

# 物聯網實務

(一)

廖裕評

# 「PMMP時代」來臨

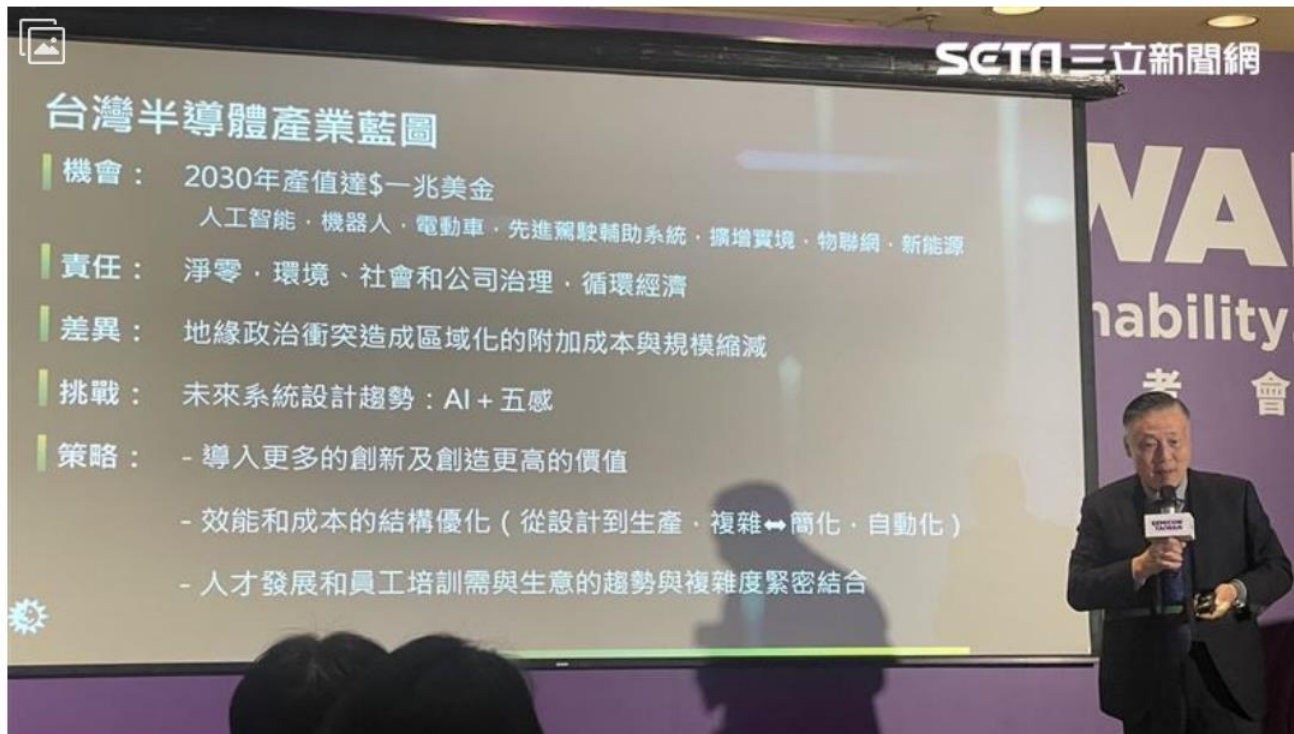


吳田玉指出，半導體產業經過30年來多次成長循環，1990年的PC問世引導全球走向人機協作PM（People-Machine），2000年手機強化人與人的連結PP（People-People），接著2010年有物聯網和智慧裝置，變成PMP（People-Machine-People），緊接著就是如今，全球大數據、AI與自駕驅動趨勢的PMMP（People-Machine-People）時代，機器與機器間的協作需求將大幅增加，將推升半導體產值在2030年衝破1兆美元。

<https://www.setn.com/News.aspx?NewsID=1349088>



# 「PMMP時代」來臨



SETN 三立新聞網

## 台灣半導體產業藍圖

- 機會：2030年產值達\$一兆美金  
人工智能·機器人·電動車·先進駕駛輔助系統·擴增實境·物聯網·新能源
- 責任：淨零·環境·社會和公司治理·循環經濟
- 差異：地緣政治衝突造成區域化的附加成本與規模縮減
- 挑戰：未來系統設計趨勢：AI + 五感
- 策略：
  - 導入更多的創新及創造更高的價值
  - 效能和成本的結構優化（從設計到生產·複雜↔簡化·自動化）
  - 人才發展和員工培訓需與生意的趨勢與複雜度緊密結合

<https://www.setn.com/News.aspx?NewsID=1349088>

# 駭客入侵系統勒索 1天2肉品市場遭殃



<https://udn.com/news/story/7320/7435207>



# IEEE Xplore Search Results

**Show**

☒ All Results

☐ Subscribed Content ?

☐ Open Access Only

Year

Single Year

Range

2020

2024

From

To

2020

2024

Author

Affiliation

Publication Title

Publisher

Supplemental Items

☐ Select All on Page

Sort By 

Relevance

☐ **Comment on “Efficient and Secure Outsourcing Scheme for RSA Decryption in Internet of Things”**

Damien Vergnaud

IEEE Internet of Things Journal

Year: 2020 | Volume: 7, Issue: 11 | Journal Article | Publisher: IEEE

Cited by: Papers (5)

Abstract

HTML

☐ **Identification and Resolution for Industrial Internet: Architecture and Key Technology**

Yang Liu; Cheng Chi; Yuwen Zhang; Tong Tang

IEEE Internet of Things Journal

Year: 2022 | Volume: 9, Issue: 18 | Journal Article | Publisher: IEEE

Cited by: Papers (5)

Abstract

HTML

☐ **Tornado: Enabling Blockchain in Heterogeneous Internet of Things Through a Space-Structured Approach**

Yinqiu Liu; Kun Wang; Kai Qian; Miao Du; Song Guo

IEEE Internet of Things Journal

Year: 2020 | Volume: 7, Issue: 2 | Journal Article | Publisher: IEEE

Cited by: Papers (47)

Abstract

HTML

# 教學目標

## 課程教學目標

隨著科技發展，物聯網裝置日漸普及，被大量運用在我們的生活中。如果可以設計程式將其蒐集到的訊息用圖表呈現，並控制裝置判斷狀況進行對應，就能使監控整個物聯網系統變得更加容易。本課程介紹IoT開發工具Node-RED。Node-RED的使用者可直接利用圖形化的「結點」編寫應用程式，每個結點分別代表不同的硬體設備、Web API或雲端服務，只要連結具有不同功能的結點，就能設計出程式。

## 考核項目及評量標準、比例

考核項目		評量標準、比例(%)
平時	作業	30
期中	報告	30
期末	專題	40

# Course design

---

- Software installation & cloud service registration
- Introduction to HTML5
- Introduction to JavaScript
- Introduction to Iot Hacking
- Design of a voting system
- Design of a chat room
- Web App control arduino board
- Open data applications
- Building a weather station
- AI applications
- AI game
- OpenCV example
- AIoT example
- project



# Reference Book



物聯網實作：Node-RED  
萬物聯網視覺化(附光碟)



物聯網實作：深度學習應  
用篇

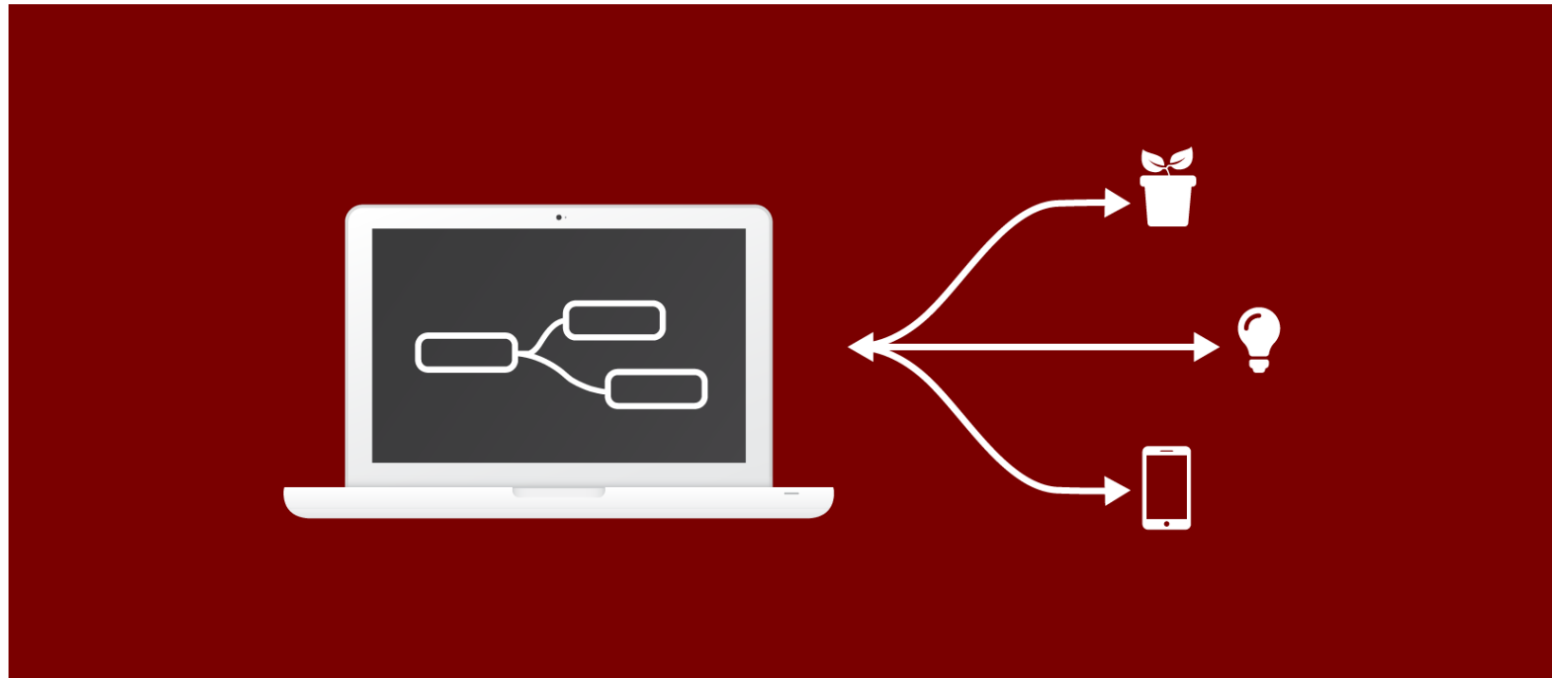


物聯網實作：工業4.0基礎  
篇(2版)

