



GÉANT2 Report on the Country Needs Assessment concerning research and education networking in Morocco

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* The publication of this report has been authorised by the director of the Moroccan NREN MARWAN, who collaborated in the Country Needs Assessment, upon a slight amendment from the original version, which was distributed to the European Commission and national stakeholders of the Moroccan NREN.

Executive Summary

GÉANT2 is the network backbone connecting the National Research and Education Networks (NRENs) of Europe. GÉANT2 is co-funded by the European Union's 6th Framework Programme through a project, which also includes a Networking Activity, NA4, to provide support to the development of research and education networks in the less-advanced countries in and around Europe.

During May and June 2005 TERENA has undertaken a study as part of the GÉANT2 Networking Activity NA4 about the status of research and education networking in Morocco. The work included a desk study, detailed information gathering and a visit of a team of experts from GÉANT2 member NRENs, which was carried out on 20-22 June.

The members of the GÉANT2 team of experts identified three main recommendations to the parties concerned in planning, operating and supporting research and education in Morocco and one set of actions to be implemented by the GÉANT2 NA4.

Recommendation 1.

Those funding research and education networking in Morocco should understand that this is not the same as the Internet and that there is a clear need for the NREN to have control of the network. The network infrastructure currently provided by the Telecom operator to MARWAN does not allow users to obtain the advanced services they require and therefore is not sustainable. MARWAN should aim accessing lower level transport technology, in order to be able to deliver IPv6, Multicast and Grids services. Eventually, MARWAN should look at the opportunity to acquire dark fibre.

Recommendation 2.

The heads of academic and research institutes and departments should encourage the introduction and use of advanced network services and applications such as videoconference, Grid and Authentication Authorisation Infrastructures in order to allow their institutions to participate and compete in the global research community. MARWAN will need to develop expertise and provide advice and support to existing initiatives like the development of a Tier2 High Energy Physics Grid node in Casablanca.

Recommendation 3.

MARWAN needs to have stable funding and sufficient, well trained, staff to meet the challenges of the foreseeable future.

Action.

GÉANT2 should facilitate participation of the Moroccan research and education community in ongoing developments and projects taking place in Europe, encourage and support participation in knowledge transfer events being organised in Europe by TERENA, GÉANT2, the EUMEDCONNECT project and individual NRENs.

GÉANT2 should help MARWAN in understanding the issues related to ownership of fibre networks.

Introduction

GÉANT2 is the seventh generation of pan-European research and education network, successor to the pan-European multi-gigabit research network GÉANT. The project within which the network is funded began officially on 1 September 2004, and will run for four years. GÉANT2 is co-funded by the European Commission and Europe's national research and education networks, and is managed by DANTE.

TERENA, the Trans European Research and Education Networking Association, is the leader of the GÉANT2 Networking Activity NA4, to support the development of research and education networks in the less-advanced countries in and around Europe.

One of the major challenges facing European research and education networking is the disparity between developments in different countries and regions. Narrowing this Digital Divide between the networking services available to researchers, teachers and students in some countries, is of the utmost importance for achieving the European Union's political objective of equal opportunities for researchers throughout the European Research Area.

The goal of the GÉANT2 Networking Activity NA4 is to contribute to reducing the divide by means of specific support actions targeted at important issues in the development of research and education networking in a specific country, which are identified in the process of a Country Needs Assessment. The findings of the assessments are meant to provide an overall picture about the status of research and education in the country concerned and to point the way to specific forms of support that can be successfully undertaken to address the most important and/or urgent problems.

The GÉANT2 Networking Activity NA4 takes care of the Country Needs Assessment and the implementation of the specific support actions. However, the responsibility for any significant development of research and education networking lies with the national stakeholders. They need to take initiatives and ensure that the necessary policies at the different levels are in place and that sufficient resources will be available. A very important objective of the GÉANT2 Networking Activity NA4 is therefore to provide recommendations to these national stakeholders – government authorities, funding bodies, research and education institutions, and networking organisations – on the policies that they should develop and the actions that they should take to narrow the Digital Divide in research networking between their country and the most advanced regions of Europe.

