

15-03-2021

Milestone M6.8 (M52)

Self-Service Portal Development: Next Steps

Milestone M6.8

Contractual Date:	31-03-2021
Actual Date:	15-03-2021
Grant Agreement No.:	856726
Work Package	WP6
Task Item:	Task 2
Nature of Milestone:	R (Report)
Dissemination Level:	PU (Public)
Lead Partner:	PSNC
Document ID:	GN4-3-21-233A61
Authors:	Marcin Adamski (PSNC), Michal Balcerkiewicz (PSNC), Ramesh Baskaran (Jisc), Tim Chown (Jisc), Sonja Filiposka (MARnet/UKIM), Ivana Golub (PSNC), Konstantinos Georgilakis (GRnet), Piotr Grabowski (PSNC), Roman Łapacz (PSNC), Jovana Vuleta (AMRES)

© GÉANT Association on behalf of the GN4-3 project.

The research leading to these results has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 856726 (GN4-3).

Abstract

User experiences and feedback on the functionalities of the self-service portal since it was rolled out in production to be used for management of the GÉANT Connection Service have been collected and refined into a prioritised list of requirements for new features and extensions. This document reviews the design and implementation steps defined in the self-service development roadmap to respond to the user requirements that were identified.

Table of Contents

Executive Summary	1
1 Introduction	2
2 SSP and SPA Platform Evolution	3
2.1 Automated Topology Management	4
2.2 Policy Management Implementation	5
2.3 Service Testing	6
2.4 Platform Integration with eduGAIN	6
2.5 Platform Extensions for the GÉANT IP Service	7
2.6 Platform Extensions for the GÉANT MD-VPN Service	8
3 Conclusions	10
References	11
Glossary	12

Table of Figures

Figure 2.1: SPA platform components for service management on top of the OpenNSA specific components and GÉANT external tools	3
Figure 2.2: Inventory GUI in the SSP portal (screenshot from GCS)	4
Figure 2.3: Inventory GUI with topology modification functionalities (screenshot from the testbed)	5
Figure 2.4: SPA platform integration with SaltStack for implementing the GÉANT IP golden configuration	8

Executive Summary

Implementation of the Service Provider Architecture (SPA) platform has been successful in providing a service management digital platform for the GÉANT Connection Service (GCS) for use by the GÉANT network engineering team. The self-service portal belonging to the platform provides a user interface that enables a consolidated view of all service instances, network topology elements and available actions.

Based on their initial experiences when using the platform, users and service designers have identified a number of enhancements and new functionalities that can be added to the SPA platform to improve and enrich its capabilities. The development team working in WP6 liaised closely with the operations team in WP7 to define a number of functional requirements, which were used as the basis for the development of a roadmap for the future evolution of the SPA platform.

The implementation of the new functionalities is being carried out in an incremental fashion where all the relevant parties are involved in the design process, which is then followed by sprints of development and testing before any new feature is released into production and offered to the users. These efforts are currently focused on several different extensions that are being developed in parallel, each in a different stage of the implementation process. The next versions of the SPA platform will enable editing of the network topology used for GCS and implementation of policy management rules to control which specific functionalities are available to different users who access the system via the eduGAIN SSO.

The most complex of these enhancements entail the use of the SPA platform components to manage the service lifecycle of the GÉANT IP service and to support the management of the MD-VPN inventory, both of which are currently in the finishing stages of the design process and still have a number of implementation phases ahead.

In addition to the work required to develop and release new versions of the SPA platform, the development team is also working on the day-to-day support of the production platform instance and the enriched testing and development environments.

1 Introduction

The Self-Service Portal (SSP) is the graphical user interface (GUI) that is currently being used by the GÉANT NOC staff to manage the production GÉANT Connection Service. The SSP is the external component of the implemented service management platform based on the Service Provider Architecture (SPA). The functionalities provided in the SSP are executed by orchestrating different SPA components that manage the GCS lifecycle. The actual implementation of the service in the network is done by interfacing with OpenNSA [\[NSA\]](#) agents that are managed by the Network & Network Service Evolution & Future Planning task (Task 2) of the Network Core Infrastructure and Core Service Evolution and Operations work package (WP7) in the GN4-3 project.

