Decoding Digital Map Code: Usage and Insights

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Presenter: Sherif Mostafa

Decoding Digital Map Code: Usage and Insights: Agenda

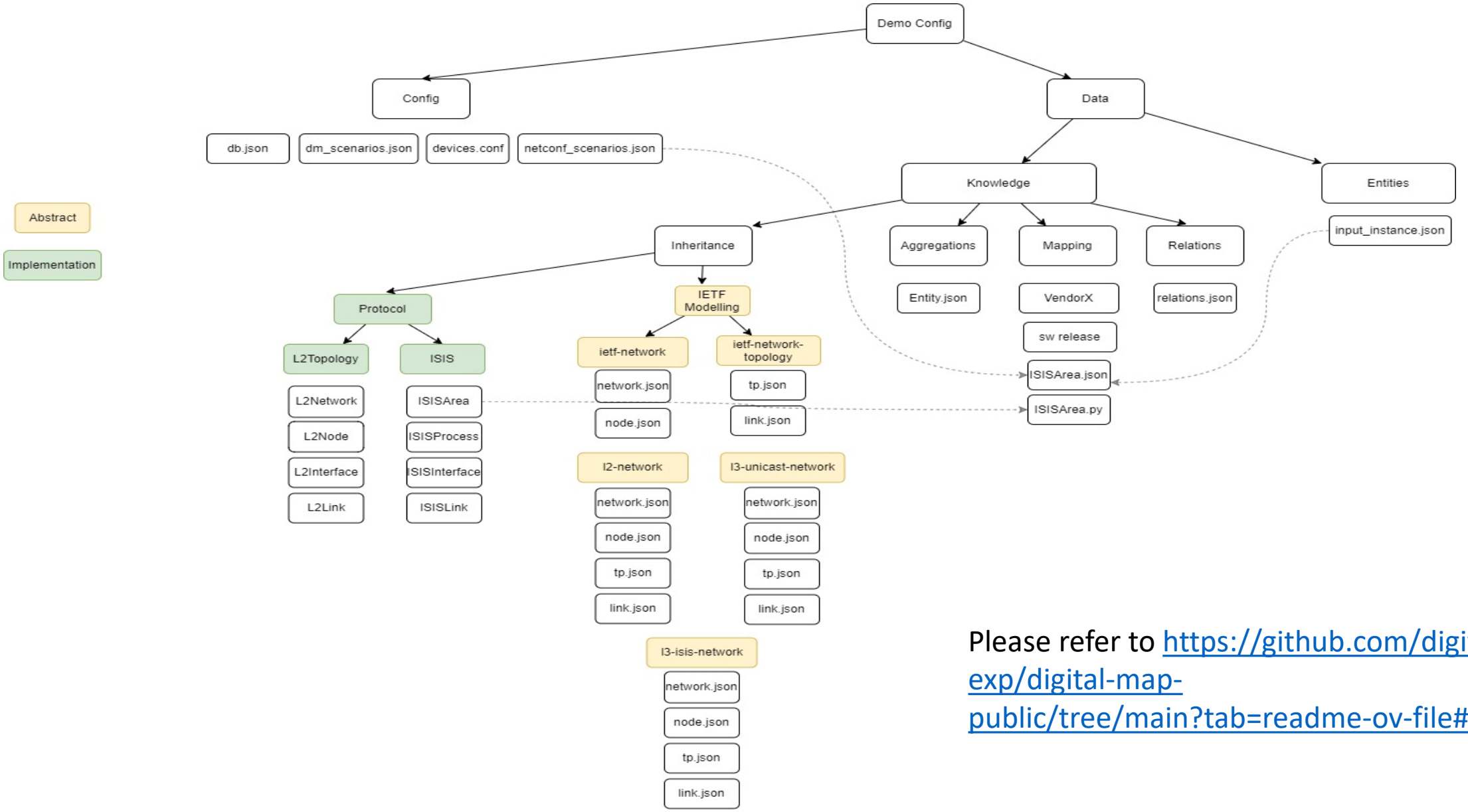
- Introduction to Digital Map POC code & Requirements
- Building Blocks of the code
- Getting started with development
- Using NEO4J for graph queries
- API REST calls