The working method of a Country Needs Assessment, which is described in detail in a GÉANT2 deliverable¹, starts from creating a team of experts from the GÉANT2 community, who have specific knowledge about the country or have faced issues similar to those currently faced by the NREN in the country concerned and, finally, have an

¹ GÉANT2 Deliverable D.4.0.2 Terms of Reference for Country Needs Assessment
http://www.geant2.net/upload/pdf/GN2-05-002v7_20050127144241.pdf

understanding of the country's political and economic environment. For the Country Needs Assessment of Morocco TERENA staff members were supported by Dany Vandromme, Director of RENATER, the National Research and Education Network of France and by Enzo Valente, Director of GARR, the National Research and Education Network of Italy.

During the Country Needs Assessment the GÉANT2 team carries out a desk study based on various information sources, including the TERENA Compendium of National Research and Education Networks. An important source of information is the NREN in the country concerned. The GÉANT2 team liaises with the NREN about the acquisition of additional information and discusses the goals and the priorities for the study. As part of the process the team may visit the country for a few days in order to understand more deeply what the difficulties and inhibitors are for the NREN and for the organisations responsible for research and education networking at a local level; to discuss possible solutions with key actors and to explore in-depth the areas that are identified as possible targets for assistance, and to discuss these options with the stakeholders in the country. At the end of the process the team assesses the information, analyses the findings and writes a report with recommendations to the stakeholders in the country concerned and to the European Commission.

The Country Needs Assessment of Morocco started in May 2005 with the study of the TERENA Compendium, information from the EUMEDCONNECT project and other publicly available reports about the status of ICT in Morocco. The objectives of the work and the priorities were discussed with the director of MARWAN, the department of the *Centre National pour la Recherche Scientifique et Technique* (CNRST) in charge of research and education networking in Morocco. A questionnaire was filled out by MARWAN staff in May 2005, who, amongst other pieces of information, provided the GÉANT2 team with details about the universities and other higher education institutions in the country, their location and the student population; the computer networking facilities; the counterparts of the NREN within the government or its administration; the situation of the internal telecommunication market in Morocco and the status of ISPs; the most important national and international projects (existing or planned) in key scientific disciplines in the country. The work was concluded by a visit of the GÉANT2 team to Rabat and Casablanca on 20-22 June. The agenda of the visit and contact details of people met during the visit are provided in Appendix B of this report.

This report is the outcome of the analysis of the findings of the Country Needs Assessment of Morocco, which identified three major recommendations for stakeholders of NRENs and one main specific support action for the GÉANT2 Networking Activity NA4. In the following of this document the recommendations and the action are discussed in detail. One aspect of the first recommendation concerns the investigation of dark fibre as a possible solution for the next generation of the Moroccan research and education network. Appendix A provides a short description of an example of a research and education network in Europe that is based on dark-fibre.

Recommendation 1.

Recommendation 1

Those funding research and education networking in Morocco should understand that this is not the same as the Internet and that there is a clear need for the NREN to have control of the network. The network infrastructure currently provided by the Telecom operator to MARWAN does not allow users to obtain the advanced services they require and therefore is not sustainable. MARWAN should aim accessing lower level transport technology, in order to be able to deliver IPv6, Multicast and Grids services. Eventually, MARWAN should look at the opportunity to acquire dark fibre.

Research networking and the Internet

The Internet had its origins in the world of research and universities. Often described as a network of networks, the Internet today is a commodity for a wide user community; however, those networks that provide connectivity and services to users in research establishments and institutions for higher education are still the most advanced part of the entire Internet. Those networks – the research and education networks – offer very large network capacities and advanced services that are not available generally on the commercial Internet.

