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Deliverable D5.8

Service Delivery and Operations Report

Deliverable D5.8

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Authors:	M. Adomeit (AMRES), I. Golub (PSNC); M. Milinović (CARNet/SRCE); A. Delvaux (PSNC); R. Karlsen-Masur (DFN); N. Ilić (AMRES); T. Wolniewicz (PSNC)

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Abstract

This document reports on the services operated in GN4-2 by SA2 T2 and T3, including updates on uptake and usage, KPIs, and information on activities and issues occurring in the reporting period, from the beginning of January until the end of October 2018. The full technical and operational descriptions of the services can be found in Deliverable D5.2 while updates on the previous reporting period are available in Deliverable D5.4.

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Executive Summary

This document reports on the services operated by Tasks 2 and 3 of the Trust & Identity and Multi-Domain Services activity (SA2), which is responsible for operating, monitoring and managing GN4-2 services in production. This is the third service operations report and it covers the activities and status of the services from the beginning of January to the end of October 2018.

SA2 ensures that the services it operates in production are provided with the infrastructure and support needed to run at the required levels, as established by the Key Performance Indicators (KPIs), among other measures. The activity executes the day-to-day operation and maintenance of its services following the DevOps paradigm, which enables the teams to perform the agile operation and maintenance of services in production. During the reporting period, SA2 operated and provided support for five services, including four Trust and Identity services – eduroam, eduGAIN, Federation as a Service (FaaS) and eduPKI – operated in Task 2 (Trust & Identity), and perfSONAR, managed by Task 3 (Multi-Domain Services).

This third Service Delivery and Operations Report includes service descriptions, information about operations and support teams, users, update and usage, KPIs, as well as information on activities and issues occurring in the reporting period. The detailed technical descriptions of the services have remained unchanged and can be found in the first Service Delivery and Operations report covering the initial reporting period [[D5.2](#)], while updates on the period from the beginning of May to the end of December 2017 are available in the previous deliverable in this series [[D5.4](#)]

All services once again recorded progress in terms of increases in usage and footprint, delivered stable operations and exceeded their KPIs. During the reporting period, the General Data Protection Regulation (EU) 2016/679 (GDPR) came into effect and was addressed by aligning SA2 services with its requirements. Enhanced eduGAIN service support was transitioned from JRA3 development and pilot to SA2 production operations under the eduGAIN service. Transition of the managed eduroam IdP service from JRA3, which developed and piloted the service, to SA2 production operations under the eduroam service is also ongoing. Several dissemination activities took place at various events and these are listed in Appendix A.

All objectives were achieved through strong collaboration between team members within the Activity and with other relevant GÉANT project development, service and networking activities, as well as with the PLM team.

1 Introduction

GN4-2 Service Activity 2 (SA2) Trust & Identity and Multi-Domain Services, delivers and operates services in production, ensuring that they are of acceptable quality, that the relevant procedures, processes and documentation are in place for their efficient operation, and that their operational health and usage are monitored and reported to stakeholders. SA2 Task 2 and Task 3 are responsible for the service operations of the T&I and Multi-domain services respectively, Task 1 runs the test and validation process for the transition of the services in production and Task 4 investigates cross-service improvement opportunities.

The set of services operated within the activity has remained unvaried since the end of the previous service operations reporting period. These services are:

- **eduroam:** provides a secure, worldwide roaming access service for the international research and education community. (A new element of eduroam's supporting services suite – managed eduroam IdP – was launched.)
- **eduGAIN:** interconnects identity federations around the world, simplifying access to content, services and resources for the global research and education community.
- **eduPKI:** provides certificates to GÉANT services that are unable to obtain the needed certificates through standard bodies.
- **FaaS:** supports GÉANT NREN organisations that have yet to establish their own identity federation.
- **perfSONAR:** provides an open-source, modular and flexible infrastructure and tools for IPv4 and IPv6 active network measurements and monitoring.

The services are operated in a federated manner by GÉANT and its NREN partners who provide the needed infrastructure and operational teams, with SA2 as the dedicated service production operations activity. As well as by GÉANT project participants, the perfSONAR service is developed and managed via international cooperation between ESnet, Internet2, Indiana University, University of Michigan, and many others.

SA2 collaborates closely with services development activities and teams. For Trust and Identity services, SA2 peers with the development teams in JRA3. This project period was marked by particularly intense collaboration between these two activities, as several services that were developed and piloted in JRA3 were transitioned to SA2 production operations. For those transitions, the GÉANT PLM and SA2 transition processes were followed ensuring the services' compliance with legal requirements (GDPR and IPR), as well as with the quality standards set by SA2 test and validation teams in Task 1 and the operational baselines defined by the operation teams in Task 2. Further

information about those transitions can be found in the descriptions of the respective services' activities in this document. It should additionally be noted that the transition of the eduTEAMS service to production was also performed during the reporting period and is ongoing.

The perfSONAR global collaboration is organised through several teams, including a Steering Committee, perfSONAR Leads, developers and a training group. In addition, the perfSONAR team in the GN4-2 project (SA2 T3) actively collaborates with SA1, SA3 and JRA2, as well as with a number of NRENs, in shaping multi-domain monitoring solutions for the community.

During the reporting period, an initiative to address technical and legislative requirements set by the GDPR was taken across all SA2 services. This effort was strongly supported by the GÉANT GDPR team which provided internal guidelines and processes, but also assistance with legal expertise where needed. All services documented personal data lifecycle flows, based on which privacy notices were written and published.

