03-08-2020

Deliverable D3.9
GÉANT Support for R&E during the Early Stages of the COVID-19 Pandemic V1.2

Deliverable D3.9

Contractual Date:	31-05-2020
Actual Date:	03-08-2020
Grant Agreement No.:	856726
Work Package	WP3
Task Item:	Tasks 1, 2, 3 and 4
Nature of Deliverable:	R (Report)
Dissemination Level:	PU (Public)
Lead Partner:	GÉANT Association
Document ID:	GN4-3-20-41613A
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Abstract
Containing updates from several GÉANT partners since it was first issued on 29 May 2020, this document summarises the work GÉANT and its European and global partner networks have been doing to support research and education during the early stages of the COVID-19 pandemic, with particular focus on activities being supported by the EC.

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Executive Summary

This document summarises the work GÉANT and the Regional and National Research and Education Networks (RRENs/NRENs) have been doing to support research and education in Europe and across the globe during the early stages of the COVID-19 pandemic.

The overall picture shows that by simply continuing to deliver their business-as-usual high-reliability, high-speed, high-bandwidth connectivity, and key services including trust and identity, GÉANT and its partner NRENs were and remain ready and able to meet the research community's requirements in this extreme situation.

In addition to the fundamental connectivity and key services, the greatest demand has been for tools and services enabling real-time communications and remote learning. GÉANT and the NRENs have been able to meet this demand both through their own offerings, accelerating and customising these where possible (e.g. eduMEET and openUp2U), and through facilitating commercial offerings.

GÉANT has been proactive in confirming that for key COVID-19 research initiatives, particularly those supported by the EC – including the European Molecular Biology Laboratory European Bioinformatics Institute (EMBL-EBI) COVID-19 research initiative, the 18 research and innovation projects on coronavirus, the Research Data Alliance (RDA) COVID-19 Working Group and the Virus Outbreak Data Network (VODAN) – connectivity needs are being met despite changing traffic profiles, and that there are no new service requirements or gaps. It has also been proactive in supporting the GÉANT community, through increased, focused Special Interest Group (SIG) and Task Force (TF) activity, such as the SIGS on Network Operations Centres and Marcomms and the TF on Educational Services and Activities, and through targeted communications and engagement, including the GÉANT Community Café.

Whether urgent COVID-19 research, health and medicine more generally, particle physics, space, earth observation, energy, or arts and education – the GÉANT network underpins and is critical to all this work. The European research community depends on it – 100% of all high-performance computing runs on the GÉANT network. The fact that amid the urgent calls for research activity no specific mention has been made of connectivity is telling, and a matter of quiet pride but not complacency: the network is taken for granted as a robust, reliable given, even in extreme circumstances such as at present. GÉANT and the NRENs will continue to ensure they live up to that trust and dependence, confirming their fundamental, crucial importance to European and global research at all times and especially in times of crisis.

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1   Introduction

This document summarises the work GÉANT and the Regional and National Research and Education Networks (RRENs/NRENs) have been doing to support research and education during the early stages of the COVID-19 pandemic, confirming their place at the heart of R&E networking. It focuses in particular on the activities being supported by the EC: the European Molecular Biology Laboratory – European Bioinformatics Institute (EMBL-EBI) COVID-19 research initiative, the 18 research and innovation projects on coronavirus, the Research Data Alliance (RDA) COVID-19 Working Group and the Virus Outbreak Data Network (VODAN).

Supporting scientific research is the raison d'être of GÉANT and the NRENs. The leading collaboration on e-infrastructure and services for research and education, GÉANT is a fundamental element of Europe's e-infrastructure, delivering the pan-European GÉANT network for scientific excellence, research, education and innovation. Through its integrated catalogue of connectivity, collaboration and identity services, GÉANT provides users with highly reliable, unconstrained access to computing, analysis, storage, applications and other resources, to ensure that Europe remains at the forefront of research. The network is overprovisioned by design, robust and resilient, to ensure that bandwidth and availability are no limitation to data exchange or processing, with the level of security needed to ensure safety and access protection. Thus by simply continuing to deliver its business-as-usual high-reliability, high-speed, high-bandwidth connectivity, and key services including trust and identity, GÉANT was and remains ready and able to meet the research community's requirements in this extreme situation.

That said, GÉANT is also being proactive in confirming that, for key COVID-19 research initiatives, connectivity needs are being met despite changing traffic profiles, that there are no new service requirements or gaps, and no obstacles to the conduct of research, and in accelerating and extending its service offerings to the R&E community where it can. It is also supporting the GÉANT community, through increased, focused Special Interest Groups (SIGs) activity, communications and engagement.

The document is structured as follows:

- Section 2 gives an overview of each of the key activities being supported by the EC – the EMBL-EBI COVID-19 research initiative, the 18 RTD projects on coronavirus, the RDA COVID-19 Working Group, VODAN and the Data Together COVID-19 appeal and actions – and of the support provided by GÉANT.
- Section 3 describes GÉANT's own activities in the areas of network, services, support for the key global research initiative by REFEDS and InCommon, and community.
- Section 4 presents the activities undertaken by the European NRENs in the same areas – network, services and community – and also with regard to business continuity.

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- Section 5 focuses on the impact on and measures taken by Regional and National Research and Education Networks around the globe, including in Asia-Pacific, Central Asia, Africa, Eastern Mediterranean and Middle East, Latin America and North America.

- Section 6 draws together the main points and conclusions.

- Appendix A shows the projects sites register, one of the working documents GÉANT is using to coordinate its support activities.

- Appendix B provides links to the websites of European NRENs and to locations of key COVID-19-related information and support.

- Appendix C provides links to the websites of global partner regional and national research and education networks mentioned in the deliverable.

Following the original issue of this deliverable on 29 May 2020, partners were invited to submit updates if, for example, they felt there were any significant omissions. Additions and minor amendments were received from one European partner and four global partners, and have been incorporated in this Version 1.1.

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2 EC-Supported Activities

EU leaders, the President of the European Commission and the President of the European Council have all committed to do everything possible to support research, to coordinate efforts and seek synergies within the European scientific and research community. They have also underlined that there is an urgent need to share scientific information and to collaborate both within the EU and worldwide.

The Ministers responsible for research and innovation have demonstrated their own commitment by publicly declaring their support for the first ten priority actions of the first ERAvsCorona Action Plan [ERAvsCORONA_AP].[1] The Action Plan covers first short-term coordinated actions only (it will be updated regularly by the Commission services and national administrations with other R&I coordinated actions that can be taken in the short, medium and longer term). It sets out key measures the Commission services and the Member States are activating to coordinate, share and jointly increase support for research and innovation, in line with the objectives and tools of the European Research Area.

GÉANT has a key role in supporting almost all of these actions:

- #8 Access to Research Infrastructures

    The GÉANT network provides access to the research infrastructures, ensuring the cross-border availability of the services they provide (analytical facilities, biological samples, reagents, pathogen labs, regulatory support, etc.) and the data they hold (e.g. for the re-testing of raw data and assessing the societal effects and effectiveness of pandemic responses) which are vital for researchers working on the coronavirus. Further information about the network is provided in Section 3.1.

- #9 Research data sharing platform

    GÉANT's role in supporting the establishment of the European data exchange platform for SARS-CoV-2 and coronavirus-related information exchange, connected to the European Open Science Cloud, is described in Section 2.1.

- Actions #1 to #6 relate to funding. GÉANT's role in supporting the new research and innovation projects on coronavirus is described in Section 2.2.

In addition to the data-sharing platform and projects mentioned above, this section covers the RDA COVID-19 Working Group, the Virus Outbreak Data Network (VODAN) and the DATA Together COVID-19 appeal and actions. (The overviews are based on the projects' own text.) Demonstrating GÉANT's

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[1] The document has been prepared by DG Research and Innovation for communication purposes. The 'ERAvsCorona' Action Plan is a services document and does not bind the Commission or Member States. It is without prejudice to any future action of the Commission in this area.

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close links with the European Open Science Cloud (EOSC), these initiatives also feature in the list of ways EOSC is supporting COVID-19 research, as drawn up by its Executive Board, namely:

- Supporting the deployment of the dedicated European COVID-19 research data platform, fully integrated within EOSC – a priority thematic pilot initiative to realise the EOSC vision, which will facilitate comprehensive data sharing for the European and global research communities.
- Asking Member States and Associated Countries to contribute data from different domains that is related to COVID-19 research and compute resources.
- Establishing the rapid-response RDA COVID-19 Working Group.
- Utilising OpenAIRE data aggregation technology to create a dashboard to discover COVID-19 research.
- Supporting the VODAN Implementation network to build data models and pilot sharing.

2.1   EMBL-EBI

2.1.1   Overview

The European Molecular Biology Laboratory – European Bioinformatics Institute (EMBL-EBI) and collaborators have recognised the urgency to develop and deploy a pan-European COVID-19 research data platform connected to the European Open Science Cloud (EOSC). The objective is to improve and accelerate the exchange, storage, processing of and access to research data and metadata on the SARS-CoV-2 and COVID-19 disease among researchers globally. The open, trusted and scalable platform will allow scientists and public health agencies to rapidly access and share data and results, accelerating and intensifying the research into and understanding of the virus – its biology, epidemiology, transmission, and evolution – and aiding the development of diagnostics, therapeutics, and effective vaccines.

The initiative builds on existing informatics infrastructures and connectivity (e.g. between EMBL-EBI infrastructure and national public health data infrastructures), services and strengths to enable a very rapid launch of a working system.

The data platform consists of two connected components. The COVID-19 Portal will be the main interface for researchers, bringing together and continuously updating relevant COVID-19 datasets and tools. The SARS-CoV-2 Data Hubs will organise the flow of research data from the outbreak and feed the COVID-19 Portal. Essential metadata will be captured from the various Data Hubs, which will differ to reflect national and regional efforts and requirements.

As a principle, all data and metadata accessible from the COVID-19 Portal will be open and as Findable, Accessible, Interoperable, Reusable (FAIR) as possible. Existing standards already used by the research community will be favoured. In the absence of community standards, specific guidelines will be developed that will adhere to the FAIR principles and will take into account the specificities related to omics data, pre-clinical and clinical research data and epidemiological data. These guidelines will be developed in the context of the new RDA COVID-19 Working Group in synergy with existing initiatives such as the Virus Outbreak Data Network (VODAN) and the GloPID-R alliance.

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Further details are available at [EMBL-EBI_News], [EMBL-EBI_Plan] and [EBI_COVID-19].

2.1.2 GÉANT Support

GÉANT's Research Engagement and Support team has compiled a register of the key sites and institutions involved, per country. Foremost among these are the EMBL and EBI sites themselves and the SARS-CoV-2 Data Hubs (shown in Table 2.1 below and in Appendix A). The team has engaged with the site contacts to establish whether their connectivity and services needs are being met. The Partner Relations and International Relations teams have contacted the appropriate NREN and regional partner to establish whether the sites are connected to and being supported by their national/regional network.

2.1.2.1 *Network*

GÉANT and the local NRENs are providing connectivity to the following key sites:

What / Where	NREN	Comments
EMBL-EBI		
Heidelberg, Germany	DFN	DFN has extended the upgrade trial period for EMBL's Heidelberg connection. (1.5Gb redundant connection being upgraded to 10Gb.)
London/Hinxton, UK	Jisc	Jisc completed an upgrade to 100 Gbps in March on the connection to EBI's Hinxton Campus. In addition, there is a dedicated connection (also at 100 Gbps) to EBI's new offsite datacentre.
Barcelona, Spain	RedIRIS	
Rome, Italy	GARR	
Grenoble, France	RENATER	
SARS-CoV-2 Data Hubs		
National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands	SURFnet	
Erasmus Medical Centre, Rotterdam, The Netherlands	SURFnet	
Eötvös University, Budapest, Hungary	KIFÜ	
Danish Technical University (DTU), Copenhagen, Denmark	DeIC	

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What / Where	NREN	Comments
HPCs		
Jülich Supercomputing Centre, Jülich, Germany	DFN	
CINECA, Italy	GARR	
Barcelona Supercomputing Centre (BSC), Barcelona, Spain	RedIRIS	
Global		
National Center for Biotechnology Information (NCBI), Bethesda, USA	Internet2	
Beijing Institute of Genomics (BIG), Beijing, China	CSTNet	
Hong Kong Cancer Institute, Hong Kong	HARNET	

Table 2.1: EMBL-EBI key sites

2.1.2.2 *Services*

AAI

GÉANT is providing the Life Science Login AAI service for the Life Sciences community through EOSC-Life. EOSC-Life brings together the 13 biological and medical ESFRI research infrastructures to create an open, digital and collaborative space for biological and medical research. The project will publish Findable, Accessible, Interoperable, Reusable (FAIR) data and a catalogue of services provided by participating research infrastructures for the management, storage and reuse of data in the European Open Science Cloud (EOSC).

As at the time of writing (April 2020) the Life Science Login AAI service is at the pre-production stage; the Life Sciences community will initially use the pre-existing AAI service from ELIXIR. When the Life Science Login AAI Service goes into production it will replace the AAI services of the participating Life Sciences research infrastructures.

2.1.3 NREN Support

Jisc has been in contact with some of the EBI experts in data movement, to establish what support can be given, and has also offered to provide advice on data transfer tools. Other areas Jisc is investigating include whether its social science datasets on poverty\deprived areas might supplement the EBI data. The important thing for Jisc in general is to ensure that the researchers know they can call on Jisc (for UK sites such as EBI and whoever in the UK they collaborate with) and GÉANT as required.

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2.2 New RTD Projects on Coronavirus

2.2.1 Overview

On 30 January 2020, the European Commission launched a request for expressions of interest entitled 'SC1-PHE-CORONAVIRUS-2020: Advancing knowledge for the clinical and public health response to the [COVID-19] epidemic' with a budget of €10 million subsequently increased to €48.5 million.

To date, eighteen research and innovation projects have been shortlisted for funding following evaluation by independent experts. These projects will advance the understanding of the novel coronavirus (SARS-CoV-2), contribute to more efficient clinical management of patients infected with the virus, and to the public health preparedness and response to the outbreak.

The 18 projects, involving 140 research teams from across the EU and beyond, will work on:

- Improving epidemiology and public health, including preparedness and response to outbreaks. These projects will help develop better monitoring systems in order to effectively prevent and control the spread of the virus, as well as contribute to the assessment of social dynamics.
- Rapid point-of-care diagnostic tests. Increased efforts will concentrate on enabling front-line health workers to make the diagnosis more quickly and more accurately, which will in turn reduce the risk of further spread of the virus.
- New treatments, in which a dual approach will be adopted. Firstly, accelerating the development of new treatments currently in the pipeline (including therapeutic peptides, monoclonal antibodies and broad-spectrum antivirals), and secondly, screening and identifying molecules that could work against the virus, using advanced modelling and computing techniques.
- Development of new vaccines. The research will focus on developing a prophylactic vaccine and a therapeutic vaccine, which will be used for prevention and treatment respectively.