Research and education networks and their user communities form an environment that is an important source of innovation. Many of the technologies and services that are developed and tested in the research networking environment, are later exploited in the general Internet that serves companies as well as individuals who use the Internet for business and leisure.

Research network organisations, the NREN in particular, are therefore an important asset for a country, driving innovation and the dissemination and wide adoption of new technologies and services, thereby eventually contributing to the development of industry and commerce and to economic prosperity.

As a further consequence, national governments should ensure that effective collaboration is established between all actors involved in RTD in the academic and business environment, including Small and Medium Enterprises producing innovative research.

The position of Morocco with respect to European NRENs

The European model of research and education networking has a federated structure, in which university campuses and institutions are interconnected via a single national research and education network, which in turn is connected to the pan-European network backbone. In practice, in some countries universities get access to the national network via smaller regional networks or metropolitan area networks.

This federated model has proved to be very effective in making sure that all academic institutions in one country can effectively collaborate with peer institutions, both nationally and abroad, by making use of high capacity networks, providing them with a high standard of service and security.

A condition for this model to be implemented across Europe is that each country has one single entity, responsible for managing the national research and education network (the NREN) and connecting to the pan-European backbone. Such a single entity in Morocco is the *Centre National pour la Recherche Scientifique et Technique* (CNRST), which has a mandate to connect and offer network services to universities and higher education institutes. MARWAN, the organisation that is responsible for research and education networking in Morocco is not a legal entity, but a department of CNRST.

Since 10 May 2005 MARWAN is connected to the pan-European network GÉANT at 34Mbit/s via the EUMEDCONNECT project. 20% of the link is paid by CNRST, 80% is paid by the European Union.

In Morocco, connectivity and services to research and higher education institutes are currently provided by MARWAN on the basis of a contract with Maroc Telecom, which provides the network infrastructure for the MARWAN2 network. This is based on Maroc Telecom's layer-3 MPLS VPN. The network is fully managed by Maroc Telecom, MARWAN is only in charge of supporting the connecting universities. Such a network does not allow transporting anything but best-effort IPv4.

Although economically attractive for the time being, the deal between MARWAN and Maroc Telecom seems to rely on the assumption that the research network can well be managed by the commercial business, and the role of the research networking organisation is confined to a marginal support activity. This is clearly a serious inhibitor for research and education networking in Morocco to be a catalyst for innovation and ultimately a drive to the Information Society.

MARWAN need to have control of the network

The first recommendation addresses the political level and stresses that the NREN in Morocco is similar to all other NRENs in Europe and should strive to obtain better service from the operators. As a result, the NREN should have control over the network operation and implementation of the services that are required by customers. The management of the network and configuration should be in the hands of the NREN and not managed by Maroc Telecom. In this way the services that users require can be provided more directly by MARWAN without the intervention of the Telecom operator.

The current solution implemented in MARWAN2 does not look like the ideal solution for the next generation of the research and education network of Morocco. A significant aspect of our main recommendation is that MARWAN needs to obtain access to lower level infrastructure at a reasonable price. This may be based on SDH/PDH or even Ethernet technology. Eventually, the option of fibre acquisition should be explored.

Telecommunication market and access to network infrastructure

Currently there are two main Telecom operators in Morocco:

- The incumbent, Maroc Telecom, which is a private company (51% Vivendi Universal – 49% Moroccan government)
- Méditel, a private company having the 2nd licence for mobile telephony only.

There are 3 small VSAT operators.

Clearly, as far as fixed telephony and data transmission are concerned, Maroc Telecom currently has a monopoly. But the telecommunication market in Morocco has started the liberalisation process, which should be completed by 2008. 20 June 2005 was the deadline for the international tender for other operators of fixed telephony. Three segments were targets of the tender: International, Local and Intercity.

