

THE GREEK SCHOOL NETWORK: *Structure, design principles, and services offered*

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Abstract: The Greek School Network (GSN) is a closed educational network that offers advanced telematic and networking services to all units of primary and secondary education schools and administration offices in Greece. The main objective of GSN is the implementation of a network infrastructure for the interconnection of the school laboratories and the provision of a wide range of network and telematic services to students and teachers. The GSN separates its telematic services to two major groups: the centralized services and the end-user services. The purpose of this paper is to describe the GSN structure, the services it provides, and its design and operational principles.

INTRODUCTION: THE GREEK SCHOOL NETWORK

The Greek School Network – GSN (Greek School Network, 1998), described in this report, is the educational intranet of the Ministry of Education and Religious Affairs, which interlinks all Greek schools and educational administration offices, and provides basic and advanced telematic services to students, teachers, and administration personnel. It also contributes to the creation of new educational communities that use Informatics and Communication Technologies in the educational procedure. The telematic services of the GSN are based on Open Source technologies that are modified in their source to fit exactly the needs of the Greek educational community.

The GSN offers a large number of services to more than 15.000 schools and administrative units, and over 50.000 teachers in Greece, across all the 51 prefectures of Greece. The services are offered over the network that GSN has developed and maintained since 1998. The network is hierarchically structured into three layers in order to manage the complexity that comes with the large number of sites that are covered:

- **Core Network:** The Greek Schools Network interconnects with the Greek Research and Technology Network (GRNET, 1995) in seven main points, using it as its core network.
- **Distribution Network:** The distribution network provides for the interconnection of the schools and educational administrative units to the core network, and consists of 51 nodes. The GSN has installed in the capital of each prefecture, network and computational equipment, to ensure optimal access of the prefecture's schools to the network and its services, and is further separated into two distinct layers:
- **Access network:** It is used to directly and efficiently interconnect the schools to the prefecture's access point. The telecommunication junctions used to interconnect each school are selected on the basis of financial and technical criteria from an array of available options: Digital ISDN circuit (bandwidth: 64 - 128 kbps), Analog leased line (0,128 – 2 Mbps), Wireless link (10 Mbps), ADSL circuit (384/128 Kbps, 512/128 Kbps, 1024/256 Kbps), VDSL

circuit (10 - 15 Mbps), Public Switched Telephone Network circuit (56 kbps)

In order to achieve the objectives of *e-Europe 2005* regarding the provision of broadband access to all schools, the Greek Schools Network is upgrading its distribution network by increasing its installation of broadband connections (ADSL connections and 10 Mbps wireless links). Regarding the wireless links, 13 distinct wireless networks are in operation. The wireless networks allow for the provision of advanced, high-quality telecommunication and informatics services to the units connected, and significantly decreases the telecommunication operational costs.

2 THE GSN CENTRALIZED SERVICES

The Greek Schools Network offers a broad package of services to its units and users that can be separated into two main categories: the centralized services and the end-user services. The centralized services are supporting many of the end-user services and also offer GSN administrators the ability to globally monitor the correct operation of the services. The GSN's centralized services are the Directory Service, the Content Filtering service which controls the access to the Internet, prohibiting access to web sites with harmful content for children, and the Web Hosting for static and dynamic pages

2.1 The LDAP Directory Service

The main centralized service of the GSN network is the LDAP directory service. The LDAP directory holds all the teacher and school accounts and is used to authenticate the users in all services that require a login process. The attributes in the LDAP directory have been adjusted for every user in order to suit the needs of the services offered. The directory service is supported by an array of four servers, three of which are exclusively dedicated to supporting the directory service. The main server is the write master, where all additions and updates to the directory information store take place. The remaining servers store a copy of this information, which is continually synchronized with the main server (online replicas). The online replicas constantly answer to queries of other services supporting the delivery of email messages, the dialup access to the network, and the

authentication/authorization operations for the other services. It is worth noting that in addition to the typical multimaster replication model, alternative servers may assume the role of the main write master, allowing for the smooth and continuous operation of the directory in case of malfunctioning of the write master server.

2.2 Controlled Access to the Internet

The GSN has restrictive policies for the sites that can be accessed by the students. A schema with the appropriate proxy servers is used to control the access of GSN users to the Internet. The access is prohibited to categories like porn, drugs, violence, gambling etc. There are three ways for the GSN system to control the access of its users to the Internet. The first is to examine for words that identify an illegal category in the URL or in the metadata of every requested site. The second way is to communicate with international black list databases and deny access to the sites listed in these databases. The third way to control the access to the Internet is more customized to the GSN needs. The GSN has built an extra database to explicitly record sites not allowed to be accessed and sites allowed to be accessed. The first database helps restrict access to sites that are not globally black listed but whose content is not consistent with the GSN terms of use. A user has the right to suggest a site that must be blacklisted, and the administrator of the service examines the site and includes it in the custom black list database, if its content is found to be ineligible. A similar database is used to record sites whose content is not offensive, but which have been blacklisted for some reason. A user may suggest, by sending an e-mail to the administrator of the service, a site that is currently prohibited to become accessible. The administrator then examines the content of the site, and if it is found to be appropriate records it in the while list database so that GSN users can access it.

