NI – Use cases

(example of implementation to cover the needs of CETIN)

OBSAH:

1 UC 1: Network infrastructure documentation (CORE, IP, Transport) 3

2 UC 2: Access network documentation 6

3 UC 3: Provisioning of customer services 8

3.1 UC 3.1: Automatic check 8

3.2 UC 3.2: Semi-automatic and manual check 11

4 UC 4: Service decomposition 12

5 UC 5: NI Specific Functionalities (Mass Configuration Changes) 15

6 UC 6: Service availability check 18

1 UC 1: Network infrastructure documentation (CORE, IP, Transport)

Demonstration of creating basic documentation and network topology on the CORE/IP/Transport level.

The goal is:

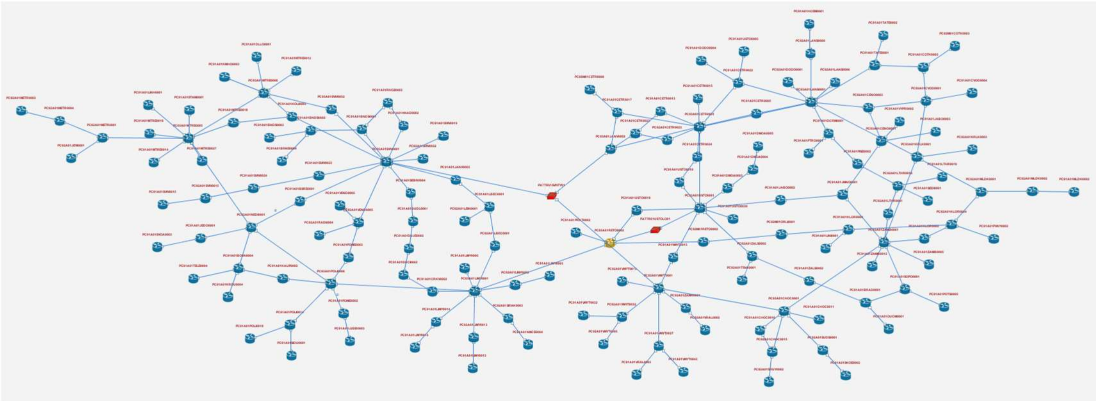
- Documentation of the network nodes
  - physical layer of network nodes documentation (rack-shelf-slot-card-slot-card-…-port)
  - logical layer of network nodes documentation (Hostname, IP address, ISIS domains, ...)
- Documentation of network connectivity
  - utilization of transmission media (optical, metallic, MW connection)
  - documentation of main and backup routes of routing within the transport network (e.g. xWDM)
  - documentation of the connection logical layer (IP addressing, VLANs, ...)

Procedure:

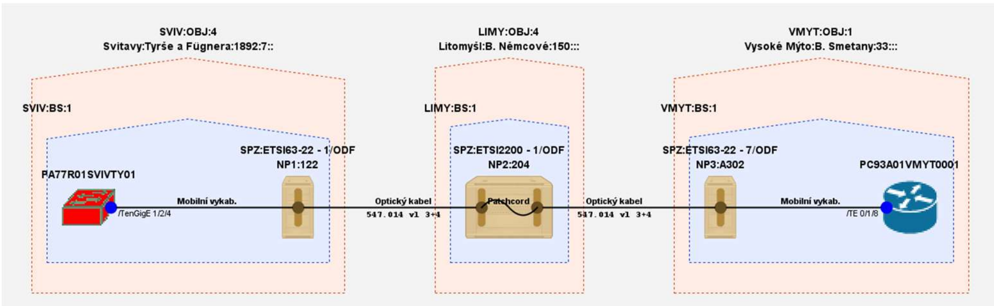
- Device model template (device library)
  - Device model – point, link
  - Allowed occupancy types (links) on the device
- Creating a device template
- Creating a device (from the device library, from a template)
- Creating a physical connectivity
  - Distribution frames and cables
- Creating a logical connectivity
  - physical layer – utilization of transmission media (optical, metallic, MW link)
  - logical layer – point-to-point connection (using the physical layer)
- Instructions for the provisioning of telecommunication links (work-orders)
  - instructions for the WFM (Work Force Management)
  - instructions for CFM (Configuration Automats)
- Visualization of telecommunication links (topological, schematic, non-graphical)

Visualization example:

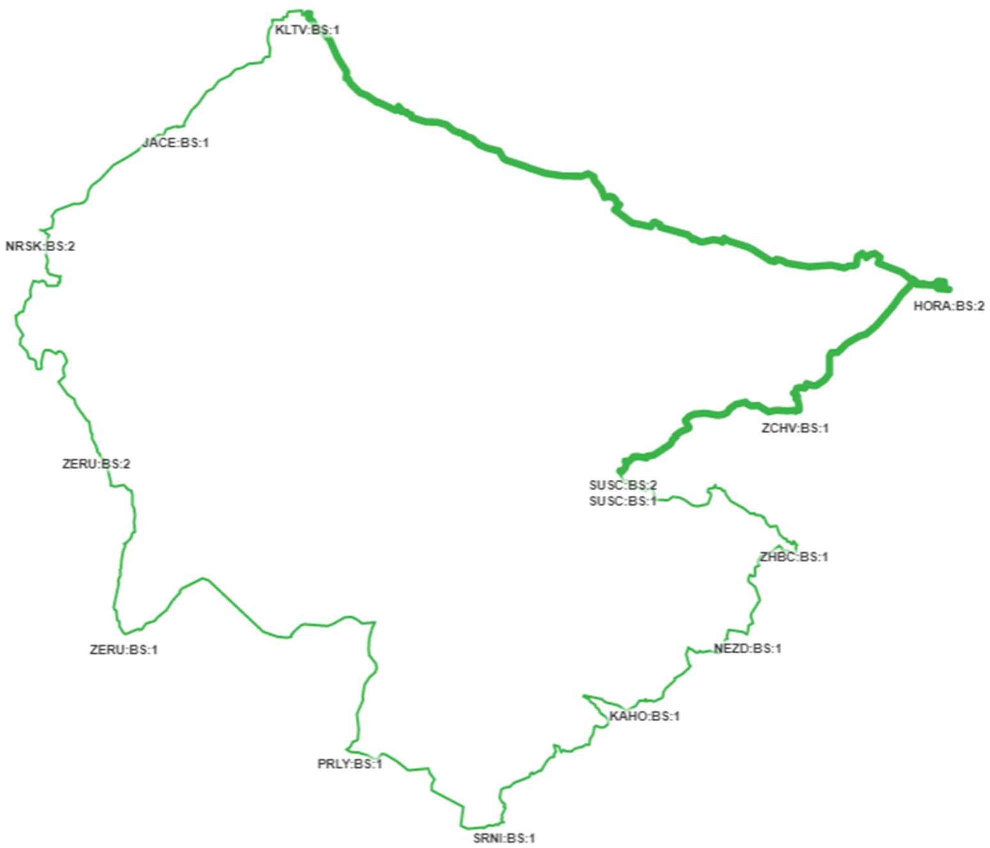
Sample logical network topology:



- The physical topology of individual network connections can be:
    - simple – implemented directly above the physical transmission media:



    - or more complex – implemented using underlying transport technology (e.g. xWDM), i.e. also with the main and the backup routes:



Note: The main route of the given network connection is shown as bold line, the backup route is represented by a thin line.

2 UC 2: Access network documentation

Demonstration of the access network documentation and the access network topology, e.g. on the xDSL/MSAN/OLT level.

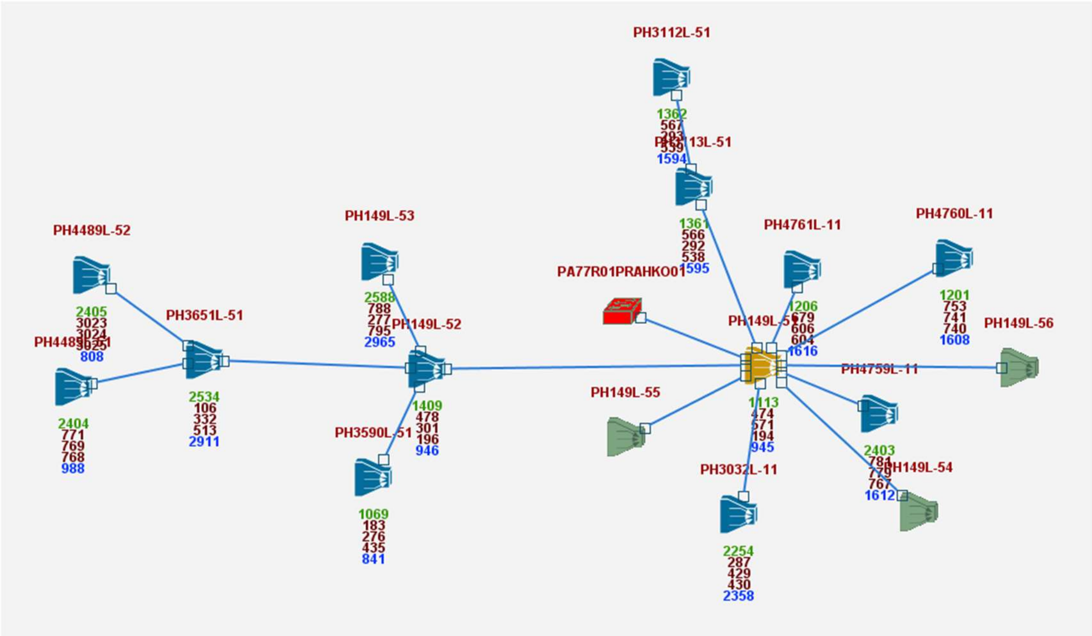
The goal is:

- Documentation of the network nodes
    - physical layer of network nodes documentation (rack-shelf-slot-card-slot-card-…-port)
    - logical layer of network nodes documentation (Hostname, IP address, VLANs, subnetting, ...)
- Documentation of network connectivity
    - utilization of transmission media (optical, metallic, MW connection)
    - documentation of the connection logical layer.

Procedure:

- Device model template (device library)
    - Device model – point, link
    - Allowed occupancy types (links) on the device
- Creating a device template
- Creating a device (from the device library, from a template)
- Creating a physical connectivity
    - Distribution frames and cables
- Creating a logical connectivity
    - physical layer – utilization of transmission media (optical, metallic, MW link)
    - logical layer – point-to-point connection (using the physical layer)
- Instructions for the provisioning of telecommunication links (work-orders)
    - instructions for the WFM (Work Force Management)
    - instructions for CFM (Configuration Automats)
- Visualization of telecommunication links (topological, schematic, non-graphical)

Visualization example:



Note: The numbers by the individual network nodes show the VLAN configuration of the given nodes for individual types of traffic (Broadband_Internet, IP-TV_per_Operator, Corporate_Traffic) - the NI system must ensure their automatic generation from the defined pools and assure they uniqueness in the given topology.