The sections that follow provide information on the five services that were in production in GN4-2 SA2 Tasks 2 and 3 from the beginning of January to the end of October 2018. The reports provided for each service include a summary service description, contact details for operations and support teams, data on uptake and usage and KPIs, and key activities and any issues encountered in service operations. The service KPIs reported here specifically capture the performance indicators for their operation in production. KPIs related to the uptake of services fall under the domain of the respective development activities and are not within the scope of this report. However, some basic uptake figures and trends are included in order to provide a holistic view of the services' operations in production.

2 eduroam

eduroam (education roaming) provides a secure, worldwide roaming access service for the international research and education community. The eduroam service allows students, researchers and staff from participating institutions to obtain Internet connectivity on their mobile devices across their campuses and when visiting other participating institutions. Its architecture is based on a specific set of technologies and regulated by a number of agreements, which combined provide the essential eduroam user experience: “open your laptop and be online”.

The contact details for eduroam for all users and interested parties are:

- Web: www.eduroam.org
- Support for users: eduroam@help.geant.org
- Support for National Roaming Operators: eduroam-ot@lists.geant.org
- eduroam Steering Group: eduroam@lists.geant.org

In the reporting period, the eduroam service recorded a high level of availability in terms of performance of its core operations and supporting infrastructure and services. The work of the DevOps and JRA3 development activity teams mainly focused on the CAT (Configuration Assistant Tool) eduroam supporting service and launch of a new element of eduroam’s supporting infrastructure: managed eduroam IdP. A major release of CAT (version 2.0) was deployed in preparation for the launch of the eduroam managed IdP service. Usage and uptake of the eduroam service recorded continuous growth. On a global scale, the eduroam service provided by GÉANT contributed to the work of the Global eduroam Governance Committee (GeGC) and continued to provide supporting services – eduroam database, CAT, monitoring, authentication traffic measurement (f-ticks) – that are used around the world.

2.1 Users, Uptake and Usage

eduroam user data is provided on the eduroam monitor site [[eduroam Monitor](#)]. All 39 GÉANT partners use the eduroam service. However, the number of National Roaming Operators (NROs) in Europe is 49, as these cover other European countries in addition to partner countries.

On a global scale, 90 territories participate in the eduroam service (Figure 2.1 shows the global map of eduroam participants). Of these NROs, 70 provided detailed data on the distribution of the eduroam service at a national level, which at the end of the reporting period totaled over 5,800 institutions participating as identity providers and more than 24,300 service locations for eduroam.

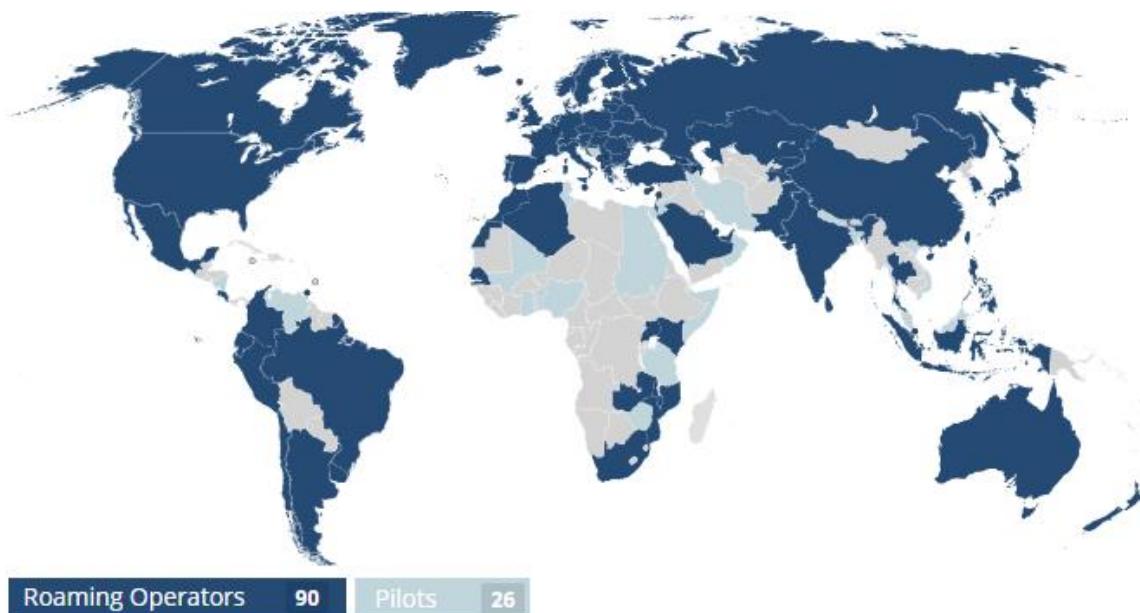


Figure 2.1: Global map of eduroam participants

The growth in eduroam usage is measured monthly by counting the number of successful user authentications, as follows:

- National authN as grand sum of all successful roaming authentications in the same country counted via f-ticks system for all European countries that provide this info (for more info on f-ticks see the eduroam Monitor site [[eduroam Monitor](#)]).
- International authN as total number of successful international (cross-border) authentications counted in the logs of ETLRs.

2018 was another year of expansion for eduroam, which saw a 22.9% increase in international authentications as well as a 22.7% increase in national authentications compared with the first 10 months of the previous calendar year.