- https://github.com/digital-map-exp/digital-map-public

Introduction to Digital Map POC code & Requirements

- Please refer to https://github.com/digital-map-exp/digital-map-public/tree/main?tab=readme-ov-file#requirement

Building Blocks



Please refer to https://github.com/digital-map-exp/digital-map-public/tree/main?tab=readme-ov-file#config

Getting started with development: Step 0

1 config/digital_map_db.json

```
{
"digital_map_db":
{
"name": "digital-map-db",
"uri": "bolt://localhost:7687",
"user": "",  #neo4j username
"password": ""  #neo4j password
}
}
```

2 config/netconf_devices.json

```
{
"devices": [
{
"category": "router",
"sys_vendor": "huawei",
"sys_type": "NE8000",
"software_version": "V800R021C12",
"host": "1.1.1.1",
"port": "22",
"username": "username",
"password": "password",
"device_handler": "huaweiyang"
}
]
}
```

3 config/netconf_scenarios.json

```
{
"scenarios": [
{
"scenario": "get_running_config"
},
{
"scenario": "server_capabilities"
},
{
"scenario": "get_yang_modules_summary"
},
{
"scenario": "get_yang_modules_and_submodules"
},
{
"scenario": "get_path_list",
"path_list": [
{
"vendor": "openconfig",
"path": "<ns0:system xmlns:ns0='http://openconfig.net/yang/system'/>",
"file": "openconfig-system"
},
{
"vendor": "openconfig",
"path": "<ns0:interfaces
xmlns:ns0='http://openconfig.net/yang/interfaces'/>",
"file": "openconfig-interfaces"
}
]
}
]
}
```

4 config/digital_map_scenarios.json

```
{
"scenarios": [
{
"scenario": "generate_flat_entity_types"
},
{
"scenario": "generate_dm_entities"
},
{
"scenario": "generate_dm_aggregated_entities"
},
{
"scenario": "generate_dm_relations"
},
{
"scenario": "generate_db_entities"
},
{
"scenario": "generate_db_relations"
}
]
}
```

Detailed description of each *digital_map_scenario* can be found in https://github.com/digital-map-exp/digital-map-public/blob/main/README.md#digital_map_scenariosjson

Getting started with development : Step 1

1

IETF/ietf-network/network.json

```
{
"network": {
"isAbstract":"yes",
"key": ["network-id"],
"properties":{
"network-id":{
"Description":"RFC8345 network-id: Identifies a network",
"Type":""
},
"network-types":{
"Description":"RFC8345 network-types. RFC8944 defines l2-topology for L2",
"Type":""
},
"supporting-network": {
"Description":"RFC8345 supporting network-id",
"Type":"list"
}
}
}
}
```

2

IETF/ietf-network-topology/link.json

```
{
"link": {
"isAbstract":"yes",
"key": ["link-id"],
"properties": {
"link-id": {
"Description": "RFC8345 link-id",
"Type": ""
},
"network-id": {
"Description": "RFC8345 network-id",
"Type": ""
},
"source.source-node": {
"Description": "RFC8345 source, source-node",
"Type": ""
},
"source.source-tp": {
"Description": "RFC8345 source, source-tp",
"Type": ""
},
"destination.dest-node": {
"Description": "RFC8345 destination, dest-node",
"Type": ""
},
"destination.dest-tp": {
"Description": "RFC8345 destination, dest-tp",
"Type": ""
},
"supporting-link": {
"Description": "RFC8345 supporting link",
"Type": "list"
}
}
}
}
```

3

IETF/l3-unicast-topology-network.json

```
{
"l3-unicast-topology-network": {
"isAbstract":"yes",
"parent": "network",
"properties":{
"l3-topology-attributes.name":{
"Description":"Based on RFC8346 name: Name of the topology",
"Type":""
},
"l3-topology-attributes.flag":{
"Description":"Based on RFC8346 flag: Topology Flags",
"Type":"list"
}
}
}
}
```