Detailed and correct documentation of the network infrastructure in the Network Inventory is key for the service feasibility checks using the network infrastructure (see further use cases).

3 UC 3: Provisioning of customer services

At CETIN, we use 3 service feasibility check modes in the Network Inventory:

- Automatic (without user intervention)
- Semi-automatic (with the help of wizards)
- Manual.

3.1 UC 3.1: Automatic check

The goal is:

- Provisioning of a customer service using the network infrastructure created in the UC 1 and the UC 2.

Procedure:

- Selection of a technical solution for the service
- Reservation of resources in the NI
    - Creation of new network resources in the NI (CPE, ONT, …)
    - Utilization of the existing resources in the NI (network infrastructure)
    - Generation of the service configuration parameters
- Instruction for the service provisioning (work-orders)
    - instructions for the WFM (Work Force Management)
    - instructions for CFM (Configuration Automats)
- Visualization of the customer service (topological, schematic, non-graphical)
- Technical feasibility check for other network resources (another NT, another optical fiber)
- Switching the service planned state to the operational state in the NI, based on a notification from an external system (Service Provisioning Workflow)

Specification of the CETIN model:

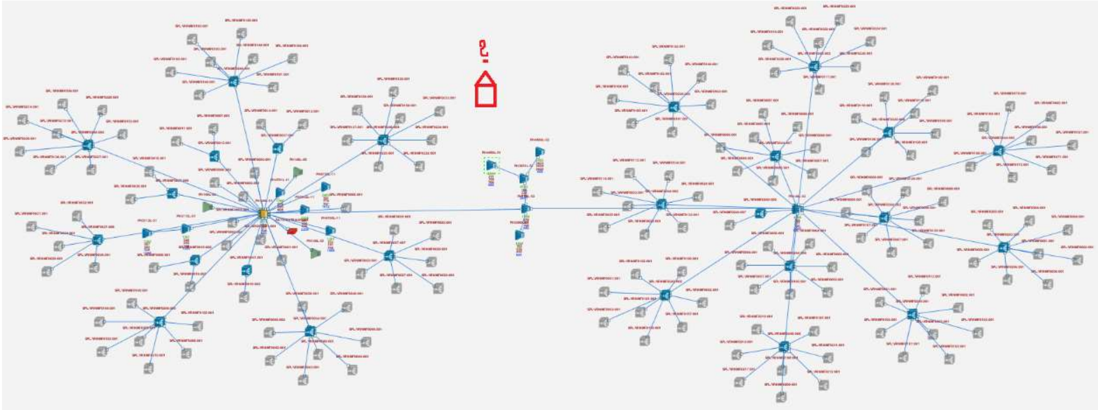
The order arriving as part of the Service Provisioning process contains the key business attributes of the service (service location + business parameters).

Before starting the technical feasibility check in the Network Inventory, the Service Provisioning Workflow finds possible technical solutions for the given service in the CETIN network from the Service Catalog - e.g.:

- technical solution through metallic network
- technical solution through fiber optic network
- technical solution via MW connection

including the priority order of the individual technical solutions (according to the configuration in the Service Catalog).

As a result, Network Inventory must instantly and automatically supply the Service Provisioning Workflow with data on which of the possible technical solutions is available in the requested service location.



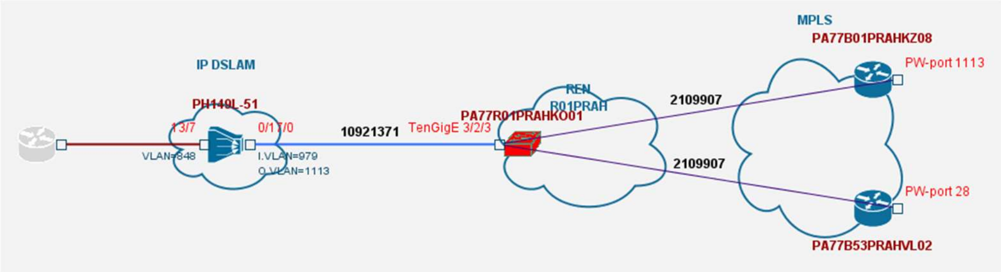
Note: The diagram contains a sample of the model of active and passive elements in the CETIN network, to which the given service (red house in the picture) can be connected in the requested location.

=> selection of a specific technical solution for a given service => definition of CFS/RFS services.

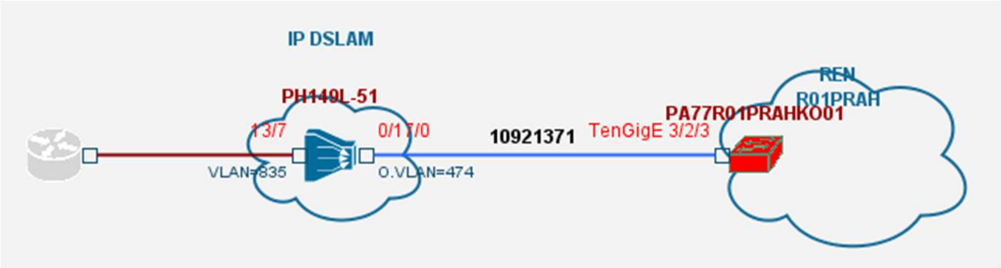
The Service Provisioning Workflow forwards the request for automatic service feasibility check to the Network Inventory, where the resource reservation + generation of all necessary configuration parameters for a given service takes place (calling the relevant RFS).

