EDUCATIONAL INFORMATION SOCIETY IN GREECE: THE GREEK SCHOOL NETWORK

Christos Bouras, Assistant Professor
University of Patras, Computer Engineering and Informatics Dept.
Computer Technology Institute, Network Technologies Sector
University Of Patras, Department Of Computer Engineering and Informatics,
GR-26500 Rion, Patras, GREECE
bouras@ceid.upatras.gr & bouras@cti.gr

Dr. Michael Paraskevas
Computer Technology Institute, Network Technologies Sector
Riga Feraiou 61, GR-26221, Patras, GREECE
mparask@cti.gr

ABSTRACT

In this paper, we present the Greek School Network. This project is financed by the Second and Third Community Support Framework of the European Union. Research and Academic Computer Technology Institute (CTI) has the responsibility for the design, coordination and the implementation of the project. The main object of the project is the implementation of a network infrastructure for the interconnection of school laboratories and educational administration offices and the provision of network services in a wide range. It forms a closed educational network, which is based on the Greek educational and research backbone network (GRNET). The Greek School Network statistics show that teachers and students have adopted the services of GSN in their school life and learning activities.

KEYWORDS

Educational Networks, Greek School Network, Content Filtering, Internet, Greece

1. INTRODUCTION

The Greek Ministry of Education (www.ypepth.gr) has advanced the planning, growth and operation of an advanced educational network, named Greek School Network (GSN – www.sch.gr), responding to the need for reform of educational services in Greece and of the integration and exploitation of Information and Communication Technologies in education. The main objectives of this network are to create a national infrastructure, interconnect all schools in an educational Intranet and provide and support advanced telematics services to the school communities. The Ministry of Education has already financed projects for small school networks since 1996. Today, the GSN is implemented with the collaboration of the Ministry of Education and many collaborating Universities and Research Centers. The technical leader of this project is the Computer Technology Institute. In this particular way of collaboration, the equivalent cover of all geographic parts of the country and particularly, the creation of powerful relations of collaboration between schools and Universities and Research Centers, the support of schools from institutions that are placed near them and the progressive transfer of the know-how to the secondary education, are ensured. The GSN planning, implementation and operation accord with the European Union policies and are financed by the Second and Third Community Support Framework (CSF) (Operational program for the Information Society www.infosoc.gr).

The experience from the European countries, U.S.A, Canada, Australia and the other countries shows that there is a national policy for the import of Network Technologies in the schools of Elementary and Secondary education. The result of that policy is the creation of a network of schools of national scope or, in certain cases, the creation of regional networks of schools of wide geographic coverage. The national academic and research network of each country which interconnects the Universities, the Research Centers, the Educational Institutes

and in some cases other institutions such as Libraries, Substantiation Centers and Museums, is usually used as the backbone network of the school networks. It is remarkable that almost each European country has a national, academic and research network. The use of private institutions (ISP: Internet Service Providers) for the provision of Network Technologies to the schools is relatively limited. Also, there are initiatives from the corresponding Ministries of Education of a lot of countries, for the connection of the school networks of each country to the national research networks (Table 1).

