Beyond THE Blinky LED: Voice recognition, Face recognition and cloud connectivity for IOT Edge devices

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@intel_stewart #IoTDevfest #intelmaker

Agenda

IoT Scenarios

Adventure Tracker Demo

How It's Made

- Sensor Data Collection Using Node.js*
- Cloud Analytics Using IBM* Bluemix
- Voice Recognition and Text to Speech with PocketSphinx and eSpeak using Python*
- Image Processing With OpenCV Using C++
- Video Capture With libav
- Media Storage Using Microsoft* Azure*
- Node.js Server on Intel® Edison Board
- App Development and Deployment Using Intel® XDK IoT Edition

Key Take Away

References

IoT Device Scenarios

- Collect sensor data and send it to the cloud for analytics
- Control connected devices remotely through cloud or local communication mechanisms

----

- Perform image processing on the device
- Text to speech and speech to text type of conversion at the device level

Reading Sensors using MRAA and UPM

libmraa aka “MRAA”: https://github.com/intel-iot-devkit/mraa

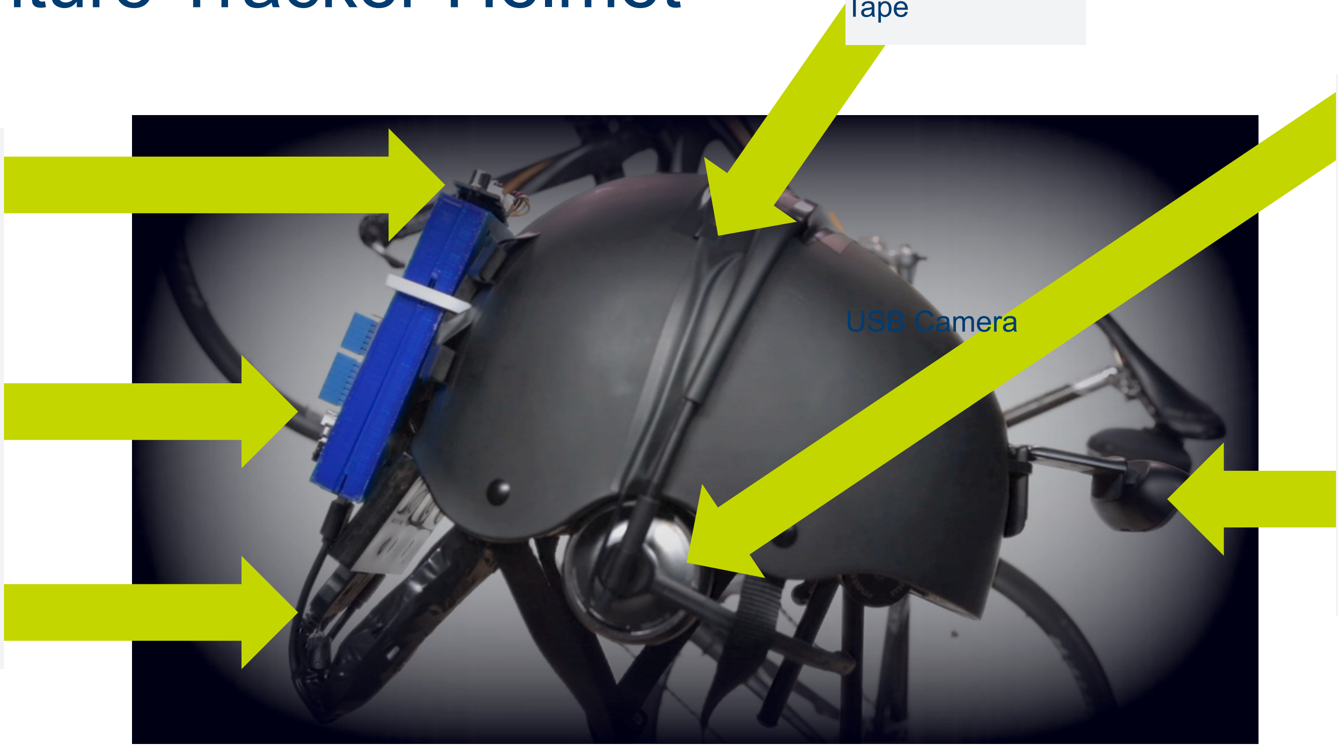
- Open Source IO Libs (UART, SPI, GPIO, I2C, AIO)
- Enables portability between devices
- Supports Intel® Galileo and Intel® Edison boards, MinnowBoard MAX, Beaglebone, Raspberry-Pi

UPM: https://github.com/intel-iot-devkit/upm

- High level library repository of sensor drivers
- Sensors/Actuators using libmraa
- Making it easy to control
- Expanding support to Industrial grade sensors

UPM and MRAA supported by Johnny-Five and Cylon.JS

Adventure Tracker Helmet



Air Quality
Temperature

Edison Board

USB Hub and
Battery

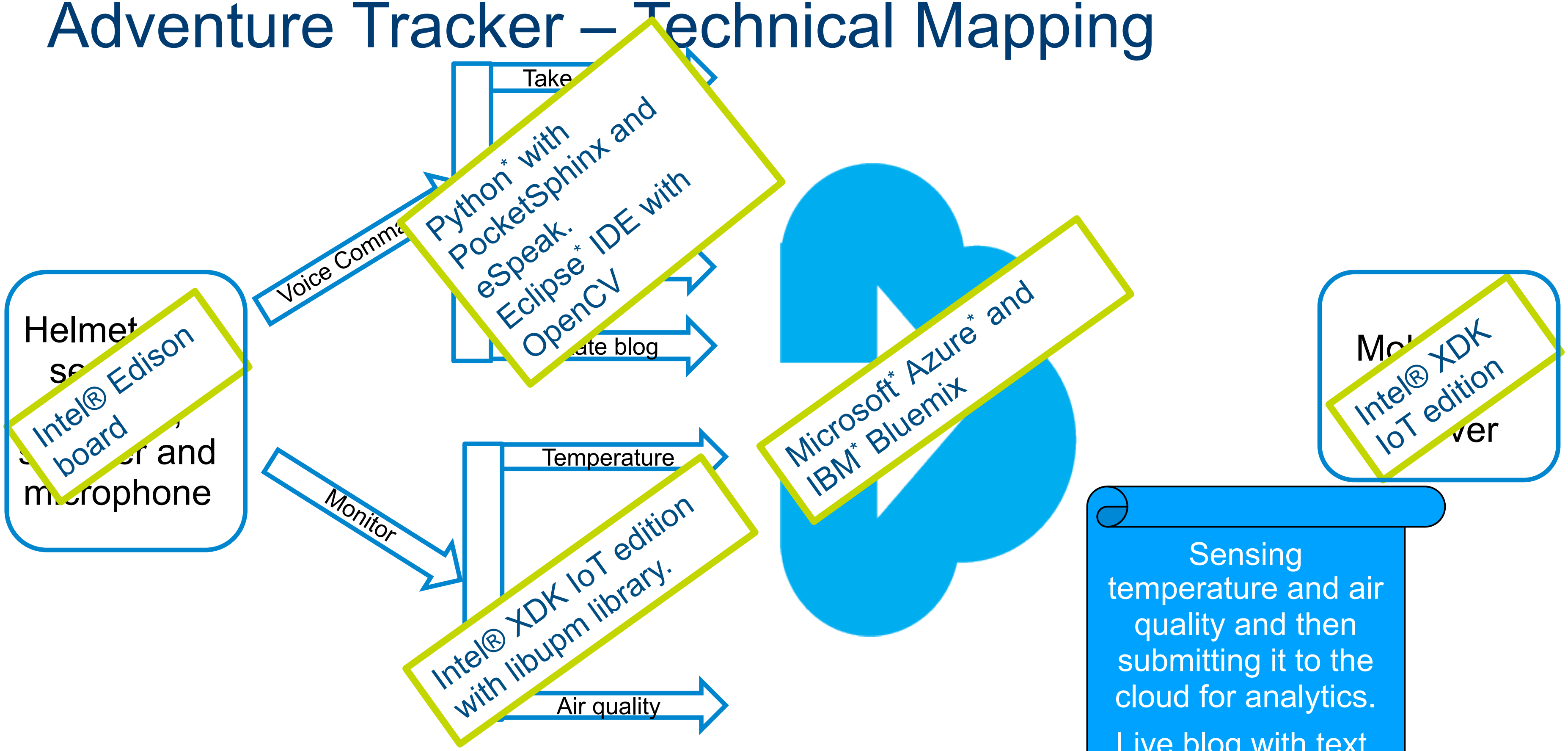
Black Electrical
Tape

USB Camera

USB Headset and
Microphone

USB Camera

Adventure Tracker – Technical Mapping



Helmet se... ...r and m...crophone

Intel® Edison board

Voice Comma...

Take...

...ate blog

Python* with PocketSphinx and eSpeak. Eclipse* IDE with OpenCV

Monitor

Temperature

Air quality

Intel® XDK IoT edition with libupm library.

Microsoft* Azure* and IBM* Bluemix

Mo... ...ver

Intel® XDK IoT edition

Sensing temperature and air quality and then submitting it to the cloud for analytics.

Live blog with text, pictures, videos.

How It’s Made, aka The Kitchen Sink

Hardware
Intel® Edison
UVC Webcam
Speaker
Microphone
Helmet

Sensors
Air quality sensor
Temperature sensor

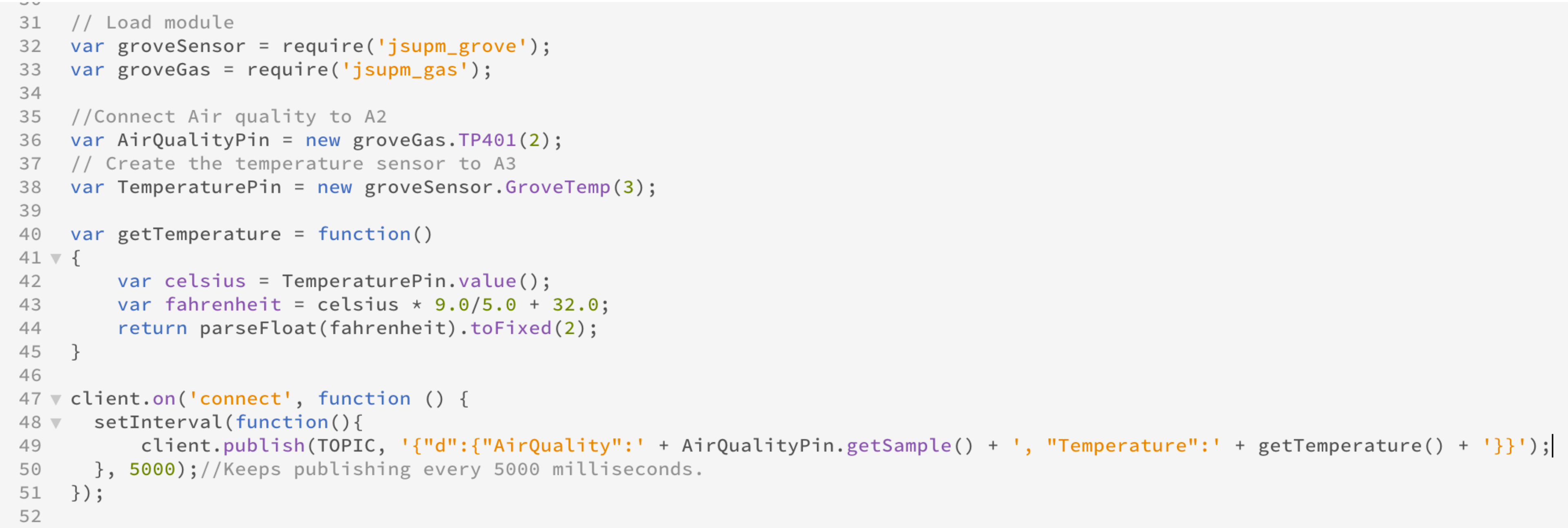
IDEs
Intel® XDK IoT Edison
Eclipse* IDE

Programming Languages
Node.js*
C/C++
Python*
HTML5 & JavaScript*

Cloud Providers
IBM* Bluemix
Microsoft* Azure* Cloud

Packages/Libraries
OpenCV
PocketSphinx
eSpeak
LibMRAA and UPM

Sensor Data Collection Using Node.js*



```
// Load module
var groveSensor = require('jsupm_grove');
var groveGas = require('jsupm_gas');

//Connect Air quality to A2
var AirQualityPin = new groveGas.TP401(2);
// Create the temperature sensor to A3
var TemperaturePin = new groveSensor.GroveTemp(3);

var getTemperature = function()
{
    var celsius = TemperaturePin.value();
    var fahrenheit = celsius * 9.0/5.0 + 32.0;
    return parseFloat(fahrenheit).toFixed(2);
}

client.on('connect', function () {
  setInterval(function(){
      client.publish(TOPIC, '{"d":{"AirQuality":' + AirQualityPin.getSample() + ', "Temperature":' + getTemperature() + '}}');
  }, 5000);//Keeps publishing every 5000 milliseconds.
});

