

Exploring the Internet of Things with Ruby

Lone Star Ruby Conf 2012



Man Versus Wild...



BEAR GRYLLS

He simply walks into Mordor.

The Great Adventure



The Oh No Moment



(aka – I am going to have to drink my urine)

Whoami

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@mwhagedorn

github.com/mwhagedorn



Agenda

- Internet Of Things in General
- Ruby and USB
- The IOT Printer
- The IOT Display

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Internet of Things?

Objects-> Internet -> Servers

“Listen to your world, talk to the Internet”

<http://supermechanical.com/>

Wifi is everywhere

- Greyhound
- Amtrak
- Airports
- Starbucks
- Its everywhere!
- Mobile data too!

QRCodes

- A 2D barcode



Virtual Store

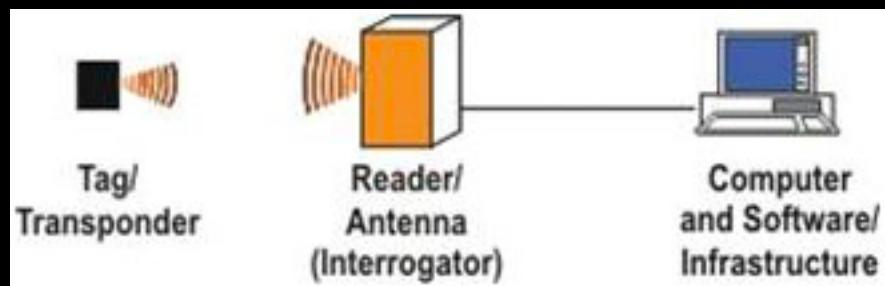


QRCodes

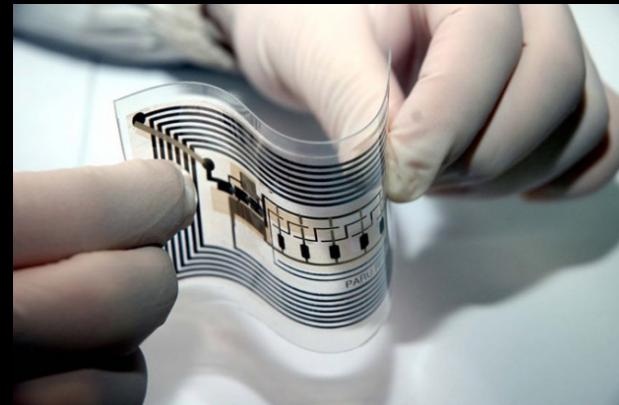
- Cheap
- Not very convenient
- Barby gem - <http://bit.ly/xp9cUe>

RFID

- Passive
- Active



RFID Contexts



Things Talk back



@MarsCuriosity

Curiosity Rover @MarsCuriosity

Follow

Coming Attraction: My hi-res descent video.
This 1 frame preview features the heat shield dropping away 1.usa.gov/PFszKb

Reply Retweet Favorite

2,474 RETWEETS 749 FAVORITES

1:32 PM - 8 Aug 12 via web · Embed this Tweet

Reply to @MarsCuriosity

Wells Oliver @wellsoliver 8 Aug
@MarsCuriosity Find a Starbucks yet?
Details

Nick @yophoric 8 Aug
@MarsCuriosity :O
Details

Sheri Lynn Pritchett @PoemTrees 8 Aug
I love U! @MarsCuriosity
Details

Tony @hotmlkgt 8 Aug
@MarsCuriosity looks like Captain America's shield :3
Details

Botanicalls



About Classic Kits Buy Press Contact Forums

Botanicalls in New York Times



Lovely Sunday New York Times article about Botanicalls and plants underlying native communication methods by Diane Ackerman. It includes what we believe to be the first published use in lower case of "botanicalling." Maybe this signals our entry into the American lexicon?

Posted on **November 16th, 2011** by **rob**. Filed under **Press**.

No Comments

MoMA Acquires Botanicalls for Permanent Collection

The Museum of Modern Art's Architecture & Design Acquisition Committee has approved the addition of **Botanicalls** to the **MoMA permanent collection**. This means that after the **Talk to Me** exhibition closes, Botanicalls will join the likes of **Eames chairs** the **BIC**



New kits are here!

[buy kit](#)

Search for:

Categories

Announcements (8)
Press (5)

Pothos Plant Tweets



URGENT! Water me!
[822-64] 98 days ago
Water me please.
[822-63] 99 days ago
Thank you for
watering me! [822-62]
99 days ago
Water me please.
[822-61] 117 days ago
You didn't water me
enough. [822-60] 117

IOT Devices

- Arduino
- Raspberry Pi
- Twine

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The USB Lamp Project

MAY 20, 2012

USB PROGRAMMING WITH RUBY

I have a current side project of looking for a simple to construct build radiator that is reasonably affordable from a hobbyist's point of view. I came across [this blog post](#), that used a sub £10 USB device for displaying the state of monitors. Although good, the drivers only appear to work on linux (not on my mac!) but I decided to not let that stop me.

I spent a couple of hours yesterday reading up on USB, the options around ruby (my current project's development language of choice) and then the [source code for the linux drivers](#) written in C++. Here's proof that I managed to learn a few things:



<http://www.thekua.com>

The USB Lamp Project

- libusb gem
 - open a context
 - browse for your device
 - open the device
 - send message
 - close device
- NOT Easy!

The USB Lamp Project

- Lots of Questions
 - How do you send messages?
 - What is the form of the messages?