The GEANT2 team met representatives of ANRT, the Regulatory Authority for Telecommunications in Morocco. In the meeting there was a discussion about the new European regulation in electronic communications, which has had two recent versions, known as the 1998 or ONP (Open Network Provision) package, and the 2002² (or 2003³) package. By now, all countries in Europe are at least formally compliant with the 1998 package and most are well advanced towards implementing⁴ the 2002 package. It is not known if Morocco has made any attempt to implement this regulatory package.

Some of the conditions to be met by a company to be able to offer electronic communication services include data privacy and respect for national security. In this respect, the power company or other utilities could not offer electronic communication services. Only Maroc Telecom meets the condition. However, it needs to be understood if the acquisition of a dark fibre infrastructure by MARWAN would be a case of buying an electronic communication service. From the talks with representatives of ANRT it appeared that the rules would allow MARWAN to buy and operate a fibre network. Additionally, no restriction could be put on private (by the research and education community only) use of fibre donated to the NREN.

The overall conclusion about fibre acquisition by the NREN in Morocco was that all actors involved need to understand much better the issues at stake, and should look closely to relevant European experiences. As a first step in such a direction this report describes as an example the case of CESNET (appendix A).

² European Commission Directives for Electronic Communication Networks April 2002, see http://europa.eu.int/information_society/topics/telecoms/regulatory/maindocs/index_en.htm#directives

³ The package was finalised in 2002 for implementation in EU Member States by mid-2003.

⁴ “Implementation” here means transposing the European framework requirements into national law.

Recommendation 2.