```

Sensors and actuators templates are available on Github and software.intel.com/iot/sensors

The Intel® XDK comes with a complete set of starting templates and examples

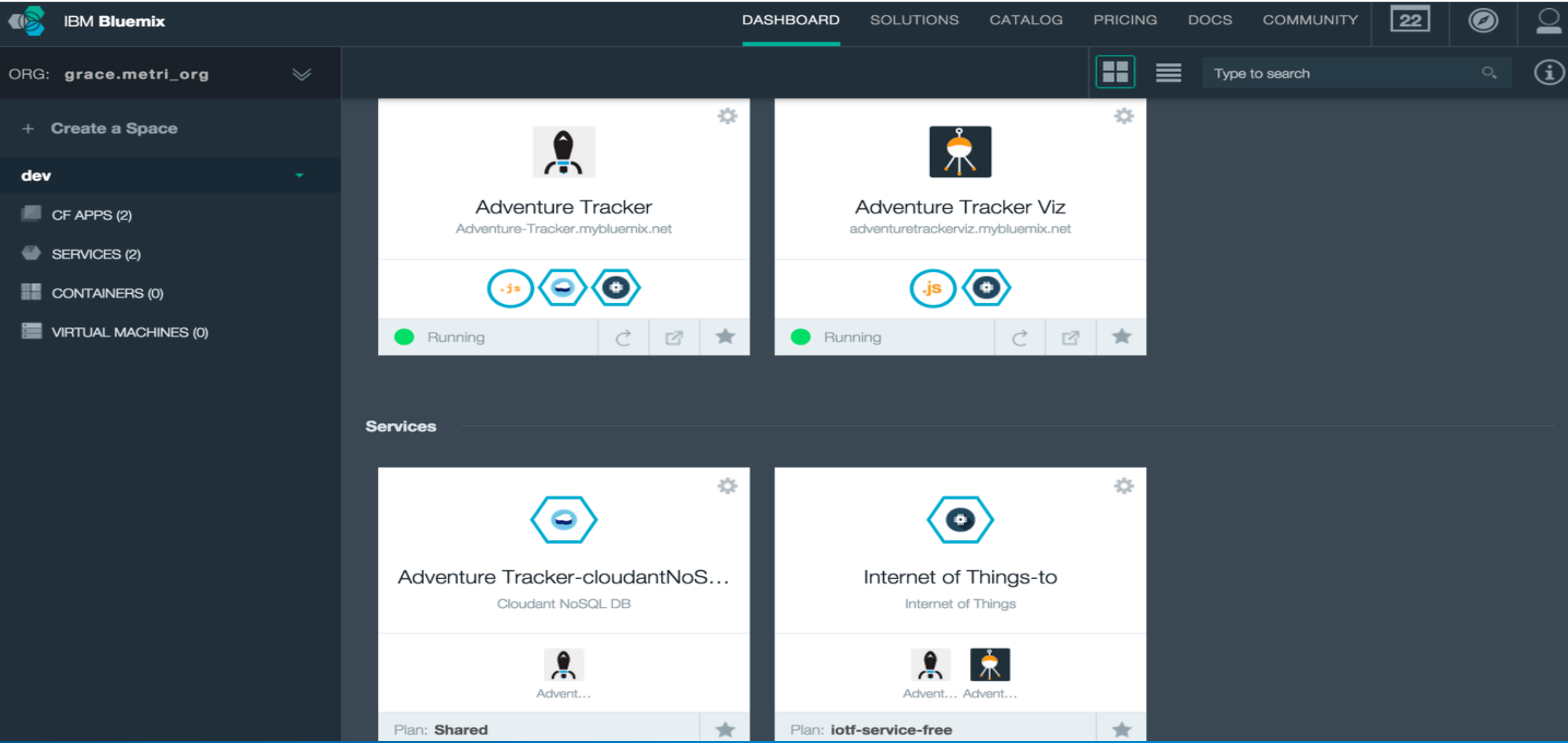
Cloud Analytics Using IBM* Bluemix

IBM* Bluemix enables users to create, deploy, and manage applications in the cloud

How to use IBM Bluemix with Intel® Edison board for cloud analytics

- Create two *SDK for NODE.JS** instances:
    1. **Adventure Tracker application:** Connects to the Edison board and receives/ stores data
    2. **Adventure Tracker Viz application:** Visualizes the collected data

Cloud Analytics Using IBM* Bluemix



IBM Bluemix

DASHBOARD SOLUTIONS CATALOG PRICING DOCS COMMUNITY 22

ORG: grace.metri_org

Type to search

+ Create a Space

dev

- CF APPS (2)
- SERVICES (2)
- CONTAINERS (0)
- VIRTUAL MACHINES (0)

Adventure Tracker
Adventure-Tracker.mybluemix.net
.js
Running

Adventure Tracker Viz
adventuretrackerviz.mybluemix.net
.js
Running

Services

Adventure Tracker-cloudantNoS...
Cloudant NoSQL DB
Advent...
Plan: Shared

Internet of Things-to
Internet of Things
Advent... Advent...
Plan: iotf-service-free

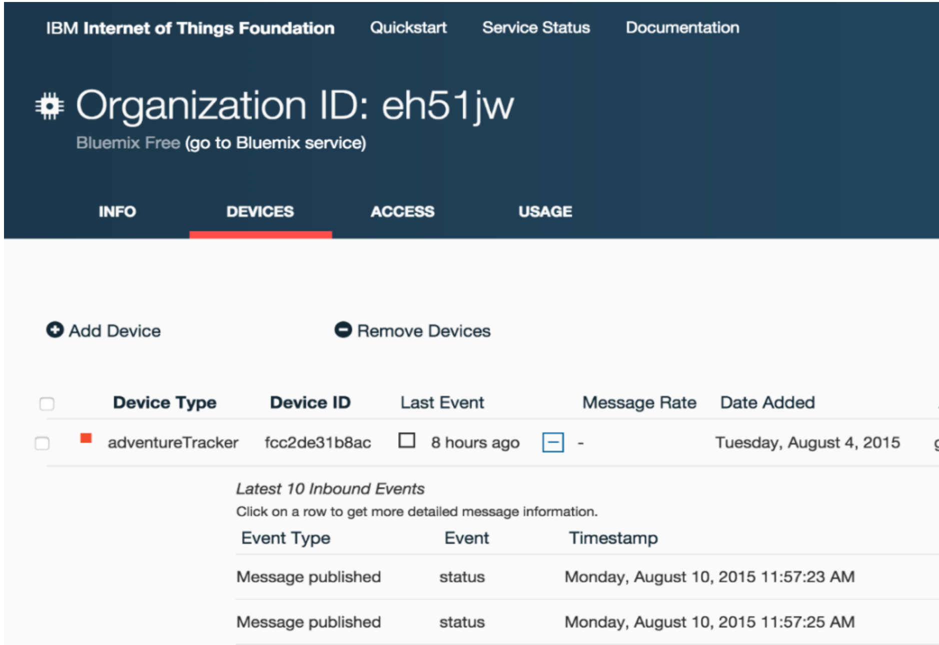
Cloud Analytics Using IBM* Bluemix

How to create *Adventure Tracker* App

Create *SDK For NODE.JS**

Add *Internet of Things service*

- Using the dashboard, add the Intel® Edison board as a device
- Note down the following information in order to establish connection between the Intel Edison board using Node.js and IBM* Bluemix
  - Organization
  - Type
  - ID
  - Authentication token
- Add Cloudant NoSQL DB



Organization ID: eh51jw

Bluemix Free (go to Bluemix service)

☐	Device Type	Device ID	Last Event	Message Rate	Date Added
☐	adventureTracker	fcc2de31b8ac	☐ 8 hours ago	⊟ -	Tuesday, August 4, 2015

Latest 10 Inbound Events

Click on a row to get more detailed message information.

Event Type	Event	Timestamp
Message published	status	Monday, August 10, 2015 11:57:23 AM
Message published	status	Monday, August 10, 2015 11:57:25 AM

Cloud Analytics Using IBM* Bluemix

How to create *Adventure Tracker Viz* App

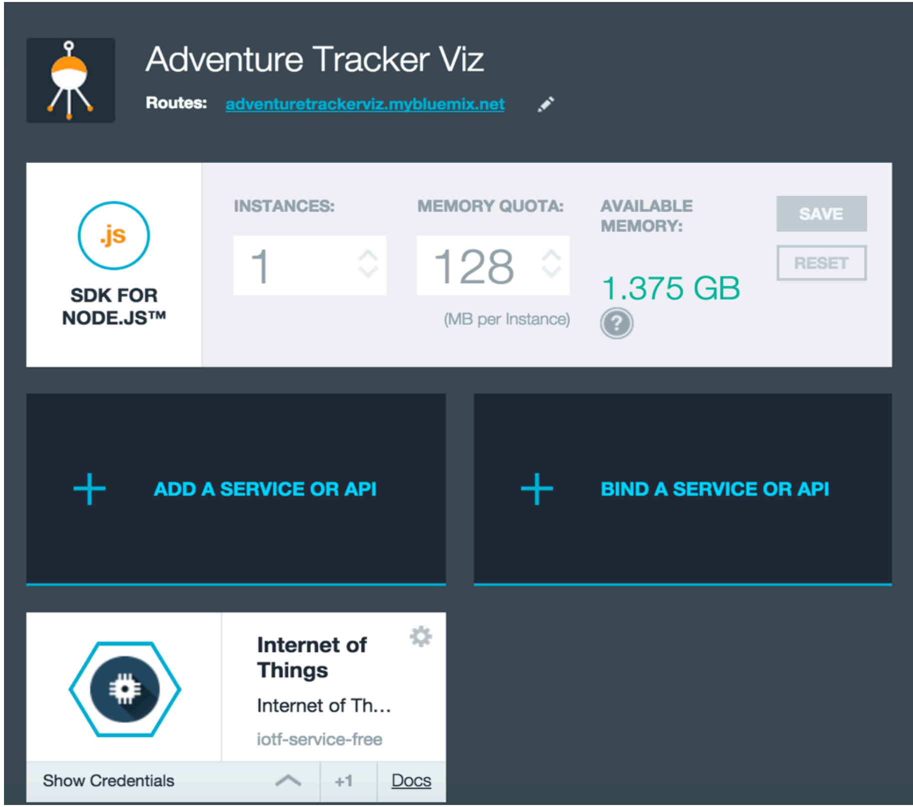
Create *SDK for NODE.JS**

Bind the previously create *Internet of Things service*

Download and install the *cf command-line* from the Bluemix website

IBM provides a stand-alone sample web app that is written on the node.js framework to visualize the events received from registered devices

- Customize it and then upload it to the app using *cf*



Adventure Tracker Viz

Routes: adventuretrackerviz.mybluemix.net

SDK FOR NODE.JS™

INSTANCES: 1

MEMORY QUOTA: 128 (MB per Instance)

