Node generator

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Kazuhito Yokoi
kazuhito.yokoi.nx@hitachi.com

Hitachi, Ltd.
Contents

1. What is Node-RED?
2. What is Open API document?
3. Node generator
4. Demonstration
5. Future work
6. Try Node generator
1. What is Node-RED?
Trends in 2018: No code development tool

- No code development tool is a visual programming tool to create custom applications without coding.

- The research firm reported about the tool.
  - “Improvements in simple development tools will dramatically expand the number of non-tech developers.”
  - “Integrate API-based data into no code applications.”

What is Node-RED?

Visual programming tool for IoT applications

- Flow-based programming which realizes quick development
- Various connectors (Node-RED nodes) to add functionalities
- Open source software under JS Foundation

1. Select connectors which have various functions
2. Drag and drop connectors to workspace
3. Wire the connectors in the processing order
4. Flow runs immediately once clicking deploy button
History of Node-RED

Node-RED has been more open and popular as OSS for both edge and cloud environments.

- **March 2014**: Developed and released by IBM
- **June 2014**: Included in the catalog on IBM Cloud
- **November 2015**: Pre-installed in Raspberry Pi
- **October 2016**: Moved to JS Foundation
- **As of October 2018**: Downloaded 50,000 times a month
Major companies have used Node-RED in their productions.

- **Cloud**
  - AT&T, AT&T IoT Platform
  - CISCO, Meraki
  - Fujitsu, K5 COLMINA Platform
  - Google, Xively
  - Hitachi, Lumada
  - IBM, IBM Cloud
  - Nokia, Nokia Innovation Platform
  - Sense Tecnic, FRED
  - Siemens, MindSphere Visual Flow Creator
  - Uhuru, enebular

- **Connectors (Node-RED nodes)**
  - Fujitsu, K5 IoT Platform
  - IBM, dashDB, Cloudant, OpenWhisk, Watson, Watson IoT Platform, Weather Company Data
  - Microsoft, Azure IoT Hub, Azure Cognitive Services, Azure Blob Storage, Azure Cosmos DB, Azure Event Hub, Azure SQL, Azure Table Storage
  - NEC, Mobile Backend Platform SecureWare

- **Edge devices**
  - Fujitsu, INTELLIEDGE A700 Appliance
  - GE, Predix Developer Kit
  - Intel, Intel IoT Gateway
  - NEC, CONNEXIVE IoT Connectivity Engine
  - Samsung, Artik
  - Siemens, SIMATIC IOT2020
  - Toshiba, SPINEX

Red: sponsor and speaker’s companies in Node+JS Interactive
Benefits of Node-RED

(1) Rapid development for IoT applications
• Non-tech developers can create IoT application within a couple of hours.
• Same development style in both edge and cloud environments

(2) Standard technologies in industrial IoT
• Essential IoT technologies (e.g. REST API, WebSocket, and MQTT)
• Pre-installed software on standard edge devices

(3) Open community
• 84 contributors are developing Node-RED.
• 3rd party 1,656 connectors
Node-RED key features to realize IoT system

OT systems

(1) Edge analytics

Sensor

Node-RED on edge devices

(2) Data collection

MQTT

(3) Device control

Sensor

Node-RED on Cloud

(4) Dashboard

(5) Data accumulation/retrieving

Data lake

Node-RED on Cloud

(6) Integration with existing systems

REST API

Business data

IT systems

(7) Connection to external services

REST API

External services
2. What is Open API document?
What is Open API document?

- A standard format which contains REST API specification
- Tools provided by the Open API project
  - Swagger Editor & UI: Editor to write Open API document and UI to generate REST API documentation
  - Swagger Core: Tool to generate Open API document from server code
  - Swagger Codegen: Tool to generate code from Open API document

![Diagram showing the process of designing and developing REST API with Open API document tools]

Design REST API

- (1) Design Open API document

Develop code

- (2) Generate code

- Open API document
- Server-side code
- Client-side code
- Server-side code
- Swagger Editor & UI
- Swagger Core
- Swagger Codegen (for client)
- Swagger Codegen (for server)
Example of Open API document

Open API document contains information about how to access the REST API.

```json
swagger: '2.0'
info:
  description: 'This is a sample server Petstore server.'
  version: 1.0.0
  title: Swagger Petstore
  license:
    name: Apache 2.0
    url: 'http://www.apache.org/licenses/LICENSE-2.0.html'
host: petstore.swagger.io
basePath: /v2
paths:
  /store/inventory:
    get:
      summary: Returns pet inventories by status
      description: Returns a map of status codes to quantities
      operationId: getInventory
      produces:
        - application/json
      parameters: []
      responses:
        '200':
          description: successful operation
```
3. Node generator
A problem when developing original connectors

- A connector mainly consists of a JavaScript file and an HTML file.
- Because a connector has several thousand lines of code (LoC), developing connector takes a long time.

Developing a connector is a time-consuming task.

