



IoT for Beginners



AKA.MS/IOT-BEGINNERS

GETTING STARTED | INTRODUCTION TO IOT

- WHAT IS "IOT"?
- IOT DEVICES AROUND US
- SETUP YOUR IOT DEVICE
- APPLICATIONS OF IOT

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A DEEP DIVE!

- COMPONENTS OF IOT APPLICATIONS
- MICRO-CONTROLLERS A DEEPER DIVE
- SINGLE BOARD COMPUTERS A DEEPER DIVE

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INTERACT WITH THE PHYSICAL WORLD

- SENSORS TO GATHER DATA
- ACTUATORS TO SEND FEEDBACK
- PROJECT: BUILD A NIGHTLIGHT

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CONNECT YOUR DEVICES TO THE INTERNET

- LEARN TO:
 - SEND & RECEIVE MESSAGES
 - CONNECT LIGHT TO MQTT BROKER
 - CONNECT DEVICE TO INTERNET

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PREDICT PLANT GROWTH USING TEMPERATURE DATA

- USE SENSED TEMPERATURE TO PREDICT PLANT GROWTH

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DETECT SOIL MOISTURE & CALIBRATE SENSOR

- SOIL MOISTURE
- HOW SENSORS COMMUNICATE WITH IOT DEVICES
- MEASURE DATA
- CALIBRATE

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AUTOMATE PLANT WATERING

- CONTROL HIGH POWER DEVICES FROM LOW POWER IOT DEVICE
- CONTROL A RELAY!
- CONTROL YOUR PLANT OVER MQTT
- SENSOR AND ACTUATOR TIMING
- ADD TIMING TO YOUR PLANT CONTROL

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MIGRATE YOUR PLANT TO THE CLOUD!

- WHAT IS THE CLOUD?
- CREATE SUBSCRIPTION
- CLOUD IOT SERVICES
- CREATE IOT SERVICE
- COMMUNICATE
- CONNECT DEVICE

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MIGRATE YOUR APPLICATION LOGIC TO THE CLOUD!

- WHAT IS SERVERLESS?
- CREATE A SERVERLESS APP
- CREATE AN IOT HUB EVENT TRIGGER
- SEND DIRECT METHOD REQUESTS
- DEPLOY SERVERLESS CODE

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KEEP YOUR PLANT SECURE

- WHY DO YOU NEED SECURE IOT DEVICES?
- CRYPTOGRAPHY
- SECURE YOUR DEVICES
- GENERATE AND USE AN X.509 CERTIFICATE

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LOCATION TRACKING

- CONNECTED VEHICLES
- GEOSPATIAL COORDINATES
- GLOBAL POSITIONING SYS.
- READ GPS SENSOR DATA
- NMEA GPS DATA
- DECODE GPS SENSOR DATA

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STORE LOCATION DATA

- STRUCTURED AND UNSTRUCTURED DATA
- SEND GPS DATA TO AN IOT HUB
- HOT, WARM, AND COLD, PATHS
- HANDLE GPS EVENTS USING SERVERLESS CODE
- AZURE STORAGE ACCOUNTS
- CONNECT YOUR SERVERLESS CODE TO STORAGE

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VISUALIZE LOCATION DATA

- WHAT IS DATA VISUALIZATION?
- MAP SERVICES
- CREATE AN AZURE MAPS RESOURCE
- SHOW MAP ON A WEB PAGE
- ON A WEB PAGE
- JSON FORMAT
- PLOT GPS USING JSON

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GEOFENCES

- WHAT ARE GEOFENCES?
- DEFINE A GEOFENCE
- TEST POINTS AGAINST GEOFENCES
- USE GEOFENCES FROM SERVERLESS

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TRAIN A FRUIT QUALITY DETECTOR

- USING AI/ML TO SORT FOOD
- IMAGE CLASSIFICATION VIA MACHINE LEARNING
- TRAIN AN IMAGE CLASSIFIER
- TEST YOUR IMAGE CLASSIFIER
- RETRAIN YOUR IMAGE CLASSIFIER

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CHECK FRUIT QUALITY FROM AN IOT DEVICE!

- CAMERA SENSORS
- CAPTURE AN IMAGE...
- PUBLISH CLASSIFIER...
- CLASSIFY IMAGES...
- IMPROVE THE MODEL!

