Thing Testing in Web of Things

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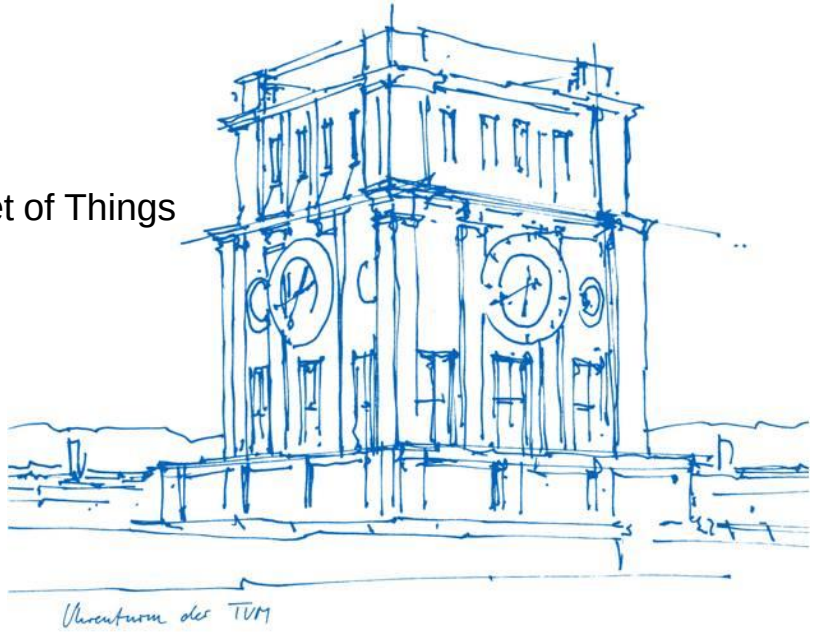

