iot.schema.org

Integration of iot.schema.org in Node-RED

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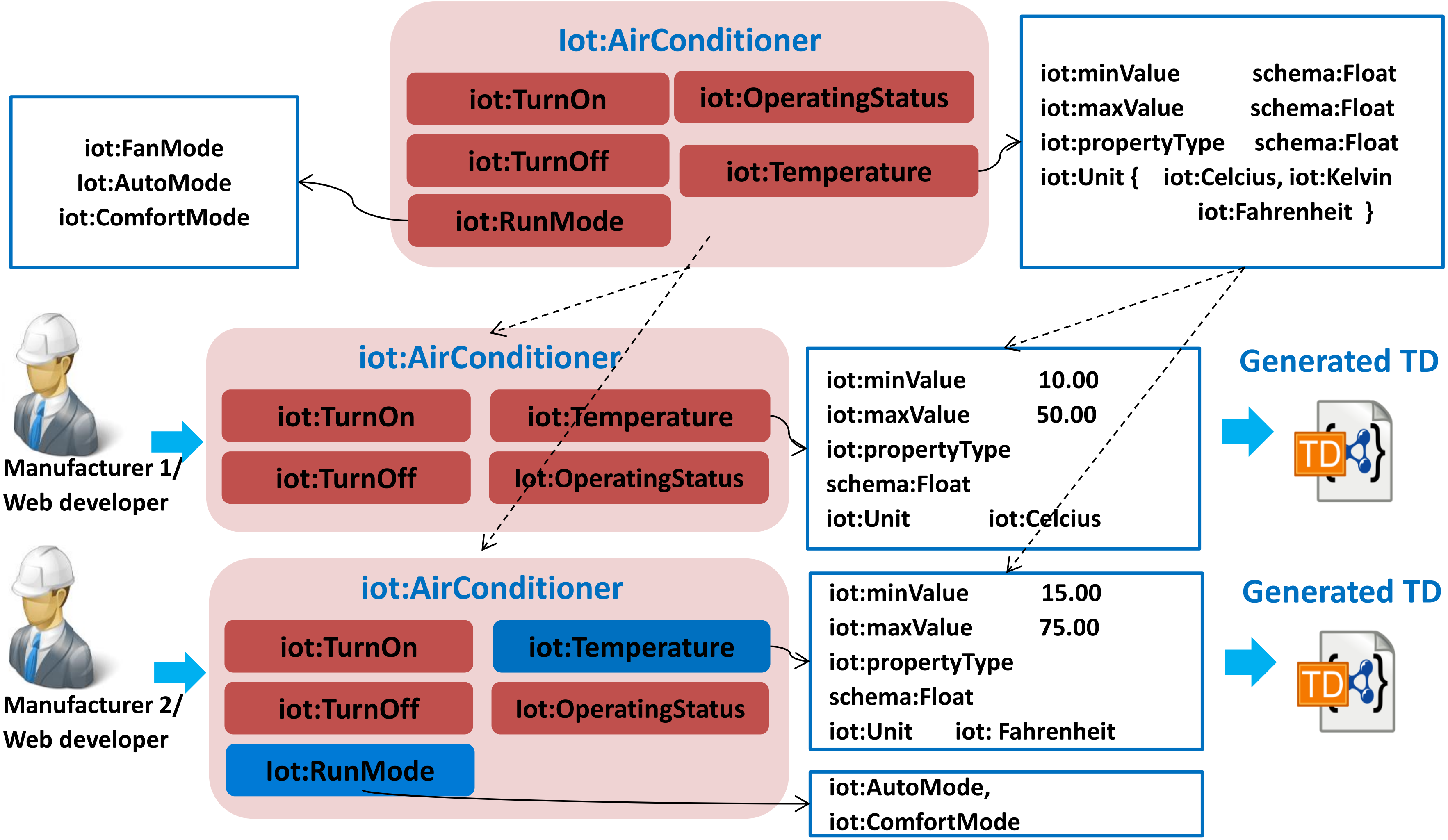
iot.schema.org in Node-RED

- Is there an easy way for a Web application developer to use iot.schema.org?
- Our goal is to provide a tool that:
  - Does not require a developer to know RDF(S), JSON-LD, RDF Shapes etc.
  - Enables an easy configuration of things when using iot.schema.org
  - Avoids translations of serializations formats, data types, units etc.

