Open APIs for Open Minds

Hands-on the FIWARE IoT and Context Data Simulator

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Agenda

1. Introduction
2. Architecture
3. Installation
4. Command-line tools
5. Simulation by example
6. Fast-forward simulation
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1. Introduction

Introduction
What? (the mother of all simulators)

- The **FIWARE Device Simulator** supports:
  - Updating entity attributes using NGSI v1 and NGSI v2
  - Sending notifications to subscribers using NGSI v1
  - Simulating devices supporting:
    - UltraLight (HTTP and MQTT)
    - JSON (HTTP and MQTT)
  - Authorization and token management
  - Running the simulation in real-time and fast-forward modes
  - Simulation progress visualization

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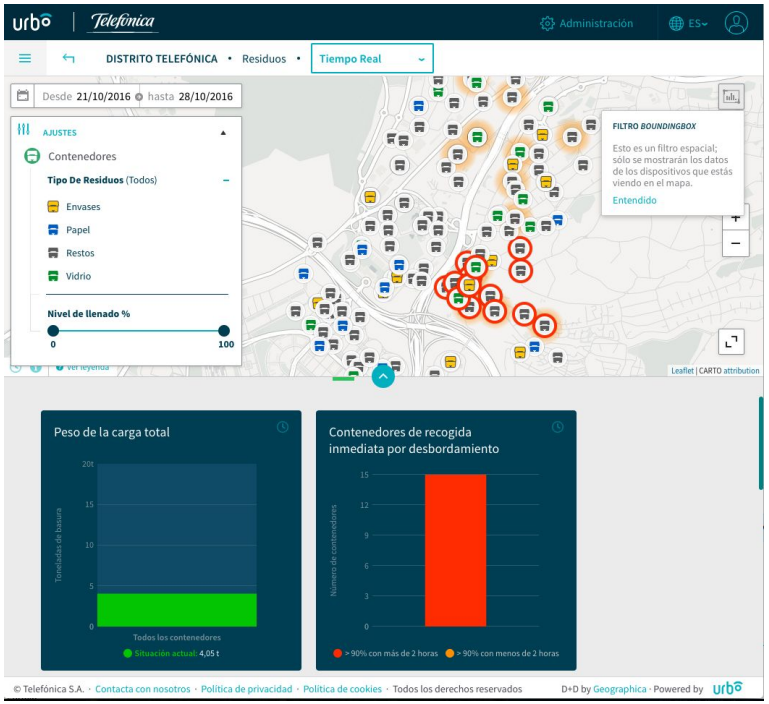
Introduction
What for? (no more “demo” videos)

- The **FIWARE Device Simulator** is currently being used by Telefónica:
  a. **Demonstrators**:
     - Urbo:
       - Illumination
       - Incidences
       - Parking
       - Public transportation
       - Waste management
  b. **Load testing**:
     - Orion Context Broker
     - IoT Agents:
       - UltraLight
       - JSON



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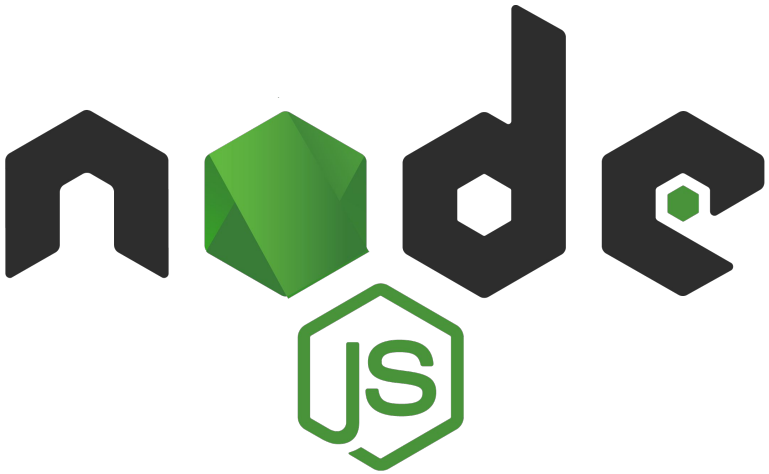
2. Architecture

Architecture
How? (Node.js + NPM packages)

