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## **Milestone M3.6 (M69)**

### **NREN Survey Distributed, Data Collected and Reporting Website Updated Version 4**

#### **Milestone M3.6**

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#### **Abstract**

This document presents the timeline and key findings of the 2021 NREN Compendium survey, as confirmation that the survey has been distributed, data collected and reporting website updated, in fulfilment of Milestone M3.6.

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# 1 About the Compendium

## 1.1 Overview

The GÉANT Compendium of National Research and Education Networks in Europe (the Compendium) is a comprehensive portrayal of the networks that underpin the research and education community in Europe.

National Research and Education Network (NREN) organisations run special communication networks dedicated to supporting the needs of the scientific and academic community within a country. The 43 European NRENs are interconnected by the pan-European GÉANT network, the largest and most advanced research and education (R&E) network in the world.

Published since 2001 and the result of a broad, collective effort, the Compendium gives a full picture of what the NRENs do to meet their users' requirements, the resources they have at their disposal, and the way they are organised. The Compendium is based on data from the annual NREN Compendium survey, which invites Europe's NRENs to provide detailed information about their network, equipment and users. The survey conducted in 2021 focused primarily on the period from January to December 2020, though some NRENs may have added more recent data if they were available. The survey questions were grouped around the NRENs' respective organisations, users, involvement in EC-funded projects, network and traffic, and services, including security, trust and identity, cloud and education. The questions were drafted under the guidance of subject specialists from within the GN4-3 project. This same group also supported the analysis of the respondents' data. In addition to the survey data, the Compendium uses data about NRENs provided by other parts of the community, and also external data. The key findings from the survey are summarised in this document; further details are provided in *Compendium 2021* [[COMP 2021](#)]. Specific reports compiled from NREN data may also be generated from the full online version of the Compendium [[COMPENDIUM](#)].

## 1.2 Methodology

The Compendium survey is carried out by GN4-3 Work Package 3 User and Stakeholder Engagement, Task 3 Stakeholder Insights (WP3 T3).

The survey questions were drafted in collaboration with subject specialists from within the GN4-3 project; the same group is also involved in reviewing and analysing the respondents' data, and helping to produce the detailed *Compendium 2021* report [[COMP 2021](#)].

The survey is conducted online, with all European NRENs invited to take part. The information is provided by those who actually carry out the NRENs' work, from the executive directors to technical officers to service portfolio strategists and many more professionals besides.

### 1.3 Timeline

The timeline for the 2021 Compendium survey is shown in Table 1.1 below.

Milestone	Date	Status
Survey distributed/opened	August 2021	Completed
Survey closed	December 2021	Completed
Data collected	January 2022	Completed
Reporting website updated	April 2022	Completed
<i>Compendium 2021</i> produced	June 2022	Completed

Table 1.1: Timeline of 2021 Compendium survey

## 2 Key Findings

Thirty-nine out of the 43 GÉANT NREs responded to the 2021 survey (a full list is provided in Appendix A of *Compendium 2021* [[COMP 2021](#)]).

Like past Compendium surveys, the 2021 results reveal changes and continuing trends in the NREN landscape, although the changes are mostly gradual. Nonetheless, the impact of the ongoing COVID-19 pandemic is evident in some of the more recent data.

The environment in which NREs operate still varies considerably. Nevertheless, most European countries have a broadly liberalised telecommunications market, where access to bandwidth and technology is unconstrained by regulation or monopoly. NREs therefore need to respond to the specific demands of the research and education community if they are to justify their existence to their funding bodies, many of which are not their primary users. The data from the Compendium survey should help to trace how NREs meet this challenge.

### Budget and staff numbers

Reflecting the continuing increase in the importance of data networks in research and education, budgets and staff numbers as a whole have expanded between 2020 and 2021 (by 2% and 7%, respectively). This growth has enabled NREs to upgrade their networks and further develop their service portfolios.

### Pan-European activities

A clear trend over the last few years has been an increase in NREs' involvement at the European level: the number of EC-funded projects (in addition to GN4-3/GN4-3N) which had at least one NREN as a participant has almost doubled from 56 in 2018 to 100 in 2021. The project with the most NREN participants is EaPConnect, which aims to decrease the digital divide within Europe by establishing and operating a high-capacity R&E network in the EU's Eastern Neighbourhood. Most of the other projects are connected to European e-infrastructures, in particular the projects supporting the delivery of the European Open Science Cloud (EOSC). The number of NREs engaging in European projects, and which individual NREs, have not changed significantly in the last four years, meaning that about a third of NREs have little involvement at the European level beyond the GN4-3 project.

### Traffic

The importance of research and education networks manifests in the volume of traffic NREs carry. Traffic volumes have increased continuously over the past years, across all NREs. However, the COVID-19 crisis left a mark on these numbers: over the years before COVID-19, traffic within the R&E networks and traffic from outside the R&E networks grew in lockstep; in 2020, the latter stagnated and even dropped slightly, while the former grew by 30%, following the trend visible in the years

before. This likely reflects the reduced presence of students and employees at the R&E institutions. A similar development can also be seen in the 2021 numbers from the GÉANT network.

Nevertheless, NRENs expect the upward trend to continue into the medium term: for the years 2021–2024, virtually all NRENs who responded to the survey forecast traffic growth, and more than half of them anticipate a growth of 50% across all organisations within the NRENs' remit. As with last year, high growth is expected to come from schools, with an anticipated traffic growth of more than 80%, but unlike previous years, high growth is also expected to come from research institutions, with 72% traffic growth, and universities, estimated to grow by 69%.

