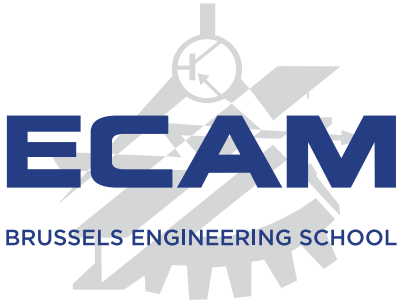


IT301μ From IoT Devices to the Cloud
with the IBM Node-RED Tool

Session 1

Node-RED Basics to Design Event-Driven Applications

Sébastien Combéfis

Winter 2020

Objectives

- Install and discover the Node-RED tool

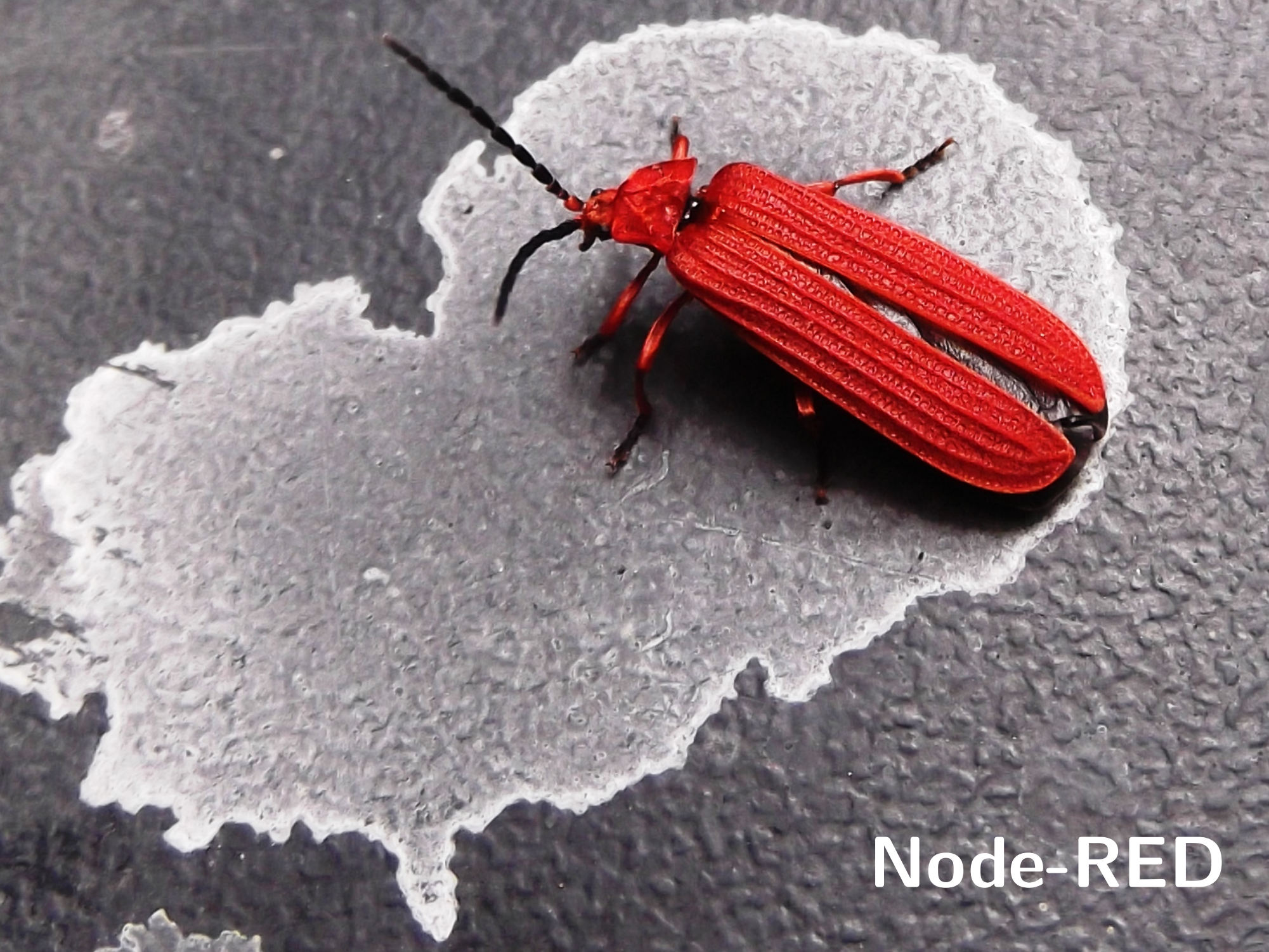
  Write a first program with this visual programming tool

- Understand the event-driven programming model

  And designing programs by defining flows with Node-RED

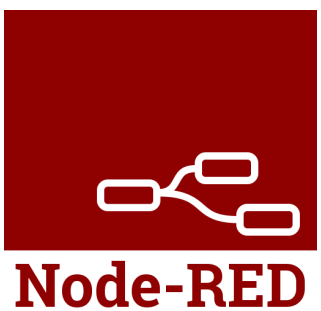
- Connect hardware to the cloud and make them interact