<https://www.books.com.tw/products/0010767362?sloc=main>



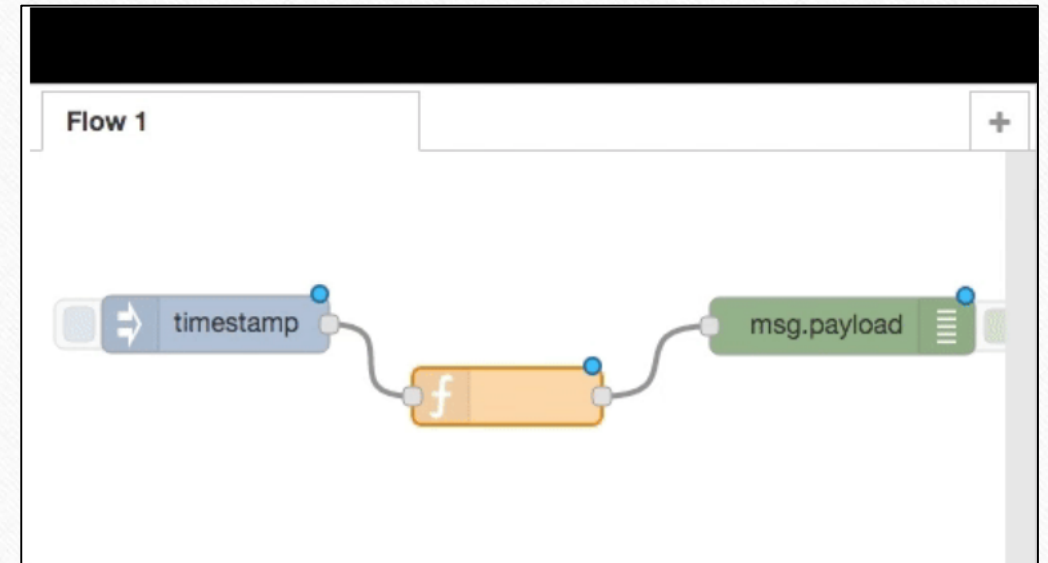
# What is Node-RED?



<https://cheesecakelabs.com/blog/glue-of-the-internet-what-is-node-red/>

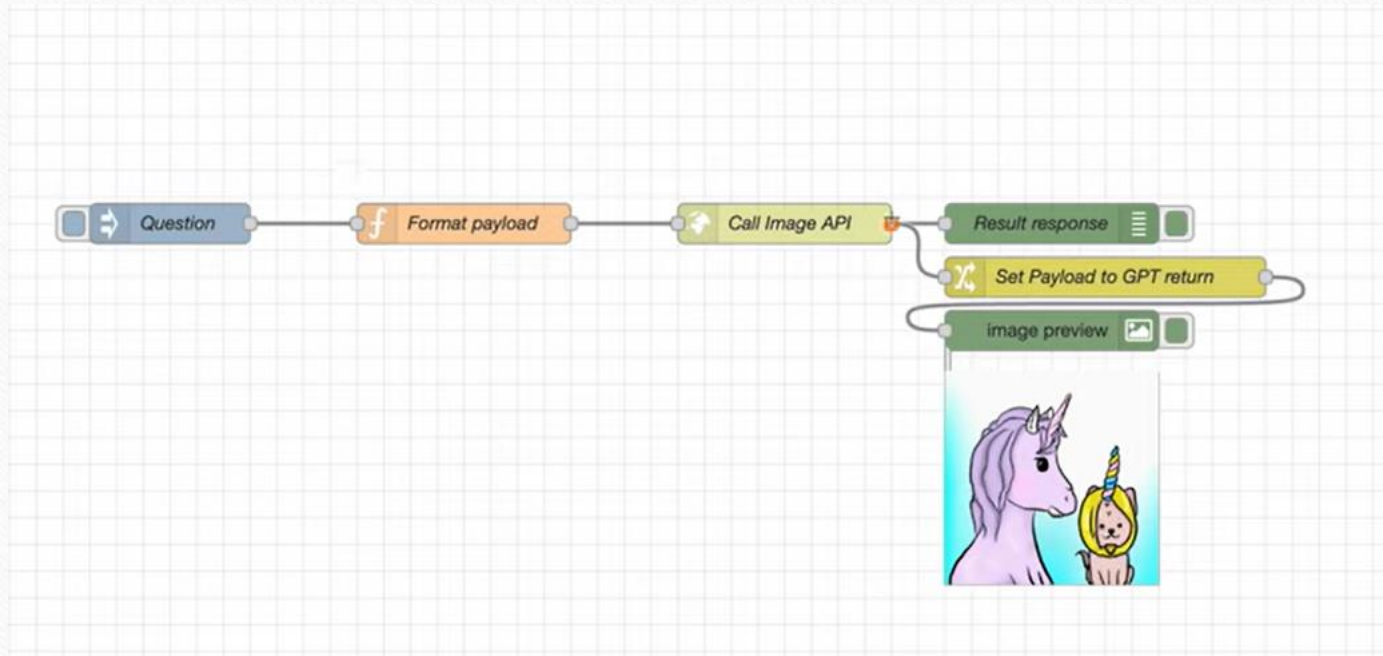
# What is Node-RED?

- Node-RED is “a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways”. It uses a visual web interface, where blocks – also called nodes – can receive and send messages to other nodes. It makes the whole integration process easier by abstracting a lot of repetitive and boilerplate code needed to make these simple things





# Generate Images with ChatGPT in Node-RED



[https://www.youtube.com/watch?v=BV\\_HFlcmrxQ](https://www.youtube.com/watch?v=BV_HFlcmrxQ)

# Node-RED

Node-RED

home

[about](#)

[blog](#)

[documentation](#)

[forum](#)

[flows](#)

[github](#)

## Node-RED

Low-code programming for event-driven applications

Latest version: v3.1.0 (npm)