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RUN YOUR FRUIT DETECTOR ON THE EDGE

- EDGE COMPUTING
- AZURE IOT EDGE
- REGISTER EDGE DEVICE
- SETUP EDGE DEVICE
- RUN YOUR CLASSIFIER ON EDGE

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TRIGGER FRUIT QUALITY DETECTION FROM A SENSOR

- ARCHITECT COMPLEX IOT APPLICATIONS
- DESIGN A FRUIT QUALITY CONTROL SYSTEM
- TRIGGER FRUIT QUALITY CHECKING FROM SENSOR
- DATA USED FOR A FRUIT QUALITY DETECTOR
- USING DEVELOPER DEVICES TO SIMULATE MULTIPLE IOT BY MOVING TO 1 PRODUCTION

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TRAIN A STOCK DETECTOR TO COUNT THE STOCK (INVENTORY) IN STORE

- TRAIN AND USE AN OBJECT DETECTOR!
- ANOTHER CUSTOM VISION SCENARIO!
- OBJECT DETECTION
- USE OBJECT DETECTION IN RETAIL
- TRAIN AN OBJECT DETECTOR
- TEST YOUR OBJECT DETECTOR
- RETRAIN YOUR OBJECT DETECTOR

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CHECK STOCK FROM AN IOT DEVICE

- STOCK COUNTING
- INVOKING OBJECT DETECTOR FROM IOT DEVICE
- BOUNDING BOXES
- RETRAIN THE MODEL
- COUNT STOCK

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RECOGNIZE SPEECH FROM AN IOT DEVICE

- MICROPHONES
- CAPTURE AUDIO FROM IOT DEVICE
- SPEECH TO TEXT
- CONVERT SPEECH TO TEXT
- SAMPLING AUDIO FOR DIGITAL VALUES

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UNDERSTAND LANGUAGE

- LANGUAGE UNDERSTANDING
- CREATE LANGUAGE UNDERSTANDING MODEL
- INTENTS & ENTITIES
- USE LANGUAGE UNDERSTANDING MODEL

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SET A TIMER PROVIDE SPOKEN FEEDBACK