Use The Source Luke...

```
void USBLamp::init() {
    char data1[8] = { 0x1f, 0x02, 0x00, 0x2e,
                      0x00, 0x00, 0x2b, 0x03 };
    send(data1, sizeof(data1));

    char data2[8] = { 0x00, 0x02, 0x00, 0x2e,
                      0x00, 0x00, 0x2b, 0x04 };
    send(data2, sizeof(data2));

    char data3[8] = { 0x00, 0x02, 0x00, 0x2e,
                      0x00, 0x00, 0x2b, 0x05 };
    send(data3, sizeof(data3));
}
```

Use The Source Luke...

```
void USBLamp::send(char *bytes, int size) {  
    ...  
    CALL(usb_control_msg(...))  
    ...  
}
```

Array#pack & String#unpack

- pack
 - Array of numbers to a binary string

```
[97,98,99].pack("c*")  
=> "abc"
```

- unpack
 - Binary string to array

```
"abc".unpack("c*")  
=> [97,98,99]
```

Demo

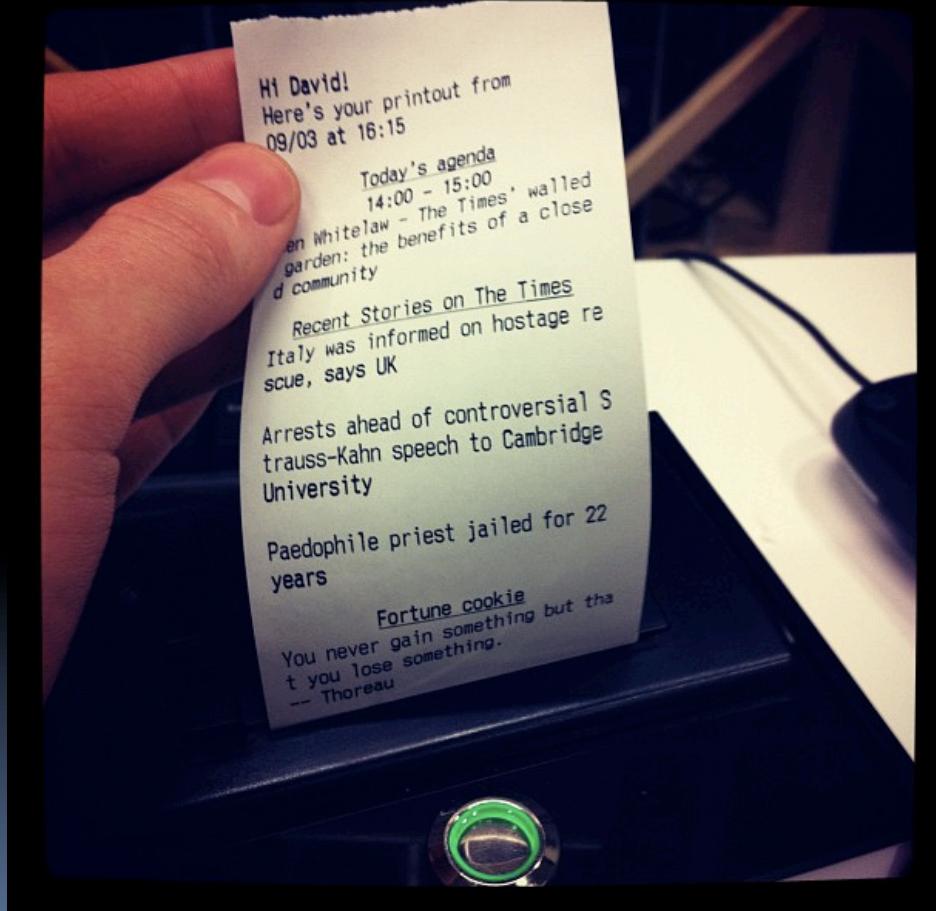
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- Ruby and RFID
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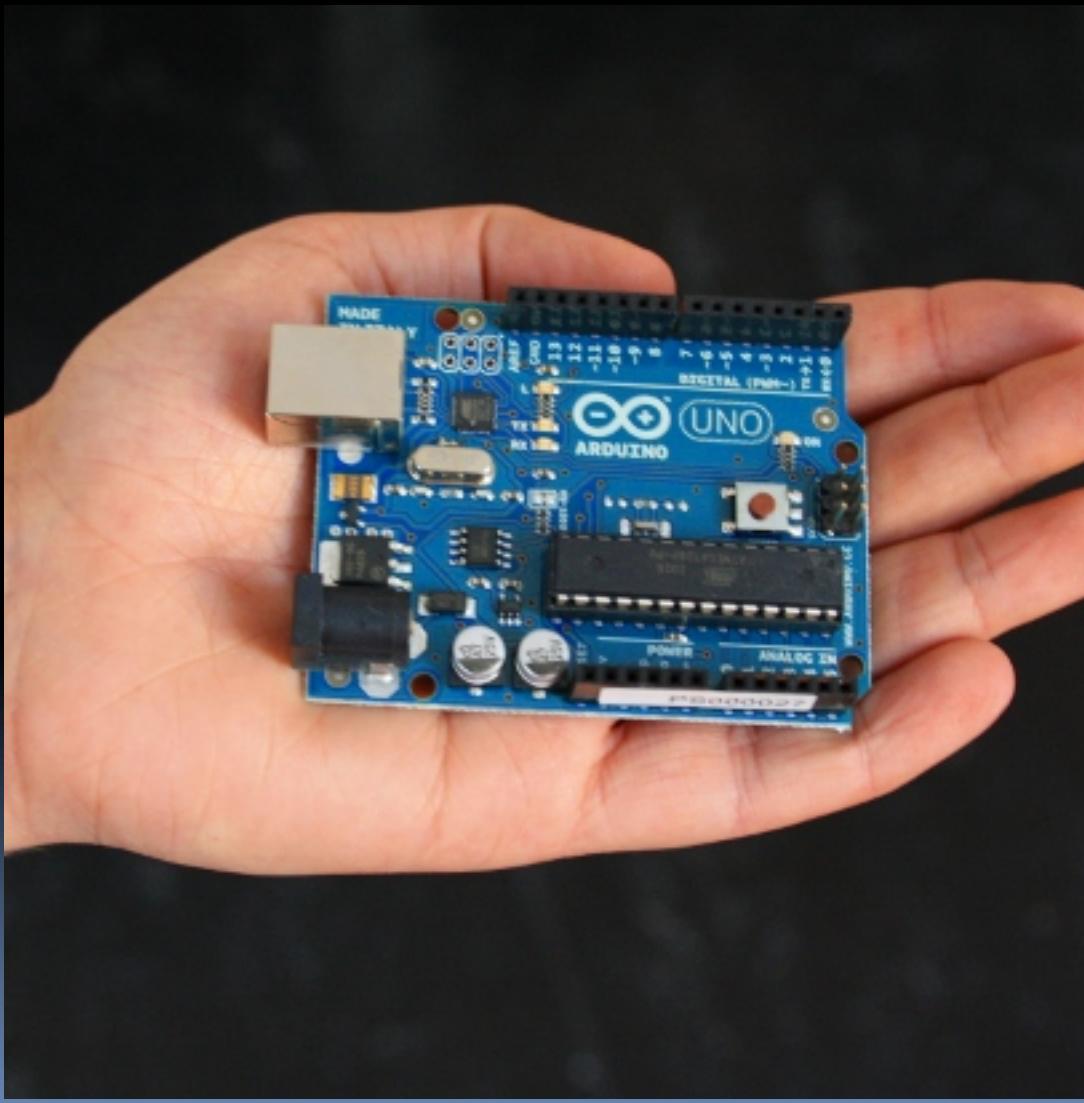
The IOT printer