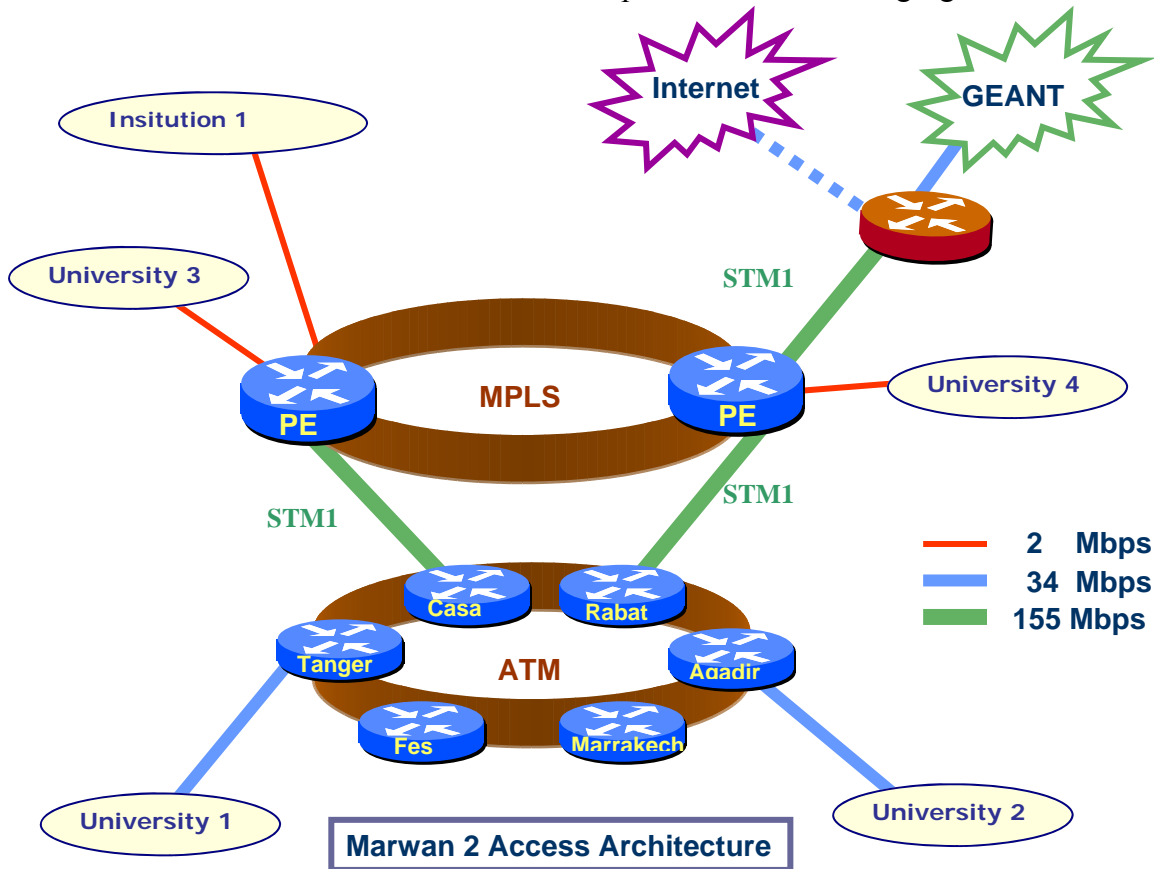
Recommendation 2

The heads of academic and research institutes and departments should encourage the introduction and use of advanced network services and applications such as videoconference, Grid and Authentication Authorisation Infrastructures in order to allow their institutions to participate and compete in the global research community. MARWAN will need to develop expertise and provide advice and support to existing initiatives like the development of a Tier2 High Energy Physics Grid node in Casablanca.

Status of RE universities/institutions connected services/applications

In Morocco there are 15 public universities (84 institutions) and 13 research centres, four of which belonging to universities, plus 55 public institutions of higher-education, which are not part of the universities and not financed by the Ministry of the Higher Education (they are financed by other ministries, such as Agriculture, etc.) and 77 private institutions of higher education.

The MARWAN current national backbone is depicted in the following figure.



The core of the MARWAN2 network is a Layer-3 MPLS VPN and is fully managed by Maroc Telecom.

As of 13 July 2005, 28 requests to connect to MARWAN2 had been received by Maroc Telecom, out of which 19 connections (15 at 2Mbit/s and 4 at 34Mbit/s) were already operational. With the transition from MARWAN1 to MARWAN2 the total aggregated bandwidth of all Moroccan universities' individual links increased by 663%, from 44Mbit/s to 292Mbit/s.

The annual budget of CNRST for the MARWAN2 network in 2005 is approximately 200,000 euro, including external connectivity and equipment.

In 2004, the Moroccan government invested about 2 Million Euro for universities to upgrade their campus networks.

All universities made the choice for the following solution:

- Interconnection of institutions close to each other by optical fiber, with Gbit Ethernet
- Interconnection of the more distant institutions by wireless (point to point or point to multipoint - 5 Ghz band)

To date, most universities have built or upgraded their campus LAN, only a few universities have not been able to do so yet.

The MARWAN2 network and the underlying investments are supported by the customers. Before the MARWAN2 network was implemented, CNRST held consultation meetings with schools and universities, which not just supported the plans, but also expressed their requirements and helped in defining the service needed by such a network.

Users need advanced services which are not available on the Internet

The primary goal of any research and education network is to deliver connectivity and associated services of high quality to its user community. There are many dimensions to the high quality that research network organisations aim to provide, for example:

- cost-effectiveness
- reliability
- offering very advanced services to users with high-level requirements
- wide connectivity via the research network infrastructure as a whole, reaching very large numbers of relevant locations worldwide
- providing good user support
- integration with the research and education communities, including the provision of support for interesting applications and services.

All researchers, teachers and students require cost-effective, reliable, widespread and advanced network services, regardless of their geographic location or subject discipline. Some have additional requirements, but there are common network services that all feel should be as available and as reliable as the electricity supply or the telephone service.

The type of services and application support that users are requesting in Morocco include applications specific for researchers, such as videoconference, digital libraries and content production. At the network service level, IPv6 and multicast are needed by the second half of 2005. Unfortunately there is no guarantee that Maroc Telecom will be able to provide such services.