- **Node.js app + NPM packages**:
  a. **Simulation configuration** (JSON file):
     - Service + subservice
     - Authentication
     - Context Broker or Subscriber
     - IoT Agents
     - Entities and devices
  b. **Interpolators**:
     - Attribute values in real time
  c. **Decoupling real and simulated time**:
     - lolex
     - time



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3. Installation

Installation
How? (quick and painless)

1. **From Github**:

```
> git clone https://github.com/telefonicaid/fiware-device-simulator

> npm install
```

2. **From Docker**:

```
> docker pull fiware/device-simulator

> docker run -t -i fiware/device-simulator /bin/bash
```

4. Command-line tools

Command-line tools
How? (running simulations)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI

Usage: fiwareDeviceSimulatorCLI [options]

  Options:
    -h, --help
    -V, --version
    -c, --configuration <configuration-file-path>
    -d, --delay <milliseconds>
    -m, --maximumNotRespondedRequests <requests>
    -p, --progressInfoInterval <milliseconds>
    -s, --silent
    -w, --dweet <dweetConfiguration>
    -l, --timeline <googleSheetsConfiguration
    -f, --from <fromDate>
    -t, --to <toDate>
    -x, --all <cli-configuration-file-path>
```


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Command-line tools
How? (transpiling configurations)

```
$FDS> ./bin/fiwareDeviceSimulatorTranspilerCLI

Usage: fiwareDeviceSimulatorTranspilerCLI [options]

  Options:
    -h, --help
    -V, --version
    -c, --configuration <configuration-file-path>
    -o, --output <output-file-path>
```

5. Simulation by example

Simulation by example
How? (general configuration)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
    "domain": {
      "service": "service",
      "subservice":"/subservice"
    },
    "contextBroker": {
      "protocol": "https",
      "host": "localhost",
      "port": 1026,
      "ngsiVersion": "1.0"
    },
    ...
```

```
        ...
    "authentication": {
      "provider": "keystone",
      "protocol": "https",
      "host": "localhost",
      "port": 5001,
      "user": "theUser",
      "password": "thePassword",
      "retry": {
        "times": 10,
        "interval": 1000
      }
    }
    ...
}
```


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Simulation by example
How? (entities & attributes)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation-once-1-attribute.json
```

```
{
    ...
    "entities": [
      {
        "schedule": "once",
        "entity_name": "Ent01",
        "entity_type": "Type01",
        "active": [
          {
            "name": "active01",
            "type": "float",
            "value": 1
          }
        ],
        "staticAttributes": [
          {
            "name": "static01",
            "type": "string",
            "value": "Value01"
          }
        ]
      }
    ]
    ...
}
```


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Simulation by example
How? (entities & attributes)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-5s-2-attributes.json
```

```
{
    ...
    "entities": [
      {
        "schedule": "once",
        "entity_name": "Ent01",
        "entity_type": "Type01",
        "active": [
          {
            "schedule": "*/5 * *
  * * *",
            "name": "active01",
            "type": "float",
            "value": 1
          },
          {
            "name": "active02",
            "type": "float",
            "value": 2
          }
        ],
        "staticAttributes": [
          {
            "name": "static1",
            "type": "string",
            "value": "Value1"
          }
        ]
      }
    ...
}
```


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Simulation by example
How? (schedules)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   ...
      {
         "schedule": "once",
         "name": "active1",
         "type": "Number",
         "value": 1
      }
   ...
}
```


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Simulation by example
How? (schedules)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   ...
     {
       "schedule": "*/5 * * * * *",
       "name": "active01",
       "type": "Number",
       "value": 1
     }
   ...
}
```

Reference: http://crontab.guru/

Simulation by example
How? (schedules)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
  ...
    {
      "schedule": {
        "start": "2016-10-31T10:00:00Z",
        "end": "2016-10-31T11:00:00Z",
        "rule": "*/5 * * * * *"
      },
      "name": "active01",
      "type": "Number",
      "value": 1
    }
  ...
}
```

Reference: http://crontab.guru/

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Simulation by example
How? (interpolators)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "Number",
       "value": 1
     }
   ...
}
```


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Simulation by example
How? (date-increment-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-date-increment-interpolator-now.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "DateTime",
       "value": "date-increment-interpolator({\"origin\":
\"now\", \"increment\": 86400})"
     }
   ...
}
```


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Simulation by example
How? (date-increment-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-date-increment-interpolator.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "DateTime",
       "value": "date-increment-interpolator({\"origin\":
\"2017-02-14T12:00:00Z\", \"increment\": 86400})"
     }
   ...
}
```


