

Algerian Research Network  
**Readiness Assessment Report**



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Authors:

Aouaouche Elmaouhab, Algerian Research Network, Algeria  
Salem Al-Agtash, German Jordanian University, Jordan

For further information or to place an order, please contact:

ASREN Office

P .O.Box: 921951 Amman 11192 Jordan

Tel: +9626 5100900

Fax: +9626 5100901

Email: [info@asrenorg.net](mailto:info@asrenorg.net)

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## *Forward*

It gives me pleasure to introduce this readiness report on the Algerian e-Infrastructures, as we move into an era of change towards investing to advance the pan-Arab research and education high-speed communication networks as part of the funding schemes provided by the European Commission in the context of EUMEDCONNECT3 and AfricaConnect2 projects. These networks provide powerful means for team collaboration, sharing of resources, and exchange of real-time simulation and data transfer at the national, regional and global levels. With the support of the European Commission and Talal Abu-Ghazaleh Organization, ASREN has been developing means to connect all Arab research and education institutions in a unified network that provides scientists, academics, students, and researchers with state-of-the-art connectivity. An open exchange point is now established in London to peer with research and education networks at the global level and will be linked to regional open exchange points to emerge in Fujairah – United Arab Emirates and Al Maadi - Egypt.

ASREN will continue to join efforts with its European counterparts to bring new technology means and services to the Arab research and education communities and to provide enhanced educational environments equipped with better tools, connectivity, and services.

**Dr. Talal Abu-Ghazaleh**  
**Chairman of ASREN**

**Summary:** This report is intended to build a business case of the Algerian NREN and its connectivity to the European GEANT network. It provides brief background information on the status of the Algerian higher education and research communities and detailed propositions on why Research and Education Networks are important for the advancement of the Algerian research profile. It also provides a list of communities and beneficiaries of research and education networks and international linkages as well as the potential for Algerian international cooperation. The report proposes key development areas for the Algerian national e-Infrastructure and recommendations to continue sustainable development of international dedicated capacity, funding sources, and service portfolio.

## I. INTRODUCTION

Algeria's educational system has grown rapidly since 1962 and in the last 12 years, attendance has doubled to more than 5 million students. Education in Algeria is free and compulsory to age 16. Higher education institutions are public and are funded entirely by the government.

The standard of higher education in Algeria is based on larger institutions encompassing several smaller specialized departments, and they offer degrees that are graded in three levels, bachelor, master and doctorate. The Ministry of Higher Education and Scientific Research issue academic degrees while the relevant ministries administer vocational qualifications.

The Algerian system of higher education has started the process of transition in 2004 from the traditional structure to the three-cycle Bachelor, Master and Doctorate system. A statutory order of 2005 laid down conditions for the organization of semester-based courses. The European Credit Transfer and Accumulation System (ECTS) is being phased in and a semester counts for 30 credits.

The Algeria's national R&E network "ARN" was deployed in the early 90s to build a technological infrastructure for the benefit of all stakeholders in higher education and scientific research. It provides national and international connectivity and regularly evolves according to the changing technologies and capabilities of available infrastructures. This network, through services developed by ARN teams support the needs for specialized information network infrastructure.

Over the last decade, the connectivity needs of academic and research institutions in Algeria have increased significantly, and so have their opportunities to collaborate with peers in Europe and other parts of the world. The connectivity upgrade puts ARN in a position to fulfil collaboration needs and has given valuable advanced network services to the Algerian higher education system.

## II. STATUS OF ALGERIAN HIGHER EDUCATION AND SCIENTIFIC RESEARCH

There are two types of institution in the field of higher education:

### A. Public academic, cultural and vocational institutions under the supervision of the Ministry of Higher Education and Scientific Research:

- Universities
- National high schools devoted to particular scientific or vocational disciplines
- National high schools devoted to educational purpose "écoles normales supérieures"

### B. Public institutions under the authority of other ministries but under the educational supervision of the Ministry of Higher Education and Scientific Research:

- higher national training institutes
- "écoles d'ingénieurs"

The network of higher education institutions comprises:

- 50 universities
- 14 dispersed university campuses
- 20 national high schools
- 11 national high schools devoted to educational purpose "écoles normales supérieures"

The University of Continuing Education (Université de la Formation Continue – UFC), which was created by decree in 1990, enables those who did not obtain the baccalauréat at school to enter higher education through 50 continuing-education centres distributed throughout the national territory.

The specific feature of the Algerian system of higher education is the existence, in addition to universities of dispersed university campuses. Each of the 14 campuses is a decentralized component of a university. These campuses are focal points that enable higher education to flourish at the local level. The task of the 20 high schools is to train engineers. The training may be specific to a particular field of activity or may be broadened to cover other areas. The role of the "écoles normales supérieures" is to train primary and secondary teachers. The number of students attending institutions of higher education is 1 400 000 (aggregate figure for all three cycles).