  Analysing a simple use case with an Arduino


Node-RED

Node-RED

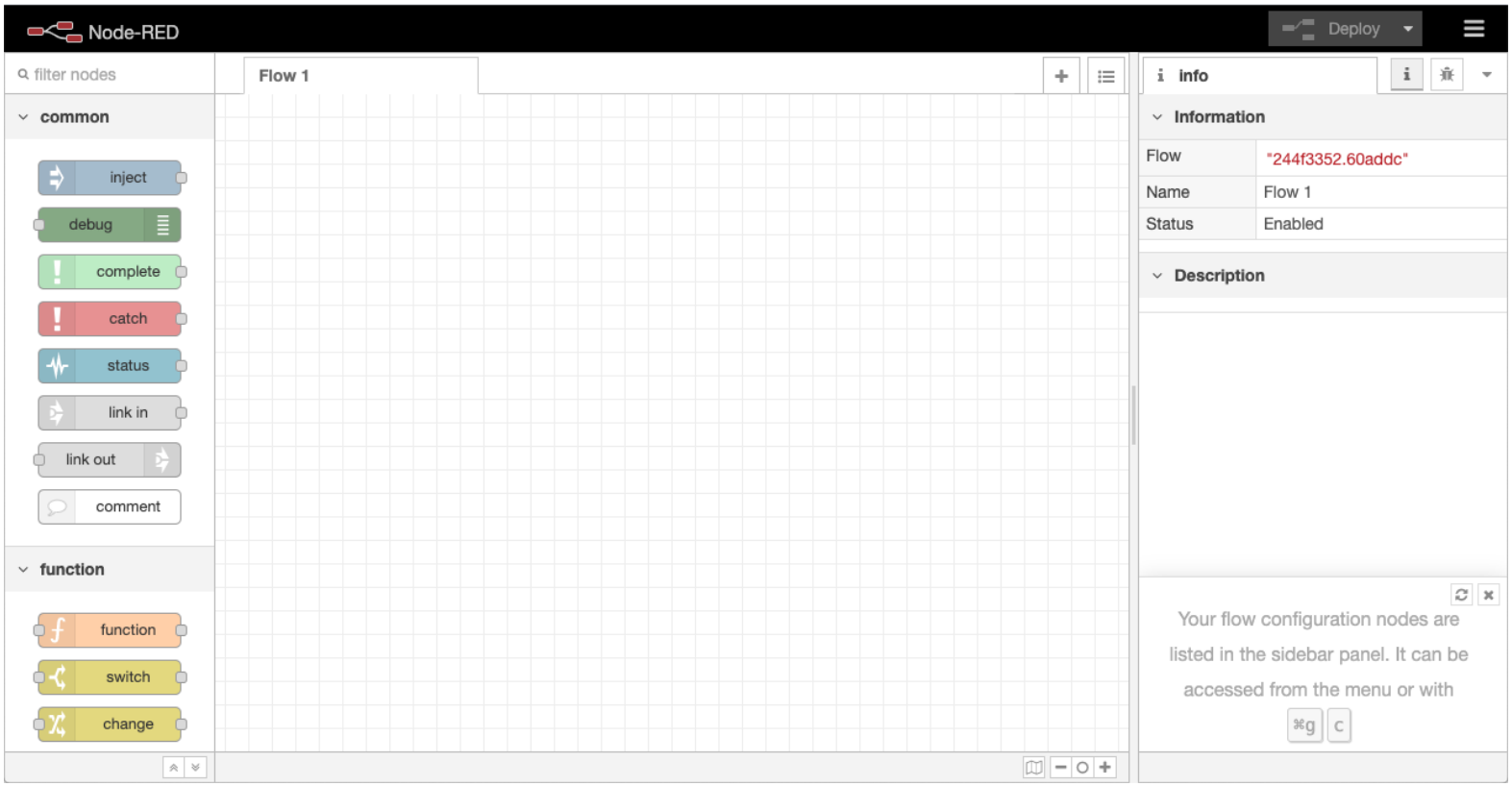
- Flow oriented and visual programming tool developed by IBM
  - Visual editor directly integrated in the web browser
  - Hardware can be easily wired with APIs and cloud services
- Tool based on the Node.js JavaScript runtime
  - JavaScript functions are created graphically or with code
  - Flows are stored in a single JSON file