- TEXT TO SPEECH
- SET THE TIMER
- CONVERT TEXT TO SPEECH

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SUPPORT MULTIPLE LANGUAGES WITH TRANSLATIONS

- TRANSLATE TEXT
- CREATE TRANSLATOR RESOURCE
- TRANSLATION SERVICES
- SUPPORT MULTIPLE LANGUAGES WITH TRANSLATIONS

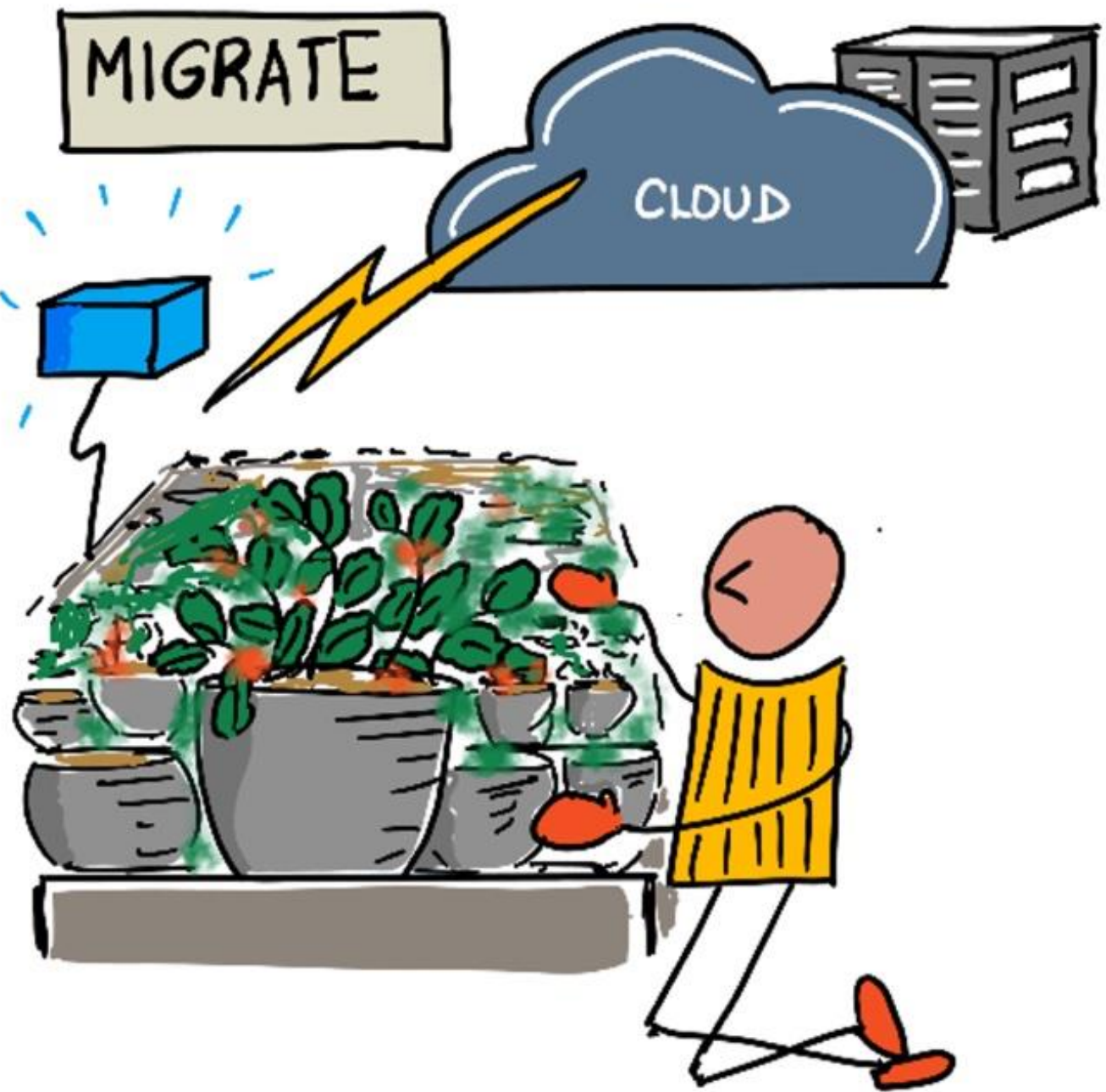
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CONGRATULATIONS

You made it!!
#IOT4Beginners



[AKA.MS/IOT-BEGINNERS-KITS](https://aka.ms/IOT-BEGINNERS-KITS)



YOUR PLANT TO THE CLOUD!

- ✓ WHAT IS THE CLOUD?
- ✓ CREATE SUBSCRIPTION
- ✓ CLOUD IOT SERVICES
- ✓ CREATE IOT SERVICE
- ✓ COMMUNICATE
- ✓ CONNECT DEVICE



**WHAT IS THE
CLOUD?**

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ON-PREMISE DATA CENTERS

- Before the cloud everything was in-house
- Companies did it all:
 - Buying and maintaining hardware
 - Power, cooling
 - Networking
 - Security
 - Software management

WHAT IS THE CLOUD?

- Someone else's computer! (well, someone else's data center)
- Economy of scale can reduce price
- Can just rent computers and manage yourself, or do more
- Platform as a Service (PaaS) and Software as a Service (SaaS) available

WHAT IS THE CLOUD?



WHAT IS THE CLOUD?



MICROSOFT AZURE

- The developer cloud from Microsoft





AZURE.MICROSOFT.COM/FREE

AZURE.MICROSOFT.COM/FREE/STUDENTS

CLOUD IOT SERVICES

- IoT services built around lightweight messaging protocols like MQTT
- Security, reliability, scaling and maintenance are all managed by the cloud provider
- Pay per month based on usage, usually with a free tier for dev work
- Can also get IoT SaaS platforms

CLOUD IOT SERVICES

- Devices connect with using an SDK, or directly over MQTT or HTTP
- The IoT Service then has connectivity to other parts of your application either using an SDK, or cloud-specific services



CLOUD IOT SERVICES

- IoT services provide enterprise level security
- Devices need a key or certificate to connect
- Services can monitor for rogue data or hackers



DEMO: CREATE AN IOT SERVICE

Create a Resource Group

Create an IoT Hub

IOT HUB COMMUNICATION

- Device to Cloud (D2C) – telemetry and other messages from the device
- Cloud to Device (C2D) – general messages to a device
- Direct Method Requests – instructions to a device to do something
- Device Twins – a shared configuration JSON document that is synchronized between device and cloud

DEMO: CONNECT YOUR DEVICE

Register device

Connect the device

Send telemetry

Monitor events

Send commands