Run on Node.js

Node-RED runtime

Several thousand LoC

JavaScript file

HTML file

Connector

UI for Node-RED flow editor
Node generator

- A tool to generate connectors automatically from various sources including Open API document
- Open source software under the Node-RED project

[Diagram showing process: Open API document -> Node generator -> Connector]

Search “nodegen” on npmjs

https://github.com/node-red/node-red-nodegen
How to generate connector?

- Node generator internally has connector templates which contain common client codes without REST API specific information.
- Node generator creates a connector by inserting the REST API specific information into connector templates.

```
[JavaScript template]
var ops = { url: {{hostname}},
           method: {{method}}
         };
request(opts, function(…) {
[HTML template]
<select>
  <option value="{{&method}}"></select>
```

- **Descriptions**
  - Hostname, HTTP methods
- **Parameters**
  - Hostname, HTTP methods
- **Connector**
  - JavaScript file
  - HTML file
  - Connector templates

- **Open API document**
  - Descriptions
  - Parameters
How much Node generator reduces development

**Case 1:** REST API already has Open API document.
- No developing tasks (just execute the command)

**Case 2:** Developer initially create Open API document instead of developing a connector.
- 55% (3 months->2 months)

Open API document LoC against generated connector LoC

Average: 55%
4. Demonstration
Bottom-up approach development

Step 1: API provider creates Open API document for REST API.

Step 2: Client-side developer generates a connector and uses it in the client-side flow.
The demonstration flow gets the locations of the space station and plots them on the world map.

1. Generate and install connector
2. Get latitude and longitude
3. Add handling of location data
4. Plot pins on the world map
Demo: Tracking space station on the world map

**ISS Location**

The International Space Station is moving at close to 28,000 km/h so its location changes really fast! Where is it right now?

Apache 2.0

**Schemes**

- **HTTP**

**default**

**GET** /iss-now.json  
Current ISS location over Earth  
(latitude/longitude)
5. Future work
Integration with Node-RED flow editor

Client-side developers can generate connectors on the UI.

1. Write the Open API document and options
2. Generate connector
3. Download the connector as tgz file

https://github.com/node-red/node-red/wiki/Design:-Node-Generator
Subflow connector support

- Subflow connector is a unit of Node-RED flow for reusing flow.
- Subflow looks a connector but it is actually JSON data.
- To share Subflow as a module, Node generator packages it.

1. Create sub flow
2. Convert subflow to normal node

Node generator

Developer

Node-RED flow editor

Flow in Subflow

JSON data

Connectors

Developers can share the connectors on npm
Web of Things (WoT) support

- WoT description is specification to connect to devices.
- Forked node generator supports WoT description as the input.

https://github.com/k-toumura/node-red-nodegen/tree/webofthings
Service Broker support

The connector which supports Service Broker automatically gets credential for cloud service.

Developers need manual operations

[Current operations]

1. Create REST API service on cloud portal
2. Copy the credential for REST API

REST API

6. Access API using credential

[After Service Broker support]

Cloud Foundry

1. Create service
2. Create service
3. Get credential
4. Get credential
5. Set credential
6. Access API using credential

Connector automatically connects to the REST API
6. Try Node generator
Try Node generator

- Installation of Node generator

```
$ sudo npm install --g node-red-nodegen
$ node-red-nodegen
```

- Documentation

https://github.com/node-red/node-red-nodegen/wiki
Get involved

To add the functionalities, we have the open discussion using the tools.

- Slack: real-time discussion with community members
- GitHub: Kanban board (projects) to share roadmap

Slack

GitHub
Node generator

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- The number of download from npm repository:
- AT&T, AT&T IoT Platform: https://flow.att.com
- FUJITSU Cloud Service K5 COLMINA Platform ユーザーズガイド:
- IBM Cloud, Node-RED Starter: https://console.bluemix.net/catalog/starters/node-red-starter
- Node-RED node for Azure IoT Hub: https://github.com/Azure/azure-iot-sdk-node/tree/master/device/node-red
- NEC Mobile Backend Platform: https://flows.nodered.org/node/node-red-contrib-nec-baaS
- Intel, Intel IoT Gateway:
- NEC, CONNEXIVE IoT Connectivity Engine: http://jpn.nec.com/connexive/ice/feature.html
- Siemens, SIMATIC IOT2020:
- エッジコンピューティングを実現する 社会インフラ・産業分野向け IoTゲートウェイ装置
- Dreamforce2016 Day4：XivelyはIoT導入のカギとなるサービスかも知れない
  https://www.terrasky.co.jp/blog/2016/161010_001859.php
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- A node to call REST API for FUJITSU Cloud Service K5 IoT Platform
  https://flows.nodered.org/node/node-red-contrib-fjiotpfhttp
- Nokia, Nokia Innovation Platform, Node-RED
  https://platform.innovation.nokia.com/services.php?service_id=5911efac48d5f4645c849b8c
- Uhuru, enebular: https://enebular.com/
- node-red-contrib-azure: https://github.com/Azure/node-red-contrib-azure
- NEC, SecureWare/Credential Lifecycle Manager: https://jpn.nec.com/secureware/clm/function.html
- FRED, https://fred.sensetecnic.com