



THE CUSTOMER SUCCESS PLATFORM

IoT Zone

Device Analytics and Predictive Maintenance with **Electric Imp**

(<https://github.com/electricimp/Dreamforce2K15>)

Matt Haines

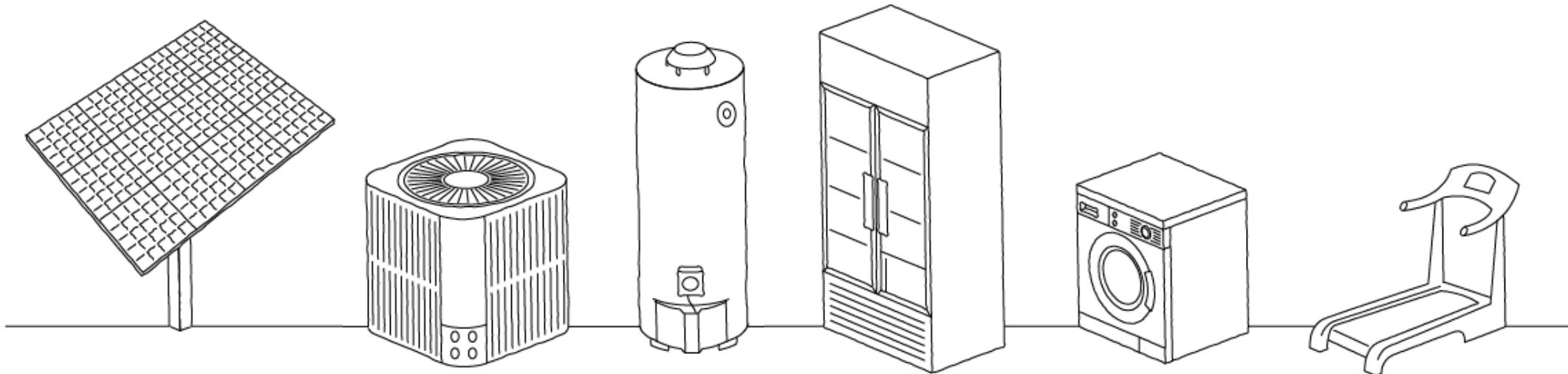
Software Engineer

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@_matthaines

Electric Imp

The Electric Imp platform integrates secure connectivity quickly, easily, and seamlessly.



The Electric Imp Connectivity Platform

Our platform cuts the upfront investment and speed up time to market by providing the core elements of connectivity – hardware, software, scalability, management tools, and continuous security maintenance.



**Imp Authorized
Hardware**

A powerful module containing WiFi and a processor



Imp OS

The software foundation for the imp's features and services



Imp Cloud

Securely run server side code, agents, that provide HTTP(S) I/O and cloud-side processing



BlinkUp™

Patented setup lets customers connect products in seconds



Imp Scalability

Push code any time, scale production, and gather insight on devices in the field



Imp Security

Security is integrated throughout the infrastructure from hardware to the cloud and continuously maintained



“Connectivity is valuable for businesses in terms of lowering costs and inspiring new services.”

Hugo Fiennes, CEO, Electric Imp



Cybex Care

Improve Member Experience

Reduce Downtime & Optimize Performance

Lower Cost of Ownership

Streamline Maintenance & Service



Part 1

Getting Connected

Getting Started

Grab the code and slides:

- <https://github.com/electricimp/Dreamforce2K15>

Create an Electric Imp account:

- <https://ide.electricimp.com/login>

Download the Electric Imp app:

- [Apple App Store](#)
- [Google Play Store](#)



BlinkUp™

Power your imp with the USB cable

Sign into the Electric Imp app

- Choose "Other Network"

- Enter the WiFi credentials:

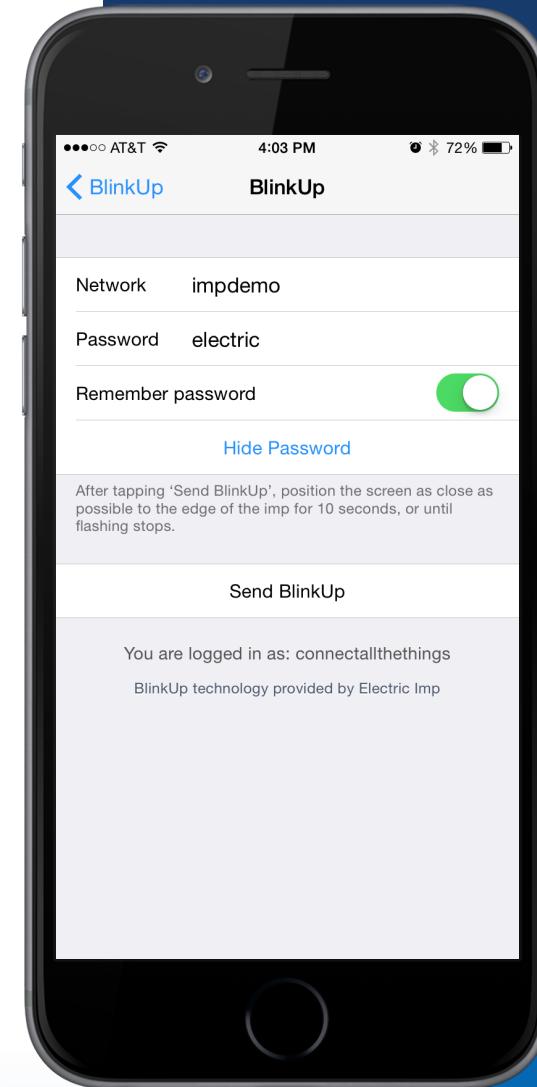
Network: imp

Password: electric

- Click **Send BlinkUp**

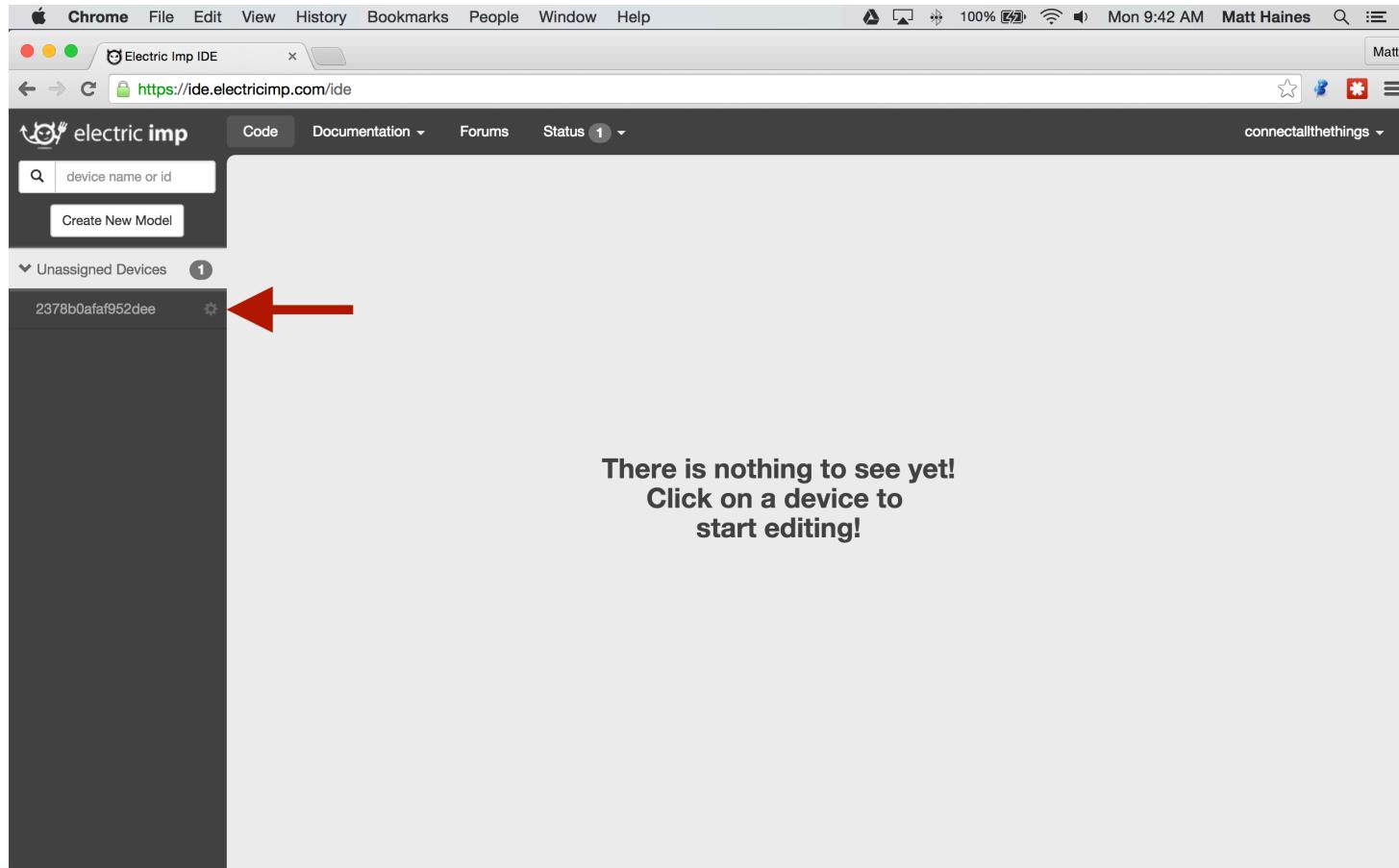
Cover the imp and April with your phone until BlinkUp completes

Your device should now be blinking **green** (online)