The result is the reserved service circuit route + generated configuration parameters of the given service in Network Inventory (in the planned state):

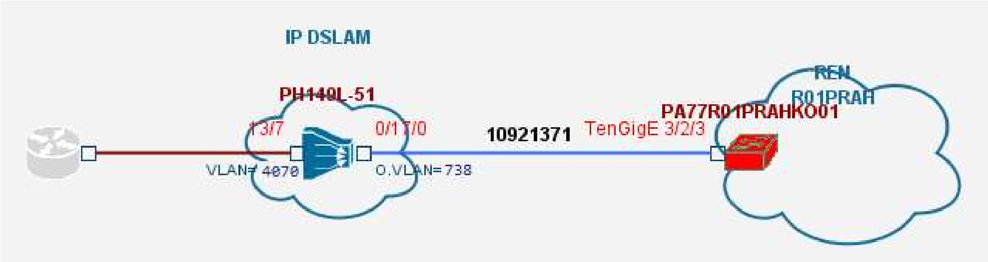
Routing of the Internet service connectivity (logical layer)



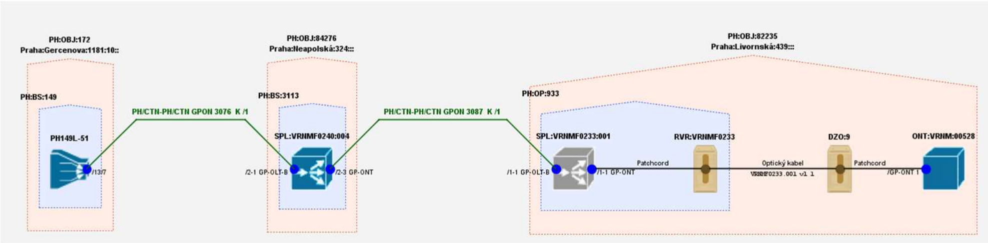
Routing of the IP-TV service connectivity (logical layer)



Service monitoring routing (logical layer)



Service routing between the customer location and the first active element in the network (physical layer)



Network Inventory then passes all necessary service provisioning parameters to the Service Provisioning Workflow:

data for WFM (Work Force Management)

STAV	TYP	OBJEKT	POZICE	ADRESA	POZNÁMKA
K	ZAŘ	PH149L-51	13/7	Praha Gercenova 1181/10	
	REL	PH/CTN-PH/CTN GPON 3076			3007285694
K	ZAŘ	SPL:VRNMF0240:004	GP-OLT-B 2/1	Praha Neapolská 324	
K	ZAŘ	SPL:VRNMF0240:004	GP-ONT 2/3	Praha Neapolská 324	
	REL	PH/CTN-PH/CTN GPON 3087			3007286001
K	ZAŘ	SPL:VRNMF0233:001	GP-OLT-B 1/1	Praha Livornská 439	
K	ZAŘ	SPL:VRNMF0233:001	GP-ONT 1/1	Praha Livornská 439	
K	PCH	Patchcord Y			
	RVR	SPL:VRNMF0233:001 (1)	1	Praha Livornská 439	Box umístěn na stěně vedle skříně ÚR.
K	KAB	VRNMF0233.001.001	1		č. 1-modrá
	DZO	9	1	Praha Livornská 439	
K	PCH	Patchcord T			
K	ZAŘ	ONT:VRNM:00528	GP-ONT 1	Praha Livornská 439	

data for CFM (Configuration Machines)

Komponenta	Komponenta_id	TŘ	Line_Profile	Modem_Type	Stav	OLT	OLT_karta	OLT_port	Log_port	Vlan_cust	Vlan_ntw_outer	Vlan_ntw_inner	Agg_area	IP_area	REN_name	BRAS_outer_vlan	BRAS_inner_vlan
Internet_GPON	123	2UN.GP1	POM500500	ONT_GPON	P	PH149L-51	13	7	0	848	1113	979	PH	PH8	R01PRAH	5113	979
Multimedia_GPON	456	2UN.GP1	POM500500	ONT_GPON	P	PH149L-51	13	7	0	835	474						
Dohled_ONT_Cetin	789	2UN.GP1	POM500500	ONT_GPON	P	PH149L-51	13	7	0	4070	738		PH		R01PRAH		

Service Provisioning then ensures the provisioning of the given service order in the CETIN network – i.e.:

- coordination of all relevant activities at CETIN
- transfer of necessary data to the WFM (Work Force Management)
- transfer of necessary data to the CFM (Configuration Automats).

Service Provisioning Workflow subsequently provides information about successful, or unsuccessful provisioning of the service to Network Inventory – based on the result, the Network Inventory changes the service status from the planned state to the operating state, or cancelling the relevant resources for the given service.

3.2 UC 3.2: Semi-automatic and manual check

The same service check process as in the case of Automatic check - same input and output attributes to and from Network Inventory.

The only difference is that service provisioning in Network Inventory does not take place automatically (i.e. completely without user intervention), but with the help of wizards or manually.

Even with the manual processing, however, not all steps are completely manually – the generation of configuration parameters must always work automatically (the generation of values from fixed pools, in dozens of orders processed in parallel, cannot be left to the users).

4 UC 4: Service decomposition

Decomposition functions are the key features of the Network Inventory – they are key to ensuring the network operations and performing various analysis.