Creating Device Models: Air Conditioner Use case



Iot:AirConditioner

iot:TurnOn

iot:OperatingStatus

iot:TurnOff

iot:Temperature

iot:RunMode

iot:FanMode
Iot:AutoMode
iot:ComfortMode

iot:minValue schema:Float
iot:maxValue schema:Float
iot:propertyType schema:Float
iot:Unit { iot:Celcius, iot:Kelvin
iot:Fahrenheit }

Manufacturer 1/
Web developer

iot:AirConditioner

iot:TurnOn

iot:Temperature

iot:TurnOff

Iot:OperatingStatus

iot:minValue 10.00
iot:maxValue 50.00
iot:propertyType
schema:Float
iot:Unit iot:Celcius

Generated TD

Manufacturer 2/
Web developer

iot:AirConditioner

iot:TurnOn

iot:Temperature

iot:TurnOff

Iot:OperatingStatus

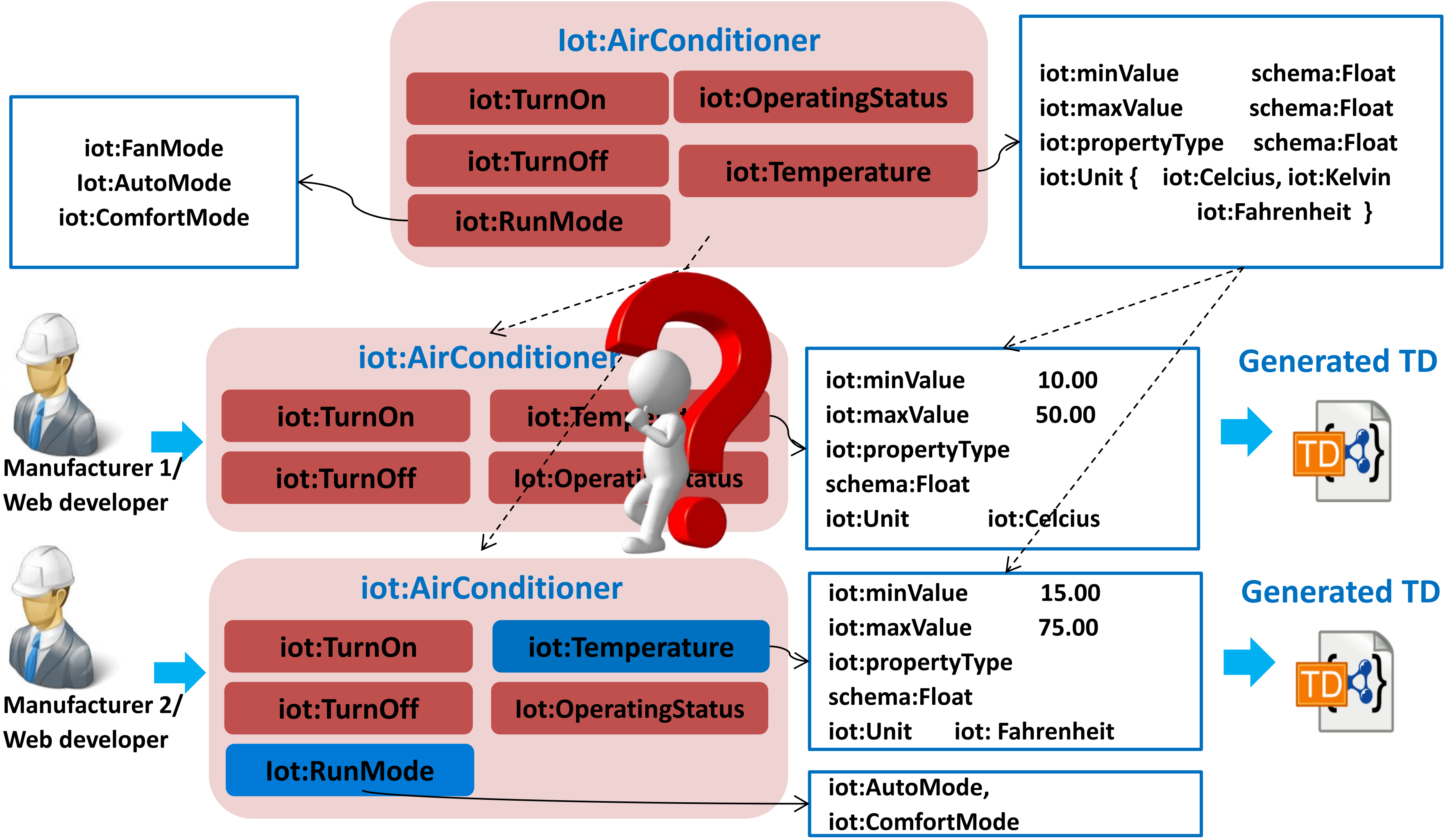
Iot:RunMode

iot:minValue 15.00
iot:maxValue 75.00
iot:propertyType
schema:Float
iot:Unit iot: Fahrenheit

iot:AutoMode,
iot:ComfortMode

Generated TD

Creating Device Models: Air Conditioner Use case



Iot:AirConditioner

iot:TurnOn
iot:OperatingStatus
iot:TurnOff
iot:Temperature
iot:RunMode

iot:FanMode
Iot:AutoMode
iot:ComfortMode

iot:minValue	schema:Float
iot:maxValue	schema:Float
iot:propertyType	schema:Float
iot:Unit {	iot:Celcius, iot:Kelvin iot:Fahrenheit }

