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PROJECT SPREAD SHEET

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Contracting partners: GÉANT and the UbuntuNet Alliance

Implementing partners:

Eastern & Southern Africa	The UbuntuNet Alliance, <i>Implementing partner for 'Cluster 1'</i>	
West and Central Africa	WACREN , West and Central African Research and Education Network <i>Implementing partner for 'Cluster 2' in partnership with GÉANT</i>	
North-Africa	ASREN , The Arab States Research and Education Network <i>Implementing partner for 'Cluster 3' in partnership with GÉANT</i>	
Europe	GÉANT , the Pan-European Network <i>Project coordinator partner and associate implementing partner for 'Clusters 2 and 3'</i>	

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Abstract: This report is intended to build a business case for re-connecting the Moroccan NREN to the European GEANT network. It provides background information on the status of the Moroccan higher education and research and innovation communities and detailed propositions on why Research and Education Networks are important for the advancement of the Moroccan 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 international cooperation. The report proposes key development areas for the Moroccan national e-Infrastructure and recommendations to continue sustainable development of international dedicated capacity, funding sources, and service portfolio.

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I. INTRODUCTION

Science and technology in Morocco has significantly developed in recent years. The Moroccan government has been implementing reforms to encourage scientific research in the Kingdom. While research has yet to acquire the status of a national priority in Morocco, the country does have major assets that could transform its R&D sector into a key vehicle for development. The factors we find behind these assets result mainly of the passage of a society where the social demand occupied the second place in a society where social demand takes the central place in R&D. Morocco's own evaluation of its national research system – carried out in 2005 – revealed that the country has a good supply of well-trained high quality human resources and that some laboratories are of very high quality compared to others who do not have the basic elements regarding equipment and human resources, the demonstration of a growing interest in research and significant efforts of the government in funding research. However, the greatest gap at that point of time lied in the link between research and innovation as well as the lack of research policy in areas such as health, environment, transport and a low recognition of the research function at the national level.

The national system of scientific and technical research in Morocco is guided by different elements, such as the pronouncements of the king, reports of special commissions, five-year plans, and the creation of a special program for the support of research. While spending on education has hitherto been relatively high (5% of GDP and 24% of government expenditures in recent years), change has been slow in coming. A royally designated "decade of education" was kicked off in Morocco in 1999 with the publishing of the National Charter for Education and Training, a road map to sector reform. As a result, literacy for men aged 15–24 has risen from 84% in 1990 to 87% in 2008, according to the World Bank, while the percentage of all students completing primary school rose from 82% to 87% over the same period.

The Moroccan government's Five- Year Plan for 2000-2004 articulated the priority lines for research. The declared objectives of this plan were to align S&T research with socio-economic development priorities. Sectors declared as priority areas were: agriculture, fisheries, drinking water, geology, mining, energy, environment, information and telecommunications technologies, and transport. This approach highlighted the need for effective institutional coordination, which enabled different parties to work together around common priority socioeconomic objectives. Among the actions implemented: the law 01-00 on the organization of higher education, the restructuration of CNRST, the establishment of the Permanent Inter-Ministerial Committee for R&D and the increase in the share of GDP devoted to scientific research. In 2003, spending on research reached MDHS 3144 million DH, or 0.79% of GDP, where the share of the public varies between 75 and 80%. The rest is divided between the private sector, partnership and international cooperation.

Through the emergency plan in 2009 and in presence of His Majesty the King was signed several development contracts between the government and universities and some institutions in charge of education, teaching and research. Among the objectives of this plan, make effective mandatory schooling until the age of 15 years, the goal is to achieve in 2012 -2013, a schooling rate of 90% for children of 12-14 years of age, Boosting initiative and excellence in high school and college, giving more autonomy and independence to the university, optimize and sustain financial resources and Facing the cross-cutting issues of the system of education and research. The government has allocated significant funding to achieve the objectives of this plan.

II. STATUS OF MOROCCAN HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Higher education in Morocco comprises 13 public and 9 private universities and 207 private and 183 public institutes and schools. Public universities and institutes are free. The Ministry of Higher Education, Scientific Research, and Professional Training govern the higher education system.

Morocco has now about 700,000 students. 90,4% are enrolled in public universities, 4,2% in non-university public institutions and 5,4% are in private institutions. The enrollment rate in higher education increased for the 19-23 years age group by 19% in 2012 to 22% in 2013. Women represent 48% of all higher education students.

The higher education curriculum includes humanities, arts and literature, social and behavioral sciences, economics and law, politics, economics, history, geography, biology and geology, medicine, pharmacology and pharmacy, biological and geological sciences, physics and chemistry, information technology, computer and information systems, military and technical studies, engineering, architecture, pedagogy and teachers' formation, and professional training.

Based on the results and previous experiences, the Ministry of Higher Education has set up a national strategy for the development of scientific research in 2025. Among the main directions of the strategy:

- Establishing greater interaction between national research and socio-economic world;
- Providing measures to make attractive the profession of researcher;
- Reviewing the system of assessment and index the career of scientific production in order to change the current structures that meet international standards;
- Identifying the resources needed to sustain the research structures;
- Encouraging the pooling of resources (Pooling and synergy) and the development of multidisciplinary collaborations;
- Establishing technology platforms involving heavy equipment measurement and analysis and ensure conditions for proper operation;
- Providing an increase in the share of GDP devoted to research and innovation that will reach 3%;
- Encouraging research partnerships with businesses, SMEs / SMIs in particular.