We divide the decomposition into 3 basic types:

1. **Service decomposition (service impact analysis)**
   Comprehensive decomposition of the NI data to provide for the given network entity:
   - location
   - node/shelf/card/port
   - link/circuit
   - cable/fiber

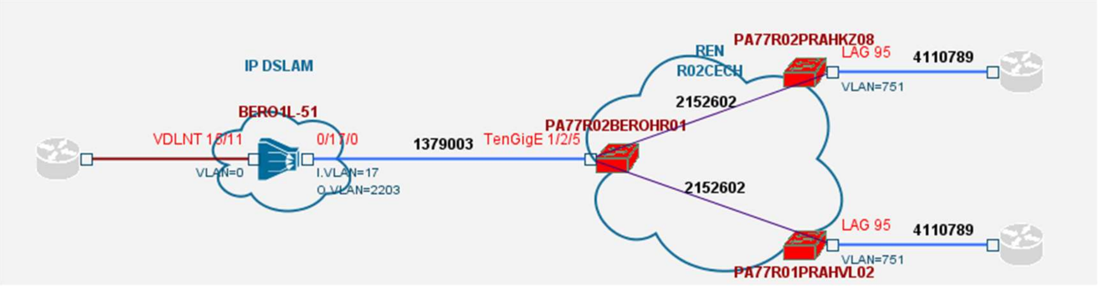
   the list of impacted services.

   Decomposition must work at all layers of NI data (from the address management layer, through the physical network layer, transport and logical network layers to the service layer).

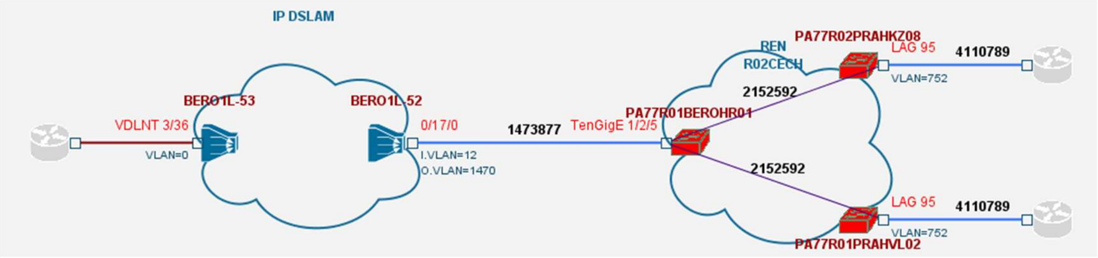
   The output of this decomposition is a list of the affected services with the identification of their complete outage or possibility for redirection to backup (technological or business).

   Note: It the following example the customer requested 2 independent connections to the defined NNI from his location:

Primary customer connection:



Backup customer connection:

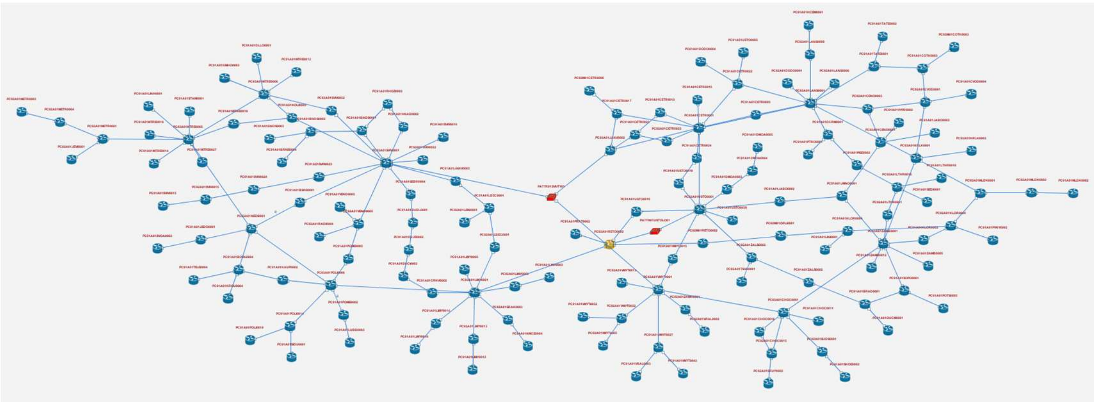


2. **Technological decomposition**
   Decomposition of network topologies to provide for the given network entity:
   - location
   - node/shelf/card/port
   - link/circuit
   - cable/fibers

   the list of impacted network nodes.

   The technological decomposition only makes sense in network topologies where a precisely defined data flow is ensured to the relevant superior network nodes - e.g. xDSL/MSAN/OLT, MBH, RAN, FTTx, etc.
   Decomposition must work not only on the logical layer of the NI links/circuits, but also with the lower layers of link documentation in the transport and physical layers. The output of this decomposition is thus a list of the impacted network nodes, which is used for CETIN's internal needs as part of the Service Assurance process.

   Note: The following network topology can be used as a sample for this use case:



3. **Service decomposition per node**
   Decomposition of services per node with the aim of providing a list of the impacted services for a specified network node:
   - Terminated on the given node, or
   - Passing through the given node.

   The output is a list of the services, which serves after subsequent processing in the BSS domain to determine the severity of the outage of the individual network nodes.
   Note: The above examples of the network topologies can be used for the use case demonstration.