Node-RED Platform

- Node-RED platform directly available from a browser

  Launched on `localhost` on port 1880, by default

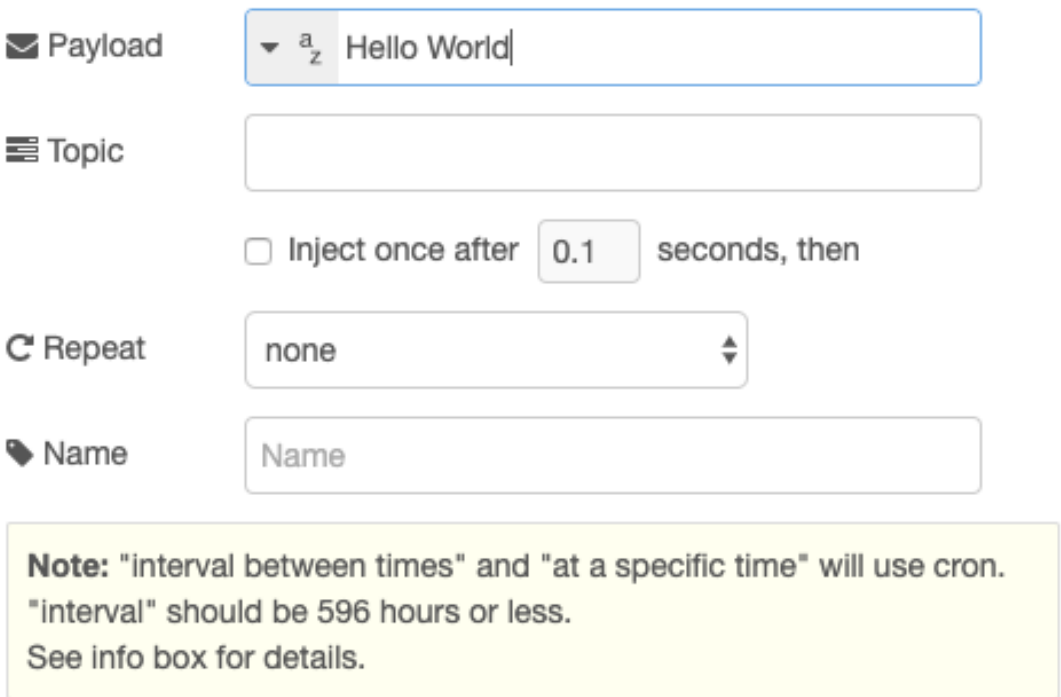


Hello World (1)

- First Hello World program with Node-RED
  - Generating a string when clicking on a button
  - Writing the content of the string on the debug sidebar
- Dragging two nodes onto the workspace from the palette
  - One `inject` node as source and one `debug` node as destination
  - Linked to make the data flow from one node to the other

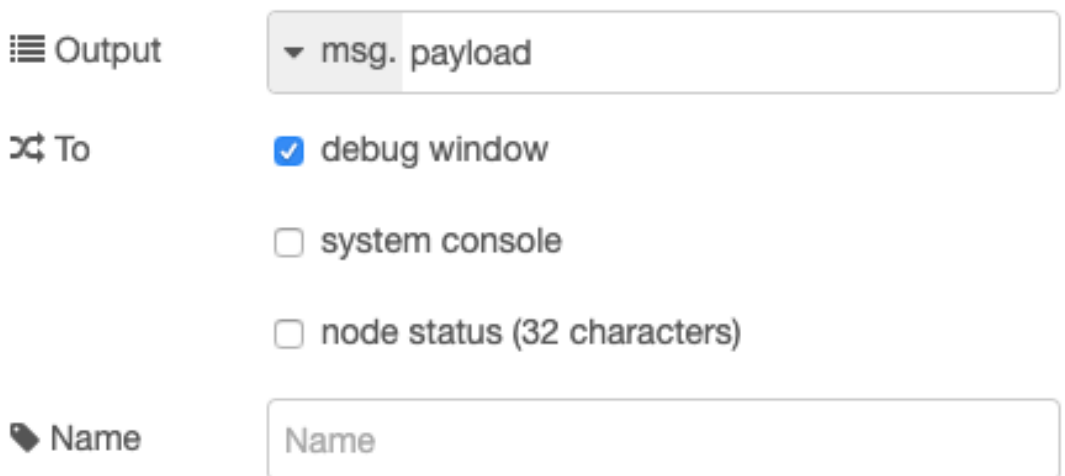
inject Node

- Inject a message with a given type in a flow
  - Message type can be string, number, boolean, JSON, etc.
  - Manual injection or injection at regular interval