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- Testing: What
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  - (JSON Schema Validation and Faker)
- Results
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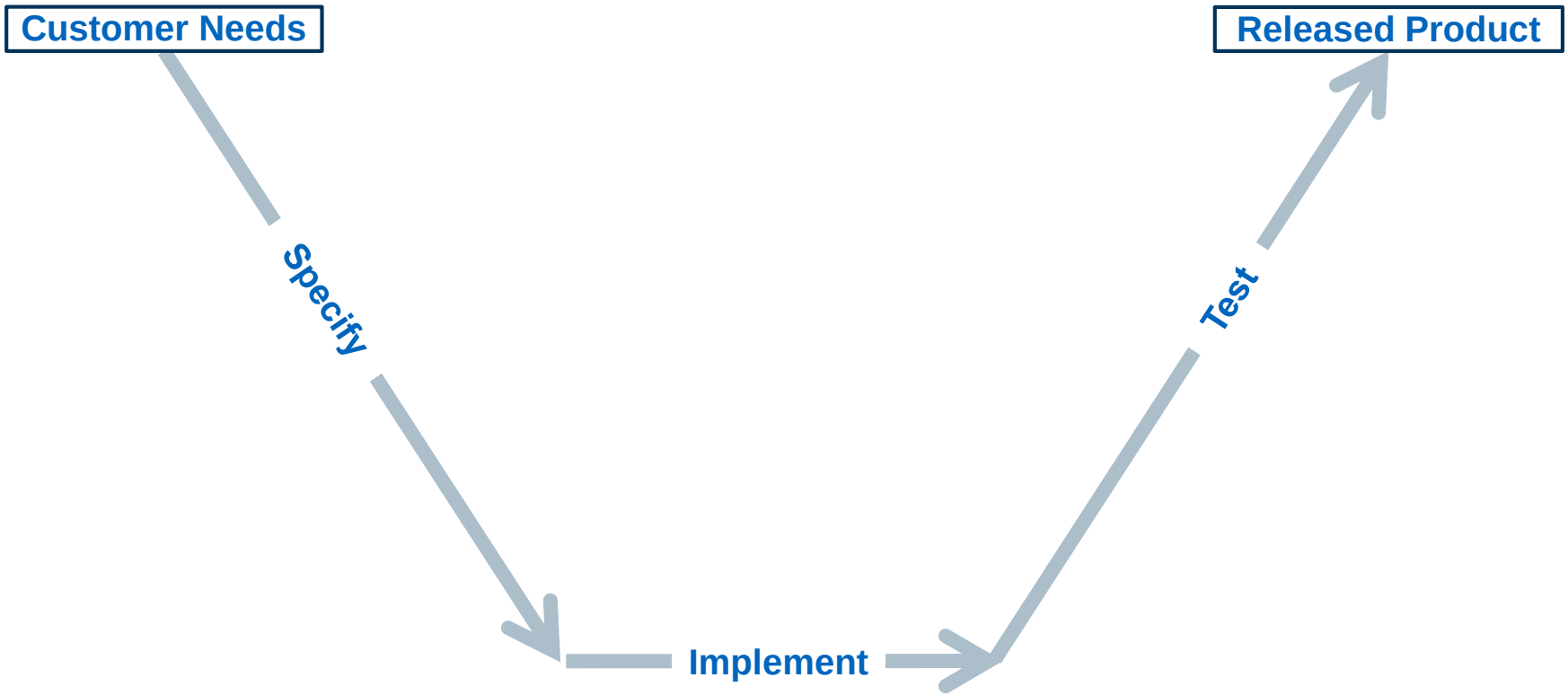
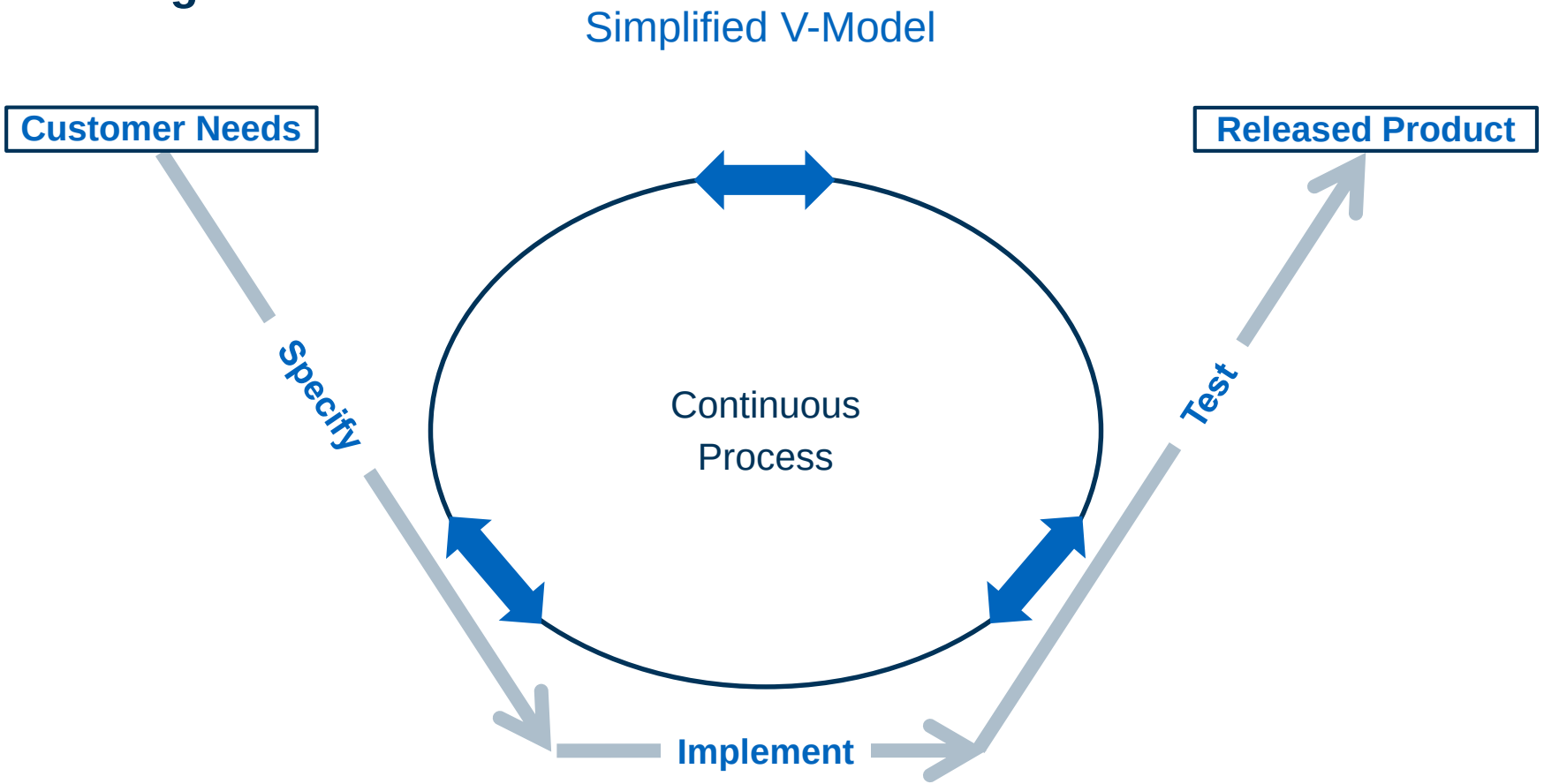
Testing: When