Research teams are expected to share data rapidly so that results can immediately inform the public health response.

Further details, including a full list of the projects, are available at [EC_18-Projects].

2.2.2 GÉANT Support

GÉANT's Research Engagement and Support team has compiled datasheets on each of the projects, for dissemination to relevant GÉANT teams and individuals, and is engaging with the project contacts to establish whether their connectivity and services needs are being met.

The team has also compiled a register of the sites and institutions involved, per country, for four key projects: EXSCALATE4CoV, BioExcel, PREPARE and Fight-nCoV [EXSCALATE4CoV; BioExcel; PREPARE; Fight-nCoV]; the Partner Relations team is liaising with the NRENs to establish whether the partner sites are connected to and being supported by their national network.

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2.3 RDA COVID-19 Working Group

2.3.1 Overview

The Research Data Alliance (RDA) has established a COVID-19 working group [RDA_COVID_19WG], whose objectives are:

- To clearly define detailed guidelines on data sharing under the present COVID-19 circumstances to help stakeholders follow best practices to maximise the efficiency of their work.
- To develop guidelines for policymakers to maximise timely data sharing and appropriate responses in such health emergencies.

The group will address the development of such detailed guidelines on the deposit of different data sources in any common data hub or platform. The guidelines aim at developing a system for data sharing in public health emergencies that supports scientific research and policy making, including an overarching framework, common tools and processes, and principles that can be embedded in research practice. The guidelines to be developed will address general aspects related to the principles the data should adhere to (FAIR and other principles), as well as specificities related to five individual areas: omics, clinical, epidemiology, social sciences and community participation.

2.3.2 GÉANT Support

GÉANT is supporting the working group by:

- Checking whether GÉANT and the NRENs are providing connectivity for key stakeholders and sites. Where they are, making contact to establish whether there are any issues, whether further services or support are required. Where they aren't, making contact to put them in touch with the appropriate NREN.
- Forwarding information to European and regional partners worldwide, to raise awareness and ensure they can proactively support their users.
- Disseminating news items with the GÉANT community, to raise awareness.

In addition, GÉANT has appointed its Chief Communication Officer, Cathrin Stöver, to the RDA COVID-19 Working Group, which makes GÉANT ideally placed to distribute information on the group's work, with the aim of ensuring the broadest possible global engagement.

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2.4 Virus Outbreak Data Network

2.4.1 Overview

The Virus Outbreak Data Network (VODAN) [VODAN] is a GO FAIR Implementation Network (IN), a consortium committed to defining and creating specific materials and tools as elements of the Internet of FAIR Data and Services (IFDS).

In general, INs implement clearly defined plans and deliverables to deliver an element of the IFDS within a defined time period; foster a community of harmonised FAIR practices; and communicate together on critical issues on which consensus has been reached and which are of generic importance for the community.

The specific purpose of the VODAN IN is to ensure that the data-related issues that have characterised previous epidemics and the early stages of COVID-19 (such as severely suboptimal data management, interoperability and reuse, and unequal or difficult access to data) are remedied and avoided for the remainder of the COVID-19 epidemic and in the future. It aims to do this by making the COVID-19 data FAIR, meaning that it is Findable, Accessible, Interoperable and thus Reusable by both humans and machines (and so also FAIR in the sense of Federated, AI-Ready). The technical components that make this possible can remain in place, waiting in ready state for potential future infectious disease outbreaks. VODAN has a set of 9 targeted objectives by which to achieve its aim.

2.4.2 GÉANT Support

GÉANT is supporting VODAN in the same manner as for the RDA COVID-19 working group, i.e. checking whether GÉANT and the NRENs are providing connectivity for key stakeholders and sites, with appropriate follow-up actions; raising awareness by forwarding information and disseminating news items.

2.5 Data Together COVID-19 Appeal and Actions

2.5.1 Overview

Data Together is a collaboration between the four major international data organisations – the Committee on Data of the International Science Council (CODATA) [CODATA], Research Data Alliance (RDA) [RDA], World Data System (WDS) [WDS] and Global Open FAIR (GO FAIR) [GO FAIR] – to optimise the research data ecosystem, and to identify the opportunities and needs that will trigger federated infrastructures to service the new reality of data-driven science [DataTogether].

Data Together's COVID-19 Appeal and Actions statement [DataTogether_COVID-19] emphasises the necessity and importance of basing data and science platforms and infrastructures on FAIR principles if both the immediate needs and the long-term objectives of global science are to be met. Doing so will maximise the ability to combine, visualise, and use data from many sources; facilitate fine-grained

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data access and protection; and allow decentralised and machine-assisted analysis. The statement urges the accelerated implementation of a FAIR ecosystem, and outlines the boundary considerations for an open science and FAIR data platform dedicated to COVID-19. It also invites data infrastructure organisations to review, support and contribute to three initiatives: the Virus Outbreak Data Network (VODAN) [VODAN], the RDA COVID-19 Working Group [RDA_COVID19-WG] and the Making Data Work for Cross-Domain Grand Challenges global programme [MakingDataWork].

2.5.2 GÉANT Support

GÉANT is supporting the appeal and actions in the same manner as for the RDA COVID-19 working group.

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3 GÉANT Activities

This section describes GÉANT's own activities to support research and education in the areas of network, services, global initiatives and community.

3.1 Network

GÉANT and the NRENs are continuing to provide high-bandwidth, low-latency, high-availability, secure connectivity to enable the European and global R&E community to collaborate at this time of particularly intensive research activity. Designed, engineered and funded always to exceed capacity requirements, the networks ensure that bandwidth is no constraint to the exchange and processing of data. (For a live view of the traffic on the GÉANT backbone network, see [GN_Weathermap].)

3.2 Services

3.2.1 Up2U

The EU-funded Up2U (Up to University) project, in which GÉANT and a number of European NRENs are project partners, has announced that openUp2U [openUp2U], a version of its trusted, remote learning platform, will be available to all schools and universities across Europe, in an effort to support continued learning during the COVID-19 pandemic.

openUp2U has been developed and offered in direct response to COVID-19, with the support of Up2U project partners including GÉANT, NORDUnet, CERN, ownCloud, PSNC, KIFU, NTUA, GRNET, GARR, The Open University and MIUN.

The Up2U platform is a next-generation digital learning environment (NGDLE) that is modular, interoperable, highly customisable and portable. Based on open source technology developed by European not-for-profit organisations and research institutions such as CERN, it offers services such as course management, videoconferencing and file sharing integrated into a learning management system so that teachers and students can collaborate in real time, supporting remote learning and educational support.

These services include:

- Moodle – a course management system based on a free open source software package designed to help educators create effective online courses [Moodle].

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- eduMEET – an open source web-based videoconferencing platform developed in the GÉANT (GN4-3) Project that provides a self-hosted, secure and trustworthy environment for distance learning [eduMEET]. eduMEET is currently in Beta stage.
- SWAN – a turn-key platform to produce digital notebooks to be created in a simple web interface – with text, code, pictures and video – that can be stored in CERNBox [SWAN].
- CERNBox powered by EOS and ownCloud – the Sync and Share storage solution for science, that allows students and teachers to work and collaborate anytime and anywhere from their mobile devices [CERNBox].

Links

What	Link
CONNECT news item Up2U remote learning platform expands access to all schools and universities across Europe	https://connect.geant.org/2020/03/25/up2u-remote-learning-platform-expands-access-to-all-schools-and-universities-across-europe

3.2.2 eduMEET

GÉANT is fast-tracking and making available new services that facilitate communication and collaboration, such as eduMEET [eduMEET]. Developed *by* the R&E community *for* the R&E community, eduMEET offers a low-cost, easy-to-use, secure, trusted VC service for small to medium-sized groups, with screen sharing, file sharing and chat facilities. Although still at Beta stage, it forms a key part of the Up2U NGDLE platform (see Section 3.2.1) and is already being widely used. Examples include:

- By a university lecturer, to deliver lectures to students, and by the students themselves, who are creating virtual rooms in which to do their group work.
- By a school's extracurricular theatre group, for their drama sessions, and by the pupils themselves, to chat after the session has finished.
- By the R&E networking community, for regular meetings and as a virtual open office for ad hoc team communication throughout the day.

Links

What	Link
CONNECT news item URAN rapidly deploys eduMEET to support openUp2U and Ukrainian home research and education	https://connect.geant.org/2020/03/31/uran-rapidly-deploys-edumeet-to-support-openup2u-and-ukrainian-home-research-and-education

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3.2.3 Cloud Offerings

To support NRENs and institutions during the COVID-19 pandemic, the GÉANT Cloud Team has assembled a list of the free cloud offers made available to the GÉANT community by providers including Google, Amazon and Microsoft, and GÉANT's own offers.

The team has also produced an overview of the paid-for cloud services from the GÉANT cloud portfolio, including Frameworks and Preferential Quotations for R&E institutions.

In both cases, the information has provided a useful, at-a-glance view of available offers and services.

Links

What	Link
GÉANT COVID-19 Community Support website Services	https://www.geant.org/People/COVID-19_Community_Support/Pages/services.aspx
GÉANT Cloud Services news item Cloud Services for the R&E Community in the Shadow of the COVID-19 Pandemic	https://clouds.geant.org/in-focus/cloud-services-covid-19/

3.3 Support for Global Initiatives

In addition to the EC-supported activities described in Section 2, GÉANT is supporting global initiatives, in particular REFEDS/InCommon.

3.3.1 REFEDS and InCommon

The Research and Education Federations group (REFEDS) represents research and education identity federations worldwide, and articulates their requirements in the ever-growing space of access and identity management [REFEDS]. As a collaborative project important to the community, REFEDS is supported by GÉANT through the GÉANT Community Programme, with GÉANT playing a Coordinator role, and providing meeting, infrastructure and invoicing support.

The US organisation InCommon provides integrated identity and access management service and software solutions at scale to address needs relating to single sign-on (SSO), access to cloud and local services, and seamless global collaboration for students, faculty, staff, and researchers [InCommon].

REFEDS is working with InCommon in the US and prominent international research collaborations to make sure that federated infrastructures are not putting barriers in the way of researchers using REFEDS and InCommon AAI to access systems, content, data, grant platforms, etc. for life science and epidemiological work specifically in support of COVID-19 research.

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Links

What	Link
REFEDS blog post COVID-19 Call to Action – We Need Your Help: Implement Research and Scholarship Entity Category	https://refeds.org/a/2430
InCommon blog post International Science Community Seeks Help from InCommon Participants	https://www.incommon.org/news/international-science-community-seeks-help-from-incommon-participants/

3.4   Community

3.4.1   SIG-NOC

In light of new challenges caused by the restrictions around COVID-19, the GÉANT-supported Special Interest Group on Network Operations Centre (SIG-NOC) organised a two-hour online meeting to share concerns, common problems and experiences with the theme 'Continued NOC operations in the face of a pandemic'. Among the questions addressed were:

- What challenges and problems have you faced at the NOC since the restrictions started?
- How did you deal with them?
- Have you set up creative solutions to work with your team or solve incidents?
- How did other institutions react to this crisis?

The meeting was attended by 48 participants from 23 different institutions and 19 countries.

Links

What	Link
CONNECT news item Continued NOC operations in the face of a pandemic	https://connect.geant.org/2020/03/17/continued-noc-operations-in-the-face-of-a-pandemic
SIG-NOC wiki page 11th SIG-NOC meeting via VC – extraordinary edition	https://wiki.geant.org/display/SIGNOC/11th+SIG-NOC+meeting+via+VC+-+extraordinary+edition

3.4.2   SIG-Marcomms

The GÉANT-supported Special Interest Group on Marketing Communications (SIG-Marcomms) held an extraordinary meeting, by VC, on 2–3 April to explore marcomms themes through the filter of COVID-19 and NRENs' responses to it. Agenda topics included:

- Crisis communications:
  - Were any NRENs prepared for the COVID-19 crisis?

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- What is the impact on NRENs and on their marcomms teams?
- What lessons can we learn from this situation for future crisis preparedness?
- Challenges and opportunities:
  - What activities have arisen / increased in the COVID-19 context?
  - What are the risks / challenges for NRENs?
  - What are the opportunities for NRENs & marcomms teams to help and to show their strategic value?
  - How and where are we / can we collect and publish stories?
- Internal communications and company culture:
  - How are internal communications adapting to the COVID-19 situation?
  - What is the impact on the company culture for NRENs?
  - What role is the marcomms team playing and what lessons can be learned?

The meeting was attended by approx. 34 participants from 25 countries and 4 continents.

SIG-Marcomms has also compiled and is maintaining a wiki page for sharing ideas and best practices in communication plus other resources around the COVID-19 pandemic, how it is affecting the NREN and R&E communities, and how GÉANT and NRENs are responding / can respond to provide each other with support and information. In particular, it provides a messaging resource, a collection of examples of internal and external communications by several organisations, which can be filtered by world region, topic, audience, organisation, channel and date.

Links

What	Link
Community Communications, PR and marketing wiki page SIG-Marcomms Extraordinary Meeting 2–3 April 2020	https://wiki.geant.org/display/tfcpr/SIG-Marcomms+Extraordinary+Meeting+-+2-3+April+2020
Community Communications, PR and marketing wiki page COVID-19 Communications – Community	https://wiki.geant.org/display/tfcpr/COVID-19+Communications+-+COMMUNITY

3.4.3 GÉANT Community Programme Wiki

The GÉANT community has compiled a series of wiki pages listing information and resources that could be useful to research and education networkers in these times of COVID-19. Representatives of NRENs, universities and other organisations who participate in GÉANT Community Programme working groups are refocusing the groups' efforts in order to address the challenging COVID-19 situation. With a goal to share best practices and resources where possible, GÉANT Task Forces (TFs) and Special Interest Groups (SIGs) are collecting information that could be useful to each other, and gearing up the use of online meeting spaces.

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Statistics on the number of visitors and page views will be provided in the next GN4-3 management report.

Links

What	Link
GÉANT wiki page COVID-19 community activities and resources	https://wiki.geant.org/display/GCP/COVID-19+community+activities+and+resources
Community channel news item GÉANT community pulls together amidst the COVID-19 challenge	https://connect.geant.org/2020/03/18/geant-community-pulls-together-amidst-covid19-challenge

3.4.4   Communications

Statistics on the number of visitors and page views for the communications described below will be provided in the next GN4-3 management report.

3.4.4.1 *CONNECT Online*

GÉANT is using its CONNECT Online website to disseminate to the R&E community key information relating to COVID-19 and to the support, services and resources available. Primarily divided between the Community News and COVID-19 In Focus channels, the items cover commercial offerings and developments of potential help to the community as well as GÉANT- and NREN-related offerings and news.