debug Node

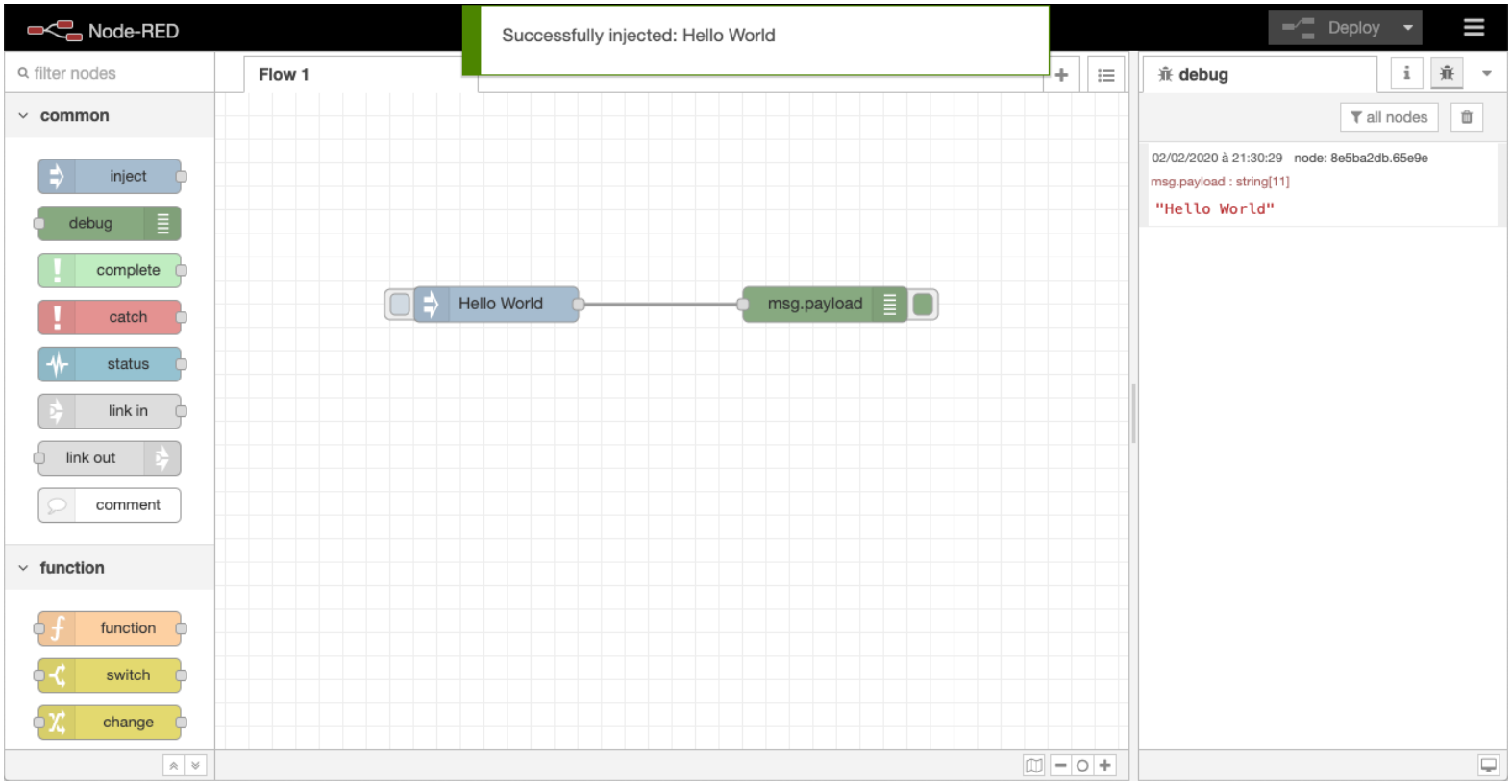
- Display a message in the debug sidebar
  - Can display the payload or the complete message object
  - Output can be sent to the debug sidebar or system console



Hello World (2)

- Deploy the program to build and launch it

  Then click on the left of the `inject` node to inject a message




Flow

Event-Driven Paradigm

- Node-RED follows the event-driven programming paradigm
  - Capture, communication, processing and persistence of event
  - Opposed to the traditional request-driven model
- An event represents any substantial change in state

  Can be a change in hardware as well as in software
- An event gives rise to an event notification message

  Sent by the system to notify another part of the event occurrence

Event-Driven Architecture

- Event-driven applications can be created in many languages

  This is an approach and not a programming language

- Several advantages of an event-driven architecture
  - Less coupling and easier maintenance
  - Better scalability and evolutivity
  - Good choice for modern distributed systems
- Loose coupling because producers do not know consumers

  And event does not know consequences of its occurrence

EDA Application

- Ability to design strong, flexible and adaptable architecture

  The event producer does not need to know the event consumer

- No deterministic response time is guaranteed

  Way easier to create realtime responsive architectures

- Typically used for IoT applications with data collection

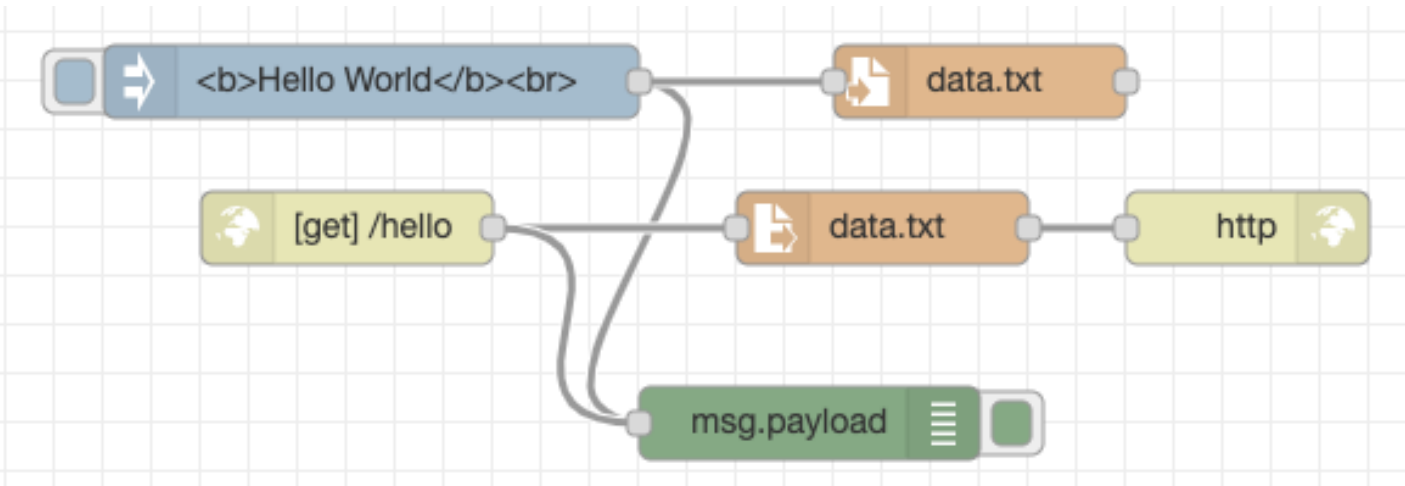
  Collected data are ingested by a software platform in the cloud

