The New Generation of The Tunisian University National Network

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1. Introduction

The tendency aiming at integrating under a digital format all the information manipulated in individual, collective or professional fields makes fundamental to build high performance networks and communication services.

The Internet constitutes a privilege frame of study. Indeed, the infrastructure of global communication associated with the universal services of communication to which the Internet longs to offer, composes the support even exclusive of integration of all the new techniques of data processing and communication. A lot of scientific and technical challenges must be however found to transform the current Internet into an Internet, called " of New generation ", offering a trivialized support for all the services of communication. The implementation of the Internet of New Generation allowing to spread in very wide scale, in an effective, trivialized and economic way a vast range of applications is rich in social, cultural and economic stakes. Among the applications which would benefit from services of the Internet of New Generation, and which constitute besides a subject of research and development, we can quote as examples the e-learning, the e-work, the cooperative work and the distributed calculation.

The Tunisian University National Network (RNU) was launched in 1997 to allow the researchers and in Research and educational establishments (EER) to use the new information and communication technologies (ICT) in the university environment. A real dynamics of implementation was engendered since 1997, led with an awareness campaign to exploit better the services which this network intends to offer.

To encourage the university community to adopt ICT in their activities, a supplementary national effort was decided in their favour, that of the free Internet services. Therefore, the RNU network offers a free access to the Internet and to the associated services.

So, the RNU secure the networking between universities, research and educational establishments (EER), Research Laboratories and Units (LUR) and certain number of establishments under the custody of the Ministry of the higher education such as the

sciences city, the university publication center, the establishments of the university works and the Internet centers given to the students. It also connects them to the commercial Internet network, to the federated Tunisian network of the research (RFR) and to the GEANT European network of the research.

This document presents the architecture of the RNU network and elaborates the guiding principles which underlie its development towards a network of new generation, called RNU2. Then it describes the target architecture and its different components.

Before presenting the architecture of the RNU, this document calls back briefly the mission of the computing center El Khawarizmi (CCK) which is responsible of the management of the network, its customers, and the services which it offers them.

2. The Computing Center El Khawarizmi and the RNU network

The mission of the Computing Center El Khawarizmi (CCK) is to supply Establishments of education and Research in Tunisia with advanced telecommunication infrastructures as well as the widest access services to the information sources that they need to reach their objectives of research and education. The CCK is the manager of the RNU network.

Being historically the first computing center, the CCK plays since 1997 a major role in the development of the access and the Internet services in the university environment in Tunisia. Its customers find in the CCK a place of information, coordination and cutting edge expertise. It implements an architecture which garantees the availability of new accessibility models to the information, the training and the services.

Today, all the EER and the LUR are connected to the RNU with a global bandwidth exceeding 100Mb/. Most of the connections are of type specialized lines (LS), others are of type ADSL. The use of the Optical fibre and the WIMAX is envisaged in the implementation of the new generation of the network RNU2 .

From 725 users in 1997, to 75990 in 2003, the number of users of the RNU marked a considerable increase to reach approximately 160000 users in 2005. This number was multiplied by three since 2001 (at the end of the 9th national plan) until August, 2005. Among these users, more than 70 % of the teachers and researchers and 31 % of the students use regularly the RNU network for their needs in scientific, technical and educational information, as well as for the exchange and the sharing of information. The number of users will exceed 500000 in 2009.

3. The RNU architecture

The university network RNU is composed, as shown on the figure 1, of :
- The Network Operator Center (NOC) supplying the IPv4 service. Today, there are three NOC on the big Tunis (La Kasbah, El Manar and La Manouba).

Before the end of 2005, four new NOC will be set up into Sfax, Sousse, Monastir and Tunis (UVT).

- The national backbone with "high bandwidth", connecting the nodes or points of presence (PP) of the CCK. The backbone connects the EER and the ULR through the NOC to the commercial Internet and the research networks, the Tunisian (RFR) and the European one (GEANT).