4. **Decomposition of neighbouring ports**
   A decomposition that, for a given input network entity:
   - node/shelf/card/port
   - link/circuit

- cable/fibers

returns the opposite impacted infrastructure ports.
The output of the decomposition serves to identify the alarming ports related to the respective planned engineering works (PEW).
Note: The above examples of the network topologies can be used for the use case demonstration.

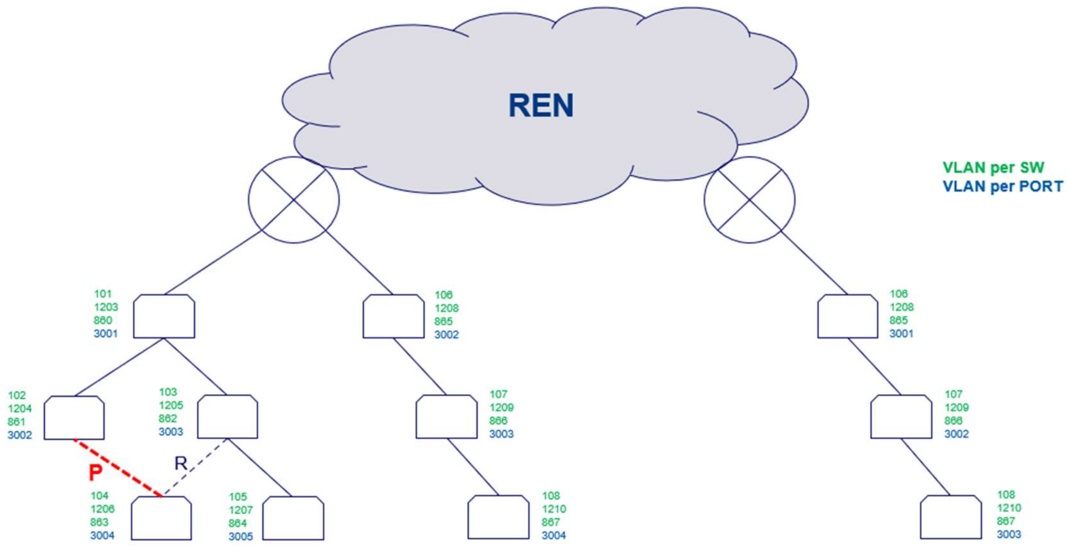
5 UC 5: NI Specific Functionalities (Mass Configuration Changes)

On the created network ACCESS node, part of the topology will be switched to another node. The system must show how it is solved:

1. Validation that there is no VLAN collision
2. A collision occurs and the system proposes for as given VLAN a new value and assigns it to the given node in the planned state
3. For all affected services, the given change will automatically update the configuration parameters (VLAN changes, change of the input port to REN, etc...)

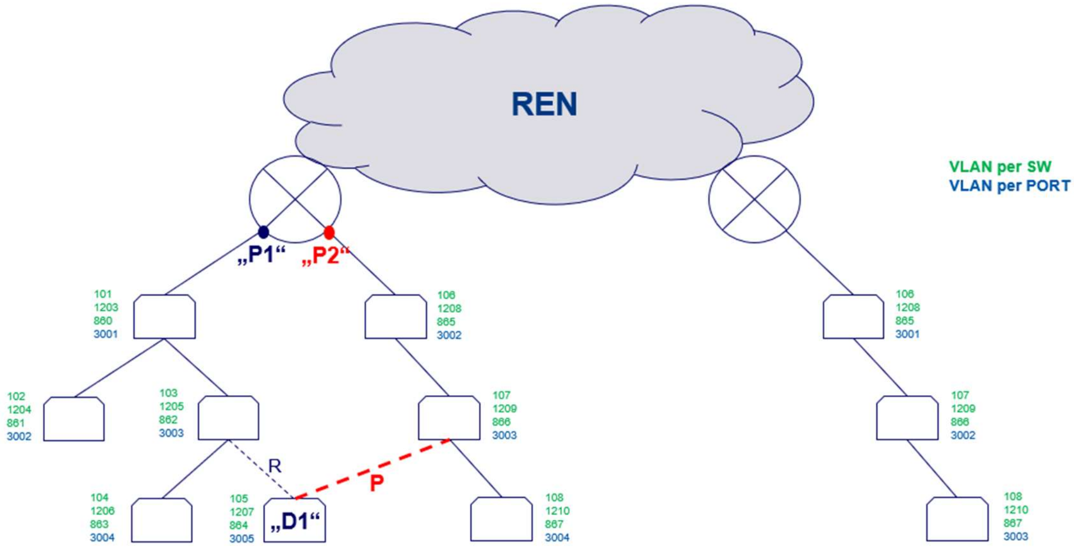
Description of mass configuration changes model situations:

- **Demonstration of access infrastructure changes, without the impact on network configuration changes**
    - In the ACCESS topology, the VLANs of individual nodes do not collide
      => there is no need to change the configuration of nodes and services in the access
    - In the ACCESS topology, the input port does not change to REN
      => no need to change the configuration of services in REN



