The Potential of National Research and Education Networks
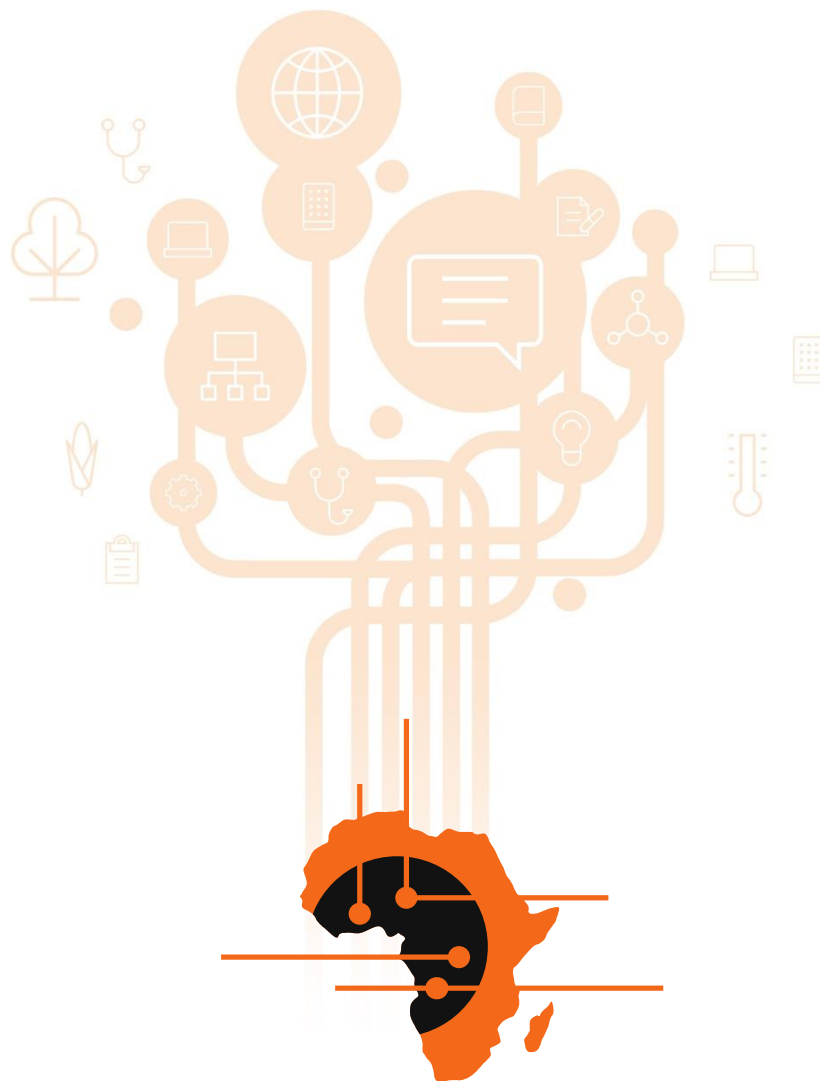
A supporting document to the TANDEM National Research and Education Network Survey

TANDEM

TRANSAFRICAN NETWORK DEVELOPMENT

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Executive Summary

NRENs play a critical role in the development of critical network infrastructure and networked services for researchers and educators. Facilitating the work of these end users has a major impact on the research benefits that researchers can create and a strong, well-educated population. Both of these in turn can have a major impact on a nation's economy. NRENs are an asset for a country and a key component to national and international development. In collaboration with WACREN, the TANDEM project is therefore developing a roadmap for the development of NRENs in West and Central Africa. The survey associated with this document is a major element in this roadmap.