Manufacturer 1/
Web developer

iot:AirConditioner

iot:TurnOn
iot:Temp
iot:TurnOff
Iot:Operati tatus

iot:minValue	10.00
iot:maxValue	50.00
iot:propertyType	
schema:Float	
iot:Unit	iot:Celcius

Generated TD

Manufacturer 2/
Web developer

iot:AirConditioner

iot:TurnOn
iot:Temperature
iot:TurnOff
Iot:OperatingStatus
Iot:RunMode

iot:minValue	15.00
iot:maxValue	75.00
iot:propertyType	
schema:Float	
iot:Unit	iot: Fahrenheit

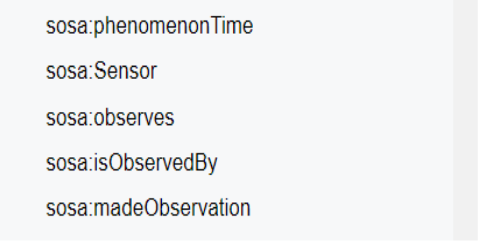
iot:AutoMode,
iot:ComfortMode

Generated TD

Usability of Ontologies & Schemas

Web Developer Perspective

W3C SSN/SOSA Ontology:



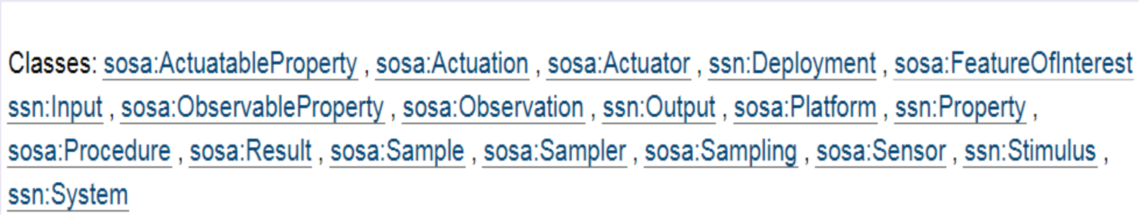
sosa:phenomenonTime

sosa:Sensor

sosa:observes

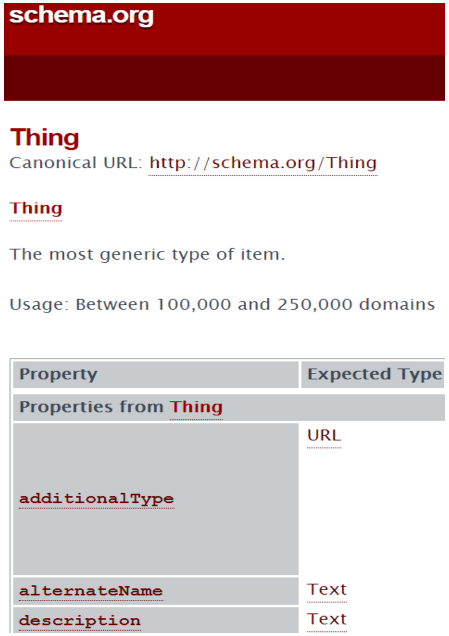
sosa:isObservedBy

sosa:madeObservation



Classes: sosa:ActuatableProperty , sosa:Actuation , sosa:Actuator , ssn:Deployment , sosa:FeatureOfInterest , ssn:Input , sosa:ObservableProperty , sosa:Observation , ssn:Output , sosa:Platform , ssn:Property , sosa:Procedure , sosa:Result , sosa:Sample , sosa:Sampler , sosa:Sampling , sosa:Sensor , ssn:Stimulus , ssn:System

schema.org:



schema.org

Thing

Canonical URL: http://schema.org/Thing

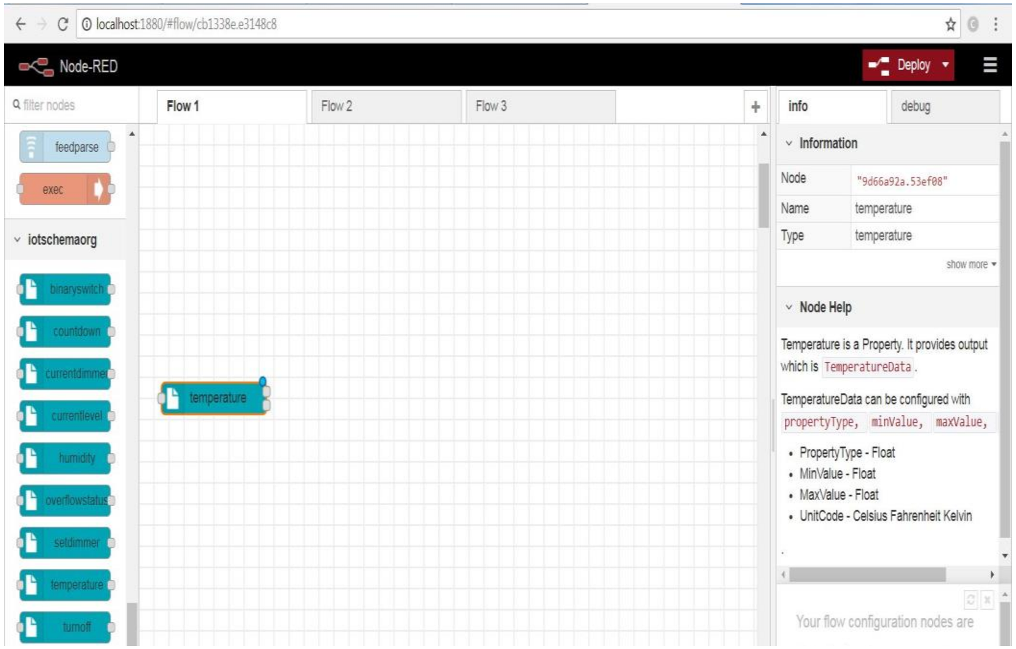
Thing

The most generic type of item.

Usage: Between 100,000 and 250,000 domains

Property	Expected Type
Properties from Thing	
additionalType	URL
alternateName	Text
description	Text

Node-RED extended with iot.schema.org Semantics



localhost:1880/#flow/cb1338e.e3148c8

Information

Node	"9d66a92a.53ef08"
Name	temperature
Type	temperature

Node Help

Temperature is a Property. It provides output which is TemperatureData .

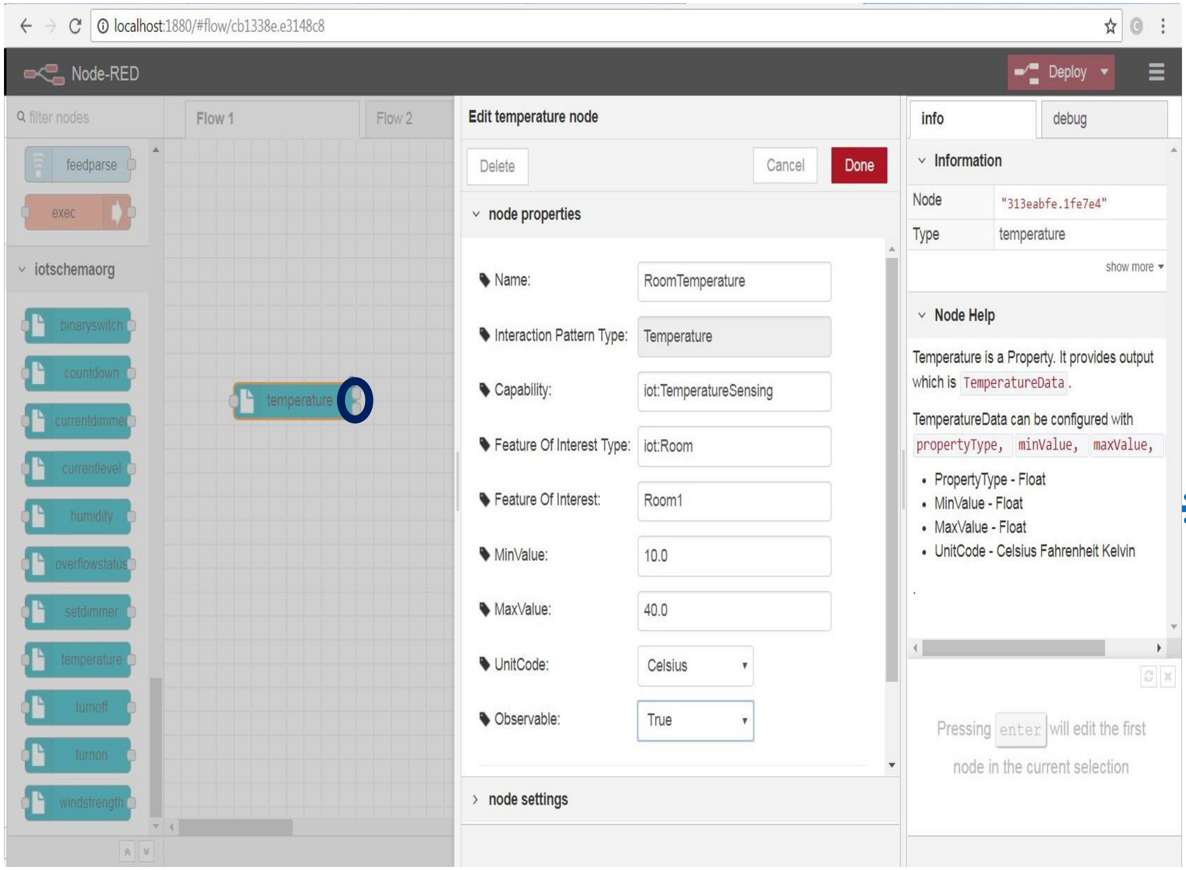
TemperatureData can be configured with propertyType, minValue, maxValue,