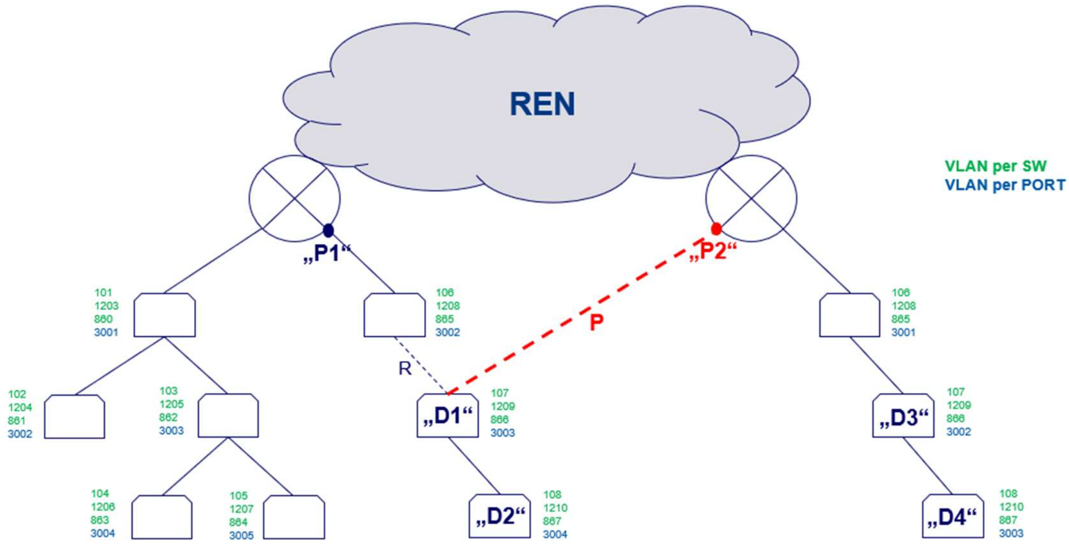
- **Demonstration of the ACCESS infrastructure change, with an impact on the REN configuration change**
    - In the ACCESS topology, the VLANs of individual nodes do not collide
      => there is no need to change the configuration of nodes and services in the access
    - In the ACCESS topology, the REN input port changes

=> it is necessary to change the configuration of the services in the REN - specifically, all services from node "D1" from port "P1" to port "P2".



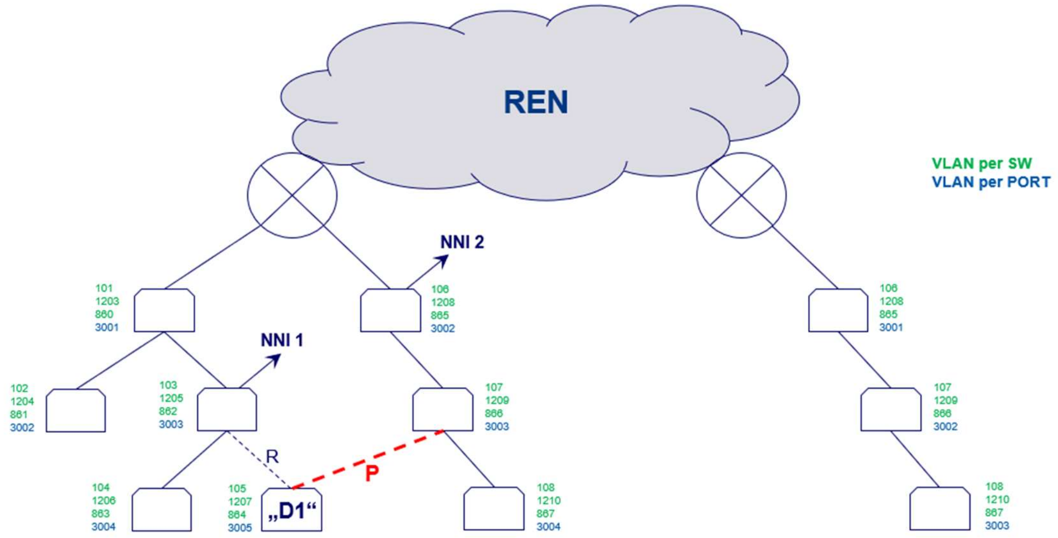
- **Demonstration of the ACCESS infrastructure change, with an impact on the ACCESS and REN configuration**
    - In the ACCESS topology, the VLANs of individual nodes collide
      => for nodes "D1, D3" and "D2, D4" there is a collision of their VLAN configurations (VLANs 107, 108, 1209, 1210, 866, 867)
      => it is necessary to generate new non-collision configurations of nodes (generate new non-collision VLANs in the planned state to existing VLANs)
      => according to the new non-collision configuration of nodes (VLAN), it is necessary to ensure the reconfiguration of the relevant services in the network
      => after the network reconfiguration, it is necessary to ensure in the NI that the VLANs are switched from the planned state to the operational state, and releasing of the original collision VLANs
    - In the ACCESS topology, the REN input port changes

=> it is necessary to change the configuration of the services in REN - specifically all services from nodes "D1, D2" from port "P1" to port "P2".



- **Demonstration of the ACCESS infrastructure change, with an impact on the ACCESS configuration**
  - In the ACCESS topology, the VLANs of individual nodes do not collide
    => there is no need to change the configuration of nodes and services in ACCESS
  - In ACCESS topology, node "D1" loses NNI (NNI 1)v
    => services from node "D1" going to NNI 1, it is necessary to find a new NNI
    - is NNI 2 compliant?
    - start the NNI change process with partner of the NNI 1
  - In the ACCESS topology, the REN input port does not change.

=> no need to change configuration of the services in REN



6 UC 6: Service availability check

The goal is:
Verify available products/services at a specific geographic point - address, coordinates, ground plots, etc.

