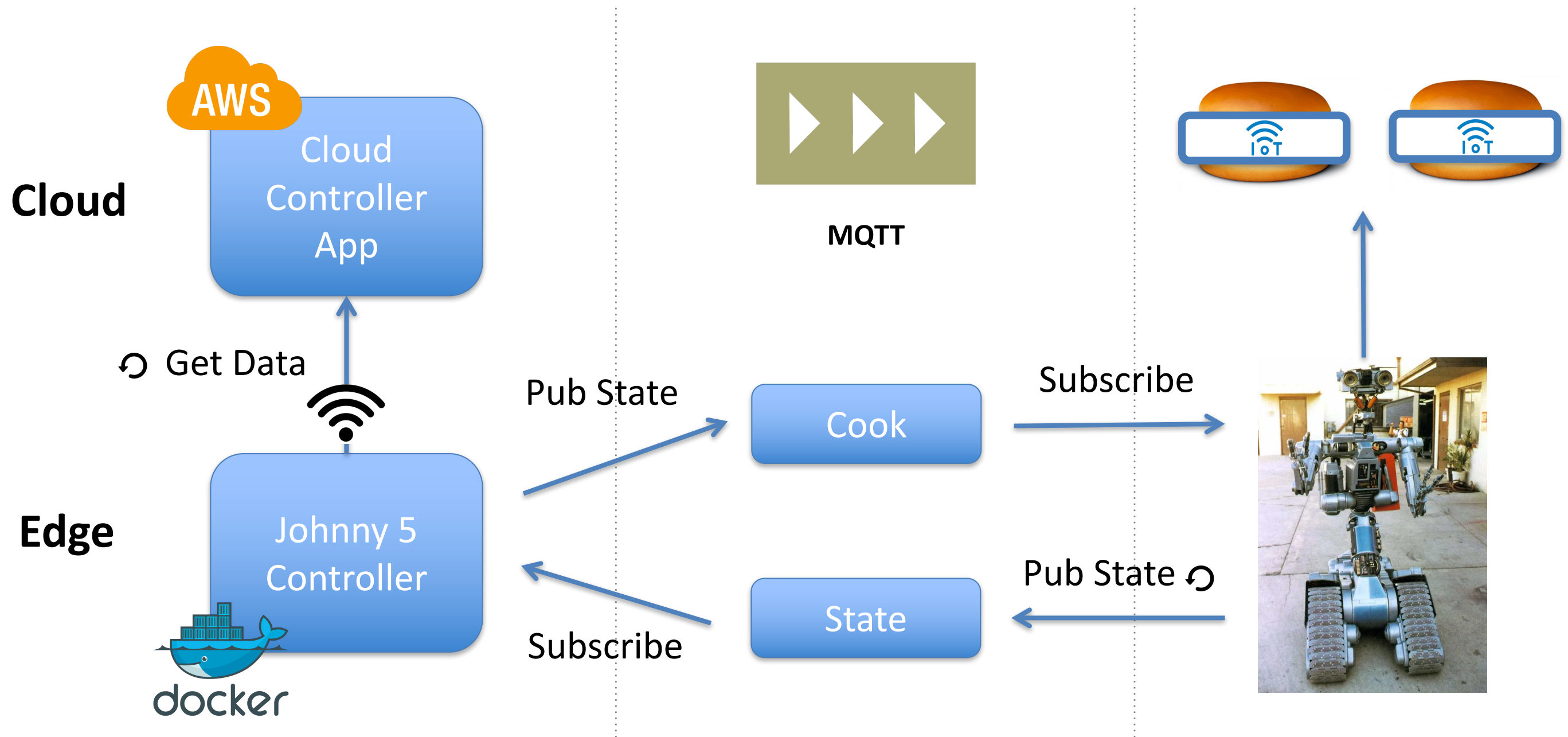
Integration Tests



Release Candidate



Edge Applications: Putting it together

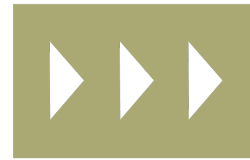


Chick-fil-A Architecture

Cloud



OAuth Server

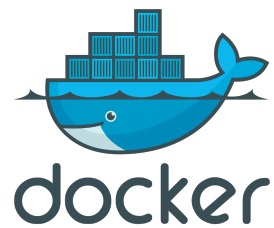


MQTT



Analytics

Edge



Edge Tools



Local
Auth



MSGing



Web
Server



Event
Fwding



Apps
...