Links

What	Link
CONNECT Online website	https://connect.geant.org/
Community News channel	https://connect.geant.org/community-news
COVID-19 In Focus channel	https://connect.geant.org/covid
Example news items	
Community channel news item GÉANT community pulls together amidst the COVID-19 challenge	https://connect.geant.org/2020/03/18/geant-community-pulls-together-amidst-covid19-challenge
Community channel news item Fast-track co-creation funding for COVID-19 related activities	https://connect.geant.org/2020/03/31/fast-track-co-creation-funding-for-covid-19-related-activities
COVID-19 In Focus channel item Rescale Partners with Google Cloud and Microsoft	https://connect.geant.org/2020/03/27/rescale-partners-with-google-cloud-and-microsoft-azure-

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What	Link
Azure to Accelerate the Race for COVID-19 Vaccine with Cloud Supercomputers for Researchers	to-accelerate-the-race-for-covid-19-vaccine-with-cloud-supercomputers-for-researchers
Community channel news item EMBL-EBI leads International collaboration to share COVID-19 research data	https://connect.geant.org/2020/04/01/embl-ebi-leads-international-collaboration-to-share-covid-19-research-data

3.4.4.2 *IMPACT Website*

The Communications team is preparing a series of COVID-19-related articles for the GÉANT IMPACT website, beginning with how GÉANT and the NRENs are supporting EMBL-EBI, and including the importance of GÉANT AAI services to the Life Sciences community and COVID-19 research activity in the context of EOSC.

Links

What	Link
GÉANT Impact website	https://impact.geant.org/

3.4.4.3 *NREN and Global Partner News*

GÉANT is promoting activities and news items from European NREN and regional partners, to demonstrate the support R&E networks are providing across the globe. The activities of PSNC, and blog posts from FCCN and from the AAU and RRENs in Africa are three examples.

PSNC

GÉANT created a news item that brought together the activities being undertaken by the Polish NREN, PSNC, to support the fight against COVID-19, including:

- Provision of PIONIER Research and Classroom services.
- Supporting the videoconference of hospitals from Shenzhen and Poznan.
- Provision of free video rooms for hospitals.
- Launch of health self-assessment website.
- Printing 3D visors for hospitals in Poznań.

Links

What	Link
CONNECT news item How PSNC are supporting the fight against COVID-19	https://connect.geant.org/2020/04/20/how-psnc-are-supporting-the-fight-against-covid-19

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FCCN

FCCN, the Portuguese NREN, submitted a blog post to CONNECT Online describing their experience during the pandemic, and how NREN services and activities are supporting the community. Highlights include:

- FCCN has strengthened its capacity to support digital services, with an upgrade to 100 Gbps in the Science, Technology and Society Network (RCTS) connection to Gigapix, the national Internet Exchange Point, and an upgrade in the access from the Azores, Madeira and Algarve universities, which resulted in an increase of 344% in the access rate to RCTS.
- Use of the collaborative platforms delivered by FCCN has increased significantly. For example, Colibri, FCCN's videoconference service, which had pre-pandemic daily averages of 124 meetings and 827 participants reached 2,698 meetings and 63,181 participants on 16 March and 13,216 meetings and 280,616 participants on 24 April.
- Other initiatives in which FCCN is involved include:
  - COVID-19 Distance Learning Observatory, to monitor and support higher education institutions, their teachers and students, in their implementation of distance learning / teaching activities.
  - The Somos todo@s digitais (we're all digital) project, which reaches out to the Portuguese population with elementary digital knowledge to help improve their skills and provide support.
  - Sciende 4 Covid portal, to mobilise the scientific communities in joint research and development projects and activities aimed at combating COVID-19.
- FCCN has used its social media channels for focused communications and engagement, including using its own version of the #StayAtHome hashtag and encouraging its community to share their experience with the work tools and support services provided.

The post also provides 8 examples of the positive media coverage FCCN has received for its activities.

Links

What	Link
CONNECT news item / blog post FCCN's experience during the pandemic and how NREN services are helping the community	https://connect.geant.org/2020/05/12/fccns-experience-during-the-pandemic-and-how-nren-services-are-helping-the-community

AAU and RRENs in Africa

A blog post from the Association of African Universities (AAU) explains why they, together with Regional Research and Education Networks (RRENs) in Africa, are calling for the strengthening of campus network infrastructure so that African higher education institutions can cope with COVID-19 and future global disruptions.

'Amidst the unprecedented COVID-19 pandemic, many academic and research communities have resolved to work remotely for health and safety reasons. This situation has proved the importance of

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building strong communications infrastructures for higher education and research institutions, able to support advanced services delivered through high-speed telecommunications networks.

'The Association of African Universities (AAU), the UbuntuNet Alliance (UA), the West and Central Africa Research and Education Network (WACREN), the Arab States Research and Education Network (ASREN) and the National Research and Education Networks (NRENs) in Africa are therefore calling for investments to support the development and strengthening of campus networks & research and education networks infrastructure and provision of online/remote teaching and learning platforms/tools for African Higher Education Institutions (HEIs). The campus networks, supported by the national and regional research and education networks, are fundamental in transforming methods of teaching, learning and research as a response to the COVID-19 pandemic that has led to the closure of a large majority of African Higher Education Institutions.'

Links

What	Link
AAU blog post AAU and RRENs appeal for strengthening of campus network infrastructure	https://blog.aau.org/aau-and-rrens-appeal-for-strengthening-of-campus-network-infrastructure/
CONNECT news item AAU and RRENs appeal for strengthening of campus network infrastructure	https://connect.geant.org/2020/04/06/aau-and-rrens-appeal-for-strengthening-of-campus-network-infrastructure

3.4.4.4 *Targeted Communications*

GÉANT is forwarding key information to NREN and global partners via established mailing lists to ensure they are well-informed and in the best position to support their users. Examples include:

- Forwarding the EMBL-EBI COVID-19 Action Plan to European NREN and international partners to ensure they are aware and well-placed to support their users.
- Forwarding information about global data initiatives, such as the RDA COVID-19 working group [RDA_COVID-19WG] and the Data Together COVID-19 appeal and actions [DataTogether_COVID-19], to regional partners in Latin America, Africa, Asia Pacific and North America, and to European NREN partners, for further sharing with their partners and communities.

Further targeted communications from Partner Relations included:

- Outreach to all NREN partners at the beginning of the lockdown period to obtain an overview of the national situations and assess early on potential needs, such as increased interest in videoconference services and tools, and learning management systems (LMS).
- Consolidated information on measures put in place by GÉANT, support available and service offerings prepared and shared through the GÉANT CEO with General Assembly members.
- Webinar on real-time communications (RTC) for research and education, and outreach for the service offering, after GÉANT secured a Preferential Quotation with the service provider as part of its Cloud Services activity, which will be made available to all NRENs.

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In mid-March, GÉANT International Relations also reached out to global partners to share information on European efforts related to the COVID-19 pandemic that may be of interest outside Europe. These included:

- The Digital Conference Webinar [Digital_Conf_Webinar].
- The GÉANT Crisis Management wiki [GN_CrisisMgt_Wiki].
- The GÉANT wiki for Educational Resources and Best Practices [GN_Ed_Wiki].
- The first Task Force on Educational Services and Activities (TF-EDU) virtual meeting held on Wednesday, 25 March 2020; GÉANT also encouraged global partners to join TF-EDU [TF-EDU].

3.4.5 Engagement

GÉANT is engaging with NREN partners and research users in a targeted manner, according to their specific roles and needs. For example, the Partner Relations, International Relations and Research Engagement and Support and Community Programme teams are:

- In collaboration with the respective NRENs, contacting research users and communities to ensure their needs are being met.
- Responding to ad hoc requests and invitations, such as:
  - Conducting a webinar with RedCLARA, the non-profit organisation that manages the pan-Latin American advanced R&E network, and RNP, the NREN for Brazil, on what GÉANT is doing to support COVID-19-related initiatives.
  - Presenting at the World Bank Summit on the same topic, with particular emphasis on OpenUp2U and eduMEET.
  - Presenting to UNESCO on Up2U and how GÉANT can support schools.

Support provided by the Partner Relations team includes:

- Providing **tailored support** to NREN partners according to specific needs identified as a result of bilateral engagement, ranging from education / videoconference service licences to GÉANT World Service (GWS) upgrades.
- Initiating the **GÉANT Community Café**. The objective is to provide an informal, open platform for the community to meet (virtually) without a fixed agenda, with the aim of helping to fill the gap in social interactions left by the suspension of the usual programme of GÉANT events and meetings. Two successful sessions took place twice in April, with up to 35 participants. The Café will be continued on a bi-weekly basis. A blog post on the first meeting is available at [Café_Blog].
- Holding **South East Europe (SEE) NREN bilateral catch-ups** focused on GÉANT support for the duration of the pandemic. Plans for the SEE NREN Support Programme have been readjusted for the coming months. The planned regional event has been postponed until next year, and the focus placed on bilateral engagement to ensure that these NRENs (who typically have a smaller budget, less staff and a smaller service portfolio) receive additional support.

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4 European NREN Activities

This information was collected from a number of sources:

- NREN replies to email enquiries from Partner Relations about their initial activities in response to the COVID-19 crisis.
- Announcements on the NRENs' websites (see Appendix B).
- Blog posts, e.g. the EaP blog [EaP_blog].
- Feedback from Partner Relations officers.

As the information below demonstrates, the NRENs are generally coping well with the immediate challenges presented by the crisis and with addressing their users' needs. User demands vary: some NRENs have a customer base that extends into areas such as health care and government and are therefore even more immediately involved in addressing COVID-19-related requirements.

It is important to stress that the NRENs' responses are mainly based on their existing service offers, which met the challenges and needs requiring only occasional adjustments or supplementary measures. Where the capacity of individual services (especially real-time communications applications) did not match the sudden surge in demand, capacity was increased or commercial offerings were facilitated. Generally, however, the NRENs' infrastructure and service offerings held up well to the demands caused by the change in use patterns, demonstrating resilience, robustness, relevance and preparedness in the face of challenging situations.

This section covers NREN activities in the following areas:

- Business continuity.
- Network.
- Services.
- Community.

4.1 Business Continuity

With regard to working practices, NREN staff are generally working from home, with no or only limited travel, and no face-to-face meetings.

The effect of working from home varies between NRENs: for many it was already part of their working practices and therefore the change was not too disruptive. However, in some cases where working

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from home was not part of the norm, there was a slight decrease in efficiency while infrastructure and processes were put in place and staff adapted to the new way of working.

Travel restrictions are having most impact on maintaining the network, as engineers are unable to make site visits. However, the network is continuing to meet user needs (see Section 4.2 below).

Customer support has moved to phone and email completely.

In the absence of face-to-face meetings, meetings are being held via videoconference where possible and practical. However, many meetings have had to be cancelled, including significant events and conferences such as those shown in Table 4.1 below.

NREN	Event
ACOnet	Events to celebrate 20 years of ACOnet in June.
CESNET	Internal strategy seminar, which usually includes all 150 employees.
RedIRIS	Annual event in Zaragoza, from 19 to 21 May.
All	TNC20 in Brighton, UK, 8–12 June – the 36th edition of this flagship GÉANT community conference. Planning for TNC21 is already underway: it will take place 21–25 June 2021, in the same location, Brighton, UK.

Table 4.1: Examples of cancelled events

4.2   Network

The network is meeting the needs of the NRENs' customers in all cases. Some NRENs (e.g. ARNES, GRENA, ULAKBIM) have taken measures to increase the capacity, but even where this is not the case, no bottlenecks have been reported. As IUCC stated in an early blog post, this is one of the benefits of a network that is overprovisioned by design: 'The entire design of the GÉANT network is to be over-engineered. Commercial ISPs engineer their networks to maximise profits. GÉANT requires link upgrades when links exceed 60% whereas ISPs maintain their networks at 95% capacity to maximise profits. The GÉANT network is built to handle sudden and unexpected traffic peaks. Exactly the kind of peaks that can happen in the midst of a global pandemic.' [IUCC_blog_24Mar]

However, the type of traffic has changed, with less research/education taking place at the campuses (and schools, where applicable) and more traffic in and out of the NREN networks.

Some NRENs have taken steps to avoid risking interruptions to the traffic. Belnet, for example, have put their network upgrade on hold for this reason, a critical risk-prevention measure in their case as they provide internet traffic to government and hospitals as well as for the R&E sector. Similarly, URAN have suspended any network architecture changes and upgrades, while RedIRIS have suspended competition for the renewal of their optical equipment for the time being, to focus on current service delivery.

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NRENs provide internet services to the health sector (prominent examples include GRNET, ACOnet, CESNET and Jisc as well as Belnet), which makes their services directly relevant to the response to COVID-19. Meanwhile KIFÜ has set up a new high-speed connection to the new COVID-19 Research Centre, provided cloud capacity in its IaaS cloud platform Cloud for Education (C4E) and allocated part of its HPC capacity to running Folding@Home COVID-19 data processing.

4.3   Services

Please note that although this section has been compiled from multiple sources, the information provided may not be exhaustive. Full details of service offerings can be found on the NRENs' websites; URLs are given in Appendix B.

4.3.1   Real-Time Communications

All NRENs report a huge demand for video real-time communications (RTC) services for various purposes, but in particular centred around education (remote lectures, seminars, lessons, etc.) and meetings of all kinds.

A number of NRENs have their own videoconference services which they offer to their users. These include commercial services rebranded by the NRENs as their own, NREN-run services based on open source systems, and solutions developed in-house. However, most of them state that their capacities are not sufficient to cover all needs. Many of them are working to extend their capacity. For example:

- DFN reported that some of their customers (e.g. Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften (LRZ)) helped out with server capacity and more licences were made available to scale up their system (DFNConf).
- KIFÜ has increased the capacity (by 3.5x) of its videoconferencing platform.
- Uninett are extending the lifespan of an older service, Videobro, which was about to be phased out.

