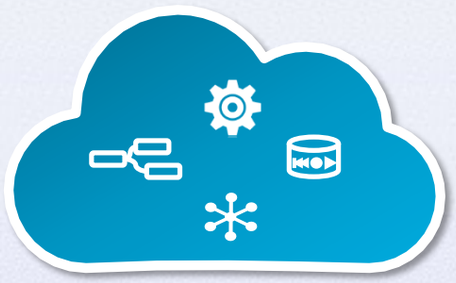
A day in the life with speech recognition, machine learning, & IOT



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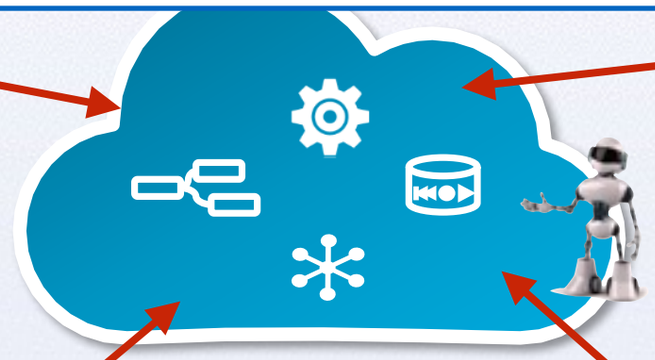
Mark VanderWiele
Distinguished Engineer
Emerging Technologies, IBM

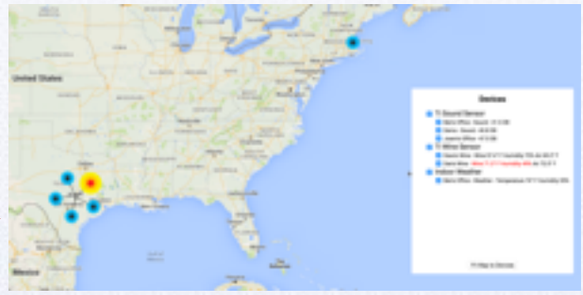
#IBMBluemix | | @MarkVanderWiele

Device Connect & Control - Journey/Experience

Cloud services: Analytics, Voice, Storage, Security, Message Storage/Delivery, Wiring/Logic, Views…

Voice Activation/Control





MQTT

MQTT

Devices: Connect
Publish-Status/Description
Subscribe - Commands

JSON

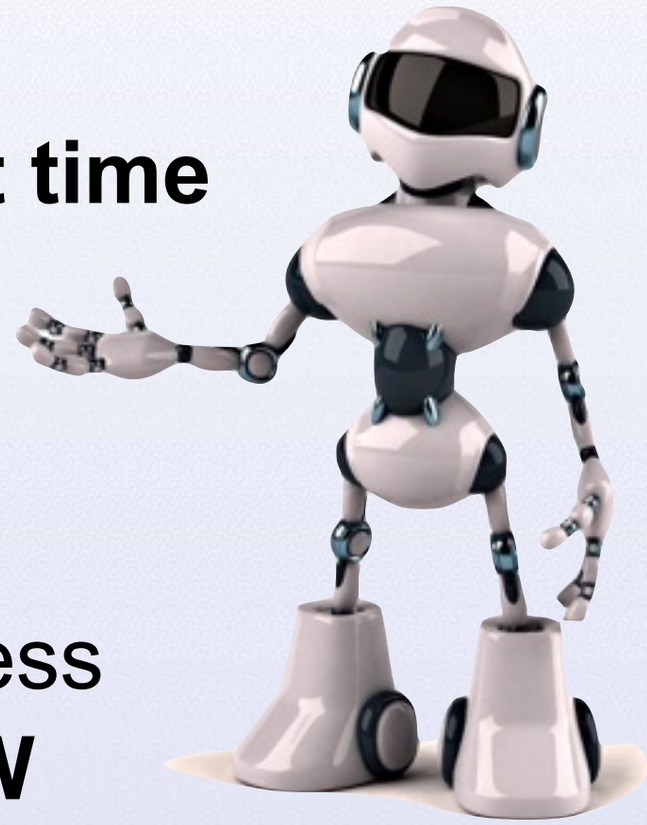
Device Brokers

HomeKit
HealthKit

Dave Boloker & Mark VanderWiele,
IBM Emerging Technologies

What's Changing?

- Devices integrating **Always on listening for key words, immediate voice activation, and voice as a command line**
- User polling/searching moving to **intelligent time sensitive user programed push.**
- Bringing machine learning and **machine intelligence to non data-scientists**
- Knowledge workers employing robotic process automation will **configure software and HW "robots" to automate** their interactions with the business systems



"The ~~last~~ "next" mile of device interface and analytics"

Dave Boloker & Mark VanderWiele,
IBM Emerging Technologies

Looking forward

We will no longer have to learn to use the machine, the machine will learn from listening to us.