4

IETF/Protocol/ISIS/ISISArea.json

```
{
"ISISArea":{
"layer":"Protocol",
"sublayer":"ISIS",
"parent": "l3-unicast-topology-network",
"properties":{
"area-address": {
"Description":"ISIS Area ID",
"Type":""
},
"level": {
"Description":"ISIS Level",
"Type":""
},
"label": {
"Description":"ISIS Area label",
"Type":""
}
}
}
}
```

5

Create mapping file (ex ISISArea.py)

6

Define relations

```
[
{
"src_entity": "ISISArea",
"src_entity_attr": "network-id",
"dst_entity": "ISISProcess",
"dst_entity_attr": "network-id",
"correlation_logic": "Equal",
"type": "contains",
"properties": "",
"show_name": "ISIS Area contains ISIS Processes",
"description": "RFC8345 containment relationship between network and contained node"
},
{
"src_entity": "ISISArea",
"src_entity_attr": "supporting-network-id",
"dst_entity": "Network",
"dst_entity_attr": "network-id",
"correlation_logic": "Equal",
"type": "supporting",
"properties": "",
"show_name": "Supporting network for ISIS Area",
"description": "RFC8345 supporting-network , network-ref"
}
]
```

Getting started with development : Step 2

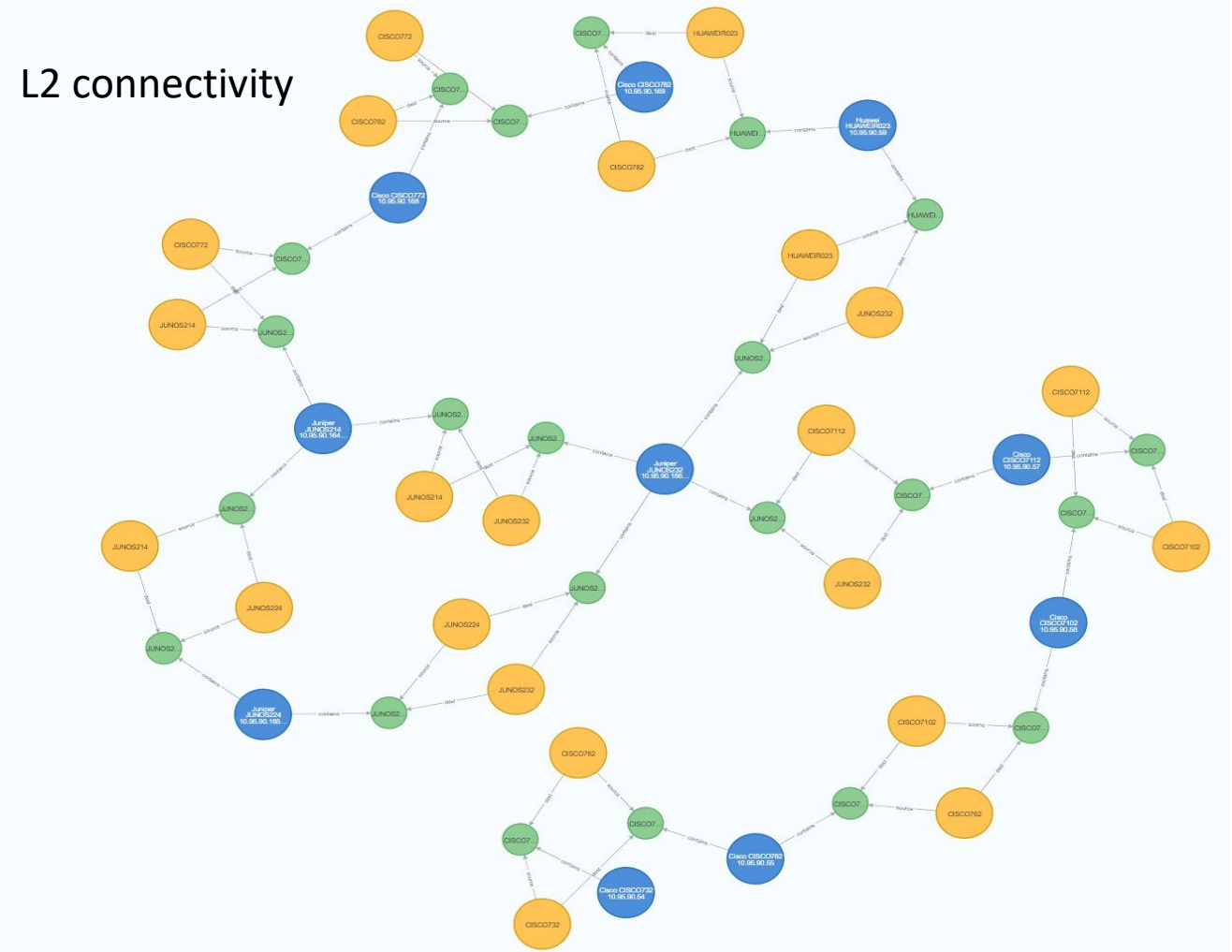
1. Run Discover Lab API call which will start reading the config files, then connecting to devices (if necessary) and retrieve all the needed configuration. Output files will be stored in generated/netconf.

