SIMAP: Concepts, Requirements and Use Cases
IETF NMOP Meeting

IETF 122 NMOP
17 March 2025
Bangkok, Thailand

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Agenda

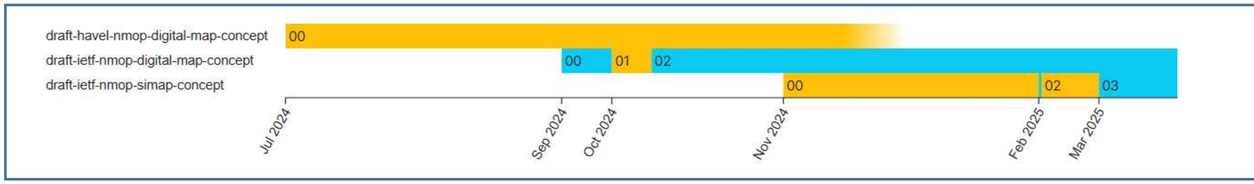
Goal: Presentation time should be spent on focused open items, with the goal to reach consensus

- Quick Refresh (Slides 3-7, 5 mins)
  - Quick Summary for those who missed the Interim and mailing list discussions (primarily for slide sharing, will not be fully presented)
  - SIMAP Refresh, Interim Meeting Summary, Updates Since IETF121 Summary, Closed Issues
- Outstanding Items & Discussion (Slides 8-15, 25 mins)
  - Present 8 Open Issues, Slide per Open Issue
  - Try to reach consensus

draft-ietf-nmop-simap-concept (Refresh)

Expected contribution:

1. Have a *reference document* for the concept of SIMAP (previously known as Digital Map) independent of the modelling approach
2. Agree on *key related terms* and their definitions
3. Inventory of a *focused set of target use cases*
4. Identify *requirements* for solution design
5. Engage with Operators in *IETF Hackathons* to identify and validate requirements



SIMAP is a data model that provides a view of the operator's networks and services, including how it is connected to other models/data (e.g., inventory, observability sources, and operational knowledge).

It specifically provides an approach to model multi-layered topology and an appropriate mechanism to navigate amongst layers and correlate between them.

This includes layers from physical topology to service topology. This model is applicable to multiple domains (access, core, data centers, etc.) and technologies (Optical, IP, etc.).

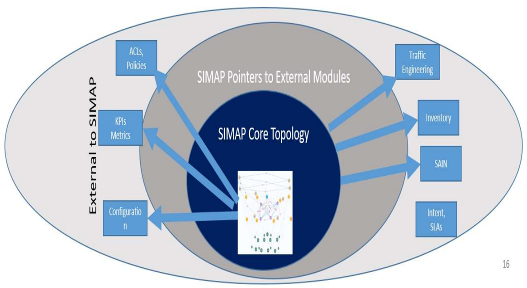
Multiple layered views

The short version

Service & Infrastructure Maps (SIMAP)

The main layers

- Capture and display internal views
- Allow to navigate, zoom in/out, etc.
- Connect to objects that might have their own representation (but without disclosing it)



Other terms:

- SIMAP modelling
- SIMAP model
- SIMAP data
- Topology
- Multi-layered topology
- Topology layer
- Service

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3 Operator Use Cases:

- ✓ Common Enablers for SIMAP:
  - ✓ Navigation Service -> Resource
  - ✓ Navigation Resource -> Service
  - ✓ Traffic Engineering (TE)
  - ✓ Closed Loop
- ✓ Inventory Queries
- ✓ Service Placement Feasibility Checks
- ✓ Intent/Service Assurance
- ✓ Service E2E and Per-Link KPIs
- ✓ Capacity Planning
- ✓ Network Design
- ✓ Network Simulation and Network Emulation
- ✓ Postmortem Replay
- ✓ Network Digital Twin (NDT)