We will converse naturally within our own digital world to:

- Ask questions
- Control devices
- Collaborate more naturally
- Purchase goods and services using “Conversational Commerce”
- Carry out our daily tasks
- Learn, adapt, and extend out digital world

Demonstration 1,2,&3: monitor and control a device with Voice commands

Using speech recognition and cloud technologies to:

Demo1

- **Securely control devices** around the world (with voice)

Demo2

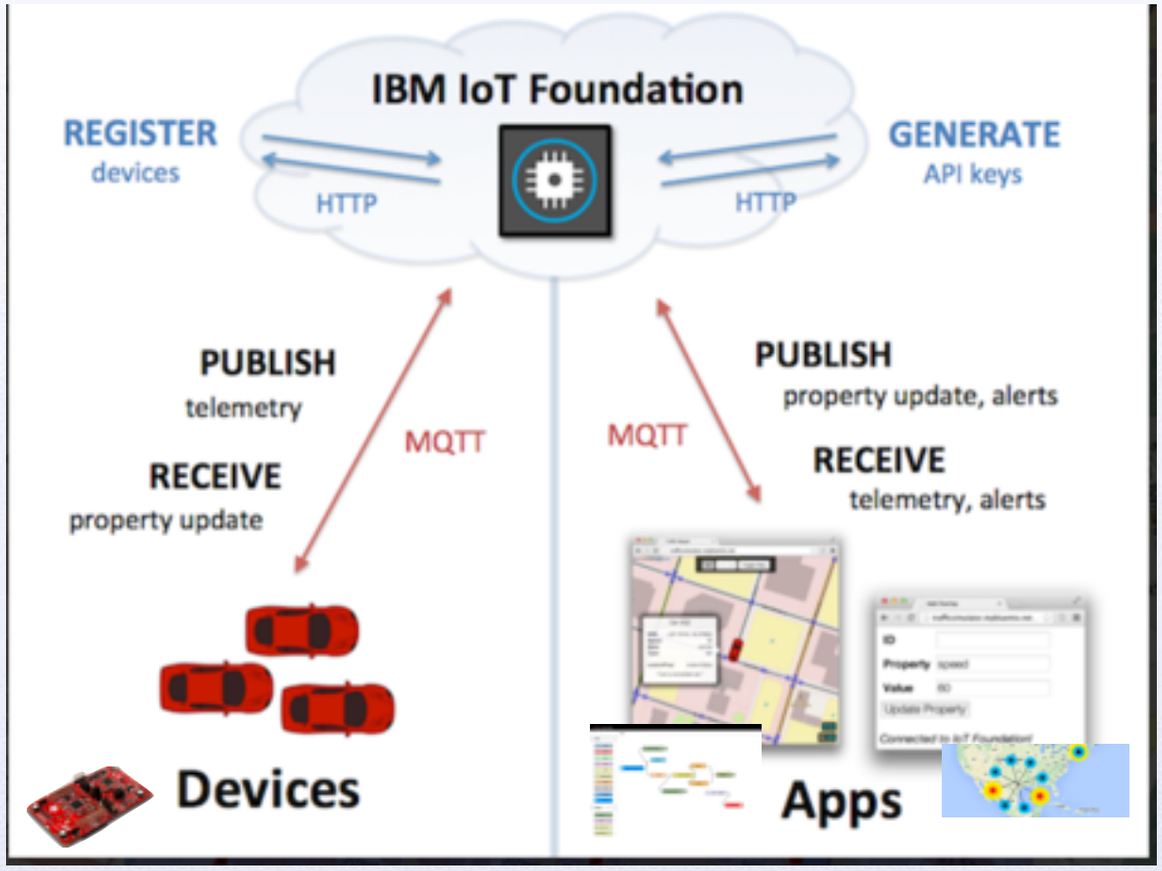
- **Monitor** and help plan my day's activities, including waking me up.
- **Summarize** my portfolio and News
  - Send to my phone or car.
- **Analyze** business data, IOT Data
- **Search and follow** hot topics
- **Plan and track** my projects, **shop**, **get help**
- **Display and analyze my devices**
- **Create reusable conversations** from my interactions, **creating a "verbal mashup"**

- **Demo 3**
  - **Visualize and control my devices** around the world

Demo 4: Connect a Device to the Cloud

Live add a new device:

- **Create IOT dev environment**
- **Bind IOT service**
- **Register new device**
- **Create keys**
- **Install sample code** on device
  - developer.ibm.com/recipes/
  - set keys (org,deviceType,deviceID, publish topic, subscribe topic)
- **Publish Information** to the cloud
- **Monitor** and create notifications
- **Store data**
- **Add some control**



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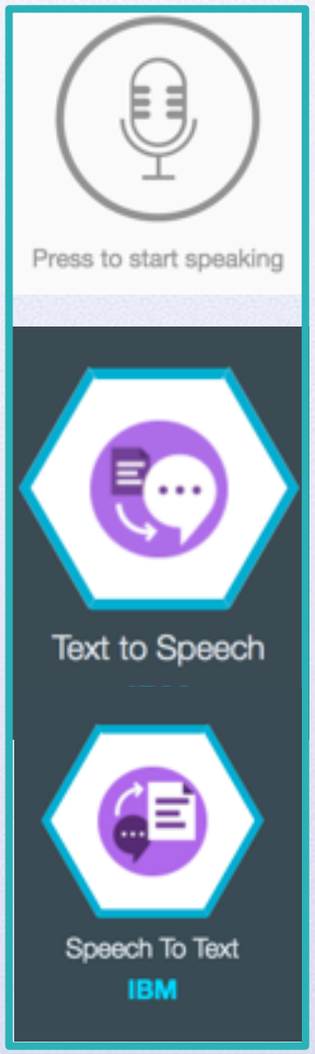
Conversational Computing to Control a Device:
Combining Services with Incremental Skill Sets

