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

Open Source Summit Japan 2018

Ide, Takaya

Nakanishi, Kazuki
Internet of Things

IoT has huge potentials to create new business

20.4B
2020
Number of connected things will be in use worldwide (Gartner)

$1.1T
2021
Forecast of global IoT spending (IDC)

1T
2025
Number of sensors connected with Internet (WEF)

34%
2015
CAGR of shipments of IoT endpoints (Gartner)

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
Node-RED
What is Node-RED?

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**

1. **Flow** : the program you created
What is Node-RED?

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

1. Drag&Drop
2. Connect
3. Deploy
Node-RED users

Big vendors have been using Node-RED in their services:
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

- 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

1. Get latitude and longitude
2. Handle location data
3. Plot pins on map
Demo: Tracking space station on map
Rapid prototyping with Node-RED
How does Hitachi uses 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
Node-RED in LUMADA

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

Customer

Vision Sharing  Ideation  PoC/PoV  Dev System  O&M

Methodology  Platform

NEXPERIENCE®
Vision Design  Service Ideation  Business Model Design  Service Value Evaluation

IoT Platform
Studio  Core  Analytics  Edge  Foundry
Node-RED in LUMADA

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

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="GUI testing framework" /></td>
<td><img src="image" alt="Node Generator" /> (v0.19~)</td>
</tr>
<tr>
<td><img src="image" alt="Persistable Context" /> (v0.19~)</td>
<td><img src="image" alt="Flow Manipulation API" /> (TBD)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Popularity</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Message sequence nodes" /></td>
<td><img src="image" alt="Introductory book" /></td>
</tr>
<tr>
<td><img src="image" alt="User defined icon" /></td>
<td><img src="image" alt="IBM Think" /></td>
</tr>
<tr>
<td><img src="image" alt="Internationalization" /></td>
<td><img src="image" alt="Index Developer Conf." /></td>
</tr>
<tr>
<td><img src="image" alt="Quality improvement" /></td>
<td><img src="image" alt="JS Interactive (Oct. 2018)" /></td>
</tr>
</tbody>
</table>

※ **Blue**: Will be introduced later

© Hitachi Co., Ltd. 2018. All rights reserved.
Reliability: Automated GUI testing framework

Testing codes for GUI to prevent the creation of new problems

- Call WebdriverIO API
- Run test scripts
- WebDriver commands
- Access

// Add an inject node and a debug node
var workspace = require("workspace");
var inject = workspace.addNode("inject"); // #1
var debug = workspace.addNode("debug", nodeWidth); // #2
// Connect an inject node with a debug node, and deploy it
inject.connect(debug); // #3
workspace.deploy(); // #4
Reliability: Persistable Context

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 connects services easily

Node development phase

- JavaScript code
- Swagger definition (e.g. MATLAB)
- Node Generator
- Original node

Production phase

- Node-RED
- MATLAB
- Flow Connection Gateway*
- REST API

Node generator project:
https://github.com/node-red/node-red-nodegen

* Currently under the development
Sequence of messages can be processed as a group. This makes various algorithm descriptions in Node-RED much easier.
Functionality: User defined icon

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.

**before**

- MQTT
  - Water level
- MQTT
  - Warehouse temp.
- MQTT
  - Penguin

**after**

- Water level
- Warehouse temp.
- Penguin
Functionality: Internationalization

- Added Japanese and Chinese translation
- Your contribution is very welcome!
We published a Node-RED introductory book for expanding Node-RED community.

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!

http://amzn.asia/hQBvEIK
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 MATLAB® Simulink®

- Need to get an alert from Microsoft Dynamics 365 automatically when a bearing seems to be broken

How can I connect them?
Data management system of Dynamics 365®

(Movie)
Combined systems with Node-RED

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

- Machine tools
  - Vibration data
- Storage
- MATLAB® Simulink®
  - Call API
  - Predict bearing wear condition
- Node-RED
  - Call MATLAB
  - Parse data
  - Register incident
- Dynamics 365
  - Register incident
  - Manage business data

Get data

Implementation on Node-RED

(Movie)
Implementation on Node-RED

We developed this system in 3 days!
Conclusion

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

Let’s contribute together!

- GitHub: [https://github.com/node-red/node-red](https://github.com/node-red/node-red)
- Slack: [https://node-red.slack.com/](https://node-red.slack.com/)
Trademarks

- Ansible is a registered trademark of RedHat, Inc.
- Chrome is a registered trademark of Google. Chrome Logo’s Source: [Google](https://www.google.com).
- 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 [Jason Long](https://jasonlong.com) is licensed under [CC BY 3.0](http://creativecommons.org/licenses/by/3.0/).
- GitHub is a registered trademark of GitHub, Inc.
- Grunt is licensed under the [MIT License](https://mit-license.org).
- 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 [MIT License](https://mit-license.org).
- 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 [MIT License](https://mit-license.org).