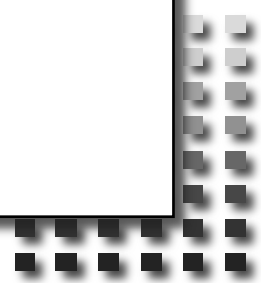




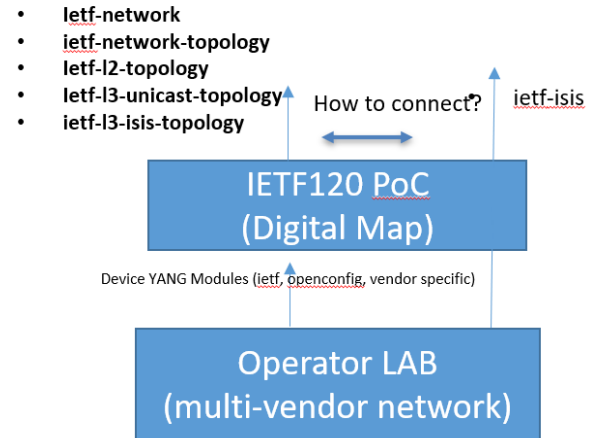
# Digital Map IETF Hackathon

IETF 120  
20–21 July 2024  
Vancouver, Canada



# Hackathon Plan

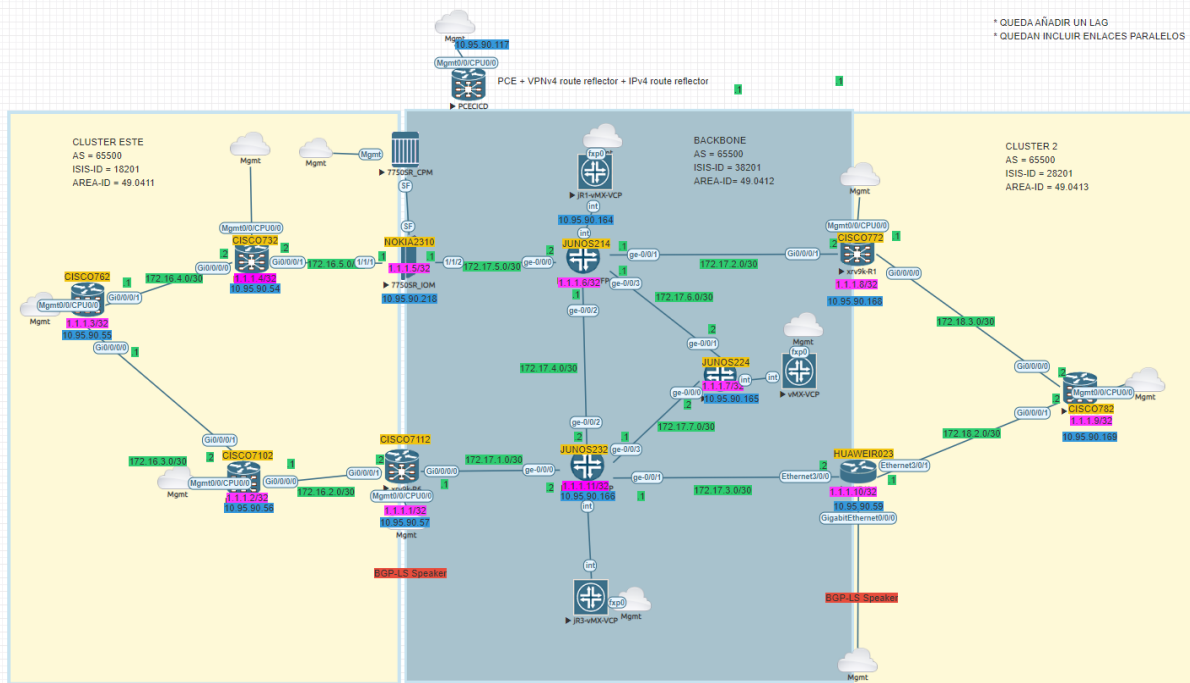
- The goal is to demonstrate how operators can use the IETF Topology Yang models to represent a real carrier IP/MPLS network.
- We want to demonstrate if RFC8345 is the suitable standard for representing the multi-layered topology for Digital Map and show the models comparison with and without the identified gaps.
- This is the first iteration, the hackathon will continue during IETF121 and beyond
- What drafts/RFC's were involved (initial set)
  - <https://www.rfc-editor.org/rfc/rfc8345> (ietf-network, ietf-network-topology)
  - <https://www.rfc-editor.org/rfc/rfc8944> (ietf-l2-topology)
  - <https://www.rfc-editor.org/rfc/rfc8346> (ietf-l3-unicast-topology)
  - <https://datatracker.ietf.org/doc/draft-ogondio-nmop-isis-topology> (ietf-l3-isis-topology)
  - <https://datatracker.ietf.org/doc/rfc9130> (ietf-isis)
  - <https://datatracker.ietf.org/doc/html/draft-havel-nmop-digital-map-concept>
  - <https://datatracker.ietf.org/doc/html/draft-havel-nmop-digital-map>
  - <https://datatracker.ietf.org/doc/draft-davis-opsawg-some-refinements-to-rfc8345>