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Simulation by example
How? (time-linear-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-linear-interpolator-float.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "time-linear-interpolator({\"spec\":
[[0,0],[20,25],[21,50],[22,75],[23,100],[24,0]],
\"return\": {\"type\": \"float\"}})"
    }
  ...
}
```

Simulation by example
How? (time-linear-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-linear-interpolator-integer.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "time-linear-interpolator({\"spec\":
[[0,0],[20,25],[21,50],[22,75],[23,100],[24,0]],
\"return\": {\"type\": \"integer\", \"rounding\":
\"floor\"}})"
    }
  ...
}
```


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Simulation by example
How? (time-random-linear-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-random-linear-interpolator-random-time.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "time-random-linear-interpolator({
\"spec\": [[random(12,13),0],[random(20,21),100]],
\"return\": {\"type\": \"float\"}})"
    }
  ...
}
```


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Simulation by example
How? (time-random-linear-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-random-linear-interpolator-random-values.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "time-random-linear-interpolator({\"spec\":
[[0,0],[20,random(25,45)],[21,random(50,75)],
[22,100],[24,0]], \"return\": {\"type\": \"integer\",
\"rounding\": \"ceil\"}})"
    }
  ...
}
```


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Simulation by example
How? (time-random-linear-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-random-linear-interpolator-full-random.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "time-random-linear-interpolator({
\"spec\": [[random(0,1),0],[20,random(25,45)],
[random(21,22),random(50,75)],[22,100],[24,0]],
\"return\": {\"type\": \"integer\", \"rounding\":
\"ceil\"}})"
    }
  ...
}
```


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Simulation by example
How? (time-step-after-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-step-after-interpolator.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "Number",
       "value": "time-step-after-interpolator(
[[0,0],[20,25],[21,50],[22,75],[23,100],[24,0]])"
     }
   ...
}
```

Simulation by example
How? (time-step-before-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-time-step-before-interpolator.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "Number",
       "value": "time-step-before-interpolator(
[[0,0],[20,25],[21,50],[22,75],[23,100],[24,0]])"
     }
   ...
}
```

Simulation by example
How? (text-rotation-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-text-rotation-interpolator.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Text",
      "value": "text-rotation-interpolator({
\"units\": \"seconds\", \"text\": [[0,\"PENDING\"],
[15,\"REQUESTED\"],[30,[[50,\"COMPLETED\"],[50,\"ERROR\"]
]],[45,\"REMOVED\"]]})"
    }
  ...
}
```