The IOT printer



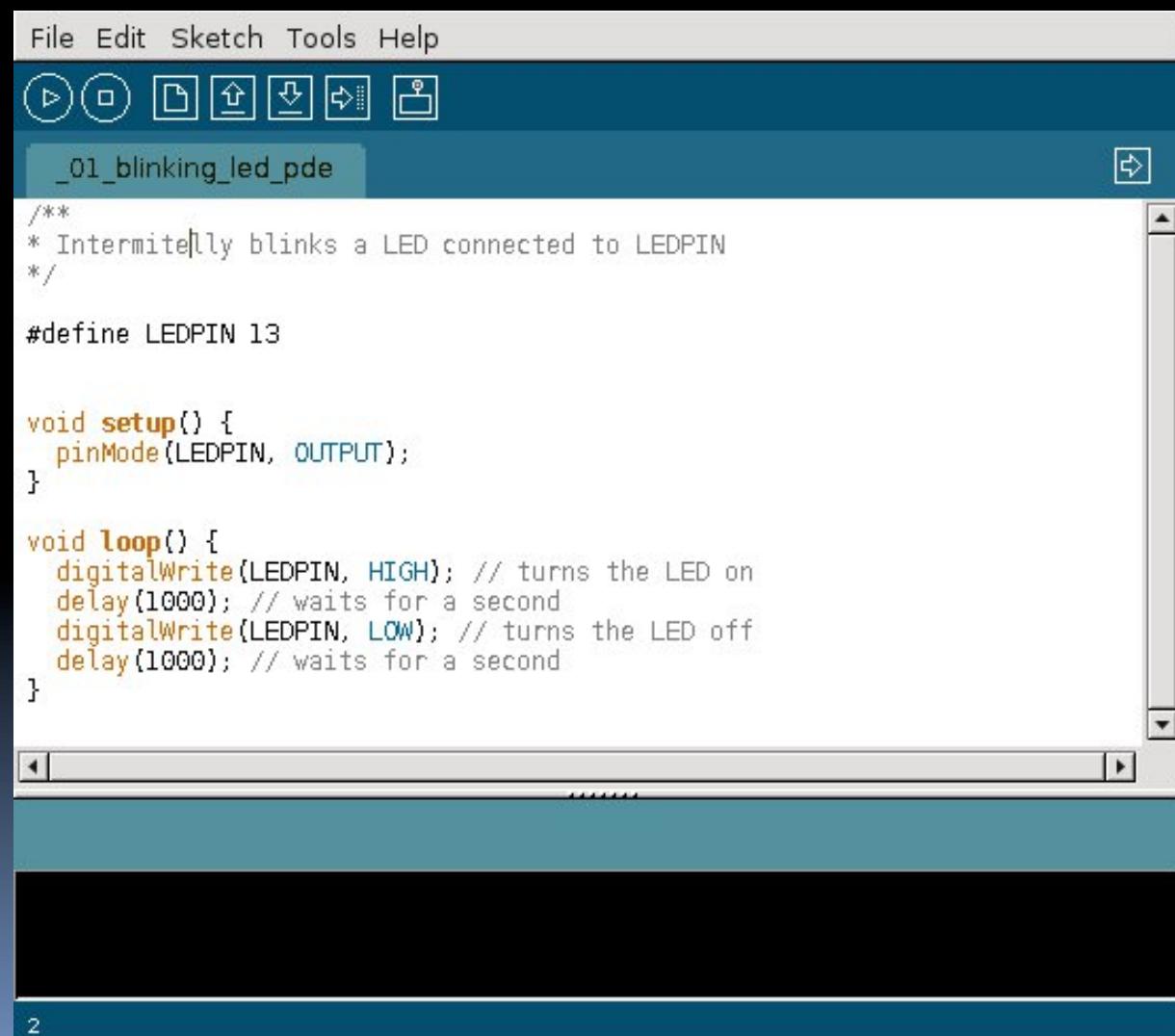
Arduino



Ethernet Shield



Arduino IDE



The screenshot shows the Arduino IDE interface with a sketch titled '_01_blinking_led_pde'.

```
File Edit Sketch Tools Help
_01_blinking_led_pde
/*
 * Intermittently blinks a LED connected to LEDPIN
 */
#define LEDPIN 13

void setup() {
    pinMode(LEDPIN, OUTPUT);
}

void loop() {
    digitalWrite(LEDPIN, HIGH); // turns the LED on
    delay(1000); // waits for a second
    digitalWrite(LEDPIN, LOW); // turns the LED off
    delay(1000); // waits for a second
}
```

The code defines a constant `LEDPIN` as 13. The `setup()` function sets the pin mode to output. The `loop()` function alternates between turning the LED on and off at one-second intervals using `digitalWrite` and `delay` functions.

To Rad or Not To Rad

Get Version
0.2.2

Sponsored by:
The Shoppe at Wulfden

[Totally Open Arduino-Compatible Hardware](#)

RAD → ‘Ruby Arduino Development’

What?

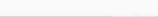
RAD is a framework for programming the Arduino physical computing platform using Ruby. RAD converts Ruby scripts written using a set of Rails-like conventions and helpers into C source code which can be compiled and run on the Arduino microcontroller. It also provides a set of Rake tasks for automating the compilation and upload process.