# Hackathon Plan (cont)

- The scope of the IETF120 Hackathon (first iteration):
  - The **multi-vendor operator LAB** was used for this hackathon (with Huawei, Cisco, Juniper devices)
  - We started with one particular problem space: How to use IETF topology model to represent a real carrier network based on IS-IS and OSPF domains (target for planning/simulation purposes).
  - This IETF120 Hackathon focused on generic topology queries, and started to compare IS-IS topology drafts augmenting RFC8345 versus potential RFC8345bis (gaps identified in RFC8345) approaches.
  - Start analysis and prototypes how to retrieve performance metrics or configuration attributes (defined in RFC9030 and retrieved via device API) northbound from the Controller via RFC8345 API and its IS-IS Augmentation

# Hackathon LAB



We used this multi-vendor Operator LAB for real-time discovery

We also have demo for

- 2 other Operator LABs
- 1 vendor LAB

All discovered before the Hackathon and simulated for this Hackathon

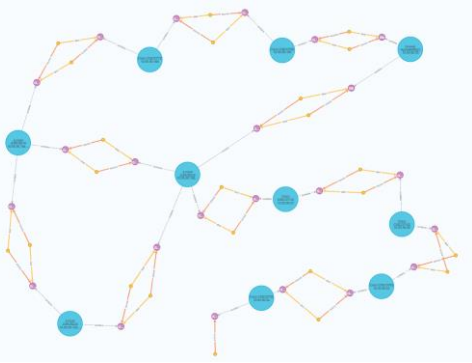
Discovered Huawei, Cisco and Juniper from the Operator LAB, Nokia planned for next Hackathon

# What was achieved

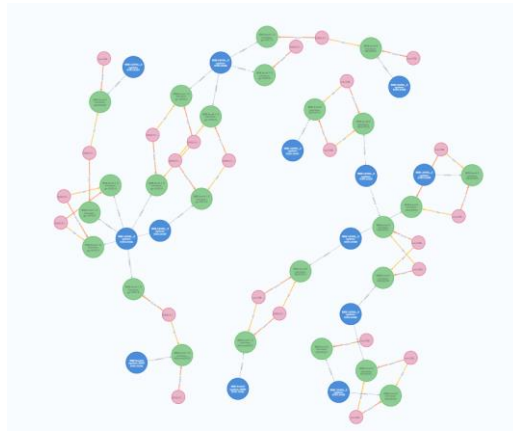
- We discovered L2 and ISIS topology for multi-vendor network and build relationship between different layers
- We mapped different device models to the network wide topology models and retrieved them via IETF Topology API
- We implemented 2 options for comparison:
  - ISIS Areas modelled as ietf-networks (not currently supported in RFC8345 as it does not allow for links between network)
  - ISIS Areas modelled as attributes only in ietf-node and ietf-termination-point
- We started working on how to connect ietf-l3-isis-topology to ietf-isis
  - First attempt via augmenting ietf-l3-isis-topology with ietf-isis subtrees
  - Conclusion: we need better approach to do at the next hackathon
- CODE (will make public in the next few days):
  - [digital-map-exp/digital-map-public \(github.com\)](https://github.com/digital-map-exp/digital-map-public)

