Learning Lab: Internet of Things (IOT)
2025/26 winter semester | module |

Assignment 05: First Steps in Node-Red

Objectives

- Creating understanding for Node-Red
- Compiling a first flow in Node-Red
- Creating a user interface with a dashboard

Required Equipment

- Installed and running Raspberry Pi with OS
- Connection to the Internet
- Power supply for the Pi
- Monitor with HDMI cable
- Keyboard and Mouse connected via USB
- Attached SenseHat

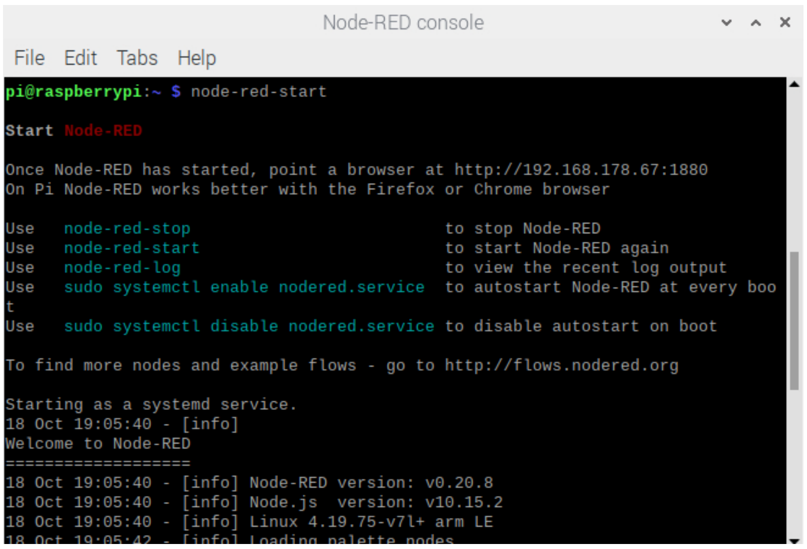
Solutions Steps

In our previous examples we always had to send commands via the screen to control our lamps or displays or to activate the sensors. We lack a possibility to automate this. Therefore we use a software: Node-Red.

Node-RED (www.nodered.org) is a visual tool for creating event-driven applications or "Flow-based programming for the Internet of Things", amongst many other uses. It is browser based and enables you to wire a whole host of different inputs and outputs together, with functions and other application logic.

Step 1: Startup Node-Red

- Connect to your Raspberry Pi and check your Node-RED installation Start Node-RED with the command `node-red-start`

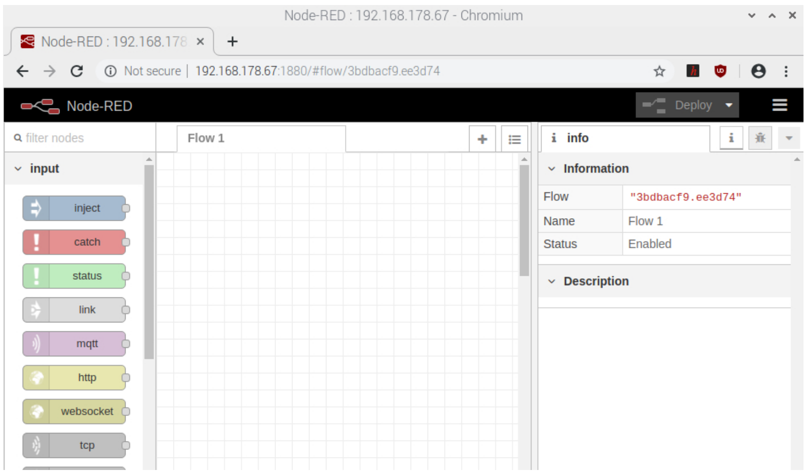


```
pi@raspberrypi:~ $ node-red-start

Start Node-RED

Once Node-RED has started, point a browser at http://192.168.178.67:1880
On Pi Node-RED works better with the Firefox or Chrome browser

Use   node-red-stop                          to stop Node-RED
Use   node-red-start                         to start Node-RED again
Use   node-red-log                           to view the recent log output
Use   sudo systemctl enable nodered.service  to autostart Node-RED at every boo
t
Use   sudo systemctl disable nodered.service to disable autostart on boot

To find more nodes and example flows - go to http://flows.nodered.org

Starting as a systemd service.
18 Oct 19:05:40 - [info]
Welcome to Node-RED
===================
18 Oct 19:05:40 - [info] Node-RED version: v0.20.8
18 Oct 19:05:40 - [info] Node.js  version: v10.15.2
18 Oct 19:05:40 - [info] Linux 4.19.75-v7l+ arm LE
18 Oct 19:05:42 - [info] Loading palette nodes
```