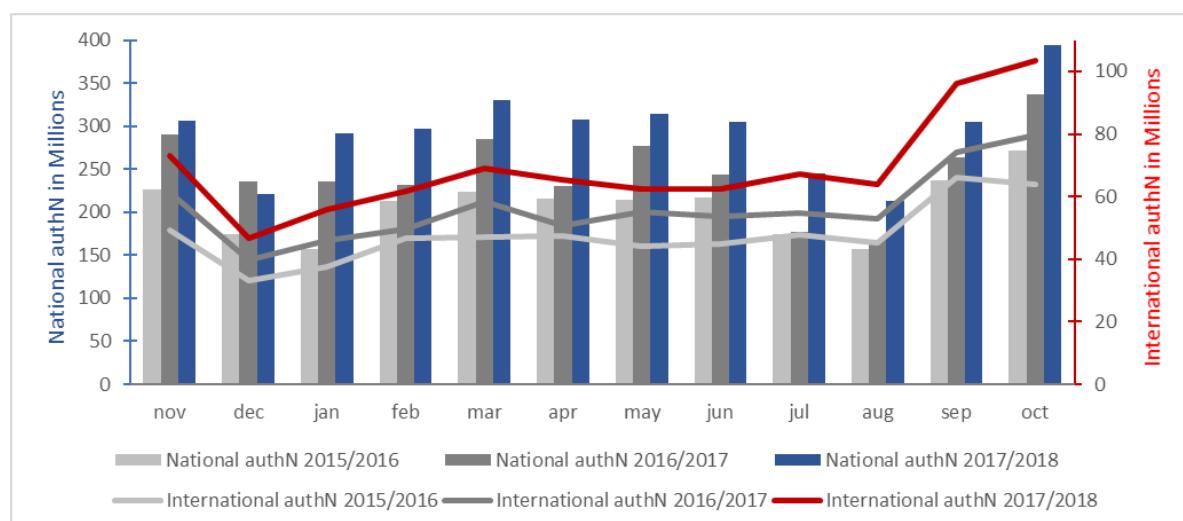


Figure 2.2: eduroam usage statistics: number of successful authentications per month

2.2 Key Performance Indicators

The KPIs for eduroam measure the availability of its core service (European Top-Level Radius servers). Table 2.1 shows that the services are running with at least one top-level roaming server 100% available, therefore performing better than the set target.

Name of the KPI	Baseline	Target	Measured
ETLR availability	99%	99.9%	100%

Table 2.1: eduroam KPIs for the period 01 January – 31 October 2018

2.3 Activities and Issues

During the reporting period, the operations and support team dealt with standard day-to-day routine activities related to the service. eduroam core services were operated to a very high standard, with at least one top-level roaming server 100% available at all times.

A number of business development and support questions were received and answered, mostly related to the use of CAT and other supporting services (monitoring, eduroam DB, F-ticks). An increase in interest in eduroam was noted and the service was promoted at several events. The OT continued to provide support to the African region in establishing the eduroam service at a regional level. In liaison with NA1 Task 6, Human Capital – Learning and Development, the SA2 team held eduroam training events for RASH (April 2018), Cynet (September 2018) and ARNES (October 2018). Training for ASREN is planned for early November 2018.

Regular monthly conference calls with the eduroam Steering Group were organised and chaired. Additional activities carried out in the reporting period include:

- Albania (.al managed by RASH) was onboarded to eduroam as part of new NROs/territories.
- In collaboration with the GÉANT GDPR team, the eduroam data inventory for GDPR was recorded, based on which the relative privacy notice was written and published.
- The final specification for the eduroam database version 2.0 was defined and migration started.
- The eduroam Configuration Assistant Tool, CAT v2.0, major release was deployed in production in October 2018. Prior to the release, the code was validated for quality and security by the SA2 T1 test team.
- In June 2018, the managed eduroam IdP service passed the GÉANT PLM gate for transition of the pilot service delivered in JRA3, to production service in SA2. Both development (JRA3) and operations (SA2) teams have since been working on the deployment of the service in the production environment. This includes:
 - preparation of operational documentation and processes;
 - preparation of user and support documentation;
 - updating the eduroam privacy notice to ensure GDPR compliance;

- validation of compliance with IPR as well as with internal quality standards by performing penetration and UI usability testing;
- provision of the production infrastructure by GÉANT IT;
- deployment of the service compliant to the SA2 production operations baseline.
- Work on auditing NROs is in progress. Both automatic and self-assessments are planned.

3 eduGAIN

eduGAIN is one of GÉANT's key Trust and Identity services, allowing trusted digital identities to be used to simply and securely access available web content and services. The eduGAIN service interconnects identity federations around the world, simplifying access to content, services and resources for the global research and education community.

Through eduGAIN:

- Identity providers offer a greater range of services to their users, delivered by multiple federations in a truly collaborative environment.
- Service providers offer their services to users in different federations thereby broadening their target market.
- Users benefit from a wider range of services provided seamlessly and accessed through a single identity.

The eduGAIN interfederation service delivers a platform for the trustworthy exchange of metadata through the coordination of technical infrastructure and policy. The platform supports the needs of federations in establishing a common baseline for metadata interoperability and furthers the goals of federations to operate in a global identity access and service exchange.

During the reporting period, eduGAIN core and supporting services were maintained by implementing regular updates, applying patches, providing support to identity federation operators, etc. The operational KPI that measures the availability of the core service was met and exceeded. eduGAIN enhanced support was moved from the JRA3 pilot to SA2 production operations.

A single primary contact point has been introduced as support@edugain.org for all inquiries about the service. A contact address for the Operations Team (edugain-ot@lists.geant.org) is still active for direct communications with federation operators regarding technical questions but is no longer publicly advertised.

Previous work on improving the web visibility of the eduGAIN service was finalised by publishing the new PR site and updated UI for the eduGAIN technical site. Various updates to the metadata validator were implemented to support metadata validation against the aggregation policy. The supporting tools suite was updated with new features and APIs.