Event-Driven Architecture Model

- The Pub/Sub model is based on subscriptions
  - Messaging infrastructure with subscriptions on event streams
  - A published event is sent to all the subscribers
- The event streaming model is based on an event log
  - All the events are written to a single event log
  - The log can be read at any time, starting from any point

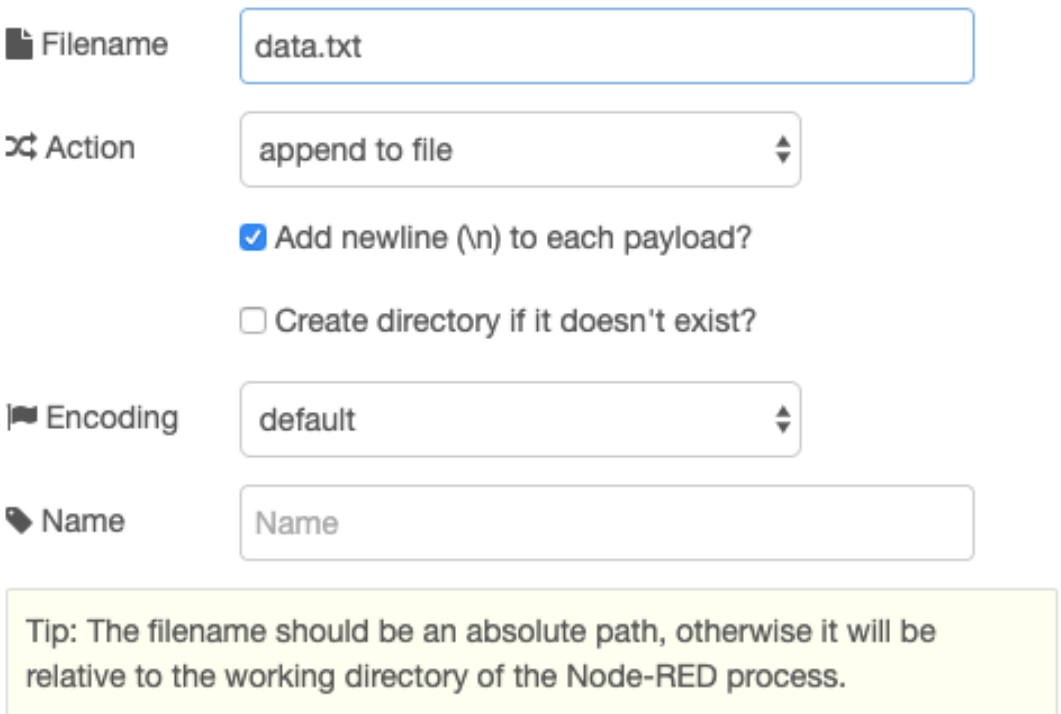
HTTP Server (1)

- Creating an HTTP end-point to propose a web service
  - `http in` node to serve a content on a URL
  - `file` node to read the content of a file
  - `http response` node to send the HTTP response to the client



`file` Node

- Write the payload of a message to a text file
  - Can append, overwrite or delete a file
  - Can configure options to create directory, set encoding, etc.