AVAILABLE MEMORY: 1.375 GB

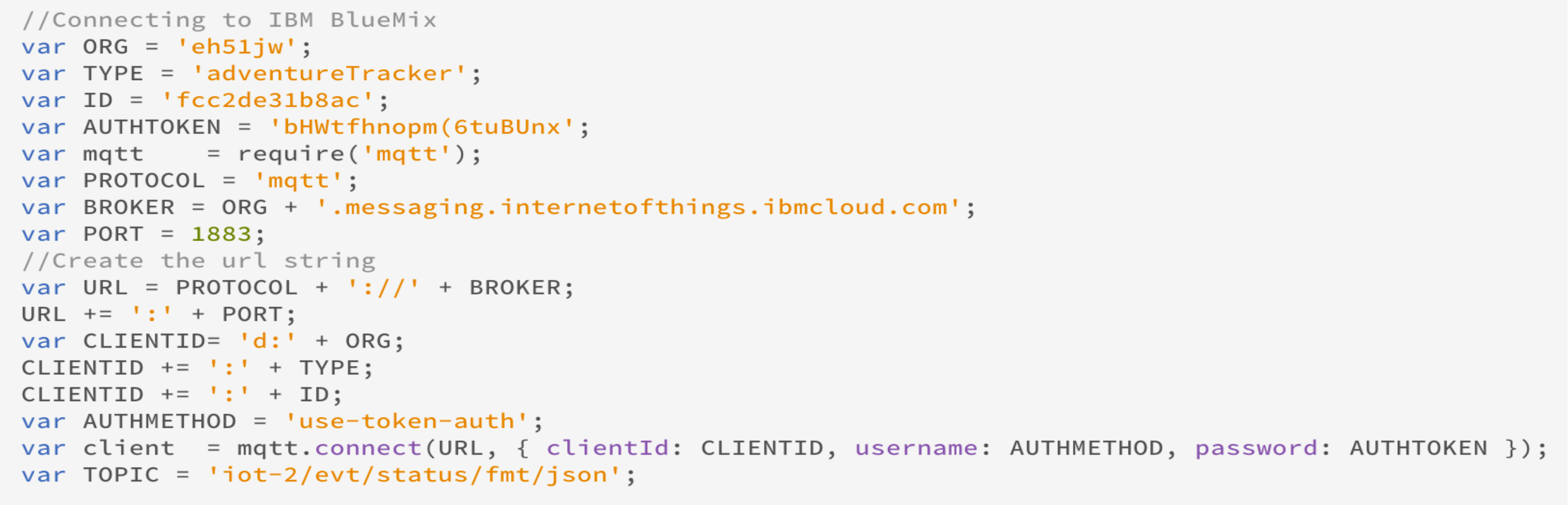
Internet of Things

Internet of Th...

iotf-service-free

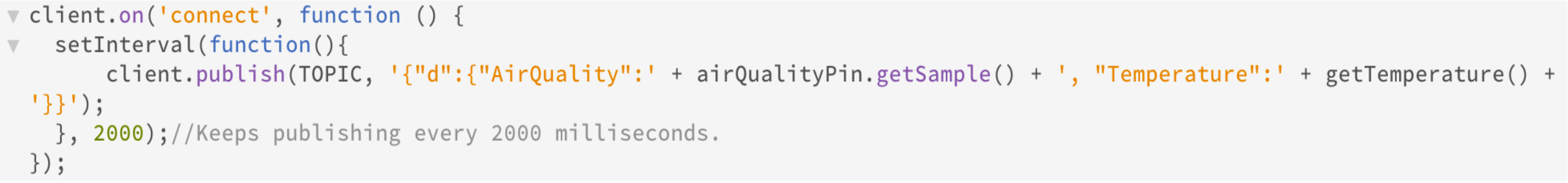
Cloud Analytics Using IBM* Bluemix

How to establish connection using Node.js*



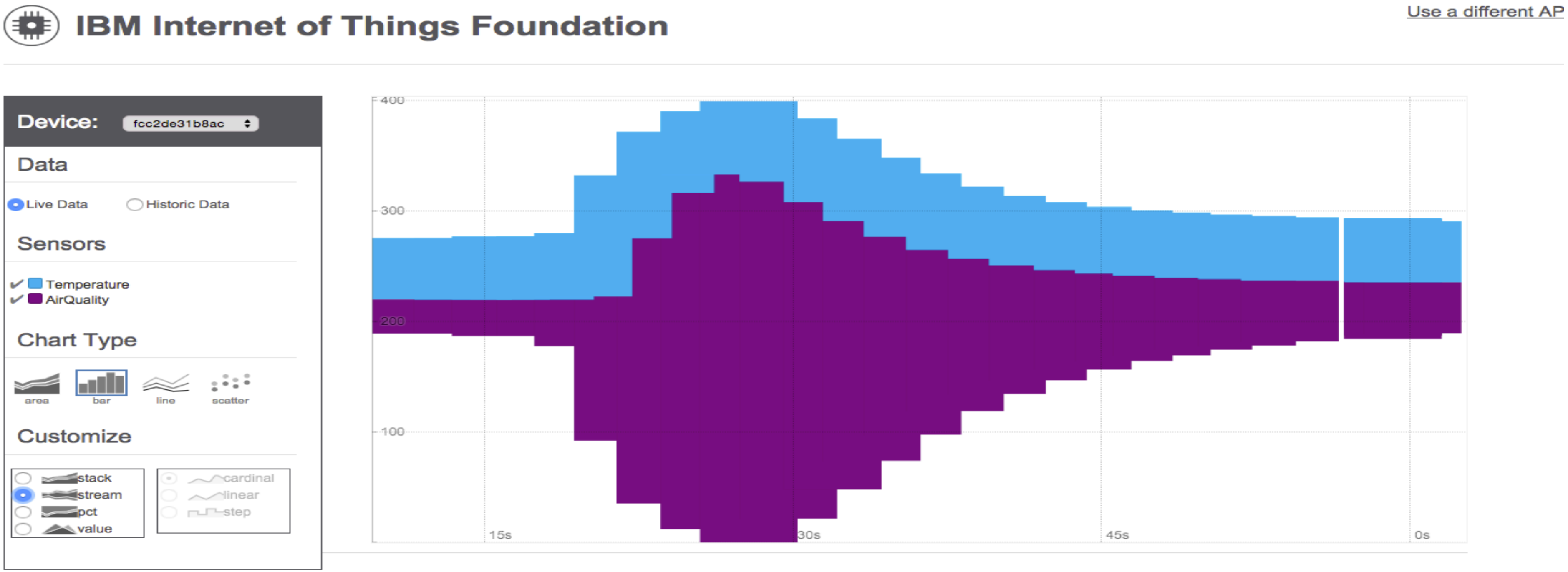
```
//Connecting to IBM BlueMix
var ORG = 'eh51jw';
var TYPE = 'adventureTracker';
var ID = 'fcc2de31b8ac';
var AUTHTOKEN = 'bHWtfhnopm(6tuBUnx';
var mqtt     = require('mqtt');
var PROTOCOL = 'mqtt';
var BROKER = ORG + '.messaging.internetofthings.ibmcloud.com';
var PORT = 1883;
//Create the url string
var URL = PROTOCOL + '://' + BROKER;
URL += ':' + PORT;
var CLIENTID= 'd:' + ORG;
CLIENTID += ':' + TYPE;
CLIENTID += ':' + ID;
var AUTHMETHOD = 'use-token-auth';
var client  = mqtt.connect(URL, { clientId: CLIENTID, username: AUTHMETHOD, password: AUTHTOKEN });
var TOPIC = 'iot-2/evt/status/fmt/json';
```

How to publish sensor data to the cloud



```
client.on('connect', function () {
  setInterval(function(){
      client.publish(TOPIC, '{"d":{"AirQuality":' + airQualityPin.getSample() + ', "Temperature":' + getTemperature() +
'}}');
  }, 2000);//Keeps publishing every 2000 milliseconds.
});
```

Cloud Analytics Using IBM* Bluemix



IBM Internet of Things Foundation

Use a different AP

Device: fcc2de31b8ac

Data

● Live Data ○ Historic Data

Sensors

✓ 🟦 Temperature
✓ 🟪 AirQuality

Chart Type

area [✓ bar] line scatter

Customize

○ stack
● stream
○ pct
○ value

○ cardinal
○ linear
○ step

Voice Recognition and Text to Speech With PocketSphinx and eSpeak Using Python*

Voice Recognition using PocketSphinx

- **PocketSphinx** is a lightweight version of CMU’s Sphinx for performing natural language processing offline
  - ALSA is used to record audio
- **eSpeak** is an open source software speech synthesizer for English and other languages

Edison doesn’t come with these libraries by default, and new repo is needed to get these files.

- To configure the repository, add the following lines to **/etc/opkg/base-feeds.conf:**

```
src/gz all http://repo.opkg.net/edison/repo/all
src/gz edison http://repo.opkg.net/edison/repo/edison
src/gz core2-32 http://repo.opkg.net/edison/repo/core2-32
```

Voice Recognition and Text to Speech With PocketSphinx and eSpeak Using Python*

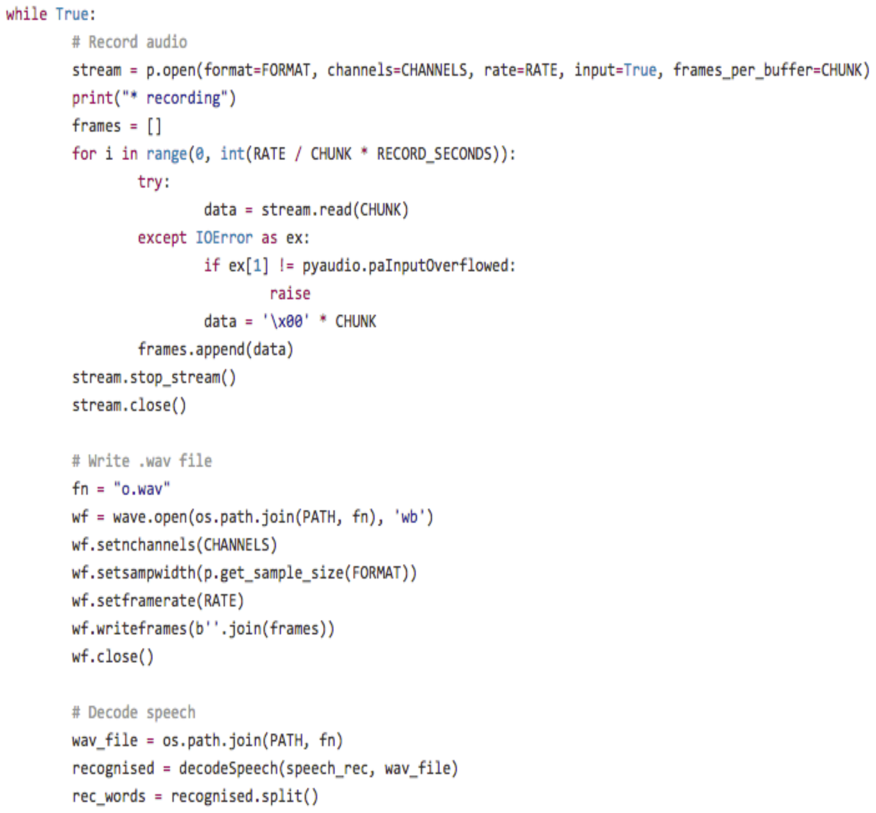
How to enable Intel® Edison board to use PocketSphinx

- Install Advanced Linux* Sound Architecture (ALSA) packages and dependencies
  - `aplay -Ll` (Check that ALSA is able to see the headset)
  - `cat /proc/asound/cards` to find the USB audio device
  - Create a `~/.asoundrc` file and add the line to configure the headset
- Use the Sphinx Knowledge Base tool to generate a new language model (.lm) and dictionary (.dic)

How to enable Intel® Edison board to use eSpeak

- Install espeak package
  - $opkg install espeak

Voice Recognition and Text to Speech With PocketSphinx and eSpeak Using Python*



```
while True:
    # Record audio
    stream = p.open(format=FORMAT, channels=CHANNELS, rate=RATE, input=True, frames_per_buffer=CHUNK)
    print("* recording")
    frames = []
    for i in range(0, int(RATE / CHUNK * RECORD_SECONDS)):
        try:
            data = stream.read(CHUNK)
        except IOError as ex:
            if ex[1] != pyaudio.paInputOverflowed:
                raise
            data = '\x00' * CHUNK
        frames.append(data)
    stream.stop_stream()
    stream.close()

    # Write .wav file
    fn = "o.wav"
    wf = wave.open(os.path.join(PATH, fn), 'wb')
    wf.setnchannels(CHANNELS)
    wf.setsampwidth(p.get_sample_size(FORMAT))
    wf.setframerate(RATE)
    wf.writeframes(b''.join(frames))
    wf.close()

    # Decode speech
    wav_file = os.path.join(PATH, fn)
    recognised = decodeSpeech(speech_rec, wav_file)
    rec_words = recognised.split()
```

