Production Supporting Systems in Factories

ระบบสนับสนุนการผลิตในโรงงานอุตสาหกรรม

Topic

- อุปกรณ์ตรวจวัดอัจฉริยะ
- ระบบสารสนเทศ
- **Industrial Control System (ICS)**
  - SCADA (Supervisory control and data acquisition)
  - DCS (Distributed control systems)

SCADA

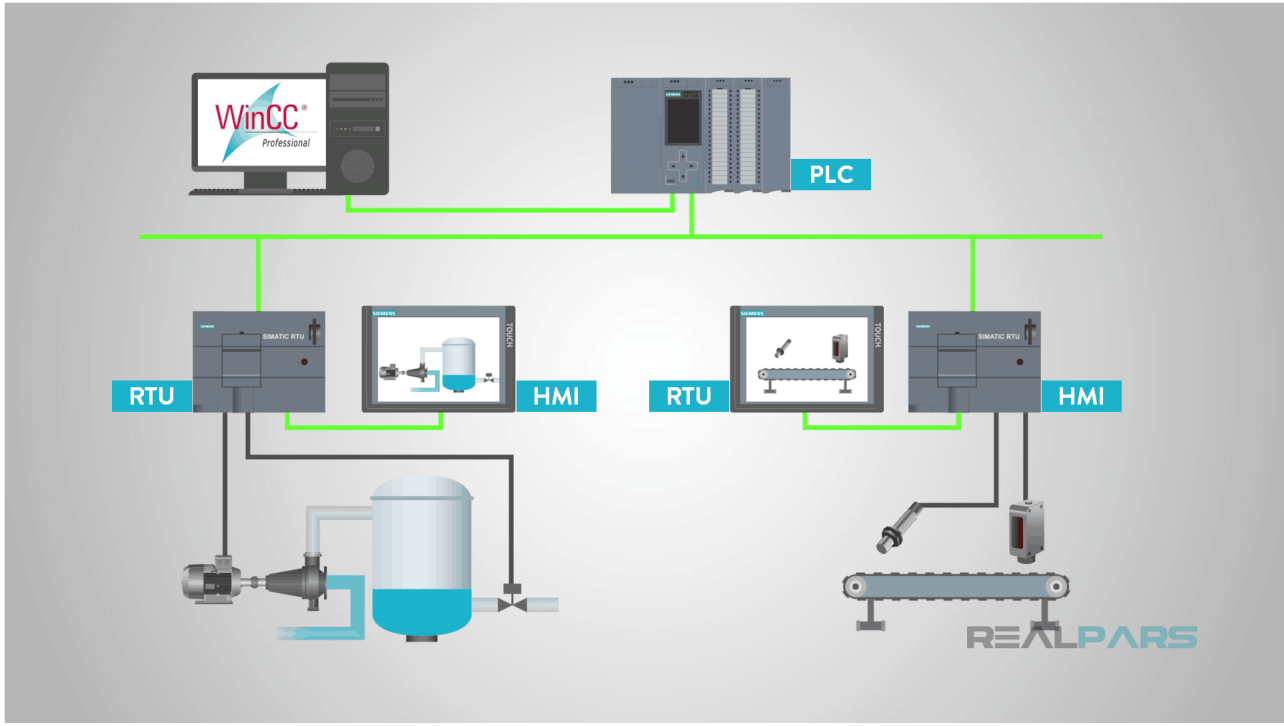
Supervisory control and data acquisition

SCADA

- A system of software and hardware elements that allows industrial organizations to:
  - **Control** industrial processes locally or at remote locations
  - Directly **interact** with devices such as sensors, valves, pumps, motors, and more through human-machine interface (HMI) software
  - **Monitor**, gather, and process real-time data
  - **Record** events into a permanent storage.

Architecture

- **PLC** (Programmable Logic Controller) and/or **RTU** (Remote Terminal Units)
- **HMI** (Human Machine Interface)
- **Field devices** - sensors and actuators
- **SCADA computer**



We will come back to this topic later.

- Now, let's learn about a control system by making a DIY "SCADA".