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Simulation by example
How? (multiline-position-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-multiline-position-interpolator.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "geo:point",
      "value": "multiline-position-interpolator({
\"coordinates\": [[-6.268386840820312 5,
36.489489332146381,[-6.257915496826172,36.46478162030615]
,[-6.252079010009766,36.461744374732085],[-6.216201782226
5625,36.456774079889286]], \"speed\": {\"value\": 30,
\"units\": \"km/h\"}, \"time\": {\"from\": 10, \"to\":
22}})"
    }
  ...
}
```


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Simulation by example
How? (multiline-position-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-multiline-position-interpolator.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "geo:point",
      "value": "multiline-position-interpolator({
\"coordinates\": [[-6.268386840820312 5,
36.489489332146381,[-6.257915496826172,36.46478162030615]
,[-6.252079010009766,36.461744374732085],[-6.216201782226
5625,36.456774079889286]], \"speed\": {\"value\": 30,
\"units\": \"km/h\"}, \"time\": {\"from\": 10, \"to\":
22}, \"return\": \"geo:point\"})"
    }
  ...
}
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-static.json
```

```
{
   ...
      {
         "name": "active01",
         "type": "Number",
         "value": "attribute-function-interpolator(1)"
      }
   ...
}
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-static.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "attribute-function-interpolator(
${{EntityName01:#:EntityType01}{active1}} +
Math.pow(${{EntityName02}{active1}}, 2))"
    }
  ...
}
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-attr-refs.json
```

```
${{EntityName01:#:EntityType01}{active1}} +
Math.pow(${{EntityName02}{active1}}, 2)
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-require.json
```

```
{
  require: ['postfix-calculate'],
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "attribute-function-interpolator(
var postfixCalculate = require('postfix-calculate');
module.exports =
postfixCalculate('${{EntityName01}{active1}} 1 +');)"
    }
  ...
}
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-require.json
```

```
var postfixCalculate = require('postfix-calculate');

module.exports =
postfixCalculate('${{EntityName01}{active1}} 1 +');
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-sim-date.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "Number",
       "value": "attribute-function-interpolator(
module.exports = new SimulationDate();)"
     }
   ...
}
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-sim-date.json
```

```
module.exports = new SimulationDate();
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-local-state.json
```

```
{
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "attribute-function-interpolator(
/* state: counter = 1 */ module.exports = {result:
${{EntityName01}{active1}} + counter, state: {counter:
++counter}};)"
    }
  ...
}
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-local-state.json
```

```
/* state: counter = 1 */
module.exports = {
  result: ${{EntityName01}{active1}} + counter,
  state: { counter: ++counter }
};
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-global-state.json
```

```
{
  globals: {
    globalVar1: 1
  }
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "attribute-function-interpolator(
module.exports = {result: ${{EntityName01}{active1}} +
globalVar1, state: {globals: {globalVar1: ++globalVar1}
}};)"
    }
  ...
}
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-global-state.json
```

```
module.exports = {
   result: ${{EntityName01}{active1}} + globalVar1,
   state: {
     globals: {
       globalVar1: ++globalVar1
     }
   }
};
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-global-local-state.json
```

```
{
  globals: {
    globalVar1: 1
  }
  ...
    {
      "name": "active01",
      "type": "Number",
      "value": "attribute-function-interpolator(           /*
state: counter = 1 */ module.exports = {result:
${{EntityName01}{active1}} + counter + globalVar1,state: {
counter: ++counter, globals: {globalVar1: ++globalVar1}}};)"
    }
  ...
}
```

Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-global-local-state.json
```