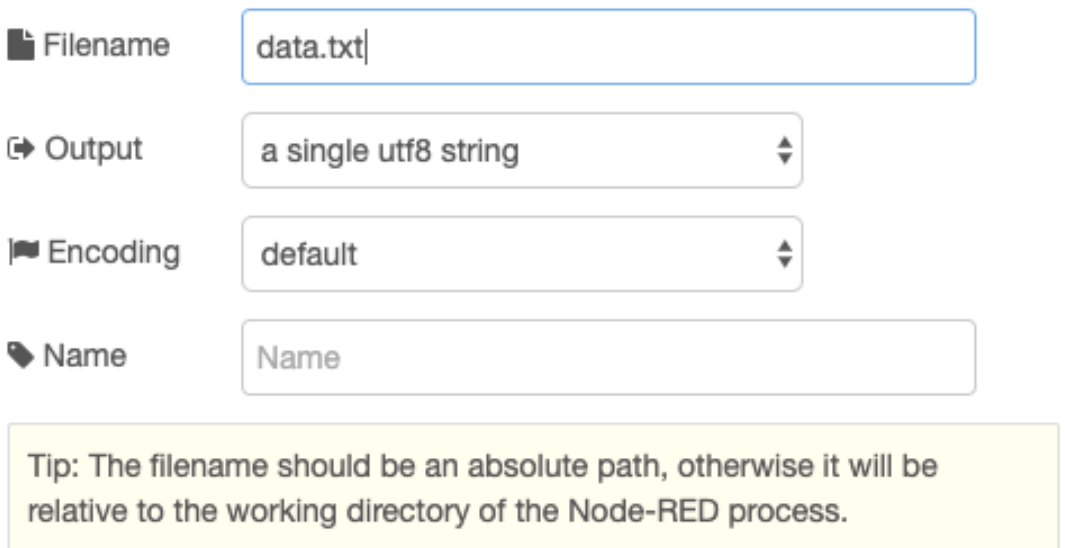


http in Node

- Set up an HTTP end-point used to create a web service
  - Define the desired URL and HTTP method
  - HTTP server listening on same URL and port as Node-RED

`file` in Node

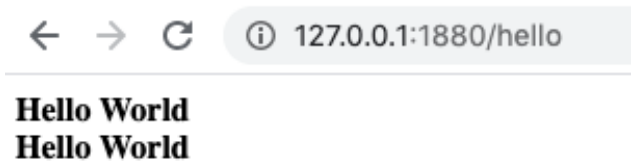
- Read the content of a text file
  - Choose the path to the file to be read
  - The file can be read at once or generate several messages

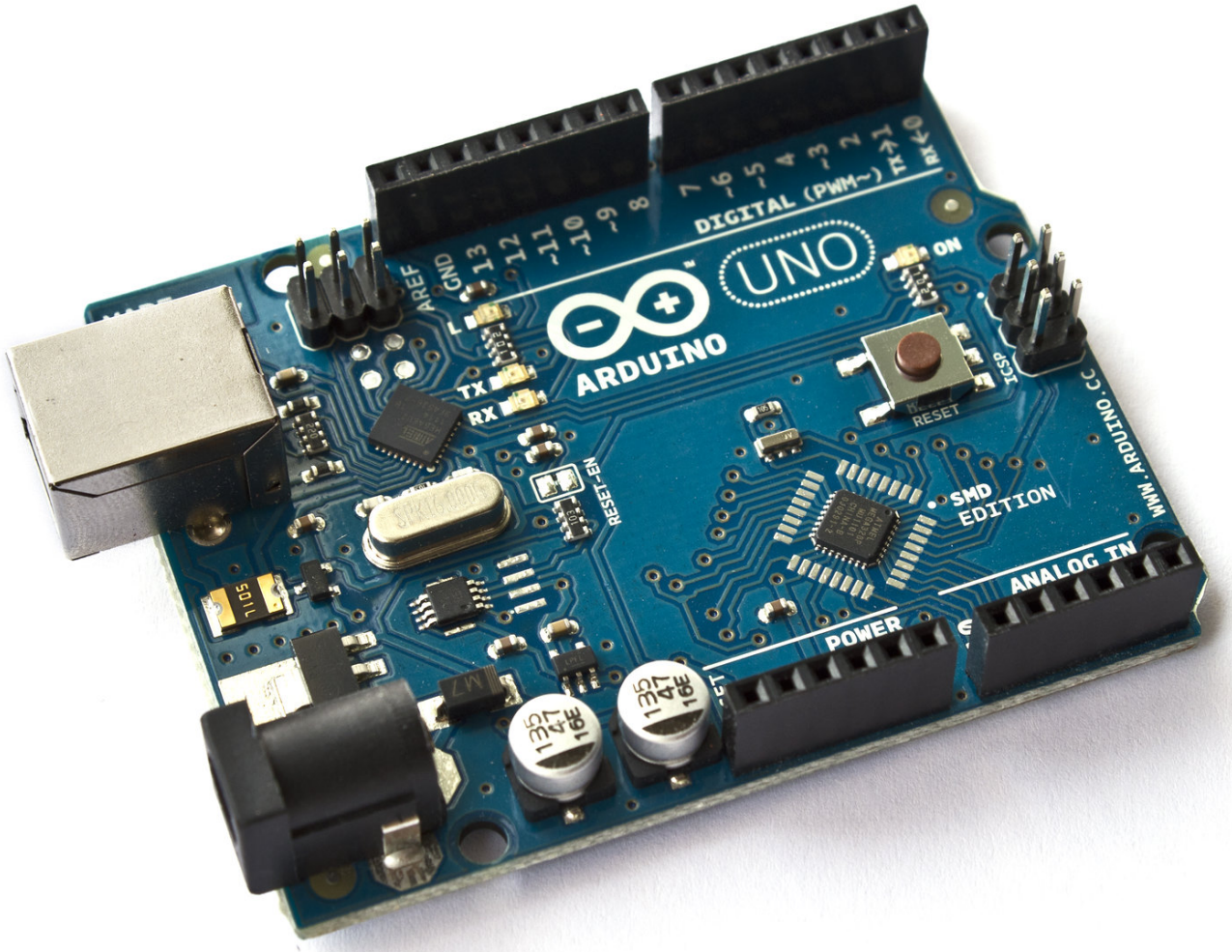


HTTP Server (2)

