

Seminario 4: Node-RED

Sistemas Distribuidos

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Sección 1 | Introducción

Introducción

Node-RED

- Entorno gráfico de desarrollo para construir aplicaciones Javascript
- Funciona sobre Node.js
- Open Source y diseñado por IBM
- Node-RED 1.0 fue publicado en 2019
- Su principal objetivo es simplificar el desarrollo de aplicaciones orientadas al manejo de eventos asíncronos



Instalación

Instalación en Linux:

- 1 Descargamos la información de todas las fuentes configuradas:

```
$ sudo apt-get update
```

- 2 Instalamos el sistema de gestión de paquetes por defecto para Node.js:

```
$ sudo apt-get install npm
```

- 3 Instalamos Node-RED:

```
$ sudo npm install -g -unsafe-perm node-red
```

La opción `-g` añade el comando node-red al PATH

- 4 Comprobamos Node-RED se ha instalado correctamente:

```
$ node-red -help
```

Nos debe aparecer la ayuda del comando `node-red` junto a la versión

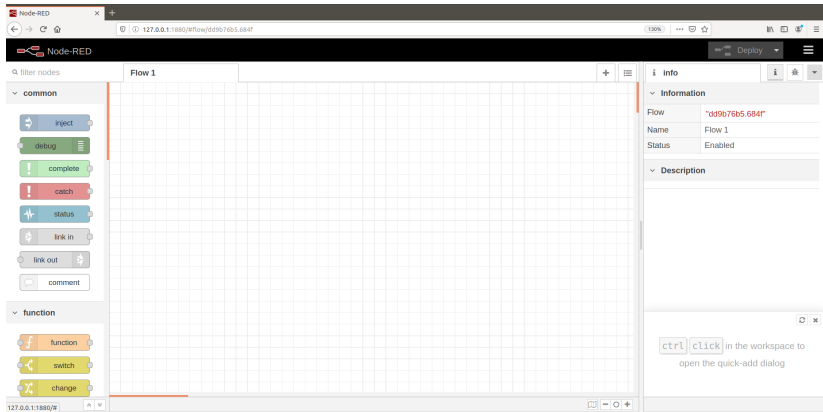
Instalación en Windows: <https://nodered.org/docs/getting-started/windows>

Lanzando Node-RED Localmente

- 1 Desde la terminal ejecutamos el comando:
`$ node-red`
- 2 Entre la información mostrada debe aparecer la dirección en la que está corriendo:
`[info] Server now running at http://127.0.0.1:1880/`
- 3 Accedemos a la dirección indicada a través del navegador web.

Lanzando Node-RED Localmente

Nos aparecerá la Interfaz de Usuario de Administración de Node-RED



Sección 2 | Conceptos Básicos

Conceptos Básicos

Node

- Unidad básico de construcción
- Bloque de software que procesa mensajes
- Puede tener entradas y salidas que permiten el paso de mensajes entre nodos
- Una entrada puede aceptar conexiones de múltiples nodos y una salida puede, también, dar salida a múltiples nodos

Conceptos Básicos

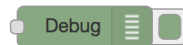
Inject Node

- Nodo de salida
- Producen mensajes sin necesidad de entrada



Debug Node

- Nodo de entrada
- Se utiliza para mostrar mensajes de depuración en el editor



Conceptos Básicos

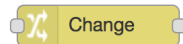
Function Node

- Nodo de entrada/salida
- Permite ejecutar código `JavaScript` sobre los mensajes que pasan por él



Change Node

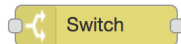
- Nodo de entrada/salida
- Puede utilizarse para modificar las propiedades de un mensaje y establecer propiedades de contexto sin tener que recurrir a un `Function Node`



Conceptos Básicos

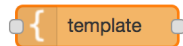
Switch Node

- Nodo de entrada/salida
- Permite enrutar los mensajes a diferentes ramas evaluando un conjunto de reglas en cada mensaje



Template Node

- Nodo de entrada/salida
- Usado para generar texto mediante una plantilla usando las propiedades de un mensaje
- Utiliza el lenguaje de plantillas **Mustache**

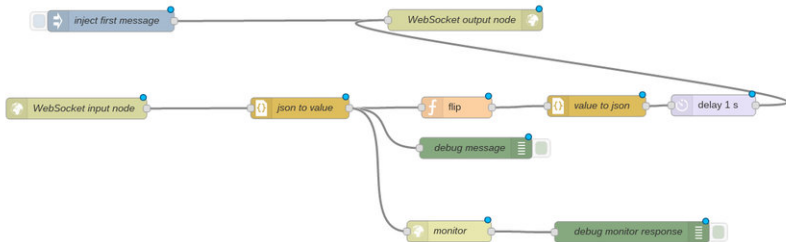


Mustache: <https://mustache.github.io/mustache.5.html>

Conceptos Básicos

Flow

- Una colección de nodos **conectados** entre sí y funcionando como una aplicación o programa
- Cada flujo puede tener un nombre y una descripción que se muestra en la barra lateral de información
- Todos los nodos de un flujo pueden acceder al mismo **contexto de flujo**