```
/* state: counter = 1 */

module.exports = {
  result: ${{EntityName01}{active1}} + counter + globalVar1,
  state: {
    counter: ++counter,
    globals: {
      globalVar1: ++globalVar1
    }
  }
}
```


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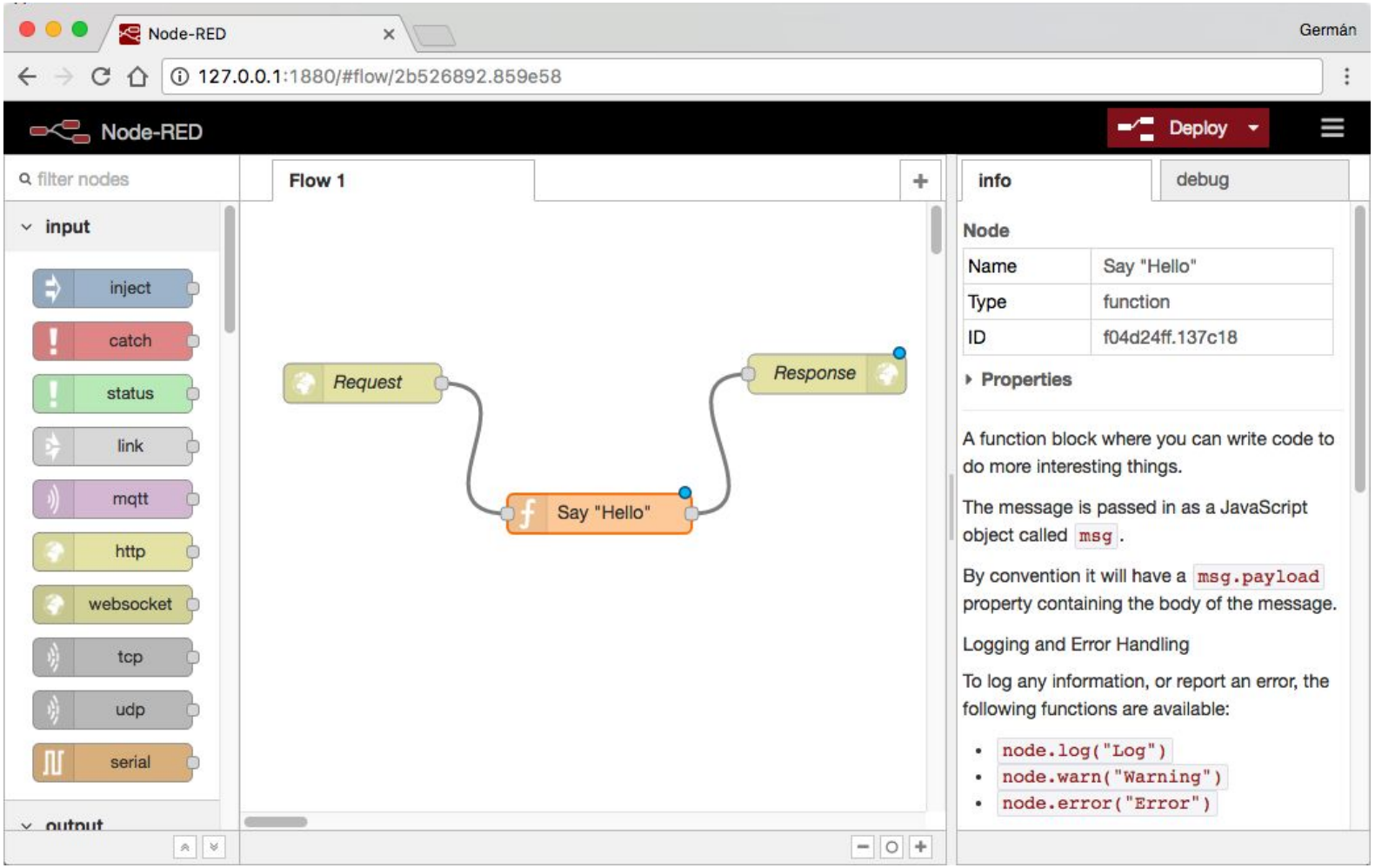
Simulation by example

How? (attribute-function-interpolator)



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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-node-red.json
```

```
{
   ...
     {
       "name": "active01",
       "type": "Number",
       "value": "attribute-function-interpolator(
var deasync = require(\"deasync\"); var requestSync =
deasync(require(\"request\")); module.exports =
requestSync({method: \"GET\", url:
\"http:\/\/127.0.0.1:1880\/api\/test001\", headers:
{\"Content-Type\": \"application\/json\",\"Accept\":
\"application\/json\"}}).body;)"
     }
   ...
}
```


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Simulation by example
How? (attribute-function-interpolator)

```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-attribute-function-interpolator-node-red.json
```

```
var deasync = require("deasync");

var requestSync = deasync(require("request"));

module.exports = requestSync(
   {
     method: "GET",
     url: "http://127.0.0.1:1880/api/test001",
     headers: {
       "Content-Type": "application/json",
       "Accept": "application/json"
     }
   }
).body;
```


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Simulation by example
How? (metadata)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   ...
   {
     "name": "active1",
     "type": "Number",
     "value": 1,
     "metadata": [
       {
         "name": "metadata1",
         "type": "Text",
         "value": "Some attribute metadata"
       }
     ]
   }
   ...
}
```


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Simulation by example
How? (entity count)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   ...
   {
     "count": "3",
     "entity_type": "EntityType01",
     "schedule": "*/1 * * * * *",
     "active": [
       {
         "name": "active1",
         "type": "Number",
         "value": 1
       }
     ]
   }
   ...
}
```


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Simulation by example
How? (subscribers & notifications)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
   "domain": {
     "service": "service",
     "subservice":"/subService"
   },
   "subscriber": {
     "protocol": "http",
     "host": "localhost",
     "port": 8666,
     "path": "/notify",
     "ngsiVersion": "1.0"
   },
   ...
   ...
   "authentication": {
     "provider": "keystone",
     "protocol": "https",
     "host": "localhost",
     "port": 5001,
     "user": "theUser",
     "password": "thePassword",
     "retry": {
       "times": 10,
       "interval": 1000
     }
   }
   ...
}
```


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Simulation by example
How? (IoT Agents & devices)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
 {
   "domain": {
     "service": "theService",
     "subservice": "/theSubService"
   },
   "iota": {
     "ultralight": {
       "api_key":
"1ifhm6o0kp4ew7fi377mpyc3c",
       "http": {
         "protocol": "http",
         "host": "localhost",
         "port": 8085
       },
       "mqtt": {
         "protocol": "mqtt",
         "host": "localhost",
         "port": 1883,
         "user": "mqttUser",
         "password": "mqttPassword"
       }
     },
```

```
    "json": {
       "api_key":
"83ut64ib3gzs6km6izubjyenu",
       "http": {
         "protocol": "http",
         "host": "localhost",
         "port": 8185
       },
       "mqtt": {
         "protocol": "mqtt",
         "host": "localhost",
         "port": 1883,
         "user": "mqttUser",
         "password": "mqttPassword"
       }
     }
   },
   ...
 }
```