Project Demo

Link

Diagram

Link

Components

- `Node-Red App` running on a cloud server (Railway Cloud)
  - Collect sensor data
  - Displaying sensor data
  - Notifying operator of the incident through `Line App` (on a desktop computer)
  - Writing and reading from `Database` (on Google Firestore)

Components (cont)

- `Node-Red App` runnign on mobile
  - Receive command to toogle a `flashlight`
  - Process and send `accelerometer` data
- `Mosquitto App` running on a cloud server (Google VM)
  - Receiving and broadcasting data from and to both `Node-Red App`.

Protocol

- HTTP (Hypertext Transfer Protocol)
  - Basically the "internet" protocol
- MQTT
  - Leading open source protocol for connecting internet of things (IoT) and **industrial IoT (IIoT)** devices.

Comparison to SCADA components

Component	Function	SCADA Equiv.
`Node-Red` (Railway)	Collect data	PLC / RTU
	Display data	SCADA computer
	Notify to `Line`	SCADA computer
	Write to `Database`	SCADA computer

Comparison to SCADA components

Component	Function	SCADA Equiv.
`Node-Red` (Mobile)	Control sensors	PLC / RTU
`Accelerometer`	Measure acceleration	Sensor
`Flashlight`	Light	Actuator

Enough talk. Let's get started.

Module 1-1: Setting up `Node-Red`

- Install Node.js
- Install Visual Studio Code

- Change default terminal in `VSCode` (Windows only)
  - Open a window
  - Select `terminal` -> `New Terminal`
  - press `ctrl` + `p`
  - Type `> Terminal: Select Default Profile` and click
  - Select `cmd`

- Install `Node-Red`
  - Create a new folder
  - Drag a folder into `VSCode`
  - Select `terminal` -> `New Terminal`
  - (Terminal) `npm init -y`
  - (Terminal) `npm install node-red`
  - Create a directory called `local`

- Configure `Node-Red`
  - Click at the file `package.json` to edit
  - Add this line `"start": "npx node-red -u ./local -p 1880"`

```
{
  // ...
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1",
    // Add a new line here
    // Don't forget to add the extra "," above.
    "start": "npx node-red -u ./local -p 1880"
  }
  // ...
}
```

- Start `Node-Red`
  - (Terminal) `npm start`
- Visit the web browser at
  - `http://127.0.0.1:1880` or
  - `http://localhost:1880`

Module 1-2: Navigating around `Node-Red`

Create flows to

- Show timestamp in the `debug` panel.
- Show date and time using `function` node. (See code on the other page.)
- Send continuous random numbers. (Use `Math.random()`)
- Use `switch` and `change`.

```
const date = new Date();
msg.payload = date.toDateString();
return msg;
```

Module 1-3: HTTP `Get` Request

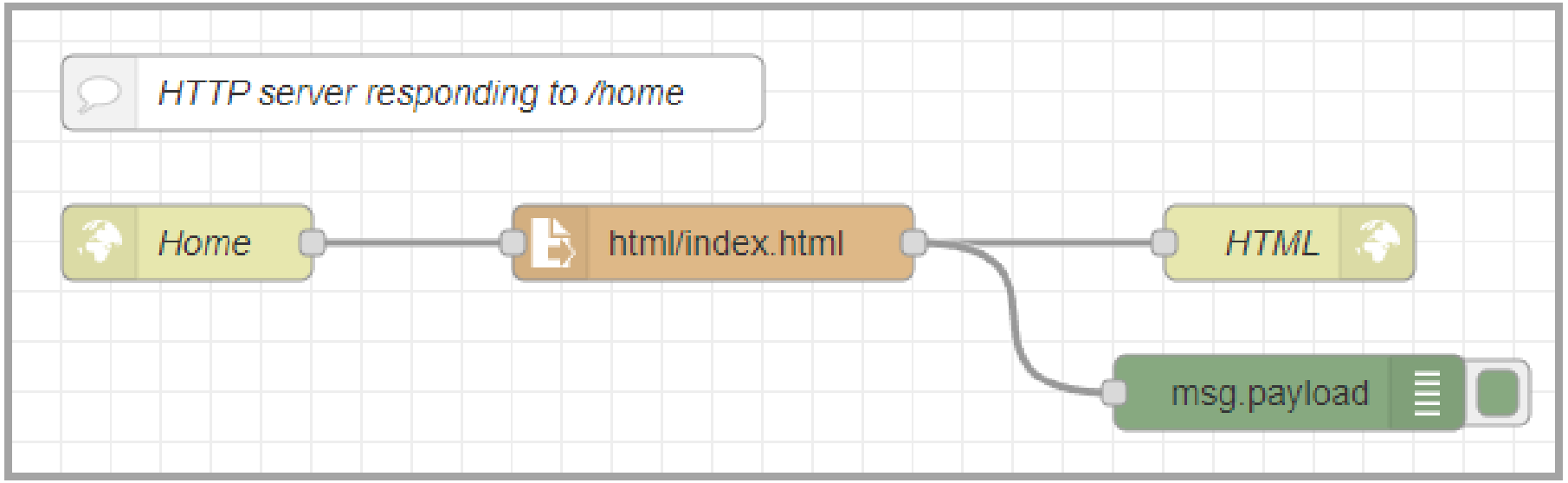
- Send a `get` request to `http://google.com`.
- Display a response to a `debug` panel.
- Write a response to `index.html`