Three points of presence CCK are at present operational on the backbone of the RNU. Before the end of 2005, two new will be set up in the center (Sousse) and in the South (Sfax) of Tunisia to cover better the territory and improve the quality of the services.
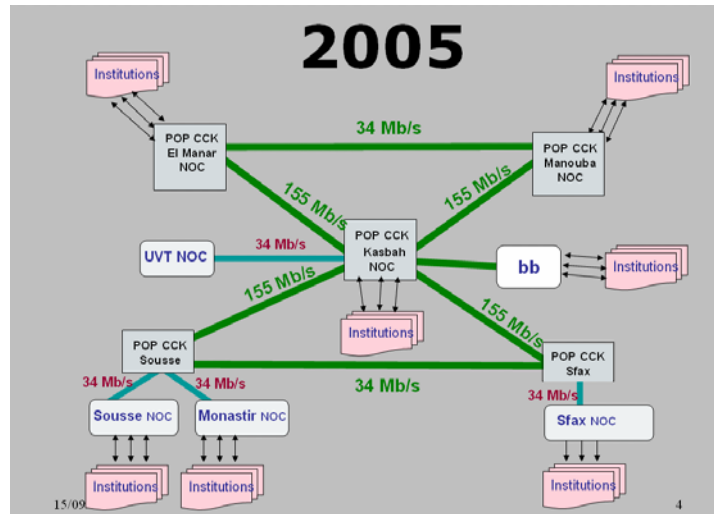

Figure 1 : Architecture of the RNU network

4. The new generation of the university network : RNU2

The CCK intends, according to the strategy of the ministry of the higher education, to endow the sector of the Research and the Higher education in Tunisia of an infrastructure of telecommunications by optical fibres serving every institution with a good quality of service.

Indeed, in front of the evolution of the new applications and their characteristics, new requirements on the Internet of New Generation are imperative : **High bandwidth, quality of service, heterogeneousness and ubiquity** (coordination and transparent integration of all the network technologies (WLAN, Bluetooth, mobile networks, satellite networks, etc.)), **cooperation** , **mobility , adaptability** , **Protocols of new generation, security** are new key characteristic terms of the Internet of New Generation that have to underlie the actions of research and development on the Internet of New Generation.

In this context and to face these new challenges, Tunisia took the commitment to get ready for it. And so RNU will evolve gradually towards **RNU2**.

The RNU2 aims at supplying an access to the network with **high speed** (in Gb/s in the medium term), **reliable** (thanks to the redundancy) and **evolutionary** (that is which minimizes the impacts of the technological evolution). So it will stimulate the use and the deployment of the very wide band applications.

The 2nd generation of the University National Network (RNU2) will supply in the EER sophisticated infrastructures of telecommunications, as well as the widest possible access to the sources of information, well important in the education and research activities.

The architecture of the RNU2 bases itself on the development of a university intranet consisted of private and virtual networks for the higher education and scientific research. It is about architecture at 3 levels:

- The network of the higher education (figure2). In this network,
  - The Connectivity intra-RNU2, makes an unlimited connectivity. The national backbone with "high bandwidth" of the RNU2, allows the users to communicate and to establish virtual networks widened to sites or campus taken away.
  - The commercial Internet Connectivity, offers the access to networks outside the zone "intra-RNU2". It guarantees an adequate bandwidth.
  - The research Connectivity, gives access to data banks and to national research networks (RFR), and international (GEANT), etc.
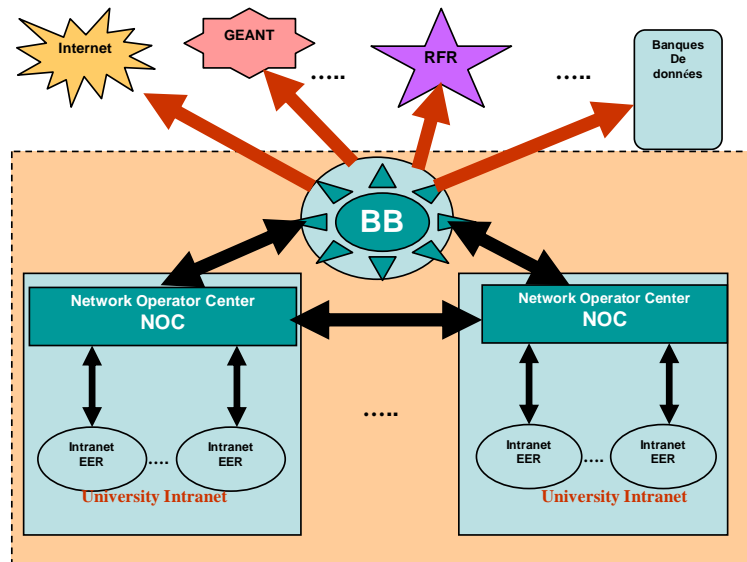