Table 1 International experience for school networks

Country	National Research Network (NRN)	School Network	Access Network (NRN/ISP)
EUROPE			
Austria	Aconet	Austrian School Network (ASN)	Aconet (NRN)
Belgium	Belnet	Peripheral, because of different languages Scholen Internet Project Brunette	ISP/NRN
Holland	Surfnet	Direct connection to Surfnet or indirect through Universities that are connected to Surfnet	Surfnet (NRN)
Denmark	Sektornet Darenet	Direct connection to Sektornet	Sektornet (NRN)
Finland	Funet	There isn't School Network	Free choice through Funet ή ISP
Norway	Uninett	There isn't School Network	ISP & Initiatives of the Ministry of Education for connection to Uninett
Sweden	Sunet	Swedish School Computer Network	Sunet (NRN)
Island	Isnet	Direct connection to Isnet	Isnet (NRN)
United Kingdom	Janet/Ukerna	There isn't National School Network	RM IFL (ISP) Program of the Ministry of Education NGfL
Ireland	Heanet	Schools IT 2000 Ednet Ireland	Telecom Eirann for access to NRN Ireland-on-Line (ISP)
France	Renater	Peripheral networks with direct connection to Renater	Renater (NRN)
Portugal	RCCN	Direct connection to RCCN	RCCN (NRN)
Spain	Rediris	There isn't National School Network	ISP, Initiatives of the Ministry of Education for connection to Rediris
Germany	DFN/B-WiN	Schulen ans Netz	Deutche Telecom for connection to NRN
Italy	Garr	Deure Bologna Kidslink	Garr (NRN)
Hungary	Hungarnet	Sulinet	Hungarnet (NRN)
Greece	GRNET	Greek School Network	GSN (Greek School Network)
OTHER COUNTRIES			
Australia	EdNA	EdNA, Actein, National networks at the level of states	EdNA (NRN) States Networks (NRN)
U.S.A	Esnet NSFnet	National networks at the level of states - K12 net	NSFnet (NRN) ISP
Japan	Nacsis Imnet	100 School, Networking	Initiatives of the Ministry of Education for connection to NRN
Chile	Enlaces	Direct connection to Enlaces	Enlaces (NRN)
Canada	Canarie CA*net II	Schoolnet - Plugging kids into the World	Canarie (NRN)
China	Cernet	There isn't National School Network	Initiatives of the Ministry of Education

The international experience shows that the research and educational networks present some characteristics that are not presented in the other commercial networks. Those characteristics are the following:
- High speed of transmission with reliability in the interior and in the exterior. The majority of the backbone networks operate at the speed of 34 and 155 Mbps.
- Requirement for transmission of multimedia, so as educational applications to be supported.
- Avant-garde concerning the used technologies and the added services.

- High subsidy at the beginning of the operation of such networks.

The GSN is ambitious to provide useful and certified networking services as the refresh the educational methods, the encouragement of collaboration, the effective distribution of educational material to the students and teachers, the support of the learning process through the networking environment, the flexible search and retrieval of useful verified information, the creation and distribution of presentations, the conduct of thematic discussions, seminars and lectures through the network, the access to services of digital libraries of educational and research institutes, the co-operation and communication between Secondary and Higher Education, the communication with European and international educational networks and the capability of supplying education to persons with accessibility problems. As a result, the GSN aspiration is to constitute an environment of application of new technologies to the educational system where it will be possible for new educational methods to be applied, evaluated and used.

2. NETWORK ARCHITECTURE

At the time the network was being designed, some crucial factors were taken into account that affects its implementation and its future development. Special care was given to the users' specific needs, the interconnection speed and the basic and advanced services provided to the users from the school network. These factors were (a) the geographical areas that the network covers, (b) technological issues, i.e. available networking technologies, provided applications, expansion possibilities, etc, and (c) financial factors, i.e. cost of equipment, installation cost of telecommunication circuits, network operating cost, Internet access cost, housing cost at the points of presence, cost for the pilot running, management and operation cost, equipment depreciation and backup system implementation cost, etc.

The design model and the operational specifications of the GSN are based on the TCP/IP protocol. Also, the network's topology has a hierarchical structure and consists of the following levels: Backbone network, Distribution network, Access network and Local area network in school laboratories

As **backbone network** is used the Greek Research and Technology Network, (www.grnet.gr), with seven entrance points and total installed capacity up to 40 Mbps. The choice of GRNET as the GSN's provider was a strategic choice of the Ministry of Education, absolutely compatible with the international practice.

Distribution network is the part of the network that interconnects points of presence with the backbone network. The topology has such design in order to preserve the operational cost in low levels, which is particularly critical in large networks. The network nodes are distinguished in two categories: (a) Main nodes that are points of presence which are interconnected directly with the corresponding node of the backbone network, and (b) Secondary nodes that are points of presence which are interconnected indirectly with the backbone network through connections with the nearest regional node.

All the nodes have special networking devices that provide the interconnection of the educational and administration units in their area, as well as the interconnection between the nodes. Also, there are a large number of servers, distributed all over Greece, that provide the network services to the users and the administration tools for network management.

Access network is the part of the network, which interconnects educational and administrative units with the nearest node.