Create a New Model

ide.electricimp.com

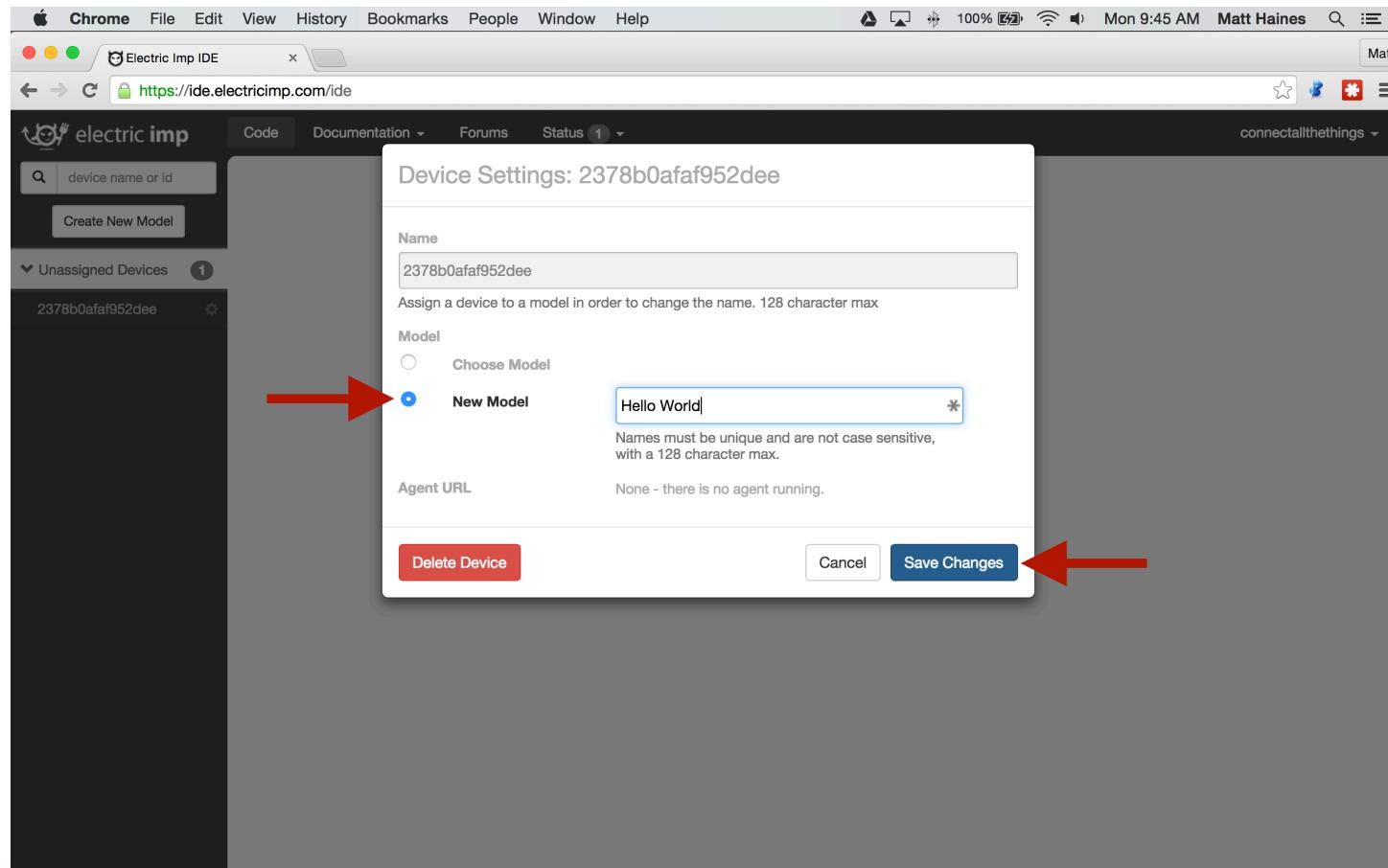


- Open the IDE
- Find your unassigned device
- Click the Device Settings Gear



Create a New Model

ide.electricimp.com

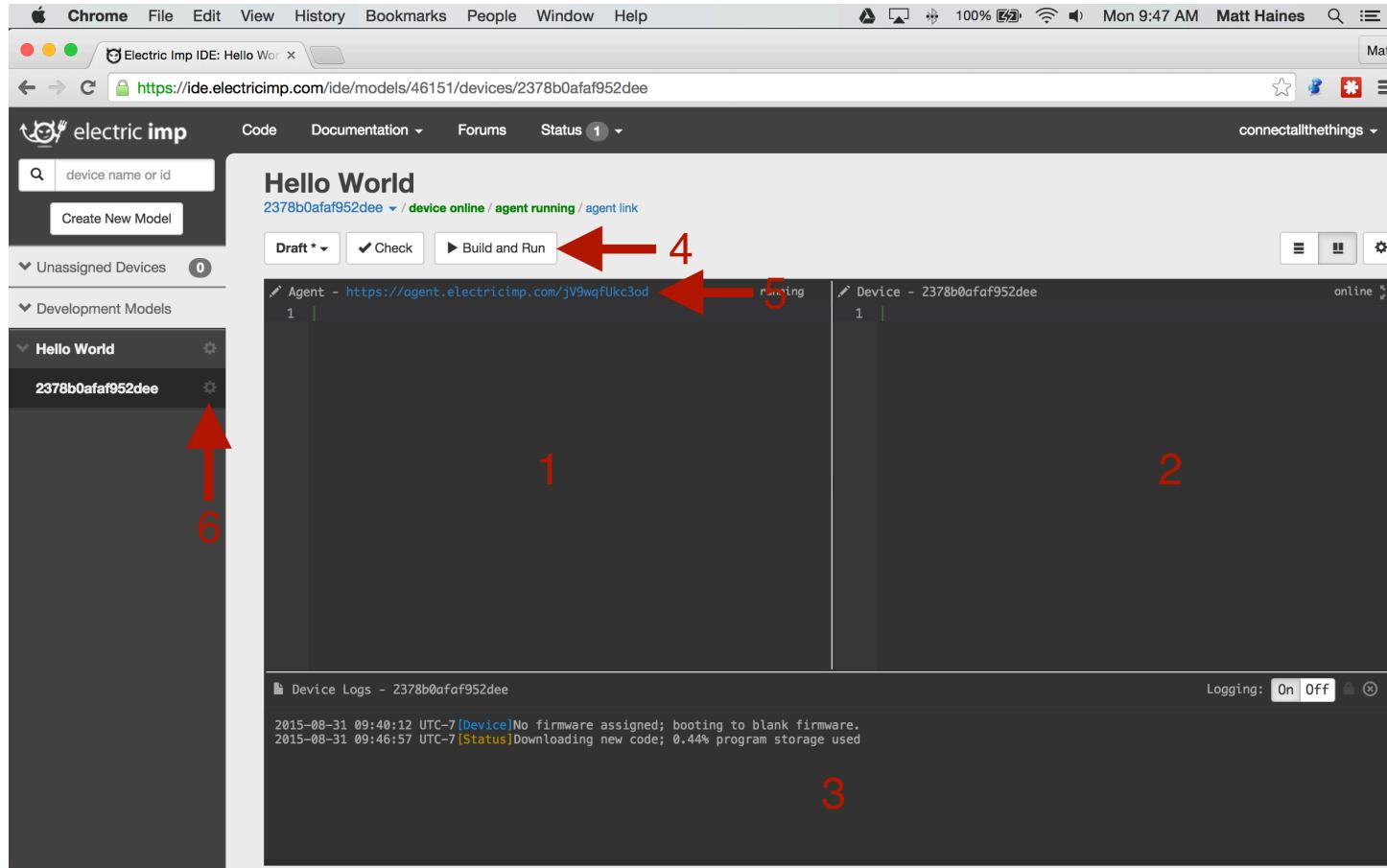


- Select "New Model"
- Enter a Model Name
- Click "Save Changes"



IDE Overview

ide.electricimp.com

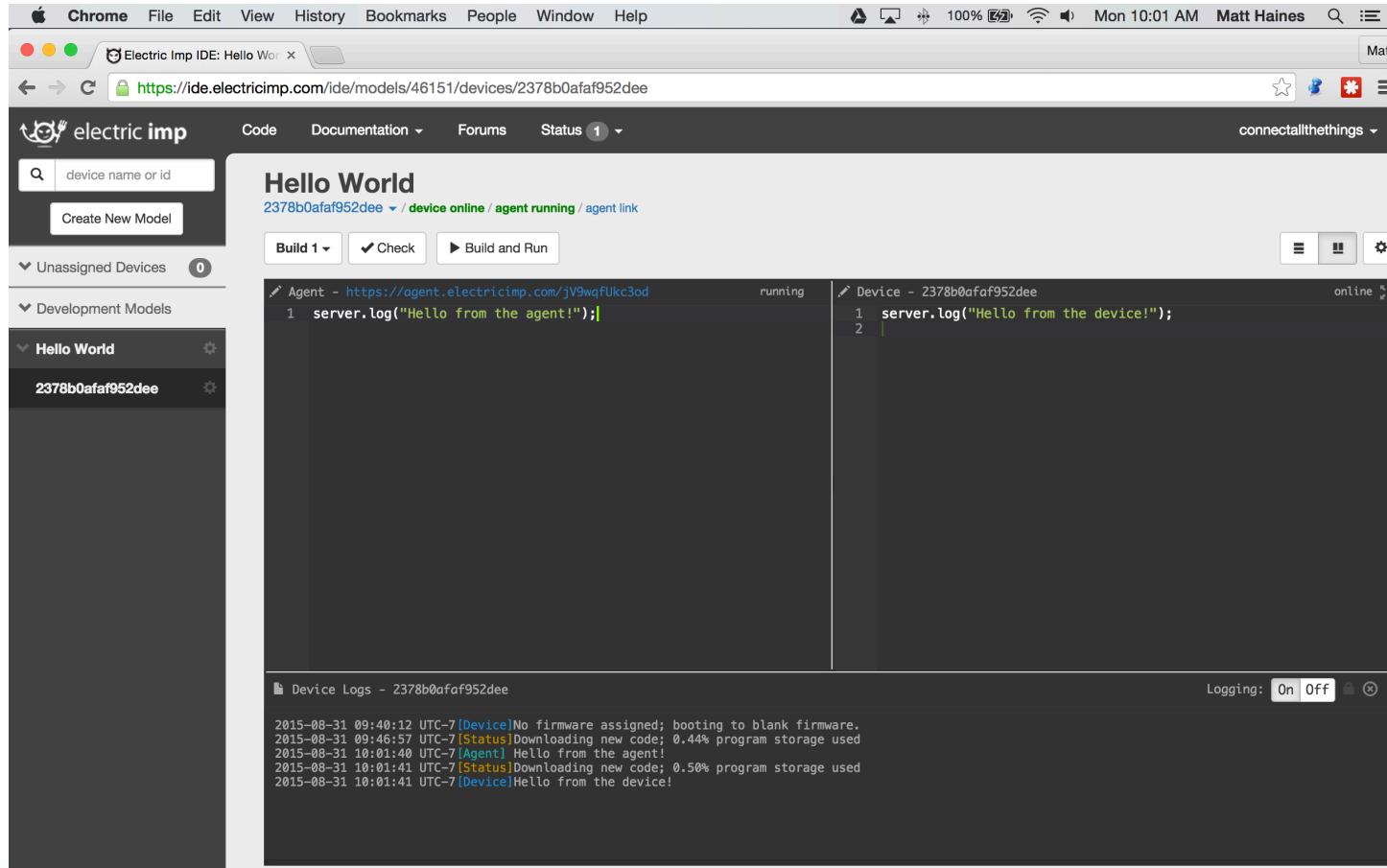


- 1 – Agent Code Window
- 2 – Device Code Window
- 3 – Log Window
- 4 – Build and Run
- 5 – Agent URL
- 6 – Device Settings Gear



Hello World!

ide.electricimp.com



- Copy Device Code
 - 1-HelloWorld/hello.device.nut
 - Copy Agent Code
 - 1-HelloWorld/hello.agent.nut
 - Build and Run
- Notes:
- server.log