3.1 Users, Uptake and Usage

Users of the eduGAIN service are listed on the status page of the eduGAIN technical web site [[eduGAIN tech](#)]. At the end of the reporting period, eduGAIN had 57 active members and five voting-

only members. Of the active members, 32 are GÉANT partners' identity federations; these are listed in Table 3.1 below:

Country	Identity Federation
Armenia	AFIRE
Austria	ACOnet Identity Federation
Belarus	FEBAS
Belgium	Belnet Federation
Croatia	AAI@EduHr
Czech Republic	eduID.cz
Denmark	WAYF
Estonia	TAAT
Finland	HAKA
France	Fédération Éducation–Recherche
Georgia	GRENA Identity Federation
Germany	DFN AAI
Greece	GRNET
Hungary	eduld.hu
Ireland	eduGATE
Israel	IUCC Identity Federation
Italy	IDEM
Latvia	LAIFE
Lithuania	LITNET FEDI
Luxembourg	eduID Luxembourg
Moldova	LEAF
Macedonia	AAIEduMk
Norway	FEIDE
Poland	PIONIER.Id
Portugal	RCTSaaI
Slovenia	ArnesAAI Slovenska izobraževalno raziskovalna federacija
Spain	SIR
Sweden	SWAMID
Switzerland	SWITCHaaI
The Netherlands	SURFconext
Ukraine	PEANO
United Kingdom	UK federation

Table 3.1: eduGAIN member GÉANT partners' identity federations

During the reporting period, eight new federations became eduGAIN members, as detailed in section 3.3. Figure 3.1 shows the global map of eduGAIN participants.

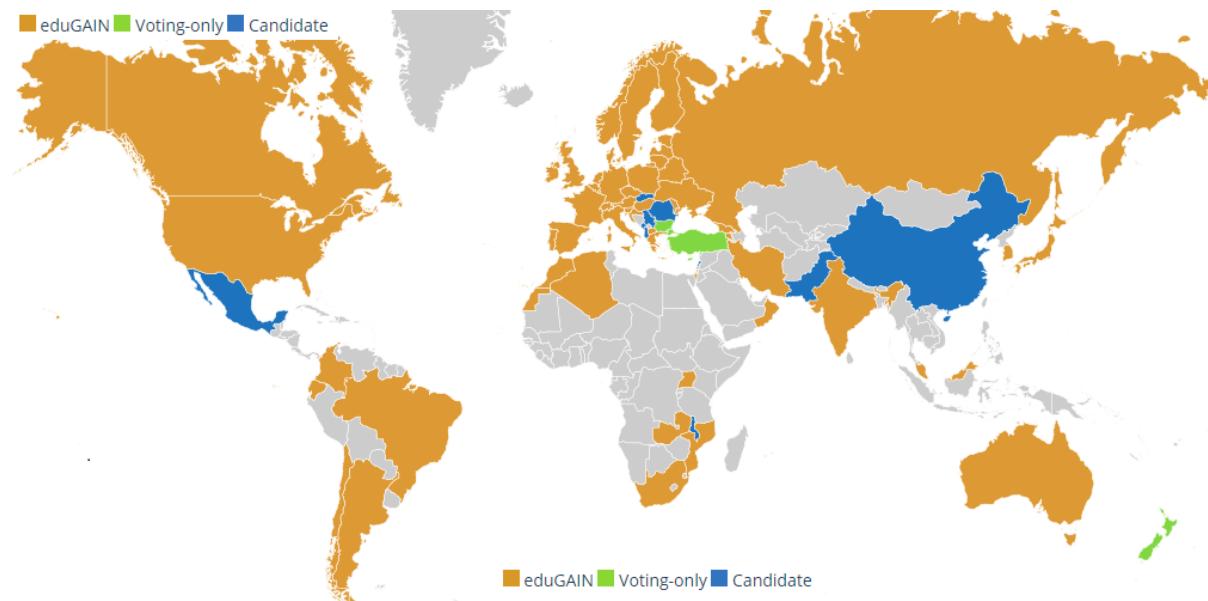


Figure 3.1: Global map of eduGAIN participants

By the end of the reporting period, eduGAIN was providing metadata containing 5125 entities. This is a growth of 19% compared to the same period last year. The biggest growth was recorded for Service Providers (26%), while the increase in Identity Providers was 14%.

Figure 3.2 shows the growth trends by number of entities in eduGAIN in the last two years. It is expected that further increase in the number of entities will be achieved through greater coverage within existing member federations rather than through the addition of new, smaller federations.

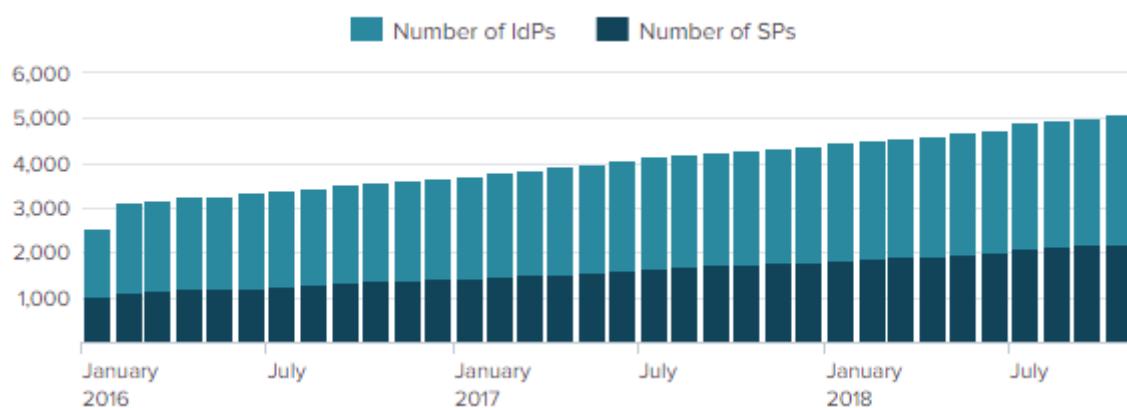


Figure 3.2: eduGAIN uptake statistics: growth in number of entities

3.2 Key Performance Indicators

The KPIs for eduGAIN measure the availability of its core service (Metadata Distribution Service). Table 3.2 shows that the services are running with minimum disruption and performing better than the set targets.