Speaking for wired connections the common broadband technology is the ADSL (Asymmetric Digital Subscriber Line), which is supports maximum capacity 8Mbps/800Kbps (downstream/upstream), using the existing local loop infrastructure for a distance until 5.5 Km, approximately. Then, as the optical networks is raised more and more and approaches the schools, the VDSL (Very high rate Digital Subscriber Line) becomes an attractive choice, especially for the large school units. Although, the VDSL does not have still standardized, it is expected that it will supports capacities up to 55 Mbps/19 Mbps (downstream/upstream), using the existing cooper wires and in distance from 300 until 1500 meters.

Our final scope for the access network is the wide use of optical fibers, where it is possible. This is the solution with the larger time life, as a fiber is a data channel appropriate for any data technology transmission at very high data rates (1 Gbps at least). In the case where the optical fibers are a part of a wider network (condominium fiber or community/municipal fiber), then are raised important economic profits, caused to the reduction of telecommunication for schools. Moreover, the usage of the optical fibers gives the flexibility to the

GSN to select the desirable data technology transmission. This is done owing to the absence of a certain telecommunication provider in order to interconnect our nodes.

A wireless network can be a very attractive solution when the construction of a wired broadband network is impossible for technical or economical reasons. Today there is a large number of wireless products, such as wireless bridges (IEEE 802.11b – WiFi), which are operate in the ICM band (2.4 GHz) and support capacities up to 11 Mbps. Other wireless technologies and protocols, such as the IEEE 802.11a and LMDS, supports data rates in the range 34 – 50 Mbps and they can be used by the GSN in order to interconnect its nodes or schools.

3. NETWORK USERS

Because the sensitive educational character of the GSN and the need to protect the students at their access in the Internet, the GSN has adopt as a strong requirement the certification of its users. So, the users are distinguished in the following categories: (a) School units, in which are given one or more accounts to access the network, (b) Administrative units, in which are given one or more accounts, (c) Teachers, in which are given personalized services (including dialup access to some subcategories of educators). The identification process is provided through an automated environment, (d) Students, which have access to GSN through the school laboratories, such as and personalized services. Their identification is done directly from their schools, with the collaboration of school administration software and LDAP service of GSN and (e) Administrative personnel, which has access through their interconnected school or administrative units, such as and personalized services.

4. NETWORK SERVICES

Most of the network services planned are already up and running, while some of the most advanced services are at the implementation stage. The network services are divided into three categories: Fundamental, basic and advanced services.

The fundamental services are defined as the set of minimum services and constitute the basic frame of the network. These include (a) the addressing scheme and routing plan and (b) the Domain Name Service (DNS) scheme.

The basic services offered to the Greek schools are the following:
1. The Dial-up service and the connectivity to the network. This service is provided only to educational or administrative units and to a very small number of teachers. We are planning to provide this service to a large number to the near future.
2. The well known E-mail service than can be delivered using various ways, such as POP3, IMAP, or webmail (www.sch.gr/webmail).
3. The Caching and Proxy Service: This service provides the smart exchange of information and improves the whole network's operation.
4. The service of Web Filtering is mainly based on the proxy service. It is transparent to users and obtains the exclusion of access to sites with harmful content. More details about this service will be given in the following slides.
5. The service of Web-page generator allows our users to make their WebPages in a simple and fast way, and using the
6. Service of Web hosting they can upload their web pages to the servers, using an ftp client. The possible users of the above two services are also schools or teachers (users.sch.gr/<user name>).
7. The well known service of the World Wide Web is also allowed to our users.
8. The service of Discussion Forums allows the communication among members of an educational group as well as the newsgroups service
9. The Directory Service (LDAP) provides access to indexes related to users' information. This service is very important, because it supports, in the background, the other services.
10. The service of the School Network Portal (www.sch.gr) provides useful information about school network and interconnected units and also operates as the single point of the school web sites. (Information: info@sch.gr)
11. The services of Personal Calendar and Address Book are two services with obvious use.

12. In order to manage the large number of network users, there is the Users' Administration service (www.sch.gr/usersadmin), which supports a distributed operation and several hierarchical levels of administration.
13. News service (news.sch.gr)
14. The service of Statistics (www.sch.gr/statistics) provides useful information on the network's operation and is very useful when the network's upgrades are designed.
15. The Voice over IP is a pilot service, which is provided on a limited scale, mainly to administration units.
16. Finally, the service of Help-Desk (www.sch.gr/user_support) is based on a distributed structure and obtains the uninterrupted operation of the whole network. The service is accessed by users mainly over a free phone line, but fax, email or web access is also provided.