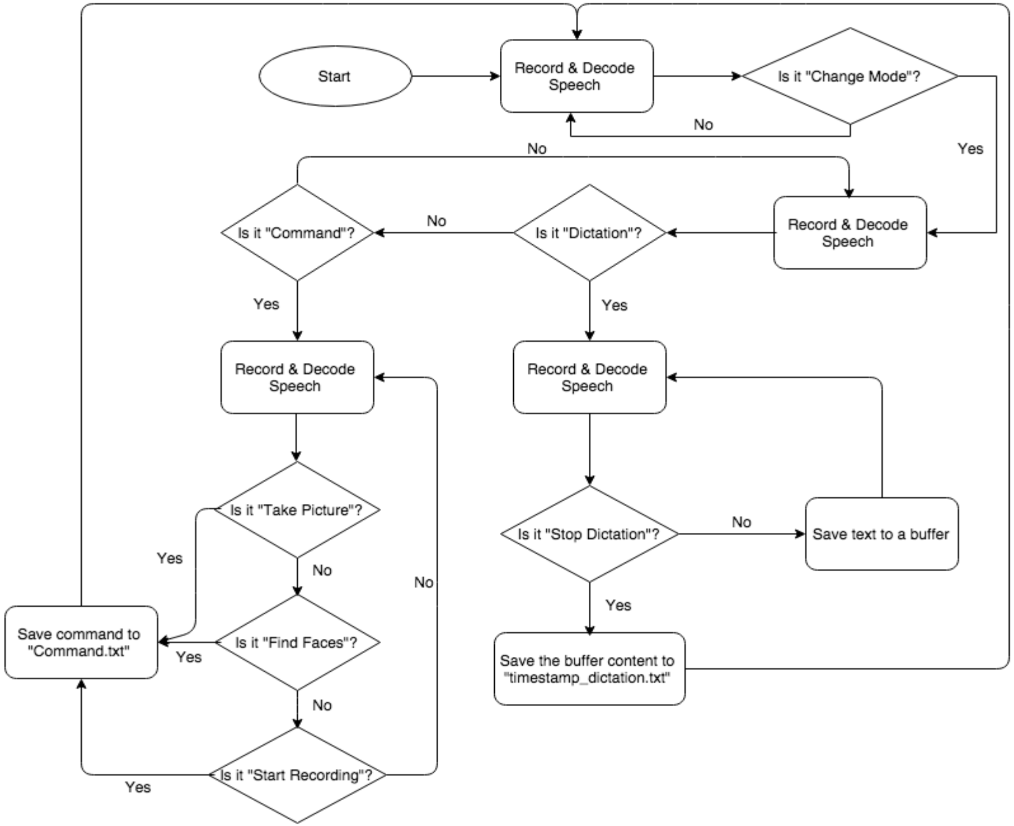


Image Processing with OpenCV using C++

OpenCV is an open source computer vision and machine learning software library

How to install OpenCV package on Intel® Edison Board

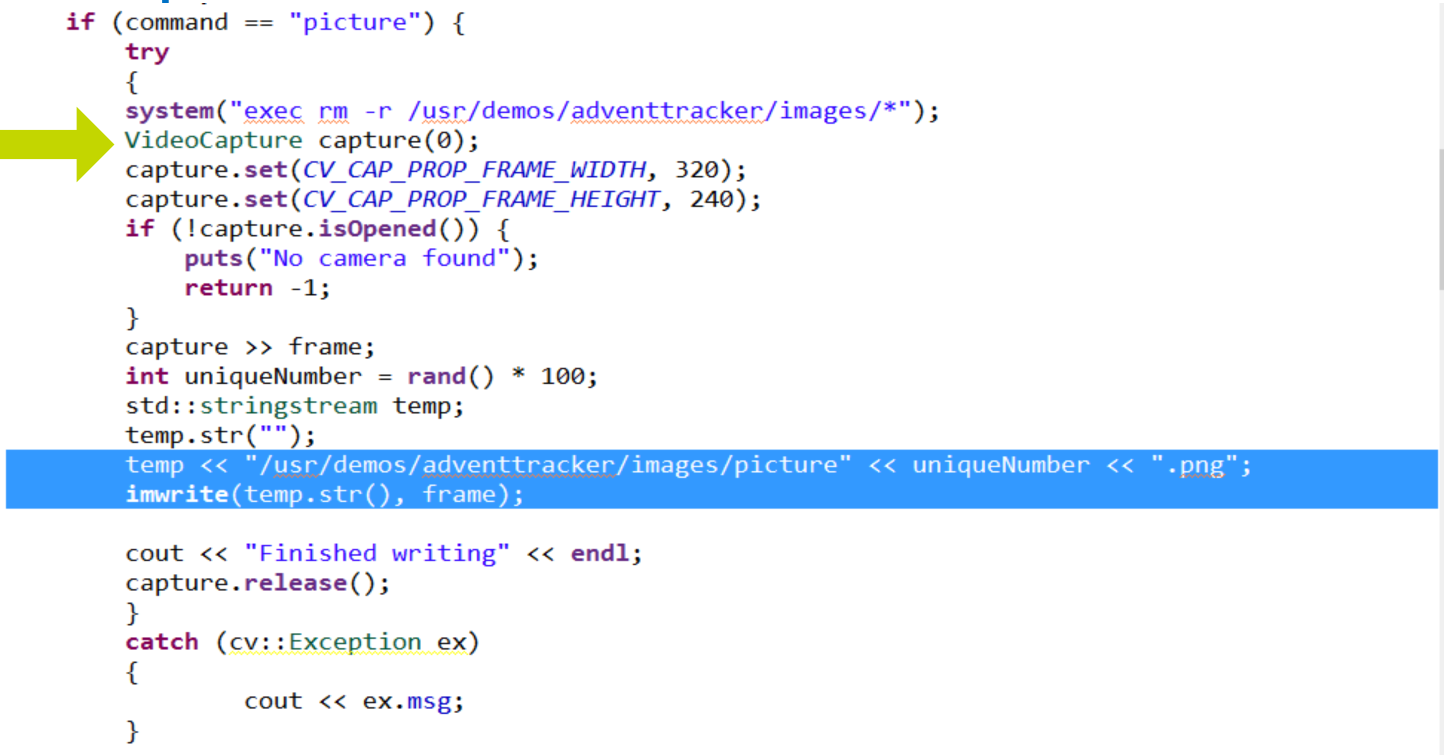
- Add OpenCV package repository location to **/etc/opkg/base-feeds.conf**

```
$opkg update

$opkg install python-opencv
```

Image Processing With OpenCV Using C++

How to take pictures

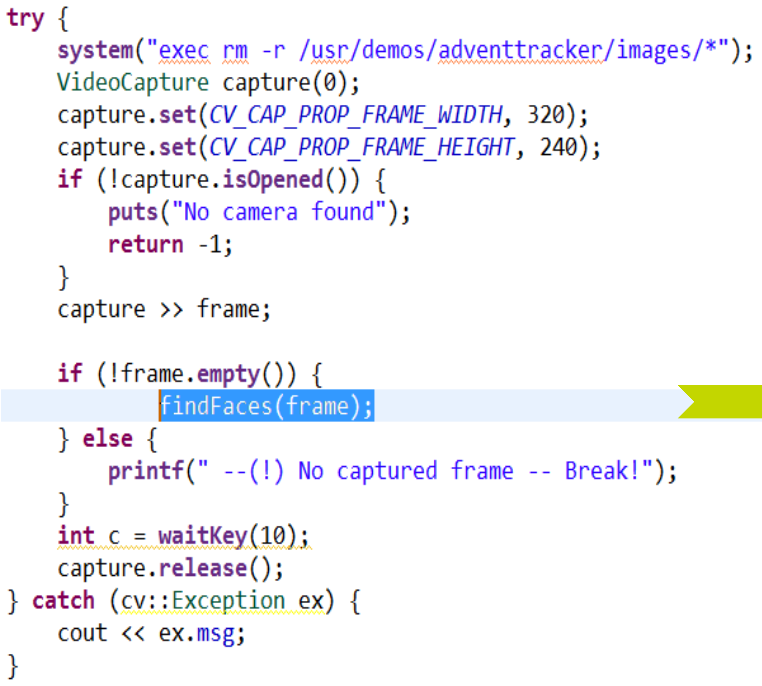


```
if (command == "picture") {
    try
    {
    system("exec rm -r /usr/demos/adventtracker/images/*");
    VideoCapture capture(0);
    capture.set(CV_CAP_PROP_FRAME_WIDTH, 320);
    capture.set(CV_CAP_PROP_FRAME_HEIGHT, 240);
    if (!capture.isOpened()) {
        puts("No camera found");
        return -1;
    }
    capture >> frame;
    int uniqueNumber = rand() * 100;
    std::stringstream temp;
    temp.str("");
    temp << "/usr/demos/adventtracker/images/picture" << uniqueNumber << ".png";
    imwrite(temp.str(), frame);

    cout << "Finished writing" << endl;
    capture.release();
    }
    catch (cv::Exception ex)
    {
            cout << ex.msg;
    }
```

Image Processing With OpenCV Using C++

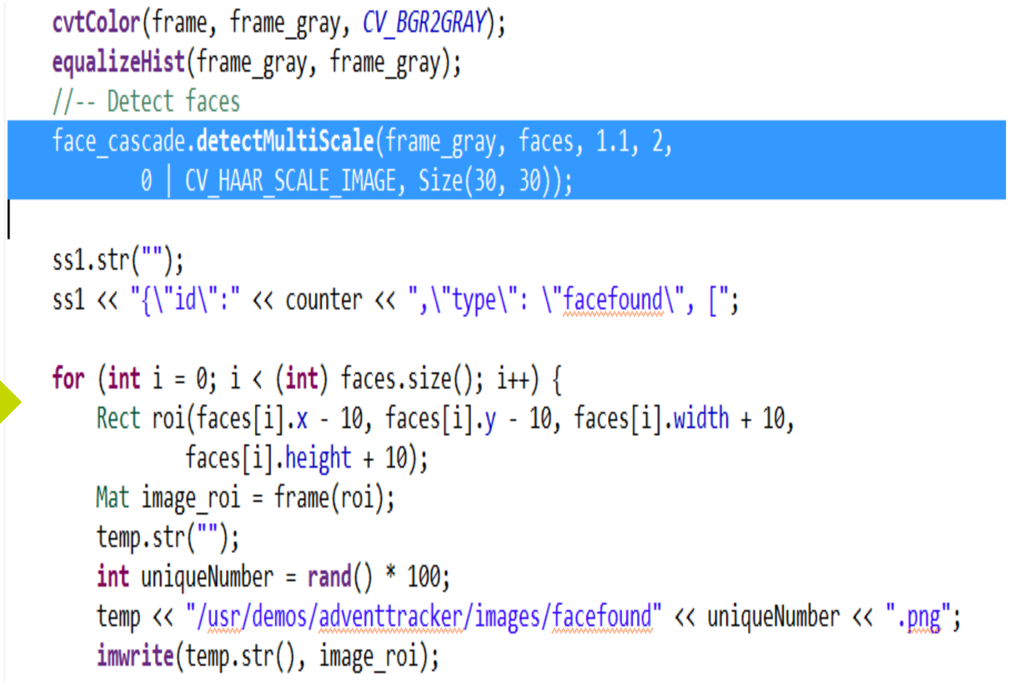
How to find faces



```
try {
    system("exec rm -r /usr/demos/adventtracker/images/*");
    VideoCapture capture(0);
    capture.set(CV_CAP_PROP_FRAME_WIDTH, 320);
    capture.set(CV_CAP_PROP_FRAME_HEIGHT, 240);
    if (!capture.isOpened()) {
        puts("No camera found");
        return -1;
    }
    capture >> frame;

    if (!frame.empty()) {
        findFaces(frame);
    } else {
        printf(" --(!) No captured frame -- Break!");
    }
    int c = waitKey(10);
    capture.release();
} catch (cv::Exception ex) {
    cout << ex.msg;
}
```

findFaces(frame)