- Filling the file and then connecting to the HTTP server

  Data read from the file is displayed on the browser



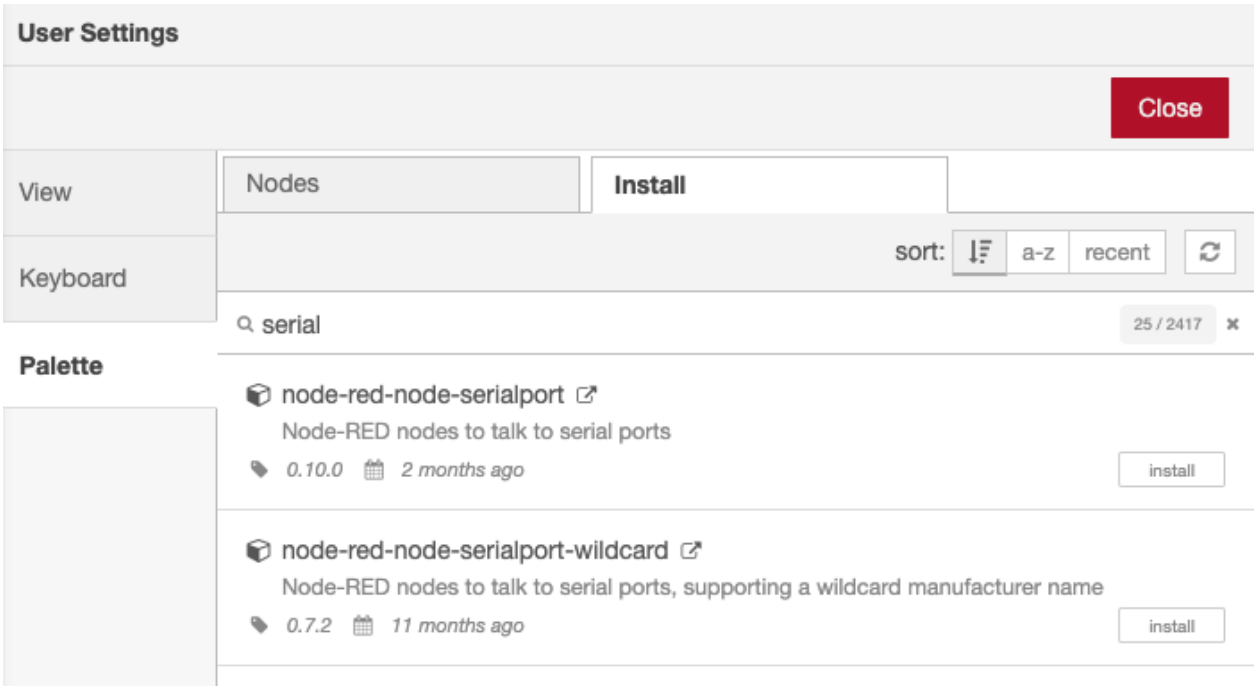


Connecting Hardware

Installing Module

- Installing a module through the `Manage Palette` menu

  Adding the `node-red-node-serialport` module, for example



Arduino Hello World (1)

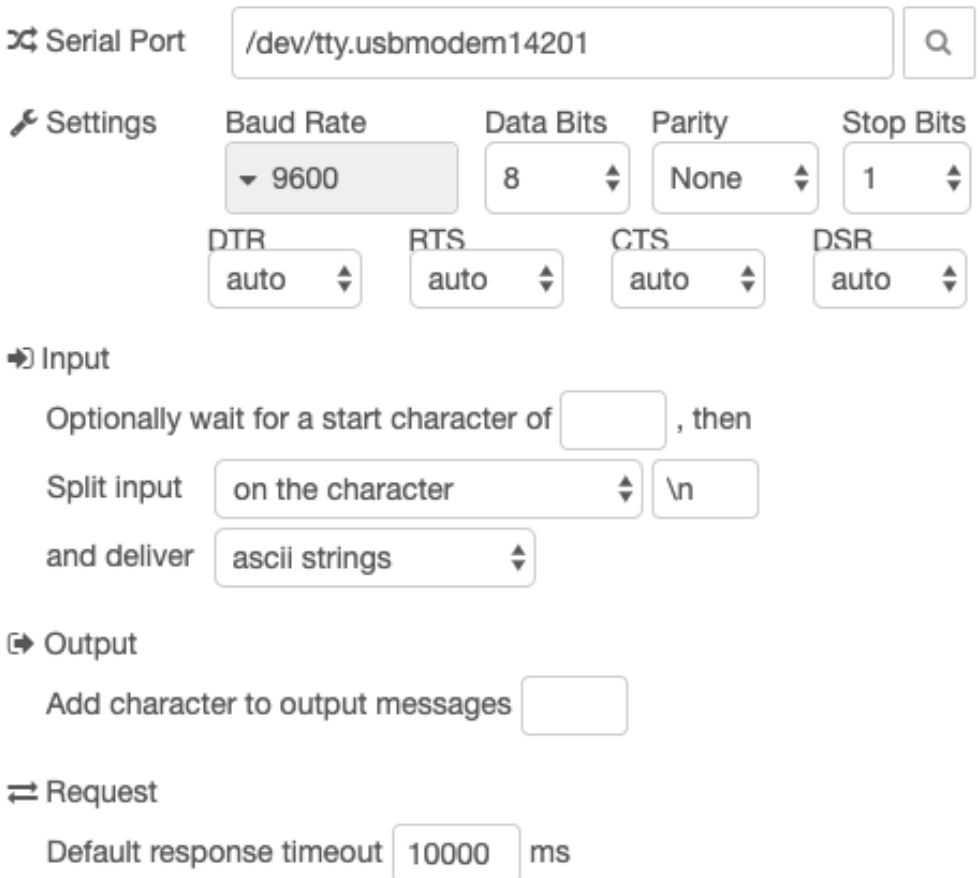
- Arduino program writing Hello World on the serial port