Advanced users in Moroccan universities are involved in Grid applications, particularly in such disciplines as High Energy Physics (HEP), biochemistry, astronomy, meteorology, seismology. HEP looks like the most developed discipline with four universities collaborating on the ATLAS project at CERN and with the University Hassan II in Casablanca being a Tier-3 node. Existing plans to make Casablanca a Tier-2 node should be encouraged and adequately supported.

There is significant support for Grids in the country. A government investment originally targeting building a large supercomputing centre in Casablanca was recently converted to support the implementation of a distributed Grid infrastructure in the whole country.

MARWAN should take overall responsibility for implementing this Grid infrastructure. The GÉANT2 team feels that issues like virtual organisations, AAI, certification, resource brokers and other essential Grid components need to be fully understood, and that MARWAN staff and individuals from other institutions involved in RTD in this area should be encouraged to participate in European activities, like TERENA task forces, etc.

Recommendation 3.

Recommendation 3

MARWAN needs to have stable funding and sufficient, well trained, staff to meet the challenges of the foreseeable future.

During the visit the GÉANT2 team met several end-users of MARWAN. All the users met during the visit showed support to MARWAN and expressed high interest in using the MARWAN2 network. The GÉANT2 team appreciated the effort made by universities in building their campus LANs in order to make better use of MARWAN2. Now that the process of connecting universities to MARWAN has been almost completed MARWAN needs to encourage the users in making better usage of the network. This could start with supporting applications from the larger user communities, such as High Energy Physics.

The GÉANT2 team noticed that the Moroccan government supports MARWAN significantly; however this needs to be more consistent and recognise that in order to play the role of an NREN, which is comparable to European counterparts, MARWAN needs greater independence in the provision/operation and planning of network services. This issue needs to be addressed at the level of the network infrastructure, as detailed in the discussion of recommendation 1, but also at the level of the resources which are available to the NREN.

The table below, provided by MARWAN, presents a comparison of Moroccan NREN with other research networks concerning the backbone network capacity, and the resources allocated. This comparison regards CERIST (Algeria), RFR (Tunisia), ULAKBIM (Turkey), RedIRIS (Spain), RENATER (France) and GARR (Italy). Clearly the Moroccan NREN is under-dimensioned in terms of personnel.

	Backbone	Legal Status	Personnel	Outsourced
MARWAN (.ma)	155 M	Public	5	0
CERIST (.dz)	34 M	GIP	25	0
ULAKBIM (.tr)	622 M	Public	26	0
RedIRIS (.es)	2.5 G	Public	20	0
RENATER (.fr)	2.5 G	GIP	30	13
GARR (.it)	2.5 G	GIP	23	5

The budget of MARWAN is included in the total budget of CNRST, which comes from the *Ministère de l'Enseignement Supérieur*. Currently, there is no specific budget earmarked for MARWAN. Each year the director of CNRST has to negotiate the financial commitment for the following year with the relevant ministry.

As a consequence the GÉANT2 team recommends that adequate staff resources, which are not available today, are provided. Staff members need to be trained in the most advanced areas of technical and operation. Stable funding must be allocated to MARWAN and clearly earmarked for research and education networking.

The issue of training and expertise is also important. Some training components are included in the work programme of the EUMEDCONNECT project and need to be fully exploited. In addition, part of GN2-NA4 actions should be targeted specifically to support training activities in the country, either for the MARWAN staff, NOC staff, University staff or any combination of them. Grids represent a possible area for training and knowledge transfer. Grids are a strategic application driving networking in Europe quite now. Developments in this area will drive network use in Morocco.

APPENDIX A

The current development among National Research and Education Networks in the world is heading towards optical networks established by customers (also called Customer-Empowered Fibre network, CEF). These are enabled by dark fibre, optical fibre dedicated to use by a single organisation – in this case a research network organisation – where the organisation is responsible for attaching the transmission equipment to ‘light’ the fibre. NRENs are keen to access dark fibre to improve their networks, rather than lease complete services from telecom operators or commercial Internet Service Providers (ISPs).