and - don't do it now - stop it with `node-red-stop`

- Open Node-RED in a browser. You can then access the Node-RED editor by pointing your browser at `http://<RASPBERRY_IP_ADDRESS>:1880` (type yourself or copy & paste from terminal window output).

  Hint: <RASPBERRY_IP_ADDRESS> is just a placeholder for your Raspberry Pi's IP address which you found out in assignment 2.

Flow	"3bdbacf9.ee3d74"
Name	Flow 1
Status	Enabled

  You see the workspace. The main workspace is where flows are developed by dragging nodes from the palette and wiring them together. On the left side you see the palette. The palette contains all of the nodes that are installed and available to use.

Step 2: Our first flow

1. Add an Inject node The `Inject node` allows you to inject messages into a flow, either by clicking the button on the node, or setting a time interval between injects.

   Just try and drag and drop the inject node.

2. Add a Debug node

   The `Debug node` (see output nodes) causes any message to be displayed in the Debug sidebar. By default, it just displays the payload of the message, but it is possible to display the entire message object.

3. Wire the two together

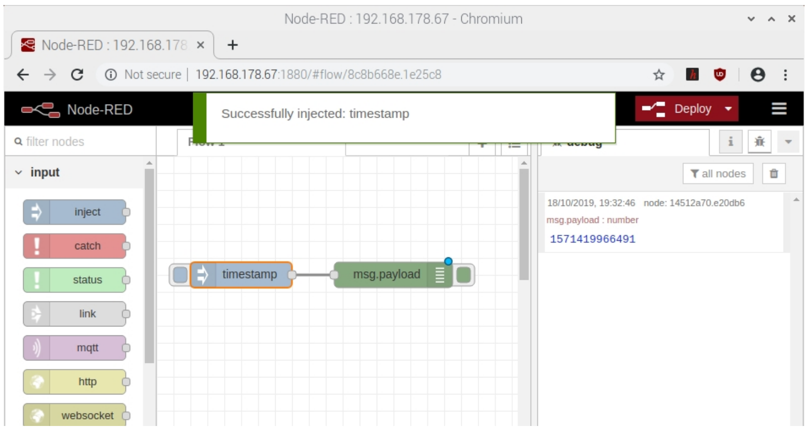
   Connect the `Inject` and `Debug nodes` together by dragging between the output port of one to the input port of the other.

4. Deploy

   At this point, the nodes only exist in the editor and must be deployed to the server. Click the `Deploy` button.

5. Inject

   Switch to the debugging window on the right sidebar by clicking the icon `debug` (= bug symbol). Click on the left side of the `timestamp button` to trigger an event. You should see numbers appear in debugging window (at the right sidebar). By default, the Inject node uses the number of milliseconds since January 1st, 1970 as its payload (the default setting). Let's do something more useful with that.



Successfully injected: timestamp

```
18/10/2019, 19:32:46   node: 14512a70.e20db6
msg.payload : number
1571419966491
```

6. Add a Function node

   The messages between the nodes are simple JavaScript objects. JavaScript is another programming language that is integrated into websites and interpreted by the web browser, i.e. executed on the computer of the specific person.

   Therefore, the `function` node allows you to pass each message though a JavaScript function and modify it (https://nodered.org/docs/user-guide/writing-functions).