Algeria aims to establish a national system with effective links between industry, universities and research establishments. In the Act of 4 April 1999, as amended and extended by the Act of 23 February 2008, scientific research and technological development had come to the fore as national priorities. It also defines objectives and the means to be used to achieve them.

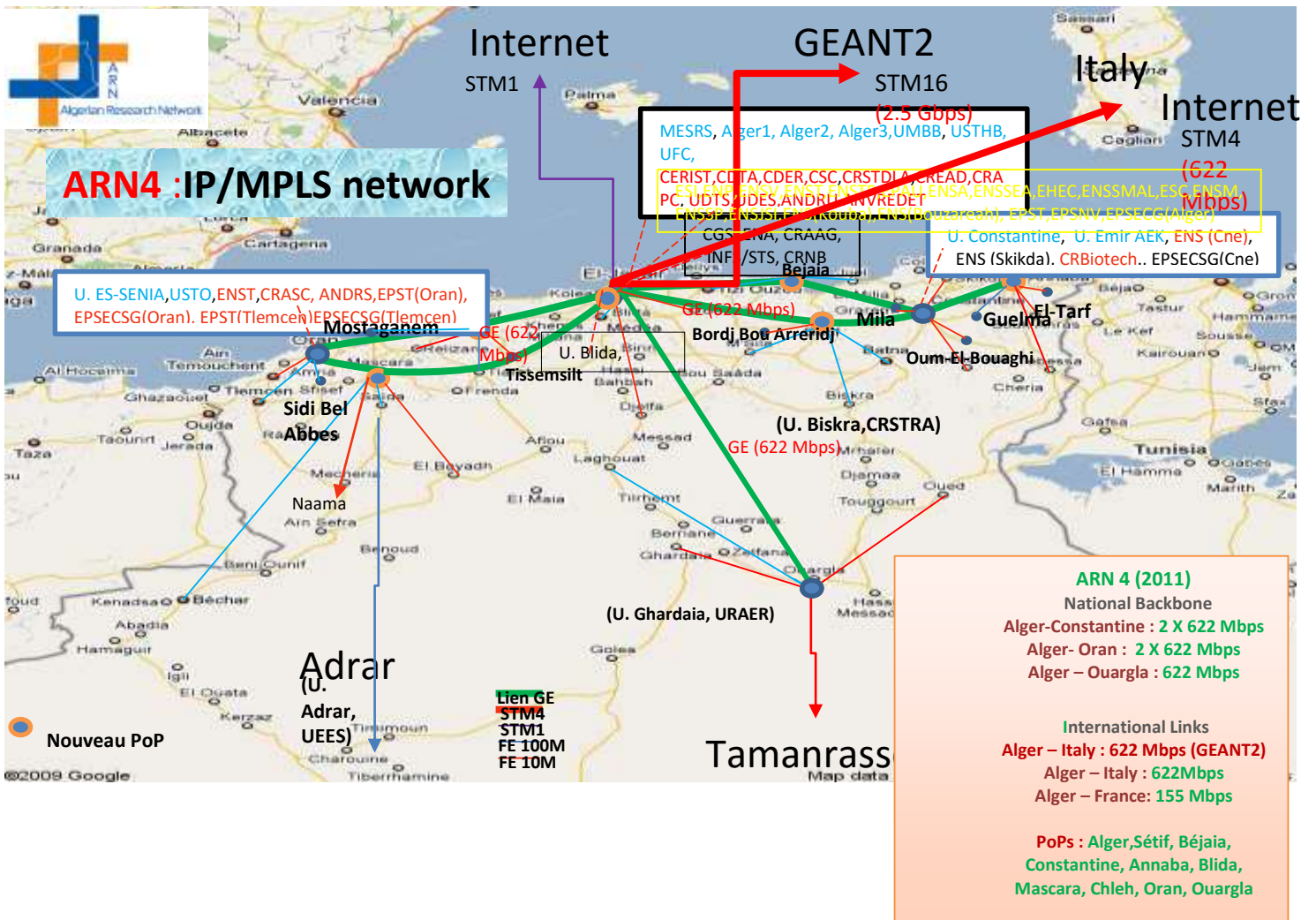
As for research facilities, the network of 1 431 research laboratories, 12 research centres, 15 research units and 6 thematic research agencies should increase the country's human resources in the realm of science, enhancing the number of teaching researchers to 27 000 and 3 000 researchers in 2015, as well as investing in major items of research infrastructure. For the next 10 years, the sectorial priorities are to improve the quality of higher education by training staff for senior management posts and to make progress in the fields of education, water, agriculture and food, health, energy and industry, the development of arid and semiarid regions and information and communication technology.