<https://nodered.org/>

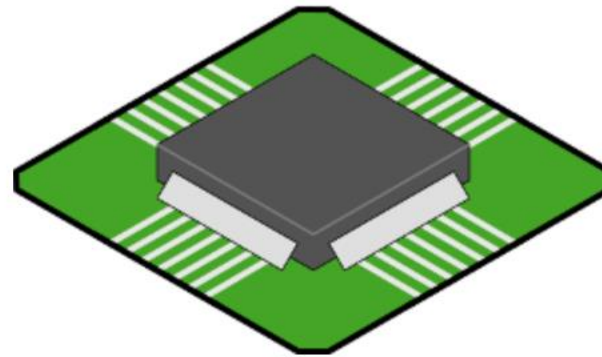


# Node-RED



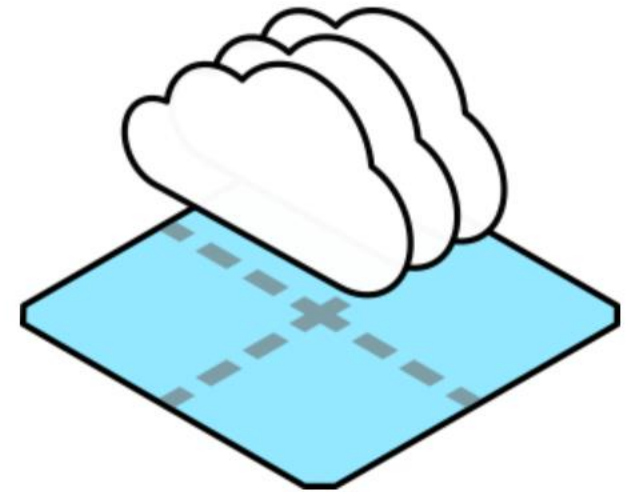
Run locally

- Getting started
- Docker



On a device

- Raspberry Pi
- BeagleBone Black
- Interacting with Arduino
- Android



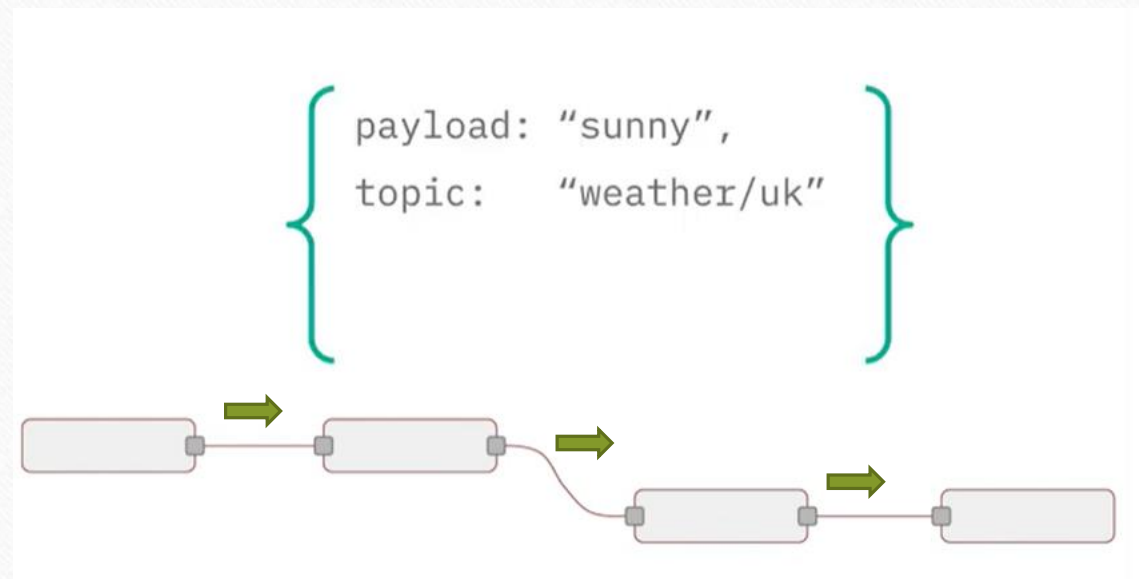
In the cloud

- FlowFuse
- Amazon Web Services
- Microsoft Azure

<https://nodered.org/>

# Working with messages

---



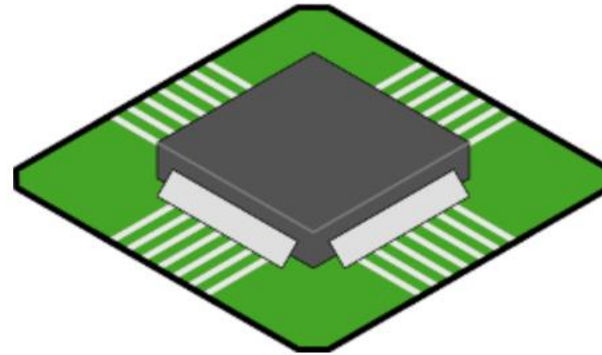


# Node-RED



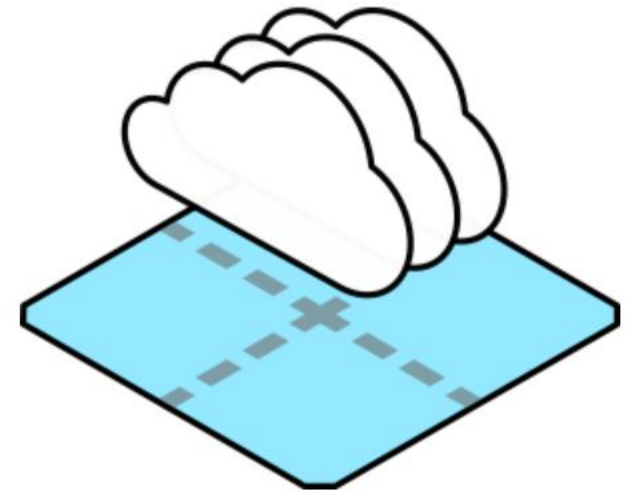
Run locally

- Getting started
- Docker



On a device

- Raspberry Pi
- BeagleBone Black
- Interacting with Arduino
- Android

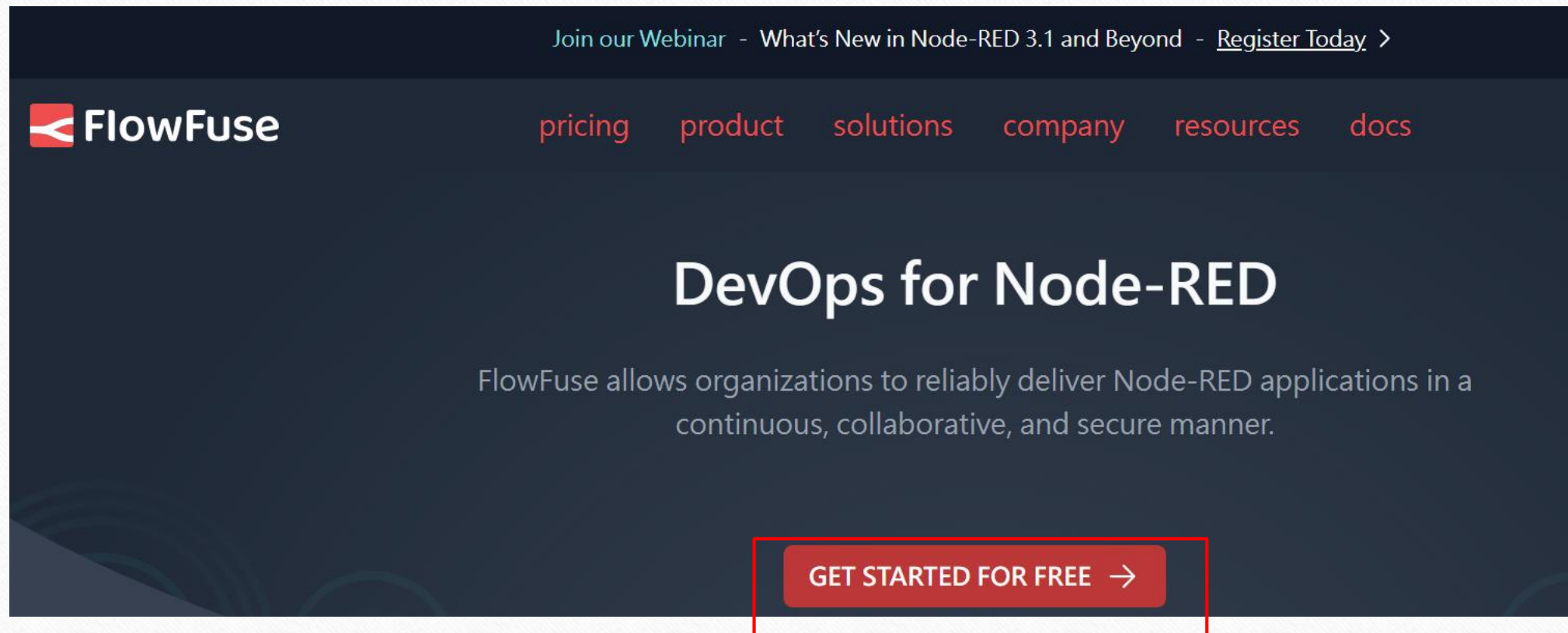


In the cloud


- FlowFuse
- Amazon Web Services
- Microsoft Azure

<https://nodered.org/>

<https://flowfuse.com/>

The image is a screenshot of the FlowFuse website homepage. At the top, there is a dark blue header with a navigation menu. The FlowFuse logo is on the left, and links for pricing, product, solutions, company, resources, and docs are on the right. A banner below the header promotes a webinar. The main content area features the title 'DevOps for Node-RED' and a descriptive paragraph. A red button with the text 'GET STARTED FOR FREE' and a right arrow is at the bottom right.

Join our Webinar - What's New in Node-RED 3.1 and Beyond - [Register Today](#) >

 **FlowFuse**

[pricing](#) [product](#) [solutions](#) [company](#) [resources](#) [docs](#)

## DevOps for Node-RED

FlowFuse allows organizations to reliably deliver Node-RED applications in a continuous, collaborative, and secure manner.

[GET STARTED FOR FREE →](#)



# Get Started Faster with Node-RED and FlowForge



## Quick to start.

The quickest way to get started with Node-RED. No downloads and installation are required. Just sign-up and start building.



## No Credit Card Required

Try for free for 30 days with no credit card required.



USERNAME

FULL NAME

E-MAIL ADDRESS

PASSWORD

WHAT BRINGS YOU TO FLOWFUSE?

☐ BUSINESS NEEDS ☐ PERSONAL USE

☐ EDUCATIONAL USE ☐ OTHER

☐ I ACCEPT THE [FLOWFUSE TERMS & CONDITIONS](#).

SIGN UP

Already registered? [Log in here](#)

# Get Started Faster with Node-RED and FlowForge



## Quick to start.

The quickest way to get started with Node-RED. No downloads and installation are required. Just sign-up and start building.



## No Credit Card Required

Try for free for 30 days with no credit card required.



USERNAME

yuping

FULL NAME

yu-ping liao

E-MAIL ADDRESS

lyp@cycu.org.tw

PASSWORD

.....

WHAT BRINGS YOU TO FLOWFUSE?

☐ BUSINESS NEEDS

☐ PERSONAL USE

☒ EDUCATIONAL USE

☐ OTHER

☒ I ACCEPT THE [FLOWFUSE TERMS & CONDITIONS.](#)

SIGN UP



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## No Credit Card Required

Try for free for 30 days with no credit card required.



Confirm your e-mail address.

Please click the link in the email we sent to [lyp@cycu.org.tw](mailto:lyp@cycu.org.tw)

# Please verify your email address

Please verify your email address

外部

收件匣 x



**FlowForge** <flowforge@flowforge.cloud>

寄給我 ▾



英文 ▾



中文 (繁體) ▾

[翻譯郵件](#)

Hello, **yu-ping liao**,

Use the link below to verify your email address.

<https://app.flowforge.com/account/verify/eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiJ1c2VleHAiOiJlE2OTQ3MDk3NjlsImhhdCI6MTY5NDUzNjk2Mn0.mMNJw6HTfOfV-1tT0OCa9tOzx>



# VERIFY MY EMAIL



**Please verify your email**

Once verified, you will be able to access  
the platform.

VERIFY MY EMAIL

## Welcome to your free FlowFuse trial

外部

收件匣 x



**FlowForge** <flowforge@flowforge.cloud>

寄給我 ▾

上午12:44 (0 分鐘前)



英文 ▾



中文 (繁體) ▾

翻譯郵件

關閉下列語言的翻譯功能：英文 x

Hello yu-ping liao,

Welcome to FlowFuse. We hope you enjoy your free trial for your first 30 days with us.

To get started, log in to FlowFuse and begin creating Node-RED flows in your first application.

You can also invite other users to join your team to collaborate on your applications.

Your 30 day trial gives you full access to your new Starter team, where you can have up to two Node-RED instances and two devices.

Once the trial ends, you will need to add your credit card details to keep it running. But don't worry - we'll remind you when the trial is nearing its end.