NREN	Own Video Service	Based On	URL
ARNES	ARNES VID	Jitsi	https://www.arnes.si/services/multimedia/video-transmissions/
	ARNES Vox		https://www.arnes.si/services/multimedia/vox-web-conferences/
ASNET-AM	MEET.ASNET.AM	BigBlueButton/GreenLight	https://asnet.am/services.php?art=Videoconference&lang=en
	BAREV.ASNET.AM	Jitsi	
CARNET	CARNET Jellyfish		https://www.carnet.hr/en/usluga/carnet-video-conferences/
CESNET	CESNET Meetings	Pexip	https://www.cesnet.cz/services/webconference/?lang=en
DFN	DFNConf	Pexip	https://www.conf.dfn.de/en/

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NREN	Own Video Service	Based On	URL
FCCN	Colibri	Zoom	https://www.fccn.pt/en/collaboration/colibri/
	VideoCast		https://www.fccn.pt/en/collaboration/videocast/
GARR	OpenMEET	Jitsi	https://www.servizi.garr.it/en/voice-and-video-communications/openmeet
	GARR Webmeetings	Adobe Connect	https://webmeetings.garr.it/
	eduMEET		https://edumeet.org/
	Vconf		https://vconf.garr.it/econfportal-hd/www/news
KIFÜ	eduMEET		https://edumeet.org/
RENATER	Rendez-Vous	Jitsi	https://www.renater.fr/en/RENDEZ-VOUS
	RENAvisio	Scopia	https://www.renater.fr/en/RENAvisio
SURF	Videobellen	Jitsi	https://www.surf.nl/en/node/2839
SWITCH	Meet		https://www.switch.ch/meet/
	SWITCHinteract (fees required)	Adobe Connect	https://www.switch.ch/interact/
ULAKBIM	Jitsi[1]	Jitsi	https://eksisozluk.com/jitsi--3792351
Uninett	Videobro		https://www.uninett.no/en/video-bridge
URAN	WebClass	BigBlueButton	http://www.uran.ua/~eng/videoconf.htm

Notes:

1. Open source solution offered by the NREN to its users as a service.

Table 4.2: NRENs' own video services

At the same time, some NRENs also promote various third-party or commercial services. These are often just recommendations (often based on their availability among their customer base) but in some cases also include licences that the NRENs hold (it is not always clear which is the case, so there might be more licences available through NRENs than is shown in Table 4.3 below).

NREN	Third-Party or Commercial Video Service	URL
ARNES	Webex	https://www.webex.com/de/index.html
	H.323	https://www.arnes.si/services/multimedia/high-quality-videoconferences/
CARNET	Webex	https://www.webex.com/de/index.html
CESNET	Zoom (licences)	https://zoom.us/

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NREN	Third-Party or Commercial Video Service	URL
	Microsoft Teams	https://www.microsoft.com/en-gb/microsoft-365/microsoft-teams/group-chat-software
	Google Meet	https://apps.google.com/meet/
	Webex	https://www.webex.com/de/index.html
DeIC	Adobe Connect	https://www.adobe.com/products/adobeconnect.html
	Zoom	https://zoom.us/
DFN	Adobe Connect	https://www.adobe.com/products/adobeconnect.html
Funet/CSC	Zoom	https://zoom.us/
Jisc	Zoom	https://zoom.us/
PSNC/PIONEER	eduMEET	https://edumeet.org/
	medVC.eu	https://medvc.eu/
RESTENA	Webex	https://www.webex.com/de/index.html
SURF	Microsoft Teams (cooperation with MS)	https://www.microsoft.com/en-gb/microsoft-365/microsoft-teams/group-chat-software
	Amazon Chime video	https://aws.amazon.com/chime/
	Webex	https://www.webex.com/de/index.html
Uninett	Zoom	https://zoom.us/
URAN	eduMEET	https://edumeet.org/
NORDUnet	Zoom (NORDUnet-operated Zoom service)	https://www.nordu.net/content/zoom-0
	Adobe Connect	https://www.nordu.net/content/adobe-connect

Table 4.3: Third-party and commercial video services promoted by NRENs

18 NRENs specifically discuss videoconference services on their websites, whether their own or a commercial service.

4.3.2   Remote Learning

Another urgent user need is for tools to facilitate remote learning. This is a common area of activity for NRENs and they offer a range of options. These differ in scope depending on the NREN's customer base (whether only universities or schools as well) and on the focus of the NREN (whether they provide only network services or offer other services as well).

In most cases these tool options are part of the NREN's usual service offer, so they are not new (with the exception of openUp2U – see Section 3.2.1). However, they are being strongly promoted by the respective NREN and are receiving a lot more attention to ensure they meet users' needs. (For example, KIFÜ has developed its Cloud for Education (C4E) platform to support multi-site redundancy

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and elasticity.) Table 4.4 lists tools that NRENs actively promoted for use in the new situation. As seen before, these are not specially introduced services but existing service offers that have become even more useful in the new situation. Roughly these tools can be categorised as follows:

- Learning management systems (LMSs).
- Remote teaching tools (e.g. video platforms, RTC systems with educational features).
- Content (e.g. repositories of teaching material, access to data bases). This is sometimes offered by the NREN but more often in cooperation with other organisations.

NREN	Service	Remark	URL
ARNES	ARNES Classroom		http://www.arnes.si/nov-arnesov-videokonferencni-sistem/
ASNET-AM	EDU.ASNET.AM	Moodle-based	https://www.asnet.am/services.php?art=e_learning&lang=en
Belnet	Up2U		https://up2university.eu/
CARNET	Google Suite		https://edu.google.com/products/gsuite-for-education/
	Edutorij	Repository of material for teachers	https://www.carnet.hr/en/usluga/edutorij/
	e-Lektire	School books and more	https://www.carnet.hr/en/usluga/e-lektire/
	Portal Nikola Tesla	Digital educational content	https://www.carnet.hr/en/usluga/portal-nikola-tesla/
CESNET	Videoarchive	Media server that can be used e.g. to store lecture videos	https://www.cesnet.cz/services/videoarchive/?lang=en
DeIC	Kaltura	Media portal, video platform	https://www.deic.dk/en/node/701
	Panopto	Media portal, videostreaming	https://www.deic.dk/en/Panopto
EENet	Moodle		https://moodle.org/
	Koolielu (School Life)	Education content	https://www.hitsa.ee/ict-in-education/school-life-portal
	eKOOL		https://ekool.eu/index_et.html
FCCN	Colibri	Videoconferencing for lectures	https://www.fccn.pt/en/collaboration/colibri/
	B-ON	Access to literature	https://www.fccn.pt/en/knowledge/b-on/
GARR	Collection of webinars		https://www.garr.it/en/news-events/1688-4-webinars-dedicated-to-schools
IUCC		Cooperation with MEITAL, the Inter-	https://www.iucc.ac.il/en/meital/

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NREN	Service	Remark	URL
		University Centre for e-Learning	
Jisc		Work to increase access to content for research and education	https://www.jisc.ac.uk/news/statement-on-access-to-content-in-response-to-covid-19-20-mar-2020
KIFÜ	Web portal for digital vocational training	KIFÜ provided infrastructure and capacity; teachers from vocational schools provided the curriculum	https://kifu.gov.hu/content/szakk%C3%A9pz%C3%A9si-tananyagt%C3%A1r-k%C3%A9sz%C3%BClt-kif%C3%BC-k%C3%B6zrem%C5%B1k%C3%B6d%C3%A9s%C3%A9vel
	Cloud for Education (C4E)		https://kifu.gov.hu/szolgaltatasok/ikt/felho/cloud_for_education
MREN	Moodle		https://moodle.org/
PSNC	PIONIER Research and Classroom cloud services		https://classroom.pionier.net.pl/
	dMuseion	Digitalised museums	http://cyfrowe.mnw.art.pl/dmuseion
	dLibra	Digitalised libraries	https://dingo.psnc.pl/dlibra/
RASH/ANA	Virtual University	Portal to digital content	https://vuni.rash.al
RENAM	Up2U		https://up2university.eu/
RENATER	National Centre for Distance Learning (CNED)	Via the French Ministry of Education	https://www.cned.fr/
	FUN MOOC	Online, free and open courses	https://www.fun-mooc.fr/
	Others		https://www.renater.fr/fr
	Gestionnaire d'Accès aux Ressources Numeriques (Educational Resource Access Manager) (GAR)	Access to digital resources	https://gar.education.fr/
SURF		SURF points users to a selection of LMS and other learning tools	https://communities.surf.nl/group/59

Table 4.4: Remote learning tools promoted by NRENs

In addition, a number of NRENs offer advice on a variety of issues (either directly or by pointing to/cooperating with other organisations). This is quite diverse, ranging from how-tos for the

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installation of teaching tools to home education advice and support material for creating online classes. NRENs offering advice include:

- CARNET, Jisc, HITSA/EENet, GARR, IUCC, SURF, DFN, CESNET, Uninett, URAN.

19 NRENs specifically discuss remote learning on their websites, covering one or more of the above aspects.

4.3.3 Other Services

Again, many of these offerings and initiatives are not new but they are being promoted in the light of the COVID-19 crisis:

- Computational resources for users (e.g. cloud storage, virtual machines (VMs)):
  - ○ ASNET-AM, BASNET, GRENA, GRNET, PSNC.
- HPC resources for COVID-19 research: SURF.
- Trust and identity:
  - ○ KIFÜ developed a wrapper interface/proxy for the Teaching Administration System (KRETA) to enable teachers to use their KRETA identity for eduID.hu (Hungarian R&E identity federation).

4.4 Community

4.4.1 Communications

Communications activities by NRENs include the following:

- Promotion of research initiatives:
  - ○ PRACE call for COVID-19 research proposals: promoted by ACOnet, CSC/Funet, IUCC, RENAM.
  - ○ Fast Grants: promoted by BASNET.
  - ○ EUvsVirus-Hackathon: promoted by PSNC.
- Advertising of general research-relevant projects such as folding@home, OpenAccess and FAIR: advertised by SURF, KIFÜ, IUCC, ARNES.
- Warnings about COVID-19-related scams: issued by Belnet, CyNet, CESNET, FCCN.

4.4.1.1 Examples

EaP

A blog post by the six Eastern Partnership (EaP) / EaPConnect countries – Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine – outlines how their NRENs are providing tools and services to support COVID-19 research and remote working and education. Examples include:

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- RENAM (Moldova) is enabling researchers at the Emergency Medicine Institute in Chisinau to use the Digital Imaging and Communications in Medicine (DICOM) Network for storing and transmitting medical images.
- ASNET-AM (Armenia) is supporting the Institute of Informatics and Automation Problems of the National Academy of Sciences in preparations to model the behaviour of the virus.
- GRENA (Georgia) has increased the VM resources and optimised the configuration for several universities.
- BASNET (Belarus) is supporting bioinformatics researchers from the United Institute of Informatics Problems (UIIP) to submit a proposal to the Fast Grants [Fast-Grants] COVID-19 funding initiative.

The post also summarises the online communication and learning tools offered by the EaP NRENs.

Links

What	Link
EaPConnect blog post EaPConnect partners support research and education during the COVID-19 pandemic	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/

IUCC

An IUCC blog post explains how IUCC in Israel, GÉANT and the global NREN community are working together to support research and education. The following two paragraphs are an extract:

'When it seems like the end of the world is near and your researchers need unsurpassed connectivity to research and cure the COVID-19 virus, who will they turn to? The clear answer is in. They will use their NREN and GÉANT connectivity. While the EU is requesting streaming companies to change their default streaming to a lower grade since the European Internet Service Providers (ISP) are having trouble meeting capacity, the GÉANT network continues to hum along providing essential and life-preserving connectivity.

'During this global crisis the IUCC network in Israel continues to provide non-stop connectivity without any bottlenecks, even when an accident involving a tractor cut a fibre bundle at a major intersection near Tel Aviv. This kind of engineering and the GÉANT backbone kept institutions connected until the carriers fixed their fibre cuts within four hours.'

Links

What	Link
IUCC blog post When a Pandemic Hits You Want an Academic Network	https://www.iucc.ac.il/en/blog/covid-19-pandemic-iucc-network/
CONNECT news item When a Pandemic Hits You Want an R&E Network	https://connect.geant.org/2020/03/24/when-a-pandemic-hits-you-want-an-re-network

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4.4.2 Engagement

- Online events:
  - ○ PSNC is supporting the wider community, not just the R&E community, through its involvement with online events, using technology to provide access to arts and cultural activities that have been widely cancelled as a result of COVID-19. For example, it has facilitated the live broadcast of a performance by New Theatre (Teatr Nowy) in Poznań [PSNC_TeatrNowy] and transmission of the rosary prayer with Archbishop Stanisław Gądecki from the private chapel of the Bishops' Residence in Ostrów Tumski [PSNC_RosaryPrayer].
- Support for governments:
  - ○ KIFÜ is providing a videoconferencing and communication platform for the Hungarian government (for ministerial meetings, press conferences, etc.) and extending its existing videoconferencing and streaming capability of KIFÜ (e.g. streaming via external registered web broadcasters, installing videoconferencing room systems at ministries).

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5 Global Partner Activities

This section focuses on the impact of the COVID-19 pandemic on Regional and National Research and Education Networks (RRENs/NRENs) around the globe, and the measures that RRENs and NRENs have taken to support activities in the fields of research and education impacted by the crisis.

5.1 Eastern Partnership Countries

- Information on the six Eastern Partnership NRENs – ASNET-AM (Armenia), AzScienceNet (Azerbaijan), BASNET (Belarus), GRENA (Georgia), RENAM (Moldova) and URAN (Ukraine) – is provided in Section 4 European NREN Activities. Specifically, they are mentioned in Section 4.2 Network, Section 4.3.1 Real-Time Communications, Section 4.3.2 Remote Learning and Section 4.4.1 Communications, with further detail in the EaP blog post [EaP_blog].
- **EaPConnect project events and workshops:** All EaPConnect workshops have been cancelled or postponed until the autumn of 2020, at which point EaPConnect2 will have started.

5.2 Asia-Pacific

- **TEIN*CC**
  - ○ 17 Asi@Connect sub-projects being undertaken by partners have been impacted: 14 have had to cancel or postpone events while 3 were able to switch to online events. It is expected that there will be greater use of online resources to deliver sub-projects in the coming months.
  - ○ On 7 May the Bangladeshi NREN, BdREN, organised a digital seminar to exchange best practice among Asi@Connect partners in supporting COVID-19 activities. This is part of an Asi@Connect sub-project on facilitating the use of videoconferencing that also sees the involvement of NORDUnet (NORDUnet has agreed to extend Zoom licensing free of cost till 31 December 2020).
- **CERNET (China)**
  - ○ In early February 2020 CERNET moved quickly to ensure all academic teaching continued remotely throughout the epidemic. Bandwidth was upgraded by 65G free of charge to 150 user sites across China and enhanced, distributed network management was introduced to maintain service quality. CERNET also accelerated the deployment of the CERNET Authentication and Resource Sharing Infrastructure (CARSI) to support scientific research protection and control in academic and research institutions. Through CARSI, teachers,

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students and researchers can access 140K journals and 10K experiments and teaching videos at home and abroad.