Conceptos Básicos

Message

- Es la información que se pasa entre los nodos de un flujo
- Son simples JavaScript Objects que pueden tener cualquier conjunto de propiedades (payload)
- En el editor aparecerán como `msg`
- El valor de una propiedad puede ser cualquier tipo de JavaScript válido, como:
Boolean (`true`, `false`), Number (`5`, `23.56`), String (`"Hello"`), Array (`[1,2,3,4]`), Object (`{'a':1, 'b':2}`) o Null
- Cuidado, se usa el formato JSON, JSON \neq Javascript Object

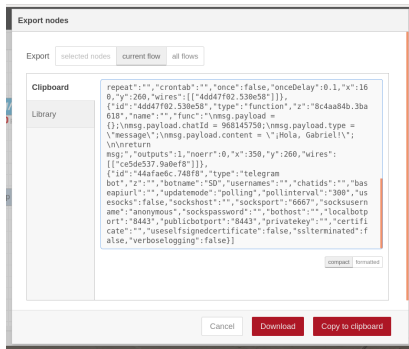
Wire

- Conectan los nodos y representan cómo los mensajes pasan a través del flujo

Conceptos Básicos

Context

- Utilizado para almacenar información que puede ser compartida entre diferentes nodos sin usar los mensajes que pasan a través de un flujo
- Alcance:
 - **Node**: solo visible para el nodo que almacena el valor
 - **Flow**: visible para todos los nodos que comparten el mismo flujo
 - **Global**: visible a todos los nodos
- Por defecto, el contexto se almacena solo en memoria, es decir, su contenido se borra cada vez que Node-RED se reinicia



Sección 3 | Creando Flujos

Hola Mundo

The screenshot displays the Node-RED web interface in a browser. The main workspace, titled 'Flow 1', contains a flow with two nodes connected in sequence: a blue 'inject' node labeled 'Hola Mundo' and a green 'msg.payload' node. The left sidebar shows the 'common' and 'function' node categories. The right sidebar features a 'debug' console with a list of messages. Each message entry includes a timestamp, a node ID, and the payload value 'Hola Mundo'.

Timestamp	Node ID	msg.payload
18/4/2020 20:17:18	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:20	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:22	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:24	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:26	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:28	node: 8232033e.b9aca	string[10]
18/4/2020 20:17:30	node: 8232033e.b9aca	string[10]

Switch & Template Nodes

The screenshot shows the Node-RED web interface in a browser. The main workspace displays a flow named "Flow 5". On the left, there are two panels: "common" and "function". The "common" panel contains nodes like inject, debug, complete, catch, status, link in, link out, and comment. The "function" panel contains function and switch nodes. In the workspace, four inject nodes are connected to a central "switch" node. The inject nodes are labeled "Hola", "55", and two "inject" nodes. The "switch" node has three outgoing connections to "Saludo", "Número", and a "template" node. The "template" node is connected to a "msg.payload" node. On the right, a "debug" console shows the output of the flow. The output shows messages being routed to "Saludo" and "Número" based on their content, and then to the "template" node which outputs a string message.

```

graph LR
    subgraph Inputs
        direction TB
        I1[inject: Hola]
        I2[inject: 55]
        I3[inject]
        I4[inject]
    end
    I1 --> S[switch]
    I2 --> S
    I3 --> S
    I4 --> S
    S --> Saludo[Saludo]
    S --> Numero[Número]
    S --> Template[template]
    Template --> Payload[msg.payload]
  
```

Debug Console Output:

```

18/4/2020 20:59:46 node: Saludo
msg.payload: string[4]
"Hola"

18/4/2020 21:00:06 node: Número
msg.payload: number
55

18/4/2020 21:00:14 node: 8e301d38 c88b58
msg.payload: string[51]
"El coche Ford Focus tiene un precio de 15000 euros!"

18/4/2020 21:01:22 node: 8e301d38 c88b58
msg.payload: string[51]
"El coche Seat Ibiza tiene un precio de 5000 euros!"

18/4/2020 21:01:36 node: 8e301d38 c88b58
msg.payload: string[51]
"El coche Ford Focus tiene un precio de 15000 euros!"
  