KPI	Baseline	Target	Measured
MDS availability	99%	99%	99,998

Table 3.2: eduGAIN KPIs for the period 01 January – 31 October 2018

3.3 Activities and Issues

During the reporting period, DevOps and the support team dealt with standard day-to-day routine activities related to the service's operations. eduGAIN core services were operated to a very high standard, as shown by the MDS availability KPIs.

Additional activities that were carried out in the reporting period include:

- In collaboration with JRA3, eight federations were onboarded, i.e. became members of eduGAIN (Malaysia – SIFULAN, Morocco – eduidM.ma, Mozambique – CAFMoz, Oman – OMREN, Russia – RUNNET and φEDURus, Uganda – RIF, Zambia – FIDREN).
- eduGAIN operations team members participated in the JRA3 working group that reviewed and updated the eduGAIN constitution and the eduGAIN SAML profile. The requirements introduced by the new profile have been implemented in a separate instance of the eduGAIN validator to help federations in adapting to the profile.
- In collaboration with the GÉANT GDPR team, the eduGAIN data inventory for GDPR was recorded, based on which the relative privacy notice was written and published. Based on JRA3's milestone document *Assessment of DP Legislation Implications* [[M9.2](#)], an advisory about addressing GDPR requirements by Identity Federations in eduGAIN was compiled and published. Data that could potentially be considered personal stored in the eduGAIN metadata contact attributes was removed from the historical copies of eduGAIN metadata that are kept for statistical reasons.
- In December 2017, the eduGAIN enhanced service passed the GÉANT PLM gate for transition of the pilot service delivered in JRA3 to production service in SA2. The development (JRA3) and operations (SA2) teams collaborated to transition eduGAIN support to the production environment. This included:
 - preparation of the manuals for the support teams detailing the workflows for reactive and proactive support;
 - set up of the support team;
 - preparation of the eduGAIN web sites, etc.

- The new design of the technical site and accompanying tools were implemented and installed in production.
- A new work item to change from a country-centric to a federation-centric description of eduGAIN has been added and implementation of this has started. It is expected that this work will be finalised and be in production on the technical site before the end of 2018.

The operations team also managed a number of issues not directly falling under the scope of eduGAIN service operations, but which nevertheless could have potentially impacted the service, such as federation metadata feeds nearing their expiry dates or the need for a signing key rollover.

4 eduPKI

eduPKI supports GÉANT services in defining their requirements for digital certificates. It helps coordinate the provision of certificates at a pan-European level as well as enables existing Certification Authorities (CAs) to issue certificates for GÉANT services that require them.

The eduPKI service provides other GÉANT services with support in defining their security requirements and issuing the digital certificates they need. eduPKI CA is a Certification Authority that issues X.509 digital certificates for GÉANT Services that are not able to obtain suitable certificates from a CA local to them. The certificates are issued in accordance with the Trust Profiles defined by the eduPKI Policy Management Authority (PMA) to meet the demands of GÉANT Services. The GÉANT services that have eduPKI trust profiles are eduroam and Multi-Domain Network services.

The contact details for eduPKI for users and all interested parties are:

- Official website: www.edupki.org
- E-mail: contact@edupki.org

During the reporting period, the eduPKI service was operated on a regular basis by maintaining infrastructure and service components, providing support and serving certificate requests. The operational KPIs that measure service availability were met and exceeded. Two operational issues were noted that led to an approximately 105-minute outage in certificate issuing, but no users were affected. Extensive support through consultations and discussions was provided to development teams in JRA3 T4 for eduroam Managed IdP and let's RadSec.

4.1 Users, Uptake and Usage

eduPKI's users are the GÉANT services and tools that require valid and up-to-date certificates. At the end of the reporting period, those services included eduroam and the GÉANT Multi-Domain Network services.

With regard to the eduroam eduPKI trust profile, the following NRENs have one or more certificates issued for their constituency (either for the NREN federation operator or for individual institutions within the NREN): ACOnet, ASNET-AM, Belnet, CARNet, CESNET, DFN, FCCN, GARR, HEANET, Jisc/Janet, NIIF/HUNGARNET, DeIC, UNINETT, SUNET, FUNET, PSNC, RENATER, RESTENA, redIRIS, SANET, SURFnet, SWITCH, TENET and UbuntuNet. Additionally, certificates are issued for the IETF and GÉANT organisations. 24 new certificates were issued during the reporting period. Taking into account the ongoing expiration of certificates the total number of valid certificates at the end of the reporting period for the eduroam eduPKI trust profile is 107.

The main user of the GÉANT Multi-Domain Network Services eduPKI trust profile is GÉANT. During the reporting period there were no new certificates issued for these services. At the end of the reporting period there were six valid certificates for this eduPKI Trust Profile.

4.2 Key Performance Indicators

The eduPKI service's KPIs measure the availability of the Certification Authority (CA) and Certificate Status Check services. The availability of the Certificate Status Check is shown by measuring the availability of the current Certificate Revocation List (CRL) and responses via Online Certificate Status Protocol (OCSP) through their dedicated web services. Table 4.1 shows that the services are running with minimum disruption and performing better than set targets.