FIWARE

Simulation by example
How? (IoT Agents & devices)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
  ...
  "devices": [
    {
      "schedule": "once",
      "device_id": "Device01",
      "protocol": "UltraLight::HTTP",
      "api_key": "iuerm6o0ty4ew6fi544mpya5f"
      "attributes": [
        {
          "object_id": "attr1",
          "value": 1
        }
      ],
    }
  ]
  ...
}
```


FIWARE

Simulation by example
How? (device count)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
  ...
  {
    "count": "5",
    "schedule": "*/1 * * * * *",
    "entity_type": "DeviceType03",
    "protocol": "UltraLight::MQTT",
    "api_key": "ag235jdo0kkhd367du77mpgs54",
    "attributes": [
      {
        "object_id": "attr1",
        "value": 1
      }
    ]
  }
  ...
}
```


FIWARE

Simulation by example
How? (import())

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
  "exports": {
    "contextBroker_NGSIv1": {
      "protocol": "https",
      "host": "1.2.3.4",
      "port": 1026,
      "ngsiVersion": "1.0"
    },
    "every 5 seconds": "*/5 * * * * *",
    "autoincrement_1":
"attribute-function-interpolator(${{Entity:
001}{active:001}} + 1)",
  },
  "domain": {
    "service": "service",
    "subservice": "subservice"
  },
  "contextBroker":
"import(contextBroker_NGSIv1)",
  "authentication":
"import(authentication)",
  "entities": [
    {
      "schedule": "import(every 5
seconds)",
      "entity_name": "EntityName01",
      "entity_type": "EntityType01",
      "active": [
        {
          "name": "active1",
          "type": "Number",
          "value":
"import(autoincrement_1)"
        }
      ]
    }
  ]
}
```


FIWARE

Simulation by example
How? (`import()`)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c simulation.json
```

```
{
  "exports": {
    "<template-name>": [
      {
        "condition":
"${{<entity-property-1>==<regular-expression-1>}}",
        "content":
"the-content-to-import-a-string-in-this-case"
      },
      {
        "condition":
"${{<entity-property-2>==<regular-expression-2>}{<attribute-property-2>==<regular-expression-2>}}",
        "content":
"the-content-to-import-a-string-in-this-case"
      }
    ]
  }
  ...
}
```


FIWARE

6. Fast-forward simulation

Fast-forward simulation
What? (inception mode on)

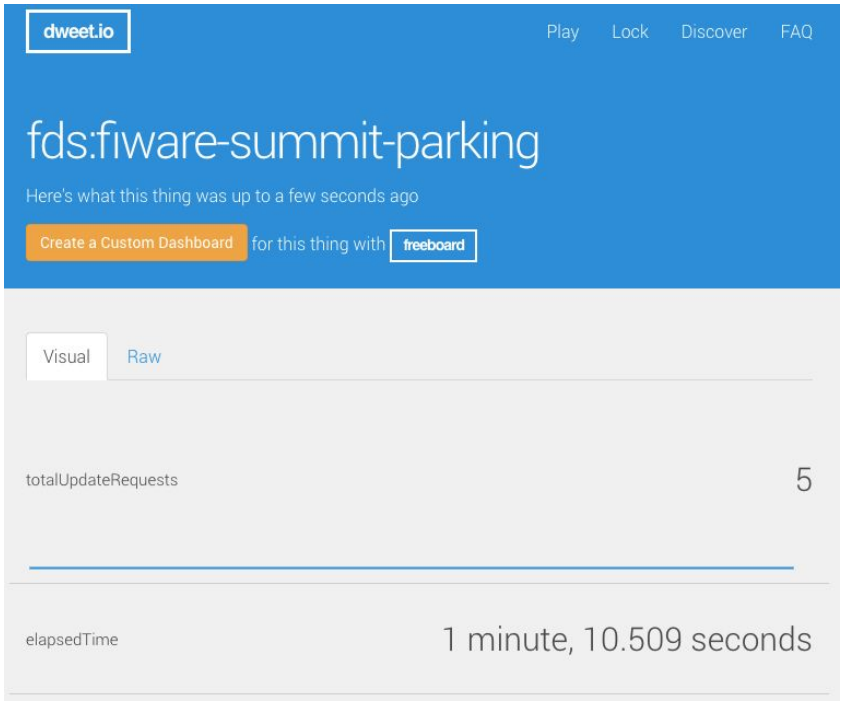
```
$FDS> LOGOPS_LEVEL=debug ./bin/fiwareDeviceSimulatorCLI -c
simulation-5s-2-attributes.json -f 2017-01-01T00:00:00Z -t
2017-02-01T00:00:00Z -p 1000 -m 10
```