Module 1-4: HTTP Server

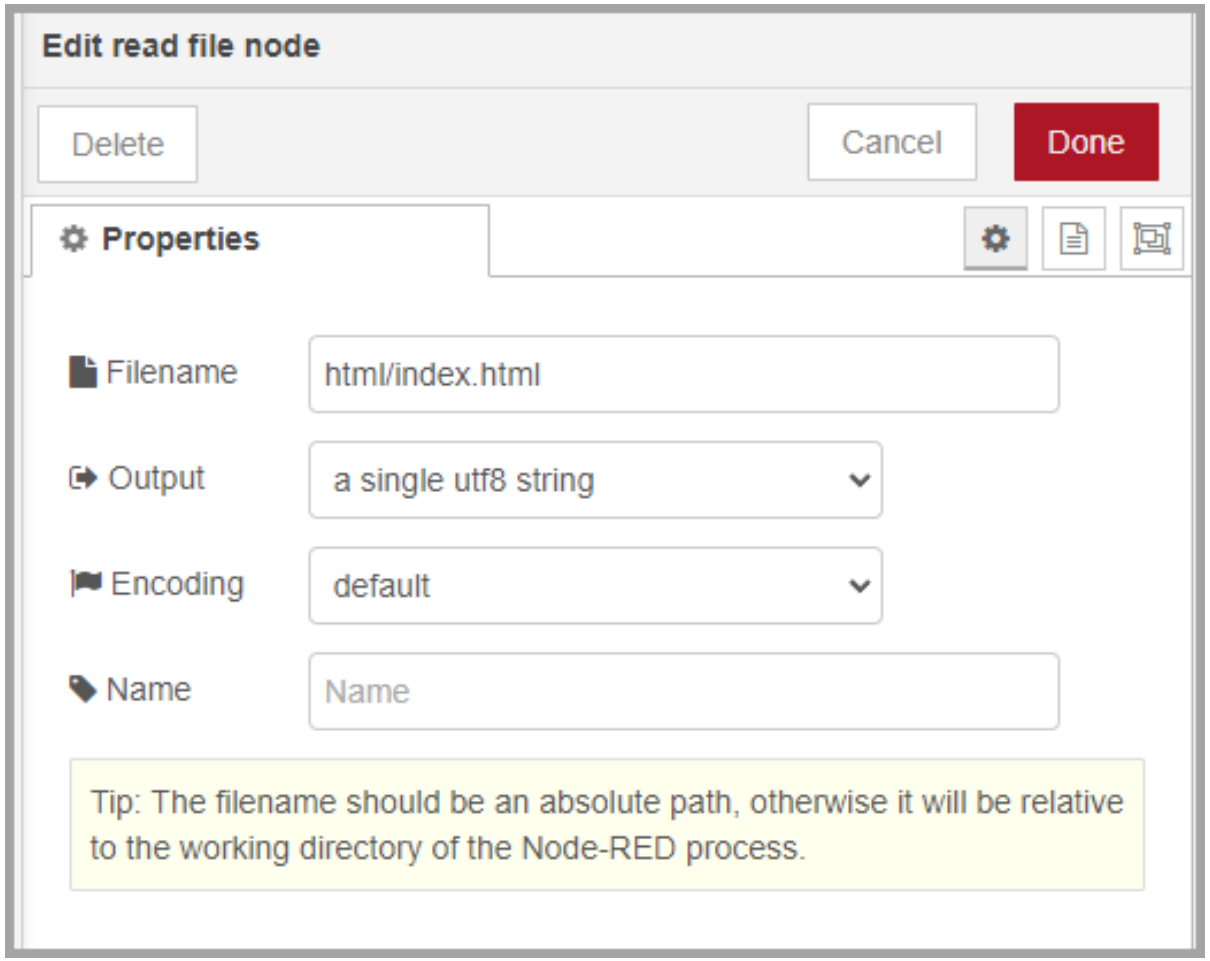
- Create a server that responds to the `GET` request to `/hello`.
  - Respond with a static string.
  - Respond with a dynamic string.

```
const date = new Date();
msg.time = date.toLocaleTimeString();
return msg;
```