KPI	Baseline	Target	Measured
Availability of Certificate Status Check	99.9%	99.9%	100%
Availability of CA Service	99.7%	99.9%	99.98%*

(*) planned and unplanned downtimes for the CA service which cumulated to 6 hours during the 306 days of the reporting period

Table 4.1: eduPKI KPIs for the period 01 January 2018 – 31 October 2018

4.3 Activities and Issues

During the reporting period, the DevOps and support teams dealt with standard day-to-day activities related to the service. Additional activities that were carried out in the reporting period include:

- Support for certificate requirements was provided to the JRA3 development Task 4 that focuses on eduroam Managed IdP and let's RadSec.
- Operation of eduPKI CA and issuance of certificates for eduroam RadSec infrastructure servers.
- Support for eduroam's Registration Authority within eduPKI CA.
- Provided access for the eduroam development JRA to the eduPKI Test CA to automatically request and retrieve server certificates via API.
- Research into a possible Java/Bouncy Castle vulnerability that might have affected the certificate key generation tool provided by eduPKI CA, which was found not to present an issue.
- Completed necessary documentation and changes to ensure GDPR compliance.
- Contribution to the GN4-2 PKI certificate strategy paper that informs further work in the PKI area.
- Supported work for the Certificate Transparency Log Server by the JRA2 T6 team and for perfSONAR by SA1.

In terms of operations, a couple of issues with the underlying infrastructure of the eduPKI CA – a broken VPN-encryption device (60 minutes) and a fault on a leased fibre (45 minutes) – led to certificate application and approval functions being unavailable for about 105 minutes altogether within a reporting period of 304 days. No eduroam infrastructure operator was affected.

5 FaaS

GÉANT Federation as a Service (FaaS) provides an easy entry point for NRENs joining eduGAIN who are developing or are in the early stage of operating a web single sign-on identity federation. FaaS is offered to Federation Operators (typically NRENs), to facilitate them in the uptake and day-to-day operation of their identity federation. By taking advantage of the FaaS offer, Federation Operators can:

- Operate their Identity federation in a scalable manner according to best current practices.
- Exchange metadata with the eduGAIN metadata service in an automated manner.

FaaS delivers a service that supports NRENs by providing them with the infrastructure needed to operate an identity federation (web-based Single Sign-on) with access to eduGAIN included.

The FaaS offering can be accessed via a server name chosen by the NREN, and the Web UI localised as desired (language, logo, etc.) to maintain the same look and feel of services provided by the NREN Federation Operator for NREN members.

The contact details for FaaS for users and all interested parties are:

- Website: http://www.geant.org/Services/Trust_identity_and_security/Pages/FaaS.aspx
- e-mail address: faas@lists.geant.org

During the reporting period, FaaS user instances were maintained on a regular basis by implementing updates, applying patches, supporting users, etc. Operational KPIs for the service were met and exceeded. One minor issue with metadata aggregation was noted and appropriate actions were taken to address this.

5.1 Users, Uptake and Usage

FaaS users are GÉANT partners who have not yet deployed or are in the early stages of operating a SAML2-based identity federation. With FaaS these users benefit from a hosted set of tools (SaaS – Software as a Service) that help significantly decrease the effort required in creating and maintaining a secure Identity Federation.

At the time of writing, seven NRENs are using FaaS: LITNET, MREN, GRENA, ASNET, MARnet, AMRES and CyNET. An indicator of service usage can also be the number of entities registered through a FaaS user instance. This number depends on the level of federation progress and growth and is also an indicator of federation maturity. At the end of the reporting period, there were 68 entities registered

overall in all FaaS user instances, which is as expected considering FaaS target users are smaller developing identity federations.

5.2 Key Performance Indicators

KPIs for FaaS measure the availability of FaaS user instances. This availability is calculated based on the mean value of the availability of the Apache SSL service of all FaaS user instances. Table 5.1 shows that FaaS user instances are available with minimum disruption and performing better than set targets.

Name of the KPI	Target	Baseline	Measured
Availability of FaaS user instances	99 %	99%	99,95%

Table 5.1: FaaS KPIs for the period 01 January 2018 – 31 October 2018

5.3 Activities and Issues

During the reporting period, the operations and support team dealt with standard day-to-day routine activities related to the service.

Additional activities that were carried out during the reporting period include:

- Regular system and software updates on all FaaS instances.
- Nagios monitors to check for metadata files availability were added.
- A FaaS privacy notice has been written and approved by the GÉANT GDPR team.
- Several certificates used on web servers on production instances were renewed in coordination with the users.

Only one issue was noted concerning the metadata aggregation process employed on FaaS instances, i.e. that during the metadata aggregation pyFF exits with a non-zero code, which “breaks” the wrapper script and results in the creation of metadata files with the wrong permissions. A quick workaround to this problem was applied by modifying the appropriate wrapper script. A permanent solution was then implemented by upgrading Python packages used by pyFF. The issue nevertheless had a negligible impact thanks to the quick response of the FaaS team.

6 perfSONAR

perfSONAR is an open-source, modular and flexible architecture for active network performance monitoring that provides a view of network performance across multiple domains, allowing NOC and PERT engineers to seamlessly analyse and diagnose network behaviours across the entire end-to-end path. The tools provided in the perfSONAR suite perform active measurements of throughput, packet loss, delays and jitter, and record network route and path changes.

The SA2 Task 3 team offers two types of perfSONAR-related services:

- perfSONAR software development and user support within the international collaboration with ESnet, Internet2, Indiana University and University of Michigan.
- Supporting the GÉANT community to deploy perfSONAR in their environment as a part of perfSONAR's consultancy and expertise service, providing advice, training and support for designing and deploying a perfSONAR-based measurement architecture.

6.1 perfSONAR International Project

The perfSONAR project is supported by five international partners: ESnet, Internet2, Indiana University, University of Michigan and GÉANT. The global perfSONAR team develops, maintains, distributes and provides support for the full perfSONAR tools suite that is installed and used on numerous R&E networks around the world to perform active measurements and monitor network performance.