```

Function Node

The screenshot shows the Node-RED web interface in a browser. The main workspace displays a flow diagram with the following components:

- Inject Nodes:** Two inject nodes labeled "Dólar" and "Euros" are connected to a function node.
- Function Node:** A node labeled "Cambia divisa" (Change currency) receives input from the inject nodes and outputs to two message payload nodes.
- Message Payload Nodes:** Two "msg.payload" nodes receive data from the function node. One is connected to a "Plantilla Euros" template node, and the other is connected to a "Plantilla Dólares" template node.
- Output:** Both template nodes are connected to a final "msg.payload" node, which outputs the converted values.

The right sidebar shows the "debug" console with the following log entries:

```

divisa: "euro"
cantidad: 4.5
18/4/2020 22:51:44 node: 61bd3d37.5d2e9c
msg.payload : Object
  divisa: "euro"
  cantidad: 4.5
  cambio: object
    divisa: "dólar"
    cantidad: 4.905
18/4/2020 22:51:44 node: 90a7cb88.5f3d88
msg.payload : string[15]
"4.5$ son 4.905€"
18/4/2020 22:52:33 node: 90a7cb88.5f3d88
msg.payload : string[27]
"4.5€ son 4.1400000000000001$"
18/4/2020 22:52:36 node: 90a7cb88.5f3d88
msg.payload : string[15]
"4.5$ son 4.905€"
  
```

Context

The screenshot shows the Node-RED web interface. On the left, the 'common' and 'function' node palettes are visible. The main workspace shows a flow with a 'timestamp' node connected to 'Función 1', which is connected to 'Función 2'. The 'Edit function node' dialog is open for 'Función 2', showing the following JavaScript code:

```

1 var i = global.get('contador') || 0;
2 i++;
3 msg.payload = "F2: Contador = " + i;
4 global.set('contador',i);
5 return msg;

```

The 'Outputs' field is set to 1. The 'debug' console on the right shows the following log entries:

```

*F1: Contador = 1*
19/4/2020 0:14:54 node: fbacb324.8eac3
msg.payload: string[16]
*F2: Contador = 2*
19/4/2020 0:14:58 node: fbacb324.8eac3
msg.payload: string[16]
*F1: Contador = 3*
19/4/2020 0:14:58 node: fbacb324.8eac3
msg.payload: string[16]
*F2: Contador = 4*
19/4/2020 0:15:01 node: 931f76cc.aa01e8
msg.payload: string[16]
*F3: Contador = 5*
19/4/2020 0:15:10 node: fbacb324.8eac3
msg.payload: string[16]
*F1: Contador = 6*
19/4/2020 0:15:10 node: fbacb324.8eac3
msg.payload: string[16]
*F2: Contador = 7*

```

Sección 4 | Sockets y HTTP

UDP

The screenshot shows the Node-RED web interface in a browser. The main workspace displays a flow named "Flow 1" on a grid. The flow starts with a "udp 20001" node (grey) that connects to a "function" node (orange). From the function node, three lines connect to "msg.port", "msg.ip", and "Cliente" nodes (all green). These three nodes then connect to a "udp :" node (grey). The left sidebar shows the "common" and "function" node categories. The right sidebar contains a "debug" console with the following log entries:

```
19/4/2020 14:02:48 node: Cliente
msg.payload : buffer[73]
▼ buffer[73] | string
Holy cow, Rick! I didn't know hanging out with you was making me smarter!

19/4/2020 14:05:10 node: Cliente
msg.payload : string[73]
"Holy cow, Rick! I didn't know hanging out with you was making me smarter!"

19/4/2020 14:05:11 node: ca9dad43.d3d9f8
msg.ip : string[9]
"127.0.0.1"

19/4/2020 14:05:11 node: 9d338ff.03f328
msg.port : number
51129
```

GET Request

The screenshot displays the Node-RED web interface in a browser. The address bar shows the URL `127.0.0.1:1880/#flow/6229679a.372a56`. The interface is divided into three main sections: a left sidebar with node categories, a central workspace, and a right sidebar with a debug console.

Left Sidebar (Nodes):

- function** (orange): function, switch, change, range, template, delay, trigger, exec, rbe.
- network** (purple): mqtt in, mqtt out.

Central Workspace (Flow 3):

- An **inject** node (blue) is connected to an **http request** node (yellow).
- The **http request** node has two outgoing paths:
 - One path goes to a **msg.payload** node (green).
 - Another path goes to a **function** node (orange) labeled "Convertir K a °", which is then connected to a **template** node (orange).