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Glossary / List of acronyms

ACRONYM	DEFINITION
ICT	Information and Communication Technologies
TANDEM	The TransAfrican Network Development project
NREN	National Research and Education Network
RREN	Regional Research and Education Network
WACREN	West and Central African Research and Education Network
NORDUnet	Collaboration between five Nordic NRENs
GÉANT	European RREN
Ubuntunet Alliance	East and Southern African RREN
ASREN	Arab States Research and Education Network
RedCLARA	Latin American RREN

1. Introduction

The presence of a strong NREN can have a major impact on the social and economic development in a country in addition to Research and Education.

The purpose of the AfricaConnect (www.africaconnect.eu) projects is to create international high-capacity Internet networks for research and education in Africa.

WACREN is the West and Central African Research and Education Network (www.wacren.net). WACREN's mission is to build and operate a world-class network infrastructure, develop state-of-the-art services, promote collaboration among national, regional, international research and education communities and build the capacity of the NREN community in the region.

The TransAfrican Network Development project (TANDEM) aims to help WACREN to achieve its goals and to be able to participate in the forthcoming AfricaConnect2 project. In turn this will help WACREN to lead the development of strong NRENs in countries across the region. This will make it possible for African researchers and educators to work with their peers around the world and collaborate on international projects towards socio-economic development in West and Central Africa.

A major step towards this is to understand why research and education network services are needed by end users in the region. A survey has been launched to elicit end-user needs (http://www.tandem-wacren.eu/project-activities/services/end-user-survey/).

This document presents background information that supports the survey. It contains an overview of the purpose of TANDEM and the survey, a short description of NRENs and supporting organisations, a discussion of possible services that can be offered by NRENs, the role that a strong *Regional* Research and Education Network can play in supporting NRENs and, importantly, what NRENs mean to end users. The results of the survey will be available from March 2016 on the TANDEM website www.tandem-wacren.eu.

2. What is a National Research and Education Network?

Research and education organisations are intensive users of national and international communication networks and services. A National Research and Education Network (NREN) is a dedicated Internet infrastructure and service provider to the research and educational communities within a country[1]. NRENs provide connectivity and services to higher education institutions (typically universities) and research institutes, national and international Communities of Practice, but can also support schools, further education colleges, libraries, museums and other public institutes. In some cases, services may be also provided to other sectors such as government and healthcare, for example. The primary focus of all NRENs is arguably therefore to connect universities and research institutes as well as further institutes such as libraries and museums. There are NRENs in many countries in Europe, Latin America, Asia/Pacific, North America and Africa at different levels of maturity. NRENs are a vital component in e-Learning, e-Science and e-Research strategies as they bring a common approach to the coordination and deployment of national

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[1] https://www.terena.org/activities/development-support/r+e-faq/general.html#about

and international communication networks and services. NRENs can provide a wide range of services including, for example, networks and connectivity, middleware (security, authentication and mobility, cross-institute federated support for national and international education and research), networked collaboration services for e-Learning, e-Science and e-Research, and general support services including training, dissemination and international project development. These are further discussed in this document.

Typically there is a single NREN in each country, although some countries may have specific networks for different research and educational sectors. The organisational and ownership (governance) model for NRENs varies. For example, NRENs can be separately incorporated, government departments, or operated by third parties (often university departments) under contract. There are a variety of governance models. Importantly, NRENs can provide network access and provision at a national level rather than at an individual institute level, as well as a common approach to solving national connectivity and service requirements.[2] The recent Compendium of NRENs in Europe (and across the world) contains a map of NRENs worldwide (Map 1.2.1).[3]

There are many organisations and initiatives worldwide that support the global realisation of NRENs and the services that their end users request. The Regional Research and Education Network GÉANT[4] coordinates these activities in Europe. It is owned by its core membership of 36 NREN organisations and one Representative Member (NORDUnet), which participates on behalf of five Nordic NRENs. In Latin America, RedCLARA[5] supports NRENs and network infrastructure across the continent. In Africa, the Ubuntunet Alliance[6], WACREN[7] and ASREN[8] are leading networking infrastructure and African NREN development across their respective regions. These supporting organisations are important to the development of NRENs and can provide information, advice and leadership across a wide range of services as well as helping to strengthen scientific and academic community collaboration. These organisations can also play a significant role in liaising between the region and the wider networking community. Lists of NRENs and their status can be found through their regional associations (e.g. ASREN, GÉANT, RedCLARA, Ubuntunet Alliance and WACREN). Annex A gives a brief overview of each of these Regional Research and Education Networks.