The GÉANT project partners that are providing resources for the development, maintenance and support of perfSONAR are CARNet, DFN-FAU, GÉANT Association and PSNC. PSNC also provides a perfSONAR Service Manager, who is responsible for managing and supervising development, operations and support.

The contact details for the perfSONAR project are:

- Main website: <https://www.perfsonar.net>
- Installation and usage documentation: <https://docs.perfsonar.net>
- User mailing list as the entry point for any support request: perfsonar-user@internet2.edu or <https://lists.internet2.edu/sympa/info/perfsonar-user>
- Developers' resources are available at: <https://github.com/perfsonar/>

6.1.1 Users, Uptake and Usage

Active network measurements are useful to network engineers, PERT engineers, system administrators, researchers and students. perfSONAR users include:

- Organisations (e.g. Universities, GÉANT NRENs and GÉANT itself) that want to provide active network measurement possibilities to their users or to any collaborating organisations' users (enabling multi-domain measurement possibilities).
- Organisations that want to perform active measurements within their own domain or any other perfSONAR-enabled domain.
- Individual users who want to monitor end-to-end performance or performance on particular links of interest.
- Network researchers interested in developing or monitoring and assessing the performance of new high-speed networks, technologies and protocols.

perfSONAR users are located worldwide and form the global perfSONAR community. The current usage map is available on the perfSONAR website [[perfSONAR usage](#)]. Figure 6.1 shows the 2053 nodes with 10420 services¹ implemented worldwide In October 2018.



Figure 6.1: perfSONAR installations worldwide

There are more than 400 perfSONAR deployments in European countries, including, but not limited to Armenia, Austria, Belarus, Belgium, Croatia, Denmark, Estonia, Germany, Ghana, Great-Britain, Hungary, Italy, Lithuania, Luxembourg, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, and Switzerland.

¹ The number of services depends on the perfSONAR version (BWCTL was retired so these services are no longer available) and on which services the users have activated.

6.1.2 Key Performance Indicators

The key performance indicator for perfSONAR measures the number of perfSONAR major releases per year. Table 6.1 shows the KPI value for the reporting period.

Name of the KPI	Target	Baseline	Measured
Number of perfSONAR major releases per year	1	1	1

Table 6.1: perfSONAR KPIs for the period 01 January 2018 – 31 October 2018

A major perfSONAR 4.1 release was issued in August 2018. Additionally, three minor releases were issued: perfSONAR 4.1.1 also in August 2018, perfSONAR 4.1.2 in September 2018 and perfSONAR 4.1.3 in October 2018.

6.1.3 Activities and Issues

During the reporting period, the work of the perfSONAR global team was focused on the new major release, perfSONAR version 4.1, and the two subsequent minor releases. The GÉANT team contributed to building, testing and fixing all Debian/Ubuntu packages, implementing the TWAMP tools, the testing and debugging of perfSONAR 4.1 release candidates, and a major review of the installation and configuration documentation. The team was also responsible for running perfSONAR webinars at a time suitable for a European audience.

Key new features and improvements in the new perfSONAR major release version 4.1 include:

- New measurements mesh orchestration software – pSconfig – (that has replaced the mesh-config-agent) that is fully integrated with pScheduler and MaDDash.
- Integration of a new set of tools implementing the TWAMP protocol.
- General improvements to the GUI.
- Upgrade for the supported operating systems, that now includes Ubuntu 18. The support for Debian 7 and CentOS 6 was dropped as those operating systems reached end of life (EOL).
- Support for docker container images for the perfSONAR tools and testpoints package bundles.

perfSONAR minor release versions 4.1.1, 4.1.2 and 4.1.3 focused on minor updates and bug fixes. The roadmap for the perfSONAR project can be found on the perfSONAR website [[perfSONAR roadmap](#)].

The 4.1 perfSONAR release was promoted through webinars and presentations at different events (GÉANT Service and Technology Forum, TNC18, etc.). Online training and dissemination events have been recorded and published on a dedicated perfSONAR YouTube channel [[perfSONAR YouTube](#)].

During the reporting period, support was also provided via the regular channels; queries were mostly related to upgrades of existing installations and feedback about usage of the new perfSONAR releases or, in the case of new users, regarding the perfSONAR installation and setup.

6.2 perfSONAR Consultancy and Expertise

perfSONAR Consultancy and Expertise aims to provide support and disseminate knowledge about perfSONAR usage for the GÉANT community and offers four different activity types:

- Help to ensure that design measurement architectures and infrastructures based on perfSONAR fit the performance monitoring and measurement needs of the requesting party.
- Specific training on perfSONAR deployment, usage and best practices.
- Extra support to deploy and operate perfSONAR provided by GÉANT and NRENs, as requested.
- Maintenance and operation of a set of perfSONAR services useful to the global perfSONAR community and GÉANT area perfSONAR users in particular.

In order to support these activities, the operation and maintenance of the perfSONAR Small Nodes platform continued.

The GÉANT project partners that provide resources to the perfSONAR project are CARNet, DFN-FAU, and GÉANT Association, as well as PSNC, which also provides a Service Manager who supervises and manages service operation and support. The contact details for perfSONAR Consultancy and Expertise are:

- Main website: <http://www.personar.net>
- GÉANT wiki service page:
<https://wiki.geant.org/display/timops/perfSONAR+Consultancy+and+Expertise>
- perfSONAR Small Nodes project dashboard: <http://perfsonar-smallnodes.geant.org/>

6.2.1 Users, Uptake and Usage

Target users of this service are teams and individuals from the GÉANT community. Since active network measurements and network performance monitoring require specific and advanced knowledge, users are mostly from Network Operating Centres (NOCs) and/or the Performance Emergency Response Teams (PERTs) of NRENs, the NRENs' constituencies or cross-domain projects that they might participate in. However, the service's availability is not limited to a specific user group.