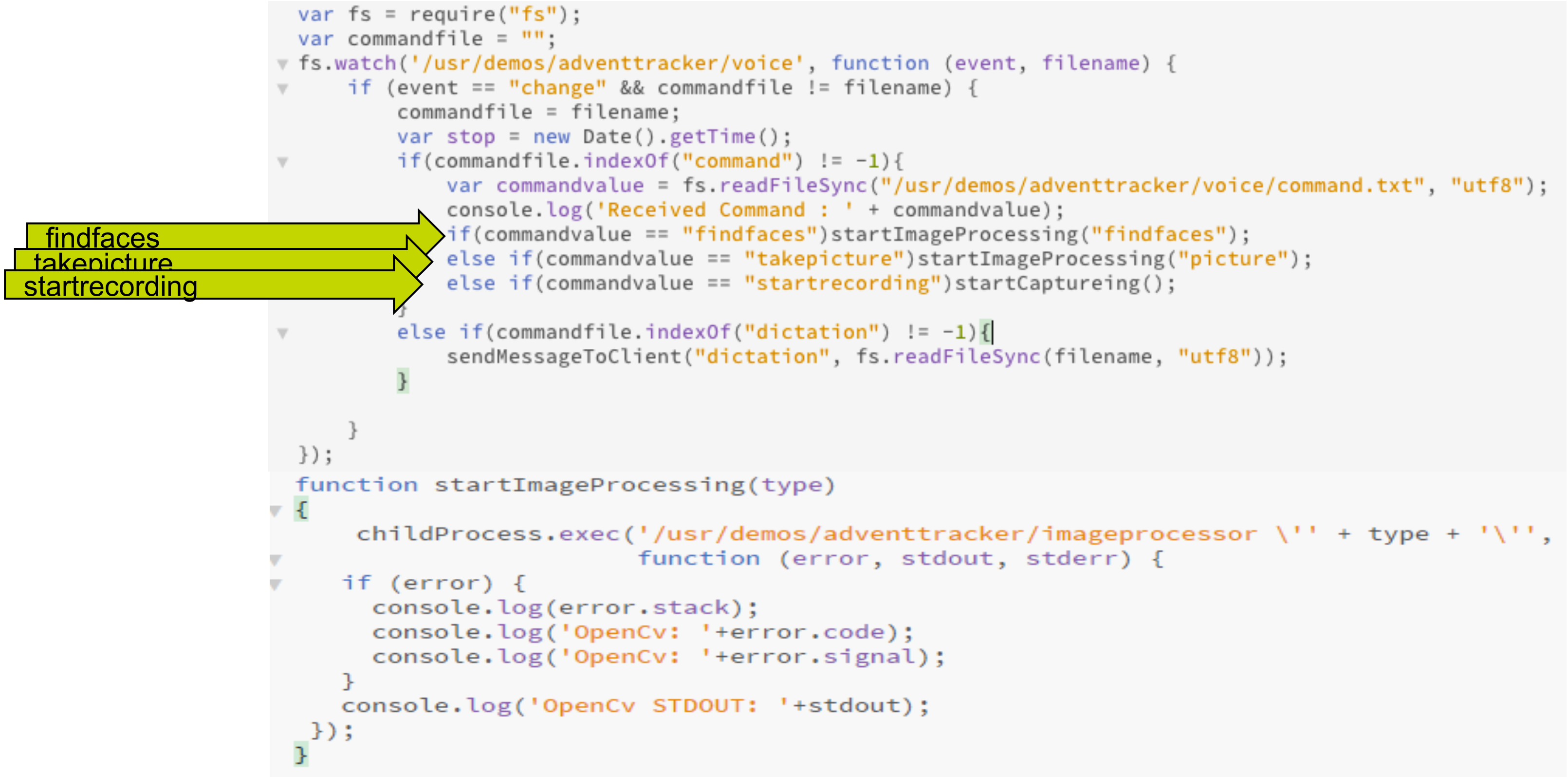
```
cvtColor(frame, frame_gray, CV_BGR2GRAY);
equalizeHist(frame_gray, frame_gray);
//-- Detect faces
face_cascade.detectMultiScale(frame_gray, faces, 1.1, 2,
        0 | CV_HAAR_SCALE_IMAGE, Size(30, 30));

ss1.str("");
ss1 << "{\"id\":" << counter << ",\"type\": \"facefound\", [";

for (int i = 0; i < (int) faces.size(); i++) {
    Rect roi(faces[i].x - 10, faces[i].y - 10, faces[i].width + 10,
            faces[i].height + 10);
    Mat image_roi = frame(roi);
    temp.str("");
    int uniqueNumber = rand() * 100;
    temp << "/usr/demos/adventtracker/images/facefound" << uniqueNumber << ".png";
    imwrite(temp.str(), image_roi);
```

Image Processing With OpenCV Using C++

How to execute from Node.js*



```
var fs = require("fs");
var commandfile = "";
fs.watch('/usr/demos/adventtracker/voice', function (event, filename) {
    if (event == "change" && commandfile != filename) {
        commandfile = filename;
        var stop = new Date().getTime();
        if(commandfile.indexOf("command") != -1){
            var commandvalue = fs.readFileSync("/usr/demos/adventtracker/voice/command.txt", "utf8");
            console.log('Received Command : ' + commandvalue);
            if(commandvalue == "findfaces")startImageProcessing("findfaces");
            else if(commandvalue == "takepicture")startImageProcessing("picture");
            else if(commandvalue == "startrecording")startCaptureing();
        }
        else if(commandfile.indexOf("dictation") != -1){
            sendMessageToClient("dictation", fs.readFileSync(filename, "utf8"));
        }

    }
});
```

```
function startImageProcessing(type)
{
    childProcess.exec('/usr/demos/adventtracker/imageprocessor \'' + type + '\'',
                      function (error, stdout, stderr) {
   if (error) {
     console.log(error.stack);
     console.log('OpenCv: '+error.code);
     console.log('OpenCv: '+error.signal);
   }
   console.log('OpenCv STDOUT: '+stdout);
 });
}
```

Video Capture With libav

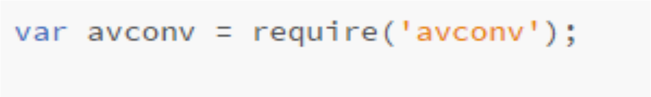
Libav provides cross-platform tools and libraries to convert, manipulate and stream a wide range of multimedia formats and protocols

Install libav using

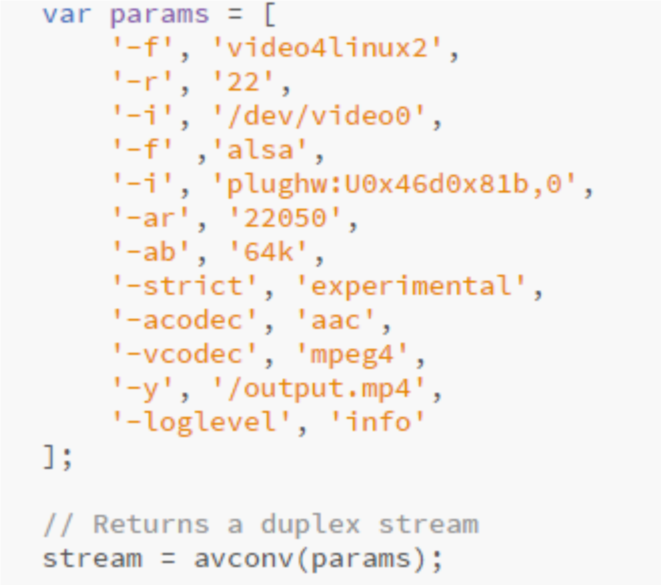
- opkg install libav

Install “avconv” npm module

Use avconv in Node.js* program to create and convert mp4 videos



```
var avconv = require('avconv');
```

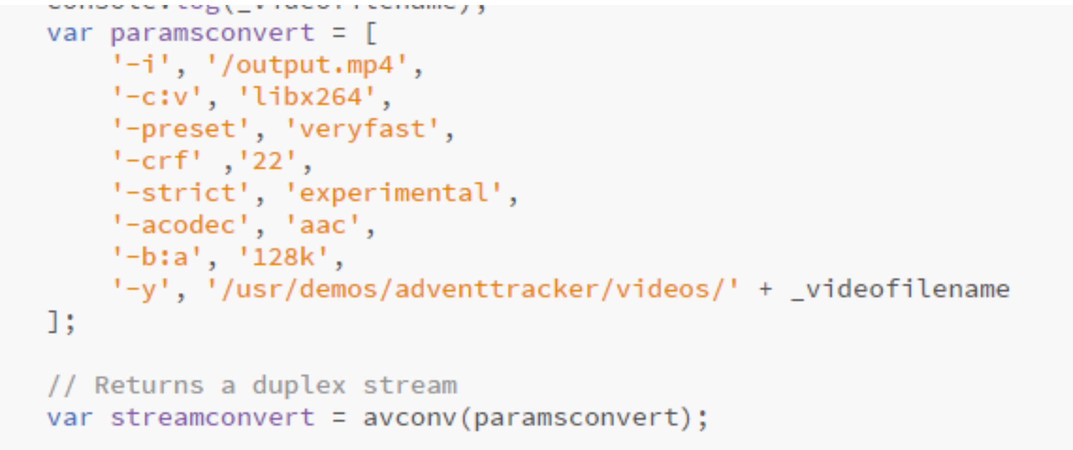


```
  var params = [
      '-f', 'video4linux2',
      '-r', '22',
      '-i', '/dev/video0',
      '-f' ,'alsa',
      '-i', 'plughw:U0x46d0x81b,0',
      '-ar', '22050',
      '-ab', '64k',
      '-strict', 'experimental',
      '-acodec', 'aac',
      '-vcodec', 'mpeg4',
      '-y', '/output.mp4',
      '-loglevel', 'info'
  ];

  // Returns a duplex stream
  stream = avconv(params);
```

Video Capture With libav

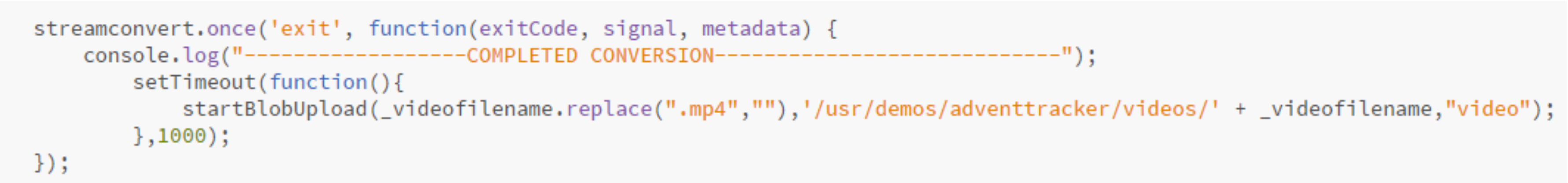
Convert this mp4 to HTML5 compatible H.264 format



```
console.log(_videofilename);
var paramsconvert = [
    '-i', '/output.mp4',
    '-c:v', 'libx264',
    '-preset', 'veryfast',
    '-crf' ,'22',
    '-strict', 'experimental',
    '-acodec', 'aac',
    '-b:a', '128k',
    '-y', '/usr/demos/adventtracker/videos/' + _videofilename
];

// Returns a duplex stream
var streamconvert = avconv(paramsconvert);
```

Once converted to H.264 format, upload this video file to Azure*



```
streamconvert.once('exit', function(exitCode, signal, metadata) {
    console.log("-----------------COMPLETED CONVERSION---------------------------");
        setTimeout(function(){
            startBlobUpload(_videofilename.replace(".mp4",""),'/usr/demos/adventtracker/videos/' + _videofilename,"video");
        },1000);
});
```

Media Storage Using Microsoft* Azure*

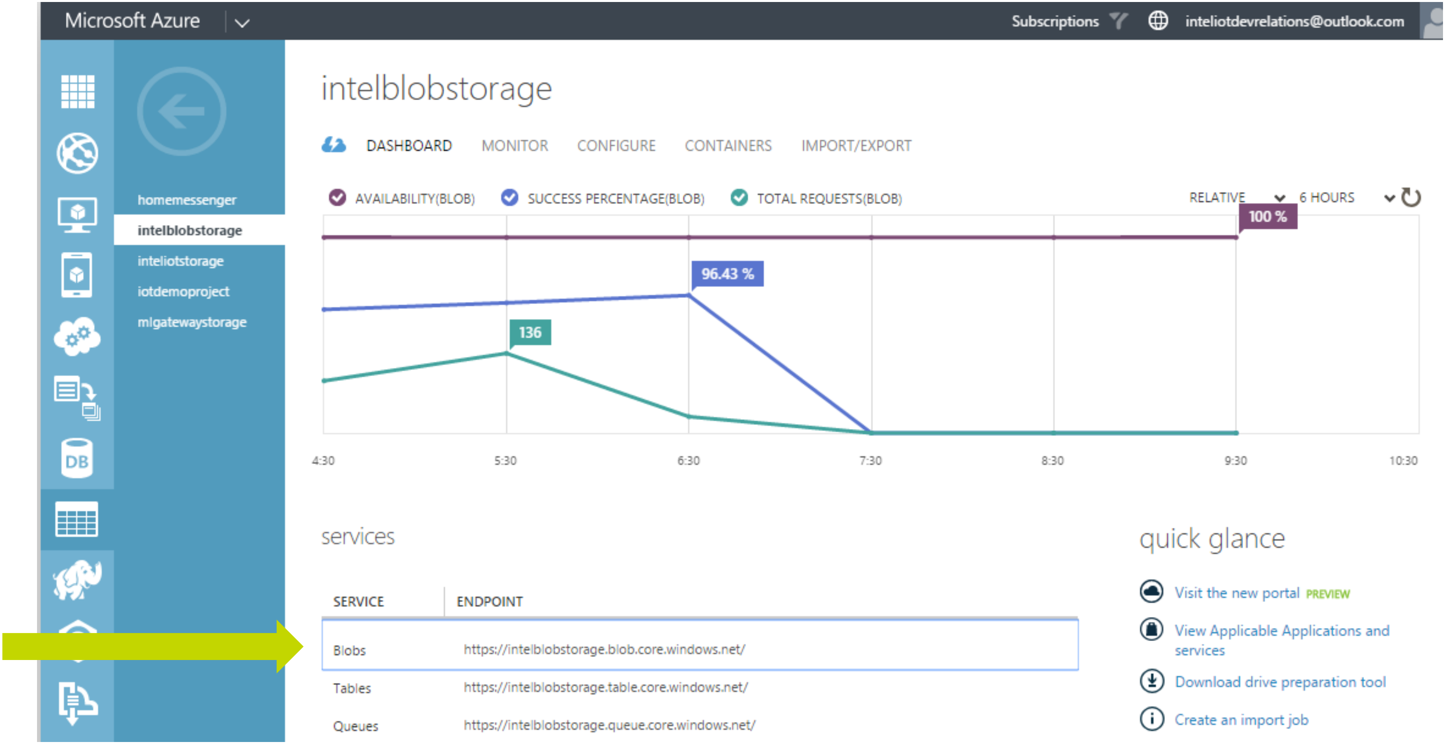
How to use Azure* Cloud with Intel® Edison board