2.3 Web Hosting

The Web Hosting service provides space for web pages and web applications using the GSN Web servers. The service is provided to the schools and teachers community to create their own web sites. The web sites are separated to schools' web sites and administration units and teachers' web sites

Each school or administration unit connected to the GSN has its own Domain Name (DNS) under the sch.gr domain. This DNS is the address of a virtual web hosting server for this unit. If a unit has more than one accounts, each of them has an independent web site accessible under the address <unit DNS >/xxxx.

The service allows the users to publish static HTML pages or dynamic pages using PHP and MySQL. The GSN offers to its users a web based database administration interface accessible under the Web Portal. Each school or administration unit is allowed 100 MB of web space, and each individual teacher is allowed 50 MB of web space. The GSN offers four different tools for building web pages. Two of them focus on building static web pages and the other two tools focus on building dynamic web pages. The tools were all developed by the GSN team and they can be accessed by registered users through the web portal. In addition to the web page building tools, GSN users have FTP access to their web space, so that they can simply upload a site they have already built elsewhere.

The schools and teachers sites are shown in the web portal in a special area dedicated to the users' sites. The sites are grouped according to their thematic area in a thematic catalogue that is available to the visitors of the web portal. A rating mechanism is also available, and the sites with the highest rates are shown in the first page of the web portal. Through the web portal, users can add web sites to their favourite preferences, which are shown in a special area of the portal. The portal also provides a search mechanism for the teacher and school web sites through a graphical interface (a map of Greece), allowing searches by author, name, and geographical area.

3 THE GSN END-USER SERVICE

The end-user services offered by GSN are:

- Web Portal (Greek School Network, 1998), offering news services and personalized access to all GSN telecommunication and informatics services under a single login method.
- E-mail, accessible through the POP3 and IMAP protocols, as well as the world wide web and E-mail lists
- News service, forum discussions and electronic magazine

- Wizards for automatic webpage creation
- Asynchronous distance learning, for hosting and distributing digitized courses
- High end multimedia services such as Teleconference, Video On Demand for delivering streaming educational multimedia material and Live Web Casting of various educational events
- Automated registration procedure for educational staff and students
- Remote network access (dialup)

All the end user telematic services are implemented in the GSN Web Portal.

3.1 The Web Portal

The framework used for the implementation of the GSN Web Portal has been mainly based on the Jetspeed Portal of the Apache Software Foundation.

The framework used offers a programming context oriented towards the implementation of web portals that have a large number of users. At this moment, Jetspeed is actively being developed and its feature set is constantly being expanded. The GSN developing team is further expanding the functionality of the framework engine to develop a portal environment that suits the needs of the GSN users.

The Web Portal Design adheres to the following general specifications:

- The portal permits the execution of micro-applications that are integrated in it as portlets. This specification allows for the natural separation of the application and the presentation layer, by offering virtually unlimited potential regarding the presentation location and format of the output of each portlet. The output of all portlets is well defined on the basis of XML/DTD schemas.
- A number of services are currently being implemented as Web Services. This will dramatically increase the re-utilization of these services as well as their distribution to the end users. Public access may be offered to Web Services (through UDDI) separately from the web portal; for instance such services may be incorporated in the users'

pages (e.g. services that deliver maps based on the G.I.S.).

- The usage of Jetspeed as the underlying framework offers clear advantages, since issues related to security, user authentication and authorization, content display mechanisms in a customized environment, separation from the portlet implementation programming language, velocity engine template support for content display and integration with other Open Source applications have already been solved.

The GSN has developed further the Open Source portal to support LDAP authentication over secure password encryption (encrypted with the Unix Encryption algorithm according to the SUN ONE LDAP Server), to support personalized pages for every registered user and to make the login procedure easier by keeping the navigation of an anonymous user when he/she decides to login to the portal. Furthermore, the appropriate modules have been created so that all the available portlets of the Jetspeed portal can support LDAP authentication. A single sign-on system has been implemented which allows all GSN members to use all services requiring login after they have logged-in once in the GSN web portal. The web portal has more than 50.000 users who have their own customized views of the web portal.

To support a higher number of concurrent users we have implemented a load balancing technique. The Apache httpd server (Apache Server Project, 1996) is the main web server in use, combined with at least one application server, which offers the execution environment for Servlets and JSP pages. The Apache web server handles all incoming requests, forwarding them to the application servers using the mod_jk module. Each application server hosts an identical version of the Web Portal.