Figure 2 : The High Education Network

- The intranet of the university (figure3) : The EER belonging to the same university will be connected to the Network Operator Center (NOC) of the university which has to support the high bandwidth.
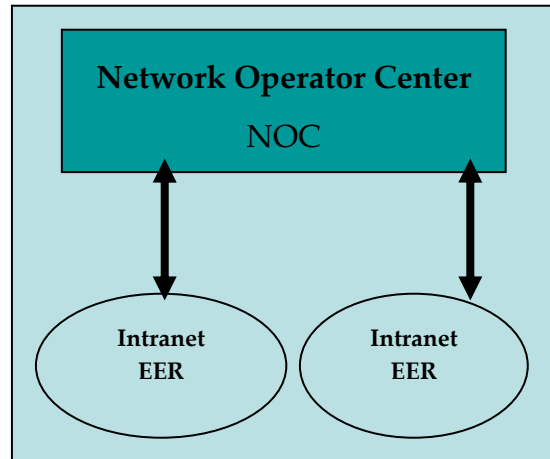

Figure 3 : University Intranet

- The intranet of the EER (figure4) : The local intranet is made around Virtual Prived Networks (VPN). Four VPNs by institution are proposed : the teachers VPN, the students VPN, the researchers VPN and the administration VPN
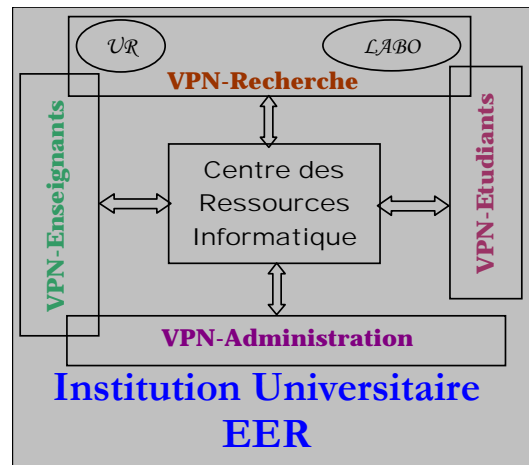

Figure 4 : The EER Intranet

5. A new stage in the process of the higher education development

The RNU2 will allow the academicians to take advantage of evolved applications which become the base of the scientific work, the current and the one of tomorrow.

It is about a multitude of on-line services (e-services), more effective and faster, allowing the users to make their educational, administrative and research activities from any

point of access including their home. The e-services assured thanks to the network will be :

- educational Services : Courses and tools of accompanying of the educations, the medical and scientific prints, the telemedecine, the forum of exchange with the students and with the administration, the frames of projects and trainings, on-line class, forum of exchange with the teachers and with the administration, the trainings, …
- high performance computing (HPC) : successful tools and libraries of calculation, analysis and modelling, specialized for every type of data.
- access to the IST : on-line access to the national collective catalog (via BIRUNI system), on-line access to the other resources (resources of the CNUDST, the monographs, the on-line reviews, the waiters(servers) CD, the other media)
- Administrative services : e-desk of the Student (timetable, exams, juries, etc.)

In 2009, the access to the e-services will be assured(insured) by means of a smart card multiservices personalized.

6. Conclusion

The new generation of the RNU network will be the network of the innovation for the higher education and scientific research on various levels; technological by the adoption of the Internet of new generation, and services by new types of services more performant and centerd on the personalization adapted for every type of user.

The access with high bandwidth will be guaranteed on base of optical fibres connecting between them the points of presence of the RNU2, and with the various universities NOC. The success of the RNU2 is bound to the implementation of VPN networks which will allow to create a secured university Intranet inside every university campus, and to connect them with a wide band to the commercial Internet. The network will allow the integration of various technologies to offer the services in adequaton with the educational needs of the students, the teachers and the researchers of the EER.