Upon the initial rollout of SSP and the underlying SPA components at the beginning of the GN4-3 project, Task 2 Network Services Evolution & Development of GN4-3 WP6 Network Technologies and Services Development has been serving as support to ensure the smooth operation of GCS management using the SSP. Although the SSP layout and functionalities have been designed and implemented according to NOC specifications, initial user experiences, as well as the OpenNSA development work by the WP7 team, have led to gathering and refining further requirements for additional features and functionalities that should be offered by the SSP and the SPA platform. Furthermore, the positive results obtained from using SPA for GCS management have led to the possibility being considered of extending the platform to support the management of other WP7 services such as the GÉANT IP service and the MD-VPN service.

The WP6 T2 development team has already started the process of design and implementation of the new functionalities to respond to the needs and expectations of the current and prospective users of the SSP. This document gives details of the current status of this process and outlines the next planned steps in the evolution of the SSP and its underlying SPA components. Each new feature is envisioned as an independent step that can be rolled out in a new SPA version so that the new functionalities are pushed into production and made available to the users as soon as possible.

The SSP and SPA evolution roadmap has been defined in close collaboration with the users and WP7 to prioritise work on the list of newly requested features not only based on complexity but also to align it with the related activities in WP7 so that changes in the network management components are reflected in the service management platform. Regular meetings with the users and the WP7 team enable dynamic adjustments and re-evaluation of priorities in response to changes and unforeseen external factors.

Each sub-section in Section 2 of this document is devoted to a different capability that will be implemented in the platform. Conclusions are drawn up in Section 3.

2 SSP and SPA Platform Evolution

The current SSP version that is being used in production enables the management of the full GCS lifecycle, starting from ordering a new service through tracking the fulfilment process and service monitoring and ending with the termination of an active service. It also provides a view of the full resource inventory that stores the OpenNSA topology information as it is used by its agents.