3.2 E-mail and E-mail lists

This service is used by the Greek educational community and by the Vocational Training personnel. The accounts for the service are separated in the following user groups: a) Accounts for Schools and Administrative units, b) Accounts for Teachers, c) Accounts for Students.

The service has all the standard characteristics of an e-mail service, plus some additional characteristics we have developed in order to

provide a more flexible and secure service to the educational community. The extra features provided include, virus protection using the Sophos antivirus software that is installed in all GSN mail servers and spam protection with new anti-spamming filters.

Spam protection is activated only upon user request (through a corresponding checkbox in the web portal), and when it is activated a new folder, named "spam", appears in the users mailbox. When a message is tagged as "spam" (in the GSN mail server, when the message has been sent more than a predefined number of times and the sender does not have the right to send multiple messages), it is automatically placed in the spam folder. The user may also choose to categorize as spam all the e-mails arriving from known spam sources that are in GSN's rbl lists.

The mailing list service enables the development and maintenance of mailing lists that can be used to deliver a large number of messages to large numbers of GSN users. There are two main categories of mailing lists currently active in GSN: lists with dynamic subscription of members, and lists with static subscription of members. In the lists that allow dynamic subscription, the members are coming from the LDAP directory Server of the GSN. The list mail address may, for example, look like dim@sch.gr, where the above list may identify all the first grade schools of Greece. In the lists with static subscription, the list administrator can enlist one or more users, or the users themselves can become members of the lists of their choice, by filling in their e-mail and some personal data in the appropriate web form.

To prevent the members of the lists from accessing material that is inconsistent with the GSN terms of use, most of the lists have a moderator who is responsible for the material that is distributed through the lists. Some lists are completely open, but these are a minority. The use of a moderator is mandatory in most cases, because the educational community is a very special community of people and messages that contain spam, viruses, pornography and other related content must not be allowed in the users' mailboxes.

3.3 News Service, Forum Discussions and Electronic Magazine

The news service allows registered users, such as schools and teachers, to post announcements. The

announcements are hierarchically grouped, based on their content to different categories and topics. Each announcement has a certain scope: it may apply to the users of a specific educational unit, a prefecture, the group of all registered units, etc. The GSN portal also offers to its members a forum discussion board which allows the users to create new posts, reply to messages in a particular post and create new discussions.

The electronic magazine of GSN is a classic newsletter service used to inform GSN users of educational news and new services introduced. The service was built from scratch, and gives the opportunity in all schools to construct their own newsletter. An archive system keeps all the versions of the newsletter and every newsletter can be accessed as a web page through the GSN portal.

3.4 Asynchronous Distance Learning

The software used for this service is Moodle (Moodle, 2002), which is a software package for the production of online courses and web pages, offering a complete set of internet education services. GSN users can subscribe to an available course and also, following a particular procedure, become trainers in a course. The e-learning service is accessed through the GSN web portal. The e-learning environment is fully translated into Greek together with all the modules of the platform, and a great deal of content has already been developed and organized in various thematic areas.

3.5 Teleconference Service

The teleconference service of GSN enables a conference between two or more participants located at different sites by using the IP network of GSN to transmit audio, video and text (chat) data in real time. A teleconference also offers the possibility of having a presentation from one participant to the others (e.g., a PowerPoint presentation) or sharing an application. There are two different categories of teleconference services, a point-to-point (two-person) conferencing system and a multipoint conferencing (point to multipoint), which allows three or more participants to sit in a virtual conference room and communicate as if they were sitting right next to each.

The teleconference service is integrated with the instant messaging service. The teleconference

system has been tested under various use scenarios, including synchronous teleconferences among a number of schools all over Greece and the central offices of the Greek Ministry of Education. Users participating in the teleconference can see each other (the screen is separated to show the input from the web cameras of all participating users), and when a user is speaking he is shown in the central screen, so that all the others can see and understand who is the speaker at any time.

4 CONCLUSIONS

All European countries have developed or are in the process of developing telematic services that focus on the needs of their respective educational communities. The Greek School Network has developed a number of services for the educational community in Greece, using state of the art technology. The online services offered to the educational communities must include a variety of tools for helping in the communication between their members and in the introduction of new educational methods. The needs of the educational communities around the world for online services and educational material are growing rapidly, making it necessary for all countries to try to find ways to meet these demands. One parameter that must be always kept in mind during this effort is the cost of the services offered, since these services must be provided to the students and teachers free of charge. This makes Open Source solutions preferable to commercial options. Since the educational communities and especially the pupils must be protected from ineligible material, extra care must be taken regarding content delivery and security. A great deal of research has taken place in recent years on new methods and e-learning environments, new ways of approaching e-learning, and new tools that people can use. The GSN participates in these efforts by providing an asynchronous e-learning environment and a variety of online services to the educational community of Greece.

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