- Create blob storage container
- Find the access keys
- Find the http end point
- Upload blob data to this http end point

Media Storage Using Microsoft* Azure*

Create your

blob storage



Microsoft Azure

Subscriptions

inteliotdevrelations@outlook.com

- homemessenger
- intelblobstorage
- inteliotstorage
- iotdemoproject
- mlgatewaystorage

intelblobstorage

DASHBOARD MONITOR CONFIGURE CONTAINERS IMPORT/EXPORT

services

SERVICE	ENDPOINT
Blobs	https://intelblobstorage.blob.core.windows.net/
Tables	https://intelblobstorage.table.core.windows.net/
Queues	https://intelblobstorage.queue.core.windows.net/

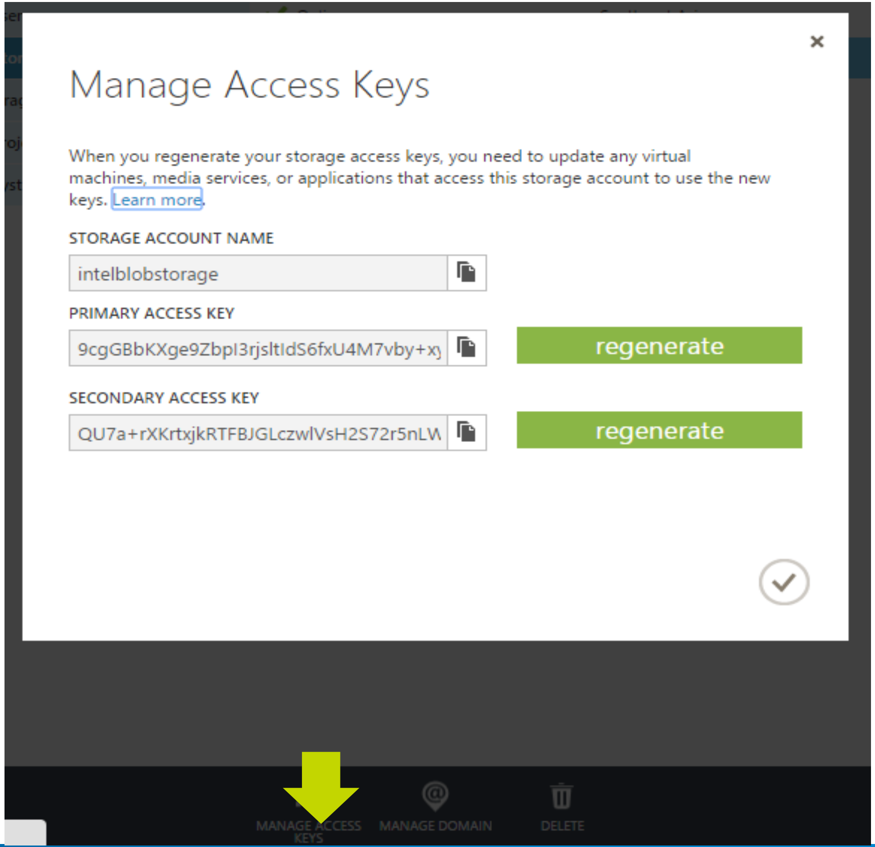
quick glance

- Visit the new portal PREVIEW
- View Applicable Applications and services
- Download drive preparation tool
- Create an import job

This is not the endpoint you are looking for.

Media Storage Using Microsoft* Azure*

Find your keys



Manage Access Keys

When you regenerate your storage access keys, you need to update any virtual machines, media services, or applications that access this storage account to use the new keys. Learn more.

STORAGE ACCOUNT NAME

intelblobstorage

PRIMARY ACCESS KEY

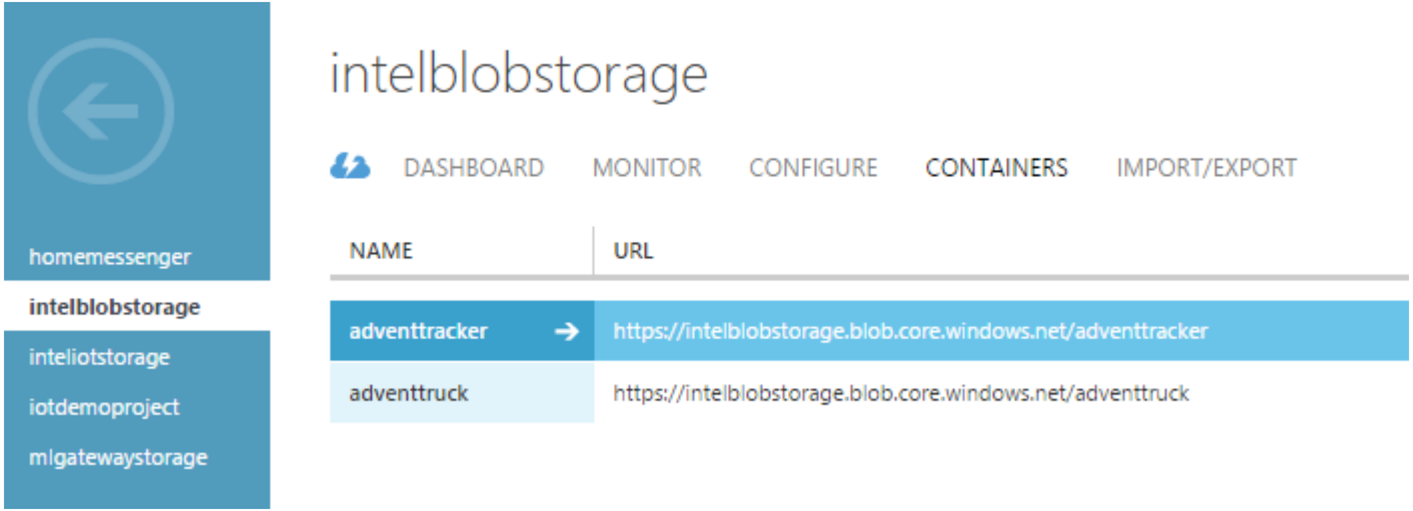
9cgGBbKXge9ZbpI3rjsltIdS6fxU4M7vby+xy

SECONDARY ACCESS KEY

QU7a+rXKrtxjkRTFBJGLczwlVsH2S72r5nLW

Media Storage Using Microsoft* Azure*

Note down your http end point

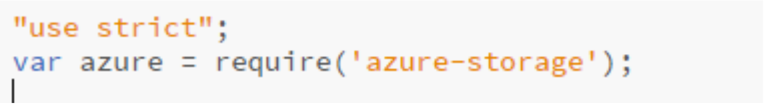


NAME	URL
adventtracker →	https://intelblobstorage.blob.core.windows.net/adventtracker
adventtruck	https://intelblobstorage.blob.core.windows.net/adventtruck

Media Storage Using Microsoft* Azure*

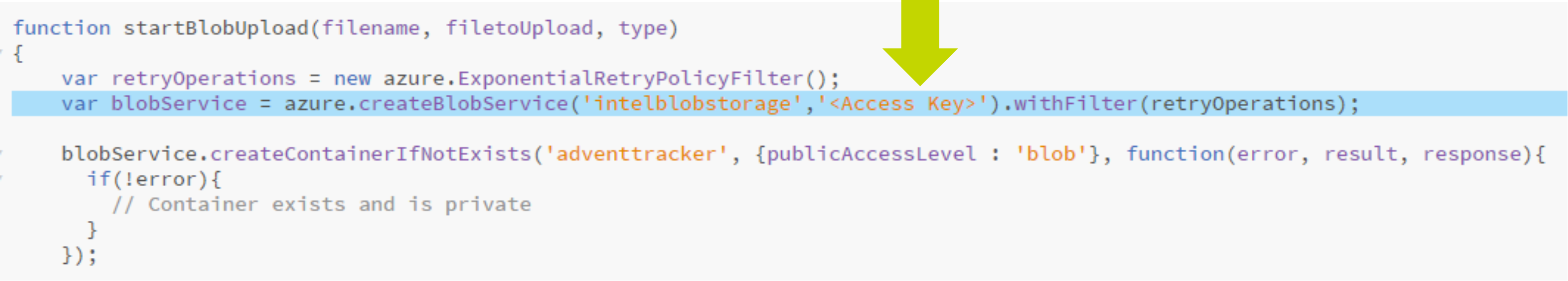
How to enable the Intel® Edison board to use Microsoft* Azure*

npm install azure-storage



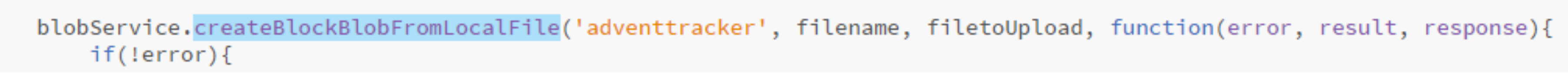
```
"use strict";
var azure = require('azure-storage');
```

Replace this with your key



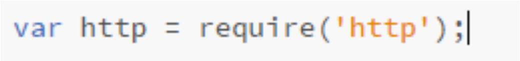
```
function startBlobUpload(filename, filetoUpload, type)
{
    var retryOperations = new azure.ExponentialRetryPolicyFilter();
    var blobService = azure.createBlobService('intelblobstorage','<Access Key>').withFilter(retryOperations);

    blobService.createContainerIfNotExists('adventtracker', {publicAccessLevel : 'blob'}, function(error, result, response){
      if(!error){
        // Container exists and is private
      }
    });
```

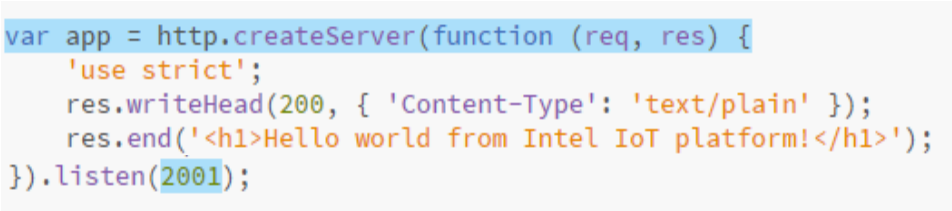


```
blobService.createBlockBlobFromLocalFile('adventtracker', filename, filetoUpload, function(error, result, response){
    if(!error){
```

