



TECHNOLOGY CAMP

DAY 4 : INTERNET-OF-THINGS

Introduction to Internet-of-Things

Session 1



YELLOW CIRCLE INC
PO Box 2383
Elk Grove, CA 95759-2383

Teacher Lesson Plan

Introduction to Internet-of-Things

Session Name:

Introduction to Internet-of-Things

Summary:

The internet of things is expanding rapidly. The number and types of objects being connected to the internet is increasing exponentially. From smartphones, and smart homes, to IoT connected medical devices, and industry, the IoT is an increasingly important part of everyday life.

Time Allotment:

65 minutes

Learning Objectives:

- *Define the IoT and describe how it is used*
- *Describe how the IoT works*
- *Define what is a Raspberry PI*
- *Describe how a Raspberry PI can be used in the IoT*
- *Learn how to use Node-RED on the Raspberry PI*

Supplies:

- *Scrap paper / notepad to take notes*
- *Laptop / computer with Internet access*
- *Raspberry Pi and connected breadboard with pre-built circuits*

Learning Activities:

- **(3 minutes) - Teacher Introduction**



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Introduction to Internet-of-Things

Introduce yourself to students. Provide your name, industry experience, current job, fun activities you do. This is session one, and a very good place to define some ground rules.

- **(4 minutes) - Volunteers Introduction**

Introduce volunteers that are present in the classroom. Teachers will be provided with a quick bio of each volunteer who are helping in the classroom.

- **(3 minutes) - Session overview**

The internet of things is expanding rapidly. The number and types of objects being connected to the internet is increasing exponentially. From smartphones, and smart homes, to IoT connected medical devices, and industry, the IoT is an increasingly important part of everyday life.

- **(3 minutes) – Discussion : What is IoT?**

IoT is short for Internet of Things. The Internet of Things refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems. - webopedia.com

https://www.webopedia.com/TERM/I/internet_of_things.html

What IoT Devices do you use right now? – Discuss different IoT technologies that students may use: smartphones, voice assistants, medical devices, security systems, etc.

- **(4 minutes) - Video - Internet of Things (IoT)**

<https://www.youtube.com/watch?v=sdpxddDzXfE>

Stop at 3:10 to skip ad

- **(8 minutes) – Activity: IoT Trivia**



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*Use the following questions to begin a discussion of the present and future of IoT. All questions are based on and additional trivia facts can be found at:
<https://www.comparitech.com/internet-providers/iot-statistics/>*

- In 2018, how many devices were connected to the internet?

7 Billion

- According to Gartner, how many things will be connected by the end of 2019?

14 Billion (est. 25 Billion by the end of 2021)

- What is the most commonly connected IoT device? How many were in use in 2018?

A Smartphone (over 3 Billion users)

- According to Gartner, by 2020, how many internet connected devices will there be for each person on the planet?

4 devices for each person on the planet. (How many do you have right now?)

- **(5 minutes) – What is the Raspberry Pi?**

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. ... It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games. ... [T]he Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras.-raspberrypi.org

<https://www.raspberrypi.org/help/what-%20is-a-raspberry-pi/>

- **(5 minutes) - Lab: Raspberry Pi Set up**



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- Please **do not** unplug or turn off the PI without shutting it down from the App Menu



(in the upper left corner). Doing so could corrupt the SD card.


- Open your laptop and double click on the VNC Viewer icon.



- Login using the default credentials:

- UserID: pi

- Password: raspberry

- When the Raspberry Pi desktop appears, click on the VNC icon  in the upper

Connectivity

right and note your IP address listed under Connectivity

 IP Address Here

- Open a new browser tab and enter **`http://{Your IP Address Here}:1880`** to start Node-RED

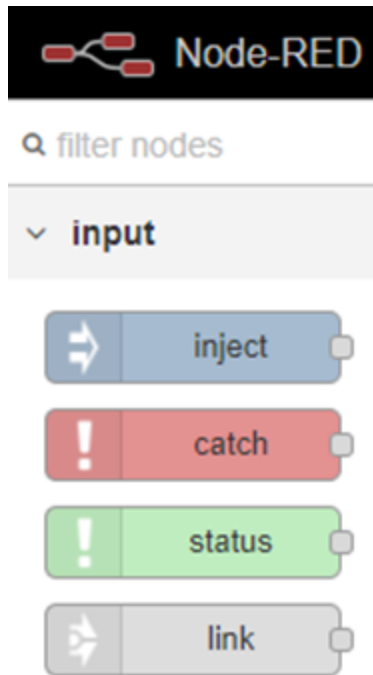
- **(5 minutes) - Video : Node-RED Introduction**

