

# Node-RED – WoT-Discovery Integration and Thing Orchestration

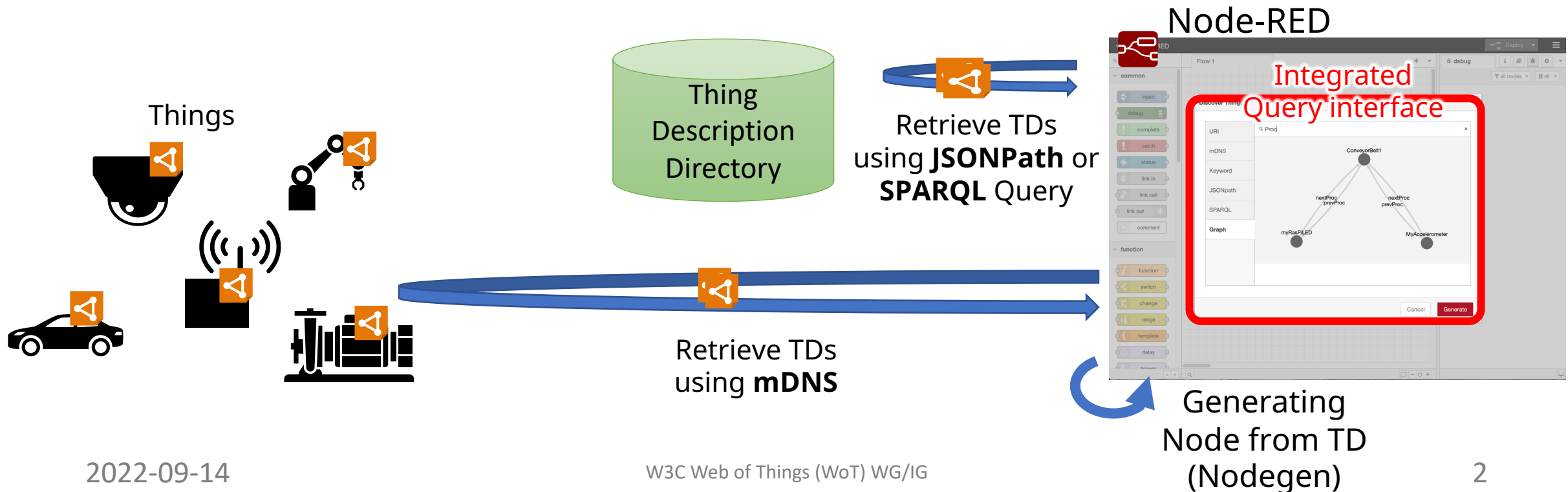
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# Node-RED – WoT Discovery Integration

We are developing the tools to facilitate Thing orchestration with Node-RED.

- A tool to generate a Node-RED node from a Thing Description (Nodegen)
  - <https://github.com/node-red/node-red-nodegen>
- A tool to explore Things using WoT Discovery on the Node-RED editor.
  - (not yet released to the public yet)



# Supported Discovery Methods

Primitive method:

Direct

Discover Things

Fetch TD from:

URI

URI for TD

mDNS

Keyword

JSONpath

SPARQL

Graph

Cancel Generate

mDNS + DNS-SD

Discover Things

URI

myRasPILED myRasPILED\_wot\_tcp.local.

mDNS

MyAccelerometer ktomdataack\_wot\_tcp.local.

Keyword

JSONpath

SPARQL

Graph

Cancel Generate

raw JSONPath

Discover Things

URI

q \$[?(@.title=~"/STRING/|@.description=~"/STRING/)]

mDNS

No matches found

Keyword

JSONpath

SPARQL

Graph

Cancel Generate

raw SPARQL

Discover Things

URI

PREFIX id: <https://www.w3.org/2019/wot/id#>  
PREFIX dc: <http://purl.org/dc/terms/>  
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>  
SELECT DISTINCT ?id ?title ?desc  
WHERE {  
 ?id rdf:type id:Thing;  
 dc:title ?title;  
 dc:description ?desc;  
 dc:description/dc:title ?descTitle FILTER(contains(str(?descTitle),  
 lcase("STRING"))).  
}

SPARQL

Query

Graph

No matches found

Cancel Generate

Compound method:

Keyword search using JSONPath, SPARQL

Discover Things

URI

Search Thing from TDD

mDNS

Keyword

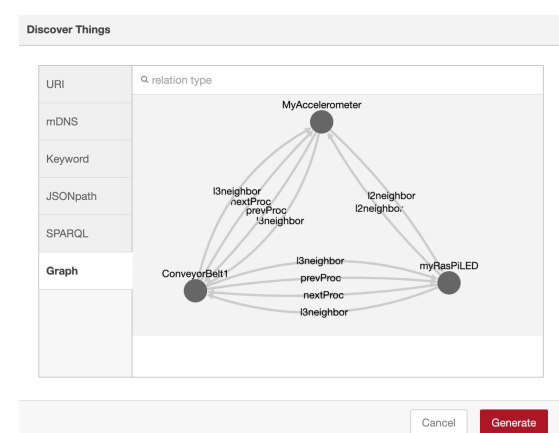
JSONpath

SPARQL

Graph

Cancel Generate

Visualizing "links"



# Visualize relationship between Things using "links" information

- Discovery makes it easy to find Things, but even if only a list of Things that match the criteria is presented, it is difficult to know which Thing is necessary one.
- Thing Description can describe the relationship between Things using "**links**".
- Presenting this information as a graph will allow the developer to easily select the node they needs.

## § 6.3.8 links

All name-value pairs of an instance of `Link`, where the name is a Vocabulary Term included in the Signature of `Link`, *MUST* be serialized as members of the JSON object that results from serializing the `Link` instance, with the Vocabulary Term as name.

It is recommended to follow the link relation values as provided in Section 5.3.4.1 [Link](#). The examples provided below demonstrate the use of different link relation types.

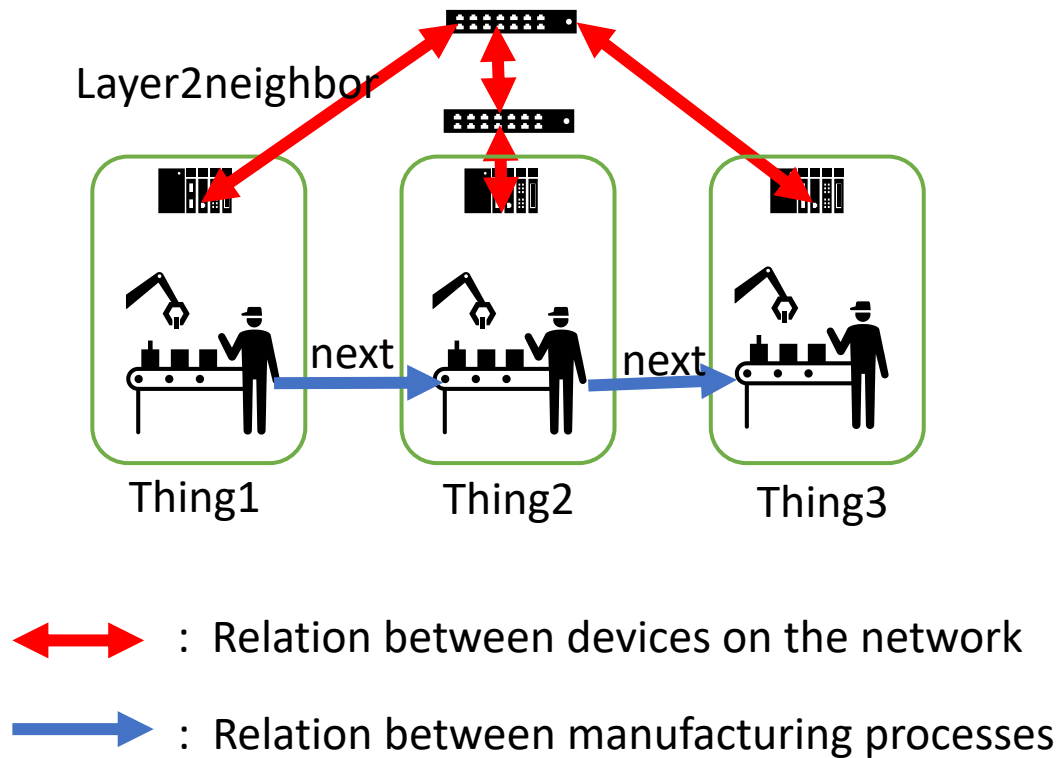
A reference can be provided that points to a Thing (e.g., a controller) that controls the underlying unit (e.g., a lamp). For this `controlledBy` can be used:

### EXAMPLE 27: Sample of a Link serialization

```
...
"links": [{
  "rel": "controlledBy",
  "href": "https://servient.example.com/things/lampController",
  "type": "application/td+json"
}]
...
```

Section 6.3.8 links from Web of Things (WoT) Thing Description 1.1

# Usage example of "links"

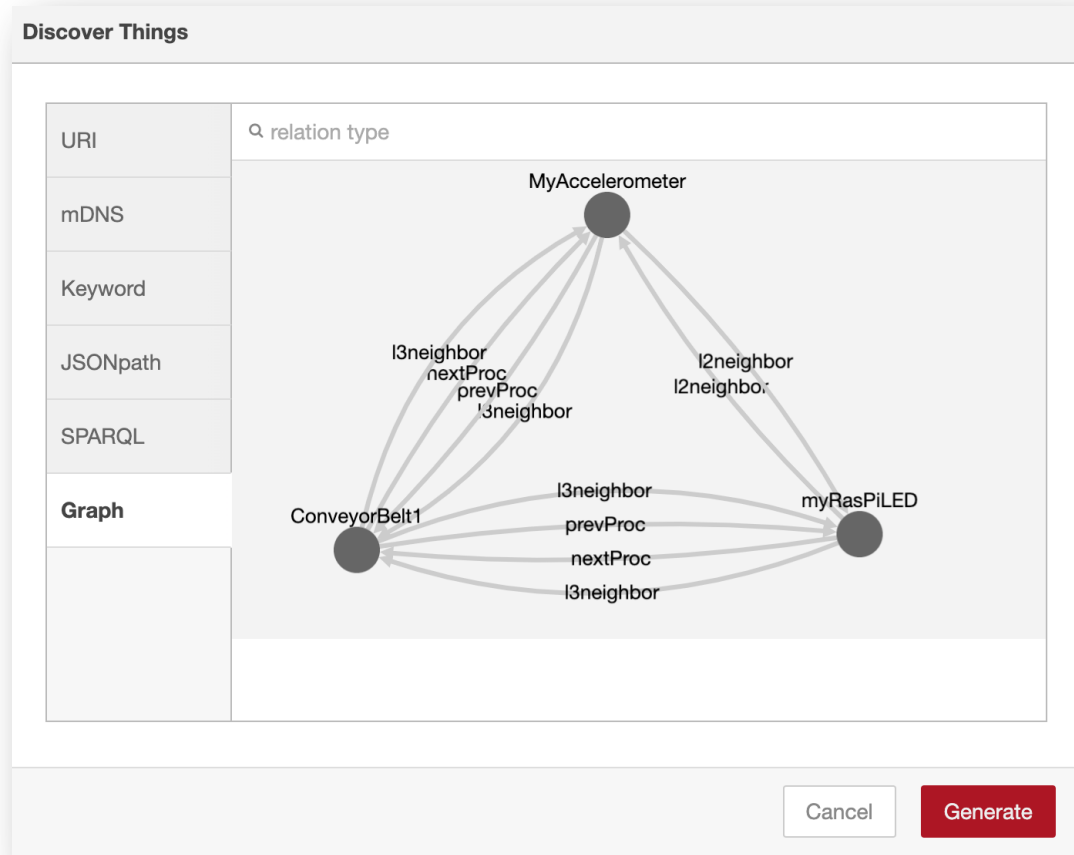


Thing1's Thing Description

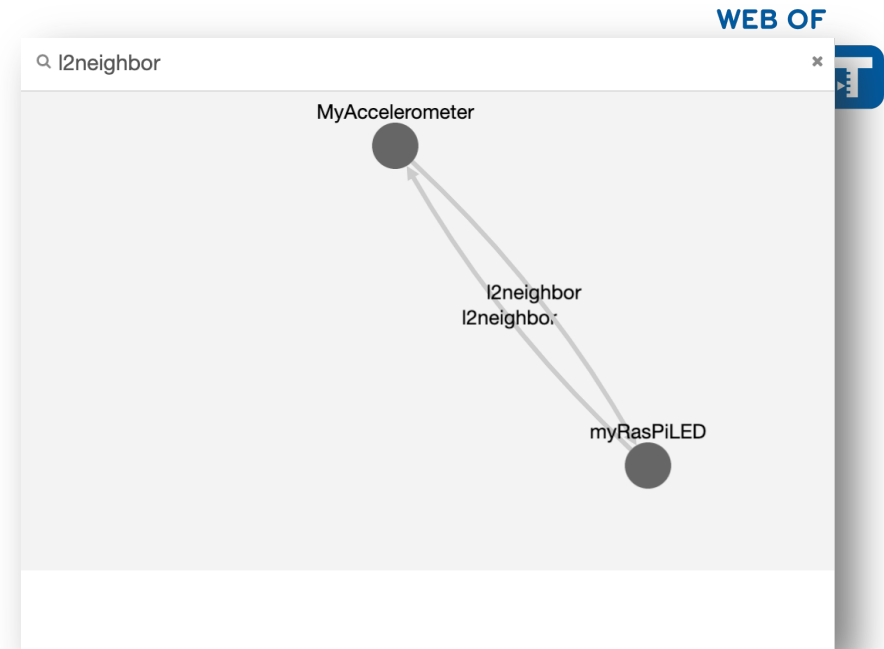
```
{
  "title": "Thing1",
  "links": [{
    "rel": "nextProc",
    "href": "https://.../Thing2"
  }, {
    "rel": "l2neighbor",
    "href": "https://.../Thing3"
  }, {
    "rel": "l3neighbor",
    "href": "https://.../Thing2"
  }],
  ....
}
```