Cognitive Services



- Analyze
- Correlate
- Learn and Change

- Command and Control
- Connect and trigger
- GEO Location service

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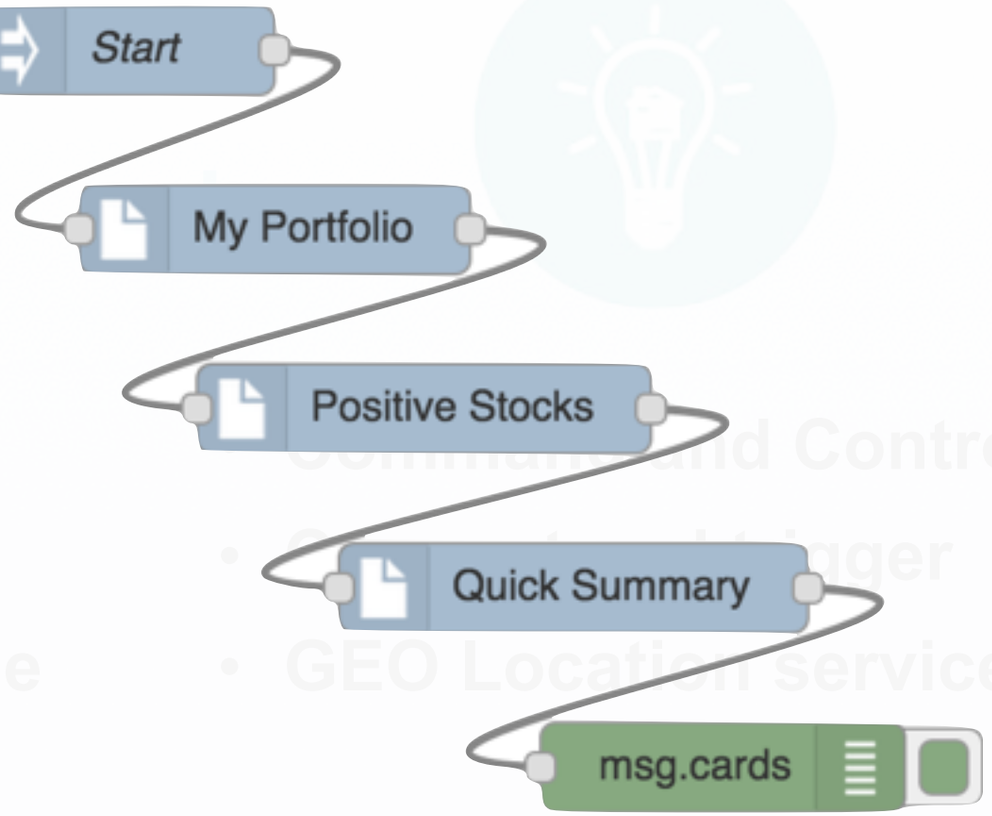
IBM Emerging Technologies

Conversational Computing:
Combining Services with Incremental Skill Sets

Create,Save and Replay Discussions Like Play List



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PaaS - Platform as a service, with large pallet of services

Build Apps Using Services

Single Sign On

Node-RED Starter
Community *BETA*

Apache Spark
IBM

Speech To Text
IBM

Concept Expansion
IBM *BETA*

Internet of Things
Platform Starter
IBM

Cloudant NoSQL DB
IBM

Twilio
Third Party

Language Translation
IBM

AlchemyAPI
IBM

Insights for Twitter
IBM

Text to Speech
IBM

Dialog
IBM

API Management
IBM

MongoDB by Compose

Behind The Scenes

Speech & NLP Controllers

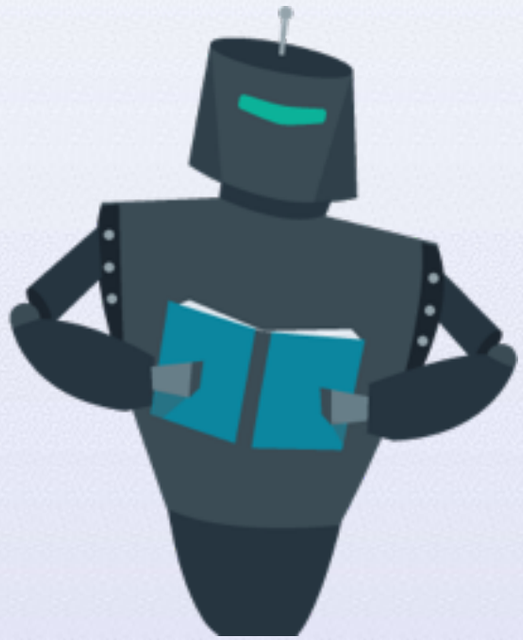
Main App (MVC)

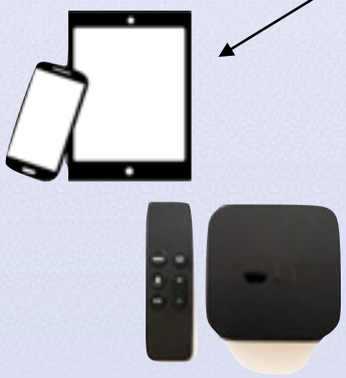
Alchemy News

BigInsights Twitter Sentiment

Business Service (KPIs)