NRENs in the WACREN region include:

Ghana:	GARNET
Côte d'Ivoire:	RITER
Togo:	TogoRER
Niger :	NigerREN
Nigeria:	NgREN
Mali:	MaliREN
Senegal:	snRER
Gabon:	GabonREN

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[2] www.terena.org/publications/files/20090127-case-for-nrens.pdf

[3] www.terena.org/publications/files/Compendium-2014.pdf

[4] www.geant.org

[5] www.redclara.net

[6] www.ubuntunet.net

[7] www.wacren.net

[8] www.asrenorg.net

Benin: RerBenin
Cameroon: RIC

In terms of physically linking emerging African and European NRENs, the AfricaConnect project has established a high-capacity Internet network for research and education in Southern and Eastern Africa and is a gateway to global research collaboration via its interconnection with GÉANT. The AfricaConnect2 project is extending this into West and Central Africa (led by GÉANT and WACREN) and North Africa (led by GÉANT and ASREN).

GÉANT provides an excellent website that provides a wide range of information that supports the reasons why NRENs are so important to national and international research and education communities[9].

3. What Services Can NRENs Provide to End Users?

GÉANT periodically surveys NRENs across the world to know which services they provide, who their users are, and what future plans they have. This is based on a Common NREN Information Model which has been jointly developed by representatives of the major Regional Research and Education Network associations (including those listed above). A questionnaire based on this model is sent to NRENs. The Compendium of National Research and Education Networks in Europe[10] is a comprehensive annual report on the status of European and other NRENs. To illustrate what services a national NREN could provide end users, the Compendium together with relevant reports from other regions[11] have been analysed. Examples of possible services are presented below in three categories:

- Network and Connectivity Services;
- Middleware Services;
- Collaboration Support Services.

3.1 Network and Connectivity Services

Network and connectivity services are the core activities of an NREN and many NRENs either lead or have a major role in the development of a country's research and education network. NRENs can be a focal point for national negotiations for cost-effective network access for research and education stakeholders. An NREN can therefore easily and economically increase network capacity and performance. Similarly, an NREN can be a leader of a framework for the management of critical national infrastructure by providing secure infrastructures and services based on authentication, but also in taking part in the development of Internet Exchange Points (IXP). NRENs can also help institutions to innovate by, for example, helping the introduction of new networking technologies such as efficiently managed wireless networks. NRENs can also organise effective international connectivity including connections to both international partner Research and Education

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[9] http://services.geant.net/case-for-nrens/Pages/Home.aspx
[10] Geant Association (2014). Geant Association Compendium of National Research and Education Networks in Europe. Geant Association, Amsterdam, Netherlands.
[11] https://compendium.terena.org/reports/answers_per_nren

Networks, the general Internet, cross-border fibre networks to reach neighbouring NRENs, etc. The existence of an NREN in a country brings together network organisation and network provider negotiation in a way and at an economy of scale that would not be possible for individual stakeholder organisations. Importantly, an active NREN can be a significant factor in creating a common high-quality, high-bandwidth national network for its members by supporting a dedicated high-performance network that provides a level of performance, reliability and control impossible to achieve solely over the public Internet.