Simplified V-Model



Testing: When



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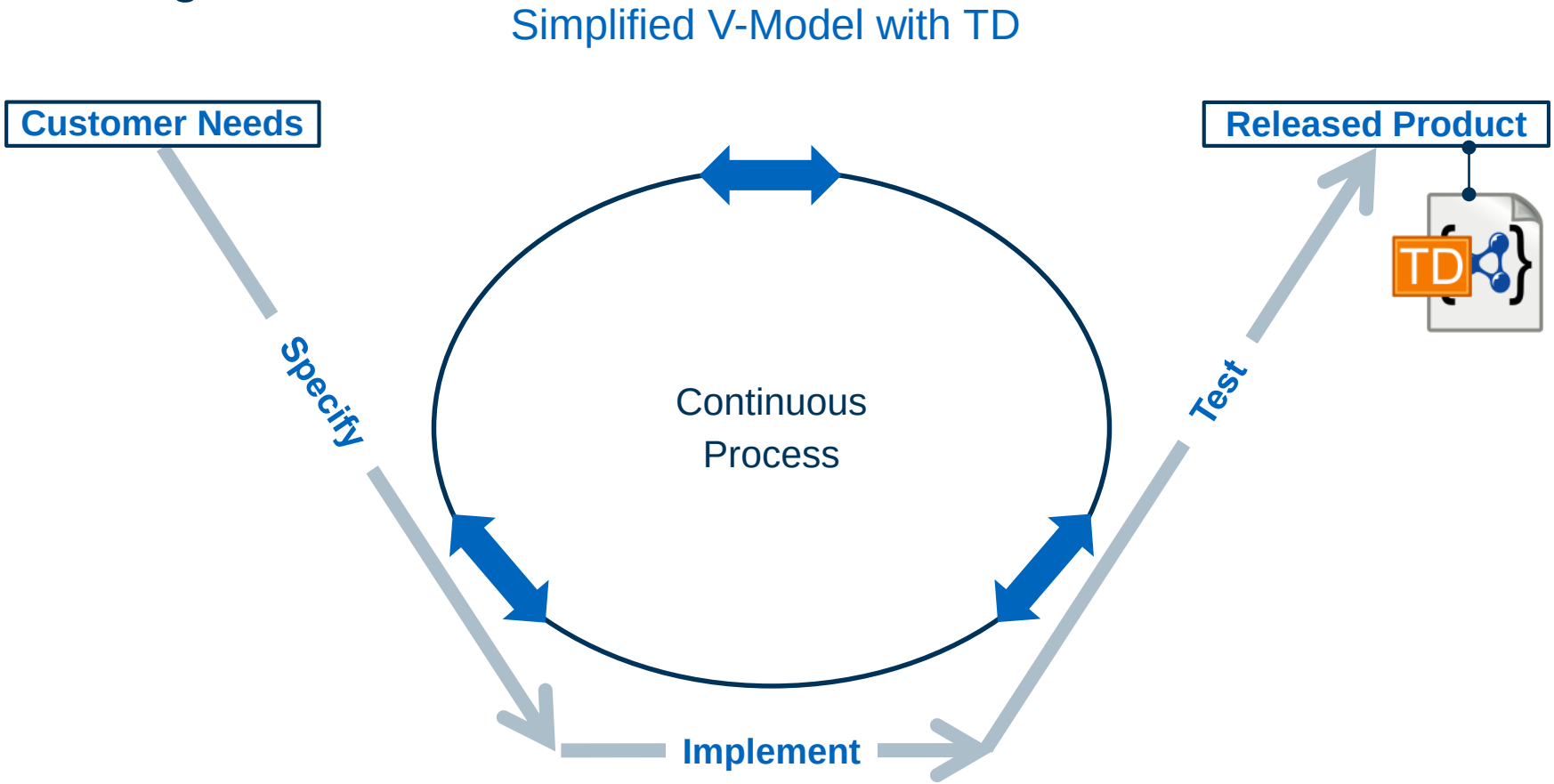