IOT Foundation Services





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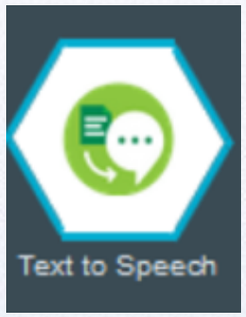
Speech to device command flow

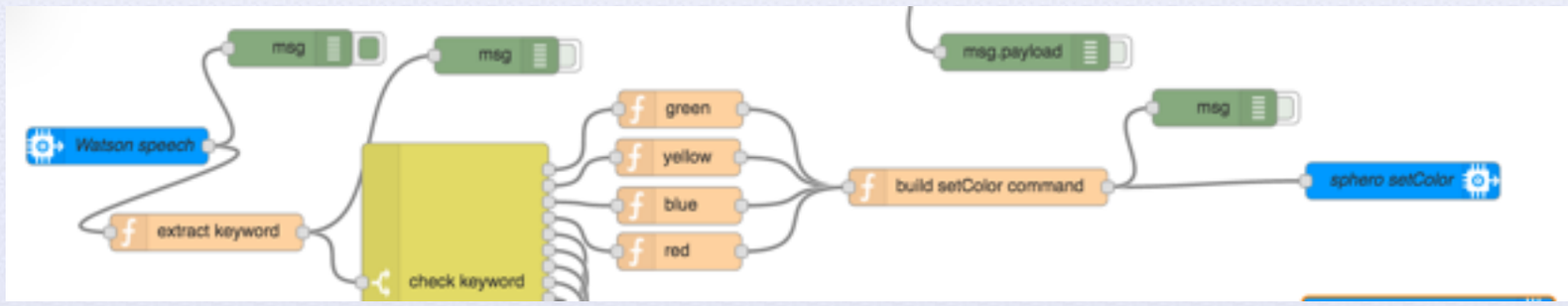
http://www.ibm.com/smarterplanet/us/en/ibmwatson/developercloud/doc/speech-to-text/#sampleApp



MQTT

{ "topic": "iot-2/type/watsonSpeech/id/watsonSpeech/evt/partial/fmt/json",
"payload": { "value": "red", "device_id": "mfast" } }

Node Red



MQTT

{“deviceId": "mfast", "payload": "{\"d\":{\"r\":255,\"g\":0,\"b\":0}} }

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Speech code - handle speech to txt and txt to speech

1.Speech to Text API

I said “my drone is Bryan's bebop”

I got “my German is Brian’s Bieber”

“Can you ask my drone to fly please”

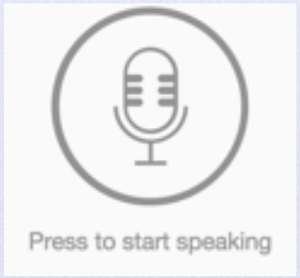
“Can you ask my drum the fly place”

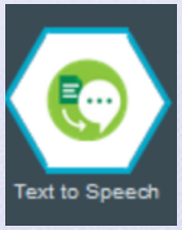
2. Match text to CMD
Guess vs Final?
Word confidence score
Conversations & Context?
Phonetic matching?
Acronyms?
Nouns n verbs?
Utterances?

```
YesIntent yes
YesIntent yep
YesIntent yeah
YesIntent please do
YesIntent sure
```

or

```
PortfolioIntent how is my stock portfolio doing
PortfolioIntent stocks update
PortfolioIntent stock update
PortfolioIntent check stocks
PortfolioIntent check my stocks
PortfolioIntent check portfolio
PortfolioIntent portfolio update
```