- Reponse to `/home` with an HTML document.
  - Create flow `http in`, `read file`, `http response`, `debug`



- `http in` node
  - `Method` = `GET`
  - `URL` = `home`
- `read file` node
  - `Filename` = `html/index.html`
  - See next page.

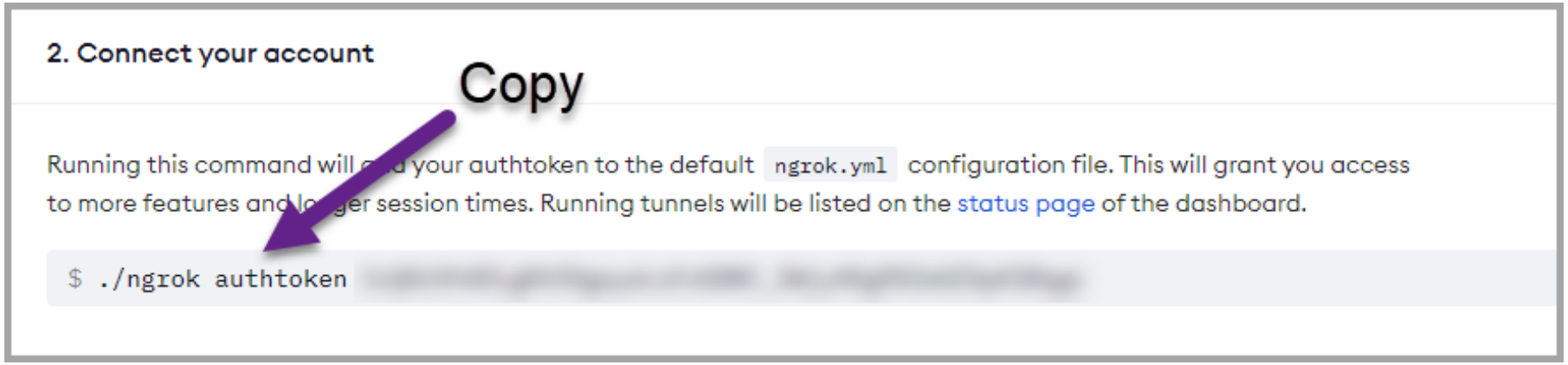

Edit read file node
Delete
Cancel
Done
Properties
Filename
html/index.html
Output
a single utf8 string
Encoding
default
Name
Name
Tip: The filename should be an absolute path, otherwise it will be relative to the working directory of the Node-RED process.

- `http response` node
  - No need to do anything.