- PropertyType - Float
- MinValue - Float
- MaxValue - Float
- UnitCode - Celsius Fahrenheit Kelvin

Your flow configuration nodes are

Node-RED extended with iot.schema.org Semantics

Type 1 Nodes



Edit temperature node

node properties

Name: RoomTemperature

Interaction Pattern Type: Temperature

Capability: iot:TemperatureSensing

Feature Of Interest Type: iot:Room

Feature Of Interest: Room1

MinValue: 10.0

MaxValue: 40.0

UnitCode: Celsius

Observable: True

Information

Node	"313eabfe.1fe7e4"
Type	temperature

show more

Node Help

Temperature is a Property. It provides output which is `TemperatureData`.

TemperatureData can be configured with `propertyType`, `minValue`, `maxValue`,

- PropertyType - Float
- MinValue - Float
- MaxValue - Float
- UnitCode - Celsius Fahrenheit Kelvin

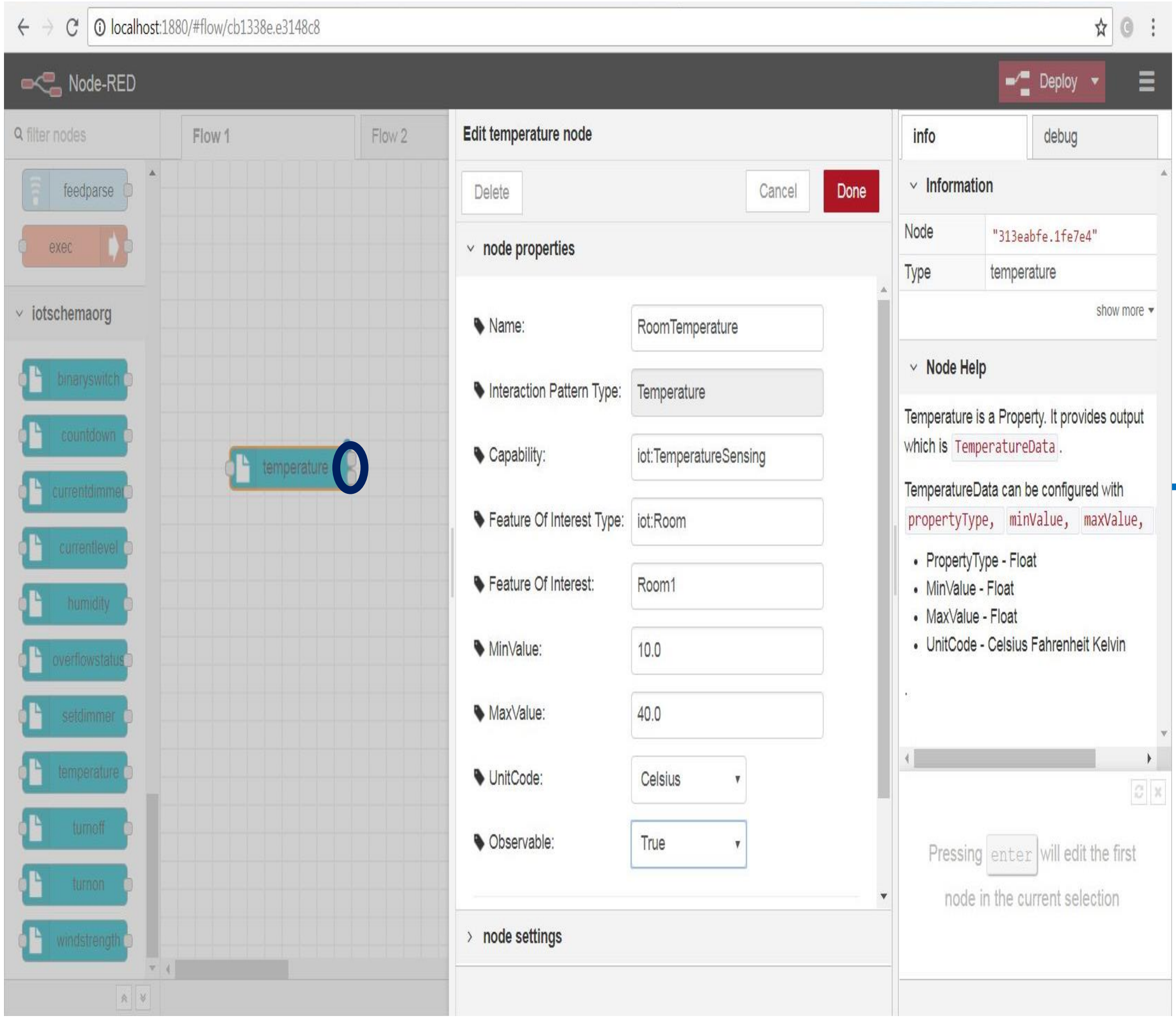
Pressing `enter` will edit the first node in the current selection