Service API’S

MQTT/ JSON

IBM IOT Foundation

3. Format response Text to Speech API

4. Send Command to IOT/ Foundation-device

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Pick Your Device

IBM IoT Foundation

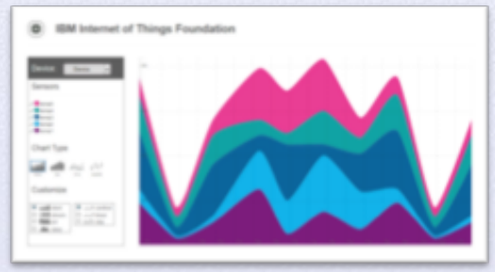
Recipes

developer.ibm.com/recipes/

ARM mbed

BeagleBone with SensorTag

SimpleLink™ Wi-Fi® CC3200 LaunchPad



Intel Galileo

Raspberry Pi

Arduino Uno
with Wi-Fi Shield

Device Simulator

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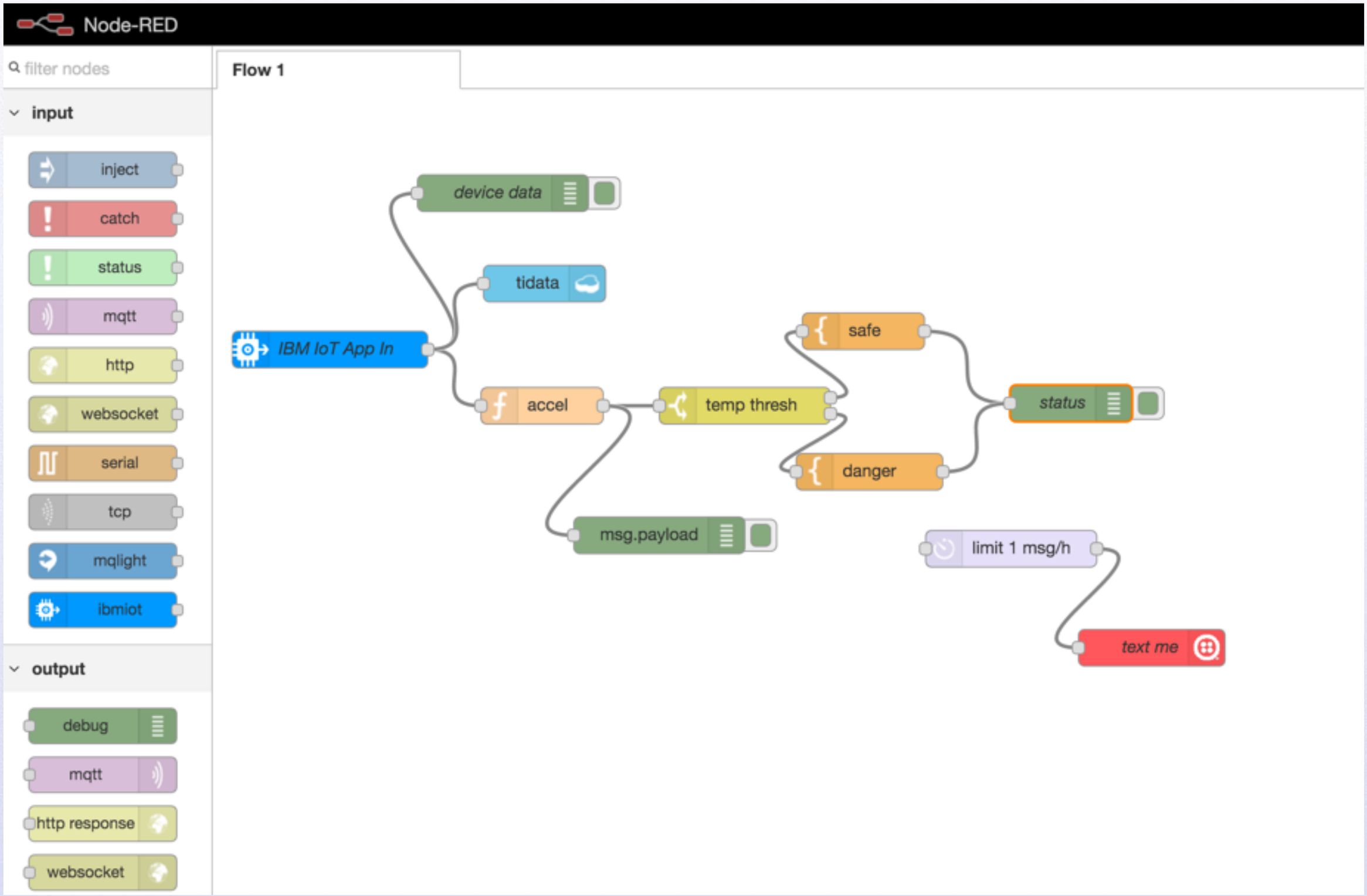
Wire new flows for your device



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Device control - from speech to command