4 Operator Requirements:

- ✓ REQ-BASIC-MODEL-SUPPORT
- ✓ REQ-LAYERED-MODEL
- ✓ REQ-PASSIVE-TOPO
- ✓ REQ-PROG-OPEN-MODEL
- ✓ REQ-STD-API-BASED
- ✓ REQ-COMMON-APP
- ✓ REQ-GRAPH-TRAVERSAL
- ✓ REQ-TOPOLOGY-ABSTRACTION
- ✓ REQ-LIVE
- ✓ REQ-SNAPSHOT
- ✓ REQ-POTENTIAL
- ✓ REQ-SEMANTIC
- ✓ REQ-LAYER-NAVIGATE
- ✓ REQ-EXTENSIBLE
- ✓ REQ-PLUGG
- ✓ REQ-BIDIR
- ✓ REQ-MULTI-POINT
- ✓ REQ-MULTI-DOMAIN
- ✓ REQ-SUBNETWORK
- ✓ REQ-SHARED
- ✓ REQ-SUPPORTING
- ✓ REQ-STATUS
- ✓ REQ-DATA-PLANE-FLOW
- ✓ REQ—CONTROL-PLANE

=> Design Requirements
=> Architectural Requirements

5 Multi-Layered Topology - Layers/Technologies (IETF Hackathons – IETF120, IETF121, IETF122, future)

- ✓ L1 Topology, including:
  - ✓ Optical
  - ✓ Active and Passive
- ✓ L2 Topology
- ✓ L3 Topology
- ✓ Control plane routing (underlay control plane correlatable to underlay L3 topology, overlay control plane correlatable to overlay L3 topology)
  - ✓ IGP (OSPF, IS-IS, iBGP)
  - ✓ eBGP
- ✓ Tunnels (MPLS-LDP, MPLS-TE, SRv6)
- ✓ L3VPN Service
- ✓ Application Flow / Data Flow

Interim Meeting February 2025 (Summary)

- Topic 1: SIMAP Activities Since IETF#121 (Olga Havel)
  - Closed:
    - Moved service->resource and resource-service into enablers
    - Removed subservice term, except when referring to SAIN
    - Agreed on service definition
    - DTN clarification added
    - New Requirements added
  - Open:
    - All use cases need to be reviewed from the perspective if all info required for SIMAP is there – meaning do we have the relevant to define the API requirements or do we need some additional clarification
    - Many use cases are linked (e.g. Thomas mentioned “Inventory queries”, “Network Design” and “Capacity Planning as related and suggested some merges). Benoit says that we
- Topic 2: Do we need Link State in SIMAP Core model (Oscar Gonzales de Dios)
  - Closed
    - Added requirement and the text from the open issues
- Topic 3: Overview of the Approaches to Extending the SIMAP with Conf/Stats (Pierre Francois)
  - Open: Different approaches presented at Hackathon, Sherif will present on Tuesday
- Topic 4: Passive Topology Comments (Olga Havel)
  - Closed: SIMAP should include passive topology, but not in the real network as it cannot be discovered, only in proposed or intended.
  - Open: How it is modelled in IVY should be discussed on IVY mailing list
- **Notes: https://datatracker.ietf.org/doc/minutes-interim-2025-nmop-01-202502140930/**
- **Next Steps**
  1. **Olga Havel: A set of open issues to be closed. Please keep the mailing list involved and close items and let the WG converge.**
  2. **Pierre Francois/Vivekananda Boudia: Please share the hackathon finding and linking to other data sources. Please consider to document.**
  3. **Keep IVY involved for the passive discussion**
  4. **Great energy. Keep discussing before IETF 122 in Bangkok. The presentation time at IETF 122 in Bangkok should be spent on focused items, with the goal to reach consensus.**

Updates Since IETF121 (Summary)

Table of Contents

IETF121

IETF122

Table of Contents

Main Changes:

- changes to use cases, separating enablers from business use cases
- new requirements and changes to existing requirements
- addition of SIMAP positioning chapter
- addition of Appendix Section for Abstract Topologies in IETF
- lots of changes based on the discussions on the mailing list
- editorial changes