To Rad or Not To Rad

github

PUBLIC atduskgreg / rad

Code Network Pull Requests 2 Issues 5 Wiki Graphs

Ruby Arduino Development: a framework for programming the Arduino physical computing platform using Ruby — [Read more](#) 

[Clone in Mac](#) [ZIP](#) [HTTP](#) [Git Read-Only](#) <https://github.com/atduskgreg/rad.git> 

branch: master Files Commits Branches 1 Tags 1 Downloads

Latest commit to the **master** branch

Edited README.markdown via GitHub

 **mwilliams** authored a year ago  commit [353a9f4040](#)

rad /

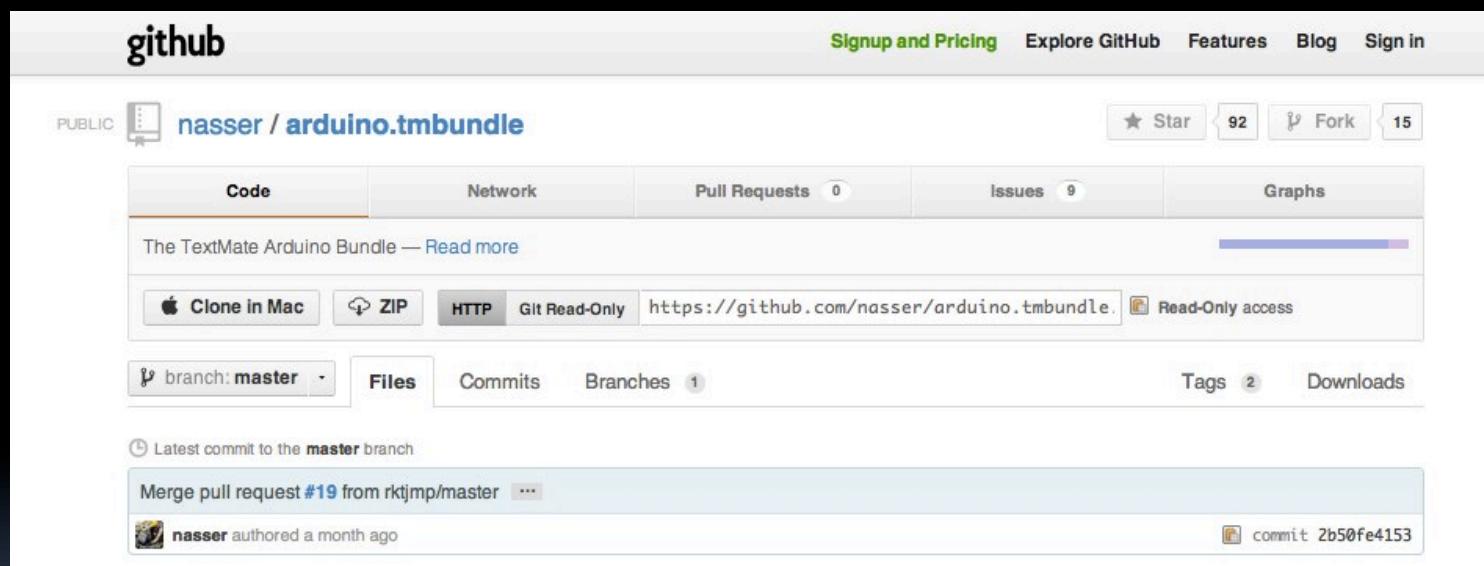
name	age	message	history
bin	4 years ago	Added linux install code from Colin Harris. also, refactored darwin i... [Greg Borenstein]	

A red circle highlights the "age" column header in the table.

Tools You Can Trust



Use TextMate!

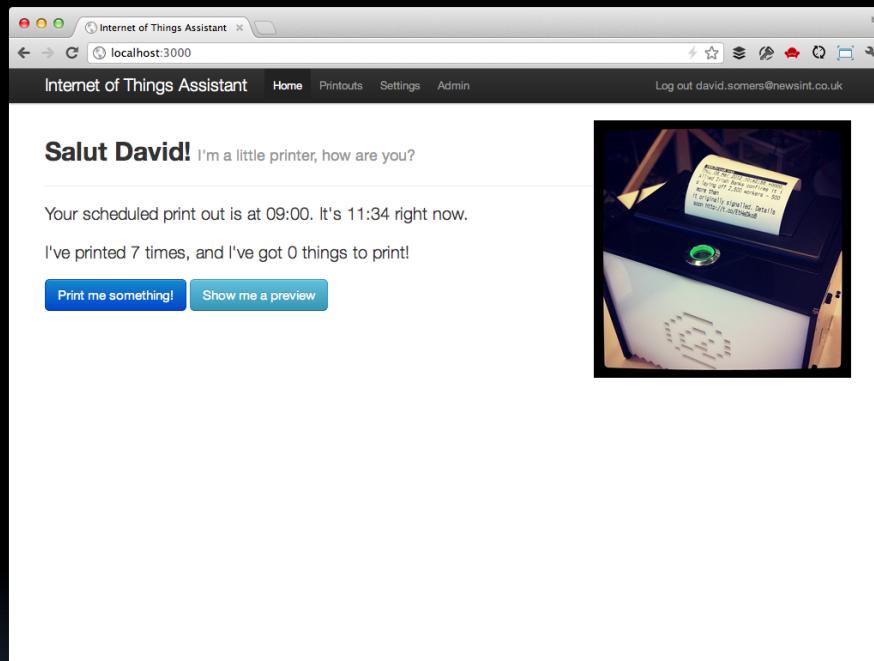


Use Terminal!