About the Advanced services, we expect a number of these are going to be set up in the next months. These services are the Teleconference, the Asynchronous Open Distance Learning and the Video on Demand.

5. THE WEB-FILTERING SERVICE IN THE GSN

In this section we will describe the policies about a crucial service for every educational environment. This is the content (or web) filtering issue. We also describe the architectural scheme we have chosen to implement this service in the GSN.

As is also known, the minimum requirements to control the usage of the telematic services only for educational scopes are (a) the use of acceptable use policies, (b) the information of the teachers, (c) the control of the software that gets installed in school computers and, of course, (d) the creation of educational material.

The implementation of our policy is based on the following steps (a) specification of the pages considered improper, harmful or illegal, (b) information of the teachers, parents and students, (c) creation of educational software (this is done by other project), and (d) policies and techniques in place

Since everybody seems to admit the problem, we must find the methods which will deal with it in the best way. These are the use of: (a) keyword blocking, (b) negative and positive lists and (c) content labelling and rating systems. Definition of content with the use of Content Labelling and Rating systems is done with the attachment of a set of tags to each Webpage, which specifies the kind of the information displayed on it. Organizations that provide ratings for web sites are the Internet Content Rating Association (ICRA), the SafeSurf and the Entertainment Software Rating Board (ESRB). While the SafeSurf is the first system at this kind ever implemented, it seems that today the most famous rating system is the ICRAfilter. The ICRAfilter is a browser-independent tool which is intended to provide parents with a means to filter their children's internet access according to ICRA labels, their own "block" and "allow" lists or third party lists of web sites. We will be able to install it on any PC running Microsoft Windows. The real power of the ICRA*filter* is that it also supports lists of web sites created by other organizations and companies extending the width of its solution. ICRA is talking to a number of potential list creators and there is special provision to have several lists available.

To implement the service of content control we can use Commercial Software, Freeware programs (here the Rating Systems are included) or Hardware Solutions. All these are mainly based on the use of negative lists. There are three different sub-approaches: (a) The proxy-cache server does the filtering on its own, if filtering and blocking requests are not massive and if the server provides such a possibility, (b) Plug-ins does the content control. That approach offers much more options and in most cases, there are ready site lists grouped by their content. These lists are updated frequently, and (c) The last category includes the products that can operate as independent servers used only for filtering. In this way they can be used separately, especially when they are not used for caching, whereas the site lists are provided and updated automatically.

For the GSN needs, we decide to adopt an Open Source solution. What made us eventually prefer freeware programs was the fact that Commercial programs are mainly intended for client machines, while hardware solutions always have a considerable cost. Combining that with the exceptional performance of Squid proxy server left us with no other choice. As is well known, for a school network the use of the proxy server – especially when it is configured as transparent – is the ideal point to implement the control on the requested objects, because it concentrates the users' requests and is the only entrance point of web traffic. As we use Squid as the transparent proxy-cache server, that solution fits us perfectly in our case. Also, we use some external programs, such as the SquidGuard, to accomplish efficient and quick access control. This approach offers much

more options and in most cases, there are ready site lists, frequently updated and grouped by their content. An interesting piece of information is the way related sites are grouped. Our blacklist database contains the following categories: porn, aggressive, drugs, violence and gambling. Specified statistical data about the usage of the web-filtering service are presented in the Statistical Data section.

6. STATISTICAL DATA OF THE CONNECTIVITY PROGRESS

In this section we present some statistical data of the project's progress and the GSN's usage. The connection of the schools and the administrative units, takes place simultaneously with the qualitative upgrade of telecommunication connections of the units to the Internet and with the provision of new advanced services to the users. The distribution network has been completed according to the planning since the spring of 2001, while its extension and upgrade has already begun, so as to completely serve the necessities of networking of the elementary education. The total number of connected units is 7.763 educational and administrative units (January 2003). The interconnection of the educational units of the secondary education has been completed since December 2001 according to the eEurope targets (Table2, Figure 1).