- **NKN (India)**
  - Virtual classroom services, access to digital libraries and videoconferencing are being provided over the NKN backbone.
  - NKN prioritised a capacity upgrade for medical research institutions and teaching hospitals.
- **ThaiREN (Thailand)**
  - ThaiREN is supporting the Thai Massive Open Online Course (MOOC) platform and extensive use of Zoom.
- **NREN (Nepal)**
  - In conjunction with other partners, NREN has developed a Nepal COVID-19 surveillance app [Nepal_COVID-19_App].
- **PERN (Pakistan)**

  PERN has:
  - Deployed shared High Availability (HA) Moodle instances for students without internet.
  - Deployed a shared BigBlueButton instance.
  - Supported 20+ universities migrating to hosted Moodle.
  - Rolled out MS Teams to 50+ universities.
  - Collected data on online readiness of universities.
- **LEARN (Sri Lanka)**
  - LEARN is supporting RTC services (Zoom) and LMS (Moodle).
- **AfgREN (Afghanistan)**
  - AfgREN has hosted the Higher Education Learning Management System (HELMS) on Amazon Cloud for students who have access to the internet and made a copy locally available through the National Internet Exchange of Afghanistan (NIXA) for students without internet access.
- **AARNet (Australia)**
  - AARNet has doubled the capacity of its Zoom service to respond to increased demand as customers shift course delivery online, and has implemented enhanced security features. International capacity has also been increased for academic studies and COVID-19 research, including tripling capacity with China.
- **REANNZ (New Zealand)**
  - REANNZ has temporarily lifted internet burst capacity for all members.

5.3 Central Asia

- **CAREN CC**
  - The CAREN Cooperation Centre (CAREN CC) has provided the BigBlueButton webconferencing system [BigBlueButton] for the HiEdTech project by creating accounts in 15 universities across five Central Asian countries.

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- ○ The CAREN CC provided technical support for a webinar entitled 'How the Republic of Korea turned the tide on COVID-19 using ICT', held as part of the collaboration between Central Asia and the Asian and Pacific Training Centre for ICT for Development (APCICT).
- **KRENA (Kyrgyzstan)**
  - ○ KRENA has provided BigBlueButton [BigBlueButton] for its users, particularly for students of the telematics department of the Kyrgyz State Technical University.
  - ○ Teleconferences and teleconsultations at the National Centre of Cardiology and Internal Medicine connected to the KRENA network have become an integral part of everyday Kyrgyz events in response to COVID-19. Medical doctors from the Department of Pulmonology use Zoom for videoconferencing and share their experiences on diagnosis, treatment and personal protect against COVID-19.
  - ○ KRENA is enabling cooperation between Dr. Miklos Kozlovszky of Obuda University, Hungary, and the Kyrgyz State Technical University on the remote monitoring of patient data (blood pressure, heart, pulse, etc.), which is needed especially in such situations as quarantine and self-isolation of citizens during the COVID-19 pandemic. This work presents the next steps for the development of a mobile service for personal electrocardiogram (ECG) monitoring, which was started with the financial support of the CAREN Enlighten Your Research (EYR) programme and the technical support of the CAREN network and Obuda University (Hungary).

5.4 Africa

5.4.1 North Africa

- **ASREN**
  - ○ ASREN holds bi-weekly videoconferences with its partners to exchange experiences and best practices (e.g. assessments, etc.).
- **Morocco**
  - ○ The Ministry of Education has launched an e-learning portal [Morocco_eLPortal] hosted on the MARWAN network and has encouraged the use of Zoom, etc. for K12. However, there is an impact on home education caused by the unaffordability of tables, computers or internet access in low-income homes, hence the main focus is currently on educational TV channels.
  - ○ All universities are connected to the MARWAN network. Some universities are more experienced in distance learning with advanced platforms, whilst others provide downloadable material on their websites.
  - ○ MARWAN's focus is now on providing sufficient cloud computing services for educational content.
- **Algeria**
  - ○ Television channels are broadcasting lessons for students in primary and secondary education. This is important for Algeria where many homes lack access to computers or tablets, as well as the internet.

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- ○ The ARN data centre hosts university e-learning platforms.
- ○ ARN is interested in a national instance of openUp2U.
- **Egypt**
  - ○ EUN has coordinated with major IT vendors in relation to university support services (e.g. MS Teams, Webex, AWS).
  - ○ Efforts have been made to maximise the benefits of learning management systems (LMS) already used at most universities.
- **Tunisia**
  - ○ CCK has set up a videoconferencing tool based on Jitsi to assist faculty members in holding synchronous classroom sessions with their students.
  - ○ CCK has set up a VPN-SSL service for the entire academic community to give access to scientific resources published by Elsevier, Springer, IEEE, Wiley, etc., and available via the Centre National Universitaire de Documentation Scientifique et Technique (CNUDST) [CNUDST].
  - ○ The Ministry of Higher Education has officially requested from the three main telecoms operators free 4G access to all digital resources and services commonly used by the Tunisian academic community, namely resources hosted at *.rnu.tn and *rnrt.tn, G Suite Enterprise for education, Microsoft Office 365, etc.

5.4.2   East and Southern Africa

Infections have been registered in nearly every if not all countries of East and Southern Africa. Governments are taking very strict measures to limit the spread of the virus because most African countries are unable to manage the crisis if it reaches levels seen in Europe due to the status of their health systems and a lack of resources. Typically, most governments in the region closed schools and universities many weeks ago. While most European universities have migrated to online teaching and learning, most universities in East and Southern Africa remain completely closed.[2] In fact, some NRENs have seen their traffic reduced to as low as 10% (e.g. KENET in Kenya).

Highlights of what is happening in the region and what the UbuntuNet Alliance is doing to support the NREN community include the following:

- **UbuntuNet Alliance**
  - ○ The UbuntuNet Alliance has initiated regular meetings with the NREN CEOs in the East and Southern Africa region to share experiences and learn what the NRENs are doing to support the universities in each country. This forum has proved very effective for sharing of best practices and ideas across the NRENs in the region. The online/VC attendance by the NREN CEOs has been very encouraging.
  - ○ The UbuntuNet Alliance is working with telecoms operators on the possibility of zero rating for educational websites for students in Africa. The engagement relates also to relevant support and to opening up in the countries where NRENs have identified potential for increased support levels. For instance, Eb@le, the NREN in the Democratic Republic of the

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[2] A summary provided by the UbuntuNet Alliance shows that, as at 11 June, the universities in 6 of the 15 NRENs/countries in the region have either opened or are in the process of opening (with dates set and/or plans for phased opening).

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Congo (DRC), has had positive discussions with the telecoms company Airtel for possible zero rating of educational websites [Airtel].

○ The UbuntuNet Alliance participated in a videoconference organised by the Association of African Universities and the UbuntuNet Alliance, WACREN and ASREN to discuss joint actions that can be taken by the four organisations in response to the COVID-19 pandemic, supporting universities with digital solutions. A joint press statement has been issued [AAU_PR] and a concept paper is being developed that will be used to seek financial support from the African Union Commission, African governments and development partners to support digital solutions for the COVID-19 disruption to teaching and learning.

○ The UbuntuNet Alliance is exploring the possibility of hosting BigBlueButton [BigBlueButton] using cloud services to support NRENs and their universities where there is interest in migrating to online teaching and learning but the required infrastructure is lacking. UbuntuNet Alliance engineers have already implemented the BigBlueButton solution and are testing it under pilot before potential roll-out to NRENs and universities in the region that do not have capacity to host on their own. The Alliance is also providing technical support to NRENs that are working towards helping their member universities to migrate to online teaching, such as ZAMREN in Zambia and MAREN in Malawi.

○ The UbuntuNet Alliance has been engaging with the World Bank on responses to COVID-19 and on 30 April 2020, they jointly hosted a 1.5 hour VC meeting with the NREN CEOs and CTOs sharing ideas on best response measures, challenges and opportunities. The meeting was entitled 'NRENs as Life-Savers for Universities during COVID-19'.

○ The UbuntuNet Alliance website home page [UbuntuNet] provides a link to the COVID-19 Corona Virus South African Resource Portal [SAcoronavirus]. The portal offers a range of information and resources relating to the virus for the general public.

- **Somalia (SomaliREN)**

○ An example of work by NRENs to support their member institutions is SomaliREN [SomaliREN], which, for instance, is connecting universities and supporting them in the use of services such as BigBlueButton (an open source webconferencing system [BigBlueButton]) for online teaching and learning. Nevertheless, SomaliREN still needs support itself to do more to help the universities in Somalia. For instance, SomaliREN is exploring ways to increase capacity as the demand for online teaching and learning now requires the running of 70 concurrent lectures via BigBlueButton.

- **Kenya (KENET)**

○ The NREN in Kenya, KENET [KENET] is offering a data bundle to university students negotiated down from $15 to $5 for 10GB per month.

- **Tanzania (TERNET)**

○ The Tanzania NREN, TERNET [TERNET], is facilitating negotiations with the local telecoms for affordable bundles for students and faculty.

- **Zimbabwe (ZIMREN)**

○ Similar discussions are ongoing in Zimbabwe between the NREN (ZIMREN) and telecommunications companies.

- **Mozambique (MoRENet)**

○ The Mozambican government is strongly supporting the NREN in Mozambique, MoRENet [MoRENet], to offer online teaching and learning. MoRENet has requested an upgrade of

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an additional 5 Gbps for its access to the UbuntuNet network. UbuntuNet engineers have commissioned 2.5 Gbps as per the original contract, with potential for expansion in the near future. UbuntuNet engineers are currently working with MoRENet engineers to effect a capacity upgrade for the Malawi connection to the UbuntuNet network.

- **Uganda (RENU)**
  - The Uganda Christian University have immediately expanded their learning management system and have held take-home exams. University students are being reached through email, mobile messenger services and social media platforms (e.g. Facebook, Instagram).
  - RENU, the Ugandan NREN, has expressed an interest in a local deployment of openUp2U. Discussions are ongoing between GÉANT and RENU to look at the feasibility of a local deployment.
- **Malawi (MAREN)**
  - The Catholic University of Malawi has been migrating to an online platform, although it is recognised that some students will not be able to access it. Those students will be given a chance to start from where they left off after the COVID-19 pandemic is over. The university developed the online teaching platform and modules within weeks of the pandemic.

5.4.3   West and Central Africa

The first case of COVID-19 in West Africa was recorded in Nigeria at the end of February. The infection has since spread to nearly every if not all countries in West and Central Africa. The exponential expansion of the infection is putting national health systems and economies under increased pressure.

Countries in West and Central Africa have officially imposed international and national restrictive measures, from complete or partial border closures, to mandatory self-quarantining and lockdown orders. Most countries have closed their administrations, banned public gatherings and imposed curfews on major cities. The situation is having a considerable impact on higher education institutions in Africa: while most European universities have migrated to online teaching and learning, most universities in Africa remain completely shut down. Some are using online education, with varying degrees of effectiveness.

The WACREN backbone is the youngest regional backbone in the international R&E networking landscape, with four countries currently connected to the network, of which two have been connected in the past six months.

In the face of the pandemic crisis, WACREN has been actively supporting its NREN community – to help that community in turn support its user communities and ensure academic continuity – as follows:

- As also mentioned in Section 5.4.2, WACREN has participated in a videoconference organised by the Association of African Universities and the UbuntuNet Alliance, WACREN and ASREN to discuss joint actions that can be taken by the four organisations in response to the COVID-19 pandemic, supporting universities with digital solutions. A joint press statement has been issued [AAU_PR] and a concept paper is being developed that will be used to seek financial support from the African Union Commission, African governments and development partners to support digital solutions for the COVID-19 disruption to teaching and learning.

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- WACREN is supporting the Ghanaian NREN, GARNET, in scaling up its virtual learning infrastructure offering. GARNET is rolling out WACREN Zoom and trialling its integration with learning management systems to support a virtual learning environment. Access is managed via a pilot eduID Ghana federation, currently with identity providers from 12 institutions in the community. A similar activity is in progress in Nigeria with Eko-Konnect.

- WACREN is organising several online training activities for the community that can no longer be held face to face. For example:
  - Capacity-building workshops scheduled for the cancelled WACREN 2020 conference are being converted into online training sessions starting from June 2020.
  - The LIBSENSE [LIBSENSE] workshop on open scholarly communication infrastructure will now be held as a series of community calls amongst library and NREN stakeholders.
  - The peering and traffic engineering training for staff from NRENs connected and aiming to connect to the WACREN backbone will also take place remotely. The technical training will feature a new network and security management supplement ahead of a face-to-face workshop tentatively planned for the second week of October 2020 in Cotonou, Benin.

- WACREN has also been supporting the COVID-19 Smart Development Hack in their community, an initiative from the Federal Ministry for Economic Cooperation and Development (BMZ), the European Commission and 'Team Europe' partners including other EU Member States, tech companies and civil society [WACREN_C19SDHack]. After the announcement of the opportunity in WACREN's community lists, interest from Côte d'Ivoire, Ghana and Nigeria in an Open Science platform to fight COVID-19 based on previous WACREN initiatives led to the timely submission of a number of implementation proposals.

5.5   Eastern Mediterranean and Middle East

- **Lebanon**
  - Universities associated with Lebanon's NREN, TechCARE, have swiftly transitioned to distance learning and working from home with voice over PowerPoint and recorded videos for asynchronous lessons, and webconferencing tools (Zoom, Webex and MS Teams) for real-time communications sessions.
  - TechCARE-associated universities are using Respondus as an online proctoring tool for online student assessment [Respondus].
  - TechCARE secured reduced 4G charges for students via concerted lobbying of the Ministry of Higher Education and Ministry of Telecoms.
  - The American University of Beirut (AUB) shared its own experiences (online virtual labs, teaching in times of crisis, working from home) with other universities, and has received recognition from EDUCAUSE, a non-profit association of IT leaders and professionals that helps higher education elevate the impact of IT [EDUCAUSE].

- **Palestine**
  - No NREN has been established yet and the major obstacles remain adequate connectivity and access to affordable tablets, PCs, etc.
  - The Ministry of Higher Education has developed a portal for teaching content to be uploaded for grades 1-12 [Palestine_eLPortal]. Recorded lessons are being broadcast by

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local TV stations and a dedicated YouTube channel. Students and teachers communicate also via social media groups.

- ○ Universities have their own open educational resources (OER), with Al-Quds Open University leading.

- **Jordan**

  - ○ 3 TV channels have been allocated for delivering primary and secondary education.
  - ○ Platforms such as NoorSpace [NoorSpace] and Darsak [Darsak] have been created to enable the provision of educational material and videos in addition to exams and evaluation for public education.
  - ○ ISPs have provided extra bandwidth to students and also in the rural areas.
  - ○ Big private schools use their own systems and tools for education and evaluation and follow-up.
  - ○ JUNET (the Jordanian NREN) has continued to provide internet services only to public universities. ASREN might intervene with the Ministry of Higher Education to extend provision also to the private ones.

- **KSA**

  - ○ The Saudi Research and Innovation Network, Maeen, secured up to 50% capacity increase at no extra cost for connected members.
  - ○ Maeen is providing unlimited access to the Zoom collaboration service hosted on the Maeen Cloud.
  - ○ Maeen is providing unlimited bandwidth access to e-learning providers in KSA.