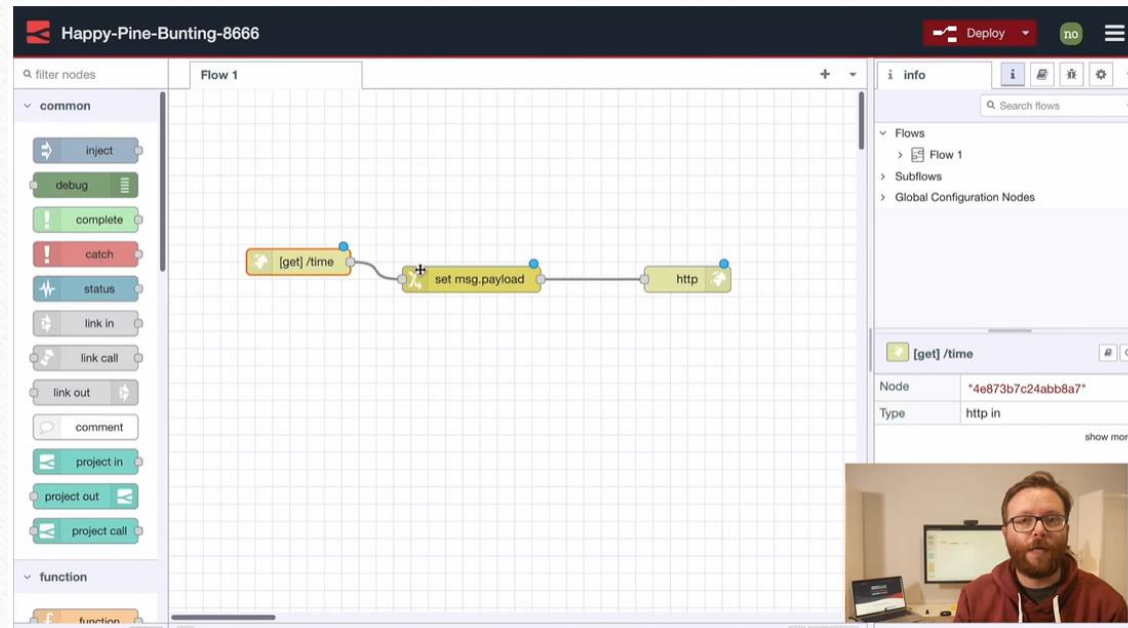
We hope you enjoy the FlowFuse experience.

Cheers!

Your friendly FlowFuse Team

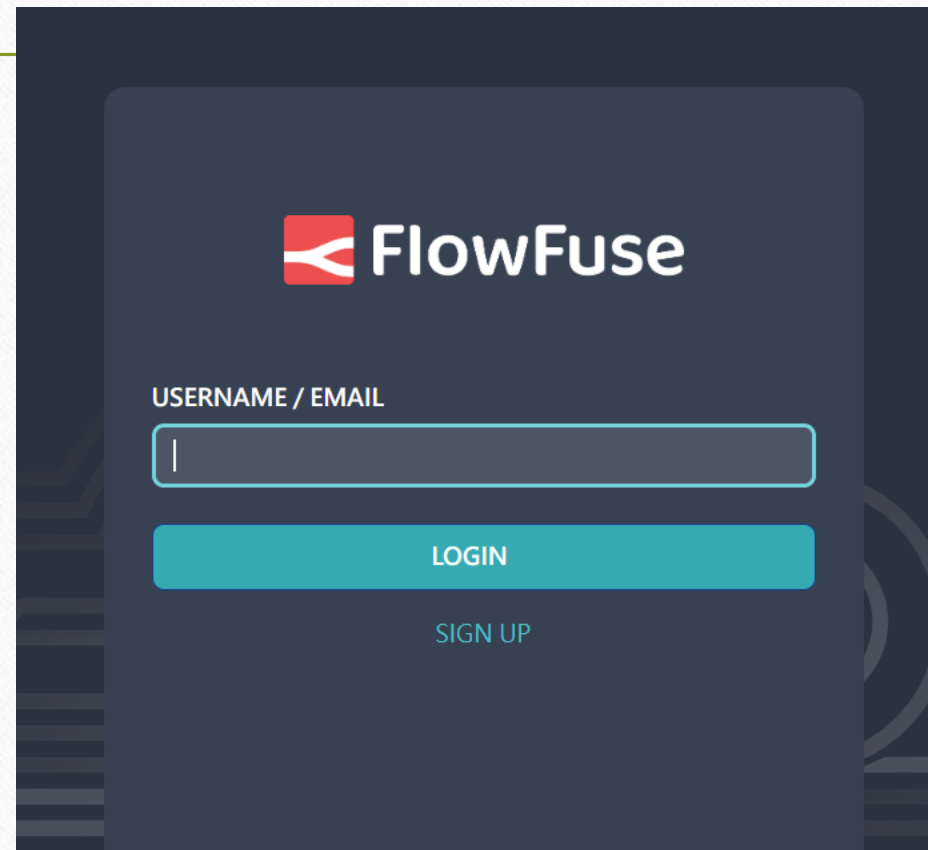


# What is FlowForge? (A Quick Tour)



<https://www.youtube.com/watch?v=K4xw09DbSdI&t=2s>

<https://app.flowforge.com/>



The image shows a login interface for FlowFuse. It features a dark blue background with a lighter blue rounded rectangle in the center. At the top of this rectangle is the FlowFuse logo, which consists of a red square with a white stylized 'F' and the text 'FlowFuse' in white. Below the logo is a label 'USERNAME / EMAIL' in white. Underneath the label is a light blue input field with a vertical cursor. Below the input field is a teal button with the word 'LOGIN' in white. At the bottom of the rectangle is the text 'SIGN UP' in a smaller, lighter blue font. The entire interface is framed by a thin green line, and there are dark blue vertical bars on the left and right sides of the frame.

**FlowFuse**


USERNAME / EMAIL

LOGIN

SIGN UP



# FlowFuse

 **FlowFuse**

TEAM:  
Team yu-ping liao

yl

Applications

Instances

Devices

Library


Members

Team Admin Zone

Audit Log


Billing

Team Settings


 You have **30 days left** of your free trial. Click here to setup billing at any time to keep your instances running after the trial the ends. >

## Applications

A list of applications belonging to this Team.


 Yu-ping liao's Application 1 Instance

Instances

 team-yu-ping-liao-yuping-e33a6b4c  
https://team-yu-ping-liao-yuping-e33a6b4c.flowforge.cloud

running

flows never deployed

Open Editor 

🔍 過濾節點

流程1

▼ 共通

⇒ inject

debug

! complete

! catch

📶 status

➡ link in

🔄 link call

➡ link out

💬 comment

▼ 功能

f function



## Welcome to Node-RED 3.0!

Let's take a moment to discover the new features in this release.

1/9

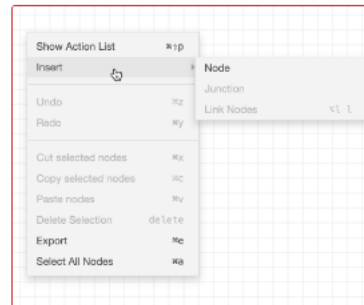
Start ➤



## Context Menu

The editor now has its own context menu when you right-click in the workspace.

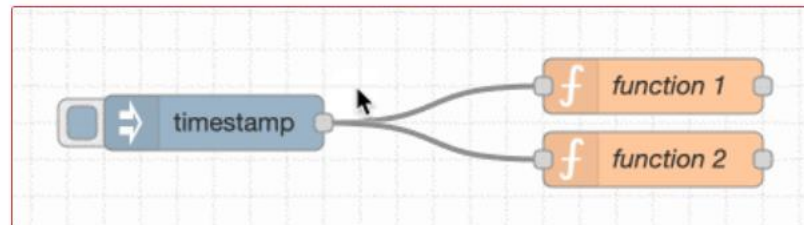
This makes many of the built-in actions much easier to access.



## Wire Junctions

To make it easier to route wires around your flows, it is now possible to add junction nodes that give you more control.

Junctions can be added to wires by holding both the Alt key and the Shift key then click and drag the mouse across the wires.

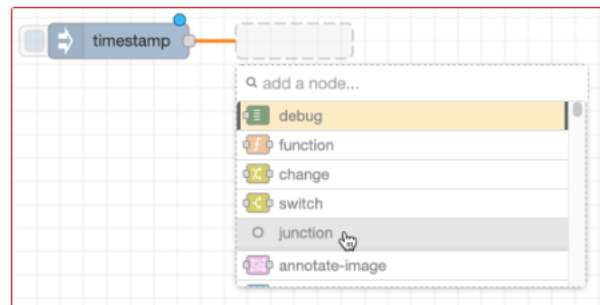




## Wire Junctions

Junctions can also be added using the quick-add dialog.

The dialog is opened by holding the Ctrl (or Cmd) key when clicking in the workspace.

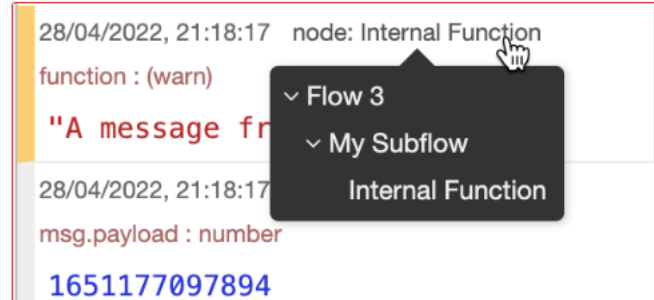


## Debug Path Tooltip

When hovering over a node name in the Debug sidebar, a new tooltip shows the full location of the node.

This is useful when working with subflows, making it much easier to identify exactly which node generated the message.

Clicking on any item in the list will reveal it in the workspace.





## Continuous Search

When searching for things in the editor, a new toolbar in the workspace provides options to quickly jump between the search results.

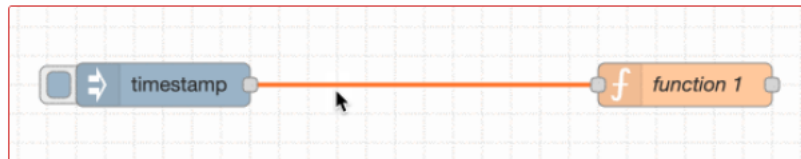


## New wiring actions

A new action has been added that will replace a wire with a pair of connected Link nodes:

- **Split Wire With Link Nodes**

Actions can be accessed from the Action List in the main menu.





## Default node names

Some nodes have been updated to generate a unique name when new instances are added to the workspace. This applies to `Debug`, `Function` and `Link` nodes.

A new action has also been added to generate default names for the selected nodes:

- `Generate Node Names`

Actions can be accessed from the Action List in the main menu.