Table 2 Interconnected educational units in GSN

Level of Education	Total of units	Percentage of interconnection
Kindergarden	5.667	2,8%
Primary education units	5.974	46,0%
Secondary education units	3664	100,0%
Initial Vocational Training (IVT) units	141	100,0%
Total	**15.446**	

Also, more than 1.000 administrative units have been connected to the GSN, while more than 2.000 teachers have acquired personal account for access to the services of GSN following automated process of registration through the site www.sch.gr.
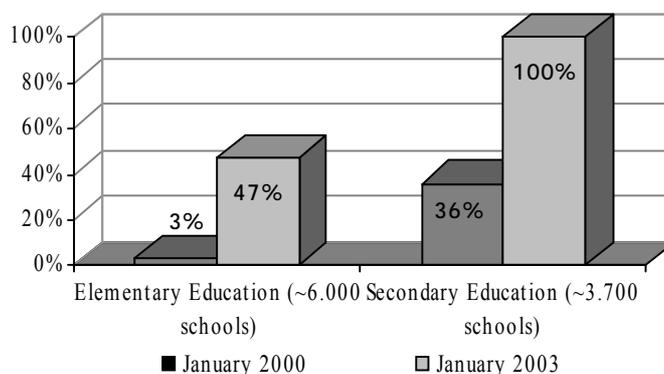

Figure 1 Interconnection of schools of the elementary and secondary education

The exterior traffic (inbound/outbound) from/to the GSN has rapid growth, as it is shown in the Figure 2. It should be marked that the following data concern the traffic from/to GRNET and do not concern the internal traffic of GSN that does not pass through the nodes of GRNET and that is also very important.

The proxy and content control service ensures the controlled access of users of GSN to the World Wide Web, while it contributes to the better disposal of the resources of the network. The average number (years 2001 – 2002) of demands to the Proxy service is 1.600 requests/min and the maximum value is 7.300 requests/min. At

the same time, the followed (from 1999) policy of the content control cuts off the 7% of the access demands to sites with content that has been characterized as inappropriate for the students.
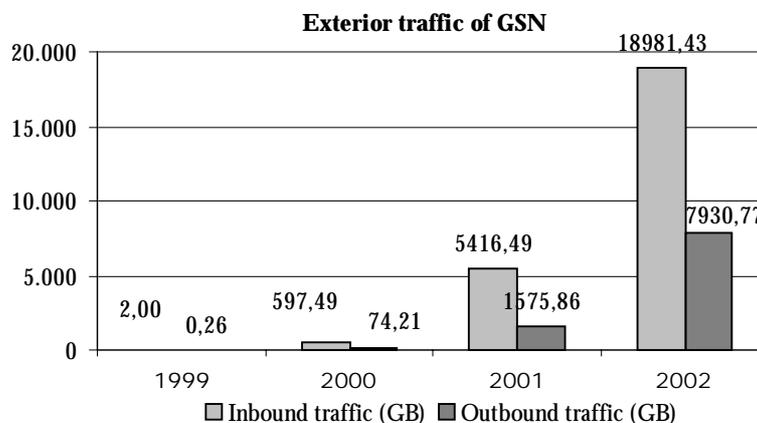

Figure 2 Exterior traffic of GSN from/to GRNET

The user's administration service ensures the certification and the management of the user accounts of GSN. The active accounts are shown in the Table 3.

Table 3 Number of accounts of GSN per category

Category of users	Dec. 2001	Dec. 2002
Active e-mail accounts	6.065	13.789
Accounts of Elementary education units	1.053	3.384
Accounts of After-Secondary education units	419	455
Accounts of Secondary education units	4.103	6.842
Accounts of teachers (certified users)	228	2.041
Total of active user accounts	**5.803**	**12.722**

7. CONCLUSIONS

Most of the educational networks offer access to the Internet, while all of the developed or developing countries have elaborated programs of connecting Schools to the Internet. Specifically, according to studies developed in U.S.A, the reason that teachers and students use access to the Internet is to perform the above functions: (a) Use of the e-mail to communicate with persons outside school, (b) Exchange of ideas and information by using e-boards, (c) Search and information retrieval concerning educational resources, school papers and studies, (d) Entertainment and search of information according personal interests, and (e) Participation in the elaboration of common work through the Internet. The same studies concluded that the most used applications, of those that are used to give access to the net, are the e-mail and the Web Browser.