- **Oman**

  - ○ OMREN has managed to convince the government to allow videoconference tools that were previously not permitted (e.g. Zoom [Zoom] and Google Classroom [Google_Classroom]).
  - ○ OMREN has configured and launched the filesender service Mirsal [Mirsal].
  - ○ ISPs are providing free access to all edu.om domains from mobiles and home for students to access materials at their schools and colleges. This was achieved as a result of significant lobbying by OMREN.
  - ○ The Ministry of Education is broadcasting lessons through Oman TV.

- **UAE**

  - ○ The IT team of the UAE NREN Ankabut has created an online learning ecosystem, primarily for Khalifa University, with a variety of virtual classroom platforms to choose from (BigBlueButton [BigBlueButton], MS Teams [MS_Teams], Blackboard Collaborate [Blackboard_Collab]) and provided training for faculty and students.
  - ○ Bandwidth has been ramped up.

5.6 Latin America

The National Research and Education Networks (NRENs) of Latin America, together with RedCLARA, are coordinating actions to support their member organisations and the health authorities of their

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countries in the fight against COVID-19. An overview of these activities is provided on the RedCLARA website [RedCLARA_C19Overview]. The information provided includes a contact email address for each of the Latin American NRENs, and a RedCLARA contact email address for countries where an NREN does not currently exist in the region. The website also emphasises that RedCLARA and its member NRENs are not-for-profit organisations.

In addition to the actions taken as a group, referred to in the paragraph above, the Latin American NRENs are, in particular, developing and carrying out supporting actions at a national level. These are described in the following sub-sections.

5.6.1 Network

RedCLARA states that its network and those of the NRENs are being provided the maximum support possible. RedCLARA and some of the Latin American NRENs are in the process of upgrading their networks under the EU-funded BELLA-T project. BELLA-S activities also continue towards completing the construction of the EllaLink cable system that will provide BELLA connectivity to interconnect GÉANT and RedCLARA and support Copernicus traffic between the two regions. It is possible that the impact of COVID-19 – for instance, the lock-down measures – may affect delivery schedules, via restrictions of movement or delays in supply chains. Work is ongoing with suppliers to understand any potential risks of delays. In the case of BELLA-S, the manufacture and construction process continues, and delays, if any, are currently forecast to be minimal.

5.6.2 Services

5.6.2.1 *Videoconferencing and Webconferencing*

- **RedCLARA**
  - With the support of companies dedicated to the provision of desktop videoconferencing services, there is provision of free licences to facilitate videoconferencing services to hospitals, health centres, health professionals and researchers who require it. This is also available for universities and research centres that decide to implement measures to contain the COVID-19 pandemic, by implementing remote working or classes for staff and/or students.
  - The **VC Espresso** videoconferencing service is an easy-to-use tool, available 24 hours a day [VCEspresso]. VC Espresso allows users to schedule and attend webconferences irrespective of whether they are registered on RedCLARA's Colaboratorio collaboration platform.
  - Through RedCLARA, Cisco is offering free 90-day **Cisco Webex** Meetings licences to universities, research and health centres in Latin America [Cisco_Webex].
- **REUNA (Chile)**
  - REUNA has seen its VC usage grow rapidly, from 7,619 VCs held during 2019 to 376,202 VCs held from March to June. The number of users increased from 1,649 to 27,178, reaching a total of 504,757 hours of videoconferencing in that period.
  - In addition, REUNA supports the University of Concepción (UdeC), an NREN partner institution, where specialists have created an online platform for COVID-19 Risk Evaluation

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[UdeC_C-19], in order to decongest health-care centres and provide professional guidance to the community. It uses the videoconferencing service provided by REUNA, named PLAZA, through which teleconsultations with medical professionals are carried out. As of 26 May, approximately 1.5 million accesses had been registered on the platform, 75% of which came from users in Chile, and 701 teleconsultations had been carried out, of which 197 resulted in users being sent into quarantine.

- **CEDIA (Ecuador)**
  - CEDIA has also seen rapid growth of VC usage, from less than 1,000 VCs each week to 80,000. The number of VC licences has grown from around 5,000 to near 20,000.

    At the beginning of March 2020 CEDIA had 122 recurring users in its records; currently, there are around 6,000 active users at the Ecuador level. The number of sessions held between March and May 2020 amounts to more than 26,140 meetings, with nearly 11 million hours accumulated.
    CEDIA has provided its member institutions with the videoconference service through the ZOOM platform.

- **CUDI (Mexico)**
  - CUDI supported universities' needs with Webex temporary free licences. Twenty-five institutions benefited, with up to 1,000 licences for each institution.
  - CUDI also distributed Zoom VCs to support its members.

- **RNP (Brazil)**
  - VC usage grew by 946% between March and April. Compared with April 2019, RNP observed a growth factor of x 10. The increased usage required 60 additional servers.

- **RENATA (Colombia)**
  - RENATA increased VC capacity, installing additional servers to provide VC Espresso services.

5.6.2.2 *Remote Learning*

- **CEDIA (Ecuador)**
  - Moodle services have impacted NRENs that provide the service, in the case of CEDIA through its platform Aprendiendo.ec, a joint effort with the Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT), the Council of Higher Education (CES). The platform has online education content, online libraries, bibliographic resources, open access repositories, multimedia tools and learning games.
  - CEDIA effectively managed an inter-institutional agreement with the renowned learning platform COURSERA, granting free access for the administrative and teaching staff of its member institutions. For CEDIA, it is vital to provide complementary services that allow a permanent contribution in updating knowledge and development of its members' human capital, in this case, with more than eleven subject areas of choice.

5.6.2.3 *Cloud Services*

- **CEDIA (Ecuador)**
  - Between March and May, the use of CEDIA's cloud infrastructure increased by 40%. This is largely due to the increasing demand for resources that the activities of Ecuadorian

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○ educational institutions require to function virtually. It is also caused by the migration, implementation, and deployment of new LMS solutions, operated by CEDIA members.

○ Currently, CEDIA's Moodle cloud service has 200,000 active users among students and teachers nationwide. Before the pandemic, 56 institutions used the CEDIA cloud; currently, 64 educational institutions are using CEDIA's infrastructure, connectivity and technical solutions for their resources and distributed content.

○ Due to the impact of COVID-19, CEDIA has seen an increase in the use of and requests for virtual desktops, which are required by member institutions. CEDIA has registered a 14% increase in demand between March and May 2020 compared with previous years.

- **REUNA (Chile)**

○ In the Private Cloud area, REUNA supports the University of Concepción (UdeC) for the technological development of its coronavirus portal [UdeC_C19]. The UdeC Telemedicine Unit uses the REUNA virtual server platform, + Spacio, where the website is hosted and the processing of the data provided by users is carried out.

5.6.2.4 *Health and Welfare Support*

- **CEDIA (Ecuador)**

○ The ECHO project was created to meet the need for primary Hepatitis C care in the New Mexico community [ECHO]. It focuses on telematically linking specialised doctors with health professionals deployed in rural areas. It currently works in more than 39 countries, among which Ecuador has participated since 2017 with diverse content such as diabetes type 2, hypertension and gynecology.

Since 18 March 2020, CEDIA, within the ECHO project, has developed 8 medical clinics on COVID-19, addressing topics of general interest such as: respiratory management in first, second and third level of care; international experiences in primary care; experimental treatments for COVID-19; advances in research and academia on tests and exams for COVID-19; COVID-19: pregnancy and childbirth; COVID-19: algorithms and decision making.
CEDIA has hosted tutorials from more than 20 national and foreign doctors and academics, and a total of 616 connections with health professionals from urban-marginal and rural areas throughout the country.
This project was carried out until the week commencing 4 May.

○ Since 23 March CEDIA has designed a platform based on videoconference services that facilitates the private, personalised and confidential contact of citizens with health professionals while maintaining social distancing. Currently, the platform is operated nationwide by various institutions, including the Ministry of Public Health of Ecuador, the Ministry of Economic and Social Inclusion, the Children's and Women's Hospital of Cuenca, the North Technical University, the Ambato Technician University, the Central University of Ecuador and the Organisation for the Attention of Psychological Emergencies.

These partner institutions have contributed with around 300 professionals, providing simultaneous consultations through this platform. They have carried out more than 1,500 medical orientations and received excellent feedback from users.

○ BEST.EC is a student welfare assistance platform, which offers students preventive and assistance actions in order to ensure biopsychosocial well-being, comprehensive training

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and human development, seeking to raise their quality of life and develop their potential to continue and complete their studies [BEST]. This site aims to become a permanent link between educational institutions and their students, offering its services at the informational, guidance and assistance level. CEDIA member institutions have free access to this service and can tailor it according to their institutional requirements.

This platform has the following services: Psychological Support, Psycho-educational Support, Vocational Guidance, Primary Medical Care, Legal Advice.

5.6.2.5 *Processing Capacity*

Computing capabilities are made available via SCALAC (Advanced Computing System for Latin America and the Caribbean) [SCALAC] for research activities associated with the virus.

5.6.2.6 *Webinars and Seminars*

- **RedCLARA**
  - Webinars and seminars are being carried out by telehealth networks in Latin America, supported by RedCLARA.

    Four webinars have been held to date, including one entitled 'COVID-19: Technological Innovation in education in times of crisis' that took place in two sessions, on 22 and 24 April respectively. Recordings of the webinars have been made available to the public on the RedCLARA website [RedCLARA_Webinars1; RedCLARA_Webinars2].
  - RedCLARA retransmitted several of the webinars offered by the Latin American NRENs listed below and coordinated others covering all Latin American members, including simultaneous translation services for Portuguese and English-speaking conferences.
- **RENATA (Colombia)**
  - Developed 26 open online activities with a total of 5,397 participants.
- **CUDI (Mexico)**
  - Offered 7 webinars with a total of 829 connections/participants.
- **CEDIA (Ecuador)**
  - Trained around 6,000 participants in webinars and nearly 1,000 in-person participants.
- **RNP (Brazil)**
  - Through the regional school of networks, organised a total of 22 webinars with 6,046 participants.

5.6.2.7 *Large File Transfers – eNVIO*

RedCLARA's large file transfer service, eNVIO (based on FileSender [FileSender]), allows users to upload documents, images, presentations, videos and more on the R&E networking cloud platform and to then share them easily and securely with peers [eNVIO].

5.6.2.8 *Wolfram – Mathematica*

Mathematica is a modern technical computing system that covers most areas of the discipline, such as neural networks, machine learning, image processing, geometry, data science, visualisations and

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others [Wolfram Mathematica]. The system is used in many technical, scientific, engineering, mathematical and computer fields. It was created by Stephen Wolfram and developed by Wolfram Research of Champaign, Illinois.

Wolfram is offering free access to its technology to anyone involved in COVID-19-related research, on request. Free access to the 'Mathematica Online' has been arranged for RedCLARA members involved in such research and will last until 15 August 2020.

5.6.3   Community

5.6.3.1 *Engagement*

RedCLARA's annual conference (TICAL/e-CIENCIA) was due to be held from 31 August to 2 September, in Cuenca, Ecuador. In response to the pandemic, the event will now be held in a virtual format only.

5.6.4   NREN Activities

National efforts in Latin America include the increase of availability of services such as webconferencing and infrastructure to support remote learning, trust, identity and security services, etc. Specific services provided by some of the Latin American NRENs to support the institutions and health system within their nations were compiled and published on RedCLARA's website under the following URLs:

- **RNP (Brazil)**
  https://www.redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte/servicios-brasil-rnp

- **RENATA (Colombia)**
  https://www.redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte/servicios-colombia-renata

- **REUNA (Chile)**
  https://www.redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte/servicios-chile-reuna

- **CEDIA (Ecuador)**
  https://www.redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte/servicios-ecuador-cedia

- **CUDI (Mexico)**
  https://www.redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte/servicios-mexico-cudi

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5.7   North America

5.7.1   Canada: CANARIE

- **Network:** Together with the regional R&E networks in Canada, CANARIE is working to ensure that NREN infrastructure continues to support the needs of Canadian research and education communities as the COVID-19 situation evolves. Network teams are on alert and sharing information as they monitor network operations across the country. Normal network escalation protocols remain in effect.

- **R&E Resource Promotion:** CANARIE has posted an online list (regularly updated) of available resources for the R&E community. This includes resources that are available via membership of the Canadian Access Federation, as well as from other organisations in the community. The full list is available at [CANARIE_Resources].

- **Events:** CANARIE has cancelled the Canadian Research Software Conference, originally scheduled for May 26–27 in Montreal. CANARIE's annual event for its members (the CANARIE Annual Summit) is scheduled to be held in the autumn. CANARIE is currently reviewing whether it will be possible for this to go ahead.

- **Research Funding:** In response to logistical challenges that members of Canada's higher education community faced, CANARIE extended the deadline for proposals to the 1st funding call for Local Research Software Support from 17 March to 30 April, with successful projects notified on 8 June.

- **Coordinated R&E Network Mutual Support:** A wiki has been developed for the regional R&E networks in Canada and CANARIE to share information on spare resources that could potentially be shared with other networks in the event of a shortage due to supply chain and delivery issues.

- **Cybersecurity:** Regular meetings are held for CANARIE and the regional networks to discuss cybersecurity issues and countermeasures that are encountered as a result of working-from-home orders, etc. that provide new opportunities for malicious attacks.

- **Research Engagement:**
  - CANARIE is engaged with RDA though Research Data Canada, which is funded by CANARIE.
  - CANARIE is engaged with the Ontario Health Data Platform COVID-19 effort, which is related to medical/clinical data.
  - CANARIE is involved with CanCOVID, a system for research collaboration on COVID.
  - CANARIE is investigating ways that the Canadian Identify Federation can support research and data-sharing activities related to COVID-19.

5.7.2   United States: ESnet

- Lawrence Berkeley National Laboratory, where Energy Sciences Network (ESnet) is headquartered, is located in the San Francisco Bay Area. ESnet is in full remote operations during the California state-wide 'stay at home' order and the Bay Area's 'shelter in place' order issued in response to the COVID-19 pandemic. ESnet is considered mission-essential to the Department of Energy's scientific research infrastructure and will remain open. Although

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ESnet's operations centre is in Berkeley, California, about 40 per cent of the staff live in other states across four time zones and are used to working offsite.

- During Esnet's full remote operations, physical access to operational sites will only be needed to fix hardware failures or an unexpected outage. ESnet's network operations centre will continue to support users remotely. Upgrades and new connections might be delayed as ESnet staff deal with disrupted travel, shipping, and site access due to the evolving public health crisis.