In view of the challenges, which Algeria is facing, technological development and engineering are strategic goals. Successful pursuit of these goals will have an impact on the development of all the component parts of the national economy. Moreover, there is a need to rethink the national system for the evaluation of activities in the field of scientific research. In this regard, the obligation to produce results and to improve the general efficiency of the system must be emphasised, too.

### **III. ALGERIAN RESEARCH NETWORK (ARN)**

ARN is managed by CERIST (Research Centre on Scientific and Technical Information), organisation that has been at the forefront of meeting the networking needs of its growing user base since its inception in 1994. CERIST is a research centre in ICT and scientific and technical information and was established in 1985. In 1994, CERIST introduced Internet technology in Algeria and launched the first national IP backbone network and was delegated the management of ccTLD (.dz).

In 2006, ARN launched the national grid initiative DZ e-Science GRID in 2006. ARN participates in various EC projects related to e-infrastructure, such as EUMEDCONNECT, EUMEDGRID, EUMEDGRID-Support, EPIKH and CHAIN-REDS.



Through its interconnection to EUMEDCONNECT, ARN enables researchers, academics and students in the country to participate in world-class international research and educational activities. Co-founded by the European Union, EUMEDCONNECT3 connects universities and research centres in North Africa and the Middle East and enables them to collaborate with over 4,000 institutions across Europe through its interconnection to GÉANT, the pan-European R&E network.

### The ARN Network Infrastructure

1. ARN connects 124 institutions including universities, research centers, national schools and preparatory schools.
2. ARN is built on a national backbone with 10 POPs.
3. ARN uses three international links with about 3.2 Gbps; one with the pan-European research network GÉANT (2.5 Gbps) and two Internet links to commercial suppliers (777 Mbps).

ARN, in 2016, interconnects over 800,000 users at 124 research and academic institutions across the country, increases of 20%, 40%, 50% and 60% respectively since the start of the previous phase of EUMEDCONNECT in 2004, EUMEDCONNECT2 in 2008, EUMEDCONNECT3 in 2012 and AfricaConnect2 in 2015.

Algeria joined the AfricaConnect2 project in June 2015 as part of the North African regional project cluster, alongside Egypt, Morocco and Tunisia.

ARN has developed the following services:

- Network infrastructure (IPv4 & Ipv6): [www.arn.dz](http://www.arn.dz)
- National grid infrastructure "DZ e-Science GRID": [www.grid.arn.dz](http://www.grid.arn.dz)
- Certification authority DZ e-Science CA agreed by EugridPMA: [www.ca.grid.arn.dz](http://www.ca.grid.arn.dz)
- Grid Science Gateway "DZ e-Science GRID SGW": [www.sgw.grid.arn.dz](http://www.sgw.grid.arn.dz)
- Identity federation "ARNaai": [www.aai.arn.dz](http://www.aai.arn.dz)
- Eduroam federation "ARNeduroam": [www.eduroam.arn.dz](http://www.eduroam.arn.dz)

Algerian institutions are actively participating in a substantial number of EC-funded higher-education TEMPUS and FP7 research projects dealing with issues particularly relevant to Algeria and the Mediterranean as a whole. NEUROMED, for example, brings together neuroscientists from both shores of the Mediterranean to exchange best practice and to jointly build up centres of excellence. EUMEDCONNECT3 facilitates this capacity-building process by providing stable, high-capacity Internet connectivity between geographically dispersed scientists and by supporting the seamless exchange of huge, bandwidth-hungry medical files, such as MRI scans.

Over the last decade the connectivity needs of academic and research institutions in Algeria have increased significantly. As a result, we have seen international networking capacity increase by a factor of 50 – from an initial circuit of 45Mbps in 2004 to the current 2.5Gbps. Within AfricaConnect2 and in conjunction with ASREN and partners in Europe the focus is now on providing more value-added services on top of connectivity such as cloud and collaborative services.

#### IV. ALGERIAN INTERNATIONAL COOPERATION

The European Commission (EC) has launched a program called EUMEDIS in the field of information and communications technology in the Euro-Mediterranean region in February 1999. Following the call for proposals launched in 2000, EC included among the projects identified and proposed by the institutions and enterprises of the European and Mediterranean countries.

As part of the European Neighbourhood Program (ENP) instrument, EC has been funding the establishment of the EUMEDCONNECT research network since 2004. The network has maintained a dedicated high-speed network to the Mediterranean research and education communities serving over 2 million researchers, academics and students in seven southern Mediterranean countries, namely Algeria, Egypt, Jordan, Morocco, Palestine, Syria and Tunisia. With its direct links to its pan-European counterpart GÉANT, the network facilitates the participation of the Mediterranean community in world-class research and education initiatives. The network has points of presence (PoPs) in Sicily, at Catania and Nicosia, Cyprus, and recently established in London linking to the GÉANT network with capacities that ranged from 45 Mbps to 2.5 Gbps.