- You can monitor the serial port via Terminal
 - > `ls /dev/tty.*`
 - > `screen <dev> <baud-rate>`
- End with cntrl-A, cntrl-\

IOT-Assistant

github.com/newsinternational/iot-assistant



Architecture

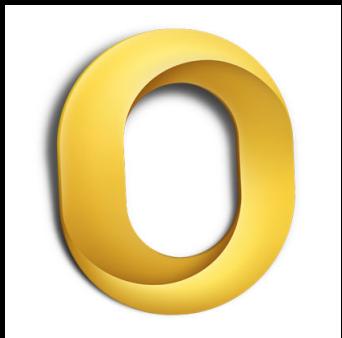


OAuth
Calendars

Tweets



Suiting It To Me



Calendar

Tasks

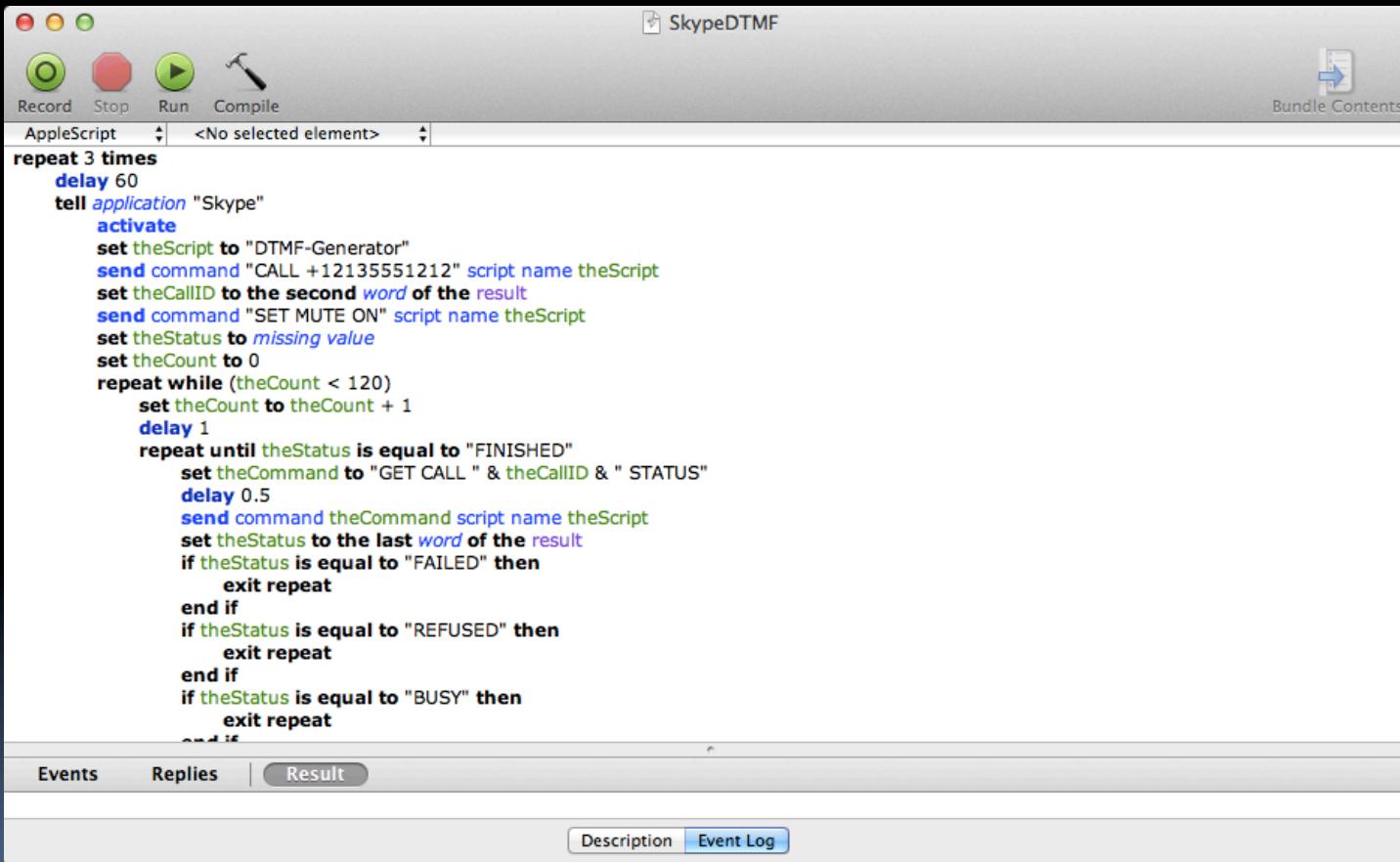
News

Twitter
(Oauth)

Omnifocus Challenges

- How can I get my tasks exported?
- How can I get them up to the server?