## Node Updates

- The Debug node can be configured to count messages it receives
- The Link Call node can use a message property to dynamically target the link it should call
- The HTTP Request node can be preconfigured with HTTP headers

9/9

關閉

Q 過濾節點

流程1

+ ▾

i 信息

i

📄

🔍

⚙️

▾

Q 搜尋流程

▾ 流程

&gt; 📄 流程1

&gt; 子流程

&gt; 全局配置節點

📄 流程1

Q

流程

"06a09b0ffd817c75"

↺ ×

ctrl-f 可以在流程內搜索節點。

▾ 共通

⇒ inject

debug

! complete

! catch

📶 status

⇒ link in

🔄 link call

link out ⇒

💬 comment

▾ 功能

f function





Q 過濾節點

流程1



✓ 共通

- inject
- debug
- complete
- catch
- status
- link in
- link call
- link out
- comment

✓ 功能

- function



i 信息



Q 搜尋流程

✓ 流程

- > 流程1
- > 子流程
- > 全局配置節點

→ 時間戳

節點	"8ab8b8e1649a071f"
類型	inject

展開

您可以通過點擊 **enter** 來顯示被選中節點的屬性設置畫面。



Team-Yu-Ping-Liao-Yuping-E33a6b4c



部署

過濾節點

link in

link call

link out

comment

功能

function

switch

change

range

template

流程1

時間戳

function 1

信息

搜尋流

- 流程
  - 流程1
  - 子流程
  - 全局配置節點

function 1

節點	"78a75cd81"
類型	function

過濾節點

流程1

+

-

信息

i

📄

搜尋流程

共通

inject

debug

complete

catch

status

link in

link call

link out

comment

時間戳

function 1

debug 1

流程

流程1

子流程

全局配置節點

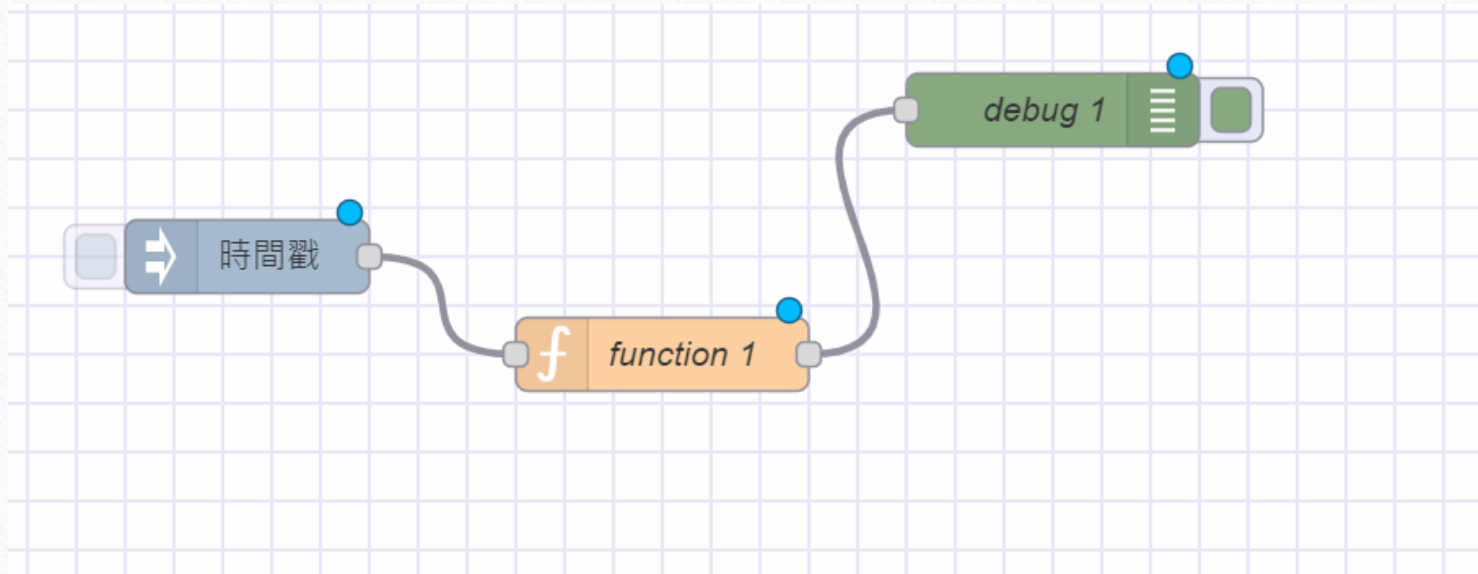
debug 1

節點 "14610aa7fe22"

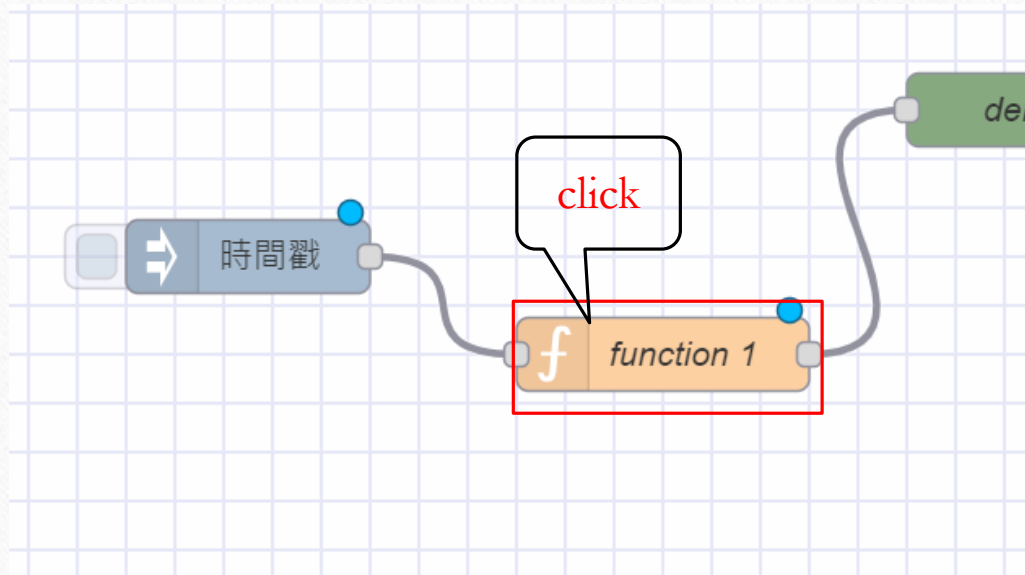
類型 debug



# wiring



# Click 'function 1'



編輯 function 節點

刪除 取消 完成

屬性

名稱 function 1

Setup 設置 函數 關閉

```
1  
2 return msg;
```

msg.payload="hello";



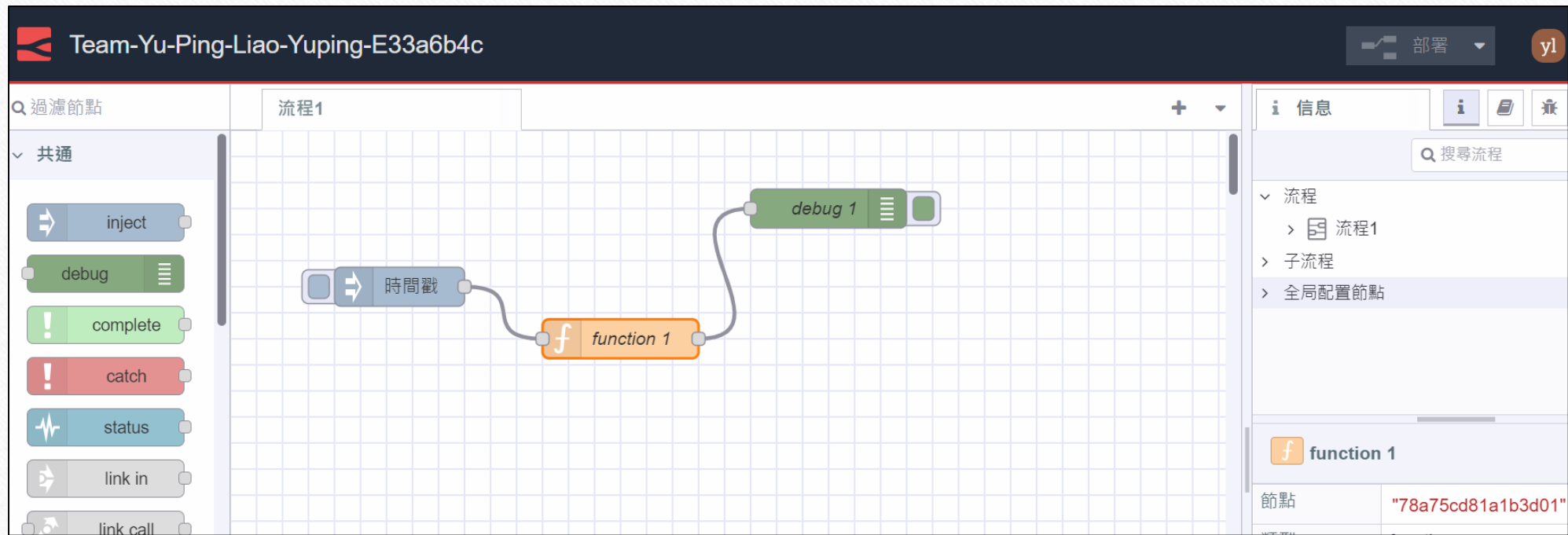
The image shows a Node-RED interface on a grid background. On the left, a blue '時間戳' (Timestamp) node is connected to an orange 'function 1' node. The 'function 1' node is selected, and its configuration panel is open on the right. The panel has a title bar '編輯 function 節點' (Edit function node). At the top right of the panel are buttons for '刪除' (Delete), '取消' (Cancel), and '完成' (Done), with '完成' highlighted by a red box. Below the title bar is a '屬性' (Properties) section with a '名稱' (Name) field set to 'function 1'. At the bottom of the panel are tabs for 'Setup', '設置' (Settings), '函數' (Function), and '關閉' (Close), with '函數' selected. The '函數' tab shows a code editor with two lines of JavaScript code: '1 msg.payload="hello";' and '2 return msg;'. The first line is highlighted by a red box.