   - Delete the existing wire (select it and hit delete on the keyboard).
   - Wire the `Function node` in between the Inject and Debug nodes.
   - Double-click on the `Function node` to bring up the edit dialog. Copy the following code into the function field (if you type it, you could skip the comments //)
   - Name the function toDate.

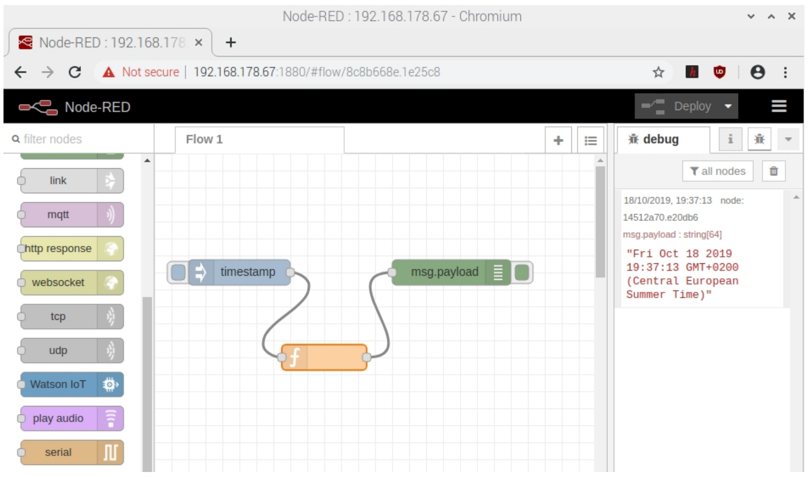
   We use the function node for manipulating the messages. The message is passed in as an object called `msg` (and must always return a msg object). `payload` is one properties (attributes) of the object `msg`. Do you know the structure of an object in Python?

   ```
   // Create a Date object from the payload
   var date = new Date(msg.payload);
   // Change the payload to be a formatted Date string
   msg.payload = date.toString();
   // Return the message so it can be sent on
   return msg;
   ```

   With msg.payload we get the value of the attribute payload of the object msg. We use the (predefined constructor) Date to get an new object. With date.toString() we use an inbuilt function (of Javascript) to convert the object's content into a string.

7. Deploy the model:

   Click Done to close the edit dialog and then click the deploy button. Now when you click the Inject button, the messages in the sidebar will be more readable time stamps.



```
18/10/2019, 19:37:13   node: 14512a70.e20db6
msg.payload : string[64]
"Fri Oct 18 2019 19:37:13 GMT+0200 (Central European Summer Time)"
```

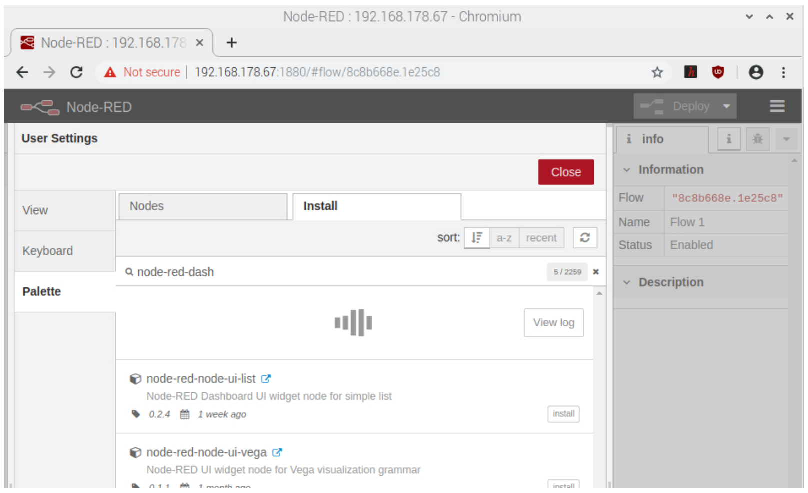
8. Test: Just click on the inject node and change the repeat to interval (every 5 sec). Done and deploy! What happened?