3.2 Middleware Services

Middleware provides critical common services for end users and their applications. These include:

Security Services
There has been a worldwide increase in Internet security issues ranging from viruses to SPAM[12] management to large-scale Distributed Denial of Service[13] attacks. NRENs can provide a range of security services and advice to mitigate these attacks to help institutions create reliable and sustainable security policies that support confidentiality. Some have a dedicated Chief Information Security Officer, formal security policies and compliance with formal security standards (e.g. ISO 27001). Some NRENs also have specific staff members that deal with security issues (e.g. Computer Emergency Response Teams (CERTs))

Authentication and mobility services
The goal of these services is to give specific end-user groups access to services based on each user's identity and role (faculty, staff, student, etc.) as provided and managed by the users' home institution. This means that if an end user has the correct access rights, that end user should be able to log in to any integrated network across a region or to use any shared software or data application regardless of their physical location. A user registered at one university would therefore be able to log in and use a network and appropriate applications at another university. These services are important as they provide a trust framework and underpin how Communities of Practice can work together and seamlessly access common communication, computing, software, data and sensor resources provided by different institutions. Certification Authority services (providers of digital certificates that prove who you are) and Identity Federation services (use of an user's local institution credentials (user ID/password) to allow access services provided by members of the federation) support this form of access to specific end user services and can organise access on the basis of a project, a consortium, a separate entity, a collaboration with primary education, etc.

eduroam[14] is possibly the most well-known example of a mobility service that is commonly provided internationally. It is a secure world-wide roaming service that allows users to obtain Internet connectivity when visiting other institutions by simply opening their laptop. Eduspot[15] is another example of mobile end user access.

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[12] Unsolicited email messages (https://en.wikipedia.org/wiki/Spamming)
[13] http://www.digitalattackmap.com/understanding-ddos/
[14] www.eduroam.org
[15] https://services.renater.fr/mobilite/eduspot/index

Overall, certified federated access to services means that end users can be organised into groups to access resources within an NREN's boundary or across several NRENs. Data protection and access services can be provided at this level. This means networked service support for collaborative initiatives supporting Communities of Practice or large-scale educational programs across multiple national and international institutes can be organised in a standard, straightforward manner. Other examples of federation service include:

- Library resources;
- Catalogue systems and document delivery;
- Collaboration tools such as wikis, event calendar and document repositories;
- Mailing-list subscription services;
- e-learning tools and web portals;
- Video- and web-conferencing;
- Streaming video portals;
- Software licensing;
- Webshops for a range of academic services;
- Access to many different software services, data services, high performance computing (grid/cloud) and sensors;
- Science gateways.

3.3 Collaboration Support Services

There are many types of tools and services that support collaboration between end users and across Communities of Practice.

Network collaboration tools
In research and education, collaboration technology is playing a key role in making project, research and administration work more effectively, by connecting remotely located personnel online. Such remote collaboration helps optimise how time is used, reduce travel costs and lower the environmental impacts of travelling. Examples of NREN services in this area include:
- Numbering schemes and Voice over IP (VoIP) to connect institutional IP telephony deployments or individual end-users;
- Video- and web-conferencing to provide a high-quality audio/video-based collaboration environment, often enhanced by other tools enabling joint work;
- Group collaboration services: i.e. the bundling of services that allow collaborative groups to form and work together easily, independent of their location;
- Multimedia content repositories for the online presentation of materials recorded by higher education and research organisations to complement remote teaching/learning and science dissemination.

Networked e-Science and e-Research resources
e-Science exploits advanced Information and Communication Technologies (ICT) to create innovative collaborative, compute- and/or data-intensive research across all disciplines, throughout the research lifecycle[16]. Collectively, these are known as e-Infrastructures[17] and are supported by national and internationally interconnected RENs. For an end user, e-

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[16] http://escience2015.mnm-team.org/?p=61
[17] http://www.geant.net/About/European_e-Infrastructure/Pages/Home.aspx

Infrastructure services are typically accessed through a web-based portal, or Science Gateway, that uses NREN-provided security services (Identity Federations and Certification Authorities) to access a wide variety of data, software, computing and sensor services provided by one or more institutions. Emerging examples of e-Infrastructure applications in Africa can be found from the eI4Africa project[18] as well as in a live Science Gateway demonstrator for Africa (the Africa Grid Science Gateway – this showcases several demonstration services for life sciences and environmental research)[19]. A review of Science Gateways being used by international Communities of Practice shows the range of collaborations that can benefit from these services and has been produced by the European Grid Infrastructure (EGI) organisation[20].