A budget of 400 million DH has been allocated for the 2013-2016 period in order to fund research projects in different areas. 75% of this funding comes from the Ministry of Higher Education, Scientific Research, and Professional Training, 25% are provided by the OCP S.A. Group and the Ministry of Infrastructure, Transport and Logistics. This program is managed by CNRST. It covers the priority areas (Health, Environment, Energy, Social Sciences, etc.), research around phosphates and scientific research in road safety.

III. MOROCCAN UNIVERSITY NETWORK

MARWAN is the national computer network that is dedicated to education, training and research. It is an information infrastructure connecting educational institutions and is run by the National Centre for Scientific and Technical Research (CNRST).

Since its inception in 1998, MARWAN has been a driver for Moroccan universities to develop new services in education, technology transfer and scientific research. CNRST relies on the evolution of communication technologies internationally to improve the quality, service and network architecture of MARWAN. It is currently in its third version (MARWAN3). Its Backbone is based on VPN/MPLS. It offers links between 4 and 200 Mbps. MARWAN is connected to the internet with 2Gbps. A Google Global Cache service is deployed.

More than 95% of institutions' links are in fiber. MARWAN is an LIR, it has its own IPv4 and IPv6 addresses and its own AS.

Among the services offered by MARWAN we can find:

- The Moroccan Identity Federation for education and research eduIDM (www.eduidm.ma)
- EduRoam (www.eduroam.ma)
- MaGrid : National Computing Grid (www.magrid.ma), including certification authority MaGrid-CA (ca.magrid.ma)

MARWAN has been connected to EUMEDCONNECT 2004 -2011 for linking to European research and academic sites and is interested in re-establishing connection. CNRST Team supports the Africa & Arabia ROC.

MARWAN is funded by Ministry of Higher Education, Scientific Research, and Professional Training. The ministry pays for the Internet link, whilst each institute pays for its link to the MARWAN network.

At CNRST, eduroam.ma (Education Roaming) has been implemented as the secure roaming access service developed for the research and education community in Morocco. Eduroam allows students, researchers and staff from participating institutions to obtain Internet connectivity across their home campus and when visiting other member institutions. The visiting users are authenticated using the same credentials as they would use at their home institution for wireless access. The goal is that everybody should get wireless access to the Internet easily and securely no matter where they are.

The Moroccan Identity Federation for Education and Research EduIDM aims to provide organizational and technical framework for sharing, through a controlled and secure access to different resources between members. By a single user identity, you can access to electronic resources of other institutions members. One of the objectives is to benefit from eduGAIN services. eduGAIN is a service developed within the GÉANT Project - a major collaboration between European national research and education network (NREN) organisations and the European Union. It interconnects identity federations around the world, simplifying access to content, services and resources for the global research and education community.

Morocco has implemented a grid computing infrastructure called "Magrid" through its first cluster in CNRST-Rabat in 2006. Magrid infrastructure was extended through the establishment of two more clusters for a total capacity of 160 CPUs and 26 TB of storage. Magrid is connected to Euro-Mediterranean infrastructure EUMEDGRID and the Arab-African infrastructure AfricaArabia ROC. Currently, 150 users Magrid account exploiting twenty applications in several scientific fields (Digital Chemistry, Earth Science, Bioinformatics, Physics ...). CNRST deployed the certification authority "Magrid CA" in 2007 to secure Magrid infrastructure.

IV. INTERNATIONAL COOPERATION

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 panEuropean 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 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.

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 intercontinental research groups which facilitates mobility and the work of global science communities.

V. KEY DEVELOPMENT AREAS

Research and education connectivity still lacks international outreach to allow Moroccan researchers access resources and peer with counterpart in the European institutions. The absence of dedicated international linkage is holding back collaboration within Morocco and excluding researchers from a variety of European projects. CNRST with relevant stakeholders needs to put efforts together to support the advancement of research and education through connectivity and better access to international research and educational resources and communities. The funding of EUMEDCONNECT3 and AfricaConnect 2 projects provides a great opportunity for Morocco to interlink with the European, Arab, and African research and education networks.

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

Short-term recommendations

1. To build, support and enhance high-speed networks dedicated for research and education by upgrading the current network to provide high quality access to network services and resources;

2. To set up MARWAN international circuit (initially 155 Mbps STM1 which will be upgraded to 1 Gbps for MARWAN4) connecting the MARWAN to GEANT and other international RENs;
3. To participate in the AC2 funding and be part of the REN community at the African and Arabian countries;
4. To promote the utilization of research and education networks through applications support provided by Science Gateways, Eduroam, and other e-Infrastructure services;
5. To deploy a Network Operations Center at CNRST headquarters with all required hardware and software resources and trained personnel to adequately manage and monitor traffic activities on the Moroccan NREN;
6. To integrate eduGAIN and benefit from their services;
7. To strengthen Margrid by the establishment of clusters in universities.

Medium term recommendations:

1. To demonstrate benefits of research and education networks to stakeholders and decision makers through case studies
2. To promote network with dedicated bandwidth and high-speed communication capabilities, enabling researchers to carry out innovative scientific research collaborations;
3. To introduce state-of-the-art service portfolio, including virtualization, cloud computing, high performance computing, and multimedia services;
4. To advocate the importance of research and education networks amongst decision makers and stakeholders to support the development of a sustainable national e-Infrastructure;
5. To support training and capacity building activities in areas related to network operation and management, and building expertise in emerging technologies;
6. To organize and participate in national/international workshops, technical training sessions, and mentoring programs;
7. To support long term sustainability of MARWAN national integrated e- Infrastructure;
8. To develop a Moroccan integrated backbone connecting all universities, research centers, colleges, schools, libraries and other organizations through a one national high-speed communication network;
9. To secure national and international funding to invest in and manage sustainable Moroccan national academic e-Infrastructure.

