



# Internet and Intranet Web sites at Rouen University Hospital

[[Home page](#)]

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## Abstract

Rouen University Hospital (RUH) is one of the first French hospitals to be connected to the Internet via the French national research network RENATER. Every medical and administrative department have already been connected. We established an Internet Web Site, the first at a French hospital, [URL: <http://www.chu-rouen.fr>] on February 1995. It is principally used to classify the main biomedical resources, in particular the French-speaking sites: CISMéF project, which, in March 1998, has obtained the label "Experimentation of public interest" by interministry committee (procedure "Information Highways"). These sites, in November 1998, now total over 4,600 with 50 new sites each week. It contains an index per medical speciality and one per disease based on the MeSH (Medical Subject Heading) thesaurus from the bibliographic database Medline. In November 1998, over 2,000 different machines have accessed our site each working day (excluding ours). Our Intranet Server is based on the concept of a virtual library which improves access to the information and productivity: 1) from Agence de Presse Medicale dispatches and 2) distributed access to Medline and to the 45 most prestigious biomedical journals with a full-text access. Some French products and prototypes should be considered as regards Intranet and Hospital Information Systems (Cannes, Grenoble, Hyères and Ville-Evrard hospitals) and Internet/Intranet and Community Health Information Networks (Annecy hospital). To enable microcomputers of our Hospital Information System to be connected to the Internet, the executive director has decided to permit global access via a direct link to our internal network. Since 1992, an Electronic Patient Record (EPR) has been operational in our hospital and therefore the need to establish a secure infrastructure is indispensable. The security policy is based on an in and out flow filtering. As regards the in flow, at present only Web and mail accesses have been authorised without any internal network access. As concerns the out flow, several user-profiles are available to minimise virus attacks. Internet and Intranet RUH Web sites respect the Net Scoring, criteria to assess the quality of health information on the Internet: credibility, content, links, design, interactivity, quantitative aspects, ethics, and accessibility.

## Introduction

In this study, we describe the implementation of Internet & Intranet Web site at Rouen University Hospital and connection methodology to the Internet.

## Methods

At the beginning of 1994, the Director General of our hospital took the strategic decision to establish a high-speed connection (T1: 2Mb/s) to the Internet. Rouen University Hospital is one of the first French hospitals to be connected to the Internet via the French national research network RENATER since October 1994.

RENATER is a federate network composed of province networks linked to RENATER via high-speed connections. SYRHANO is the province network of Upper Normandy and is largely

subsidised by the provincial council authority. CRIHAN is a non-profit association also supported by the provincial council, which is in charge of the technical support and supplies access to the Internet.

The first connected microcomputer was located in the medical library. In 1995, 12 departments were connected followed by 35 in 1996. In November 1998, every medical and administrative department is already connected: the 1,500 microcomputers of RUH have its own Internet browser, including one microcomputer in each department's library.

The Internet/Intranet project is multi-disciplinary, which includes one person from the micro-computer subunit, one person in charge of the security, one person from the network subunit, one person (BT) who is the end-users' representative and one project manager (SJD).

Use of the Web page was evaluated by the Gestats program after excluding requests by our Hospital Information System computers and image files.

## **Security**

To enable microcomputers of our Hospital Information System (HIS) to be connected to the Internet (potentially 600), we took the strategic decision to have a permanent and a direct connection through our HIS network. Since 1992, an Electronic Patient Record (EPR) has been operational in our hospital and therefore the need to establish a secure infrastructure was indispensable [1]. The security policy is based on an in- and out-flows filtering. As regards the in-flow, at present only Web and mail accesses have been authorised without any internal network access. Concerning the out-flow, several user-profiles are available to minimise virus attacks. Only a minority of the users has access to the FTP, most of the others have only access to Email and Web. To guarantee a maximum of security, the Internet Web site has been externalised from our internal network to be localised in a so-called "demilitarised zone" between the two routers. In contrast, our Intranet Web sites are located in our internal network, and therefore access is limited to our HIS.

When a university has access to the Internet via RENATER, France Telecom (the main Telecom Company in France) supplies a router and we in turn implement a second router, which is only managed by our department to isolate our internal network from the Internet. Between these two routers, a filtering station and a supervision station have been implemented. The first station filters the in and out calls function of predefined tables. The second station traces all the events function of used protocols. On our Internet Web site, statistics and detection tools have also been implemented.

## **Results**

### **Internet Web site**

The Rouen University Hospital (RUH) is the first French hospital to have created a Web site in February 2 1995. Its URL (Universal Resource Locator) address is <http://www.chu-rouen.fr>. The two authors are its co-webmasters.