Applescript

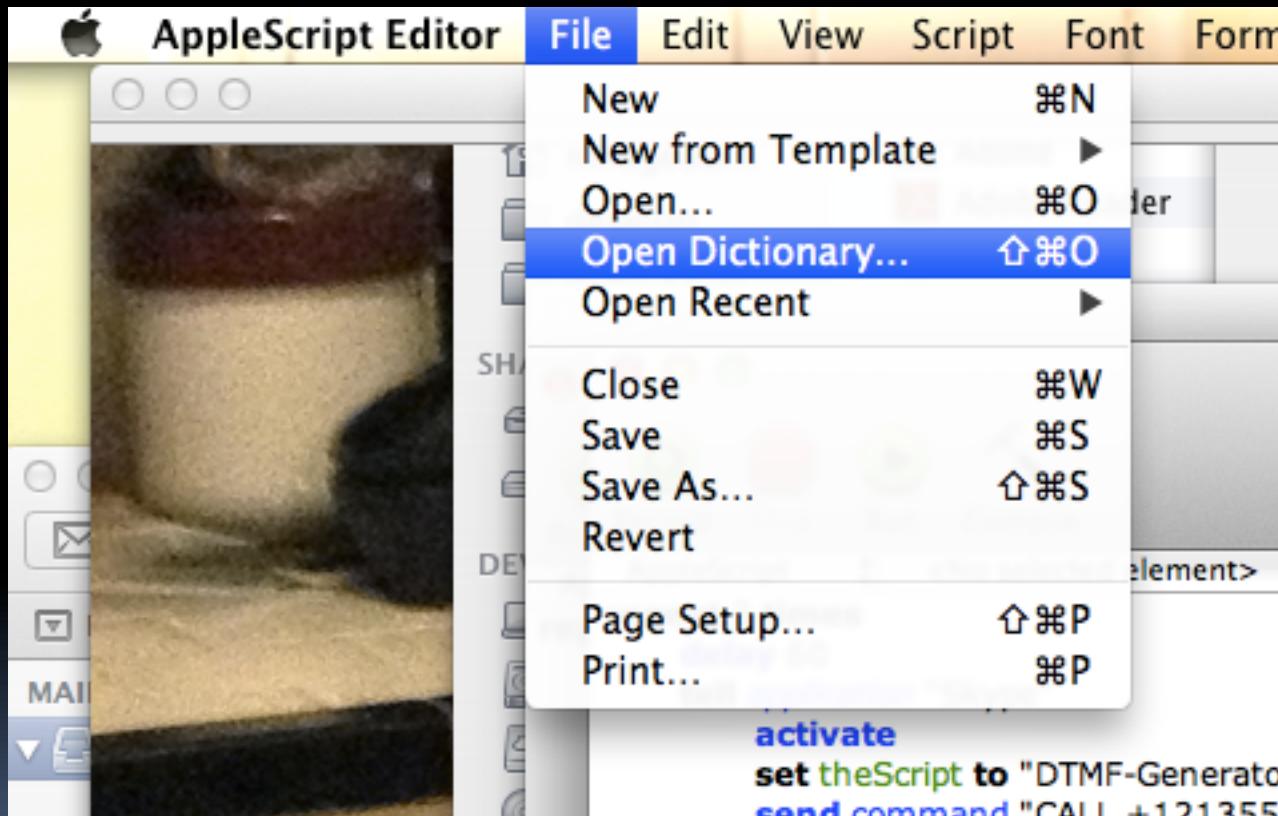


The screenshot shows the AppleScript Editor window titled "SkypeDTMF". The menu bar includes "File", "Edit", "Script", "Run", "Script Editor", "Help", and "About". The toolbar features "Record" (green circle), "Stop" (red octagon), "Run" (play button), and "Compile" (magnifying glass). The status bar indicates "AppleScript" and "SkypeDTMF". The main pane displays the following AppleScript code:

```
repeat 3 times
    delay 60
    tell application "Skype"
        activate
        set theScript to "DTMF-Generator"
        send command "CALL +12135551212" script name theScript
        set theCallID to the second word of the result
        send command "SET MUTE ON" script name theScript
        set theStatus to missing value
        set theCount to 0
        repeat while (theCount < 120)
            set theCount to theCount + 1
            delay 1
            repeat until theStatus is equal to "FINISHED"
                set theCommand to "GET CALL " & theCallID & " STATUS"
                delay 0.5
                send command theCommand script name theScript
                set theStatus to the last word of the result
            if theStatus is equal to "FAILED" then
                exit repeat
            end if
            if theStatus is equal to "REFUSED" then
                exit repeat
            end if
            if theStatus is equal to "BUSY" then
                exit repeat
            end if
        end repeat
    end tell
end repeat
```

Below the code, there are tabs for "Events", "Replies", and "Result", with "Result" being selected. At the bottom are buttons for "Description" and "Event Log".

Applescript Dictionary



Exporting Omnifocus tasks

```
#!/usr/local/bin/macruby
framework 'Foundation'
framework 'ScriptingBridge'

OFOC = "com.omnigroup.Omnifocus"
@of  = SBApplication.applicationWithBundleIdentifier(OFOC)
load_bridge_support_file 'Omnifocus.bridgesupport'

@doc = @of.defaultDocument

tasks = []
@doc.flattenedTasks.get.each do |task|
  tasks << task
end
```

How can the server get this?

- Omnifocus tried to solve this
- Have to expose your desktop on internet
- More work than most people want to do

Use HP Object Storage!

The screenshot shows the HP Cloud Storage interface. At the top, there is a navigation bar with links for Products, Documentation, Community, Blog, and Console. On the far right of the navigation bar are icons for Chat Now and a user profile. Below the navigation bar, there is a secondary navigation menu with tabs for Dashboard, Compute, Storage (which is currently selected and highlighted in blue), and Account.

In the main content area, there is a search bar labeled "New Container Name" with a "Create" button next to it. To the right of the search bar is a link "Get Storage API Keys".

The main content area displays a list of containers under the heading "region-a.geo-1". The list is presented in a table format with a header row labeled "Name". The data rows show three containers: "calendar", "my container", and "omnifocus". Each data row has an "info" icon (an "i" inside a circle) at the end.

A callout box titled "Options and Info" contains the text: "Click the icon for more info on an item and interaction options."

HpObjectStore Helper

- Uses Fog

```
def tasks_dir
  @connection.directories.get("omnifocus")
end

def update_tasks_file(content)
  tasks_dir.files.create(:key => "tasks.json",
                        :body => content)
end
```

On the Server

```
#response = google_request(  
    "https://mail.google.com/mail/feed/atom")  
response = hpcloud.tasks_file
```