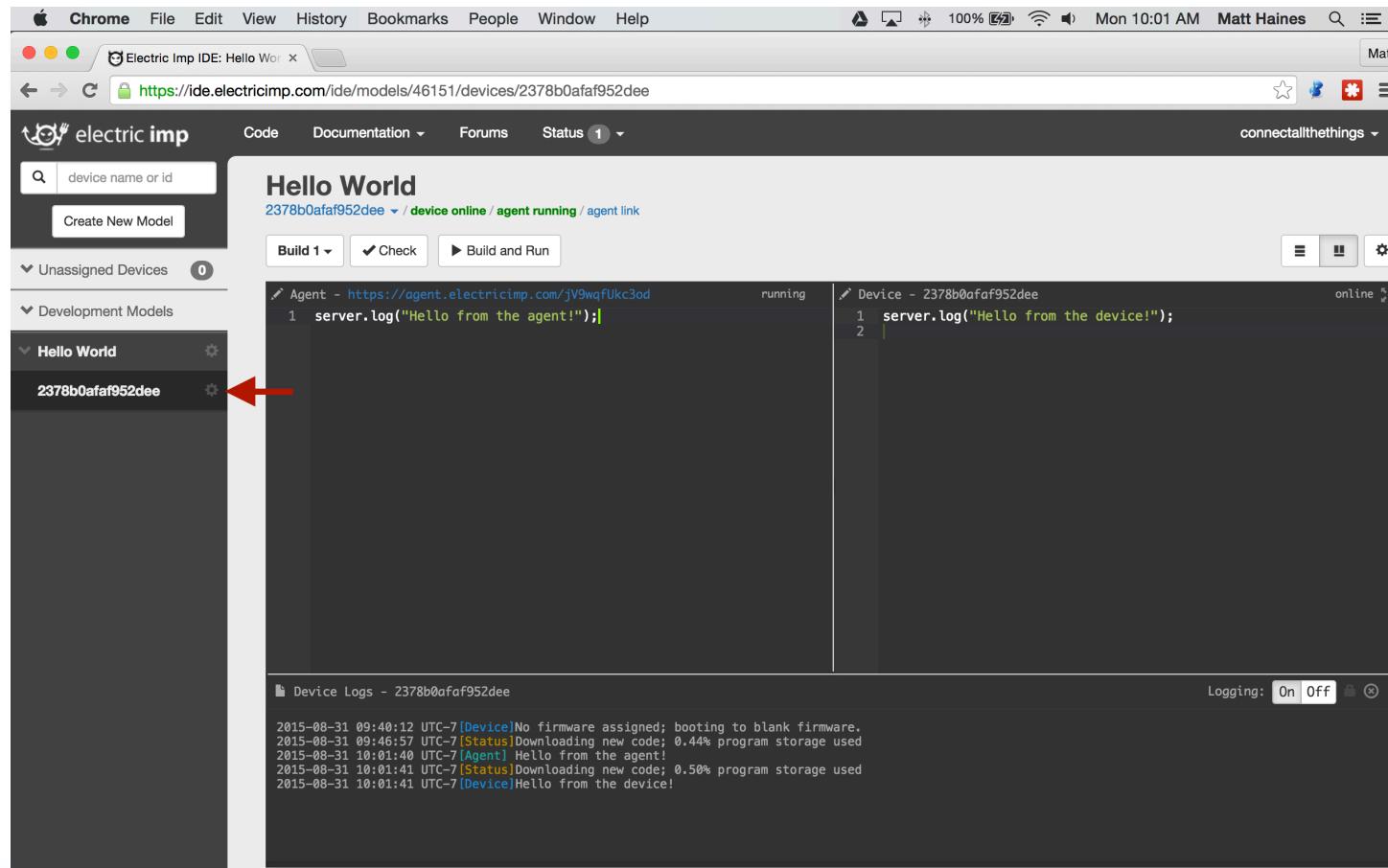


Part 2

Collecting Data

Create a New Model

ide.electricimp.com



The screenshot shows the Electric Imp IDE interface. On the left, there's a sidebar with sections for 'Unassigned Devices' (0), 'Development Models', and 'Hello World'. Under 'Hello World', the device ID '2378b0afaf952dee' is listed, with a red arrow pointing to the gear icon next to it. The main area displays two code editors: 'Agent' and 'Device'. Both contain the same code:1 server.log("Hello from the agent!");

```
1 server.log("Hello from the device!");  
2 |
```

A status bar at the bottom shows 'Device Logs - 2378b0afaf952dee' and a log entry:

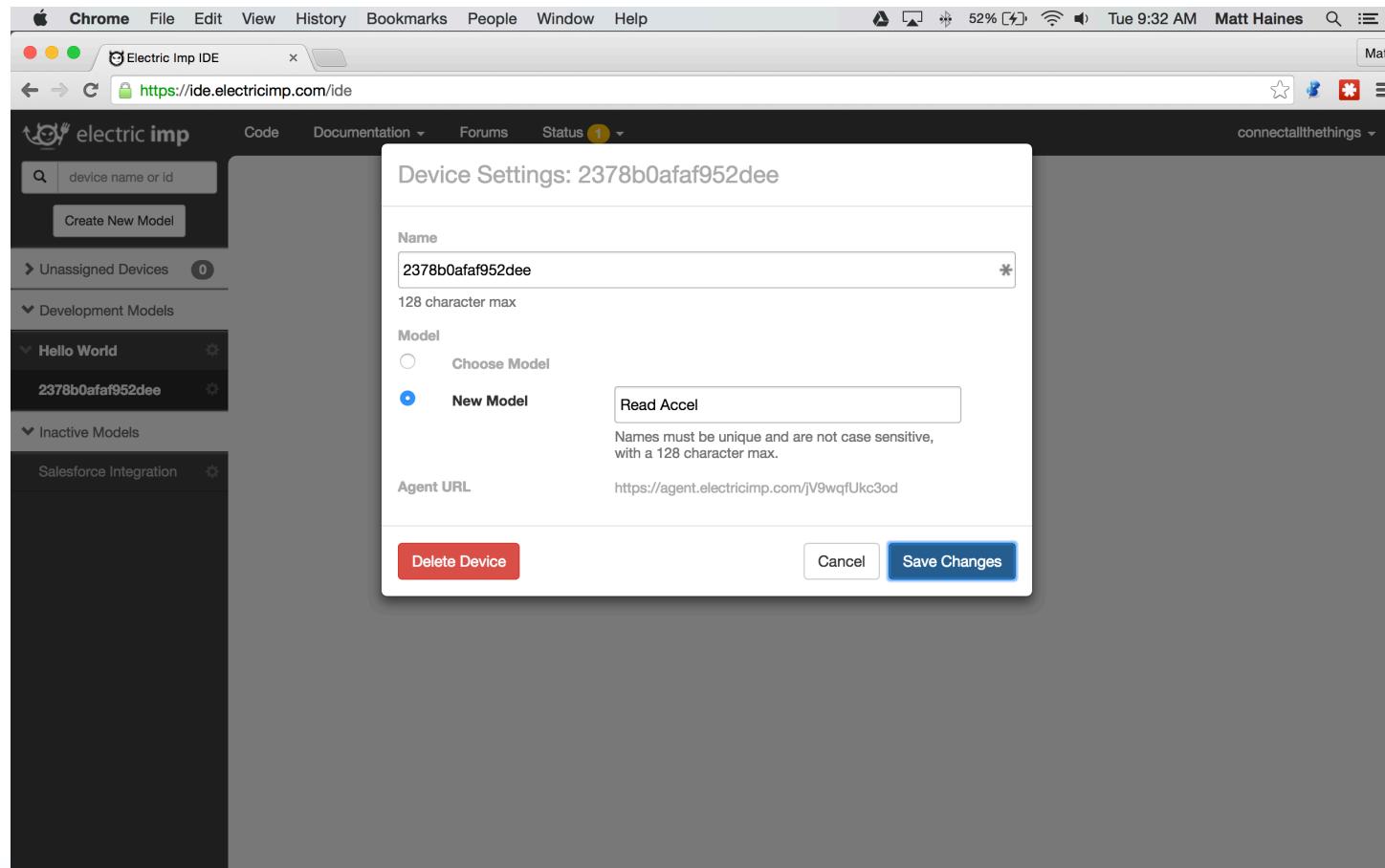
```
2015-08-31 09:40:12 UTC-7 [Device] No firmware assigned; booting to blank firmware.  
2015-08-31 09:46:57 UTC-7 [Status] Downloading new code; 0.44% program storage used  
2015-08-31 10:01:40 UTC-7 [Agent] Hello from the agent!  
2015-08-31 10:01:41 UTC-7 [Status] Downloading new code; 0.50% program storage used  
2015-08-31 10:01:41 UTC-7 [Device] Hello from the device!
```

