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Web and Apps
3) JSON

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JSON

- Last Week
- Introduction
- Basic JavaScript syntax
- JSON in Node Red
- More complicated example
- The change node
- Conclusion

Last Week

HTML / CSS

- **Page HTML contains tags**

```
<h1>Hello world</h1>
<div class="menu">
    <div class="menu_item"><a href="page1.html">Page Un</a>↘
    →</div>
    <div class="menu_item"><a href="page2.html">Page deux</a↘
    →></div>
</div>
```

- **HTML is represented by a Tree : The Document Object Model (DOM)**
  - Tags are nodes
  - Texts are leaves
- **Layout is written in CSS**
  - Nodes of a given tag : `tag`
  - nodes of a given class: `.class`
  - node having a given ID: `#id`
  - We define properties of the nodes of the DOM
  - Fonts, effects, colors, surroundings.

Introduction

JavaScript Object Notation - JSON

- **Wikipedia:**
  avaScript Object Notation (JSON) is an open standard file format, and data interchange format, that uses human-readable text to store and transmit data objects consisting of attribute-value pairs and array data types.
- **Transfer format**
  - Between an App and a server
  - Between a Web Client side application (JavaScript in the browser) and a server
  - Between two servers

JSON syntax

- Strings are enclosed in double quotes
  - `"Hello world"`
- Lists are represented with square brackets
  - `["A","B'',"C","D"]`
- Objects are represented with curly brackets
  - `{}`
- Objects contain `key : value` pairs
  - `{"color":"red", "taste": "sweet", "name": "orange"}`
- Objects and lists can be mixed

Example1 JSON

- **Data for one patient**

```
{
  "first_name" : "John",
  "last_name" : "Smith",
  "weight" : 80,
  "height" : 1.80,
  "city" : "Biel",
  "country" : "Switzerland"
}
```

Example 2 JSON

- **List of temperatures**

```
[
  {
      "temperature" : 37.3,
      "date" : "12/02/2020"
  },
  {
       "temperature" : 39.3,
       "date" : "13/02/2020"
  },
  {
       "temperature" : 37.9,
       "date":"15/02/2020"
   }
]
```

Example 3 JSON

- **List of patients**

```
[
 { "first_name" : "Johnny", "last_name" : "Smith", "weight" ↘
 →: 81, "height" : 1.80 }
 { "first_name" : "John", "last_name" : "Do", "weight" : 78, ↘
 →"height" : 1.70}
 { "first_name" : "Edith", "last_name" : "Mayer", "weight" : ↘
 →50, "height" : 1.60}
 { "first_name" : "Lili", "last_name" : "Baleine", "weight" : ↘
 →180, "height" : 1.65}
]
```

Exercise

- **Write a JSON structure for representing the following list of vital signs:**

Date	Sign	Value
3/03/2020	temperature	37.0
4/03/2020	temperature	39.0
4/03/2020	pulse	104
5/03/2020	BP	159/107

- **Insert this list into the data of Johny Smith with the key** `vital_signs`.

JavaScript

- **Node.js**
  - Is a framework working server side
  - Code is executed inside the server
  - Prepares data to be send to the client
- **Programming is done in JavaScript**
  - JavaScript is executed Server-side, inside the server
- **Node Red**
  - A visual framework for programming a Node.js server
  - Instructions are represented with nodes
  - Nodes can be programmed and configured in JavaScript
  - The nodes are executed inside the SERVER

Basic JavaScript syntax

Parsing and Serialization of JSON objects

- **Parse a JSON string into a JS-Object**
  - `JSON.parse()`

```
str = "{'val':'12', 'foo': 'bar'}";
obj = JSON.parse(str);
node.log(obj.val); // writes 12
```

- **Serialize a JavaScript Object in JSON format**
  - `JSON.stringify()`

```
var obj= new Object();
obj.val=34;
obj.name='John';
str = JSON.stringify(obj);
```