Using optical networks on a national and global scale is strategically important for development of certain important science and research fields. These networks enable applications and projects that could not be realised using traditional telecommunication carrier services.

In Europe an increasing number of NRENs, like SURFnet (The Netherlands), SWITCH (Switzerland), DFN (Germany), CESNET (Czech Republic), and many more have customer empowered fibre networks, based on dark fibre. At the pan-European level, the new GEANT2 backbone will have large parts of the international links based on dark fibre.

The case of CESNET is described here in some detail because it is one of the most advanced and active NRENs worldwide in such a development and also presents a good case in the context of this report having faced the issues of finding alternative solutions in a situation of Telecom monopolistic regime. CESNET set off on this development in 1999 as one of the first organizations at the time when only a few NRENs were supporting this trend.

Since 2002, intensive efforts have been made in order to convert the CESNET2 production network to optical technologies. Experiments were carried out during the first half of 2002 on two lines utilizing state-of-the-art technology, without using in-line amplification (Nothing-In-Line, NIL): a 189 km-long line between Prague and Pardubice and a slightly shorter line between Prague and Ústí, with transfer rate of 1Gbit/s. At the end of 2002, CESNET was leasing more than 1,000km of fibre pairs. In 2003, CESNET established collaboration with a supplier helping them to construct the optical fibre first-mile lines. In June 2005, CESNET has been using 4,200 km of dark fibre, including 3,500 km in the CESNET2 nation-wide production network.

What is particularly interesting in this context is that when CESNET leased the first intercity optical fibre in 1999 Czech Telecom had a monopoly position and still had a problem with leasing dark fibre. In the year 2000 CESNET started operation of 2.5Gbit/s circuit 323 km between Prague and Brno. This was based on a contract between CESNET and the oil distribution company MERO ČR on the basis of research co-

operation. Before this date, leased dark fibre was used in the Czech Republic only in some metropolitan academic networks.

During the last five years the situation has improved, thanks to improved liberalisation. In the Czech Republic it is now possible to lease dark fibre from some telecom operators, railway companies, oil and gas companies. However, initially it was necessary to discuss a lot about possibilities and conditions of fibre leasing. At present there are many laid cables between some of the big towns. In these cases it is possible to acquire dark fibre cost-effectively. The problem is not anymore to acquire dark fibre between cities, but first mile fibre to customer premises.

There are various possible types of dark-fibre acquisition by NRENs, including leasing fibre with or without maintenance, buying Indefeasible Right of Use (IRU) or laying one's own fibre. The CESNET model is leasing fibre lines, including maintenance, where maintenance fee can be a component of the monthly leasing costs. Dark fibre leasing is based on open procurement. CESNET have established different types of leasing contracts, depending on which conditions were most favourable, varying from contracts for two to five years with possibility of extension to contracts for undefined period of time.