- Click the Device Settings gear



Create a New Model

ide.electricimp.com



The screenshot shows a Chrome browser window for the Electric Imp IDE at <https://ide.electricimp.com/ide>. The main interface has a dark theme with some light-colored panels. On the left, there's a sidebar with sections like 'Unassigned Devices' (0), 'Development Models' (Hello World, 2378b0fafaf952dee), and 'Inactive Models'. The central area displays 'Device Settings' for device ID 2378b0fafaf952dee. A modal dialog is open, titled 'Device Settings: 2378b0fafaf952dee'. It contains fields for 'Name' (set to '2378b0fafaf952dee'), 'Model' (radio buttons for 'Choose Model' and 'New Model' (selected)), and 'Agent URL' (set to <https://agent.electricimp.com/jV9wqfUkc3od>). Below the modal are buttons for 'Delete Device', 'Cancel', and 'Save Changes'.

- Select New Model
- Enter a new Model Name
- Click "Save Changes"



Agent / Device Communication

ide.electricimp.com

The screenshot shows the Electric Imp IDE interface. The top navigation bar includes 'Chrome', 'File', 'Edit', 'View', 'History', 'Bookmarks', 'People', 'Window', 'Help', and system status indicators. The title bar says 'Electric Imp IDE: Read Accel'. The address bar shows the URL <https://ide.electricimp.com/ide/models/46154/devices/2378b0afaf952dee>. The main content area displays the 'Read Accel' model code, which contains application code for calculating 3D magnitude and handling impact events, and impact code for configuring interrupts. The code is color-coded for syntax. On the left, a sidebar lists 'Unassigned Devices', 'Development Models' (with 'Read Accel' selected), and 'Inactive Models'. A search bar at the top has 'device name or id' and a 'Create New Model' button. The bottom right corner shows a 'Logging' section with 'On' and 'Off' buttons.

- Copy Device Code
 - [2-ReadAccel/read.device.nut](#)
 - Copy Agent Code
 - [2-ReadAccel/read.agent.nut](#)
 - Build and Run

Notes:

 - #require
 - imp.wakeup
 - agent.send / device.on



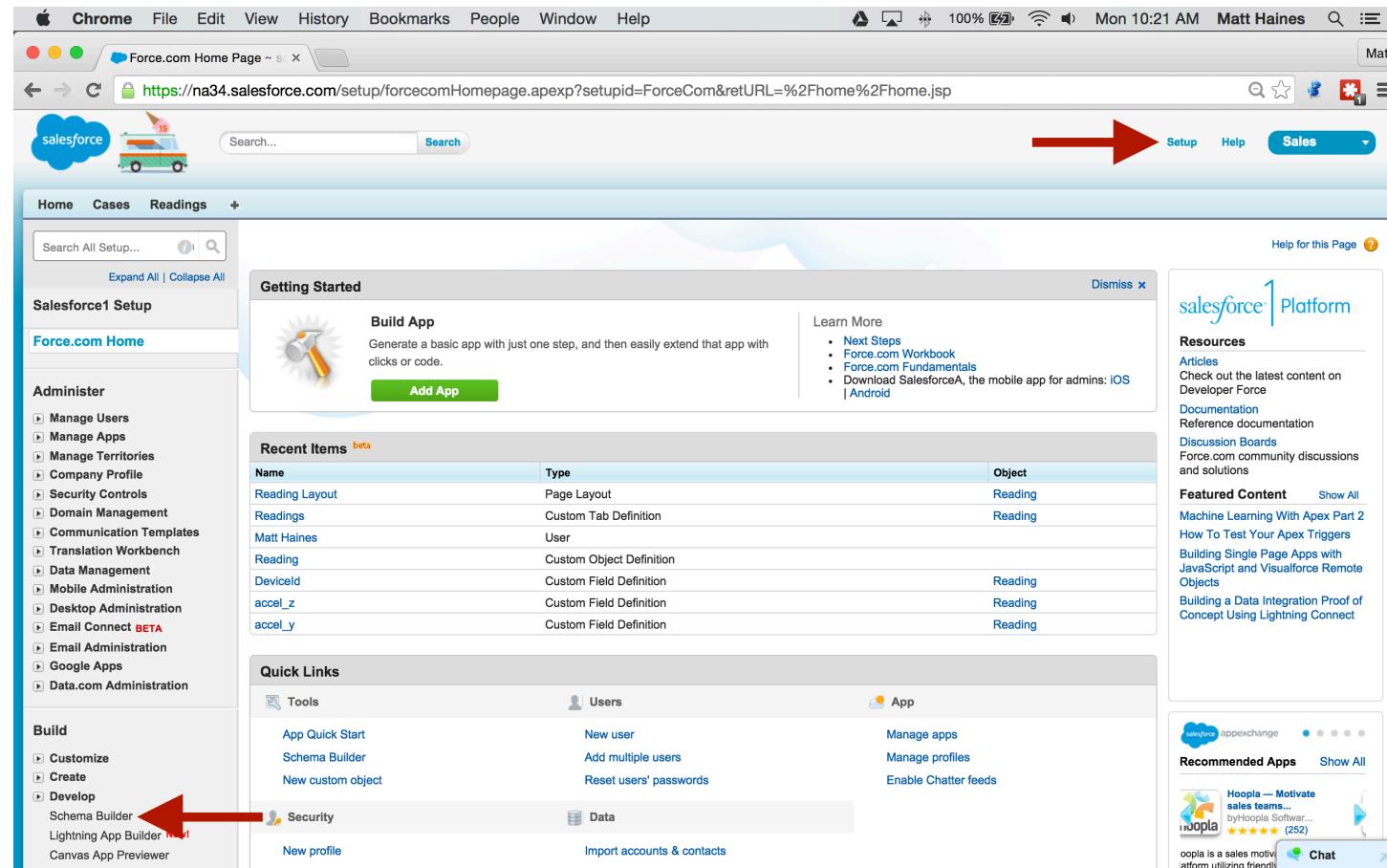
Part 3

Integrating with Salesforce



Create a Custom Object

developer.salesforce.com



A screenshot of a Chrome browser window displaying the Salesforce Developer Home Page. The URL is https://na34.salesforce.com/setup/forcecomHomepage.apexp?setupid=ForceCom&retURL=%2Fhome%2Fhome.jsp. The page features a navigation bar with links like Home, Cases, Readings, and a search bar. On the left, there's a sidebar with sections for Salesforce1 Setup, Force.com Home, Administer (with links for Manage Users, Manage Apps, etc.), and Build (with links for Customize, Create, Develop, Schema Builder, Lightning App Builder, and Canvas App Previewer). A red arrow points to the 'Schema Builder' link under the 'Develop' section. Another red arrow points to the 'Setup' button in the top right corner of the main content area. The main content area shows a 'Getting Started' section with a 'Build App' button and a 'Recent Items' table listing various objects like Reading Layout, Readings, Matt Haines, and several accel_* entries. To the right, there's a 'salesforce Platform' sidebar with links for Resources, Documentation, Discussion Boards, and Featured Content.

- Log into your Salesforce Developer Account
- Click Setup (top right corner)
- Open the Schema Builder



Create a Custom Object

developer.salesforce.com

Edit Object: Readings__c

Label	Reading
Plural Label	Readings
Starts With	Consonant
Object Name	Readings
Description	
Context-Sensitive Help Setting	<input checked="" type="radio"/> Open the standard Salesforce.com Help & Training window <input type="radio"/> Open a window using a Visualforce page
Record Name	ReadingId
Data Type	Auto Number
Display Format	R-{0000} Example: A-{0000} What Is This?
Starting Number	0
Allow Reports	<input type="checkbox"/>
Allow Activities	<input type="checkbox"/>
Track Field History	<input checked="" type="checkbox"/>
Available for Customer Portal	<input type="checkbox"/>
In Development	<input type="radio"/> In Development <input checked="" type="radio"/> Deployed
Namespace Prefix	

Save Cancel

- Create a new custom object with the following attributes
- Click "Save"



Create a Custom Object

developer.salesforce.com

Create Number Field (Object: Reading)

Field Label	accel_x	
Field Name	accel_x	
Description		
Help Text		
Default Value		
Length	4	Number of digits to the left of the decimal point
Decimal Places	4	Number of digits to the right of the decimal point
Required	<input type="checkbox"/> Always require a value in this field in order to save a record	
Unique	<input type="checkbox"/> Do not allow duplicate values	
External ID	<input type="checkbox"/> Set this field as the unique record identifier from an external system	
<input type="button" value="Save"/> <input type="button" value="Cancel"/>		

- Add three Number(4,4) fields
 - accel_x
 - accel_y
 - accel_z



Create a Custom Object

developer.salesforce.com

Create Text Field (Object: Reading)

Field Label	DeviceId
Field Name	DeviceId
Description	
Help Text	
Length	32
Default Value	
Required	<input checked="" type="checkbox"/> Always require a value in this field in order to save a record
Unique	<input checked="" type="checkbox"/> Do not allow duplicate values
Is Case Sensitive	<input checked="" type="radio"/> Treat "ABC" and "abc" as different values (case sensitive) <input type="radio"/> Treat "ABC" and "abc" as duplicate values (case insensitive)
External ID	<input checked="" type="checkbox"/> Set this field as the unique record identifier from an external system

Save Cancel

- Add a text field
 - DeviceId
- Ensure the following is set:
 - Length: 32
 - Require: Yes
 - Unique: Yes
 - Is Case Sensitive: (case sensitive)
 - External ID: Yes



Create a Custom Object

developer.salesforce.com

Reading	
accel_x	Number(4, 4)
accel_y	Number(4, 4)
accel_z	Number(4, 4)
Created By	Lookup(User)
DeviceId	Text(32) (External ID) (Unique Case Sensitive)
Last Modified By	Lookup(User)
Owner	Lookup(User+1)
ReadingId	Auto Number

Your custom object should look like following:

- accel_x: Number(4,4)
- accel_y: Number(4,4)
- accel_z: Number(4,4)
- DeviceID: Text(32), External ID

NOTE: Field names are case sensitive..



Create a Connected App

developer.salesforce.com

The screenshot shows the Salesforce Apps setup page. On the left, there's a sidebar with sections like 'Salesforce1 Setup', 'Force.com Home', 'Administer' (with links for Manage Users, Manage Apps, etc.), 'Build' (with 'Customize' and 'Create' options), and a bottom menu with 'Custom Labels', 'Interaction Log Layouts', and 'Objects'. A red arrow points to the 'Apps' link in the 'Build' section. Another red arrow points to the 'New' button in the 'Connected Apps' section.

Connected Apps

No Apps found.

- Click Setup
- Build -> Create -> Apps
- Connected Apps -> New



Create a Connected App

developer.salesforce.com

The screenshot shows the 'Connected App ~ salesforce' setup page in a Chrome browser. The URL is <https://na34.salesforce.com/app/mgmt/forceconnectedapps/forceAppEdit.apexp>. The page is titled 'Salesforce1 Setup' and contains sections for 'Basic Information' and 'API (Enable OAuth Settings)'. In the 'Basic Information' section, fields include 'Connected App Name' (Devices), 'API Name' (Devices), 'Contact Email' (me@example.com), 'Logo Image URL' (Upload logo image or Choose one of our sample logos), 'Icon URL' (Choose one of our sample logos), 'Info URL', and 'Description'. The 'API (Enable OAuth Settings)' section has 'Enable OAuth Settings' checked, 'Callback URL' set to <https://agent.electricimp.com/jV9wfUkc3od>, and 'Selected OAuth Scopes' containing 'Access and manage your data (api)'. The left sidebar shows navigation links for Administer, Build, and Develop.

- Enter require information
- Enable OAuth Settings
- Add "Access and Manage your data (api)" to OAuth scope
- Click "Save"



Create a Connected App

developer.salesforce.com

The screenshot shows the Salesforce Connected App setup page for an app named 'Devices'. The page includes fields for API Name (Devices), Contact Email (me@example.com), and Contact Phone. It also displays OAuth settings with Consumer Key and Consumer Secret values highlighted in red. The sidebar on the left shows various Salesforce setup categories like Administer, Build, and Apps.