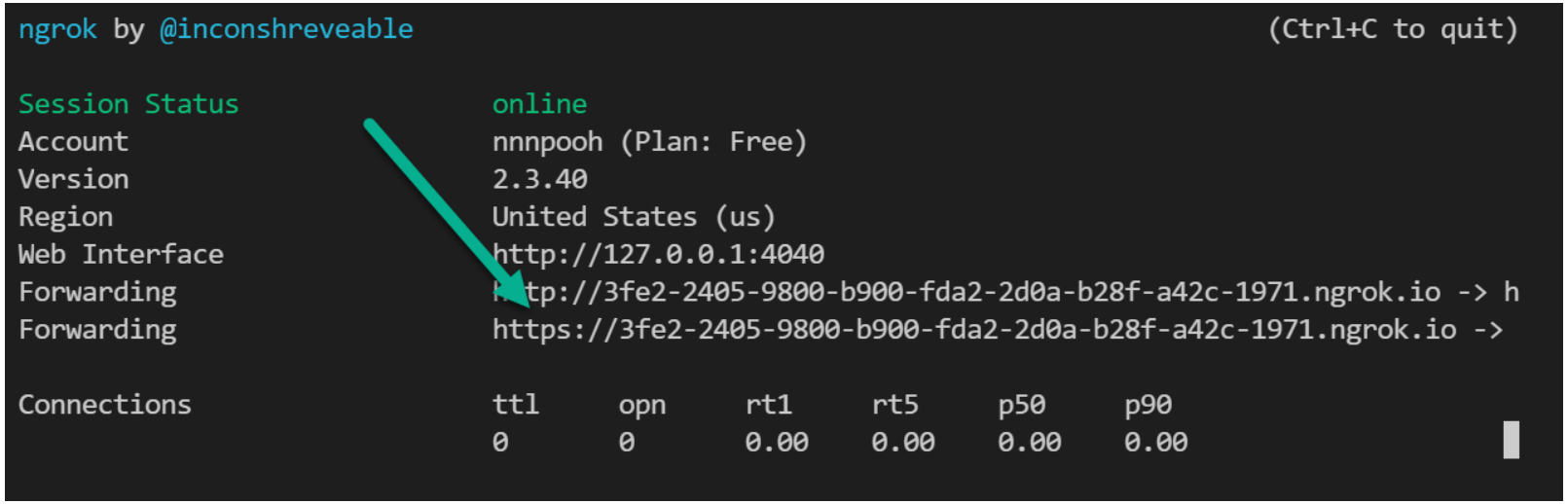
- Create a folder `html`
- Place an `index.html` in the folder
- Use web browser to the url `/home`

Module 1-5: Public server

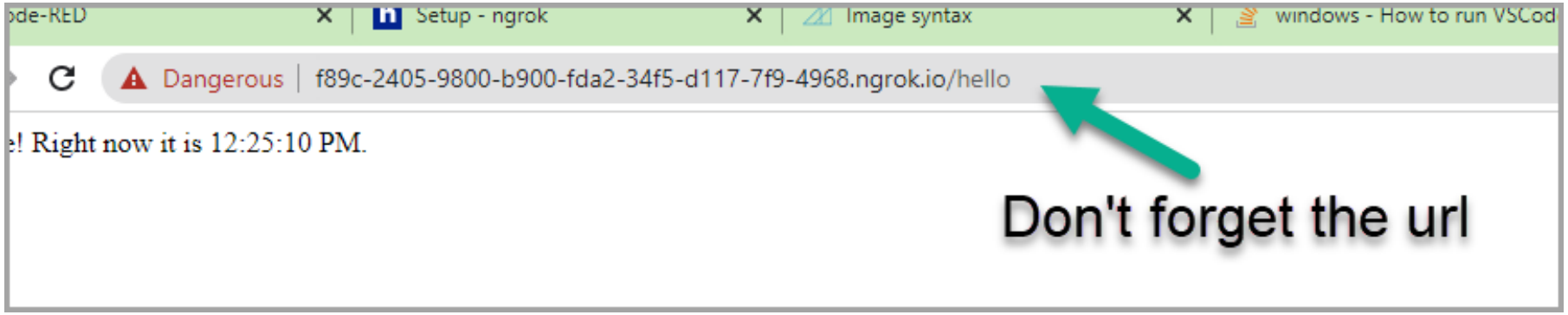
- Get `ngrok`
  - Create an account at https://ngrok.com/
  - **Verify email.**
  - Download the program.
  - Extract the program to the project folder.
  - Copy the command below.



- `VSCode`
  - Create `New Terminal`
  - Run `ngrok authtoken <YOUR AUTHTOKEN>` (Remove `./` from what you just copied.)
  - Run `ngrok http 1880`
- Copy the `https` address (`ctrl` + `shift` + `c`)



- Paste the address in the browser.
  - Don't forget to add the url in the end.



- Try sharing this link to your friends.