This main part of site is devoted to [CISMeF](http://www.chu-rouen.fr/cismef) (Catalog and Index of French-speaking Health Resources [<http://www.chu-rouen.fr/cismef>]). Click [here](#) to have more details about it.

This index [2] is necessary [3] because (a) there is a very large amount of information potentially accessible for the health professional; (b) it is often difficult to easily separate the information for the health professional from the patient information; and above all (c) the absolute requirement in medicine is to know the source and the quality of the information available in the Internet.

This site also contains (1) a description of the hospital in French and in English; (2) a monthly list of scientific publications from our hospital. This list is extracted from the Medline bibliographic database; (3) the biomedical research list of the Upper-Normandy region; and (4) the description of [eleven](#) of our departments (the Administrative Library, the Computer and Networks Department, the Emergency Department, The Health and Travel Unit, the Medical Library, the Toxicology Unit, the

Immunology Department, the Pharmacology Department, the Department of Maxillofacial Surgery, the Organ procurement and transplantation unit, and the Respiratory Disease Department. The latest includes a multimedia information bank on preneoplastic bronchial lesion detection).

Since February 1995, some new features have been added: (a) use of an internal search engine to improve to find information search (full-text search), (b) a general index with the same goal, (c) internal E-mail list to improve communication, then, (c) a "what's new" page to easily display the news about the site, in particular the newly indexed sites.

### **Use patterns of the Web site**

Use of the Web site increased in an approximate linear progression with time starting in February 1995 (see [statistics of the Web site](#)). Web server software, which provides documents to users on request, does not know the identities of individual users, such as E-mail; the only identifying data available are the Internet IP addresses of the machines from which the users connect to the site.

Analysis of a representative period, the month of June 1998, showed that, every working day, more than 1,000 machines are visiting our site (excluding ours). During this month, users from 19,060 different machines made 107,171 requests for HTML documents from this Web site originating from 96 different countries (35% from France, 30% from USA and 10% from Canada). The geographical location of the connecting machine could not be determined in the remaining 26.3% of document retrievals (Internet IP addresses without Domain Name Server).

More than 450 sites have at least one link to our site, among them some of the most prestigious, such as Hospital Web [<http://neuro-www2.mgh.harvard.edu/hospitalwebworld.html>], Medweb [<http://www.medweb.emory.edu/MedWeb/>], Karolinska Institute (DDRT) [<http://www.mic.ki.se/Diseases/index.html>], and OMNI [<http://omni.ac.uk/>]. Over 90 press articles released information about this site [<http://www.chu-rouen.fr/dsii/html/presse.html>].

This Web site contains more than 8,200 hyper-links (including 1.800 internal hyper-links) [July 1998] and 2691 files (1523 HTML, 955 GIF and 213 JPG; 193 Mb of disk space). That is why it is of utmost importance to regularly check their validity each three months. A software (Cyberlink or Linkbot) also checks every hyper-link in this site. Then the broken links are updated by the webmasters.

In March 1998, a study from the CESIM (Centre d'Etudes sur le Support de l'Information Médicale) showed that the Web site of the RUH was the most used by French doctors in their private practise. In 1997, a poll from the Quotidien du Médecin put this Web site as the best one in health in France.

The network traffic generated by the different Internet protocols (http, smtp, nntp) represent between 0.3 and 1.5% (from 100 to 300 Mb/j) of the overall network traffic of the RUH.

### **Intranet Web sites**

In 1996, we also created Intranet sites, which are based on the concept of a digital library [4] to improve access to the information and productivity. The first Intranet site has been operational since January 1997 and it provides access to the Agence de Presse Medicale dispatches. Before the existence of the Intranet version, these dispatches were only located in a single microcomputer and one secretary was doing photocopies during one third of the time. Now, more than 500 microcomputers with an Internet browser can access this information. Furthermore, we developed a new module: a dispatch data bank. All the dispatches are stored, and an internal search engine (Excite) extracts all the dispatches dealing with a subject (full-text search). Therefore, the Intranet version is cost-effective and provides information to a much broader population.

Since May 1997, the second Intranet sites established a new distributed access to the Medline bibliographic database [5] and to the fifteen most prestigious biomedical journals with a full-text access (Ovid provider) in any medical department. A six months test with a server located in the

Netherlands has demonstrated an increase of the Medline searches inside the departments and a modification of their goals, more frequently care-oriented vs. previously research-oriented.

