

Introduction of the IoT Platform Node-RED and Hitachi's Activities

Open Source Summit Japan 2018

Ide, Takaya

Nakanishi, Kazuki

Internet of Things

HITACHI **Inspire the Next**

IoT has huge potentials to create new business

20.4B Number of connected things will be in use worldwide (Gartner)

AAB659

2025 Number of sensors connected with Internet (WEF)

Forecast of global loT spending (IDC)

\$1.'

34% CAGR of shipments of IoT endpoints (Gartner)

IDC, Worldwide Semiannual Internet of Things Spending Guide, May 2016. Gartner, Forecast: Internet of Things — Endpoints and Associated Services, Worldwide, 2016 Published: 29 December 2016 ID: G00321441 Endpoints of the Internet of Things will grow at a 32.9% CAGR from 2015 through 2020, reaching an installed base of 20.4 billion units. Gartner is now projecting shipments of 6.5 billion Internet of Things (IoT) endpoints in 2020 (down from 6.6 billion units in the 2015 forecast). Annual shipments are projected to grow at a 34% compound annual growth rate (CAGR) from 2015.

Internet of Things



But IoT projects are difficult to operate

✓ IoT systems work on both of edge and cloud
 → Create the both env and connect them

IoT projects involve various people besides IT eng.
 → Difficult to collaborate on developing systems







Browser based programing tool for IoT

- Work on **cloud**, **edge**, and **local** env.
- OSS under JS Foundation originally developed by IBM
- Pre-installed in standard edge devices such as Raspberry Pi



HITACHI Inspire the Next

- **Easy** and **Rapid** development by connecting nodes
- Over **1,400** nodes available including essential IoT tech.





Big vendors have been using Node-RED in their services¹ IBM, Microsoft, GE, Intel, Fujitsu, NEC, Hitachi

Node-RED users are increasing



1. Node-RED Cloud service: Fujitsu(K5 COLMINA Platform), Hitachi(Lumada), IBM(IBM Cloud) Connector: NEC(CONNEXIVE IoT Connectivity Engine), Microsoft(Azure IoT Hub) Edge devices: GE(Predix Developer Kit), Intel(Intel IoT Gateway)

Demo: Tracking space station on map

- HITACHI Inspire the Next
- Node-RED can easily get data via web API and visualize it on the browser
- Demo: Get location of space station and plot it on map



Demo: Tracking space station on map



🔍 🔍 🧟 Node-RED	×				Θ
\leftrightarrow \rightarrow C \bigcirc localhost:1880/#	flow/e2d1668e.8c9988				€ ☆ :
Node-RED				-/=	Deploy -
Q filter nodes	Flow 1		+	info	debug
∽ input					▼ all nodes 🛍
⇒ inject					
catch					
status					
🔅 link	+				
)) mqtt					
http					
websocket					
 ✓ output 					
e debug					
link					
		- 0	+		



Rapid prototyping with Node-RED



To obtain insight, trial and error through co-creation is good approach

Node-RED is suited to this approach

Hitachi uses Node-RED in LUMADA





NEXPERIENCE[®] accelerate ideation. We need a tool to accelerate PoC/PoV of IoT



Node-RED in LUMADA

HITACHI Inspire the Next

Hitachi uses Node-RED for PoC/PoV to accelerate trial and error cycle in LUMADA





To utilize Node-RED in business, we added 150 commits and 16,000 LoC last year We will keep contributing





New features & Community activities

New features & Community activities



Reliability: Automated GUI testing framework HITACHI Inspire the Next

Testing codes for GUI to prevent the creation of new problems



© Hitachi Co., Ltd. 2018. All rights reserved. 16

Node-RED can share data among nodes using "Context" feature. It is currently held in memory.



"Persistable Context" stores "Context" on an external storage.



Connectivity: Node generator

- Node generator has functionality for generating nodes from JavaScript code or Swagger definition
- Flow Connection Gateway connect services easily



Production phase



https://github.com/node-red/node-red-nodegen

Inspire the Next

HITACHI Inspire the Next

Sequence of messages can be processed as a group. This makes various algorithm descriptions in Node-RED much easier.



HITACHI Inspire the Next

When there are multiple nodes with a same type, it is hard to distinguish at a glance. This feature helps it to recognize which node is which.



- Added Japanese and Chinese translation
- Your contribution is very welcome!



HITACHI

Inspire the Next

Popularity: Node-RED introductory book



We published a Node-RED introductory book for expanding Node-RED community.



http://amzn.asia/hQBvEIK

Contents

- Create your original application by your own!
- What is a "program"?
- You can create programs easily with Node-RED
- First Node-RED flow
- What kind of nodes can you use?
- Let's create useful applications!



Example:

Integration of advanced data analytics of OT field data and enterprise IT systems

Background

- Gather vibration data from machine tools and predict those bearing wear condition using
- Need to get an alert from Microsoft Dynamics 365 automatically when a bearing seems to be broken



ΗΙΙΔ(:)

MATLAB[®]

Simulink[®]

Inspire the Next

Data management system of Dynamics 365[®] HITACHI Inspire the Next



(Movie)

Combined systems with Node-RED



Enabling rapid and easy integration of analysis software and data management systems with Node-RED



Implementation on Node-RED





Implementation on Node-RED

ダッシュボード: ★機器モニタ	× 🛛 🚭 Node-RED : 10.212	2.53 ×						×			
← → C ① 保護されてい	いません 10.212.53.224	:11880/#flow/7c37c97	f.854318					☆ 📀 :			
Node-RED											
Q filter nodes	Call MATLAB API	Register incide #	Output graph 🗙	Graph data	Ø dummy	Ø dummy	Ø dummy	⊘ dum ▶ +			
 subflows Register incident Output graph 	Start monit	oring	Device No. 1	MATLAB API	Add device	No.1 info	Regist	er incident on Dynan			
 input 		f	Timer	MATLAB API	Add device	No.2 info					

HITACHI

Inspire the Next

We developed this system in 3 days!





- Node-RED can accelerate PoC/PoV of IoT
- Hitachi uses Node-RED and we will keep contributing

Let's contribute together!

- GitHub: <u>https://github.com/node-red/node-red</u>
- Slack : <u>https://node-red.slack.com/</u>



Trademarks



- Ansible is a registered trademark of RedHat, Inc.
- Chrome is a registered trademark of Google.
 Chrome Logo's Source: <u>Google.</u>
- Docker is a registered trademark of Docker, Inc.
- Fujitsu and COLMINA are registered trademarks of Fujitsu Ltd.
- GE and Predix are registered trademarks of General Electric Company.
- Git Logo by <u>Jason Long</u> is licensed under <u>CC BY 3.0</u>
- GitHub is a registered trademark of GitHub, Inc.
- Grunt is licensed under the <u>MIT License</u>
- IBM and IBM Cloud are registered trademarks of International Business Machines Corporation.
- Intel is a registered trademark of Intel Corporation.
- MATLAB and SIMULINK are registered trademarks of MathWorks, Inc.
- Microsoft, Azure IoT Hub and Microsoft Dynamics 365 is a registered trademark of Microsoft Corporation.
- mocha is licensed under the <u>MIT License</u>
- NEC and CONNEXIVE are registered trademarks of NEC Corporation.

- Raspberry Pi is a registered trademark of Raspberry Pi Foundation
- Slack is a registered trademark of Slack Technologies, Inc.
- Travis CI is a registered trademark of Travis CI GmbH
- WebdriverIO is licensed under the <u>MIT License</u>

HITACHI Inspire the Next