9. Deactivate Debugging: On the right side of the debug node, find a green switch for activating / deactivating debugging mode.

   Deactivate debugging for `msg.payload` by clicking the green box on right side of `msg.payload`. Now the message `Successfully deactivated: Debug` appears. (If you click again, the debugging mode will be activated again.) You can use the `switch` to stop or start the output to that particular debug node. Turn off the output by clicking the switch. The data stops scrolling in the debug panel. We will need that later.

Step 3: Dashboard

- Of course, it would be nice to display important information in a more readable way. Therefore, let's use the `node red dashboard`. Install dashboard nodes: Go to preferences (on the right side with three -), manage palette and install `node-red-dashboard` (just search for it) choose install and again install in the pop-up which appears. It last some minutes and will show a message of installed palettes. Press close afterwards.



node-red-dash 5 / 2259

Flow	"8c8b668e.1e25c8"
Name	Flow 1
Status	Enabled

node-red-node-ui-list
Node-RED Dashboard UI widget node for simple list
0.2.4 1 week ago

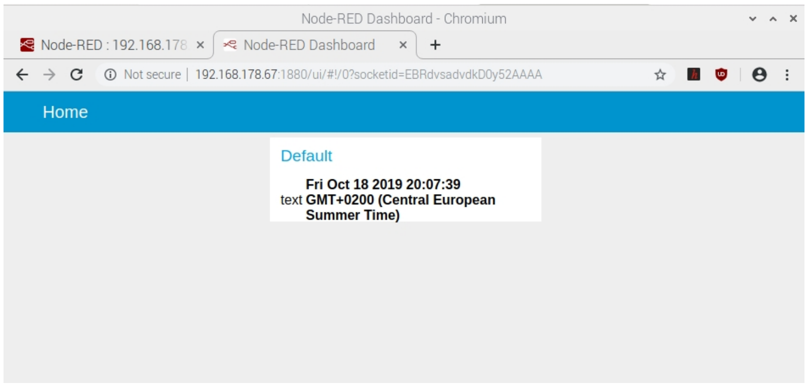
node-red-node-ui-vega
Node-RED UI widget node for Vega visualization grammar

- New nodes are added to your palette (see nodes)

- Now, let use it:

  - Add a text node (the one with the one dot/ connector on the left side): Use the text node and wire it after the `toDate` function node from your last flow.
  - Configure it (not configured nodes are marked with a red triangle). Give the node a name `TIME`, an label `TIME` and add it to an existing group. If no group exists, create the new group `GROUP1`. If required add a new tab `TAB1` for the group.
  - Deploy

- Browse your dashboard: Deploy your flow and browse to your dashboard. Point your browser to http://<RASPBERRY_IP_ADDRESS>:1880/ui in a new tab.


Node-RED Dashboard - Chromium
Node-RED : 192.168.178
Node-RED Dashboard
Not secure | 192.168.178.67:1880/ui/#!/0?socketid=EBRdvsadvdkD0y52AAAA
Home

Default

text Fri Oct 18 2019 20:07:39 GMT+0200 (Central European Summer Time)

- Congratulations! Your Node-RED dashboard is running. Now you can design your user interface!

Further Inputs

Javascript Introduction https://www.w3schools.com/js/js_intro.asp

Raspberry Pi with Node-RED Tutorial #2 – Make a user interface https://www.youtube.com/watch?v=UKv4_jvPtr4

Hints

If your SenseHAT gets disconnected, try to change from python3 to python2 in the following folder: (open the explorer, type the following path) home/pi/.node-red/node_modules/node-red-node-pi-sense-hat/sensehat

Useful Resources for Own Searches

Retrospective

Please answer the following questions

1. What are the differences between Node-RED and other programming languages?
2. What is msg.payload for?
3. Why do I need to deploy?

and document each answer.

Source(s)

- https://nodered.org/docs/getting-started/first-flow