# Topologies

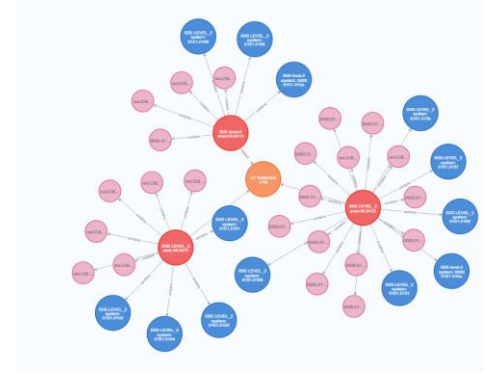
## L2 Topology



## ISIS Topology



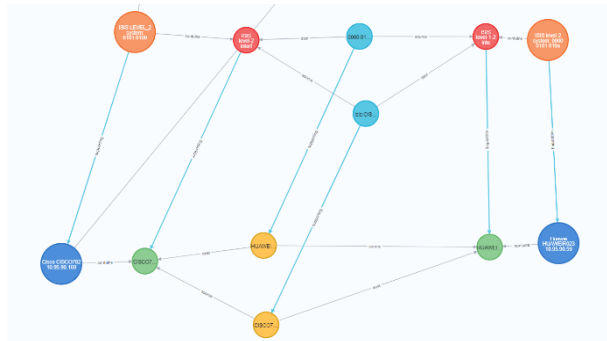
## ISIS Areas (Option 1)



## ISIS Areas (Option 2)



## ISIS Topology with Topology L2 undelay



# What we learned

- We demonstrated that IETF RFC8345 is the suitable standard for representing the multi-layered topology for Digital Map
- The operator may have one ISIS Area in the ISIS Domain or multiple ISIS Areas in the ISIS Domain, there is need for flexibility to model both ways
- In the case of multiple areas in ISIS Domain, the RFC8345 does not provide the capability for inter-area links
- We implemented 2 options for comparison
- We need a new RFC8345 augmentation for the purpose of:
  - Connecting IETF Topology Module to other IETF YANG Modules
    - What yang paths are connected to node, termination-point
  - Defining what IETF Topology Module instances are related to the IETF YANG Module instances (because we have different keys)
  - To avoid duplicating the properties in RFC8345 augmentations

# IETF APIs (2 Options)

OPTION 1: ISIS Area modelled as network  
(can support links between networks)

OPTION 2: ISIS Area modelled as attributes  
(current RFC8345 approach for domains with multiple areas)

```
{
  "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",
          "ietf-l3-isis-topology:isis-topology": "ietf-l3-unicast-topology:l3-unicast-topology,ietf-l3-isis-topology:isis-topology"
        },
        "supporting-network": [ 1 element... ],
        "node": [
          { "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"... }
        ],
        "ietf-network-topology:link": [ 6 elements... ],
        "ietf-l3-unicast-topology:l3-topology-attributes": [ 1 element... ]
      },
      { "network-id": "isis:49.0412"... },
      { "network-id": "isis:49.0413"... }
    ]
  }
}
```

```
{
  "ietf-network:networks": {
    "network": [
      {
        "network-id": "TelefonicaISISDomain:default",
        "network-types": {
          "ietf-l3-unicast-topology:l3-unicast-topology": "ietf-l3-unicast-topology:l3-unicast-topology,ietf-l3-isis-topology:isis-topology",
          "ietf-l3-isis-topology:isis-topology": "ietf-l3-unicast-topology:l3-unicast-topology,ietf-l3-isis-topology:isis-topology"
        },
        "supporting-network": [ 1 element... ],
        "node": [ 13 elements... ],
        "ietf-network-topology:link": [ 24 elements... ],
        "ietf-l3-unicast-topology:l3-topology-attributes": [ 1 element... ]
      }
    ]
  }
}
```

- processes grouped in the area via the standard IETF RFC 8345 network->node relationship
- applications and algorithms will understand topologies based on the generic entities and relationships, do not need to understand specific IS-IS attributes
- aligned with the IS-IS topology model and the IS-IS network view in the manuals and documentation, cloud entity exists in the model

- processes grouped in the area via the specific IS-IS property
- generic topology applications would need to understand the IS-IS attribute meaning and IS-IS attribute extensions in order to understand IS-IS topology



# What next (IETF 121)

- Add more layers:
  - BGP, SRv6
  - Separate L3 topology from ISIS topology (different option)
- Add more operator LABs
- Add more vendors
- Implement more advanced option for connecting ietf-l2-isis-topology to ietf-isis. The solution must be generic to support any other augmentations and yang files.
- Start working on other use cases
  - Candidates: simulation / emulation

# Team members

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