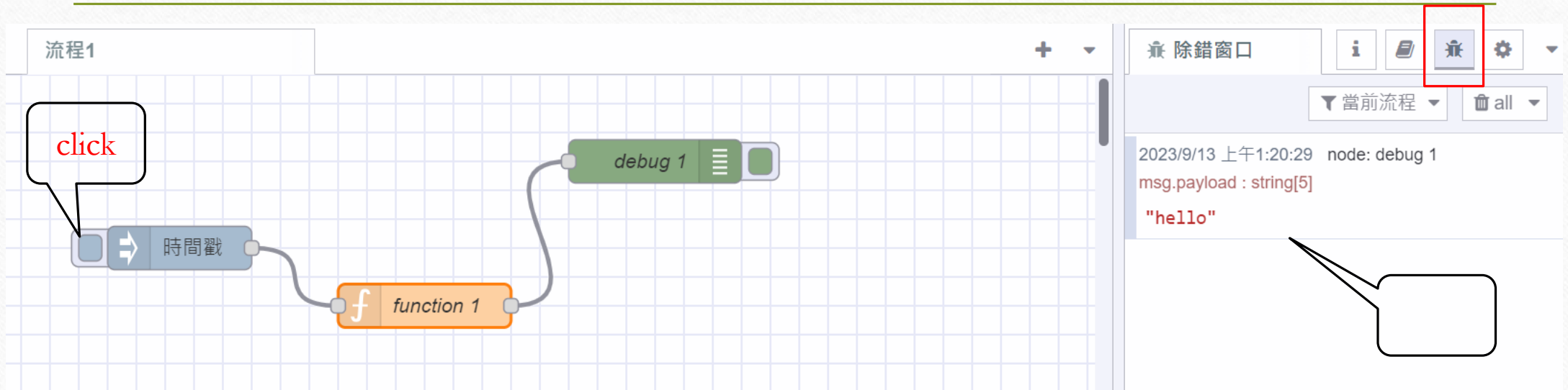
# Deploy

The screenshot displays the Azure Logic Apps Designer interface. At the top, the header bar shows the account name 'Team-Yu-Ping-Liao-Yuping-E33a6b4c'. On the right side of the header, the '部署' (Deploy) button is highlighted with a red rectangle. Below the header, the left sidebar contains a '過濾節點' (Filter Nodes) search bar and a list of common nodes under the '共通' (Common) category, including 'inject', 'debug', 'complete', 'catch', 'status', 'link in', 'link call', 'link out', and 'comment'. The main workspace shows a workflow named '流程1' (Flow 1) on a grid. The workflow consists of three nodes connected in sequence: '時間戳' (Timestamp), 'function 1', and 'debug 1'. The right sidebar shows the '信息' (Info) tab for the selected 'function 1' node, displaying its ID as '78a75cd81a1b' and its type as 'function'. At the bottom right, there is a note: '您可以在 `alt+fn` 中管理' (You can manage in `alt+fn`).

# Done

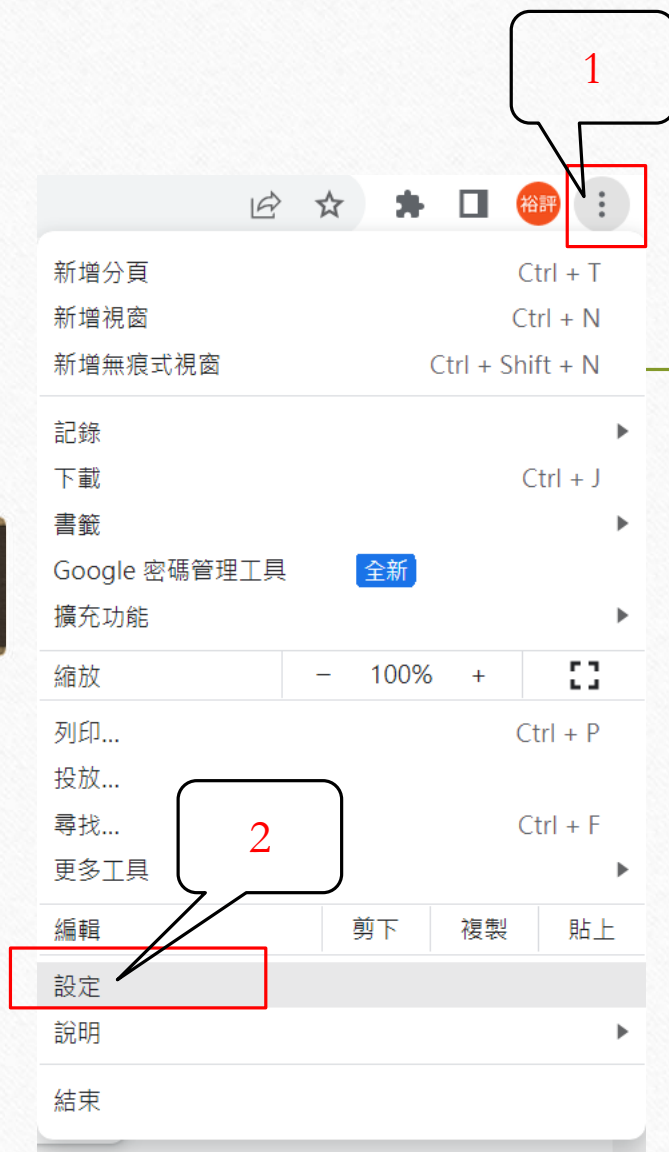


# debug window





# Change setting



偏好語言

網站會以你偏好的語言顯示內容 (如果支援的話)

1. 英文 (美國)  
這是 Google Chrome UI 的顯示語言

4





# Settings



You and Google



Autofill and passwords



Privacy and security



Performance



Appearance



Search engine



Default browser



On startup



Languages



Downloads



Search settings

## Preferred languages

Websites will show content in your preferred languages, when possible

Add languages

1. English (United States)

This language is used to display the Google Chrome UI



2. Chinese (Traditional)

This language is used when translating pages



3. Chinese



4. English

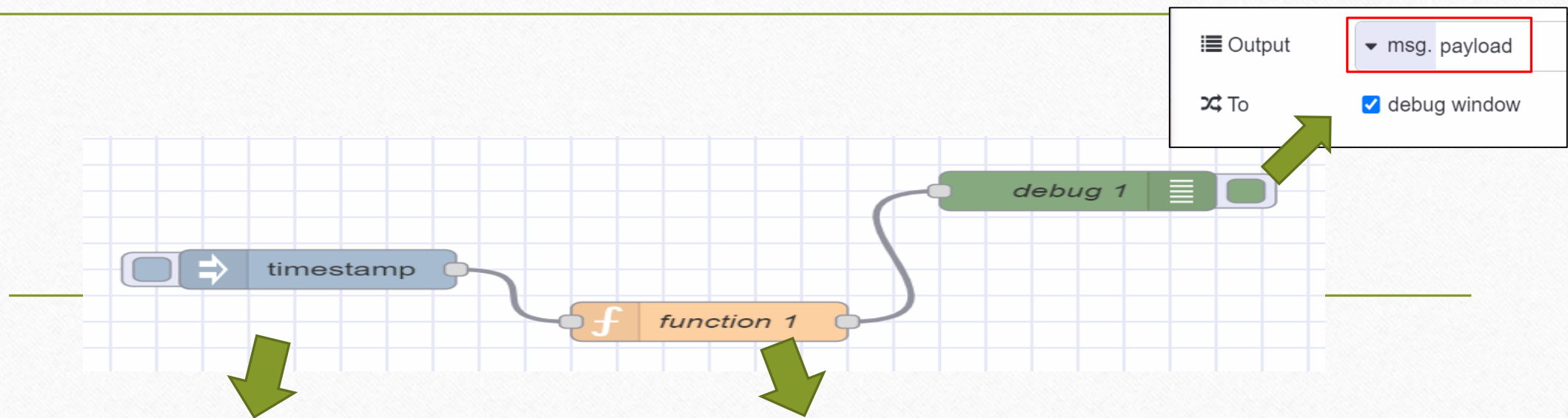


## Spell check

# Switch to Node-RED

The screenshot displays the Node-RED web interface. At the top, the header bar shows the user name "Team-Yu-Ping-Liao-Yuping-E33a6b4c", a "Deploy" button, and a user profile icon labeled "yl". Below the header, the left sidebar contains a "filter nodes" search bar and a list of nodes under the "common" category: inject, debug, complete, catch, status, link in, link call, and link out. The main workspace, titled "流程1", shows a workflow on a grid background. The workflow starts with an "inject" node (blue), followed by a "timestamp" node (blue), then a "function 1" node (orange), and finally a "debug 1" node (green). The right sidebar features a "debug" tab, an "i" icon, a "current flow" dropdown, and an "all" dropdown.