Debug in Node Red

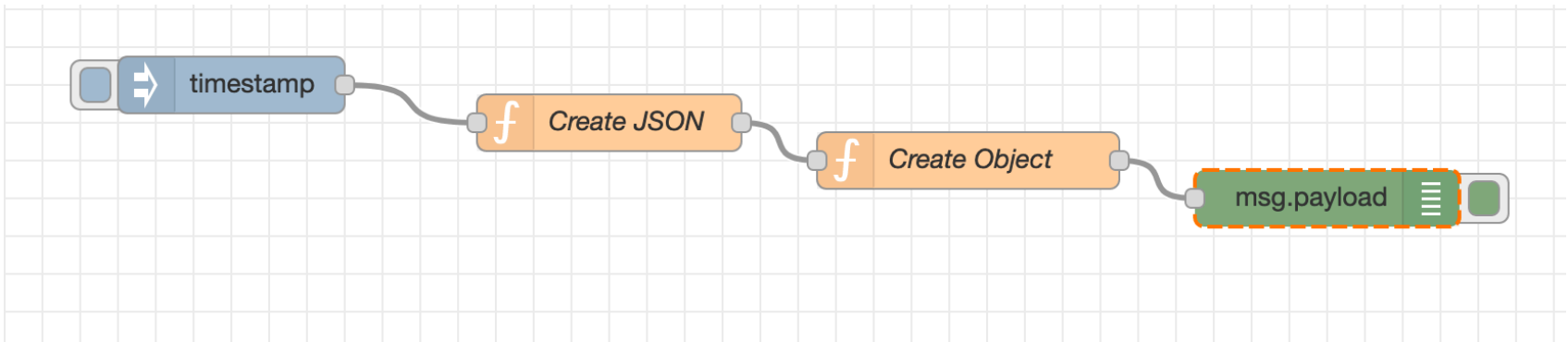
- **Use Debug Ouput**
  - Insert it inside a flow of information
  - Prints out the content of "`msg.payload`" in the *debug message* window
- **Use log command**
  - Inside JavaScript functions
  - `node.log()`
  - Output written inside the console (in our virtual machine).
- **Example: (node for manipulating an input in a Web page)**

```
node.log("Number␣="+msg.req.query.number);
var val = parseInt(msg.req.query.number);
msg.req.query.number2=val*val;
return msg;
```

JSON in Node Red

JSON in Node Red

- **Example 1**
  - We have an injection node (only for having a button)
  - Then a function node that generates the JSON
  - And another function node that consumes the JSON
  - Output is then written out.



Example1 create JSON in a node

- **Node create string:**

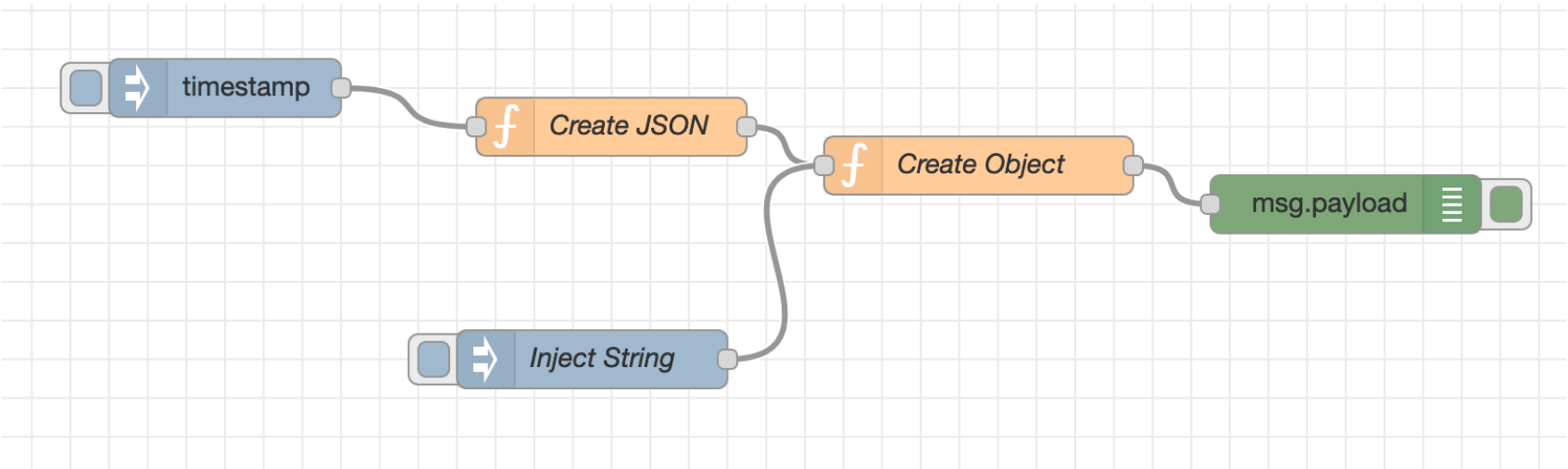
```
var data={"temp":37,"pulse":80};
node.log(typeof data);
msg.payload = JSON.stringify(data);
return msg;
```