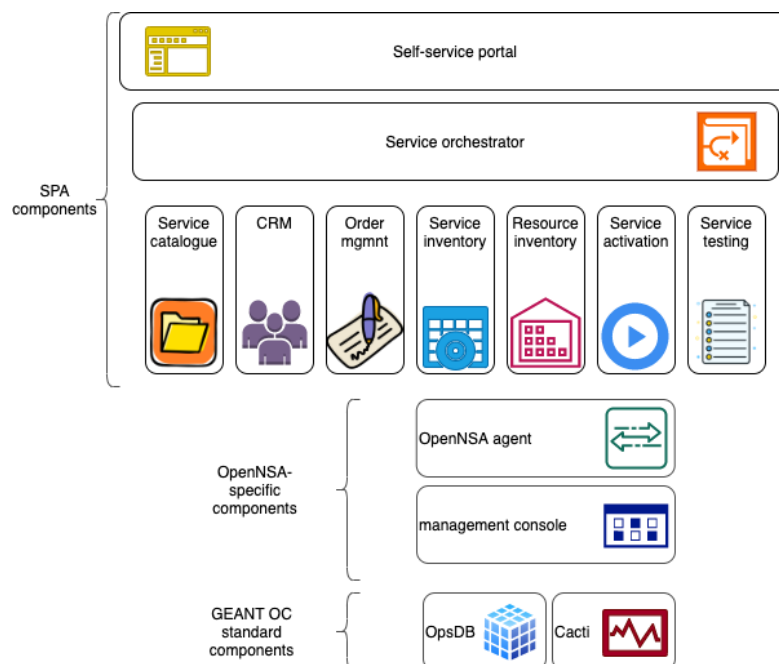


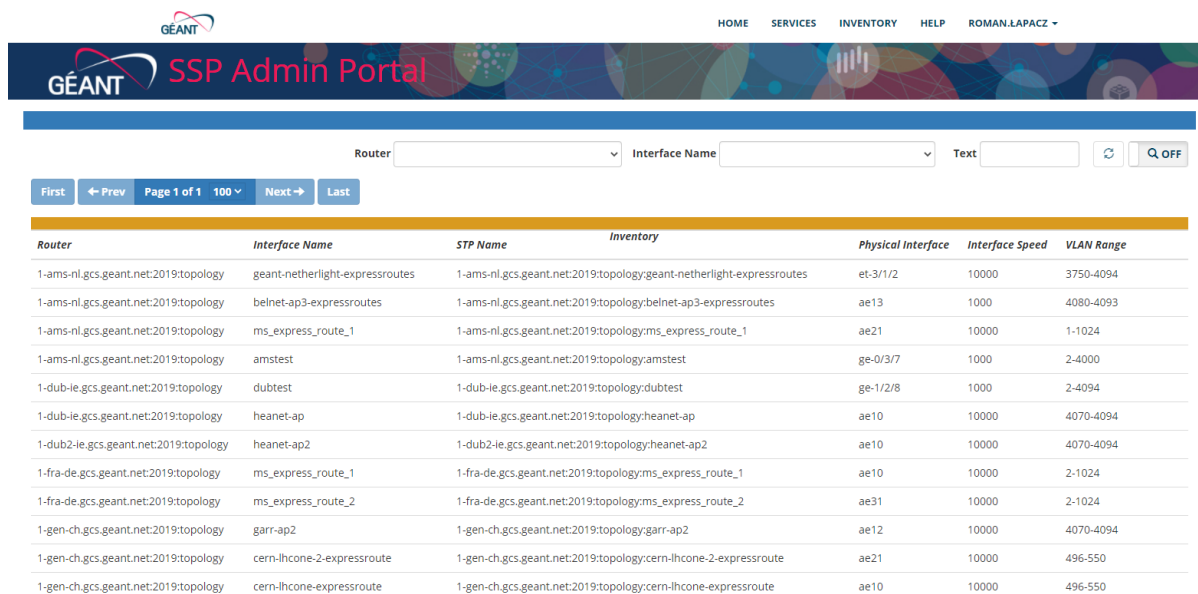
Figure 2.1: SPA platform components for service management on top of the OpenNSA specific components and GÉANT external tools

To implement all these functionalities, the SSP relies on a number of SPA components (see Figure 2.1): an order management component that tracks the user orders for service-related actions; a customer relationship management (CRM) component that stores the user (i.e. customer) information and role; a service inventory that stores the information about each service instance; a resource inventory that stores the resources available in the network; and an orchestrator wherein the orchestration processes between different components are defined in the case of complex actions such as the order-to-fulfilment process. The SPA platform is designed to be fully compliant with the TM Forum Open Digital Architecture [ODA] concepts and principles where all of its components are implemented as a standalone microservice that is reachable using a corresponding TM Forum Open API [TMFOA]. More information about each of the SPA components and the orchestration implementation can be found in GN4-3 deliverable *D6.6 Transforming Services with Orchestration and Automation* [D6.6].

2.1 Automated Topology Management

In the original implementation of GCS, topology information was stored in two different components, the OpenNSA and the SPA Inventory. The reason for this data duplication was that before deployment of the service the OpenNSA application was used as an independent and standalone command-line tool with a built-in database. With the recent software development, the application is now integrated with the SPA platform that offers a component with functionalities for resources and service storage management with appropriate TMForum REST Open APIs [TMFOA]. This means that instead of topology information being stored in two locations that need to be synchronised, it can effectively be stored in a single location. Therefore, the SPA Inventory should store topology information and make it available via REST APIs to other components of the platform or authorised external entities.

The need for better topology management and the use of the SPA Inventory as a point of truth in GCS were discussed with the WP7 Task 2 and GÉANT Operations Centre teams. It was agreed that the first step should be to develop a graphical interface (called the Inventory GUI) within the SSP portal, presenting all available STPs with associated routers and interfaces (see Figure 2.2). The current production version of the SPA platform offers a read-only view of the topology. Its future evolution in terms of topology management will involve extending these capabilities.