Every school that has access to the Internet uses the network services for educational issues. Specifically the communication between the members of the educational community is ensured via the use of e-mail, e-boards, thematic news groups, services for interpersonal and common discussion, etc. Important quantitatively and qualitatively is the use of WWW in the educational process. Also, frequent is the use of collaboration services for the development of common work using the network. Similar are the network services that are also used in the educational networks that do not constitute part or do not give access in the Internet.

In the case of Greece, the Ministry of Education which designs, implements and coordinates the project of the GSN, has enrolled projects in the Operational Program for «Information Society» (www.infosoc.gr) (3rd Community Support Framework), so as to be ensured the continuation of the operation of the network and the provision of network services and support to the final users. Moreover, these projects that are keeping pace with the international technological development, implement the upgrade of the backbone network (routers and servers) at the level of the switching speed and at the level of the number of the access ports. In that way the total of the educational and administrative units of the Elementary and Secondary education (time of completion May 2003) is served efficiently and qualitatively. The implementation of the upgrade of the access network also proceeds with the installation of broadband connections (500 connections of type ADSL, 150 connections of type VDSL and more than 200 wireless high speed connections) to equivalent number of schools of the Secondary education. Because of the high speeds that will be provided by these connections, it will be possible the provision of advanced high quality services of telematics to the particular school units. For the elementary education is forecasted the completion of interconnection to the GSN all the primary schools and an important number of Kindergartens, during 2003. Also, the planning forecasts the provision of personal access accounts to the services of the network to all the teachers of Elementary and Secondary education, administrative employees of the schools and the administrative units, and also pilot to the students. Finally, it is designed the exploitation of the infrastructure of GSN for the provision of distant learning educational services (synchronous and asynchronous distant learning).

REFERENCES

B. Collis, P. De Vries, W. Veen, & F. Vogelgang de Lier (eds.), (1994), *«Telematics in education: the European case»*, De Lier: Academic Book Centre

B. H. Lamont, (1996), *«A Guide to Networking a K-12 School District»*, Master of Science in Computer Science, Graduate College of the University of Illinois at Urbana – Champaign.

C. Bouras et al *«Basic Internet Services Environment for the Education Society»*, International Journal of Computers and Applications, ACTA PRESS, Vol. 23, Number 1, 2001, pp. 35 - 44

C. Bouras et al *«e - Learning through Distributed Virtual Environments»,* Journal of Network and Computer Applications, Academic Press, Vol. 24, No. 3, July 2001, pp. 175 - 199

C. Bouras et al *«Efficient Web - Based Open and Distance Learning Services»*, Journal of Telematics and Informatics, Elsevier Science, Vol. 17, Issue 3 (2000), pp. 213 – 237

C. Bouras et al *«Major Principles on the Design of an Educational Network»,* Open Classroom II Conference, 17 - 19 September 1997, Crete, Greece, pp. 359 - 366

C. Bouras et al *«Managing users and services using an LDAP based web – application»,* APPLIED INFORMATICS 2003, Innsbruck, Austria, February 10 – 13, 2003 (to appear)

M. Avgoulea et al *«Policies for Content Filtering in Educational Networks: The case of Greece»*, Journal of Telematics and Informatics, Elsevier Science, Vol. 20, Issue 1 (2003), pp. 71 - 95

R. I. Rothstein, (1996*), «Networking K-12 Schools: Architecture Models and Evaluation of Costs and Benefits»,* Master of Science in Management and Master of Science in Technology and Policy, MIT Sloan School of Management.

W. J. Pelgrum, (1992), «*New Information Technologies in the education systems of the EC Member States»*, Synthesis Report, European Commission

«Going Beyond Your Local Area Network», California Department of Education - K12 Network Planning Unit, (1999) http://www.cde.ca.gov/ftpbranch/retdiv/k12

http://www.ed.gov, (2003), *«U.S. Department of Education Home Page»*

http://www.en.eun.org, (2003), *«European Schoolnet»*

http://www.ngfl.gov.uk, (2003), *«National Grid for Learning (NGfL)»*

http://www.grnet.gr, (2003), *«Greek Research and Technology Network»*

http://www.sch.gr, (2003), *«Greek School Network»*

http://www.ypepth.gr, (2003), *«Ministry of Education and Religious Affairs»*