- **Function node creates a JSON object**

```
p = JSON.parse(msg.payload);
node.log(typeof p);
msg.payload = p.temp;
return msg;
```

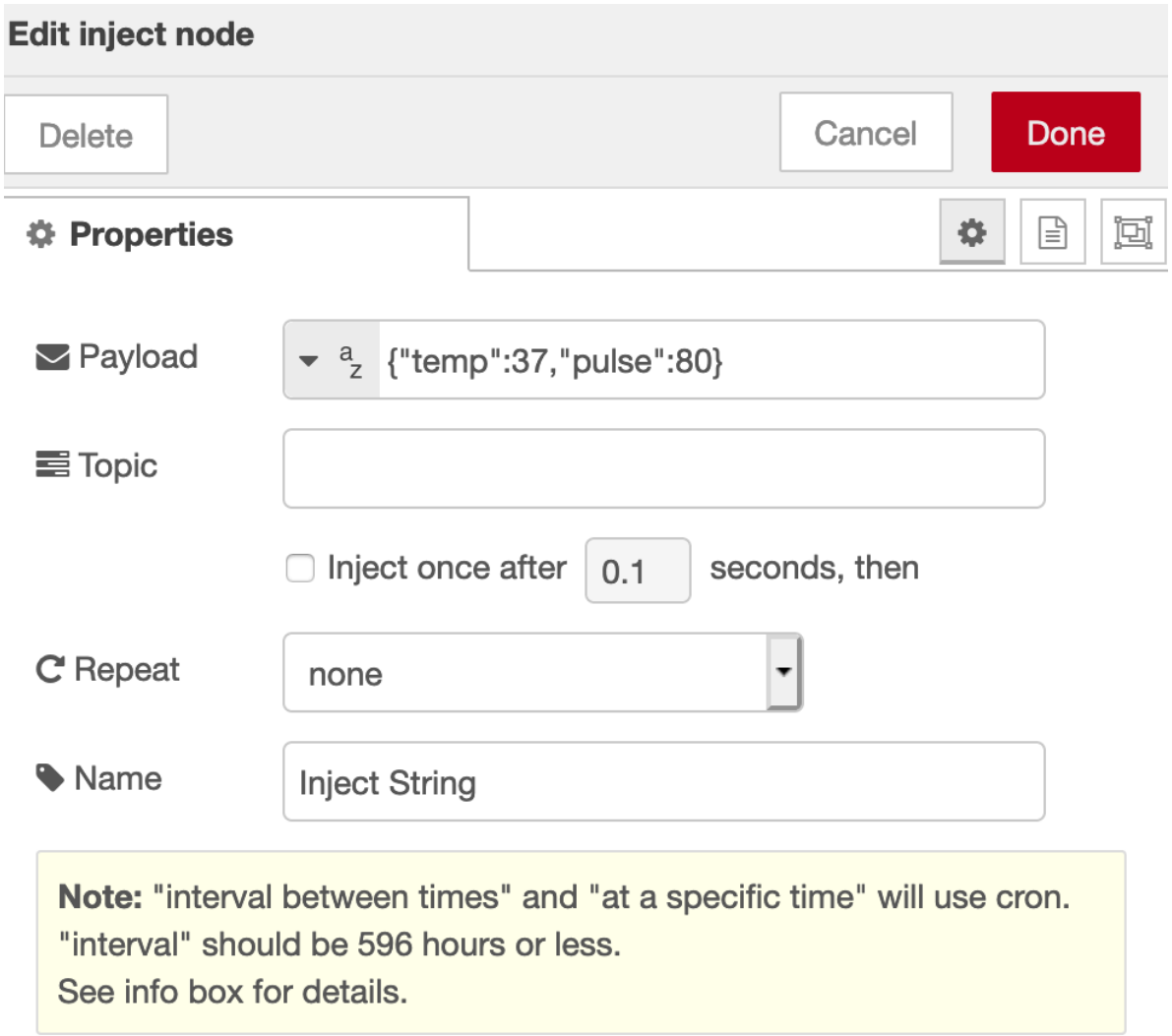
Example 2: Inject JSON

- **Use an inject Node to inject JSON as a text**



Example2

- **Text injected:**



Example 3

- **We change the type generated by the injection node**
  - From String to JSON
- **We need to change the function node:** no need to create an object, payload is already an object (and not a string).

```
//p = JSON.parse(msg.payload);
p= msg.payload
node.log(typeof p);
msg.payload = p.temp;
return msg;
```