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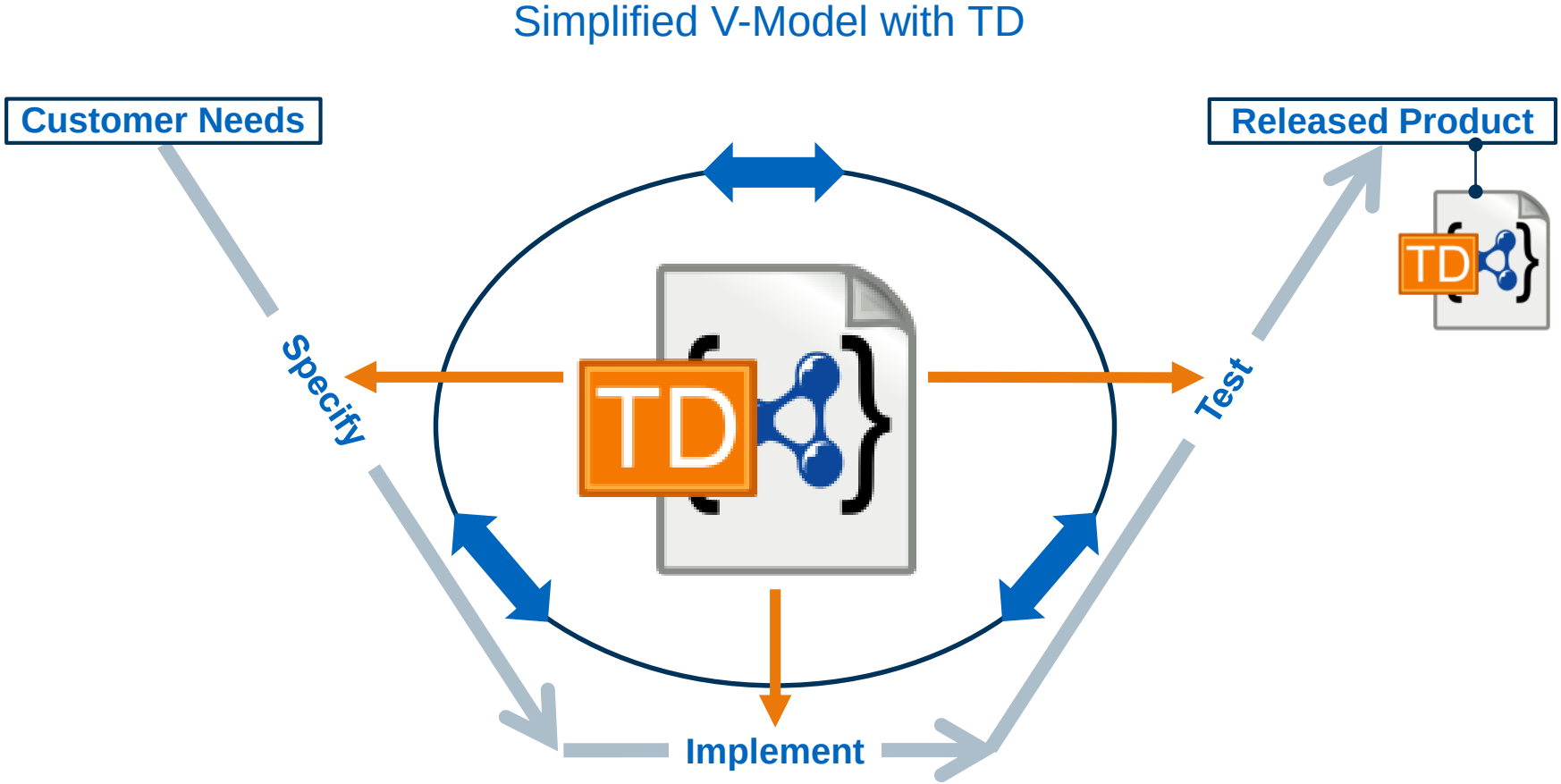

Testing: What

A black-box testing approach is used, which means:

- Testing something just by triggering the inputs and observing the outputs, without knowing the inner workings of the device.
- Testing as a user, doing only what the user can do