Router	Interface Name	STP Name	Inventory	Physical Interface	Interface Speed	VLAN Range
1-ams-nl.gcs.geant.net:2019:topology	geant-netherlight-expressroutes	1-ams-nl.gcs.geant.net:2019:topology:geant-netherlight-expressroutes		et-3/1/2	10000	3750-4094
1-ams-nl.gcs.geant.net:2019:topology	belnet-ap3-expressroutes	1-ams-nl.gcs.geant.net:2019:topology:belnet-ap3-expressroutes		ae13	1000	4080-4093
1-ams-nl.gcs.geant.net:2019:topology	ms_express_route_1	1-ams-nl.gcs.geant.net:2019:topology:ms_express_route_1		ae21	10000	1-1024
1-ams-nl.gcs.geant.net:2019:topology	amstest	1-ams-nl.gcs.geant.net:2019:topology:amstest		ge-0/3/7	1000	2-4000
1-dub-ie.gcs.geant.net:2019:topology	dubtest	1-dub-ie.gcs.geant.net:2019:topology:dubtest		ge-1/2/8	1000	2-4094
1-dub-ie.gcs.geant.net:2019:topology	heanet-ap	1-dub-ie.gcs.geant.net:2019:topology:heanet-ap		ae10	10000	4070-4094
1-dub2-ie.gcs.geant.net:2019:topology	heanet-ap2	1-dub2-ie.gcs.geant.net:2019:topology:heanet-ap2		ae10	10000	4070-4094
1-fra-de.gcs.geant.net:2019:topology	ms_express_route_1	1-fra-de.gcs.geant.net:2019:topology:ms_express_route_1		ae10	10000	2-1024
1-fra-de.gcs.geant.net:2019:topology	ms_express_route_2	1-fra-de.gcs.geant.net:2019:topology:ms_express_route_2		ae31	10000	2-1024
1-gen-ch.gcs.geant.net:2019:topology	garr-ap2	1-gen-ch.gcs.geant.net:2019:topology:garr-ap2		ae12	10000	4070-4094
1-gen-ch.gcs.geant.net:2019:topology	cern-lhcone-2-expressroute	1-gen-ch.gcs.geant.net:2019:topology:cern-lhcone-2-expressroute		ae21	10000	496-550
1-gen-ch.gcs.geant.net:2019:topology	cern-lhcone-expressroute	1-gen-ch.gcs.geant.net:2019:topology:cern-lhcone-expressroute		ae10	10000	496-550

Figure 2.2: Inventory GUI in the SSP portal (screenshot from GCS)

The next step will be to add functionalities to make changes in the topology information. The authorised portal user should be able to add, modify or remove routers, interfaces and STPs in GCS (until now, each topology update operation required manual modifications of special topology text files in OpenNSA and modifications in the SPA Inventory executed with the REST API). These functionalities have been developed in a new version of the Inventory GUI and have passed all tests in a development testbed environment (see Figure 2.3). They will be added to GCS when the WP7 team has completed an update of the Management Station application that is one of its components. This application must accept notifications about topology updates in the SPA Inventory and forward

this information to the OpenNSA agents. It is expected that this work will be completed within the next few weeks.

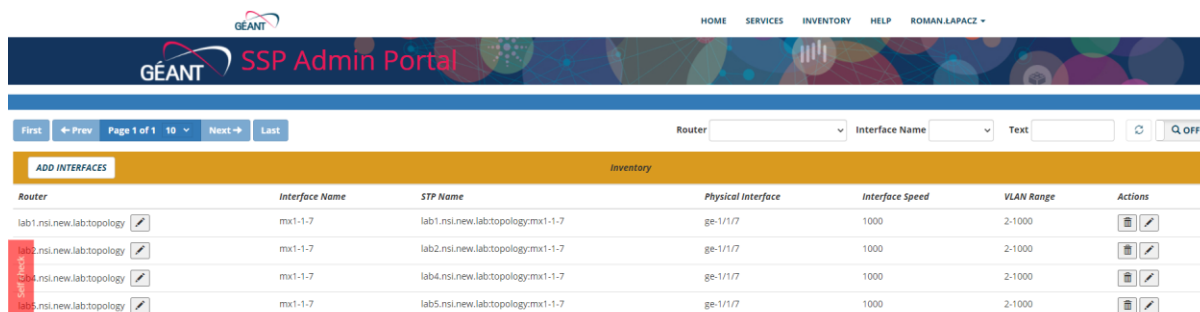


Figure 2.3: Inventory GUI with topology modification functionalities (screenshot from the testbed)