Right Sidebar (Debug Console):

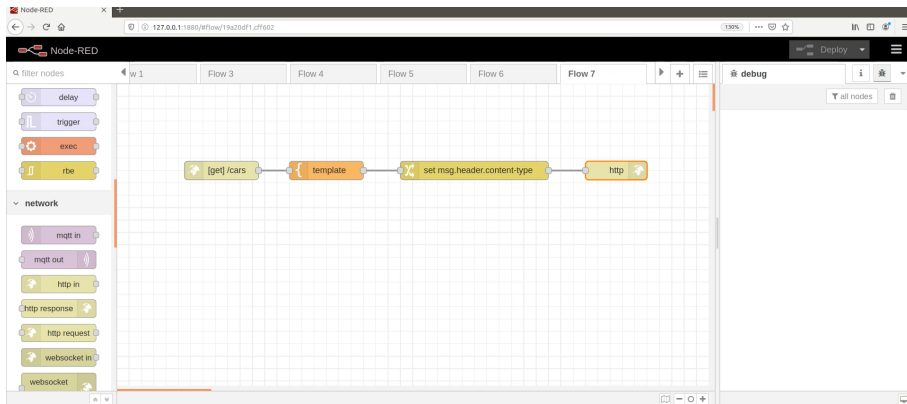
The debug console shows three messages with the following payloads:

```
19/4/2020 15:30:06 node: de5b08ce.d4d7b6  
msg.payload : Object  
> { coord: object, weather:  
  array[1], base: "stations", main:  
    object, visibility: 10000 - }  
19/4/2020 15:30:06 node: de5b08ce.d4d7b6  
msg.payload : string[32]  
"En Cadiz hay 21.410000000000025"  
19/4/2020 15:30:30 node: de5b08ce.d4d7b6  
msg.payload : Object  
> { coord: object, weather:  
  array[1], base: "stations", main:  
    object, visibility: 10000 - }  
19/4/2020 15:30:30 node: de5b08ce.d4d7b6  
msg.payload : string[34]  
"En Seville hay  
23.3799999999999995"
```


Endpoint GET + HTML Response

The screenshot displays the Node-RED web interface in a browser. The address bar shows the URL `127.0.0.1:1880/hola/Co`. The interface includes a sidebar on the left with a 'filter nodes' search bar and a 'network' category expanded, listing various input and output nodes. The main workspace shows a flow named 'Flow 5' with three nodes connected in sequence: a yellow '[get] /hola/nombre' node, an orange 'template' node, and a green 'http' node. The right sidebar contains a 'debug' tab and a 'Deploy' button. The bottom status bar shows zoom controls and a refresh icon.

Endpoint GET + JSON Response



Endpoint POST + JSON Response

The screenshot displays the Node-RED web interface in a browser. The address bar shows the URL `127.0.0.1:1880/#flow/a85b8515.cb3d28`. The interface includes a left sidebar with a node palette, a central workspace, and a right sidebar with a debug console.

Node Palette:

- filter nodes
- trigger
- exec
- rbe
- network
- mqtt in
- mqtt out
- http in
- http response
- http request
- websocket in
- websocket out
- tcp in

Flow 10:

```
graph LR; A["[post] /hello"] --> B["f"]; B --> C["http"];
```

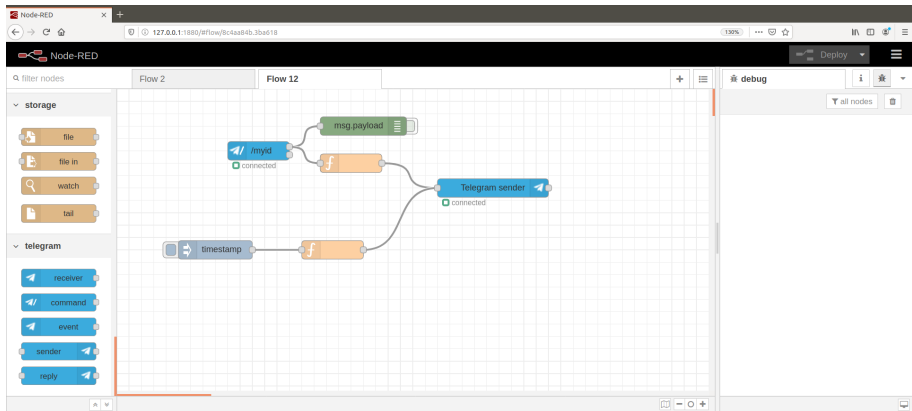
The flow consists of three nodes connected in sequence: a `[post] /hello` node (green), a function node `f` (orange), and an `http` node (green).

Right Sidebar:

- debug console (active)
- all nodes
- info
- logs

Sección 5 | Extensiones

Telegram



Sección 6 | Bibliografía

Bibliografía

- <https://nodered.org/docs/>
- <https://flows.nodered.org/node/node-red-contrib-telegrambot>