Closed Issues Since IETF121

- ✓ **Issue 38: REQ-SEMANTIC** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/38
    - Added 2 new semantics requirements (REQ-DATA-PLANE-FLOW and REQ-CONTROL-PLANE) as suggested by Thomas and added the statement after REQ-SEMANTIC that the more specific requirements follow
- ✓ **Issue 37: REQ-LAYER-NAVIGATE vs REQ-RELATIONSHIP** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/37
    - Not clear what the difference between the 2 requirements is and is not clear the split between core & design requirements
    - Added the introduction into the Requirement Section with the description of (Core replace with Operator) Operator, Design and Architectural requirements
    - Modified the text of the 2 requirements to better describe the difference
- ✓ **Issue 27: Operational Status must be accessible from SIMAP** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/27
    - Added new requirement REQ-STATUS
- ✓ **Issue 26: SIMAP must ensure that links and nodes that are down must appear in topology** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/26
    - Updated REQ-STATUS with this requirement
- ✓ **Issue 23: Is there a need to point SIMAP to a "logical configuration inventory"?** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/23
    - Updated REQ-PLUGG with the text provided
- ✓ **Issue 15: Navigation across the abstraction levels inside a single network layer (Italo)** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/15
    - Added the new requirement (REQ-TOPOLOGY-ABSTRACTION) and references to other IETF in (Appendix A.2) to the draft.
- ✓ **Issue 14: Adrian’s comments about the terminology** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/14
    - Added definition for service only, resource definition referenced from terminology graph
    - Removed subservice and we will not use it except in SAIN context (e.g. service->subservice->resource becomes service->resource)
- **Issue 9: Is DM supporting the full lifecycle?** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/9
    - Some text around lifecycle added to network inventory lifecycle
    - Use cases descriptions added and clarify it
- ✓ **Issue 3: Add more description for each use case** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/3
    - Great team effort and lots of context added to use cases, also split into enablers and business use cases
    - For any other use case comments, we can open new issues
- ✓ **Issue 1: Scope/Goal/Intended Use (from Italo)** https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/1
    - Addressed via many updates to use cases and requirements

Open Issues

- **Terminology:**
  - **Issue 13:** Multi-Layered topology versus topology hierarchy (Nacho opened, Nigel commented) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/13
  - **Issue 21:** Termination Point vs Interface (Oscar opened, replaced interface->termination point, Nigel would prefer to add clarification) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/21
- **Use Cases:**
  - **Issue 60:** Updates to the Network Design Use Case (NMOP Mailing list topic: SIMAP: Network design use case [Commercial - Anyone]) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/60
  - **Issue 61:** Use Cases are related – do we need to regroup? https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/61
- **Requirements:**
  - **Issue 58:** Add Examples for REQ-DATA-PLANE-FLOW and REQ-CONTROL-PLANE (Thomas) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/58
  - **Issue 59:** REQ-TOPO-ONLY change to link dynamic paths (Thomas) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/59
  - **Issue 62:** REQ-PASSIVE-TOPO for current network (Thomas) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/62
- **Other:**
  - **Issue 22:** Models to which the core SIMAP should navigate to (Oscar) https://github.com/ietf-wg-nmop/draft-ietf-nmop-digital-map-concept/issues/22

Terminology Issue 13: Multi-Layered topology versus topology hierarchy

Nacho:

I would avoid using the “multi-layered topology” term, unless you agree that the whole figure 2 (from RFC8345) represents a topology in itself (i.e., a topology composed of topologies from different layers).

Nigel:

We need to be careful with the term "layer", there are various granularities (e.g., marketing layers L0, L1, L2 etc. technology layer ODU, Ethernet etc. OSI layers: Transport, network...), a layer at one granularity is multiple layers at another. We also found it challenging separating network partitioning,

In TAPI we concluded that several technology layers could be grouped into a single topology (hence multi-layer). There are degrees of this, some very obvious and some not so.