- The National Energy Research Scientific Computing Centre (NERSC) [NERSC], also managed by Lawrence Berkeley National Laboratory, has been appointed to the COVID-19 High Performance Computing Consortium [C19_HPCC]. Led by the White House Office of Science and Technology Policy, industrial partners and Department of Energy, the consortium gives researchers access to supercomputers at the Department of Energy's Argonne, Lawrence Livermore, Los Alamos, Oak Ridge, and Sandia national laboratories. ESnet is providing robust, high-bandwidth connections and peerings, allowing scientists to tap into the computing resources and move data from across the world to those sites for analysis. In one project, scientists at the Beckman Research Institute at the City of Hope are running molecular dynamic simulations that apply to a range of COVID-19 research areas. In particular, they are looking at the difference between the Chinese and Italian strains of the virus as well as potential antiviral treatments. An article on this work has been published on the ESnet website at [ESnet_NERSC_News].

5.7.3   United States: Internet2

- **Network and Services**
  - Internet2 has had to make investments to augment parts of the network that are being exercised in new ways during the pandemic. For example, capacity to Zoom has been increased twenty times and Internet2 has also implemented a ten-fold increase in capacity to home broadband providers to ensure VPN traffic has a high-performance path from the home to the campus.
  - Internet2's research and education traffic has sustained at 81–82% of the level seen before campuses and schools closed. This traffic includes campus-based learning systems, research data sets and campus-to-cloud administrative uses that continue to support the academic enterprise during the pandemic. In terms of peering traffic, Internet2 is seeing only 54% of the traffic it saw when campus residence halls and K12 schools were occupied.
  - When viewed as total traffic moved for all services, the overall change to Internet2 traffic is a reduction of 34%. Internet2 'science traffic' (traffic that the Internet2 analytics tool identifies as science-related applications and science-related compute nodes) remains very consistent during this change.
  - Internet2 is seeing an increased number of service requests for resilient connectivity to cloud providers in support of hybrid campus-to-cloud applications.
  - Internet2 is actively working with campuses and cloud service providers to adjust service licences and share best practices (e.g. videoconferencing, VPN, asset management, course management systems).

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- ○ InCommon has taken proactive steps – along with other partners such as GÉANT – to support global research collaborations [InCommon_News1; InCommon_News2]. (See also Section 3.3.1.)
- **Events:**
  - ○ Internet2 cancelled its annual Global Summit, due to have been held in Indianapolis, Indiana, from 29 March to 1 April.
  - ○ Internet2 has been actively engaging the research and education community in virtual meetings and webinars on topics most helpful to its community during these times. Upcoming and past online events can be found at [Internet2_Events].
  - ○ InCommon training and BaseCAMP events have moved online, with additional webinars being offered such as 'How do YOU use eduroam'.
  - ○ The 2020 Technology Exchange, scheduled to take place in Atlanta, Georgia, from 5 to 8 October, has been cancelled.
- **Internet2 Community Resources:**
  - ○ The Internet2 website provides information on resources available within the community to support research and education activities during the pandemic, as well as a blog providing relevant information for institutions and users on managing a variety of issues (e.g. security; network impacts of increased online learning; community channels for pandemic discussions). Full details are available at [Internet2_Resources].

5.7.4   United States: International Networks at Indiana University

International Networks at Indiana University manages two projects that support US collaboration with Europe and Africa (NEAAR) on the one hand and with Asia (TransPAC) on the other. NEAAR and TransPAC both provide 100G transoceanic connectivity between the US and the corresponding regions. In response to COVID-19, International Networks is working with partners to identify traffic flows relating to COVID-19 research that require support, including troubleshooting where required.

5.8   Global Collaboration Activities

- **CEO Forum**
  - ○ The CEO Forum meeting, planned for Beijing, China, in February 2020, was moved to Los Angeles, CA, USA, on the same dates, due to the COVID-19 outbreak in China since the end of December 2019.
  - ○ The next face-to-face meeting is unknown at this moment, as the meeting originally scheduled to take place in Oxford, UK, in July 2020, has been cancelled.
  - ○ The CEO Forum will meet by VC for the remainder of 2020.
- **Global Network Advancement Group (GNA-G)**
  - ○ A 'COVID-19 Readiness' survey was sent out to the GNA-G Community. Results are being analysed at this moment. A first indication shows that NRENs have taken a lot of measures internally, and have helped their constituency to the greatest extent possible. From the

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responses received, it could also be seen that there is some collaboration among NRENs, typically on a regional scale.

○ The GNA-G Community has seen two of its three face-to-face meetings cancelled already. Whether or not the third one will take place is unknown at this stage; it is scheduled for mid-September 2020. Due to the lack of face-to-face meetings, the GNA-G Community will have two virtual meetings towards the end of May 2020.

○ Before the virtual meetings of the GNA-G Community, another survey will be carried out to try to harvest lessons learned on keeping operations running.

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6 Conclusions

At a time of tension, difference and division – over the best way to address the economic consequences of the COVID-19 pandemic, the timing and severity of control measures, and the origins of the outbreak – GÉANT, the European NRENs and RRENs and NRENs around the globe are united and committed in supporting the research and education community during the COVID-19 pandemic.

The invitations GÉANT has received to present to global organisations such as the World Bank and UNESCO are testament to its key role in providing R&E infrastructure and services, and to the NRENs' role as impartial, trusted, necessary providers.

The fact that amid the urgent calls for research activity no specific mention has been made of connectivity is telling, and a matter of quiet pride but not complacency: the network is taken for granted as a robust, reliable given, even in extreme circumstances such as at present. The same is true of the trust and identity services and Authentication and Authorisation Infrastructure that safeguard access and collaboration: there have been no calls for changes or additions because the existing services and infrastructure already meet the R&E community's most demanding requirements. GÉANT and the NRENs will continue to ensure they live up to that position of trusted dependability, confirming and cementing their fundamental importance to European and global research at all times and especially in times of crisis.

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Appendix A Projects Sites Register

	Projects				
Country	SARS-CoV-2 Data Hubs	EXSCALATE4CoV	BIOXCEL	PREPARE	Fight-nCov
DE	• EMBL ✔	• Fraunhofer Institute for Molecular Biology and Applied Ecology (has to sites (Schmallenberg and Gießen) connected both redundantly with ~500 Mbps) ✔ • Forschungszentrum Jülich ✔	• Forschungszentrum Jülich ✔ • EMBL ✔ • MAX-PLANCK-GESELLSCHAFT ZUR FORDERUNG DER WISSENSCHAFTEN EV – (Max Planck Data Facility Garching connected with 2x 15Gbps) ✔	• CAPNETZ STIFTUNG (not connected) ✔ • UNIVERSITATSKLINIKUM BONN (connected via Bonn University (2x15 Gbps) ✔	• Ulm University (connected via local subnet BelWue) ✔ • University of Duisburg-Essen (connected directly with 2x15 Gbps) ✔
UK	• EBI ✔ (Connection now 100G to Hinxton campus and also dedicated 100G connnection to their new off-site datacentre)		• University of Edinburgh • University of Manchester • IAN HARROW CONSULTING LTD	• Cardiff University • Imperial College of Science Technology and Medicine ✔ • University of Oxford ✔ • ROYAL BROMPTON AND HAREFIELD NATIONAL HEALTH SERVICE TRUST	
NL	• RIVM – National Institute for Public Health ✔ (SURF yet to confirm but site listed on their membership page) • Erasmus MC ✔ (SURF yet to confirm but site listed on their membership page)			• Academic Medical Centre of Amsterdam University (SURF yet to confirm but site listed on their membership page) • UMC Utrecht (SURF yet to confirm but site listed on their membership page) • Erasmus Universitair Medisch Centrum Rotterdam (SURF yet to confirm but site listed on their membership page) • STICHTING WONCA EUROPE ("World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians" Netherlands member is listed as Dutch College of General Practitioners – Could not find the organisation on their members list)	
HU	• Eötvös University				
DK	• DTU ✔				• Aarus University ✔
IT	• EMBL ✔	• Politecnico di Milano ✔ • Università di Milano ✔ • Università Federico II di Napoli ✔ • Università di Cagliari ✔ • INFN ✔ • Istituto per le malattie infettive Spallanzani • CINECA ✔ • Dompé Farmaceutici Spa (Coordinator) (unsure)		• Fondazione Penta ONLUS (unsure)	
BE		• Katholieke Universiteit Leuven ✔ (Site connected – not been in touch about this project)		• University of Antwerp (Coordinator) ✔ (Site connected – not been in touch about this project) • Biocartis NV (Not connected – SME – only possible in some instances so worth pursuing) • Biomax Informatics AG (Not connected – SME – only possible in some instances so worth pursuing)	

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Country	Projects				
	SARS-CoV-2 Data Hubs	EXSCALATE4CoV	BIOXCEL	PREPARE	Fight-nCov
				• Janssen Infectious Diseased Diagnostics BVB (Not connected – SME – only possible in some instances so worth pursuing) • EUROPEAN SCIENTIFIC WORKING GROUP ON INFLUENZA (Not connected – SME – only possible in some instances so worth pursuing)	
SW		• KTH Royal Institute of Technology √	• KUNGLIGA TEKNISKA HOEGSKOLAN (Coordinator) √ • FORWARD TECHNOLOGIES AB (unsure, only if in bioscience park)		• Stockholm University √ • Aldego Biomedical (unsure, only if in boscience park)
PL		• International Institute Of Molecular And Cell Biology In Warsaw (LIMCB) √ (connected, PSNC contacted them and they confirmed that current connectivity and set up is sufficient)			
ES	• EMBL √	• Barcelona Superc. Centre √	• FUNDACIO INSTITUT DE RECERCA BIOMEDICA (IRB BARCELONA). √ (connected to the Regional Network in Catalonia (https://www.csuc.cat/en/communications/anella-cientifica) with a GE physical link but limited to 500 Mbps. • Barcelona Superc. Centre √	• Servizio Galego de Saude – Santiago de Compostela √ (connected to the Regional Network in Galicia (https://www.cesga.es/en/infrastructures/communications/) with a GE link but configured on their own dark fiber link which means that they can implement an upgrade to 10Gbps just replacing the endpoints transceivers.)	
CH		• Swiss Institute of Bioinformatics √ (connected, the Swiss Institute of Bioinformatics is a bit spread over Switzerland. But their core sites are all connected via the respective local University <https://www.sib.swiss/research-infrastructure/core-facilities-competences-centers/sib-core-facilities>., All universities are connected with 10G,)	•	• European Respiratory Society (not connected) • EUROPEAN SOCIETY CLINICAL MICROBIOLOGY INFECTIOUS DISEASES (EUROPAISCHE GESELLSCHAFT FUR KLINISCHE MIKROBIOLOGIE INFEKTIONSKRANKHEITEN) (not connected)	
FR		•	•	• HLA Et Medecine • Institut Pasteur • Biomerieux SA	• CEA √
KR		•	•	• University of Split √ Faculty which is part of the project (University of Split, School of medicine) have dark fiber connection to CARNET network and they connected with 1G connection.	
IE		•	•	• University College Dublin √ (Connected with resilient 100G and also on 100G Dublin network so easy to provide 10G and 100G upgrades if needed. IT manager has been in touch but not about PREPARE project.)	

Table A.1: Annotated projects sites register, showing sites contacted as at 29 April 2020

Appendix B European NREN Websites

Table B.1 gives the URLs to the websites of European NRENs mentioned in the deliverable and to locations of key COVID-19-related information and support.

NREN	Home Page URL	Additional Sites	Additional Sites URL
ACOnet	https://www.aco.net/acohome.html?L=1	News	https://www.aco.net/news.html?tx_ttnews%5Bpointer%5D=2&cHash=627c1d9cec4e827290d23f9590fc5fe2
ANA/RASH	https://www.rash.al/en/	Portal to digital content	https://vuni.rash.al/
ARNES	https://arnes.splet.arnes.si/en/	Supercomputer use for COVID-19 research	http://www.arnes.si/superracunalniki-sling-pomagajo-pri-iskanju-zdravila-za-covid-19/
		ARNES Classroom	http://www.arnes.si/nov-arnesov-videokonferencni-sistem/
		Summary of ARNES actions	https://www.arnes.si/arnesov-pogled-se-bo-internet-med-karanteno-zlomil/
ASNET-AM	https://asnet.am/?lang=en	Summary of the Covid-related actions of/impact on EAP NRENs	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/
AzScienceNet	http://azsciencenet.az/en		
BASNET	http://basnet.by/en/index.html		
Belnet	https://belnet.be/index.php/fr	Coronavirus measures announcement	https://belnet.be/en/news-events/news/coronavirus-which-measures-have-been-taken-belnet

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NREN	Home Page URL	Additional Sites	Additional Sites URL
CARNET	https://www.carnet.hr/en/	Summary of their various VC and education-related services (they promote them in the context of COVID-19 but this is part of their normal offer)	https://www.carnet.hr/usluga/udaljenoucenje/
CESNET	https://www.cesnet.cz/?lang=en	Video archive, suggested to use for recorded lectures	https://www.cesnet.cz/services/videoarchive/?lang=en
CyNet	http://www.cynet.ac.cy/english/CyNet_Home.htm		
DeIC	https://www.deic.dk/en	Security in Zoom	https://www.deic.dk/da/news/2020-05-04/zoom
		Mediahosting services for use in education	https://www.deic.dk/en/mediahosting-0
DFN	https://www.dfn.de/en/	Overview over COVID-19-relevant developments in RTC	https://www.conf.dfn.de/dfnconf-und-covid-19/
EENet/HITSA	https://www.hitsa.ee/	Overview and links to remote education tools and portals	https://www.hitsa.ee/about-us/news/estonia-has-switched-to-digital-remote-learning
FCCN	https://www.fccn.pt/en/	B-ON online library has been expanded in reaction to COVID-19	https://www.fccn.pt/en/b-on-com-conteudos-em-acesso-aberto/
		FCCN's RTC services (which have seen much more use)	https://www.fccn.pt/en/collaboration/
Funet/CSC	https://www.csc.fi/en/home	CSC's central coronavirus site	https://www.csc.fi/en/koronavirusinfo
GARR	https://www.garr.it/en/	GARR have the relevant links on their home page	
GRENA	https://www.grena.ge/eng	Summary of the Covid-related actions of/impact on EAP NRENs	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/
GRNET S.A.	https://grnet.gr/en/	Provision of supercomputer resources for COVID_19-related projects	https://hpc.grnet.gr/news-events/grnet-hpc-resources-for-research-against-covid-19-pandemic/