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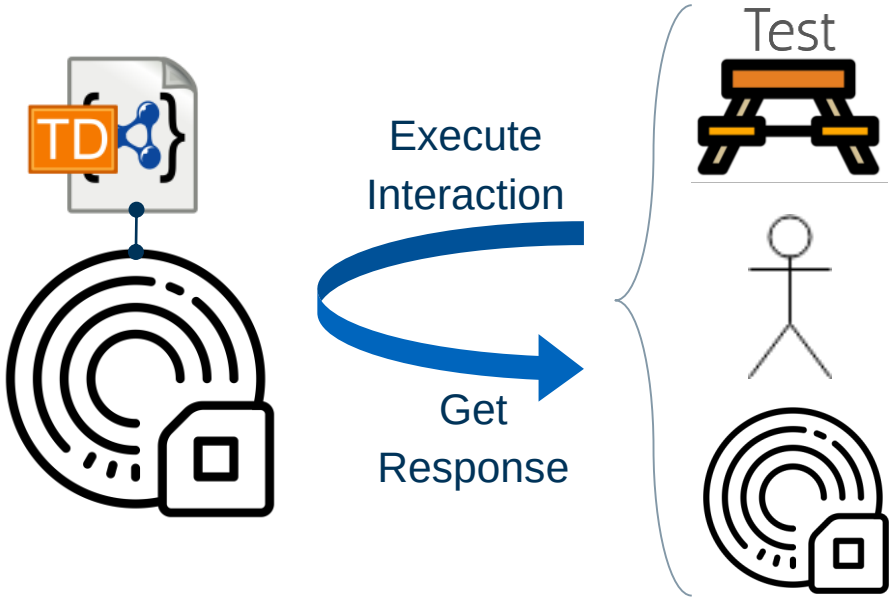

Testing: How

JSON Schema Extraction:

- Testing relies heavily on JSON Schema which is hidden in the interaction JSON Object

EXAMPLE 4

```
{
  ...
  "properties": {
      "on": {
          "label": "On/Off",
          "type": "boolean",
          "forms": [...]
      },
      "status": {
          "readOnly": true,
          "type": "object",
          "properties": {
              "brightness": {
                  "type": "number",
                  "minimum": 0.0,
                  "maximum": 100.0,

              },
```

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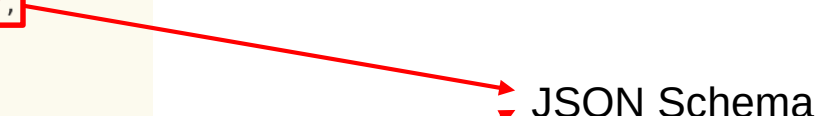
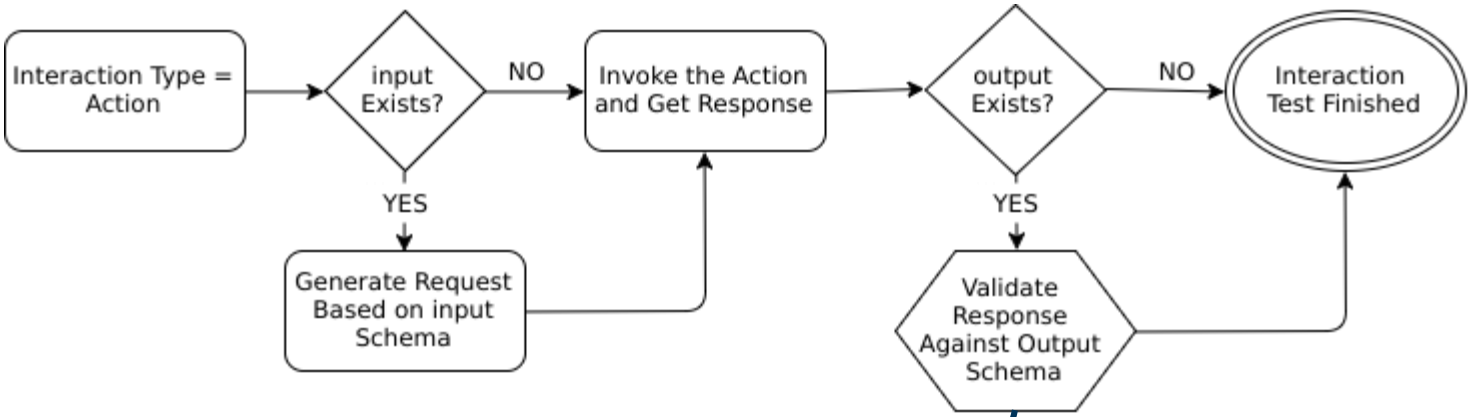