When you get IP over IP, this can be considered as one layer because of technology or several because of partitioning.

This may lead us to viewpoint, where from one viewpoint it is a single layer whereas from another it is multiple layers.

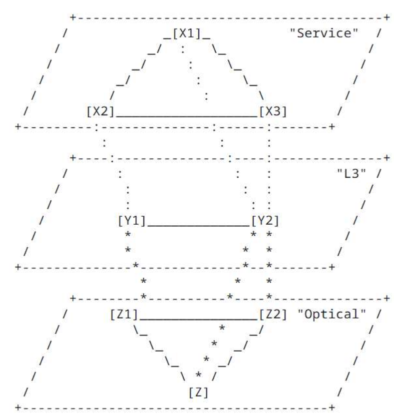

Figure 2: Topology Hierarchy (Stack) Example

RFC8345 uses network-type in the YANG model and not layer

Nevertheless, layer is mentioned 36 time (while hierarchy is mentioned only 13 times) in the document in regards to:
- Describing supporting relations
- Underlay/Overlay
- Definition of network contains nodes + layering information

- Supporting relation defined as used to support layered network topologies

✓ Why we used multi-layered network – this is the terminology used when discussing with Operators – different layers

✓ We were asked to add 2 definitions to the terminology (added/clarified):
1. multi-layered topology
2. Topology layer

Consensus Needed:
1. Proposal by Authors: Keep the multi-layered topology and explain that multiple network layers can be grouped into single topology layers and explain relation to RFC8345 topology hierarchy (stack) .
2. Proposal by Authors: Add a new requirement for different viewpoints.
3. Proposal by Authors: support partitioning via multiple network instances inside the single network + new relation (or via supporting with some meta).

Terminology Issue 21: Termination Point vs Interface

- Oscar spotted that we were mixing interfaces and termination points.
- We fixed, only termination points used now.
- Olga suggested to close.
- Nigel agrees that using termination points in the document is the right approach, but that there are still challenges with the two concepts that need clarification.
- A simple fix is to bring the definition from 8345:

==

A node has a list of termination points that are used to terminate links. An example of a termination point might be a physical or logical port or, more generally, an interface.
Like a node, a termination point can in turn be supported by an underlying termination point, contained in the supporting node of the underlay network.
==

Consensus Needed:

1. **Option 1:** (Proposal by Authors) Bring the definition from 8345
2. **Option 2:** Add better clarification and discuss on the mailing list (Nigel says he can prepare text)

Use Cases Issue 60: Updates to the Network Design Use Case

- Sherif provided the proposal and updated it based on initial Brad's feedback
- Brad added more context
- Med had some comments that have been addressed (clarification of proposed and intended)
- Benoit engaged in the discussion

Consensus Needed:

1. Option 1: Keep the existing definition
2. Option 2: (Proposal by Authors) Brad, Benoit and Sherif work together on the new definition and share on the mailing list for feedback from others

Latest from Brad, for the whole thread please check the NMOP Mailing List topic for Network Design Use Case](topic: SIMAP: Network design use case [Commercial - Anyone]))

Perhaps as you have highlighted the issue is the terminology of Network Planning, Network Architecture and Network Design. As you highlighted these are closely related and perform different functions with network planning setting the foundation, network architecture providing the framework, and network design handling the detailed implementation to create a cohesive and efficient network infrastructure.

My understanding from your response that you have highlighted that the Use Cases for SIMAP is largely network design and its life cycle. I'm not sure that is correct interpretation.

My understanding of the functions I've outlined below. If these are being used interchangeably, then there may be benefit to define them in the terminology documentation.

Network planning is a strategic, high-level process that focuses on:
• Identifying organizational goals and requirements for the network
• Assessing current and future needs, including user numbers, roles, and connectivity requirements
• Creating a blueprint for building the network infrastructure
• Determining the scope and scale of the network
• Forecasting future demand and trends to guide capacity planning and resource allocation
• Establishing a long-term vision for network growth and scalability
Planning involves identify the goals, requirements and scope of an organisation and creating the roadmap for implementation (blueprint, amongst other things). It precedes network design and architecture.