### Edit inject node

Delete Cancel Done

**Properties**

Name Name

msg. payload = timestamp

msg. topic = a<sub>z</sub>

### Edit function node

Delete Cancel Done

**Properties**

Name function 1

Setup On Start On Message On Stop

```
1 msg.payload="hello";  
2 return msg;
```

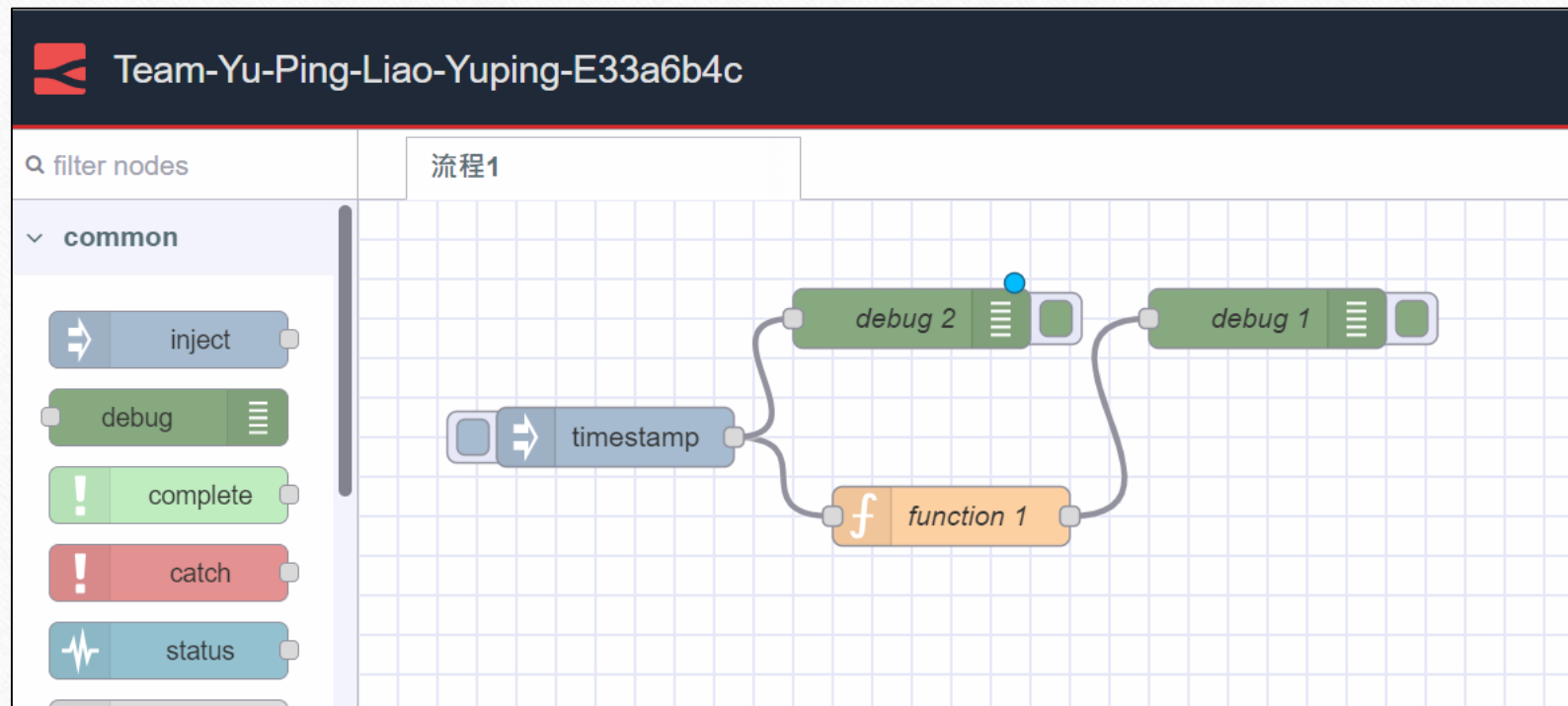
# timestamp

---

- Number of milliseconds since January 1, 1970 00:00:00

[https://www.w3schools.com/jsref/jsref\\_gettime.asp](https://www.w3schools.com/jsref/jsref_gettime.asp)

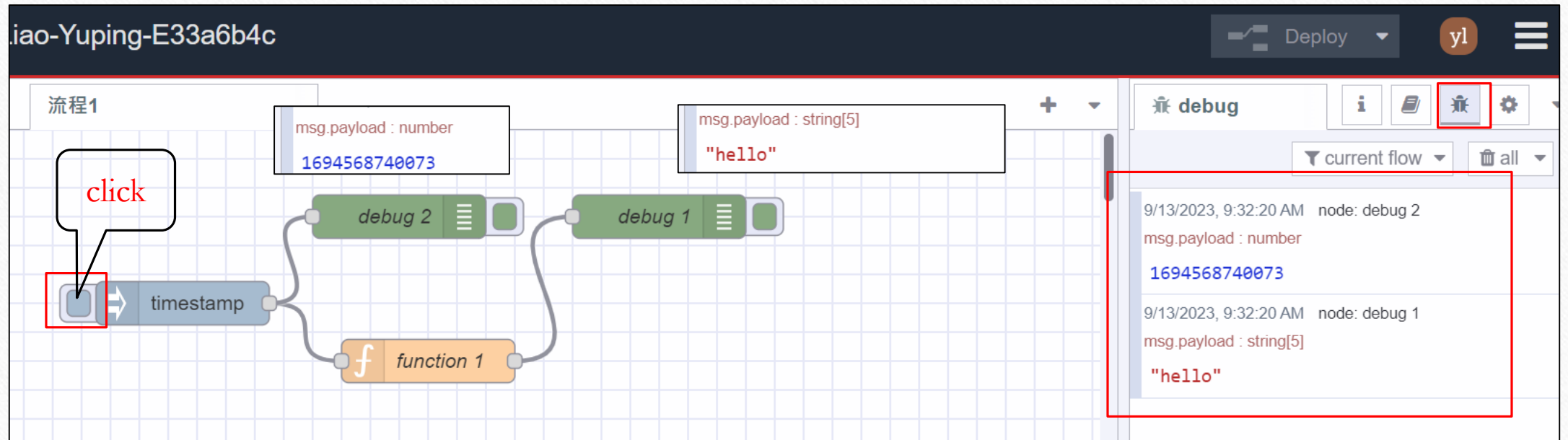
# Add a debug node



Deploy

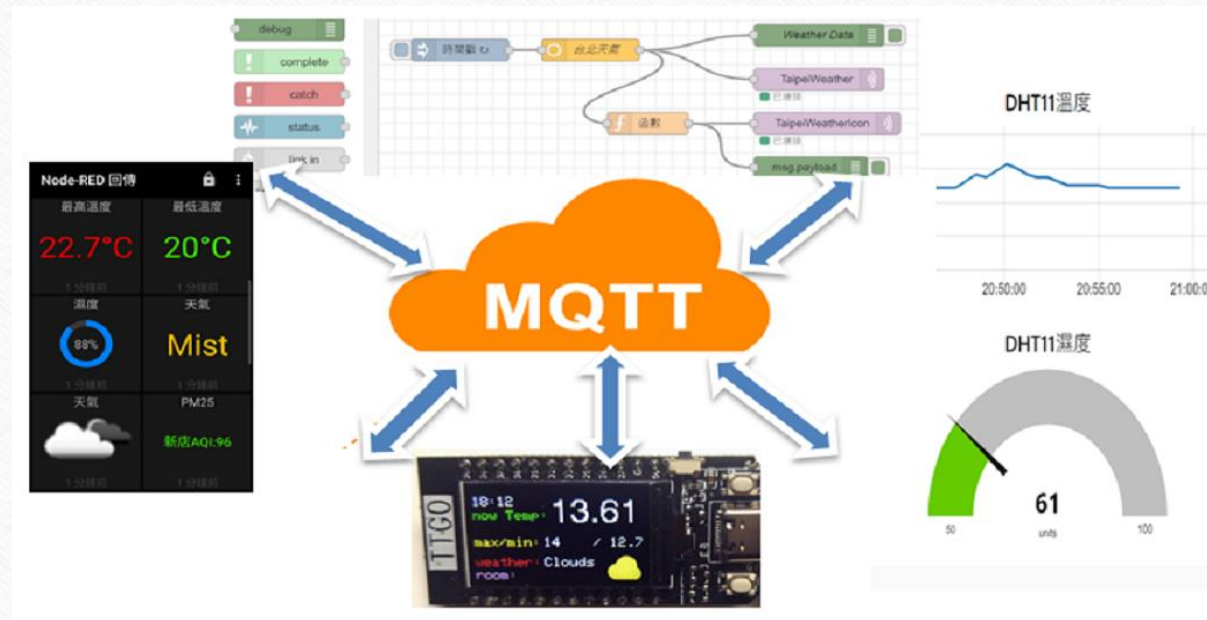


# trigger

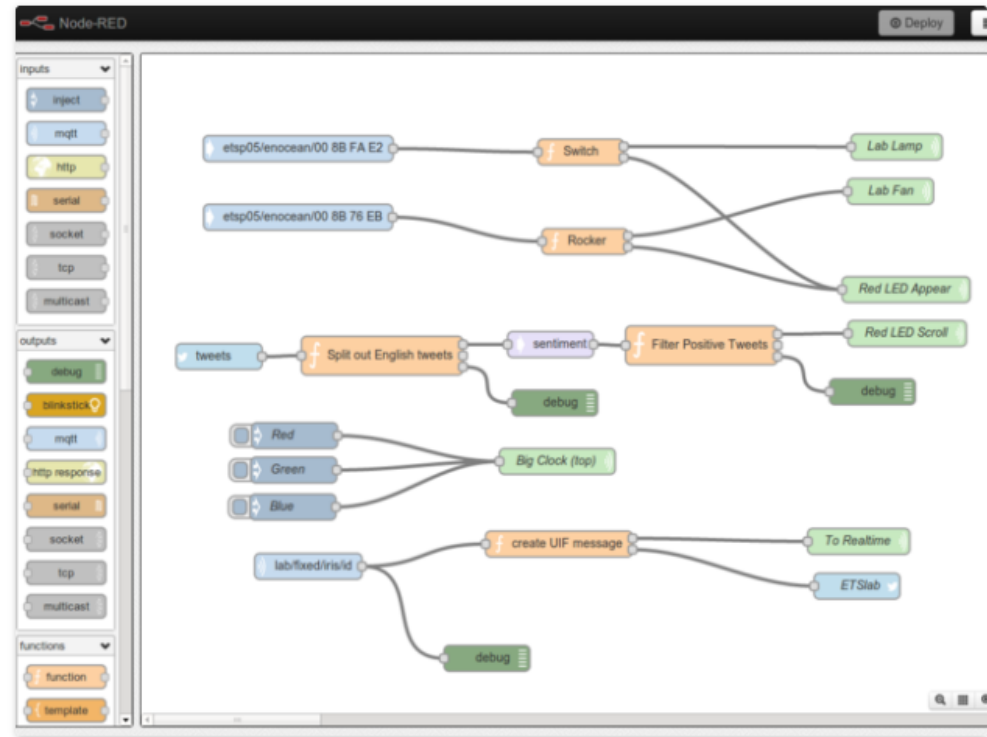
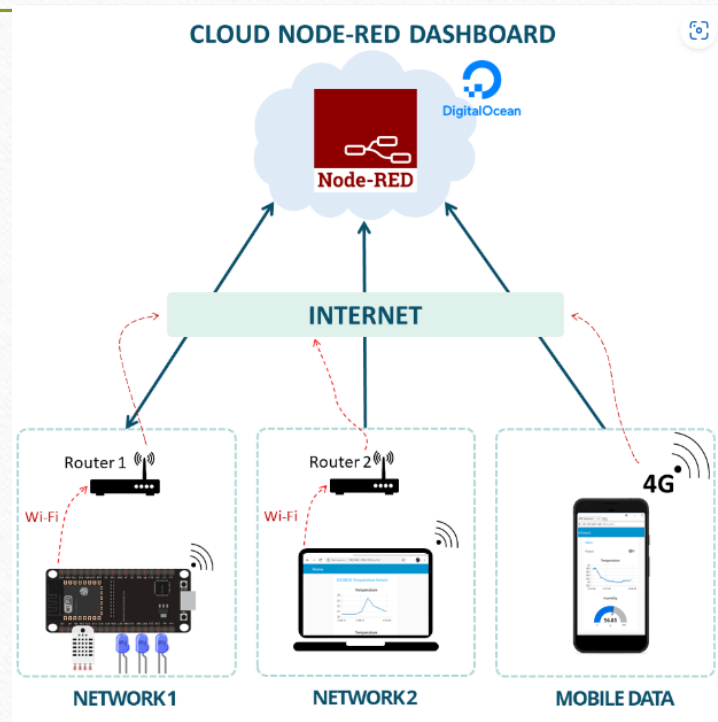