IBM IOT Foundation

MQTT

Publish

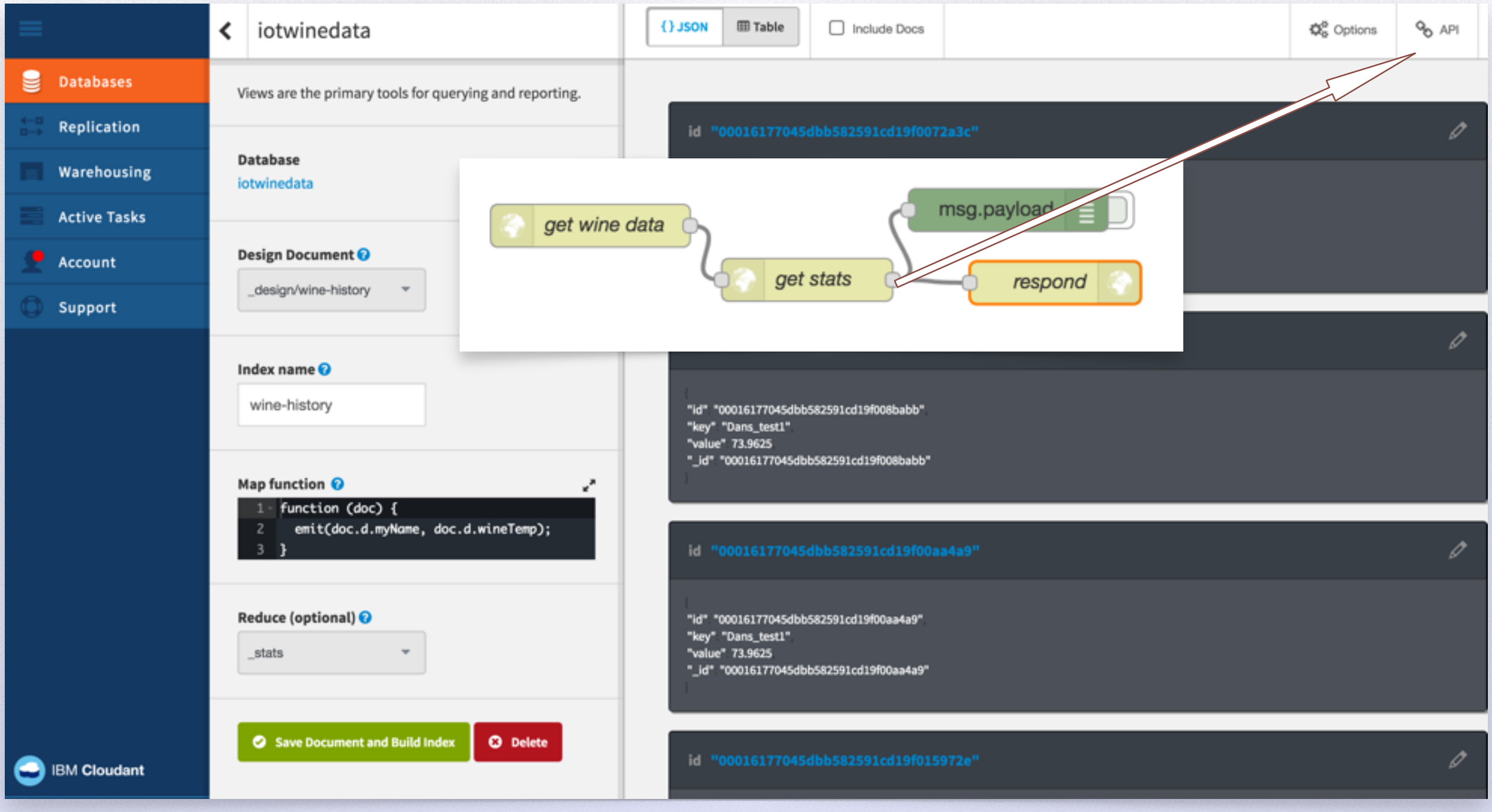
```
{
  "d" : {
    "id" : "5B937D56-2E75-5293-BE2B-CB17C2EA539B",
    "name" : "David's Home : iDevicesNightLight",
    "data" : {
      "hue" : {
        "writable" : true,
        "step" : 1,
        "max" : 360,
        "value" : 220,
        "format" : "number",
        "min" : 0
      },
      "on" : {
        "value" : true,
        "writable" : true,
        "format" : "bool"
      }
    },
    "location" : {
      "lng" : -71.15152086101887,
      "lat" : 42.29974632421209
    },
    "iso" : "2016-04-11T10:54:29.317-0400"
  }
}
```

JSON Self Describe Writable Attributes

Subscribe cmd/set

```
{
  "d" : {
    "id" : "5B937D56-2E75-5293-BE2B-CB17C2EA539B",
    "on" : true,
    "hue" : 160
  }
}
```

Cloudant map reduce - stats with API



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MQTT

MQTT is simple to implement

Connect

Subscribe

Publish

Unsubscribe

Disconnect

```
client = new Messaging.Client(hostname, port, clientId)
client.onMessageArrived = messageArrived;
client.onConnectionLost = connectionLost;
client.connect({ onSuccess: connectionSuccess });

function connectionSuccess() {
        client.subscribe(“planets/earth");
        var msg = new Messaging.Message("Hello world!");
        msg.destinationName = "planets/earth";
        client.publish(msg);
}

function messageArrived(msg) {
        console.log(msg.payloadString);
        client.unsubscribe("planets/earth");
        client.disconnect();
}
```