THE EUMEDCONNECT3 project following the EUMEDCONNECT2 and EUMEDCONNECT projectS regards the interconnection of research networks in the Euro-Mediterranean zone. This project reached the stage of realization after a study phase and maturation of the project.

The institution GEANT Association, previously known under the appellation DANTE, a non-profit company registered in the UK has been responsible for the coordination by the various Euro-Mediterranean partners as well as monitoring and implementing the project.

Algeria joined the AfricaConnect2 project in June 2015 as part of the North African regional project cluster, alongside Egypt, Morocco and Tunisia.



The EUMEDGRID was initiated in 2006 as an e-Science development project targeting communities in different domains, including physics, hydrology, bioinformatics, engineering, and archeology. It aimed at fostering e-Science and promoting e-Infrastructures in the Mediterranean region. Several grid sites have been established to support research communities in accessing grid computing facilities and resources. EUMEDGRID-Support, started in 2010, completed activities initiated in previous project and added advanced services. Now, there exists 36 Sites in 11 countries including ARN in Algeria, providing Grid services based on the EMI Grid middleware, for a total of around 4000 CPUs and 600 Terabytes of Storage Capacity.

The grid e-Infrastructure has provided support to many scientific domains and applications in physics, fluid dynamics, social science and humanities, engineering, computing science and mathematics, and bioinformatics. General and reference applications and tools in different scientific domains have been deployed to provide scientists with a portfolio of popular applications and tools including GCC, MPI, Octave, Scilab, Abinit and OpenFOAM.

The EUMEDGRID e-Infrastructure supports the execution of parallel applications within the OpenMP and MPICH2 standards for Message Passing Interfaces, thus allowing the inclusion of HPC Clusters within the infrastructure. It has also contributed to consolidating best practices and standards for enabling transparent e-infrastructure provisioning to scientists worldwide across different regional initiatives and permanent infrastructures, such as the EU flagship initiative, EGI.

The CHAIN and CHAIN-REDS are two FP7 projects that aimed to establish interoperation and long-term sustainability to regional initiatives and linking them together for a broader coordination and harmonization of advanced e-Infrastructures.

MAGIC – Middleware for Collaborative Applications and Global virtual Communities seeks to establish a set of agreements for Europe, Latin America and other participating World Regions, aiming at consolidating and completing the building blocks of middleware necessary for the establishment of a marketplace of services and real-time applications for international and inter-continental research groups which facilitates mobility and the work of global science communities.

## V. KEY DEVELOPMENT AREAS

The study is looking at key development areas:

- Sustain and operation a high-speed regional/international link to R&E networks in Europe and elsewhere
- Setup research profiles and communities, enable environments, and provide accessibility tools
- Strengthen access to computational facilities and resources available elsewhere

### A. Expected outcomes

With dedicated networks, the expected outcomes are as follows:

- Dedicated high-speed networks linking universities and research institutions to support large data traffic of applications (Multimedia, HPC, GRIDs, CERN, etc.)
- Deployed e-Science services to support common experimental activities among distributed virtual research communities.
- Establish a common culture of research and education community towards building a collaborative research and distance education
- Reduce the digital divide and beyond by linkage to the global research and education community



## **B. Recommendations**

The funding of EUMEDCONNECT3 and AfricaConnect 2 projects provide a great opportunity for Algeria to sustain the interconnection with the European, Arab, and African research and education networks.

The following represents concrete recommendations for developing a comprehensive Algerian e-Infrastructure to better serve its research and education communities at the national level.

### **Short-term recommendations:**

1. To enhance high-speed networks dedicated for research and education and provide high quality access to network services and resources.
2. To participate in the AC2 funding and be part of the REN community at the African and Arabian countries.
3. To promote the utilization of research and education networks through applications support provided by Science Gateways, eduroam, Edugain and other e-Infrastructure services.
4. To introduce state-of-the-art service portfolio, including virtualization, cloud computing, high performance computing, and multimedia services.
5. To support training and capacity building activities in areas related to network operation and management, and building expertise in emerging technologies.
6. To continue to demonstrate benefits of research and education networks to stakeholders and decision makers through case studies.

### **Medium term recommendations:**

7. To promote network with dedicated bandwidth and high-speed communication capabilities, enabling researchers to carry out innovative scientific research collaborations.
8. To continue to advocate the importance of research and education networks amongst decision makers and stakeholders to support the development of a sustainable national e-Infrastructure.
9. To organize and participate in national/international workshops, technical training sessions, and mentoring programs.
10. To support long-term sustainability of ARN national integrated e- Infrastructure.
11. To develop Algerian integrated backbone connecting all universities, research centres, colleges, schools, libraries and other organizations through a national high-speed communication network based on dark fibre.
12. To secure national and international funding to invest in and manage sustainable Algerian national academic e-Infrastructure.