Local Persistence/Storage - Redis

Connectivity



Bluetooth

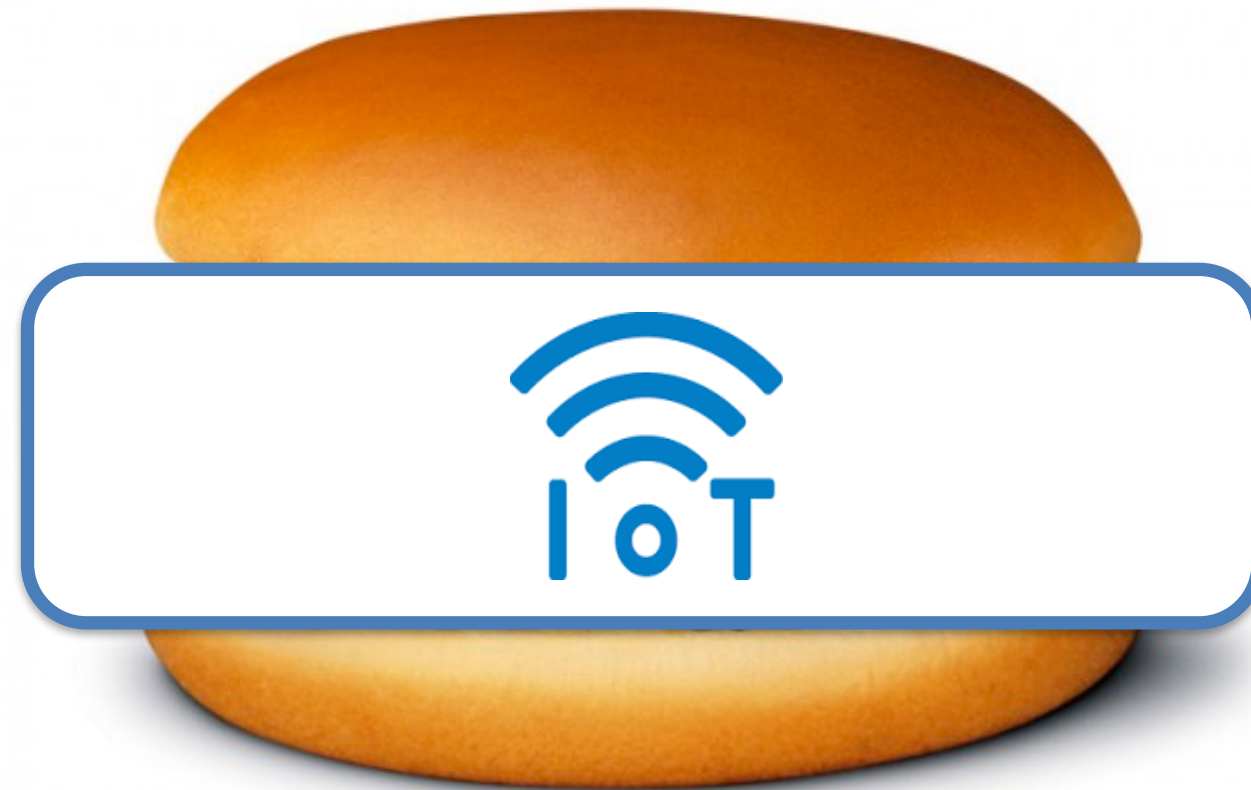
Things





A word on operations

The IoT Sandwich



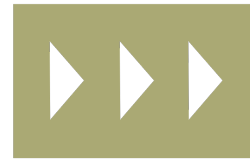
We didn't invent IOT, just the IOT Sandwich

Chick-fil-A Architecture

Cloud



OAuth Server



MQTT

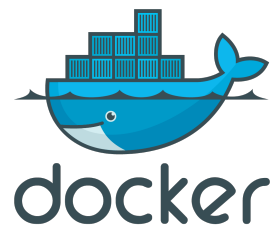


Analytics



Management

Edge



Edge Tools



Local
Auth



MSGing



Web
Server



Event
Fwding



Apps
...



Local Persistence/Storage - Redis

Connectivity



Bluetooth

Things



Key Takeaways

Connecting things creates the opportunity to **orchestrate interactions** between **devices** and **people**

- Think ecosystem: secure, open, scalable
- Cloud First, but if you need Edge, design it like a micro-cloud
- Ensure that you have a strong security story

What's Next for Chick-fil-A?

- **Analytics** and **Machine Learning** on **IoT Data**
- **Machine Learning** at the **Edge**
- Considering providing local **queueing** for Edge apps
- Re-evaluating **persistence**
- Support for **short-lived apps**

Where to find me



www.linkedin.com/in/brian-chambers



[@brianchambers21](https://twitter.com/brianchambers21)



<http://brianchambers.blog>