# Visualization Example

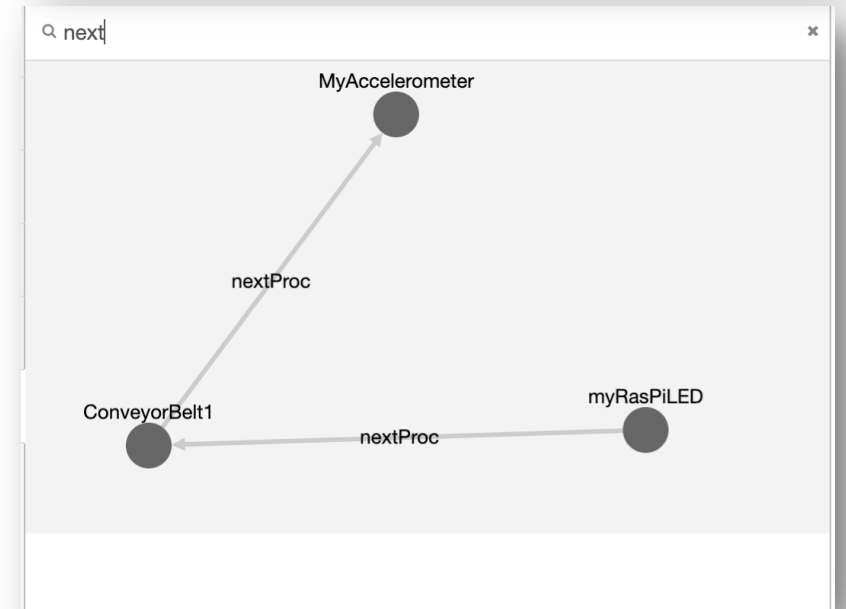
Initial state: Displaying all relations



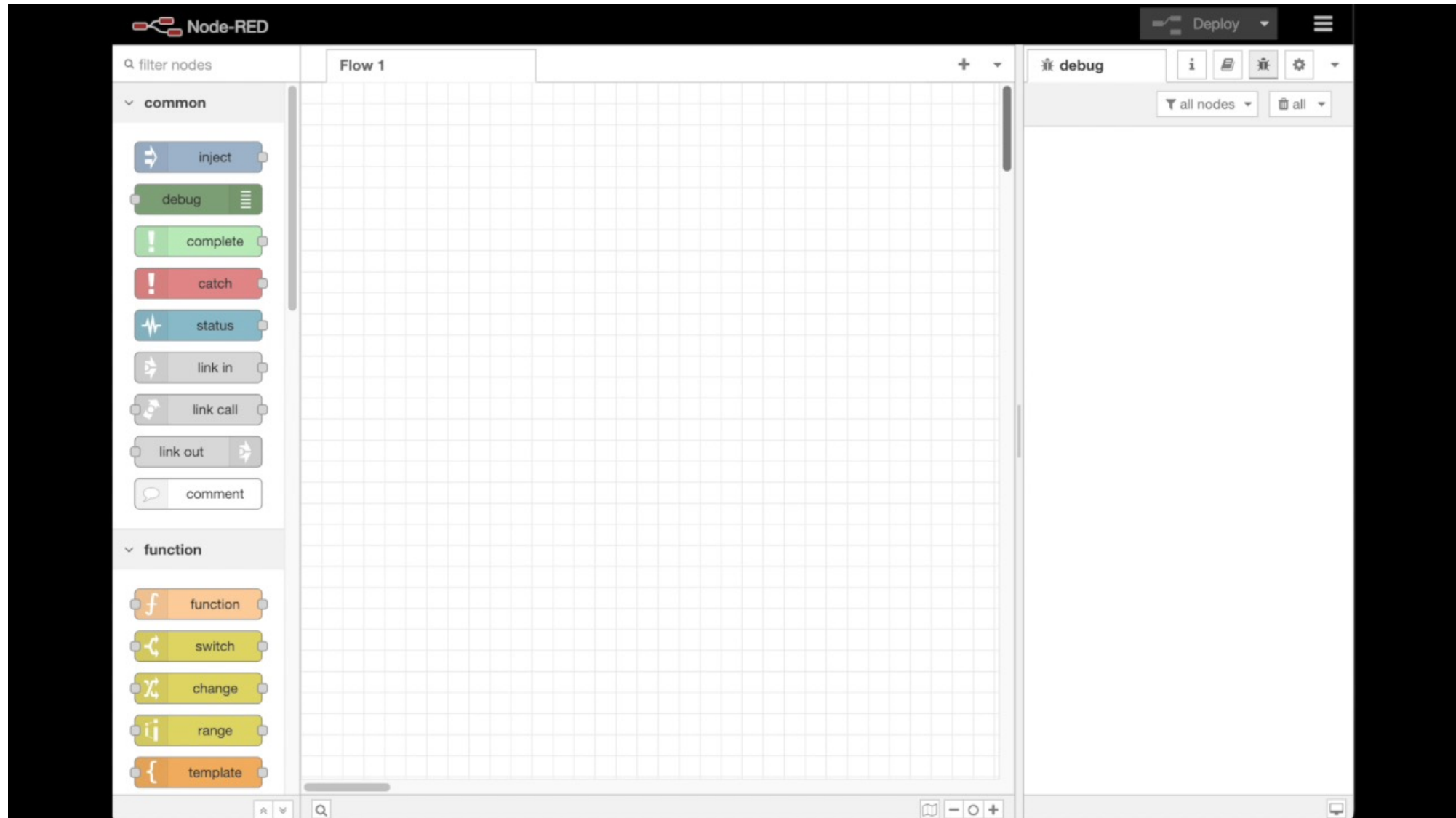
filter: l2neighbor



filter: nextProc



# Demo



# Lessons Learned

- The integration of Node-RED and WoT Discovery will simplify Thing orchestration.
- The "links" information in the Thing Description is useful to locate the Thing you need.
- How to point to a related Thing (or Thing Description)?: "href" in "links"
  - We use the additional property "tdid" to link to the thing.
    - "tdid" contains the "id" of the target Thing Description.
    - i.e., our implementation assumes that each TD has following "links" information:
 

```
"links": [{ "tdid": "urn:dev:ops:32473-WoTAccel-1234", "rel": "..."}]
```

 rather than:
 

```
"links": [{ "href": "http://ktom5stack.local/.well-known/wot", "rel": "..."}]
```
    - Current our implementation crawls TDs using mDNS and Thing Description Directory, it does not use "href" in "links".
  - Because "id" might be more stable or/and unique than the URI of the Thing Description, it might be better to be able to link using the "id" of the Thing Description.



# Appendix

- Node-RED is a trademark or registered trademark of the OpenJS Foundation in the United States and other countries.