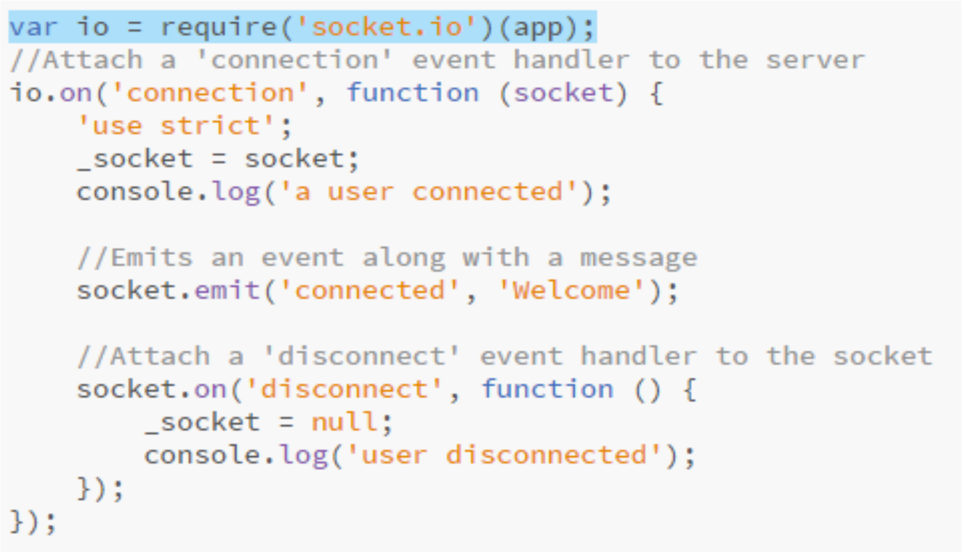
Node.js* Server on Intel® Edison



```
var http = require('http');
```



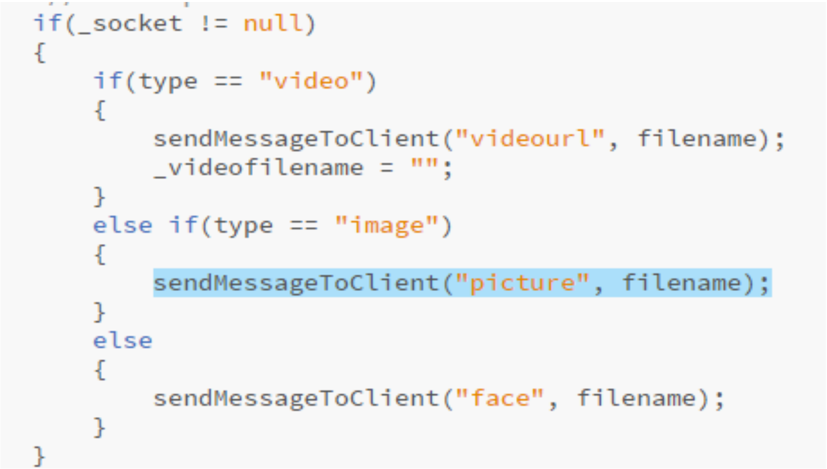
```
var app = http.createServer(function (req, res) {
    'use strict';
    res.writeHead(200, { 'Content-Type': 'text/plain' });
    res.end('<h1>Hello world from Intel IoT platform!</h1>');
}).listen(2001);
```



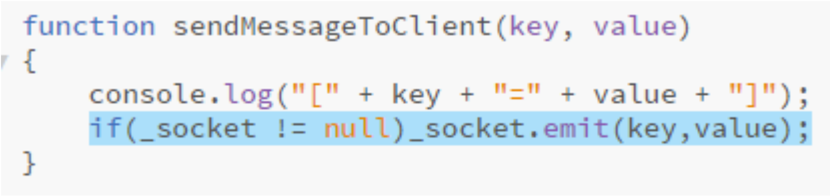
```
var io = require('socket.io')(app);
//Attach a 'connection' event handler to the server
io.on('connection', function (socket) {
    'use strict';
    _socket = socket;
    console.log('a user connected');

    //Emits an event along with a message
    socket.emit('connected', 'Welcome');

    //Attach a 'disconnect' event handler to the socket
    socket.on('disconnect', function () {
        _socket = null;
        console.log('user disconnected');
    });
});
```

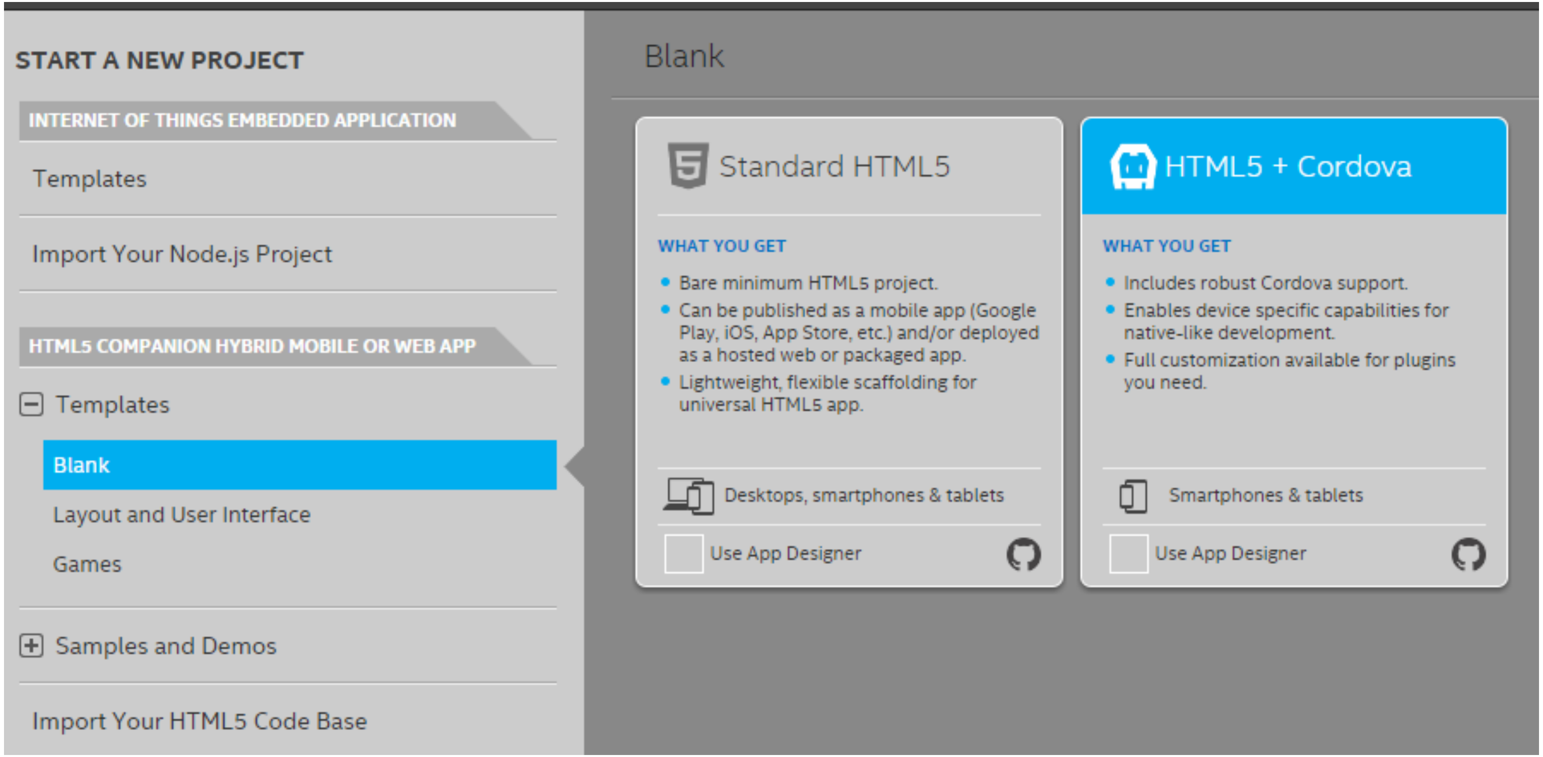


```
if(_socket != null)
{
    if(type == "video")
    {
        sendMessageToClient("videourl", filename);
        _videofilename = "";
    }
    else if(type == "image")
    {
        sendMessageToClient("picture", filename);
    }
    else
    {
        sendMessageToClient("face", filename);
    }
}
```



```
function sendMessageToClient(key, value)
{
    console.log("[" + key + "=" + value + "]");
    if(_socket != null)_socket.emit(key,value);
}
```

App Development and Deployment Using Intel® XDK IoT Edition



START A NEW PROJECT

INTERNET OF THINGS EMBEDDED APPLICATION

Templates

Import Your Node.js Project

HTML5 COMPANION HYBRID MOBILE OR WEB APP

⊟ Templates

Blank

Layout and User Interface

Games

⊞ Samples and Demos

Import Your HTML5 Code Base

Blank

Standard HTML5

WHAT YOU GET

- Bare minimum HTML5 project.
- Can be published as a mobile app (Google Play, iOS, App Store, etc.) and/or deployed as a hosted web or packaged app.
- Lightweight, flexible scaffolding for universal HTML5 app.

Desktops, smartphones & tablets

□ Use App Designer

HTML5 + Cordova

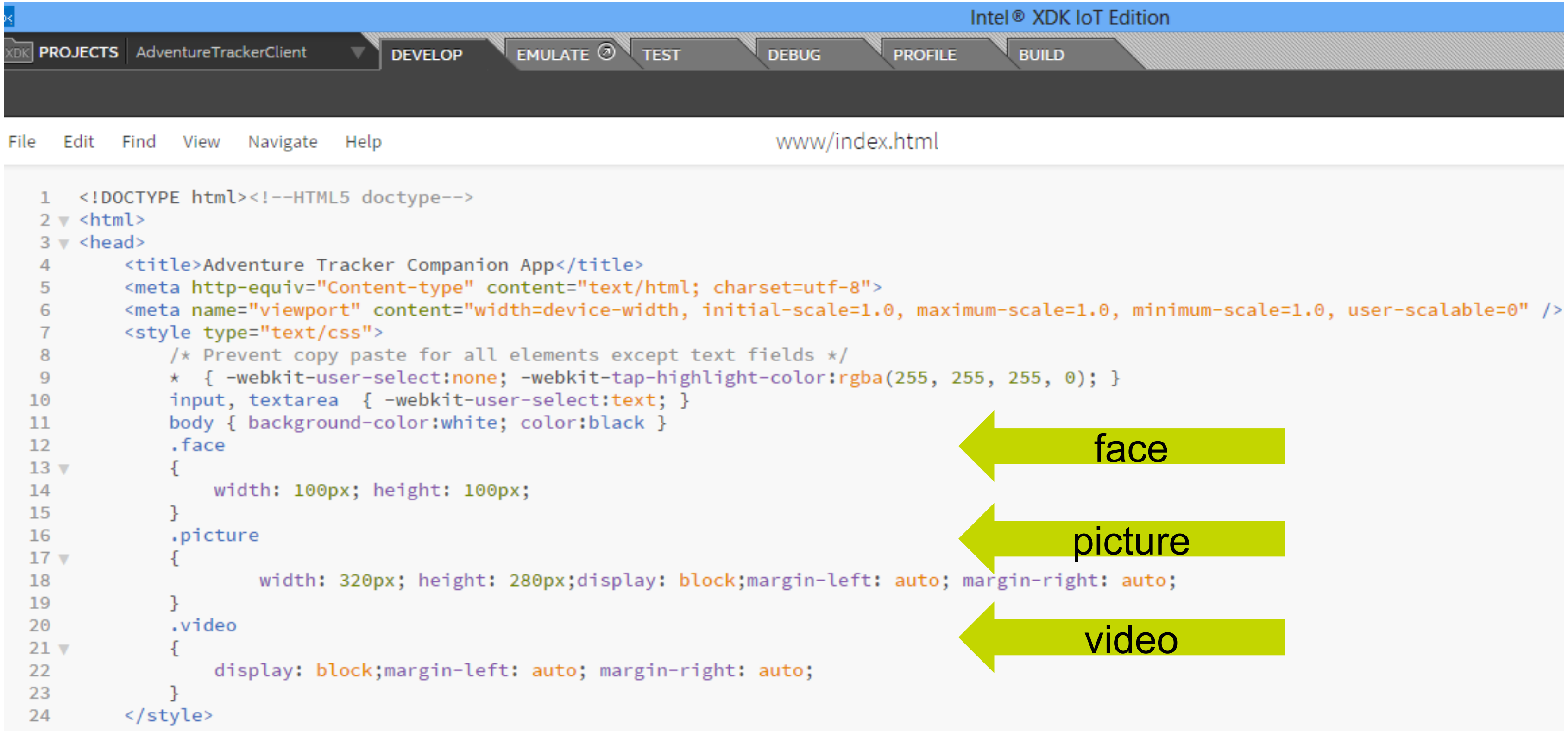
WHAT YOU GET

- Includes robust Cordova support.
- Enables device specific capabilities for native-like development.
- Full customization available for plugins you need.