<https://www.youtube.com/watch?v=vYreeoCoQPI>

- **(10 minutes) – Activity: Build Node-RED Flows**

Explain that Node-RED is a visual tool to build programs that allow your Raspberry Pi to control external devices. The programs are called flows and are built by connecting blocks from the menu on the right called nodes. Double clicking a node will present a slide out menu that allows you to set the properties for that node as we will see in the lessons.

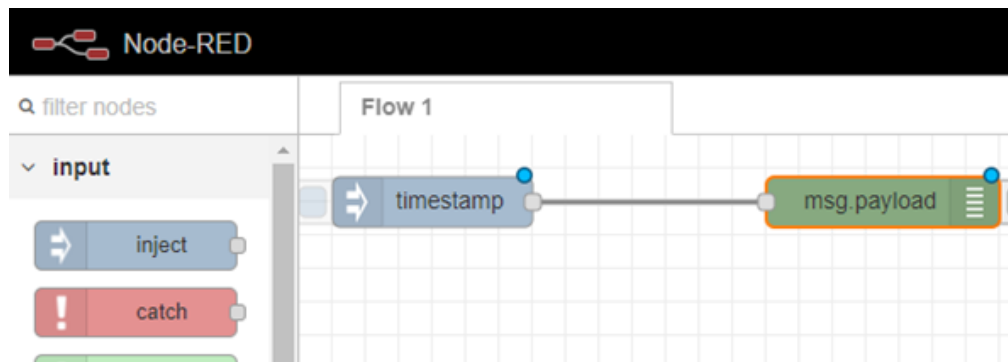
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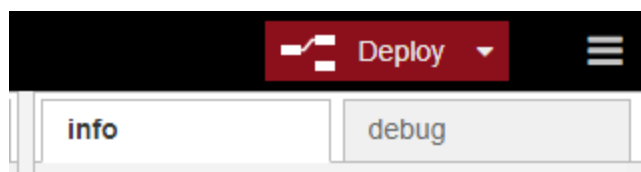
Building a Node-RED Flow that outputs to Debug

1. Select the inject node and drag it to the Flow 1 work area. Notice that the default for this node is to inject a time stamp. We will leave this for now and adjust it later
2. Now we need an output. Select the debug node and drag it to the Flow 1 work area. Notice the default is `msg.payload`.
3. Click on the box on the right side of the timestamp node and drag a "wire" to the `msg.payload` node. When you are done, your work area should look something like this:

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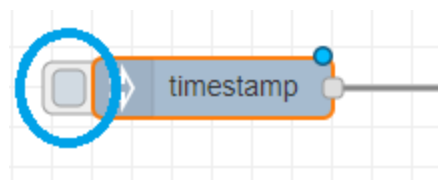
4. When you build or change a flow, you must deploy the changes before you can test it. Select deploy from the upper right of your screen to deploy your flow.



5. Once your deploy is successful, you will see a notification at the top center of the work area. You are now ready to test your flow. Notice that the deploy button is greyed out as there are no active changes to deploy.

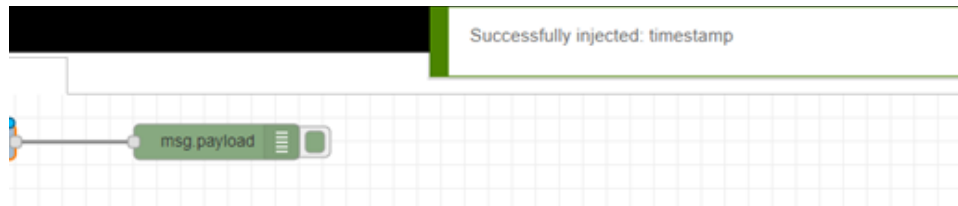


6. You are now ready to test your first flow. Click on the button to the right of the timestamp node. (Note: The blue circle in the upper right of the node is an indicator that there are parameters available to be set. We will look at that soon.)