2. Run Generate DM API call which will execute the steps defined in the *digital_map_scenarios* section. Then will store the output entities and relations in Neo4j.

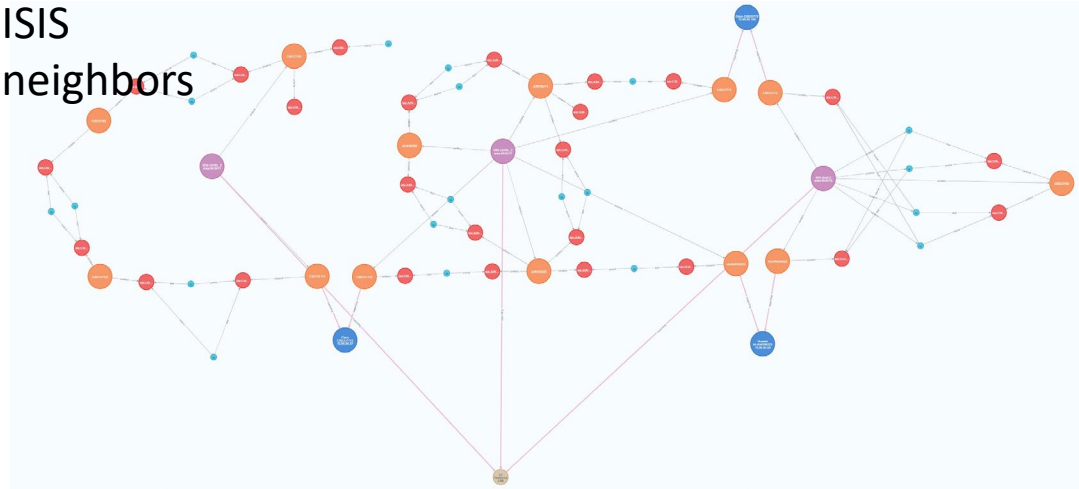
3. Get Network API call to retrieve all data with corresponding to yang models.