# Applications

- <https://www.accupass.com/event/2107191245407617674700>



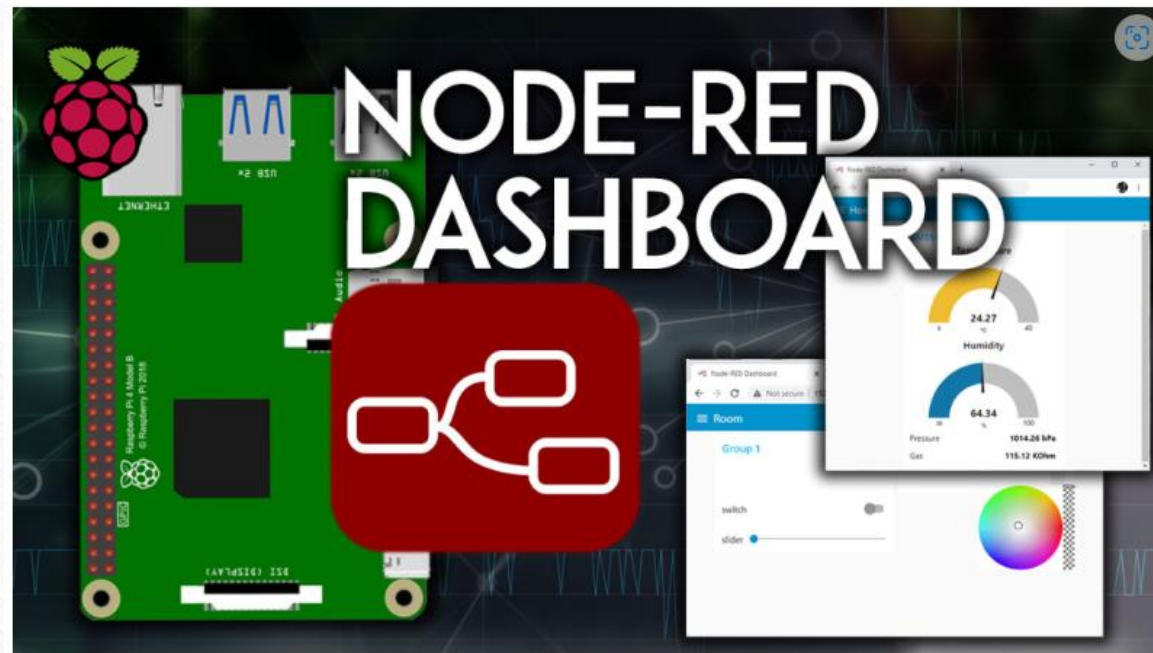
# Applications



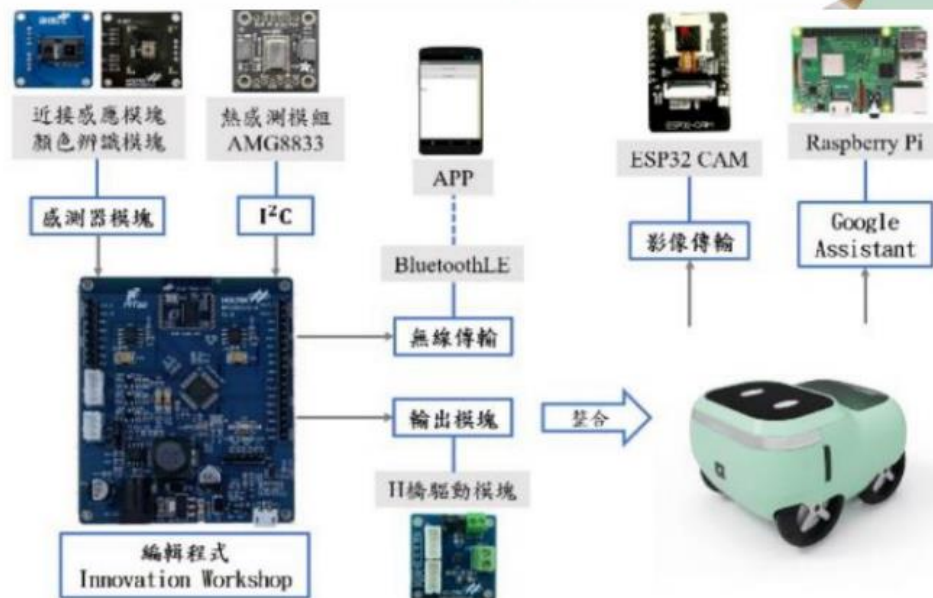
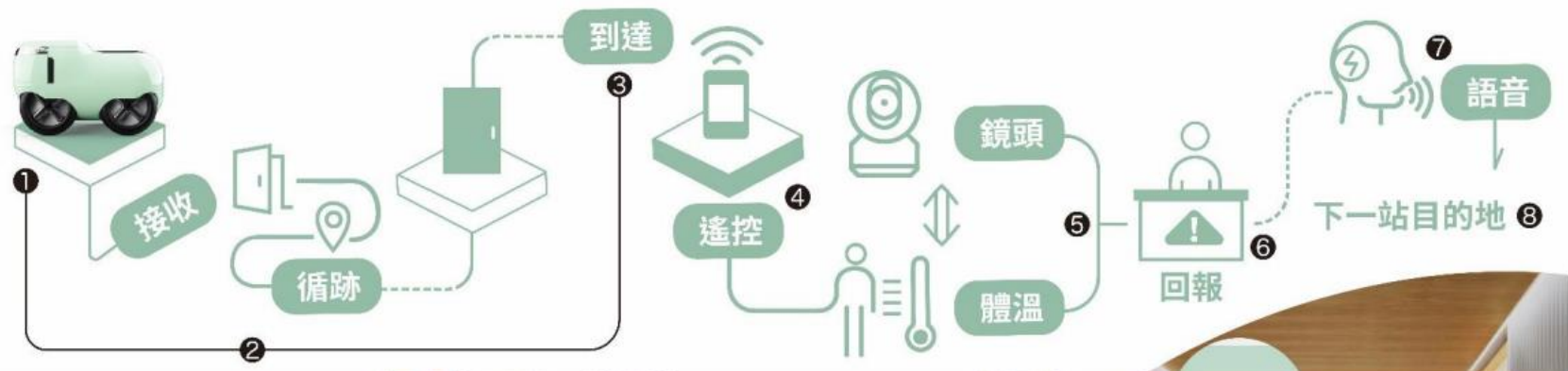
<https://aprendiendoarduino.wordpress.com/2021/11/07/que-es-node-red-3/>



# Applications

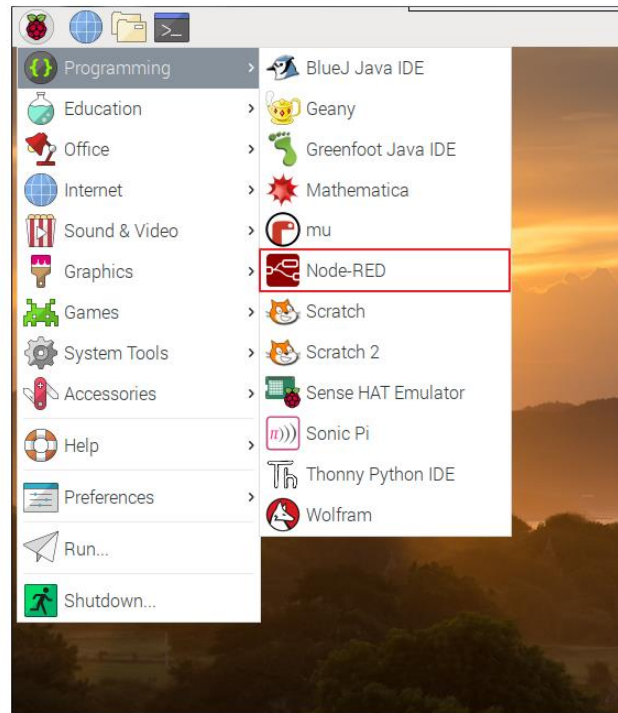


<https://randomnerdtutorials.com/getting-started-node-red-dashboard/>





# Running on Raspberry Pi



<https://atceiling.blogspot.com/2019/07/raspberry-pi-51node-reddashboard.html>



# Homework 1-1

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- Create your FlowFuse account

# Homework 1-2

- Build the flow and run