SHACL Shape:

```
iotsh:TemperatureDataShape a
   sh:NodeShape ;
 sh:and (
[ sh:property [
 sh:path schema:propertyType ;
sh:datatype xsd:float ;
 sh:minInclusive 10.0 ;
 sh:maxInclusive 40.0 ; ]; ]
[ sh:property [
 sh:path schema:unitCode ;
sh:hasValue iot:Celsius ; ]; ] ).
 iotsh:TemperatureShape a
   sh:NodeShape;
 sh:targetClass iot:Temperature ;
[sh:property [
 sh:path iot:observable;
sh:hasValue true ; ]; ] .
```

Node-RED extended with iot.schema.org Semantics

Type 1 Nodes



Edit temperature node

node properties

- Name: RoomTemperature
- Interaction Pattern Type: Temperature
- Capability: iot:TemperatureSensing
- Feature Of Interest Type: iot:Room
- Feature Of Interest: Room1
- MinValue: 10.0
- MaxValue: 40.0
- UnitCode: Celsius
- Observable: True

node settings

Information

Node	"313eabfe.1fe7e4"
Type	temperature

Node Help

Temperature is a Property. It provides output which is `TemperatureData`.

TemperatureData can be configured with `propertyType,` `minValue,` `maxValue,`

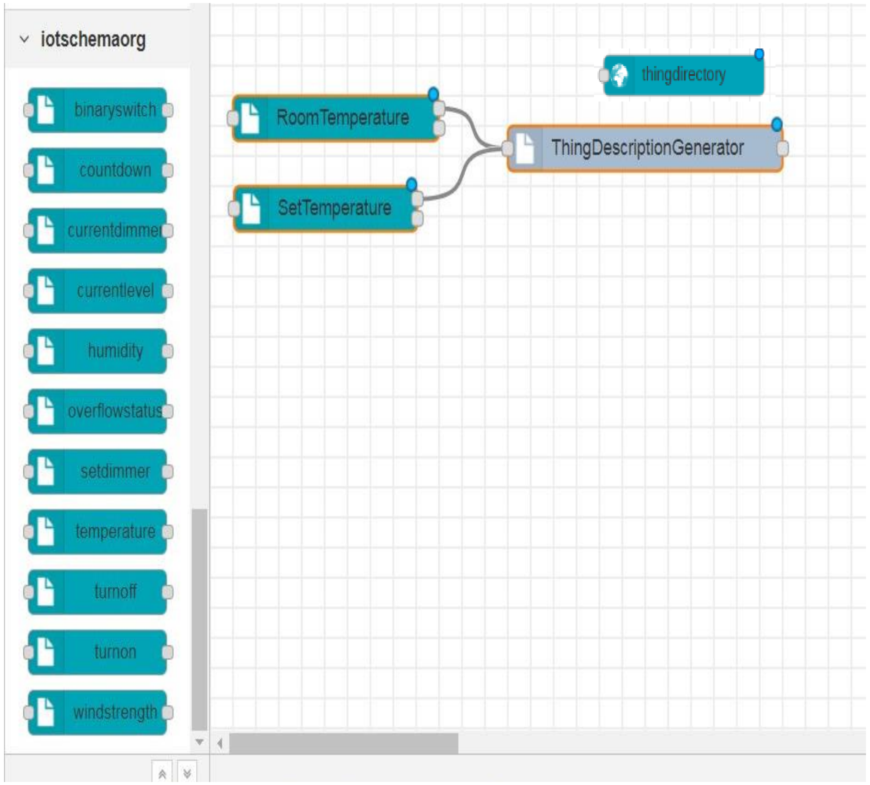
- PropertyType - Float
- MinValue - Float
- MaxValue - Float
- UnitCode - Celsius Fahrenheit Kelvin

Pressing `enter` will edit the first node in the current selection

- **Use Cases:**
- Validate data
- Shared documentation between manufacturers
- Semantic integration of existing devices
- Create semantically-enriched TDs easily
- Create Recipes (semantically-interoperable applications)