As concerns the Web Internet & Intranet sites, an [Editorial Board](#) was created at the end of 1996, following the will of the hospital leaders to control the development, the quality, the validity, the reliability, the consistency and the coherence of the Web sites [6]. This editorial board has developed a graphic chart (each HTML document must include the logo and the name of the hospital, the name and the E-mail of the author and the dating of the material). The editorial board reviews each HTML document, including if necessary external peer reviewing.

## Costs

The costs of the Internet and Intranet projects in the Rouen University Hospital are:

- One full-time engineer during six months between the decision of the Director General and the operational implementation,
- A specialised line (2 Megabits per second; in 1998, 90,000 FF paid by the hospital; the rest (300,00 FF) financed by the regional council,
- Investment for the security: approximately 150,000 FF,
- Hot line, formation and extension of computers connected to the Internet: 1/3 time engineer,
- Index of French-speaking biomedical resources: 2,5 time medical librarian,
- Management of the project: 1/2 time medical informatician

We insist on the need to create a multidisciplinary team i.e. network, microcomputer, security, system, and webmaster because of the compartmentalised complexity of the problem. The half-life of the knowledge about the Internet is evaluated at about 6 months, and then we have organised a technology and information watch every month.

## Discussion

The Internet improves the communication among the health professionals and with the general public, and improves also the access to the information. Nonetheless, most of medical resources available on the Internet only have a "marketing dimension" (description of the institution), and only a minority have a valid information content. It is quite difficult, especially for students, to evaluate the quality of the medical Web sites, which are not, in a majority of cases, peer-reviewed. We are using in our Web site several criteria to assess the quality [7-8]; some of them are inspired by a white paper [6], such as credibility, content, links, design, and interactivity. The Internet and Intranet Web site has an editorial board, which has very similar functions than its equivalent in any medical journal. Each HTML document of our Web site contains the logo and the name of the institution, the name of the author(s) of the HTML document, her/his Email to permit some feedback and interactivity, and the date of the last update. Each HTML document is peer reviewed. Other features are implemented to optimise the communication and the access to the information for the end-user: use of an internal search engine, a general index, internal E-mail list, a "what's new" page. Every three months, a software is checking the over 10,000 hyper-links of our site to detect broken links. We have tried to optimise the navigability of our Web site: the simplicity of its design leads to ease of use [6]. Our Web site is accessible by the lowest common denominator of current browser technology.

If most of the French University Hospitals have at least one access to the Internet in 1997, our security implementation is almost unique in France, specially if compared with the best French Internet/Intranet realisations, such as Grenoble [9], Nancy [10] et Rennes [11-12].

The display in the Web site of the list of scientific publications extracted from the Medline database implies internal and external transparency, and some interesting feed-backs: several multicentric clinical studies were proposed to the most prolific departments.

The establishment of a internal and external mail is cost-effective vs. fax (10 times less expensive

for an interurban mail), a reduction of human moves and a conservation of the electronic form: i.e. most of complex bibliographic searches performed by the medical librarians are sent via e-mail, avoiding data re-inputting, which improves productivity and quality.

The two Intranet Web sites (Agence de Presse Medicale dispatches and distributed access to Medline) are based on the concept of a digital library, which improves access to the information and productivity. Therefore, we are installing in each department's library a microcomputer connected to the Internet, in the summer 1997. In 1998, we are planning to extend this digital library to an Intranet version of the Electronic Vidal (French drugs dictionary) [13] and hospital protocols, and to access via Ovid to over 100 electronic biomedical journals.

Some French and US hospitals are ahead concerning the use of the Internet tools to develop their Hospital Information Systems [14]. The Grenoble University Hospital [9] gives access to several hundreds nurse protocols; others, such as the Hyeres and Ville-Evrard hospitals are improving the ergonomic of the administrative applications of the HIS. One prototype of a common electronic medical record using some Internet tools (i.e. Java, which is architecturally neutral and robust) is now tested in Cannes Hospital. Another one is developed in the Pitié Salpêtrière Hospital [15]. Several experiences are also in development in the US [14, 16-25], but most of them are re-using their HIS and not yet the emergent technologies. W3-EMRS developed at the Massachusetts Technology Institute and the Boston Children's Hospital has been partly rewritten in Java [14]. These changes, in particular a universal browser, will imply a reduction of the development cost by a factor 2 to 3, an instant deployment, a drastic reduction of administrative costs and hardware independence (PC, Mac and Unix).

We will see in the coming years that most of applications of the Health and Hospital Information Systems will use Internet tools and technologies such as Java. For example, in February 1997, the French Ministry of Health has decided to build a giant secure Intranet to connect the 300,000 health professionals. There are two main differences with the existing Internet: the general public will not access this network and a national editorial board will validate all the available information.

Be careful; don't become too dependent on the Internet [26]!

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