In many countries NRENs have some role in supporting the provision of services and resources including:

- Grid computing/Cloud computing/High performance computing middleware;
- Computing power (CPUs) & services;
- Storage facilities & data services;
- Software services;
- Sensor services;
- Science gateways.

Some NRENs also provide a range of cloud services (computing/storage) directly rather than procured via a commercial vendor. NRENs can also play an important role in brokering agreements with cloud service providers. Indeed, GÉANT supports a market place for cloud service provision[21]. Additionally, NRENs can provide a testbed and environment for developing the above services for end-user communities.

Support Services

Some NRENs provide support services of some form. These are typically "softer" services in some form of business function rather than network service. Examples include:

- ***Training, Dissemination and Project Development Support***
  Many NRENs have separate customer-support departments and publish website lists of the services they offer as well as offering some form of best-practice guidance to client institutions (such guidance can take many forms; most common are individual consultation with member institutions and publication of technical guides in various areas). In addition, campus networking best-practice guides have been developed.

  Almost all NRENs provide some form of training courses to their users, and most organise national user conferences. Many attract new users by running best practice workshops, organise visiting events, use PR and social media and identify multiplier communities to work with. Regional Research and Education Networks can also provide NREN leadership training and training for project preparation (e.g. RedCLARA provides a Horizon2020 funding opportunities database to help Latin American researchers identify international research opportunities with Europe).

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[18] www.eI4Africa.eu

[19] http://sgw.africa-grid.org/

[20] https://documents.egi.eu/public/ShowDocument?docid=1463

[21] http://services.geant.net/clouds/Service_Directory/Pages/Home.aspx

The coverage of a Regional REN also makes it possible to lead inter-NREN projects to promote regional initiatives (e.g. RedCLARA leadership and support for LA Referencia's federated networks for scientific information[22] that aims to give visibility and access to scientific information generated in Latin America). This support by Regional and NRENs for the development of new international research projects and communities can have a major impact. RedCLARA, for example, facilitated the development of a community of IT managers from Latin American universities (TICAL) and supports their community of practice and organises an annual conference to foster interaction between stakeholders and regional NRENs. The annual conferences of the Ubuntunet Alliance and WACREN also play a key role in this area.

- *Brokerage and Professional Services*
  Some NRENs function as centres of excellence, in service of their clients. NRENs can offer brokerage services (an NREN using its expertise and knowledge to engage with the market on behalf of its clients – e.g. software licensing bulk deals for e-Learning, etc.) NRENs may achieve considerable savings for their clients where there is potential for expansion. NRENs can also undertake framework procurements for network and related equipment. Such procurements are often directed primarily at NREN requirements, though client institutions can use the negotiated terms to their advantage by purchasing equipment for their own networks. Maintenance and support contracts are often part of such frameworks; in some cases, there is a demand for the NRENs to manage these contracts as well.

- *Software development*
  NRENs can develop their own software in support of their end users and the wider international community (some own intellectual property rights to certain software). Some are involved in open-source software development.

- *e-Learning and Massive Open Online Courses (MOOCs) Support*
  MOOCs are online courses that aim to have unlimited participation and open access via the Web. These mix traditional course content including filmed lectures, readings, and problem data with online collaborative features supporting interaction between students and teachers. MOOCs typically use an open access model with an open licensing model for course content. More local versions of MOOCs exist including Small Private Online Courses (SPOCs). NRENs do not typically support MOOCs as these are typically set up by consortium of universities. However, some NRENs advise on what technology to use and how to set up the supporting ICT infrastructure, especially with respect to national and international student access.