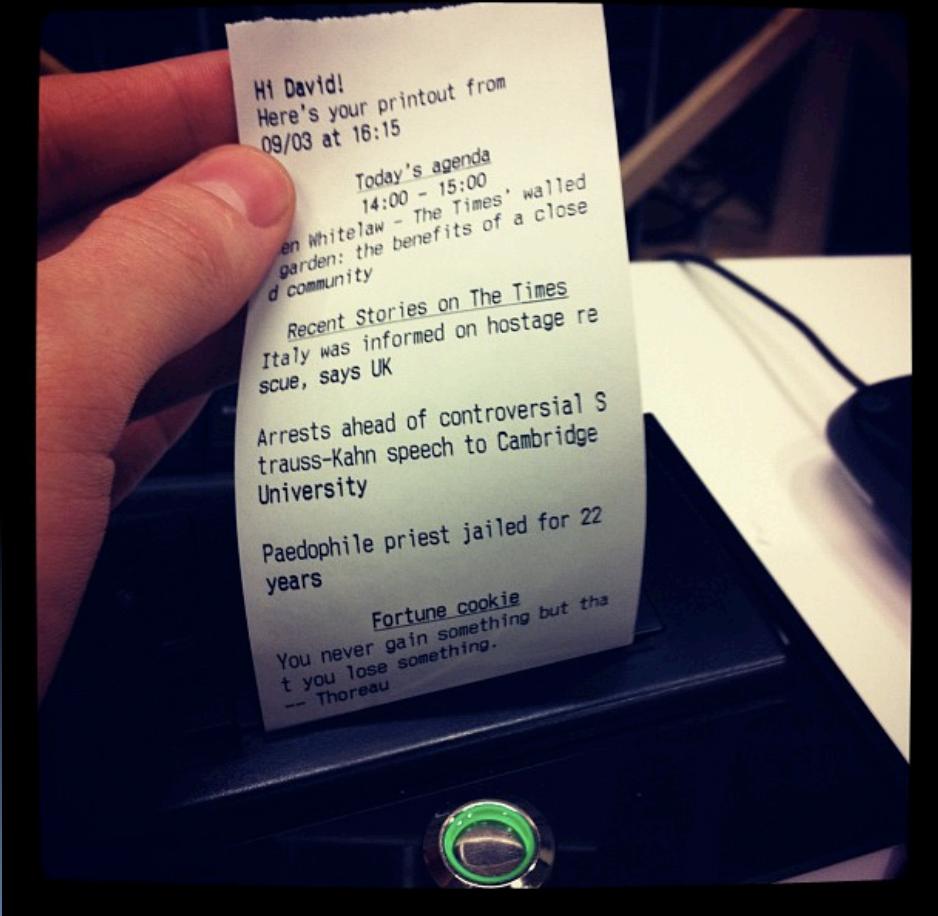
Update Cloud Bucket

- Run a chron job from my desktop server
- All my omnifocus installs are already synced
- Server gets a current task list

Outlook

- Need my calendar
- Don't want to deal with corp security
- Use the same omnifocus technique

The Printout



The Arduino Code

Internet of Things Assistant Home Printouts Settings Admin  Log out

Users Settings **Printer**

As well as the Arduino IDE, you will also need the [thermal printer Arduino library](#) in order to compile the code.

Use this form to configure your Arduino software and download the .ino file to upload to your Arduino.

MAC Address
This can be found on a sticker on your Ethernet shield or Arduino board.

Fallback IP Address
Fallback IP address to use if DHCP request fails, leave blank if you don't know/care.

IoT Assistant server
This server. Leave auto-detected value above unless you know what you are doing.

IoT Assistant URL
URL the printer should poll for new printouts. Leave auto-detected value above unless you know what you are doing.

Download .ino file

The Printer Markup

Style

```
uc Task summary
nl You have 23 tasks.
nl iot presentation
nl clean up display ...
nl put on githubpccloud.tasks_file
```

Justification

Issues

- Parser is brittle
 - Can't handle nl then a space
 - Workaround:
 - Insert LF char in the template on blank lines
 - Example
 - nl <%=10.chr%>

Demo

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The IOT Display



Original Inspiration:

<http://bit.ly/vlMMvr>

Arduino

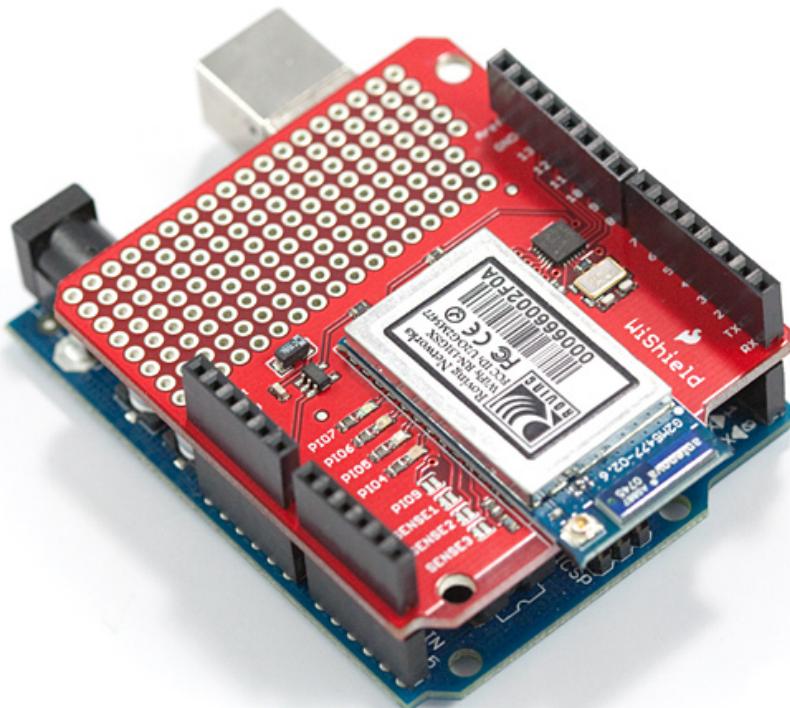


32X8 Led Panel



<http://bit.ly/wyuE5V>

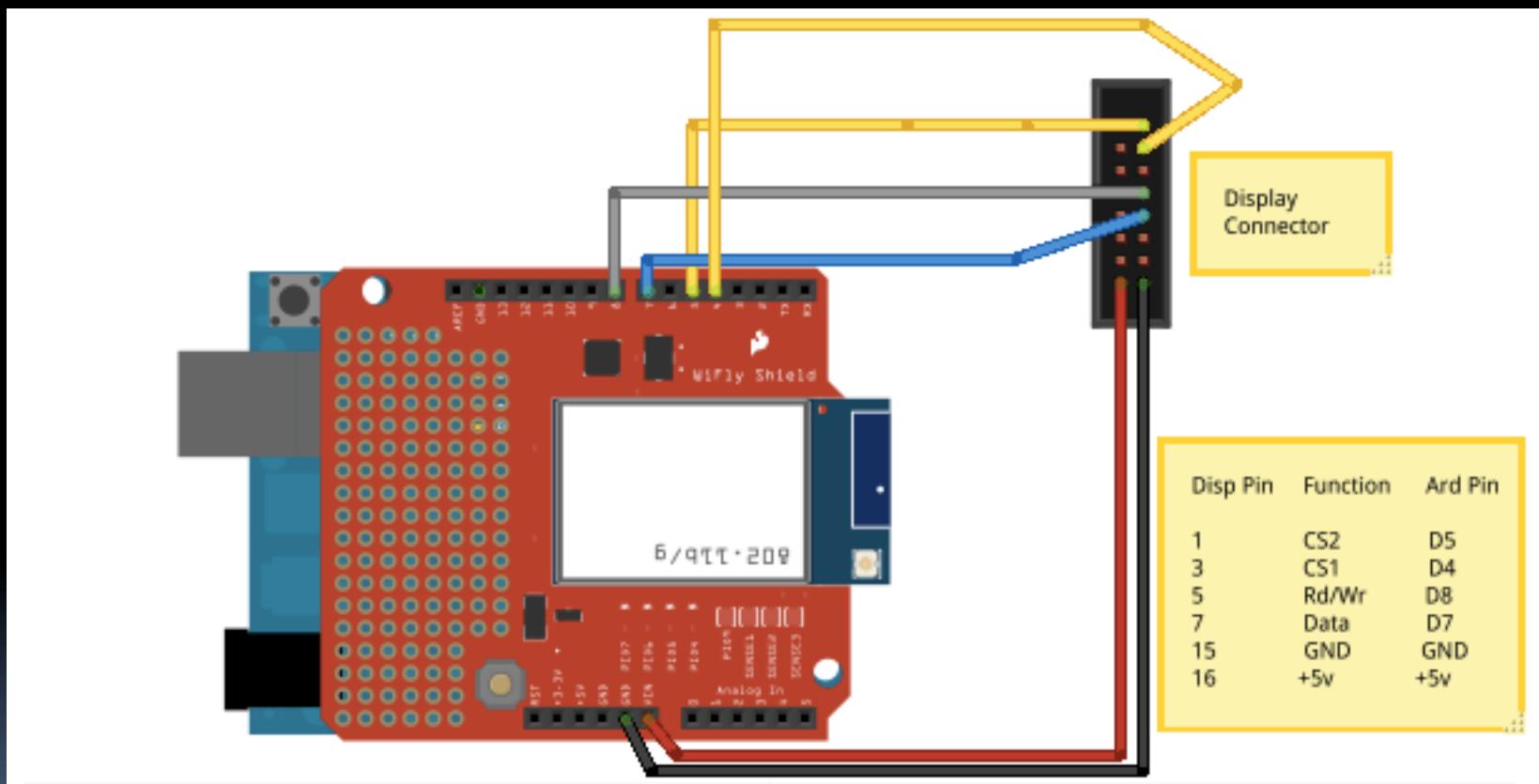
WiFi



Other Wireless Approaches

- XBee
- Bluetooth
- RF Link Transmitter (<http://bit.ly/yxQL1>)

Fritzing Sketch



My Original Concept

- An on-demand display listening for tcp requests
- Like a large Caller-ID display
- Networked version of the PS2You project

Using IOT-A

- Already had an infrastructure
- Already had a datasource
- Format didn't make sense for LED Display

User-Agent

- Use two different User-Agent header values
- User-Agent:IOTDisplay
- User-Agent:IOTPinter
- JSON representation for display

The Display JSON

```
{  
  "tasks": [  
    { "name": "do presentation" },  
    { "name": "be awesome" },  
    { "name": "" },  
  ],  
  "news": [  
    { "name": "Ann Arbor considers putting voters..." },  
    { "name": "Reward offered for return of urn..." },  
    { "name": "Eminem: Thanks for help in dark times" },  
  ]  
}
```

Memory and the Sad Panda

- Standard JSON parser took up too much memory
- Char strings storage
- Had to give up a key feature

Demo

PROGMEM

- A way to move constants out of SRAM (small)
- Stores values in Flash RAM
- Have to pull these values in when you need them

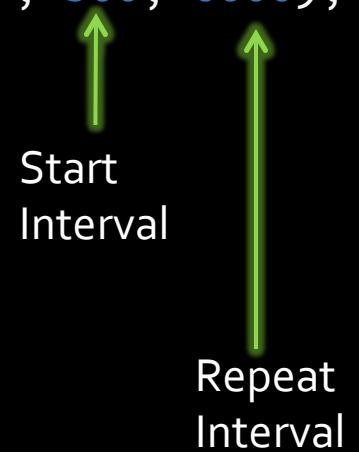
```
prog_char rssiMsg[] PROGMEM = "Checking RSSI...";
```

JSON?

- Too heavyweight for this implementation
- Probably would go for a different format

AVRQueue

```
myQueue.scheduleFunction(updateDisplayHandler, "Display", 500, 6000);
```



Thingspeak

The screenshot shows the homepage of ThingSpeak. At the top, there's a navigation bar with links for HOME (which is underlined), CHANNELS, APPS, and FEATURES. To the right of the navigation are links for Community, Documentation, Sign In, and Sign Up. A large red button with a white speech bubble icon is positioned on the right side.

The main headline reads: "create your Internet of Things application with ThingSpeak". To its right, a blue bracketed text block says: "an open application platform designed to enable meaningful connections between things and people". Below this, there's a red speech bubble icon.

A line graph titled "Dynamic Light Levels" is displayed, showing light levels over time from 22:04 to 22:06. The Y-axis ranges from 400 to 600. The graph shows a general downward trend with some fluctuations.

Below the graph, a blue speech bubble says: "You left your lights on 2 minutes ago". To its right, a yellow box says: "Light level was 89% in your room." There's also a small blue house icon.

At the bottom, there are three sections: "features", "applications", and "get started".

- features**
 - Open Source API
 - Real-time data collection
 - Data processing
 - Data visualizations
- applications**
 - Sensor monitoring
 - Energy monitoring
 - Connecting devices and systems
 - Geo location tracking
- get started**

If you are ready to get started, [Sign Up](#) for a free user account.

Improvements

- Stop Polling
 - Websockets
- Restore direct socket connection for display

Why do this?

Michael Faraday:

“of what use is a newborn baby?”

HP Cloud For Free!



<https://www.hpcloud.com/free-trial>

@mwhagedorn

Thanks!

<https://github.com/mwhagedorn/IOTDisplay.git>

https://github.com/mwhagedorn/iot_printer_remote.git

<https://github.com/mwhagedorn/iot-assistant.git>

<https://github.com/mwhagedorn/thingspeak.git>