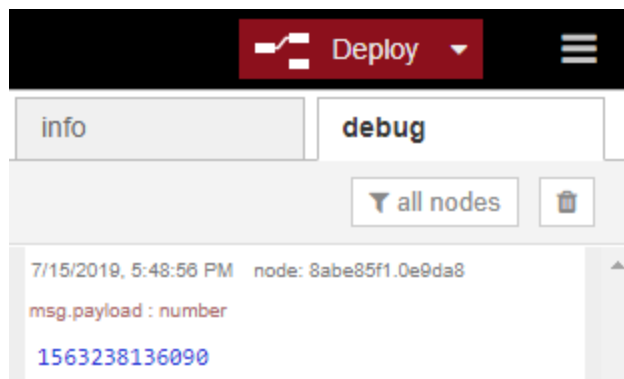


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7. The notification at the top center confirms your flow ran successfully.



8. To see what the output looks like, click on the debug tab on the left to see the timestamp message payload delivered to debug



9. Now let's look at some of the options for the inject node (currently using the default timestamp). Double click on the node to open the node properties.

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Edit inject node

Delete


Cancel

Done

▼ node properties

 Payload

▼ timestamp


 Topic

☐


Inject once after

0.1

seconds, then

 Repeat

none ▼

 Name

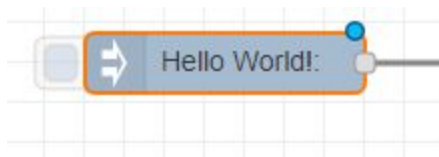
Name

Note: "interval between times" and "at a specific time" will use cron.
"interval" should be less than 596 hours.
See info box for details.

10. Click the Payload dropdown to see the different options that are available. For this lesson, select string, enter a phrase in the Payload field (for this lesson we use Hello World) and then select done.

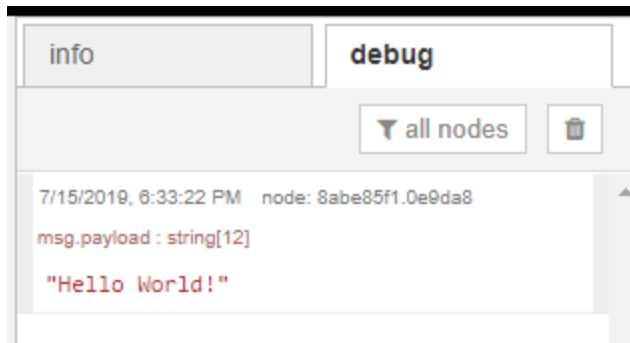
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11. Note that the inject node has now updated to the Topic Title “Hello World”. Notice also that the button to the right of the inject node is not available. This is because we have not yet deployed our changes.



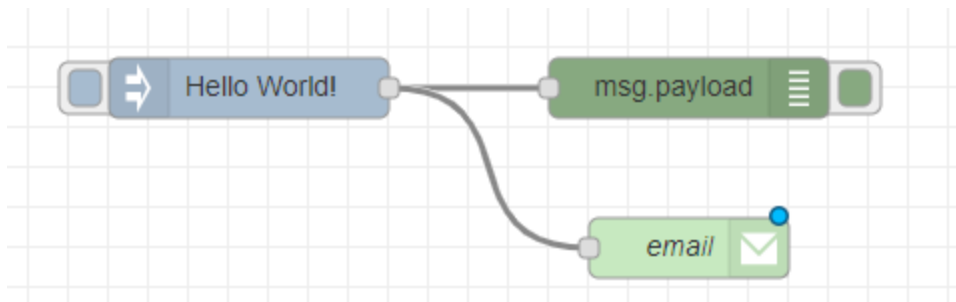
12. Test the changes by selecting Deploy and then checking the output in the debug tab. Notice the new entry below the timestamp. The “Hello World” payload has been delivered to the debug screen.