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NREN	Home Page URL	Additional Sites	Additional Sites URL
HEAnet	https://www.heanet.ie/	Coronavirus statement (and links to more COVID-19-related news)	https://www.heanet.ie/news/heanet-statement-on-coronavirus-covid-19-2
IUCC	https://www.iucc.ac.il/en/	Relevant links (e.g. MEITAL) are on the home page	
		NREN network deals well with the situation	https://www.iucc.ac.il/en/blog/covid-19-pandemic-iucc-network/
Jisc	https://www.jisc.ac.uk/	Jisc's central coronavirus site	https://www.jisc.ac.uk/coronavirus
KIFÜ	https://kifu.gov.hu/	Supercomputer use for COVID-19 research	https://kifu.gov.hu/content/koronav%C3%ADrus-itm-magyar-szupersz%C3%A1m%C3%ADt%C3%B3g%C3%A9p-seg%C3%ADti-stanford-egyetem-koronav%C3%ADrus-kutat%C3%A1s%C3%A1t
LITNET	https://www.litnet.lt/en/		
MARNET	https://marnet.mk/en/		
MREN	http://www.mren.ac.me/		
PIONIER/PSNC	http://www.pionier.net.pl/online/en/	PSNC's website	https://www.psnc.pl/
		PIONIER Classroom services	https://www.psnc.pl/start-working-online-with-pionier-research-and-classroom-services/
RedIRIS	https://www.rediris.es/index.php.en		
RENAM	https://renam.md/	Summary of the Covid-related actions of/impact on EAP NRENs	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/
RENATER	https://www.renater.fr/	Link provided by RENATER for school material	https://www.education.gouv.fr/ma-classe-la-maison-mise-en-oeuvre-de-la-continuite-pedagogique-289680
		Link provided by RENATER for higher education material	https://services.dgesip.fr/T712/covid_19

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NREN	Home Page URL	Additional Sites	Additional Sites URL
RESTENA	https://www.restena.lu/en	COVID-19 announcement	https://www.restena.lu/en/news/215-continuity-adaptation-services-and-infrastructure
SUNET	https://www.sunet.se/		
SURF	https://www.surf.nl/en	SURF's central coronavirus site	https://www.surf.nl/en/coronavirus-and-surf
SWITCH	https://www.switch.ch/	SWITCH's central coronavirus site	https://www.switch.ch/corona/
ULAKBIM	https://ulakbim.tubitak.gov.tr/en		
Uninett	https://www.uninett.no/en	Links on the home page to information around the use of MS Teams and Zoom	
URAN	http://www.uran.net.ua/~eng/news-3.htm	Summary of the Covid-related actions of/impact on EAP NRENs	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/

Table B.1: Links to websites of European NRENs and locations of key COVID-19-related information and support

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Appendix C Regional NREN Websites

Table C.1 gives the URLs to the websites of global partner regional and national research and education networks mentioned in the deliverable.

RREN/NREN	Country	Website URL
Eastern Partnership (for details of the individual NRENs, see Table B.1 in Appendix B)		
EaPConnect	–	https://www.eapconnect.eu/
Asia-Pacific		
TEIN*CC	–	http://tein.asia/sub/?mc=802010
AfgREN	Afghanistan	http://www.afgren.gov.af/
AARNet	Australia	https://www.aarnet.edu.au/
CERNET	China	http://www.edu.cn/
NKN	India	http://nkn.in/
NREN	Nepal	https://www.nren.net.np/
REANNZ	New Zealand	https://reannz.co.nz/
PERN	Pakistan	https://pern.edu.pk/
LEARN	Sri Lanka	http://www.ac.lk/
ThaiREN	Thailand	http://www.thairen.net.th/ThaiREN/
Central Asia		
CAREN CC	–	https://caren.geant.org/pages/home.aspx
KRENA	Kyrgyzstan	http://krena.kg/krena_en/assoc.htm
Africa		
North Africa		
ASREN	–	http://asrenorg.net/
ARN	Algeria	http://www.arn.dz/
EUN	Egypt	http://wcm.portal.eun.eg:10040/wps/portal
MARWAN	Morocco	http://www.marwan.ma/
CCK	Tunisia	http://www.cck.rnu.tn/newcck/index.php
East and Southern Africa		

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RREN/NREN	Country	Website URL
UbuntuNet Alliance	–	https://ubuntunet.net/
Eb@le	DRC	–
KENET	Kenya	https://www.kenet.or.ke/
MAREN	Malawi	http://www.maren.ac.mw/
MoRENet	Mozambique	http://www.morenet.ac.mz/
SomaliREN	Somalia	http://somaliren.org/
TERNET	Tanzania	https://www.ternet.or.tz/
RENU	Uganda	https://www.renu.ac.ug/
ZAMREN	Zambia	https://zamren.zm/
ZIMREN	Zimbabwe	http://zimren.ac.zw
West and Central Africa		
WACREN	–	https://www.wacren.net/
RITER	Côte d'Ivoire	http://www.riter.ci/
GARNET	Ghana	http://www.garnet.edu.gh/
NgREN	Nigeria	http://ngren.edu.ng/
Eastern Mediterranean and Middle East		
JUNET	Jordan	http://www.junet.edu.jo/Home.aspx
Maeen	KSA	https://www.maeen.sa/en/
TechCARE	Lebanon	–
OMREN	Oman	https://www.omren.om/?lang=en
Ankabut	UAE	http://www.ankabut.ae/
Latin America		
RedCLARA	–	https://www.redclara.net/index.php/en/
North America		
CANARIE	Canada	https://www.canarie.ca/
ESnet	US	http://www.es.net/
Internet2	US	http://www.internet2.edu/
International Networks at Indiana University	US	https://internationalnetworks.iu.edu/

Table C.1: Links to websites of global partner regional and national research and education networks

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[Adobe_Connect]	https://www.adobe.com/products/adobeconnect.html
[Airtel]	https://en.wikipedia.org/wiki/Airtel_Africa
[Amazon_Chime]	https://aws.amazon.com/chime/
[BEST]	https://best.ec/
[BigBlueButton]	https://bigbluebutton.org/
[BioExcel]	https://bioexcel.eu/
[Blackboard_Collab]	https://www.blackboard.com/teaching-learning/collaboration-web-conferencing/blackboard-collaborate
[C19_HPCC]	https://www.energy.gov/articles/president-trump-announces-new-effort-unleash-us-supercomputing-resources-fight-covid-19
[Café_Blog]	https://connect.geant.org/2020/04/15/welcome-to-the-geant-community-cafe
[CANARIE_Resources]	https://www.canarie.ca/covid-19-canarie-update/resources/
[CERNBox]	http://cernbox.web.cern.ch/
[Cisco_Webex]	https://www.redclara.net/index.php/en/colaboracion/coronavirus/coronavirus-2020-aporte-de-cisco-webex-meetings
[CNUDST]	www.cnudst.rnrt.tn
[CODATA]	codata.org
[Darsak]	https://darsak.gov.jo/
[DataTogether]	https://www.rd-alliance.org/sites/default/files/attachment/Data%20Together%20Final%20Version%20March%202020%5B5%5D.pdf
[DataTogether_COVID-19]	https://www.rd-alliance.org/data-together-covid-19-appeal-and-actions-0
[Digital_Conf_Webinar]	http://www.eden-online.org/organising-digital-conferences-experience-and-opportunities/
[EaP_blog]	https://www.eapconnect.eu/news-event/eapconnect-partners-support-research-and-education-during-covid-19-pandemic/
[EBI_COVID-19]	www.ebi.ac.uk/covid-19
[EC_18-Projects]	https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation/coronavirus-research_en
[ECHO]	https://echo.unm.edu/echos-impact
[EDUCAUSE]	https://www.educause.edu/
[eduMEET]	https://edumeet.org/

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[EMBL-EBI_News]	https://www.ebi.ac.uk/about/news/announcements/embl-ebi-leads-international-collaboration-share-covid-19-research-data
[EMBL-EBI_Plan]	EMBL-EBI COVID-19 Action Plan
[eNVIO]	https://www.redclara.net/index.php/en/servicios-rc/servicios-de-colaboracion/envio
[EOSC-Life]	https://www.eosc-life.eu/
[ERAvsCORONA_AP]	https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_era-vs-corona.pdf
[ESnet_NERSC_News]	https://www.es.net/news-and-publications/esnet-news/2020/esnet-nersc-continue-to-deliver-supercomputing-networking-support-for-nations-scientists-during-pandemic/
[EXSCALATE4CoV]	https://www.exscalate4cov.eu/
[Fast_Grants]	https://fastgrants.org/
[Fight-nCoV]	https://cordis.europa.eu/project/id/101003555
[FileSender]	https://filesender.org/
[GN_CrisisMgt_Wiki]	https://wiki.geant.org/display/gn43wp8/Crisis+management+information+sharing
[GN_Ed_Wiki]	https://wiki.geant.org/display/NE/COVID-19+-+Remote+educational+tools+and+supporting+information
[GN_Weathermap]	https://tools.geant.org/portal/links/p-cacti/plugins/weathermap/weathermap-cacti-plugin.php?group_id=2
[GO FAIR]	https://www.go-fair.org/
[Google_Classroom]	https://edu.google.com/products/classroom/
[Google_Meet]	https://apps.google.com/meet/
[GreenLight]	http://www.glcollaboration.com/
[InCommon]	https://www.incommon.org/
[InCommon_News1]	https://incommon.org/news/international-science-community-seeks-help-from-incommon-participants/
[InCommon_News2]	https://www.incommon.org/news/the-research-scholarship-club-wants-you/
[Internet2_Events]	https://www.internet2.edu/news-events/events/i2-online/
[Internet2_Resources]	https://www.internet2.edu/about-us/internet2-update/
[IUCC_blog_24Mar]	https://www.iucc.ac.il/en/blog/covid-19-pandemic-iucc-network/
[Jitsi]	https://jitsi.org/
[KENET]	https://www.kenet.or.ke/
[LIBSENSE]	https://spaces.wacren.net/display/LIBSENSE
[MakingDataWork]	https://codata.org/initiatives/strategic-programme/decadal-programme/
[medVC.eu]	https://medvc.eu/
[Mirsal]	https://mirsal.omren.com/
[Moodle]	https://moodle.org/
[MoRENet]	http://www.morenet.ac.mz/
[Morocco_eLPortal]	https://soutiensco.men.gov.ma/
[MS_Teams]	https://www.microsoft.com/en-gb/microsoft-365/microsoft-teams/group-chat-software
[NERSC]	https://www.nersc.gov/
[Nepal_COVID-19_App]	https://play.google.com/store/apps/details?id=com.iclick.covidnew&hl=en
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[openUp2U]	https://up2university.eu/open/
[Palestine_eLPortal]	http://www.elearn.edu.ps/
[Pexip]	https://www.pexip.com/
[PREPARE]	https://www.prepare-europe.eu/
[PSNC_RosaryPrayer]	https://www.psnc.pl/broadcast-of-the-rosary-prayer-with-archbishop-stanislaw-gadecki/
[PSNC_TeatrNowy]	https://www.psnc.pl/broadcast-of-the-performance-at-new-theater-in-poznan-by-psnc/
[RDA]	https://www.rd-alliance.org/
[RDA_COVID-19WG]	https://www.rd-alliance.org/groups/rda-covid19
[RedCLARA_C19Overview]	https://www.redclara.net/index.php/en/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte
[RedCLARA_Webinars1]	https://connect.geant.org/2020/04/29/recordings-of-the-technological-innovation-in-education-in-times-of-crisis-webinar-are-now-available-online
[RedCLARA_Webinars2]	https://redclara.net/index.php/es/colaboracion/coronavirus/coronavirus-2020-nuestro-aporte
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[SomaliREN]	http://somaliren.org/
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[WDS]	https://www.icsu-wds.org/
[Webex]	https://www.webex.com/de/index.html
[Wolfram_Mathematica]	https://redclara.net/index.php/en/colaboracion/coronavirus/contribucion-wolfram-mathematica
[Zoom]	https://zoom.us/

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Glossary

AAI	Authentication and Authorisation Infrastructure
AAU	Association of African Universities
AI	Artificial Intelligence
ASREN	Arab States Research and Education Network
AUB	American University of Beirut
AWS	Amazon Web Services
BIG	Beijing Institute of Genomics
C4E	Cloud for Education
CAREN CC	CAREN Cooperation Centre
CARSI	CERNET Authentication and Resource Sharing Infrastructure
CEO	Chief Executive Officer
CINECA	Common Infrastructure for National Cohorts in Europe, Canada, and Africa
CNUDST	Centre National Universitaire de Documentation Scientifique et Technique
CODATA	Committee on Data of the International Science Council
CTO	Chief Technology Officer
DICOM	Digital Imaging and Communications in Medicine
DRC	Democratic Republic of the Congo
DTU	Danish Technical University
EaP	Eastern Partnership
ELIXIR	European Life Sciences Infrastructure for Biological Information
EMBL-EBI	European Molecular Biology Laboratory – European Bioinformatics Institute
EOSC	European Open Science Cloud
ERA	European Research Area
ESFRI	European Strategy Forum on Research Infrastructures
EYR	Enlighten Your Research
FAIR	Findable, Accessible, Interoperable, Reusable
GAR	Gestionnaire d'Accès aux Ressources Numeriques (Educational Resource Access Manager)
GNA-G	Global Network Advancement Group
GO FAIR	Global Open FAIR
GWS	GÉANT World Service
HA	High Availability
HEI	Higher Education Institution
HELMS	Higher Education Learning Management System
HPC	High Performance Computing
IaaS	Infrastructure as a Service
IEEE	Institute of Electrical and Electronics Engineers

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IFDS	Internet of FAIR Data and Services
IN	Implementation Network
ISP	Internet Service Provider
K12	Kindergarten to 12th grade, the range of primary and secondary education
KRETA	Teaching Administration System (Hungary)
LMS	Learning Management System
LRZ	Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften
MOOC	Massive Open Online Course
NCBI	National Center for Biotechnology Information
NEAAR	Networks for European, American, and African Research
NERSC	National Energy Research Scientific Computing Centre
NGDLE	Next-Generation Digital Learning Environment
NIXA	National Internet Exchange of Afghanistan
NREN	National Research and Education Network
OER	Open Educational Resoources
RDA	Research Data Alliance
REFEDS	Research and Education Federations group
R&I	Research and Innovation
RCTS	Rede Ciência, Tecnologia e Sociedade (Science, Technology and Society Network)
RI	Research Infrastructure
RIVM	National Institute for Public Health and the Environment (The Netherlands)
RREN	Regional Research and Education Network
RTC	Real-Time Communications
RTD	Directorate-General for Research and Innovation
SEE	South East Europe
SIG	Special Interest Group
SIG-Marcomms	Special Interest Group on Marketing Communications
SIG-NOC	Special Interest Group on Network Operations Centre
SSL	Secure Sockets Layer
SSO	Single Sign-On
TF	Task Force
TF-EDU	Task Force on Educational Services and Activities
UA	UbuntuNet Alliance
UdeC	University of Concepción
UIIP	United Institute of Informatics Problems
Up2U	Up to University
VC	Videoconference
VM	Virtual Machines
VODAN	Virus Outbreak Data Network
VPN	Virtual Private Network
WACREN	West and Central Africa Research and Education Network
WDS	World Data System

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