Network architecture provides the high-level, conceptual framework for the entire network system. It defines:
• The overall structure and organization of the network
• The fundamental principles and approaches for network communication
• The network topology (e.g., star, mesh, bus, ring)
• The high-level components and their relationships
• The protocols and standards to be used
Network architecture serves as a blueprint that outlines the broad vision and strategy for the network's structure and functionality.

Network design is more detailed, concentrating on:
• Implementing the specific architecture in detail
• Selecting and configuring hardware, software, and network devices
• Addressing technical aspects such as IP addressing, routing protocols, and security measures
• Creating detailed network diagrams and documentation
• Providing configuration details and engineering limits
• Ensuring the network meets performance, security, and reliability requirements

Cheers.

Brad

Use Cases Issue 61: Use Cases are related – do we need to regroup?

Notes from the Interim Meeting:

- Thomas Graf: Regarding "Inventory queries", "Network design" and "Capacity planning". I think they are related. Reading into "Inventory queries", I understand the objective is to optimize physically the network. My suggestion is to replace "Inventory queries" and "Network design" with physical and logical network planning.
- Benoit: We can extend the use cases. What is important is whether there are new requirements for the SIMAP modeling (the last paragraph of each use case section).
- This is also related to the Issue 60 about Network Design definition Use Case

Consensus Needed:

1. Option 1: Work more on identifying and regrouping the use cases
2. Option 2: (Proposal by Authors) Focus on the parts relevant to SIMAP API and review if we have enough info for SIMAP requirements
3. Option 3: Both

Requirements Issue 58: Add Examples for REQ-DATA-PLANE-FLOW and REQ-CONTROL-PLANE

- Add examples that Thomas shared with us for the new requirements from him. The new requirements are added, but the description for the examples should be added as well.

- Proposal by Authors: No need for consensus, just editing exercise

Requirements Issue 59: REQ-TOPO-ONLY change to link dynamic paths

- Thomas: I agree with REQ-TOPO-ONLY that dynamic paths are outside of SIMAP scope. However as part of REQ-SEMANTIC, it lays the foundation to map it as external data.

- Proposal by Authors:
  - Current Text:
    - Dynamic paths may either be outside of the SIMAP or part of traffic engineering data/models
  - Change to:
    - Dynamic paths may be outside of the SIMAP, in which case they would be linked to the SIMAP as external data

Requirements Issue 62: REQ-PASSIVE-TOPO for current network

- Thomas: Regarding REQ-PASSIVE-TOPO. Do we agree that the requirement is not about mapping the passive elements in a topology. We want to associate the passive elements to the active topology. Correct?
- With this capability we would be able to understand for the capacity planning use case which passive elements are being used in which part of the topology.

- Proposal by Olga:
  - I suggest to keep the active topology requirement, but be explicit that it cannot be discovered and not be the part of the current network. But it can be part of intended topology or proposed topology, depending on the Operator's Solution.

Consensus Needed:

1. Option 1: Change the text to say that we just need to associate.
2. Option 2: Keep it in the intended and proposed topology, change the requirement text

Issue 22: Models to which the core SIMAP should navigate to

- Oscar:
  - Do we need to document which models the core SIMAP should navigate to? E.g. ivy physical inventory.
- Thomas also shared a list of modules that are his requirement
- Olga thinks the list will never be final so we can have it as highest priority documents only, and maybe Hackathon can also keep the list

Consensus Needed:

1. Option 1: Navigate to models the core SIMAP should navigate to
2. Option 2: Add examples of models the core SIMAP should navigate to
3. Option 3 (Proposal by Authors): Leave the list to Hackathon
4. Option 4: Both 2+3 , where they do not need to match as both are examples

Comments, Questions?