## Capacity

While traffic volumes grew significantly during the past year, the capacities of NRENs' backbone and access networks increase at a steady but much slower rate, reflecting the longer timescale of network upgrades. It is noticeable, though, that the access networks keep increasing in capacity, especially for the non-core user types such as schools. The capacities for access to an NREN's network range from 1 Mbps up to 100 Gbps, depending on user types. Universities and research institutes are the best-connected institution types. Half of the respondents indicate that the typical capacity for university links now exceeds 1 Gbps for connected universities, and research institutes are not far behind this. In some countries, the typical connectivity for these users has reached 10 Gbps, and more than 90% of NRENs provide these high-capacity connections to at least some universities and research institutes. Other user types mostly have more modest requirements but their link capacities are increasing as well.

## Services

NRENs have long since moved beyond their core role as connectivity providers, and now provide additional services, responding to technological changes and changes in the demands of the research and education community. A good example of this is the expansion and improvement of the trust and identity (T&I) infrastructure. Originally focused on securing access to R&E services, T&I infrastructures are increasingly being adapted to deal with the growth in cooperation and sharing of resources across institutions and borders. This is particularly apparent in initiatives such as InAcademia and MyAcademicID, which ascertain the student status in order to provide access to services that are not strictly speaking an R&E service domain, for example, student discounts. Another burgeoning type of T&I service is supporting student mobility, namely the MyAcademicID project.

Another such development is the ongoing commodification of ICT services that just a few years ago were relatively obscure, notably cloud services. That NRENs seek to make it easier for their users to take advantage of this trend is visible in the increasing use of the Open Clouds for Research Environments (OCRE) Framework among NRENs. Here, NRENs have moved to make their experience in procurement of these types of services available to their customers, leveraging their market size to gain discounts for their users. Cloud services are a prime example here, but procurement support extends to other areas as well.

A further trend is that NRENs are not just running infrastructure used for education, but are also supporting specific education content and services. While not all NRENs are following this path, among those that do, the development of new services appears to take on a startling pace, a trend that was accelerated by the COVID-19 crisis, which increased dramatically the need for online teaching tools.

The NRENs active in this area are becoming important gatekeepers or mediators between content/service providers and consumers in their education sectors.

### 3 Conclusions and Outlook

The Compendium's ambition is to provide an overview of and insights into the multi-faceted NREN community. It aims to simultaneously depict the diversity of the NRENs as well as illustrate that, despite their variations and particularities, the European NRENs are built around delivery of the same core, interlinked services. Through these annual snapshots, produced each year since 2001, GÉANT continues to monitor the growth and changes among the NRENs in a systematic way, providing a unique dataset with which NRENs can inform and shape their strategic decisions.

As the NRENs' business is providing infrastructure, many changes are slow. Nonetheless, changes do happen, and to track and present them the right parameters need to be assessed. Therefore, a project such as the Compendium needs to expand its scope when necessary, to document developments that shape and alter the ways NRENs are serving their user base. A good example is the role of NRENs in education: while NRENs have always served the education sector, more recently many NRENs have now moved to offer services that target its needs specifically – and this development has been further accelerated under the influence of the COVID-19 pandemic. Another example is cloud services, where the landscape has changed considerably over the years and with it the role NRENs play in the delivery of these services. Both developments are reflected in the Compendium, which documents these activities.

While the Compendium is in substantial part based on its eponymous annual Compendium survey, it has always drawn from other data sources, which have become more important over the years. The sections on the above-mentioned cloud services and education, and also the section on T&I, are good examples as they are mostly or entirely based on surveys and/or studies that are completely separate from and independent of the Compendium survey. This means that the Compendium provides a platform where results from subject-specific studies from within the NREN community are presented in a summarised form. In this way, information from disparate teams/workgroups can be consolidated and made available in one place.

For NRENs, the Compendium has often been a source of data they could use for various purposes such as lobbying or benchmarking. While the report format has advantages for such purposes as it provides ready-made figures and analysis, it cannot possibly present all aspects of the data in the survey. The team behind the Compendium is therefore working to make the data from the Compendium survey available online. A particular focus here will be on the service portfolio of NRENs, which is of general interest within the community, but it has always proved difficult to document and records of it are often patchy. Efforts are ongoing to improve this state of affairs and the next edition of the Compendium will likely be able to point to an online presence of the underlying data for further research.



## References

- [COMP\_2021] <https://about.geant.org/wp-content/uploads/2022/06/Compendium-2021-web.pdf>
- [COMPENDIUM] <https://compendium.geant.org/>

## Glossary

<b>EaP</b>	Eastern Partnership
<b>EC</b>	European Commission
<b>EOSC</b>	European Open Science Cloud
<b>GN4-3</b>	GÉANT Network 4 Phase 3 project, part-funded by the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 856726
<b>GN4-3N</b>	GÉANT Network 4 Phase 3 Network project, part-funded by the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 856728
<b>ICT</b>	Information and Communications Technology
<b>NREN</b>	National Research and Education Network
<b>OCRE</b>	Open Clouds for Research Environments
<b>R&amp;E</b>	Research and Education
<b>T&amp;I</b>	Trust and Identity
<b>WP3</b>	Work Package 3 User and Stakeholder Engagement
<b>WP3 T3</b>	WP3 Task 3 Stakeholder Insights