Connected App Name
Devices

Version 1.0
API Name Devices
Created Date 8/31/2015 10:39 AM
By: Matt Haines
Contact Email me@example.com
Contact Phone
Last Modified Date 8/31/2015 10:39 AM
By: Matt Haines
Description
Info URL

API (Enable OAuth Settings)
Consumer Key 3MVG9KI2HHAq33RzrMnYqXQLP8jCRGjx3NaivNRf4rA1QRGVoD8jQ10vB49UeXd.a7.sZ14ud4ohC8oUtif Consumer Secret 4743670508693418514
Selected OAuth Scopes Access and manage your data (api)
Callback URL https://agent.electricimp.com/JV9wqfUkc3od

Trusted IP Range for OAuth Web server flow New
No records to display

Custom Attributes New
No records to display

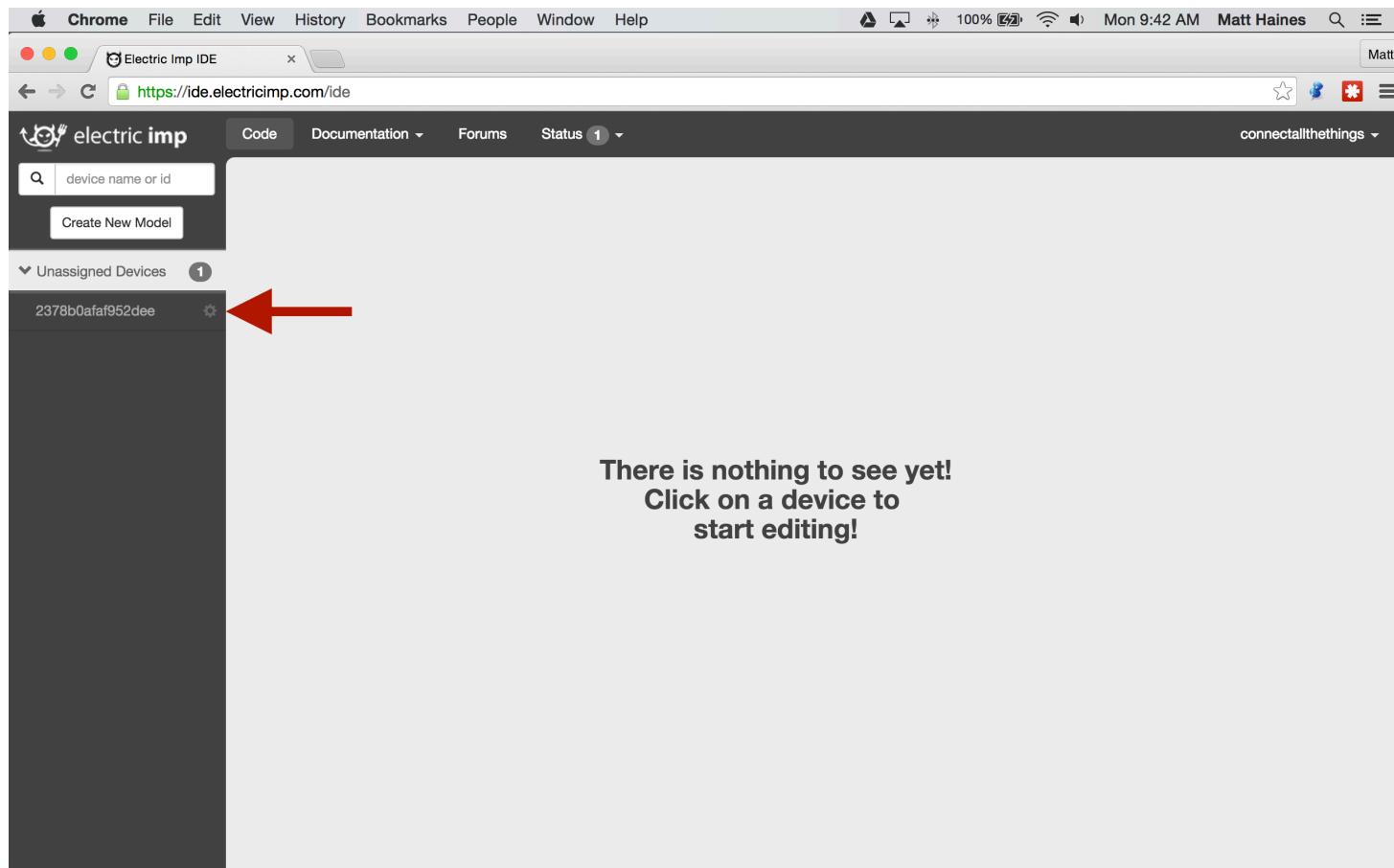
- Click "Revel Secret"
- Copy the "Consumer Key"
- Copy the "Consumer Secret"

We'll be using these in the next step



Create a New Model

ide.electricimp.com



- Open the IDE
- Click the Device Settings Gear



Create a New Model

ide.electricimp.com

Device Settings: 2378b0fafaf952dee

Name
2378b0fafaf952dee

Model
 Choose Model
 New Model

Salesforce Integration
Names must be unique and are not case sensitive, with a 128 character max.

Agent URL
https://agent.electricimp.com/jV9wqfUkc3od

Delete Device Cancel Save Changes

Device Logs - 2378b0fafaf952dee

```
2015-09-01 09:52:03 UTC-7 [Agent] Got a reading: 0.992735G (X: -0.0614375, Y: 0.250813, Z: 0.958562)
2015-09-01 09:52:04 UTC-7 [Agent] Got a reading: 0.998059G (X: -0.0633125, Y: 0.250875, Z: 0.963938)
2015-09-01 09:52:05 UTC-7 [Agent] Got a reading: 0.995902G (X: -0.0650625, Y: 0.25025, Z: 0.96175)
2015-09-01 09:52:06 UTC-7 [Agent] Got a reading: 0.984673G (X: -0.0616875, Y: 0.243625, Z: 0.952062)
2015-09-01 09:52:07 UTC-7 [Agent] Got a reading: 0.991725G (X: -0.0605625, Y: 0.251563, Z: 0.957375)
2015-09-01 09:52:08 UTC-7 [Agent] Got a reading: 0.994359G (X: -0.0644375, Y: 0.249313, Z: 0.966437)
2015-09-01 09:52:09 UTC-7 [Agent] Got a reading: 0.994726G (X: -0.0605, Y: 0.254125, Z: 0.959813)
2015-09-01 09:52:10 UTC-7 [Agent] Got a reading: 0.996948G (X: -0.0635625, Y: 0.252625, Z: 0.962313)
2015-09-01 09:52:11 UTC-7 [Agent] Got a reading: 1.00013G (X: -0.06375, Y: 0.247938, Z: 0.966812)
2015-09-01 09:52:12 UTC-7 [Agent] Got a reading: 0.993181G (X: -0.0625625, Y: 0.250625, Z: 0.959)
```

- Select New Model
- Enter a new Model Name
- Click "Save Changes"



Insert your OAuth Settings

ide.electricimp.com

The screenshot shows the Electric Imp IDE interface. On the left, the sidebar lists 'Development Models' and 'Salesforce Integration' (selected). Under 'Salesforce Integration', the device '2378b0fafaf952dee' is selected. The main area displays the 'Salesforce Integration' code for the device. A red box highlights the configuration constants at the top:

```
const CLIENT_ID = "3MVG9KIZHHAq3RzrMnYqX0LP8jCRGjx3NaiNRf4r8A";
const CLIENT_SECRET = "4743670508693418514";
const LOGIN_HOST = "login.salesforce.com";
```