Eclipse Paho JavaScript MQTT client

MQTT

Quality of Service for reliable messaging

Publish to topic iot-2/evt/<event-type-id>/fmt/json

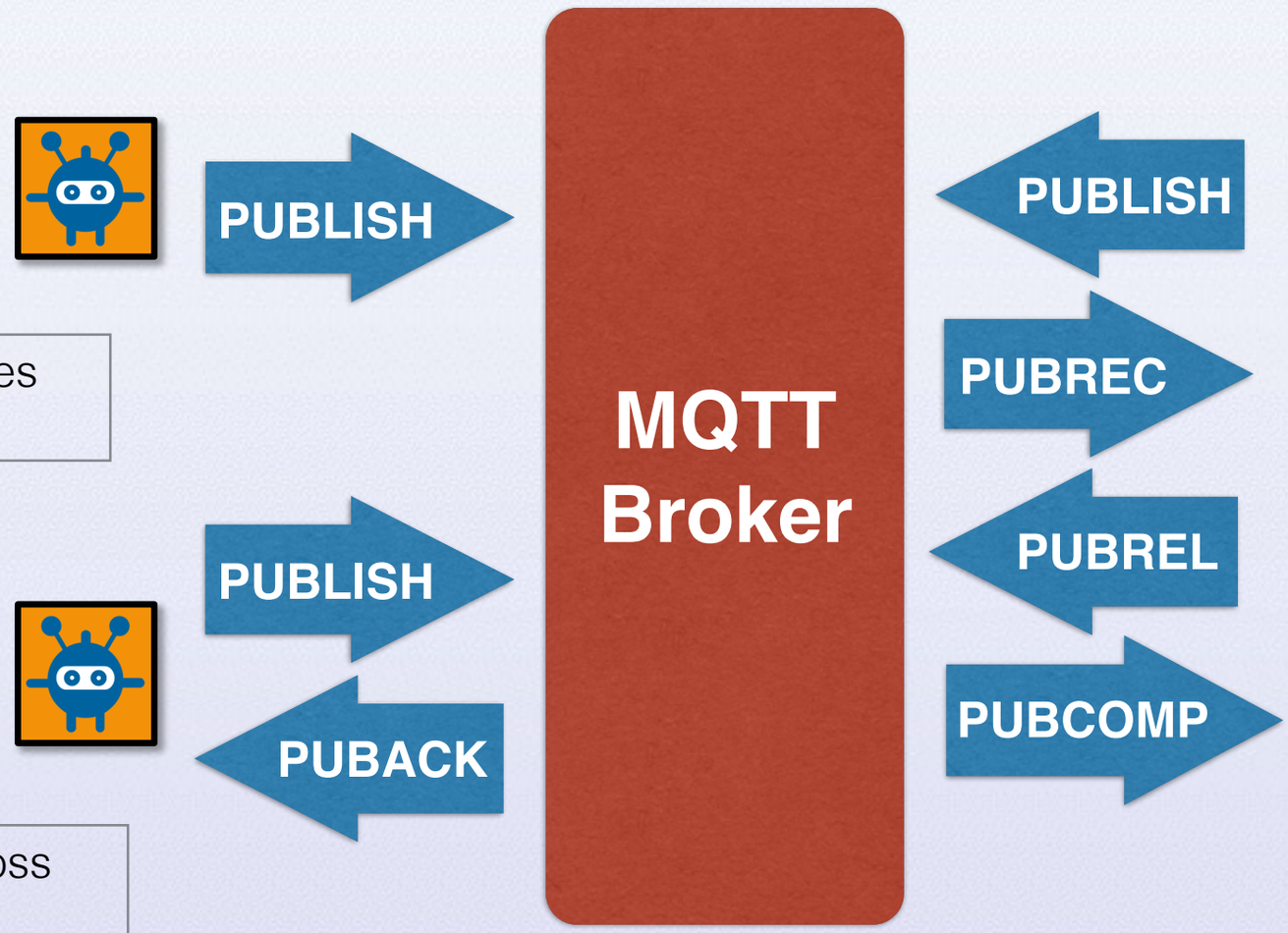
Subscribe to topic iot-2/cmd/<**event_id**>/fmt/**json**

QoS 0
at most once

- doesn't survive failures
- never duplicated

QoS 1
at least once

- survives connection loss
- can be duplicated



QoS 2
exactly once

- survives connection loss
- never duplicated

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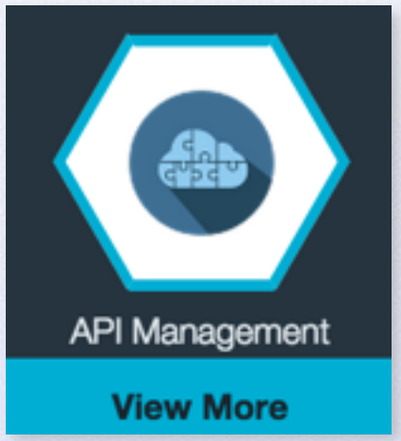
API Management

Developers want to rapidly build secure RESTful APIs, yet don't want to have to focus on elements that are not core to the API's behavior

- Security
- Access control and authentication
- Metering
- Analytics
- Versioning
- Controlling Visibility and managing subscriptions



See Bluemix.net api mgmt blog by Steve Atkin

http://www.stevenatkin.com

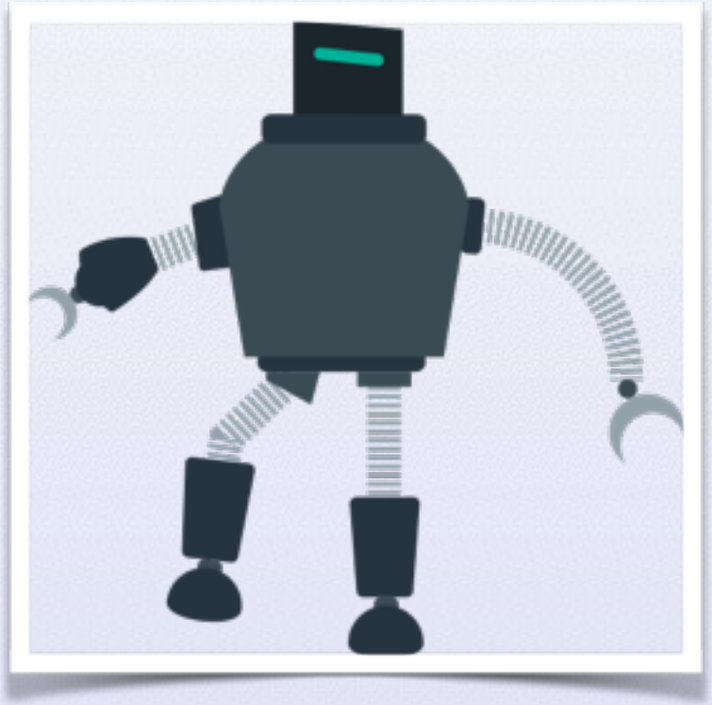
Lessons Learned?