More information on the service's users is provided in section 6.2.2 below.

6.2.2 Activities and Issues

During the reporting period, the SA2 Task 3 perfSONAR team provided a consultancy and expertise service per request and subject to available effort. Support was provided to UNINETT for using perfSONAR for their DragonLab project and to PRACE for the deployment of perfSONAR in the MD-VPN-based network.

The team gave several presentations and training sessions during the reporting period, as listed in Appendix A, related either to the new perfSONAR releases or to the Small Nodes project and measurement platform. The team was approached by SURFnet to run a hands-on perfSONAR training

for the SURFnet community as part of their workshop on “Building high-performing campus infrastructures for research”. This perfSONAR advanced training was delivered as part of a 3-day workshop that also covered subjects such as DTN, the security of Science DMZ and sharing experience about high-volume storage in research infrastructures. A half-day tutorial about perfSONAR automated deployment using Ansible was also provided, in collaboration with the University of Michigan, at the I2 TechEX conference.

There were no issues recorded in the reporting period.

7 Conclusions

This document is the final of three 10-month service reports in GN4-2, each covering operations, support and DevOps activities for services delivered through SA2.

In GN4-2, the development and operations of the Trust and Identity services have been delivered through two different activities – SA2 and JRA3. The division of these activities has provided the opportunity for each services' development and operations teams so strengthen and focus their efforts, while enabling handover and transition to production processes to be clearly defined and executed in alignment with the PLM.

The agility of the operations teams was ensured by following a DevOps structure enabling them to cater for existing services' features while new features were introduced through JRA3 developments in a non-disruptive way. This close collaboration between development and operations, but also with other teams in the project that supported outreach, training, first level support etc., has been essential towards the successful service delivery achieved in this project phase.

In this final reporting period, the KPIs for all services were once again met and exceeded. Each of the services recorded a number of DevOps activities that were performed in line with day-to-day operations and the uptake trends for all of the services showed continuous growth. Some minor issues were reported and resolved quickly, without impacting the delivery of the services. The scope of some services was widened through the addition of new functions that transitioned from JRA3 to SA2 operations.

The services were promoted through various events including trainings, presentations for higher management, technical presentations and participation in conferences. All these dissemination activities are listed in Appendix A.

Appendix A List of Dissemination Activities

#	Type of Activities ¹	Main Leader	Title	Name of Event	Date/ Period	Place
1	Presentation	Adomeit M. Milinovic M. Harris N. Axelsson P.	Regulating User Privacy in Europe: GDPR	Internet 2 Global Summit	08/05/2016	San Diego, USA
2	Meeting	Wolniewicz T.	Update:eduGAIN websites and API	REFEDS 38th Meeting	10/06/2018	Trondheim, Norway
3	Presentation	Golub I.	Trends in Network and Service Monitoring	TNC2018	13/06/2018	Trondheim, Norway
4	Presentation	Delvaux A.	Performance Measuring and Monitoring	TNC2018	13/06/2018	Trondheim, Norway
5	Presentation	Marovic B.	A map is worth a million records	TNC2018	14/06/2018	Trondheim, Norway
6	Presentation	Golub I.	perfSONAR and Vendor Integration	14th STF	04/07/2018	Poznan, Poland
7	Presentation	Trocha Sz.	Performance Monitoring Platform	14th STF	04/07/2018	Poznan, Poland
8	Workshop	Delvaux A. Trocha Sz. Chown T.	Introduction to measurements and perfSONAR with hands-on training. perfSONAR use cases.	Building high-performing campus infrastructures for research workshop	24-26/09/2018	Dwingeloo, NL

#	Type of Activities ¹	Main Leader	Title	Name of Event	Date/ Period	Place
9	Presentation	Golub I., Delvaux A.	Infrastructure Monitoring Development and Services in GÉANT Project	TechEx 2018	15-18/10/2018	Orlando, FL, USA
10	Tutorial, workshop	Delvaux A., Colone E. (U-Mich)	Automated perfSONAR Provisioning with Ansible	TechEx 2018	15-18/10/2018	Orlando, FL, USA
11	Presentation	Delvaux A.	perfSONAR: pScheduler extensibility and applicability for the GEANT community	SIG-PMV	23-24/10/2018	Manchester, UK
12	Presentation	Milinović M.	eduroam Monitoring	SIG-PMV	23-24/10/2018	Manchester, UK

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Glossary

AAA	Authentication, authorisation, and accounting
ARP	Address Resolution Protocol
CA	Certification Authority
CAT	Configuration Assistant Tool
CRL	Certificate Revocation List
CSI	Continual service improvement
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
eduroam OT	eduroam Operations Team
eduroam SG	eduroam Steering Group
EAP	Extensible Authentication Protocol
ETLR	European top-level RADIUS server
FLRS	Federation-level RADIUS proxy server
GeGC	Global eduroam Governance Committee
HI	Home Institution
I2	Internet2
IdM	Identity Management
IdP	Identity Provider
KPI	Key Performance Indicator
L1	Layer 1
L2	Layer 2
LDAP	Lightweight Directory Access Protocol
MA	Measurement Archive
MAC address	Media access control address
MDS	Metadata Distribution Service
MP	Measurement Point
NAPTR	Name Authority Pointer
NAT	Network address translation
NOC	Network Operating Centre
NREN	National Research and Education Network
NRO	National Roaming Operator
OCSP	Online Certificate Status Protocol
OT	Operations Team
PERT	Performance Enhancement Response Team
RADIUS	Remote Authentication Dial-In User Service
SaaS	Software as a Service
SAML	Security Assertion Markup Language
SLS	Simple Lookup Service
SP	Service Provider
TLS	Transport Layer Security
UDP	User Datagram Protocol
VI	Visited Institution