The WP6 Task 2 team will extend the REST API of the SPA Inventory for sending a message to the WP7 Management Station (which notifies OpenNSA) when the topology information is updated. The extension will be compliant with the notification pattern used in TM Forum Open APIs. It is expected that WP7 will adjust their tools (Management Station and OpenNSA) by the end of Q2 2021.

Once the topology update notification functionality in the WP7 Management Station has been implemented, authorised users in GCS will no longer need to manually update the topology inside OpenNSA. Instead, the topology information will be automatically fetched from the SPA Inventory.

The WP7 Task 2 team considered two possible solutions for implementing this approach. The first of these was to implement the TM Forum Open API in OpenNSA and use a REST GET method to fetch the necessary information. The second option was to recreate a new topology inside OpenNSA based on topology information fetched from the SPA Inventory right after a topology update notification is received by the Management Station. WP7 Task 2 has opted to proceed with the second solution, supported by the SPA Inventory.

2.2 Policy Management Implementation

In the current SSP version, the GÉANT NOC team has full administrative access to all exposed SSP functionalities. One of the planned developments in the evolution of GCS is to expose service management to users outside the NOC. However, in this case access to functionalities and information should be carefully managed depending on the user’s role and affiliation and other service-related parameters such as STP groups.

In order to add the policy management functionality, the WP6 Task 2 team decided to integrate the SPA platform with an existing well-known rule management solution called Drools [BRMS]. As a proof of concept two rules have been defined and successfully tested in a testbed environment:

- A user can use STPs in the E-Line service only from a certain group.
- A user can create only a limited number of circuit reservations.

In 2020, the WP7 team requested a simple policy management functionality in GCS with the following rules:

- Users with the role TEST can create a new circuit with STPs belonging to the TEST group.
- Users with the role ADMIN do not have any restrictions.

Both rules have been added to GCS. Work on policies will continue to define new more advanced rules as per WP7 requirements.

2.3 Service Testing

The service testing functionality requested by WP7 Task 2 for regular service verification has been developed as a standalone application and is part of the SPA platform for GCS.

The GCS implementation comprises multiple components running on different virtual machines (VMs) so there is a risk that any faulty behaviour of one of these elements may impact the whole service. Also, monitoring system parameters for each VM and communication between components may not detect specific issues or failures. Thus, an additional service test component has been added to the platform to provide the means to test GCS management functionalities on-demand or at regular time intervals.

The implemented application checks the service from the user's point of view. It automatically logs in to the portal, creates a new test circuit and then terminates it after a predefined period of time. This last action sends a report message to the service administrator via email or a Slack channel (depending on the configuration) [[CMPL](#)], containing details about the circuit creation and termination and their success or failure status. In case of failure, the application sends a screenshot of the portal for further analysis. Moreover, to address one of the requirements specified by WP7, the occurrence of a failure pauses the application so as to give the service administrators time to resolve the problem. Regular testing may be restarted by sending a predefined message via the REST API.

The next steps in the development of the service testing functionalities will be to provide on-demand tests in addition to regularly scheduled testing. This will enable users to test the service functionality at any moment as per their needs. For these purposes, the development team has been investigating the standardised TM Forum Service Test Management Open API [[STM](#)] that can be used to manage the on-demand testing feature. The initial design and capabilities of this functionality have been verified in a development environment. Over the next period, the team will continue implementation and testing to deploy a new version of the service test component in accordance with the requirements to automate testing tasks and verify GCS at any time. Further consultations with WP7 are needed to decide how to integrate the on-line testing with the SSP or a selected monitoring suite.