4. Impact: What does an NREN mean for end users?

A strong NREN supported by a strong Regional Research and Education Network such as WACREN could have a major impact on the research and education institutes in a country by facilitating a range of activities. The potential impact to end users could include the following in terms of a national network infrastructure and supporting services:

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[22] http://lareferencia.redclara.net/rfr/

- Creation of a high quality, high bandwidth dedicated national research and education network;
- Better and cheaper network access, capacity and performance across a country;
- More effective network links to the public Internet and across national borders to international networks;
- Reliable networks strengthened by contemporary security policies;
- National negotiation for networks and networked resource provision including hardware provision, software licences and maintenance/support contracts;
- The ability for users to logon at any institute using one set of credentials;
- Single sign-on access to communication, computing, software, data and sensor resources provided by different institutions dependent on managed group access.

This in turn can then facilitate a wide range of supporting services and initiatives for national and international Communities of Practice and large-scale educational programs. These include:

- Provision of on-line collaboration tools for research and education;
- Development of advanced ICT for e-Science and e-Infrastructures that can include computing services, storage and data services, software services and sensor services;
- Creation of science gateways or a "one-stop-shop" to support the needs of Communities of Practice;
- Training and support of networked services and best practices;
- Organisation of national end-user conferences and workshops;
- Leadership training;
- Support for software development as well as the provision of software/hardware testbeds;
- Setting up of e-Learning, open online courses and distance learning programmes;
- Advice on the development of inter-regional international initiatives, project preparation and international funding opportunities.

What does this mean for end users? An excellent NREN means that students, educators, researchers and administrators would be able to access critical resources and to work together locally, nationally and internationally using contemporary networking and computing facilities. For example:

- Students and staff would be able to bring their own devices and connect anywhere on campus or at different institutes easily and efficiently;
- Education could be supported by e-Learning facilities that would enable educators and students to work together to deliver effective educational programmes based on internationally available content and services;
- Researchers would be able to work together more easily by having access to scientific apparatus and services and to be able to collaborate easily with national and international colleagues;
- National content can be put at the disposal of international potential users, with an immediate impact of promoting these contents.

An NREN would therefore help in many ways to ease access to services, to bring people closer together and in day-to-day activities that include:

- Internet search for educational support and preparation of research papers;

- Reviewing of journals and participation in international programme committees/editorial boards;
- Remote execution of experiments;
- Access to critical services and applications provided by international partners and active research communities;
- Collaborative research (sharing data with partners, accessing advanced instrumentation in another institution, accessing advanced computing power);
- Virtual meetings using videoconferencing/Web-conferencing;
- Remote participation in conferences;
- Remote delivery of courses/conferences.

Annex A: Regional Research and Education Networks

A.1 WACREN

WACREN is the West and Central African Research and Education Network. Incubation of the regional network started at AfNOG 2006 and at the Regional Workshop on Research and Education Networks organised by the Association of African Universities (AAU) in Accra in November 2006. The need to build organisational and technical capacity within constituent NREN countries was identified as a requirement for a viable network.

A regional consultative meeting was held in November 2009 as a pre-event to the Open Access Conference 2009. The AAU was given the mandate to identify a Task Team to coordinate activities of working groups to produce documents for the establishment of the Regional Research and Education Network.

Following the meeting of representatives of 11 countries in West Africa and Central Africa (Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Gabon, Ghana, Mali, Niger, Nigeria, Senegal, Togo) in Dakar in March 2011, and on the initiative of the Research and Education Networking Unit (RENU) of the Association of African Universities (AAU), the first Board of Directors of WACREN was established, composed of nine (9) members.

In July 2013, at its first Annual General Meeting held in Abuja, WACREN stakeholders appointed a CEO, elected a Chairman of the Board and set up a Search and Nomination Committee for the other members of the Board.

The process was completed end of August 2013, with the constitution of the entire Board of six (6) members, including the CEO.