The code also includes comments for hardware configuration, IMU setup, and accelerometer enablement. Below the code editor is a log window showing device activity:

```
2015-08-31 10:48:21 UTC-7 [Agent] Got a reading: 0.989907G (X: -0.104, Y: 0.08925, Z: 0.980375)
2015-08-31 10:48:22 UTC-7 [Agent] Got a reading: 0.99546G (X: -0.10125, Y: 0.0908125, Z: 0.986125)
2015-08-31 10:48:23 UTC-7 [Agent] Got a reading: 0.998214G (X: -0.102812, Y: 0.089375, Z: 0.988675)
2015-08-31 10:48:24 UTC-7 [Agent] Got a reading: 0.999091G (X: -0.103937, Y: 0.09025, Z: 0.989563)
2015-08-31 10:48:25 UTC-7 [Agent] Got a reading: 0.998988G (X: -0.103437, Y: 0.089, Z: 0.98625)
2015-08-31 10:48:26 UTC-7 [Agent] Got a reading: 0.996286G (X: -0.104125, Y: 0.0890625, Z: 0.986812)
2015-08-31 10:48:27 UTC-7 [Agent] Got a reading: 0.996712G (X: -0.104, Y: 0.0885, Z: 0.987312)
2015-08-31 10:48:28 UTC-7 [Agent] Got a reading: 0.989964G (X: -0.103562, Y: 0.090375, Z: 0.980375)
2015-08-31 10:48:29 UTC-7 [Status] Downloading new code; 0.4% program storage used
2015-08-31 10:48:29 UTC-7 [Agent] Got a reading: 0.995404G (X: -0.105, Y: 0.088625, Z: 0.985875)
```

- Copy the Device Code

- [3-Salesforce/salesforce.device.nut](#)

- Copy the Agent Code

- [3-Salesforce/salesforce.agent.nut](#)

- Copy the Consumer Key to ln 7

- Copy the Secret to ln 8

Notes:

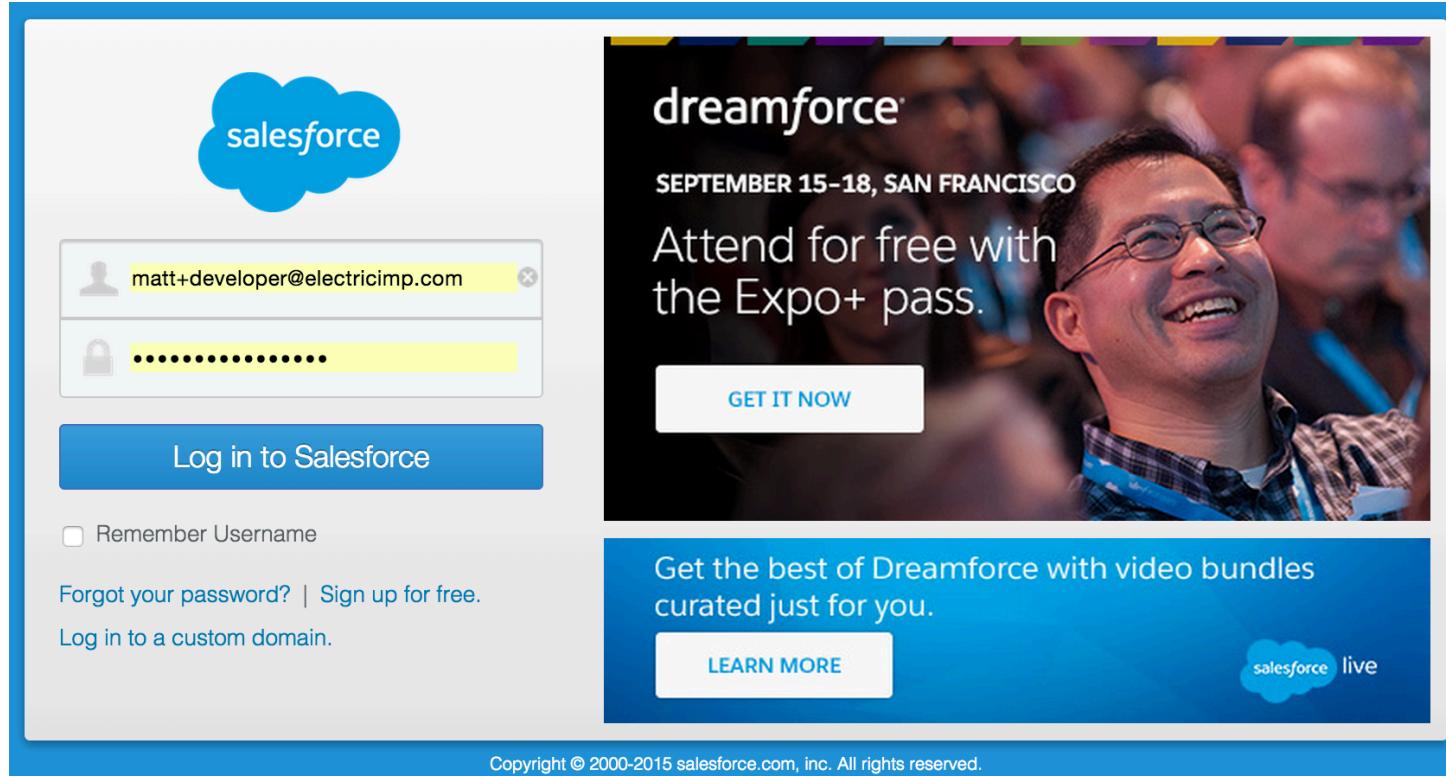
- Salesforce Library

- Rocky Library & HTTP Handlers



Authorize Your App

agent.electricimp.com/:agentId



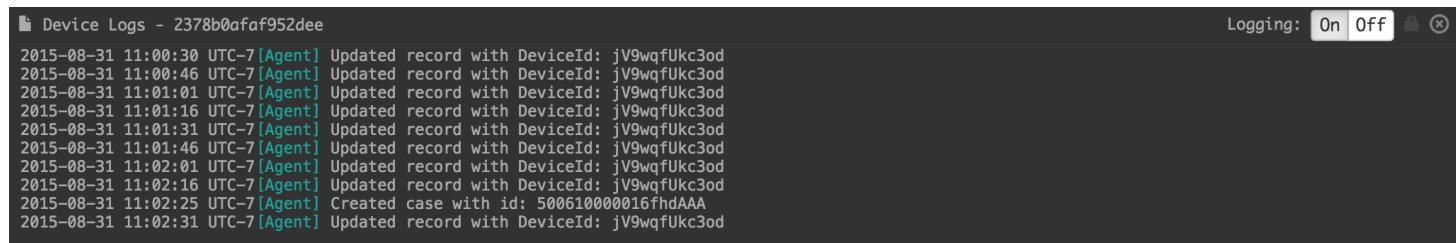
- Click on the Agent URL
- Log into Salesforce



Check the Logs (and Salesforce)

ide.electricimp.com

- Device updates a record in Salesforce every 15 seconds
- Device will open a case in Salesforce if it exceeds 1.5 G



Device Logs - 2378b0afaf952dee

Logging: On Off

```
2015-08-31 11:00:30 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:00:46 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:01:01 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:01:16 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:01:31 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:01:46 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:02:01 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:02:16 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
2015-08-31 11:02:25 UTC-7 [Agent] Created case with id: 500610000016fhdAAA
2015-08-31 11:02:31 UTC-7 [Agent] Updated record with DeviceId: jV9wqfUkc3od
```



What's Next

We're collecting accelerometer data, and...

- We can collect any other kind of data:
 - Other sensor information
 - Debug ports (field retrofits), etc

We are storing data in a custom object and creating cases, and...

- We can setup more complex custom objects and relationships
- We can setup custom workflows and analytics:
 - Better customer service through predictive maintenance and more consistent touch points
 - Improved product / customer experience through usage metrics
 - More efficient service calls, truck rolls, etc