  Watch carefully for the path to the serial device and baud rate

serial in Node

- Read data from a local serial port

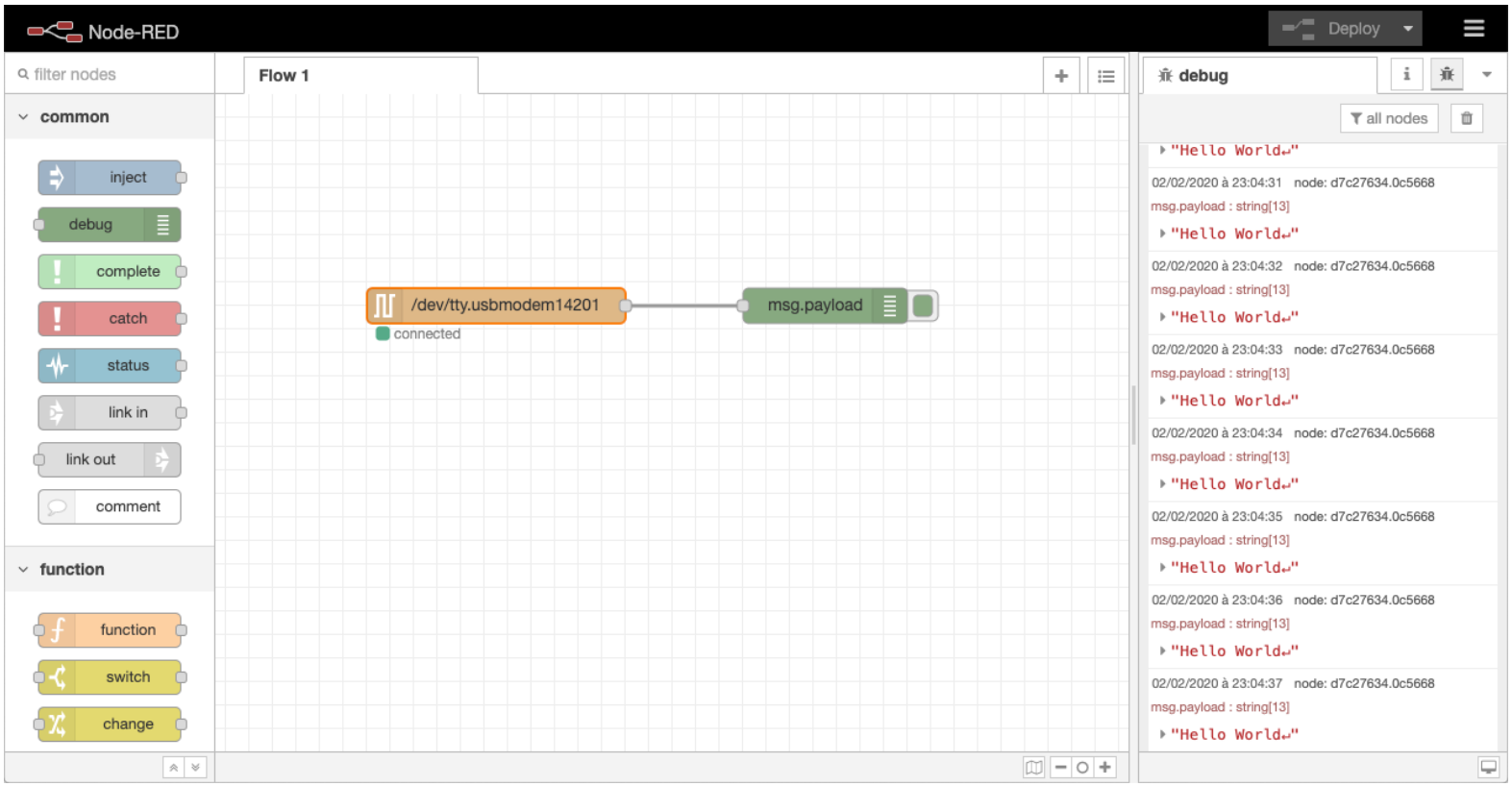
  Configuring carefully the parameters of the serial connection



Arduino Hello World (2)

- The `serial in` node is properly connected to the serial port

  All incoming messages are directly sent to the debug sidebar



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