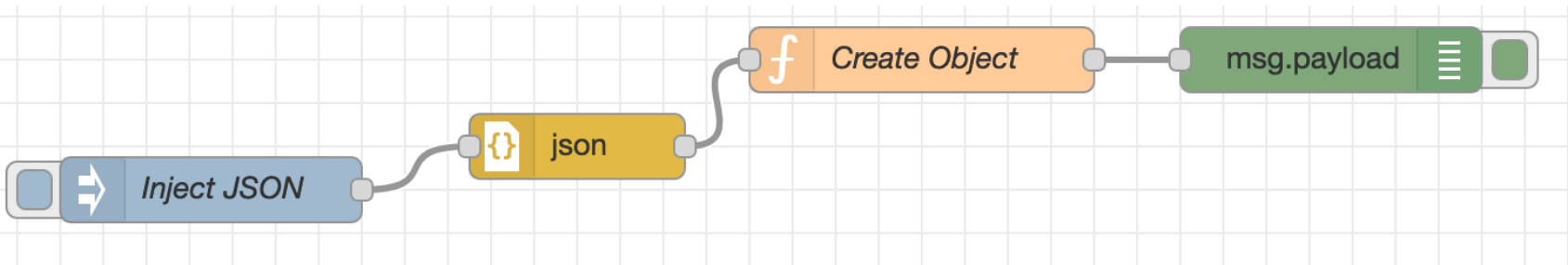
JSON Node

- **Is used to convert a JSON String to a JSON Object**
  - It parses the content of `msg.payload`
- **Or to convert a JSON Object into a JSON String**
  - It stringifies the `msg.payload`

Example 4, using a JSON node

- **We add a json node.**
  - We inject a JSON object
  - JSON node transform the object into a string
  - In the function we have:

```
p = JSON.parse(msg.payload);
//p= msg.payload
node.log(typeof p);
msg.payload = p.temp;
return msg;
```



More complicated example

Example 5:

- **Inject JSON Data is more complicated**

```
 {
  "topic": "test/s1",
  "data": {
          "temp":39,
          "pulse":120}
}
```

- **Function node**

```
p=msg.payload;
node.log(typeof p);
msg.payload=p.data.temp;
return msg;
```

The change node

Ex6: The change node

- **Inject Node (same data)**

```
{
 "topic": "test/s1",
 "data": {
        "temp":39,
        "pulse":120}
}
```

- **The change node**
  - We select the expression
  - and write `payload.data.temp`
  - The payload is replaced by the temperature.

Example 7: emulate a sensor

- **We create different nodes for injecting values and a “Max Min” Node**

```
var data = context.get('data') || {};
var data2 = context.get('data2') || {};
var period = 5; // seconds
var d= new Date();
now = d.getTime();
if(data2["count"]===undefined){
  data2["count"]=0;
}
data["sensor_id"]="0001";
data["sensor_type"]="power";
if(data["max"]===undefined){
  data["max"]=msg.payload;
}
if(data["min"]===undefined){
  data["min"]=msg.payload;
}
if(data2["stime"]===undefined)
  data2["stime"]=now;
```

Example 7: emulate a sensor (Cont.)

```
var count=data2.count;
data2.count+=1;
if(msg.payload>data.max)
    data.max=msg.payload;
if(msg.payload<data.min)
    data.min=msg.payload;
if((data2["stime"]+period*1000)<now){
  var out = JSON.stringify(data);
  msg.payload = out;
  data={}; // clear the data
  context.set('data',data);
  data2={};
  context.set('data2',data2);
  return msg;
}
context.set('data',data);
context.set('data2',data2);
return null;
```

Exercise

- **Import the example 7 into your system**
  - Access to the example page
  - Copy the source
  - Menu Import: paste the source
- **Modify the function to add an average**

Conclusion

Conclusion

- **JSON is a format for sending objects and lists**
  - Is used between all sorts of platforms (not just JavaScript).
- **One can manipulate JSON using boxes**
- **Manipulation of JSON is more convenient using code**
  - Calculating minimum and maximum requires programming
- **JSON is used to connect to a lot of services (server 2 server)**
  - One should also provide a JSON interface.

References

- **Tutorial JSON / Node Red**
  `https://www.youtube.com/watch?v=24ZY3CEsiow`
- **Nasa web site**
  `https://api.nasa.gov/`