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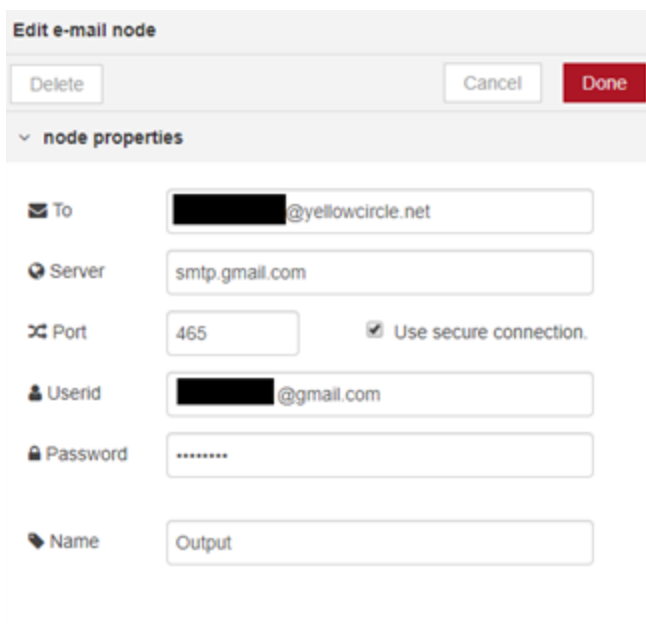
Building a Node-RED Flow that outputs to Debug and sends an email

1. Inputs can have more than one output event. In this example, begin the flow we created previously. Then, select the email output node (connection point on the left of the node) from the social section, drag it to the workspace and connect it to the inject node.



2. Double click on the email node and complete the properties in the Edit e-mail node slide out menu and Select Done and then Deploy. Use the Server name and port number provided below. You will need to use a Google account credentials for this exercise.

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Edit e-mail node

Delete Cancel Done

node properties

To [redacted]@yellowcircle.net

Server smtp.gmail.com

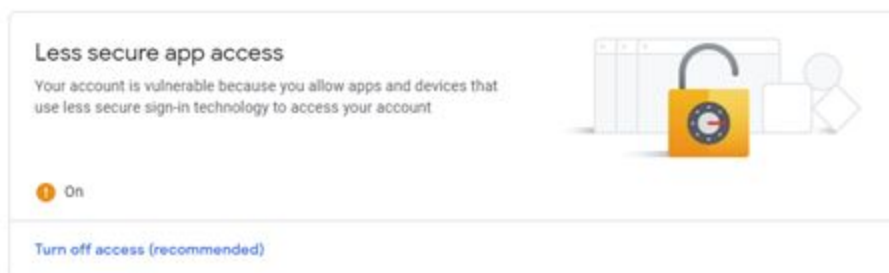
Port 465 ☒ Use secure connection.

Userid [redacted]@gmail.com

Password

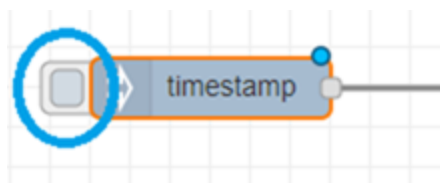
Name Output

3. **Important:** To access the Google SMTP server. Your Google account must be set to allow Less secure App access. The setting is available from your Google Account Settings Security Tab.



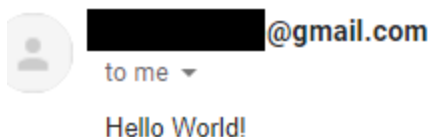
4. Click the button in the inject node. Note that the debug tab displays the payload message. Open the email account from the "To" email node properties to see the delivery of the payload in an email.

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```
7/15/2019, 6:48:30 PM node: 8abe85f1.0e9da8  
msg.payload : string[12]  
"Hello World!"
```

Message from Node-RED Inbox x



- (15 minutes) Try It!
 - *Modify the flows you built.*
 - *Build your own flows.*
 - *Experiment with using different options and not the results.*

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- **(5 minutes) Closing / Wrap-up**

- *Define the IoT and describe how it is used*
- *Describe how the IoT works*
- *Define what is a Raspberry PI*
- *Describe how a Raspberry PI can be used in the IoT*
- *How to use Node-RED on the Raspberry PI*

- **(1 minutes) - What's next?**

Inform students to head back to the cafeteria for snacks / break, and remind them to use the restroom before next session starts.



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