2.4 Platform Integration with eduGAIN

Initially, the GÉANT NOC users logged in to the SSP with user credentials created within the Django Content Management System [[DCMS](#)] that forms the basis for the development of the SSP.

While these user accounts are still available and maintained in coordination with the NOC team, they are now considered fail-over users that can be used to access the portal in case the Single Sign-On (SSO) service fails. The NOC users have requested the integration of the SSP with the eduGAIN [\[GEGS\]](#) service that is being used as the SSO service for all GÉANT related services and tools. In this way, they gain seamless access to the SSP for GCS management using their existing eduGAIN credentials.

The implementation of the SSO integration has been done by adding an Authentication and Authorisation (AA) component to the SSP that forwards all authentication requests to the eduGAIN proxy server. If the authentication process is successful, i.e. the supplied credentials are recognised by eduGAIN, the authorisation process continues where the AA component contacts the SPA CRM component to ensure that the authenticated user is allowed to use the SSP and to check the role that is associated with the user. Only existing users with an admin role are allowed full access and complete GCS management functionalities.

The support and implementation of eduGAIN-based SSO are being revisited for the new SSP version that is planned to be released into production soon. The new release will also include upgrades of the underlying operating system that requires an updated version of the eduGAIN component because of library dependencies.

2.5 Platform Extensions for the GÉANT IP Service

The GÉANT NOC engineers are planning to enhance the current implementation of the GÉANT IP service [\[GIP\]](#) so that the service is based on the notion of golden configuration [\[OGC\]](#) files that reflect the desired network configuration at any moment in time. The network engineers are currently working on the automated implementation of the golden configuration notion using Salt (SaltStack) [\[SS\]](#) as an infrastructure configuration automation engine.

The information defined as the golden configuration will be pushed to all networking devices with the help of SaltStack. The engine will continuously monitor this and intervene if the configuration on the networking devices does not correspond to the golden configuration, as shown in Figure 2.4.

The integration of this work with the SPA components is envisioned to be carried out in several incremental steps. In the current phase, the WP6 T2 team is working closely with the network engineers to design the detailed specification for all of the resources and resource-facing services that are needed to implement the GÉANT IP service. The complete schema of these specifications will then be used to extend the current service and resource SPA inventory so that it can be extended to take over the role of single point of truth for the GÉANT IP service as well.

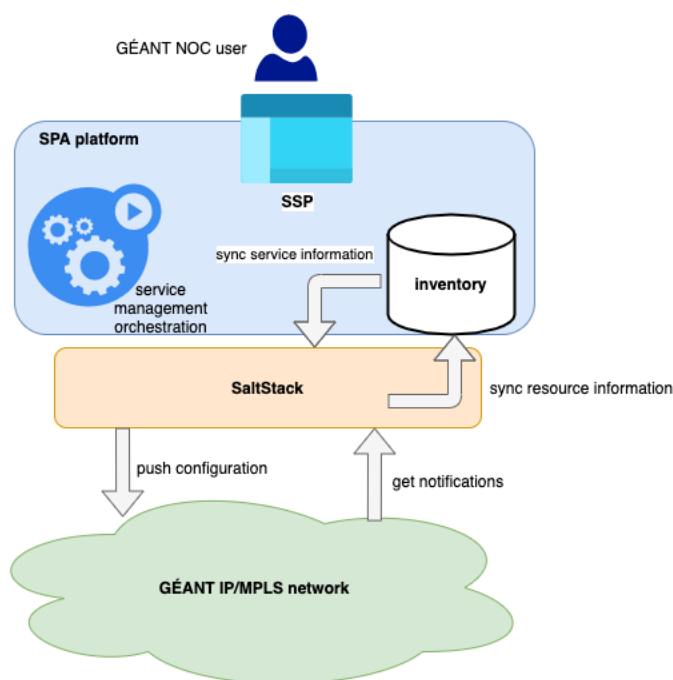


Figure 2.4: SPA platform integration with SaltStack for implementing the GÉANT IP golden configuration

In the next phase, the SSP inventory GUI will be extended with the functionalities required to view the resources related to the GÉANT IP service. The information in the inventory will also be used by the automation engine to build the necessary internal inventory information.