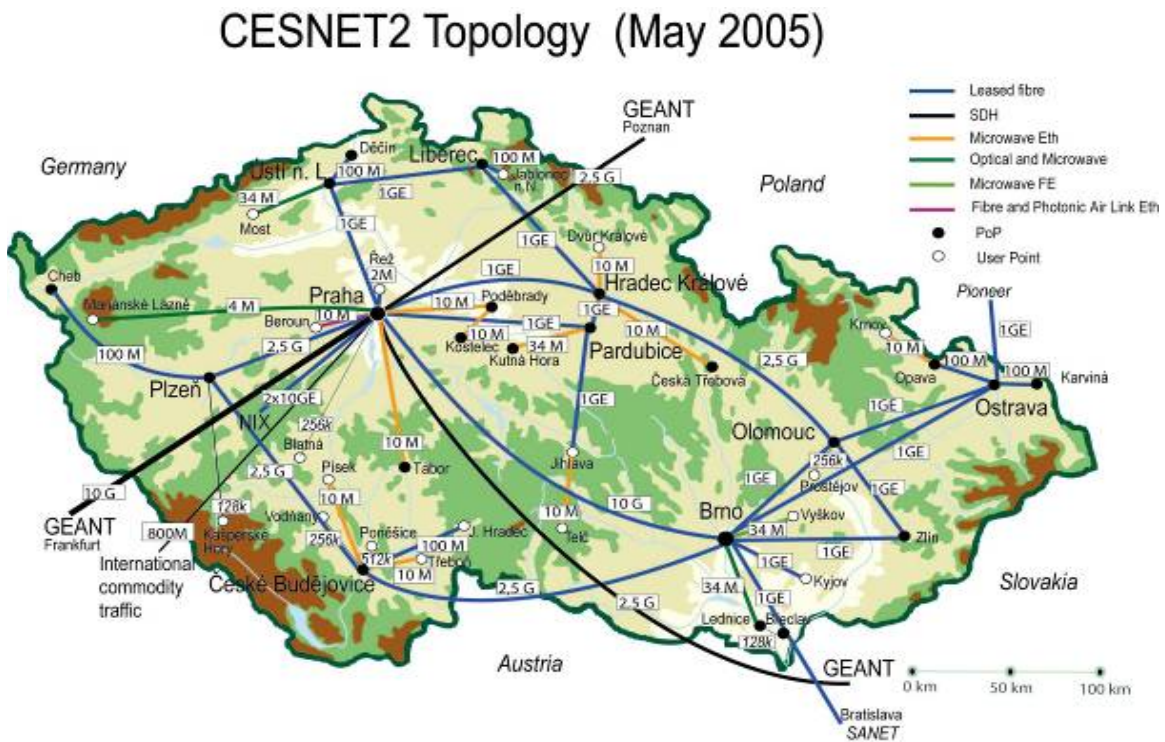


Figure 1 CESNET2 Network Topology

The upgrade of the CESNET2 production network to a customer empowered dark fibres was mostly completed in 2003. CESNET is one of the world leading organisations in CEF networks deployment. As of May 2005, all NREN gigabit lines are based on dark-

fibre, plus CESNET deployed six single-fibre intercity lines (more than 350km in total) with transmission speeds of 100Mbit/s, especially suited to connecting smaller nodes to the network. A 10 Gbit/s fibre-optic route using DWDM is operational, a dark fibre line Prague-Brno 298.3 km (attenuation 66,5dB) including 257.3 km G.655 fibre, DWDM OC-192C transmission in CzechLight testbed. CESNET has operational international 1GE dark fibre interconnections to the Slovak NREN SANET and to the Polish NREN Pioneer.

APPENDIX B - Meeting agenda and contact details

Monday 20 June 2005

- 08:30 : Meeting with the staff of MARWAN
- 10:00 : Meeting with the representatives of the *Agence Nationale de Réglementation des Télécoms* (ANRT)
- 11:00 : Meeting with the Secretary General of the *Département de l'enseignement supérieur*
- 13:00 : business lunch with the director of the *Ecole Nationale Supérieure d'Informatique et d'Analyse des Systèmes* (ENSIAS) and the director of the *Institut Nationale des Postes et Télécommunications* (INPT)
- 15:00 : Meeting with the Director and researchers of ENSIAS
- 16:00 : Meeting with the rector of the University Mohamed V – Souissi and with users and researchers
- 17:30 : Meeting with the Director and researchers of the INPT

Tuesday 21 June 2005

- 11:00 : Meeting with the rector, users and researchers of the University Hassan 2 – Casablanca
- 12:30 : business lunch with the rector of the University Hassan II - Casablanca
- 15:30 : Meeting with the Director of the Techno Park – Casablanca

Wednesday 22 June 2005

- 08:30 : Meeting with the Director of CNRST
- 10:00 : Meeting with the MARWAN staff