Procedure:

- Creation of a verification request
    - Address
        - **i.** With the existing infrastructure
        - **ii.** Without the existing infrastructure
    - Coordinates
    - Existing service
- Service availability check at the given locations
    - The system verifies all technologies and returns their availability, or unavailability.
    - The system will provide data for metallic, optical and microwave last mile connections for the given point
    - Subsequently, the available technologies will be found on the given access last mile
        - **i.** DSLAM, OLT, WDM, U-PE, SDH, GWX, PEMB, ….
        - **ii.** Considering the physical possibilities for a given technology - e.g. 80 km via the fibre optic network
- Consideration of the network limitations
    - Modification of the identified route

i. Change in the route capacity – there must be a limitation of the available speed in the check

- Resource blocked on the identified route
  i. The system must find another suitable route
  ii. If it does not exist – the system must propose an extension of the network and take this into account in the check.
- Providing output of the found values
- Manual editing of found data, impacting the output of the check
- Configuration of checks, e.g.:
  - Setting technology preferences
  - Configuration of products/services and speeds.

Output:

- List of all available technical solutions (TS)
- List of product/service codes (business products) available for the given TS
- Parameters for the evaluation
  - Network connectivity found
    i. Including available capacities in the given route
  - Available technologies for a given network point
  - Network parameters – physical (documented), calculated, measured
  - Speeds available for each technology
- Return code for the given address
- Evaluation within 0.5s timeframe

Sample output in the NI GUI

DF_ID	Popis rozvaděče	ROP_ID	Adresa	Zesilovač	V/P	Typ umístění	Volné páry	Limit. páry	Nekvalitní p.	Vol. sloty	Kabel_ID	Útlum rozh. [dB]	Typ útlumu	Útlum fyzické vrstvy [dB]	Útlum skut. rozh. [dB]	Útlum stabil. [dB]	Vzdál. [m]	Max DN [kbit/s]	Max UP [kbit/s]	Vectoring	MSAN	Result
EMPTY02662395	(BUDOVA) EMPTY02662395	2662395	Halenkovice, 403				1	0	0					0								21
NPJD2665	(KR) NPJD2665	2662395	Halenkovice, 403				5	0	0			0	USEK	0	0		0					21
NPJD751	(UR) NPJD751	4063189	Halenkovice				17	0	0			2,03	USEK	2,03	2,03		226					21
NPJD91	(SR) NPJD91	4063355	Halenkovice		V	rD0	0	0	191			2	V300	2,45	2		295	256000	25600	A		0
NPJD1HR(Napajedl)	(HR) NPJD1HR(Napajedl)	9527	Napajedla (Napajedla-střed), Masarykovo náměstí 205		M	CO						33,26	V300	32,06	33,26		5233	10240	256	Z	A	0

Fig. 1 Example of displaying the check progress and its parameters

Produkty

Kód	Název produktu	Název služby	Dostu...	Om.
P2BDCSCPS4096RP	Carrier IP Connect Speci 4 Mbit/s	Carrier IP Connect SPECI	4	
P2BDCEAPS050MKP	Carrier Ethernet Access 50 Mbit/s	Carrier Ethernet Access	50	
P2BDCESPS4096KP	Carrier Ethernet Access SPECI 4 Mbit/s	Carrier Ethernet Access - S...	4	
L2 Management 40/4	L2 Management 40/4	L2 Management	40	
P2BDCEOPS050MKP	Carrier Ethernet Access DUO 50 Mbit/s	CEA DUO	50	
O2SK 2G BTS	O2SK - 2G BTS	O2SK - 2G BTS	4	
P2BDCPCPN102MRP	Carrier IP Connect 100/20 Mbit/s	Carrier IP Connect Basic	100	
P2BDICSPS4096RP	IP Connect SPECI 4 Mbit/s	IP Connect SPECI	4	
P2BDRE0PS050MKP	Carrier Ethernet Network IP REN (0) 50 Mbit/s - Region	Carrier Ethernet Network I...	50	
P2BDCEEPS050MKP	Carrier Ethernet Economy 50 Mbit/s	Carrier Ethernet Economy	50	
P2BDTWLPS2048RP	Twin Line 2048 kbit/s	Twin Line	2	
P2BDCASPN102MRP	Carrier Access Simple 100/20 Mbit/s	Carrier Access Simple	100	
P2BDRACPS2048KP	RACO LL 2048 kbit/s	RACO LL	2	
P2BDCISPS4096RP	Carrier Internet Speci 4 Mbit/s	Carrier Internet SPECI	4	
P2BDCTAPS4096KP	Carrier TDM Access 4 Mbit/s	Carrier TDM Access	4	
P2BDICBPN102MRP	IP Connect Basic 100/20 Mbit/s	IP Connect Basic	100	

Fig. 2 Availability of products/services and their speed

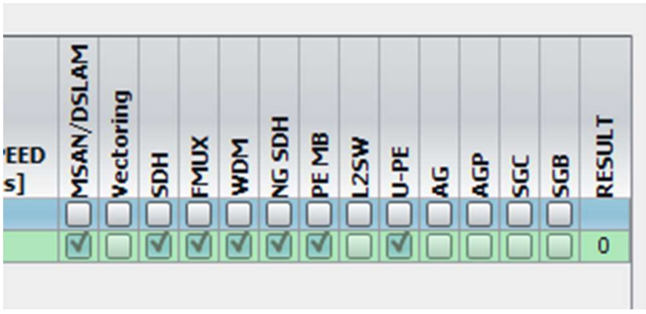


Fig. 3 Availability of network technologies for the given location