Following this, the design and implementation of the GÉANT IP service management processes that are to be handled by the SPA orchestrator will start along with the design of the complete service specification. Based on these processes the SSP will then be extended to enable the desired GÉANT IP service management functionalities and the view of the status of all GÉANT IP service instances.

2.6 Platform Extensions for the GÉANT MD-VPN Service

In collaboration with WP7, the WP6 T2 development team has started working on extending the SPA platform's components to enable it to store all information related to the MD-VPN service [[GVPN](#)], such as resources, related party information and service instances.

After careful examination of the data model used for the current MD-VPN inventory implementation, the team identified that the data stored in the SPA platform should be distributed in both the inventory and the CRM. The inventory will be used to store all resources and service-specific parameters, while the CRM should store the party related information describing who owns the service instances and who maintains the distributed resources and their configuration, as well as information about the service providers and the relationship between these parties. It was concluded that the current Customer Management API used to access the information stored in the CRM is not sufficient to deal with the hierarchical representation of the party information needed for MD-VPN, and thus an investigation of the Party Management API has started to ensure that this interface can provide access to all relevant information.

The work on extending the CRM and the inventory to enable them to store all data related to the MD-VPN is in progress. Once the extension is completed, the WP7 team will proceed with migration from the current MD-VPN service inventory, by building a new application layer that will interface with the SPA components to fetch the information and present it in the MD-VPN GUI.

3 Conclusions

Based on the GÉANT network engineers' requirements and in close collaboration with WP7 T2, the SPA platform implementation being conducted by the development team in WP6 T2 is continuously being extended with new functionalities. All the platform's new features are rolled out in production incrementally according to the priorities defined by the users.

The flexibility of the architecture and the positive experience with the management of GCS have led to current efforts at aiming to reuse the SPA components for the management of other GÉANT services such as the GÉANT IP service and the MD-VPN service.

The WP6 T2 team is currently working on several additions and enhancements as part of the identified roadmap for the future evolution of the SPA platform. In addition to the newly added components and features, the existing implementation also requires regular updates and enhancements so that it can keep pace with the current trends in the development of digital platforms based on microservices and related technologies such as containers. For example, in the last year there have been major releases of new versions of the TM Forum Open APIs specification that entail significant changes in the data model and approach to service and resource specification.

The development team will continue with its incremental approach to the improvement of the SPA platform, while at the same adjusting the SPA evolution roadmap to respond to the requirements and priorities of the users.

References

[NSA]	OpenNSA wiki documentation
[ODA]	TM Forum Open Digital Architecture
[TMFOA]	TM Forum Open APIs specification available on GitHub
[D6.6]	GN4-3 D6.6. Transforming Services with Orchestration and Automation
[BRMS]	Business Rules Management System Drools
[CMPL]	SLACK Communication Platform
[STM]	TMF 653 Service Test Management
[DCMS]	Django Content Management System
[GEGS]	GÉANT eduGAIN Service
[GIP]	GÉANT IP Service
[OGC]	Oracle Documentation - Golden Configuration
[SS]	SaltStack based open source Salt project
[GVPN]	GÉANT MD-VPN Service
[GTS]	GÉANT Testbed Service
[VPS]	Pulse Secure SSL-VPN solution

Glossary

AA	Authentication and Authorisation
API	Application Programming Interface
CRM	Customer Relationship Management
GCS	GÉANT Connection Service
GTS	GÉANT Testbed Service
GUI	Graphical User Interface
MD-VPN	Multi-Domain Virtual Private Network
NOC	Network Operations Centre
ODA	Open Digital Architecture
OS	Operating System
REST	Representational State Transfer
SPA	Service Provider Architecture
SSO	Single Sign-On
SSP	Self-Service Portal
STP	Service Termination Point
VM	Virtual Machine
VPN	Virtual Private Network