Vision

The WACREN vision is a world-class infrastructure and services for the West and Central African Research and Education community for development.

Mission

The WACREN mission is to build and operate a world-class network infrastructure, develop state-of-the-art services, promote collaboration among national, regional, international research and education communities and build the capacity of the Research and Education Network community.

Objectives

The objectives of WACREN are the promotion and establishment of interconnections between national research and education networks in West and Central Africa to form a regional research and education network, the interconnection of this network with other regional and continental networks, and the provision of services aimed at fostering collaboration among research and education institutions in the region as well as with peer institutions at the continental and international level.

A.2 UbuntuNet Alliance

UbuntuNet Alliance is a regional association of National Research and Education Networks (NRENs) in Africa. It was established in the latter half of 2005 by five established and emerging NRENs in Eastern and Southern Africa with, these are: MAREN (Malawi), MoRENet, (Mozambique), KENET (Kenya), RwEdNet (Rwanda) and TENET (South Africa). The driving vision was that of securing high speed and affordable Internet connectivity for the African research and education community in Gb/s rather than in Kb/s.

The objectives of the Alliance are, on a non-profit basis, to:

- Develop and improve the interconnectivity between Research and Education Networking (REN) Participants in Africa and their connectivity with research and education networks worldwide and with the Internet generally;
- Develop the knowledge and skills of ICT practitioners in these institutions; and
- Provide related auxiliary services to Research and Education Networking (REN) Participants.

The Alliance is fully incorporated as a non-profit association in Amsterdam, The Netherlands. An affiliated non-profit company will soon be registered in Malawi to handle financial and other secretariat functions, and the Alliance will register further affiliates in other African countries as and when operational considerations require this.

To date, the Alliance's foot print has stretched across the largest land mass of Eastern and Southern Africa with participating NRENs in 15 countries.

A.3 GÉANT

GÉANT was formed on 7 October 2014, when its members agreed to change the Articles of Association of TERENA, changing its name to GÉANT Association, and the majority of DANTE shares were transferred to the association. The GÉANT Project is a major area of the association's work and the association is proud to have adopted the GÉANT name. Overall, GÉANT

- provides practical support for members, educators, researchers and other partners to collaborate, innovate, share knowledge and agree on policies and strategies;
- plans, procures, builds and operates large-scale, advanced international high-speed networks, including the 500 Gbps pan-European GÉANT network;
- organises events such as workshops, meetings, training and conferences, including TNC – Europe's largest networking conference for research and education;
- develops, operates and supports services relating to such areas as trust and identity, security and certification, mobility and access, and media and real-time communications;
- manages R&E networking projects in other regions, such as the Mediterranean, Africa, Central Asia and the Eastern Partnership countries;
- supports R&E networking organisations in Latin America (RedCLARA), Caribbean (CKLN) and Asia-Pacific (TEIN*CC);
- mobilises community expertise, and provides staff expertise in procurement, project management, community engagement, network operations, and outreach including dissemination and training;

- liaises with other e-infrastructure organisations, user communities, industry and with the European Union

A.4 RedCLARA

RedCLARA - *Cooperación Latino Americana de Redes Avanzadas* (Latin American Cooperation of Advanced Networks) - is a non-profit International Law Organisation, whose legal existence is dated on 23 December 2003, when it was acknowledged as such by the legislation of Uruguay.

RedCLARA develops and operates the only Latin American advanced Internet network. Established for regional interconnection and linked to GÉANT (the pan-European advanced network) in 2004 via the ALICE Project (which –until March 2008- was co-funded by the European Commission through its @LIS Programme), RedCLARA provides regional interconnections and connectivity to the world through its international links to GÉANT and Internet2 (USA) and, through them, to the advanced networks of the Caribbean (C@ribnet), Africa (UbuntuNet Alliance), Asia (APAN, TEIN), among others. Thanks to the ALICE2 Project, between December 2008 and March 2012, RedCLARA significantly improved the capacity of its network and expanded its benefits for its members and regional research communities.