How users can start developing: Sample output from Neo4j

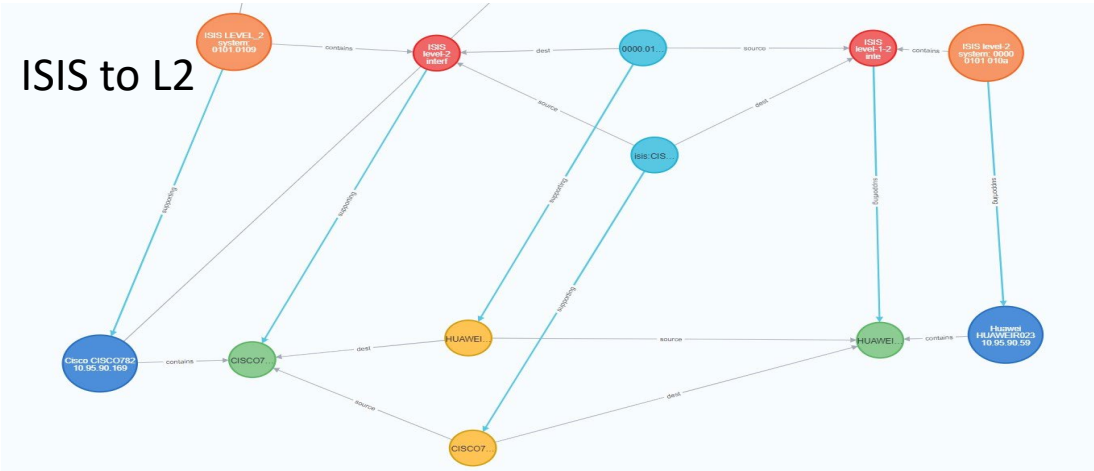
L2 connectivity



ISIS neighbors



ISIS to L2



Queries used can be found in https://github.com/digital-map-exp/digital-map-public/blob/main/README.md#neo4j

How users can start developing: Sample API response

Sample API response can be found in https://github.com/digital-map-exp/digital-map-public/blob/main/results/examples/mock-dm-ISIS-instance.json

GET /data/ietf-networks/network[network-id="isis:49.0411"]/node/node-id


```
{
    "ietf-network:networks": {
        "network": [
            {
                "node-id": "isis:49.0411.0000.0101.0104"
            },
            {
                "node-id": "isis:49.0411.0000.0101.0103"
            },
            {
                "node-id": "isis:49.0411.0000.0101.0102"
            },
            {
                "node-id": "isis:49.0411.0000.0101.0101"
            }
        ]
    }
}
```


GET /data/ietf-networks/network


```
{
  "ietf-network:networks": {
    "network": [
      {
        "network-id": "isis:49.0411",
        "network-types": {"ietf-l3-unicast-topology:l3-unicast-topology": "ietf-l3-unicast-topology:l3-unicast-topology,ietf-l3-isis-topology:isis-topology"...},
        "supporting-network": [...],
        "node": [
          {
            "node-id": "isis:49.0411.0000.0101.0104",
            "supporting-node": [...],
            "ietf-network-topology:termination-point": [
              {"tp-id": "isis:CISCO732:Loopback0"...},
              {"tp-id": "isis:CISCO732:GigabitEthernet0/0/0/0"...},
              {"tp-id": "isis:CISCO732:GigabitEthernet0/0/0/1"...}
            ],
            "ietf-l3-unicast-topology:l3-node-attributes": [...]
          },
          {"node-id": "isis:49.0411.0000.0101.0103"...},
          {"node-id": "isis:49.0411.0000.0101.0102"...},
          {"node-id": "isis:49.0411.0000.0101.0101"...}
        ],
        "ietf-network-topology:link": [
          {"link-id": "isis:CISCO732:GigabitEthernet0/0/0/0:isis:CISCO762:GigabitEthernet0/0/0/1"...},
          {"link-id": "isis:CISCO762:GigabitEthernet0/0/0/0:isis:CISCO7102:GigabitEthernet0/0/0/1"...},
          {"link-id": "isis:CISCO762:GigabitEthernet0/0/0/1:isis:CISCO732:GigabitEthernet0/0/0/0"...},
          {"link-id": "isis:CISCO7102:GigabitEthernet0/0/0/0:isis:CISCO7112:GigabitEthernet0/0/0/1"...},
          {"link-id": "isis:CISCO7102:GigabitEthernet0/0/0/1:isis:CISCO762:GigabitEthernet0/0/0/0"...},
          {"link-id": "isis:CISCO7112:GigabitEthernet0/0/0/1:isis:CISCO7102:GigabitEthernet0/0/0/0"...}
        ],
        "ietf-l3-unicast-topology:l3-topology-attributes": [...]
      },
      {"network-id": "isis:49.0412"...},
      {"network-id": "isis:49.0413"...}
    ]
  }
}
```

What's next?

- **Potential Experiments:**
  - Support OSPF Domains using "draft-ogondio-nmop-ospf-topology"
  - Proposal on how to connect topology nodes with other config modules
  - Show how Capacity Planning can be demonstrated
  - Support SRV6

- **Operators can start using it and provide feedback**

Questions?