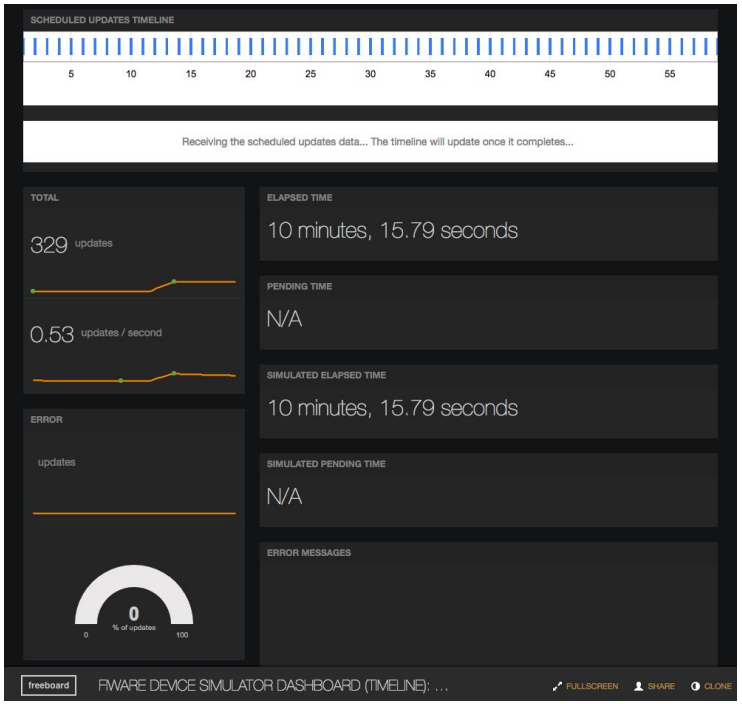
```
...
{"time":"2017-01-01T00:02:25.000Z","lvl":"DEBUG","msg":"update-request
event: { request: \n { ... }"}

{"time":"2017-01-01T00:02:30.000Z","lvl":"DEBUG","msg":"response event:
{ request: \n { ... }"}

{"time":"2017-01-01T00:02:35.000Z","lvl":"INFO","msg":"progress-info {
totalUpdateRequests: '31 updates',\n throughput: '15.35
updates/sec.',\n errorUpdateRequests: '0 updates',\n
errorUpdateRequestsX100: '0.00%',\n delayedUpdateRequests: '11
updates',\n delayedUpdateRequestsX100: '26.19%',\n elapsedTime: '2.019
seconds',\n pendingTime: '9 hours, 41 minutes, 26.301 seconds',\n
simulatedElapsedTime: '2 minutes, 35 seconds',\n simulatedPendingTime:
'1 month, 13 hours, 27 minutes, 25 seconds' }"}
...
```

7. Simulation visualization

Simulation visualization
What? (dweet.io & freeboard.io)