Enriching the device models with iot.schema.org Semantics

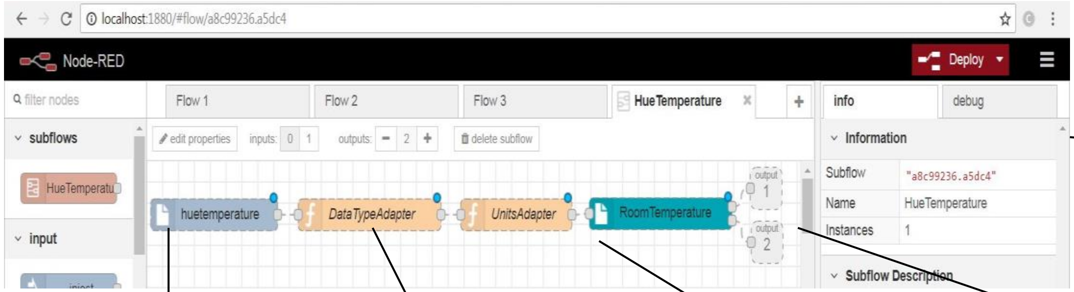
Type 1 Nodes



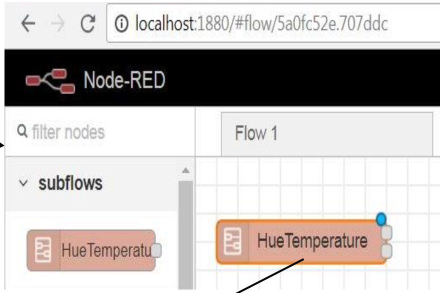
```
"@type": [ "Thing", “iot:Thermostat" ],
  "id":
  "urn:dev:wot:panasonic:airconditioner",
  "security": [{"scheme": "basic"}],
  "iot:isAssociatedWith" : { "@id": "Room1",
  "@type": "iot:Room" },
  "properties": {
    "temperature": {
      "@type": "iot:Temperature",
      "iot:capability":
  {"@id":"iot:Thermostat"},
      "io:isPropertyOf": { "@id": "Room1",
  "@type": "iot:Room" },
      "type": "object",
      "properties": {
        "temperatureValue": { "type":
              "number",          "minimum":
              10.0,  "maximum": 40.0 ,
              “iot:unitCode”: “iot:Celcius” } },
      "writable": false,    "observable": true..
```

Semantic Integration of Existing Things with iot.schema.org

Type 2 Nodes



Subflow "a8c99236.a5dc4"
Name HueTemperature
Instances 1



{
celsius: 25,
timestamp:13:00
}

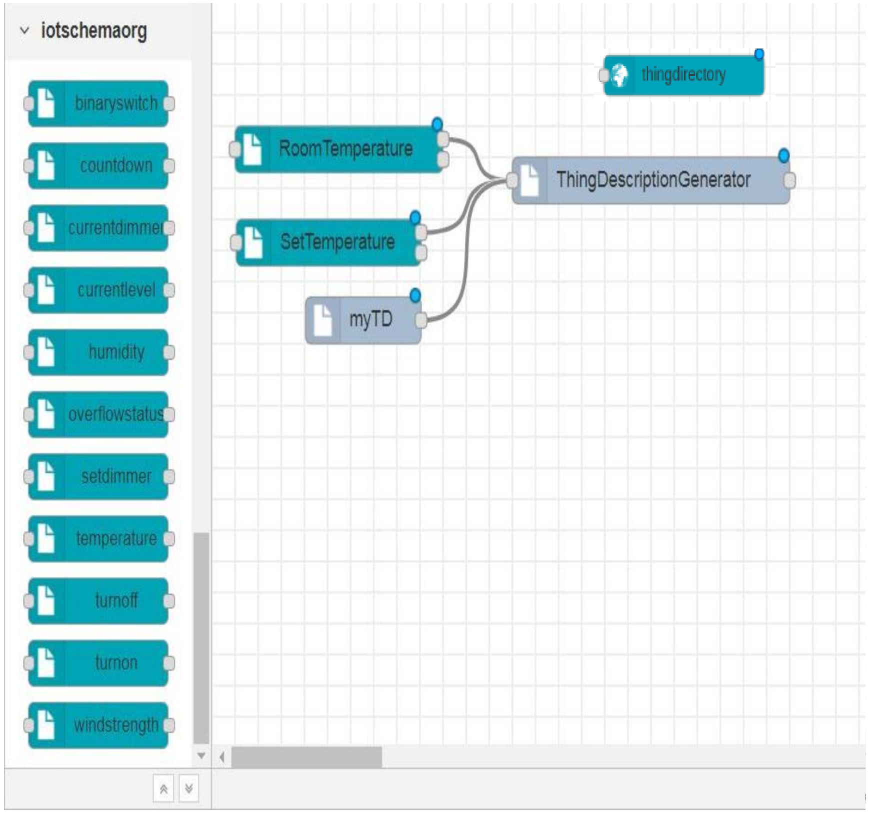
Datatype adaptor
(Int to float)
{
input: {
celcius: **25**,
timestamp:13:00
},
output: {
celcius: **25.0**,
timestamp:13:00
}
}