RedCLARA is constituted by 13 Latin American countries and its Assembly –where each country has representative- meets every six months to define courses of action and the policies to be implemented.

The initial idea for the formation of RedCLARA arose in June of 2002 in a meeting in Toledo (Spain), organised within the framework of the CAESAR Project -financed by the DG-IST programme of the European Commission. The study led to the creation of the ALICE Project (América Latina Interconectada Con Europa - Latin America Interconnected With Europe).

On that occasion the representatives of the main Latin American academic networks were confronted with the opportunity to finally bring about the Latin American network following many previous attempts to bring it into being.

After the Toledo meetings were held in Rio de Janeiro, Buenos Aires, Santiago de Chile and Mexico City. At these meetings the idea of the Latin American network took shape leading to the reality that is it today, empowering the work of the academic advanced networks of the region.

Only a year after the regional cooperation for the creation of this new infrastructure started, the statutes of the new organisation were signed at the Mexico meeting on 9th June 2003, thereby formally constituting Cooperación Latino Americana de Redes Avanzadas (CLARA; RedCLARA since March 2011) - Latin American Cooperation of Advanced Networks.

Mission
To strengthen the development of science, education, culture and innovation in Latin America through the innovative use of advanced networks.

Vision

The RedCLARA vision is that the organisation will be recognised in 2017 as a key player in strengthening science and technology in Latin America, ensuring that 60% of NREN end users use applications and collaboration platforms federated across RedCLARA, and that 80% of Latin American countries are active members.

A.5 ASREN

ASREN, the Arab States Research and Education Network, is a non-profit international organisation, registered in Dusseldorf, Germany, on 3rd June 2011, under the umbrella of the League of Arab States. ASREN is the association of the Arab region National Research and Education Networks (NRENs), as well as their strategic partners that aims to implement, manage and extend sustainable Pan-Arab e-Infrastructures dedicated for the research and education communities and to boost scientific research and cooperation in member countries through the provision of world-class e-Infrastructures and e-services.

The goal is to connect Arab institutions among themselves and to the globe through high-speed data-communications networks. Such networks will enable sharing and access to a variety of research services and applications in addition to the utilisation of highly sophisticated and technologically advanced computing resources available only at very few institutions in the world. ASREN aims to boost pan-Arab collaborative research and education projects and activities, contribute to promote scientific research, innovation and education across the Arab region.

Vision and Mission

The ASREN vision is to support pan-Arab collaborative research and education projects and activities through high-speed networks, and to contribute to boosting scientific research, innovation and education across the Arab world by increasing efficiency and productivity of research and education communities.

The ASREN mission is to implement, manage and extend sustainable pan-Arab e-Infrastructures dedicated to the use of research and education communities and to boost scientific research and cooperation in member countries through the provision of world-class e-Infrastructures and e-services.

Objectives

ASREN aims at building, maintaining and consolidating regional e-Infrastructures dedicated to e-Science and education across the Arab countries, by developing, managing and operating a regional network that interconnects the NRENs of the Arab countries, promoting the harmonisation of policies and standards in relevant areas at the regional level and advocating at the regional level amongst decision-makers and stakeholders.

ASREN also contributes to creating and sustaining National Research and Education Networks (NRENs), by supporting them in implementing leading-edge technological solutions while pursuing cost-effectiveness and favouring the exchange of expertise and best practices among NREN personnel in the region.

ASREN facilitates collaboration and cooperation among the researchers and academicians in the Arab region by increasing the availability and accessibility of knowledge resources for

students and researchers, promoting the development of Arabic contents and its availability, facilitating knowledge exchange and transfer processes across the region and with relevant partners in Europe and worldwide and promoting the adoption and usage of e-Infrastructures and services among the scientific community, also through training and tutoring activities and strengthening regional partnerships and encouraging joint scientific research at all levels.