- No “Speech to text” service is perfect
  - Needs some special sauce to map to commands
  - We found it was best to have skill sets with context

- Devices must self describe capabilities for plug and play and have pronounceable names

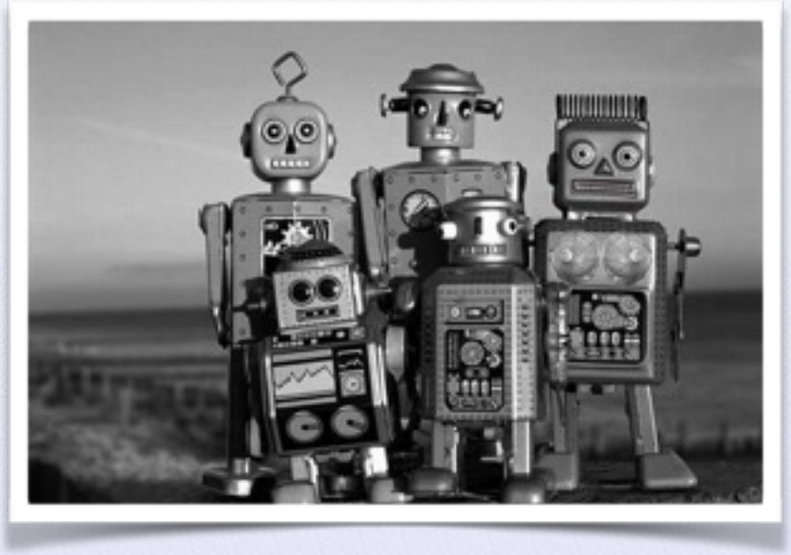
- Commands over MQTT should be sent with QOS1, QOS2 or have an ACT

- IBM IOT MQTT 4k message size limit



Lessons Learned - connecting heterogeneous devices?

- HomeKit
  - ble vs wifi
  - gateways
- HealthKit
  - security, privacy, and gateways
  - foreground/background data access
- Roll you own devices
- Standardization



The Future

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What if…

Personal assistants or other **devices could learn**

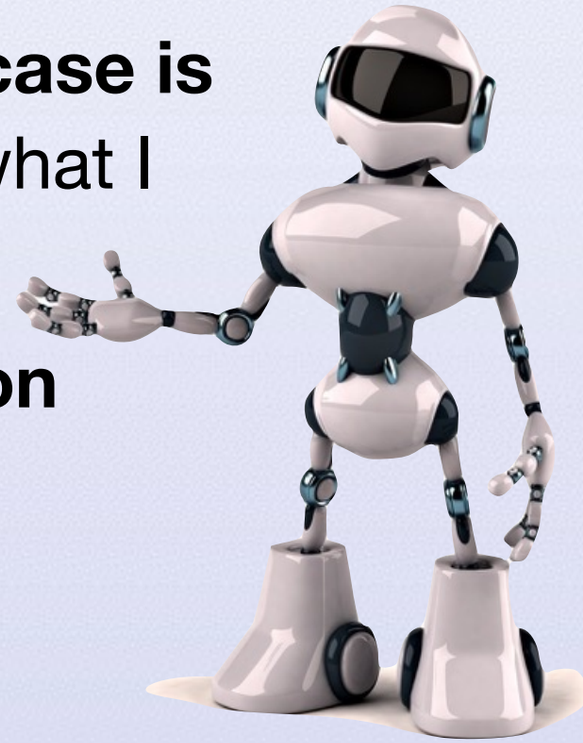
The **conversational style of interaction** with devices is more than just asking the device to perform a set of static tasks

We could **teach the devices new things through conversation**, combining tasks from an endless set of rich content components

We are **programming by example, the example in this case is in the form of conversation** - do what I say! AND learn what I do!

In many ways, the **zero UI of a conversational interaction pattern is much easier**

What better way to prescribe is there than to describe



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Why PaaS? What is Bluemix? - Sign up for a free trial

(PaaS) - for rapidly building, managing, and running cloud based applications and services of all types without worrying about the underlying infrastructure. Program in your choice of language.

(IBM's Bluemix) - Built on open-standards and open source technologies: Cloud Foundry, OpenStack, MQTT, docker,…

State of the Art User Interface

Services Catalog containing Services/APIs for Mobile, Data, Enterprise data connectors, Cognitive, Analytics, Social and any callable Rest based service

Multiple flavors - **public, dedicated, on-premise, hybrid**

Instant Runtimes

CLOUD FOUNDRY

.java liberty .js .rb on rails .rb sinatra

.php .py .go

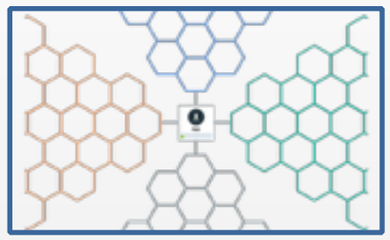
NEW: Containers

docker

NEW: Virtual Machines

openstack

Build Apps Using Services



Thank you for your time

www.bluemix.net

Tweet #IBMBluemix @qconsp @MarkVanderwiele

for more info see the following blogs

Jon Kaufman: jkaufman.io

https://github.com/watson-developer-cloud/company-insights

Ryan Baxter: ryanjbaxter.com

Steve Atkin: stevenatkin.com

Niklas Heidlof http://heidloff.net

James Thomas http://jamesthom.as/blog/categories/bluemix/

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