UnitCode adaptor
{
value: **77.0**,
unit: **fahrenheit**,
timestamp: 13:00
}

Output1: {
TemperatureShape,
}
Output2: {
value: 77.0,
iot:unitCode: fahrenheit,
timestamp: 13:00
}

Enriching the device models with iot.schema.org Semantics

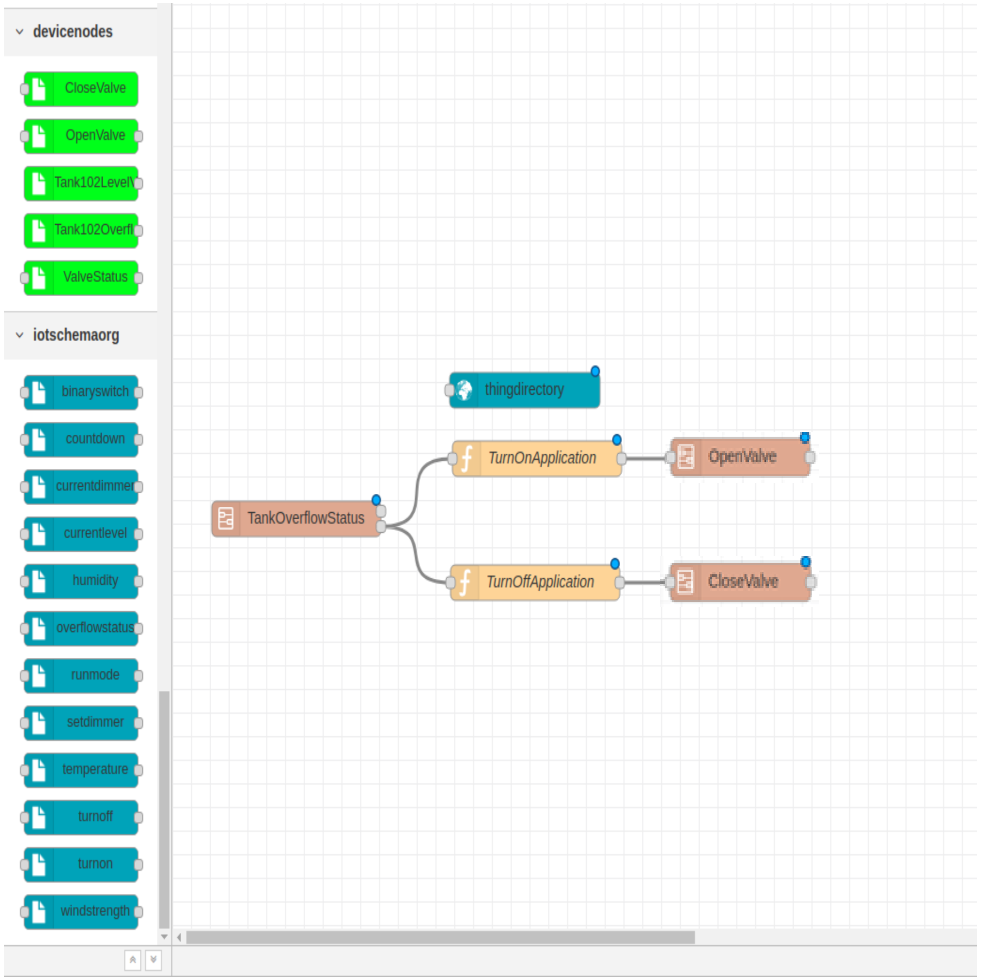
Type 2 Nodes



```
"@type": [ "Thing", “iot:Thermostat" ],
  "id":
  "urn:dev:wot:panasonic:airconditioner",
  "security": [{"scheme": "basic"}],
  "iot:isAssociatedWith" : { "@id": "Room1",
  "@type": "iot:Room" },
  "properties": {
     "temperature": {
        "@type": "iot:Temperature",
        "iot:capability":
  {"@id":"iot:Thermostat"},
        "io:isPropertyOf": { "@id": "Room1",
  "@type": "iot:Room" },
        "type": "object",
        "properties": {
          "temperatureValue": { "type":
                "number",          "minimum":
                10.0,  "maximum": 40.0 ,
                “iot:unitCode”: “iot:Celcius” } },
        "writable": false,    "observable": true..
```

Recipe Flow Creation

Application Creation



Recipe: A template that defines orchestration of Things.

- Models Things required for orchestration
- Describes how Things should interact

Node-RED Node: Recipe ingredient

Node-RED Wire: Recipe interaction

Use Cases:

- Create a Recipe as Node-RED flow.
- Add context to flow JSON description
- Store Recipe to Thing Directory

Thank You!

Questions please…