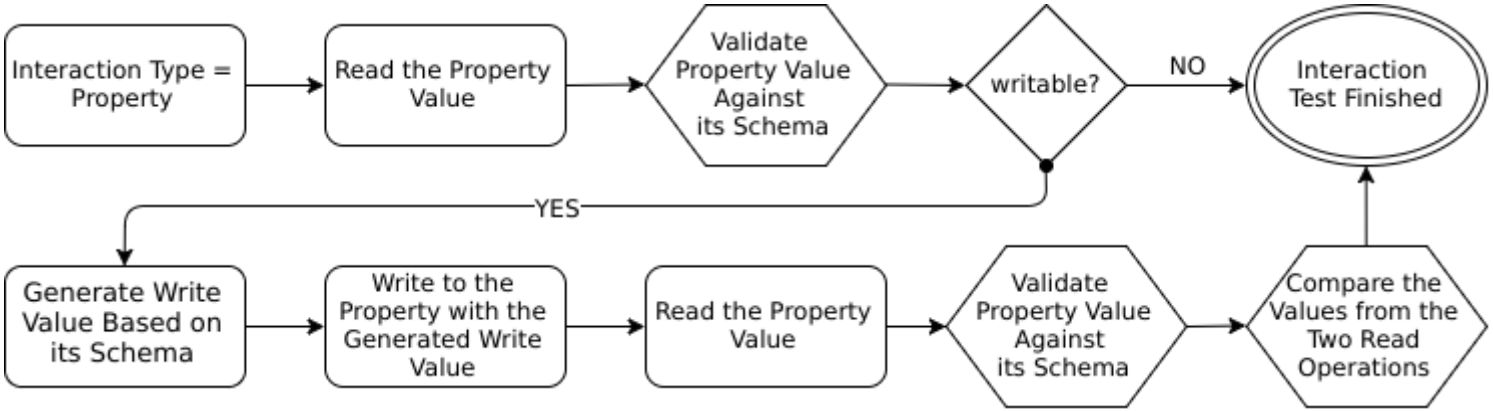
Testing: How

Action Testing:



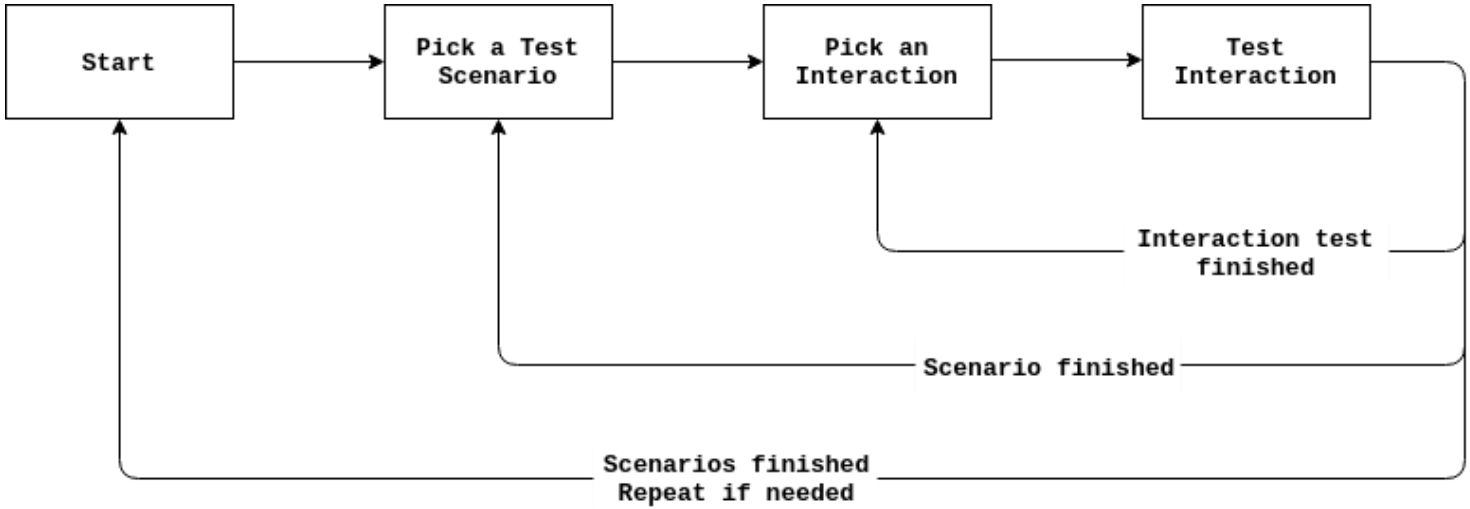
Testing: How

Property Testing:



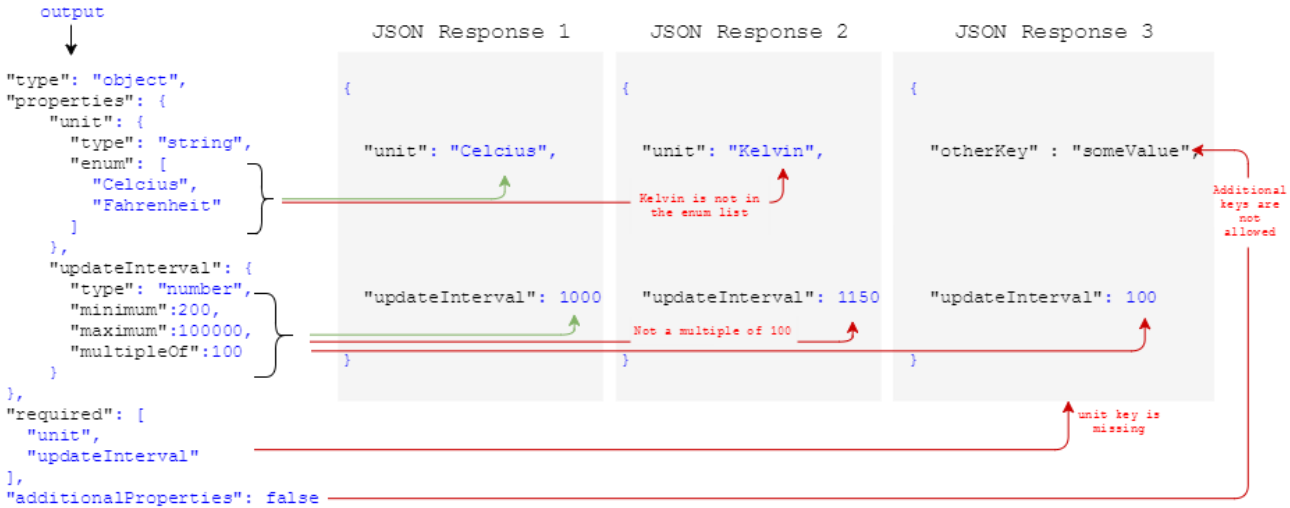
Testing: How

Proposed Generic Test Flow:



Testing: How

JSON Schema Validation



Testing: How

JSON Faking based on JSON Schemas

```
{
  "type": "integer",
  "minimum": 600,
  "maximum": 700,
  "multipleOf": 7,
  "exclusiveMinimum": true
}
```

JSON | YAML

```
651
```

```
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  "type": "integer",
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JSON | YAML

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665
```

Testing: How

Online Tools to Play with ☺

- https://www.jsonschemavalidator.net/
- http://json-schema-faker.js.org/

Results

Each interaction test can be stored for detailed analysis

```
{
  "name": "increase",
  "result": false,
  "sent": 5,
  "received": 38,
  "errorId": 16,
  "error": " Received response is not valid: Expected boolean
     return value

}
```

Results

A **simple report/table** of failed number of tests can be provided

Test Scenario Number	**TS1**	**TS2**	**TS3**
Repetition Nb			
R0	0/3	2/3	1/3
R1	0/3	2/3	1/3
R2	0/3	2/3	1/3
R3	0/3	2/3	1/3
R4	0/3	2/3	1/3

Results

An **analyzed report** of tests can be provided


```
{
        "NonExecutedActions":[],
        "RepetitionDifference":false,
        "PassedAllTests":["IncreaseTemp"],
        "FailedAllTests":["ChangeFanSpeed","TurnOff"],
        "HasSameErrorId": ["TurnOff"]
}
```

Future Work

- Event pattern testing
- Observable property testing

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- Event pattern testing
- Observable property testing
- Out of range value injection to test the limits
- Security testing

Limitations

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- Event needs to be triggered by the Thing under test, no way to invoke it.
- Cannot test how a response is constructed (white box testing)
- How precise a Thing can be tested depends on how precise its TD is

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