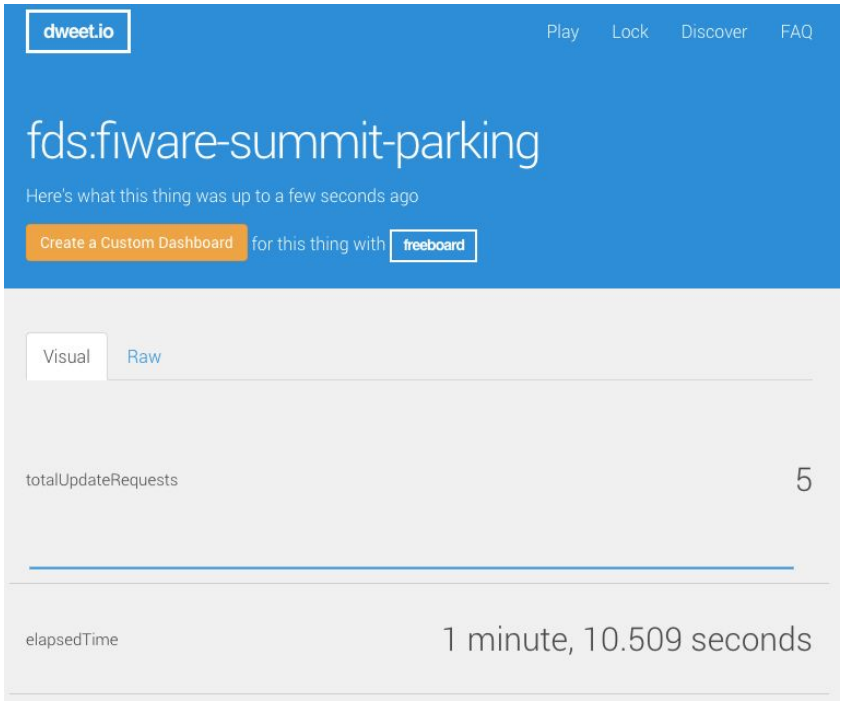
```
$FDS> ./bin/fiwareDeviceSimulatorCLI -c fiware-summit-parking.json  -p 5000
-w "{\"name\": \"FDS:fiware-summit-parking\"}" -s -l "{\"sheetKey\":
\"1PgdP2sBMPAR3RA WSuHb22hOzT8ZcYwjIAr8Nll3QUcI\", \"credentialsPath\":
\"my_google_creds.json\", \"dateFormat\": \"dd/mm/yyyy HH:MM:ss\",
\"refreshInterval\": 15000}"
```

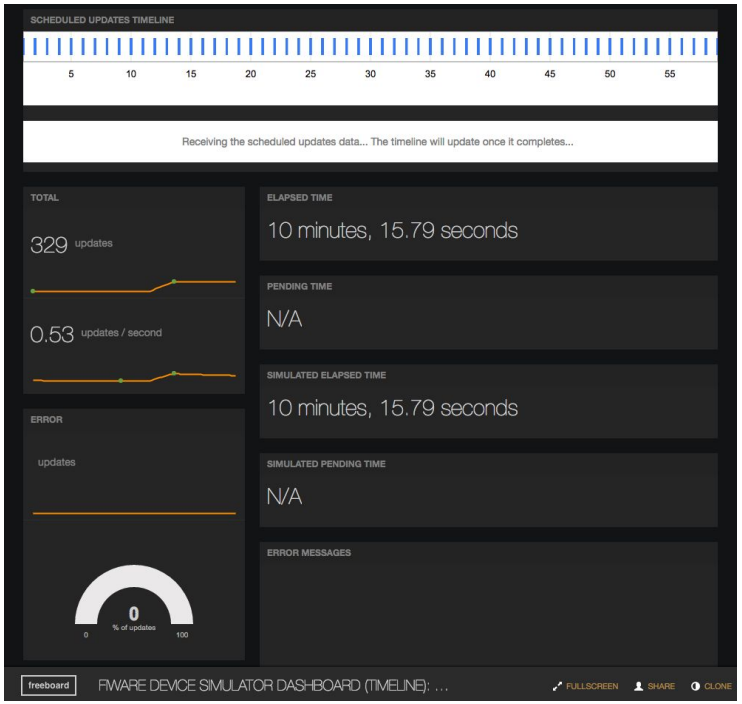




Simulation visualization
What? (dweet.io & freeboard.io)

```
$FDS> ./bin/fiwareDeviceSimulatorCLI -x cli-configuration.
json
```





8. References

References
Where? (everything is out there)

1. **Github repository**:
   - https://github.com/telefonicaid/fiware-device-simulator

2. **Documentation at ReadTheDocs:**
   - https://fiware-device-simulator.readthedocs.io/en/latest/

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Thank you!

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