Smartphones & tablets

□ Use App Designer

App Development and Deployment Using Intel® XDK IoT Edition



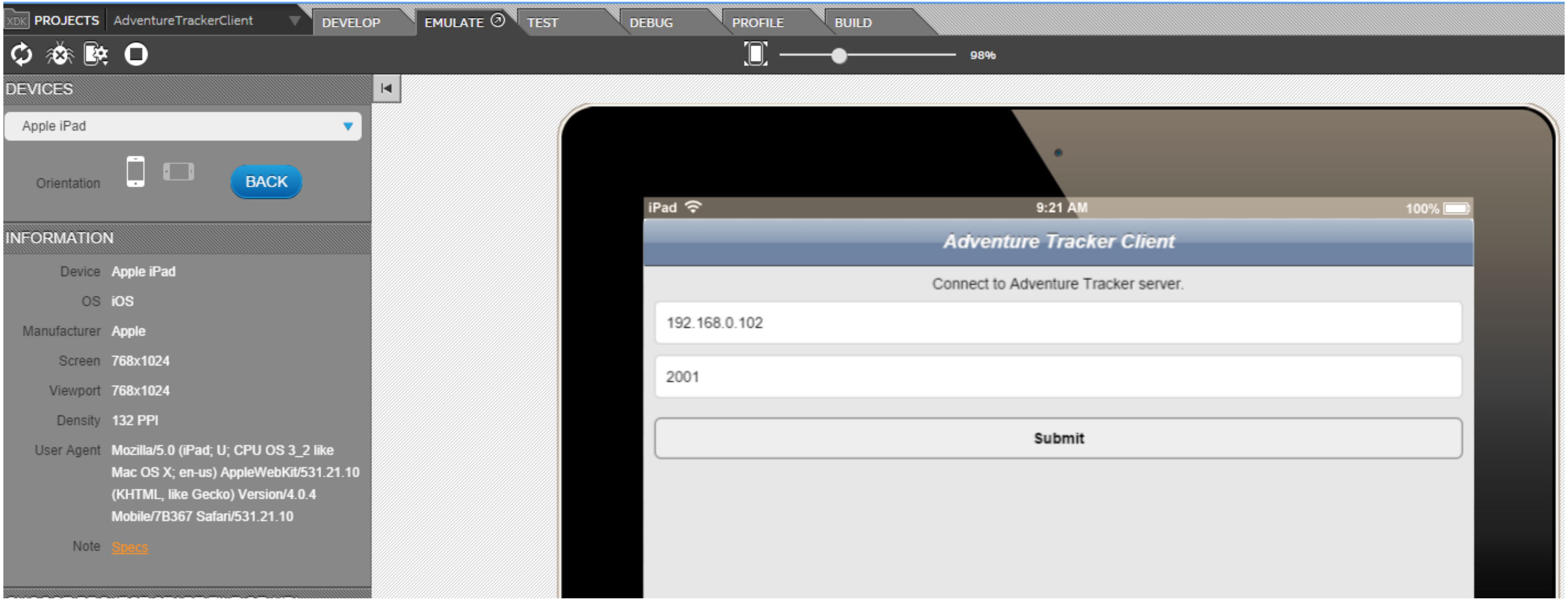
```
<!DOCTYPE html><!--HTML5 doctype-->
<html>
<head>
    <title>Adventure Tracker Companion App</title>
    <meta http-equiv="Content-type" content="text/html; charset=utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0, maximum-scale=1.0, minimum-scale=1.0, user-scalable=0" />
    <style type="text/css">
        /* Prevent copy paste for all elements except text fields */
        *  { -webkit-user-select:none; -webkit-tap-highlight-color:rgba(255, 255, 255, 0); }
        input, textarea  { -webkit-user-select:text; }
        body { background-color:white; color:black }
        .face
        {
            width: 100px; height: 100px;
        }
        .picture
        {
                width: 320px; height: 280px;display: block;margin-left: auto; margin-right: auto;
        }
        .video
        {
            display: block;margin-left: auto; margin-right: auto;
        }
    </style>
```

face

picture

video

App Development and Deployment Using Intel® XDK IoT Edition



Device Apple iPad

OS iOS

Manufacturer Apple

Screen 768x1024

Viewport 768x1024

Density 132 PPI

User Agent Mozilla/5.0 (iPad; U; CPU OS 3_2 like Mac OS X; en-us) AppleWebKit/531.21.10 (KHTML, like Gecko) Version/4.0.4 Mobile/7B367 Safari/531.21.10

Note Specs

Adventure Tracker Client

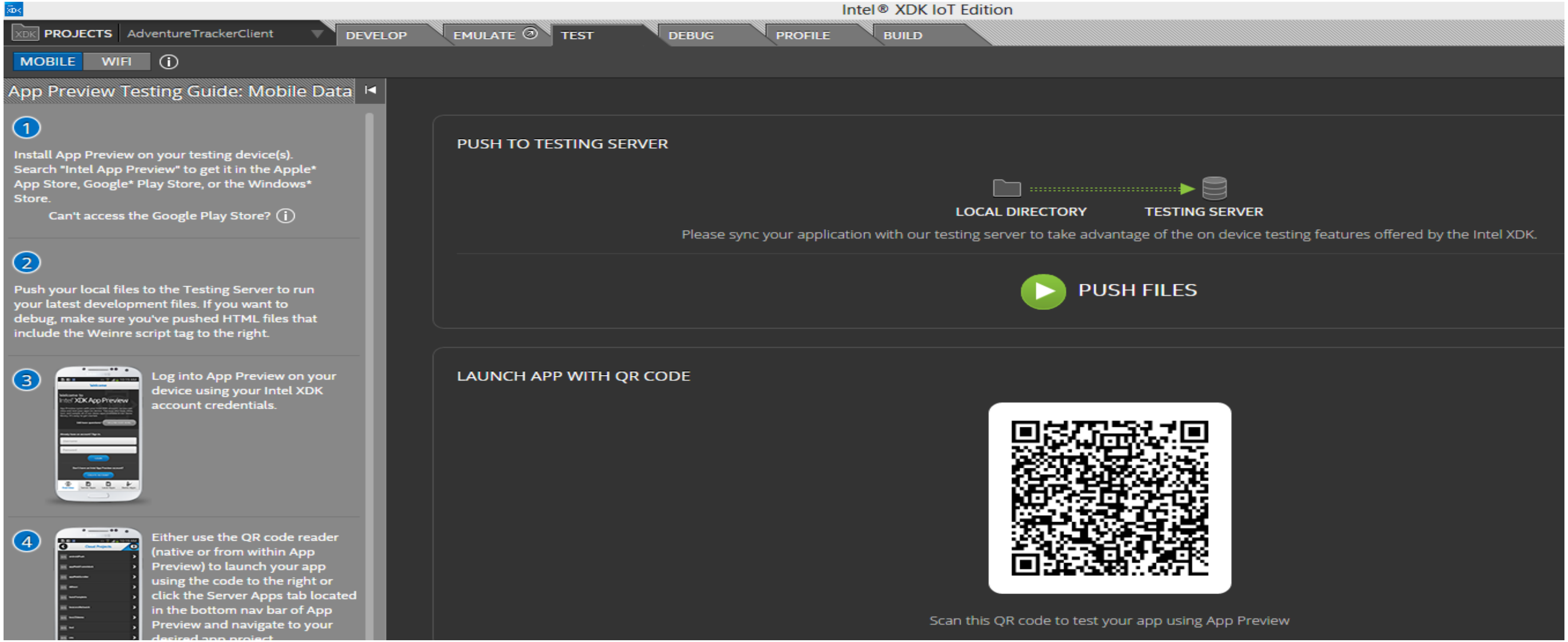
Connect to Adventure Tracker server.

192.168.0.102

2001

Submit

App Development and Deployment Using Intel® XDK IoT Edition



App Preview Testing Guide: Mobile Data

1 Install App Preview on your testing device(s). Search "Intel App Preview" to get it in the Apple* App Store, Google* Play Store, or the Windows* Store.

Can't access the Google Play Store?

2 Push your local files to the Testing Server to run your latest development files. If you want to debug, make sure you've pushed HTML files that include the Weinre script tag to the right.

3 Log into App Preview on your device using your Intel XDK account credentials.

4 Either use the QR code reader (native or from within App Preview) to launch your app using the code to the right or click the Server Apps tab located in the bottom nav bar of App Preview and navigate to your desired app project

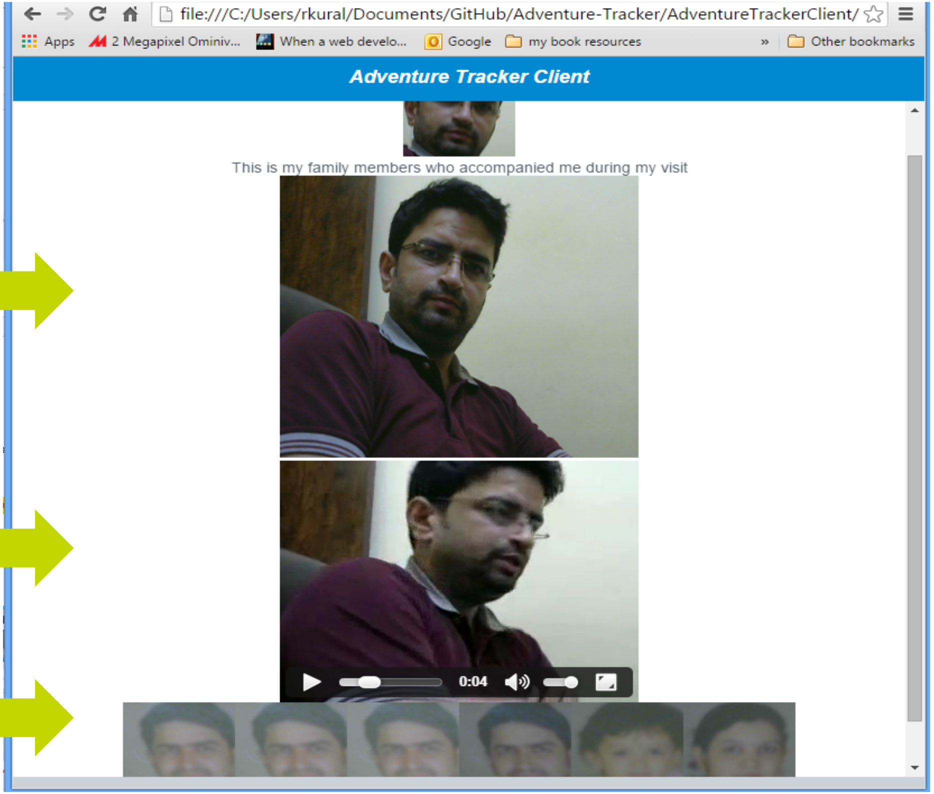
PUSH TO TESTING SERVER

Please sync your application with our testing server to take advantage of the on device testing features offered by the Intel XDK.

LAUNCH APP WITH QR CODE

Scan this QR code to test your app using App Preview

App Development and Deployment Using Intel® XDK IoT Edition



Adventure Tracker Client

This is my family members who accompanied me during my visit

picture

video

face

Next Steps:

- We will post the example code on GitHub : IP scanning in Process
- Build one yourself, add new features, eg GPS and local SD card, post on instructables.com
- Decompose this and use the modules for your own projects.
- Contribute to the project on Github.
- Send a thank you note to @GraceMetri and @ragural who developed this project originally.

References

http://software.intel.com/iot : More examples and white papers

https://software.intel.com/en-us/iot/microsoft-azure

https://software.intel.com/en-us/articles/enabling-ibm-bluemix-on-the-intel-edison-board

……………………………………..

https://github.com/w4ilun : Edison XDK/Node.JS and Socket.io examples

https://github.com/drejkim/edi-cam : A standalone video streaming Open-CV example.

https://github.com/smoyerman/ More voice control, ibeacon, OpenCV examples

Command Line Audio Examples

Find your device

`cat /proc/asound/cards` : USB Audio is device 2 on my system

To record audio

`arecord -vv -fdat "hello.wav”` Hit `ctrl-c` to stop recording.

To play it back, using correct default device

```
aplay hello.wav
```

To have the system speak in a Scottish accent

```
espeak -s 120 -v en-sc "Thank you for listening, this is espeak using the Scottish variant" --
stdout | aplay -Dplughw:2,0
```

experience
what's inside™