DEVELOPMENT OF AN OPEN SOURCE WEB PORTAL FOR THE EXCHANGE OF MEDICAL DATA

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Abstract: The Teleradiology/Emergency Medicine Network in the Metropolitan Rhine-Neckar Region (Germany) enables the exchange of medical data. However, the inclusion is difficult because of technical reasons for some partners like general practitioners. For that reason a web portal for the exchange of medical data within the Teleradiology/Emergency Medicine Network is under development. The Digital Imaging and Communications in Medicine (DICOM) e-mail standard offers the base for the data exchange. The portal itself will be developed by Java Server Pages (JSPs) and Java Servlets. The data will be saved in a MySQL database. The external DocCheck authentication service will be integrated additionally to the internal user administration. The concept has been finished and the portal is under development. The concept foresees that the web server is located in the demilitarized zone (DMZ) of the Heidelberg University Hospital and the database is running within the clinical network. The portal offers the possibility to use the Teleradiology/Emergency Medicine Network without any charge.

1 INTRODUCTION

A Teleradiology/Emergency Medicine Network for the inter-institutional exchange of medical information (especially image data) has been in operation in the Metropolitan Rhine-Neckar Region for six years (Bergh, Hollerbach, Schall 2005). The network was built within the scope of a teleradiology project, it was subsidised by the ministry for social affairs of Baden-Wuerttemberg in Germany. The network connects about 27 hospitals and many more partners like surgeries, research facilities and home office stations with a steadily increasing number.

Since 2009 the second stage from that teleradiology project which is also financed by the ministry for social affairs of Baden-Wuerttemberg has been running. This project has two main objectives. The first one is the interdisciplinary expansion of the network. The second aim is to expand the network to get a comprehensive patient care in Baden-Wuerttemberg. In the following one component will be presented to succeed in the second aim.

2 OBJECTIVES

The communication within the Teleradiology/Emergency Medicine Network is based on the open DICOM e-mail standard (Weisser et al. 2006, Mildenberger et al. 2005). The communication partners require special DICOM e-mail clients for the data exchange with dedicated e-mail servers and thus other partners. Especially installation, maintenance and configuration demand technical knowledge which low-frequented users like general practitioners seldomly have and which

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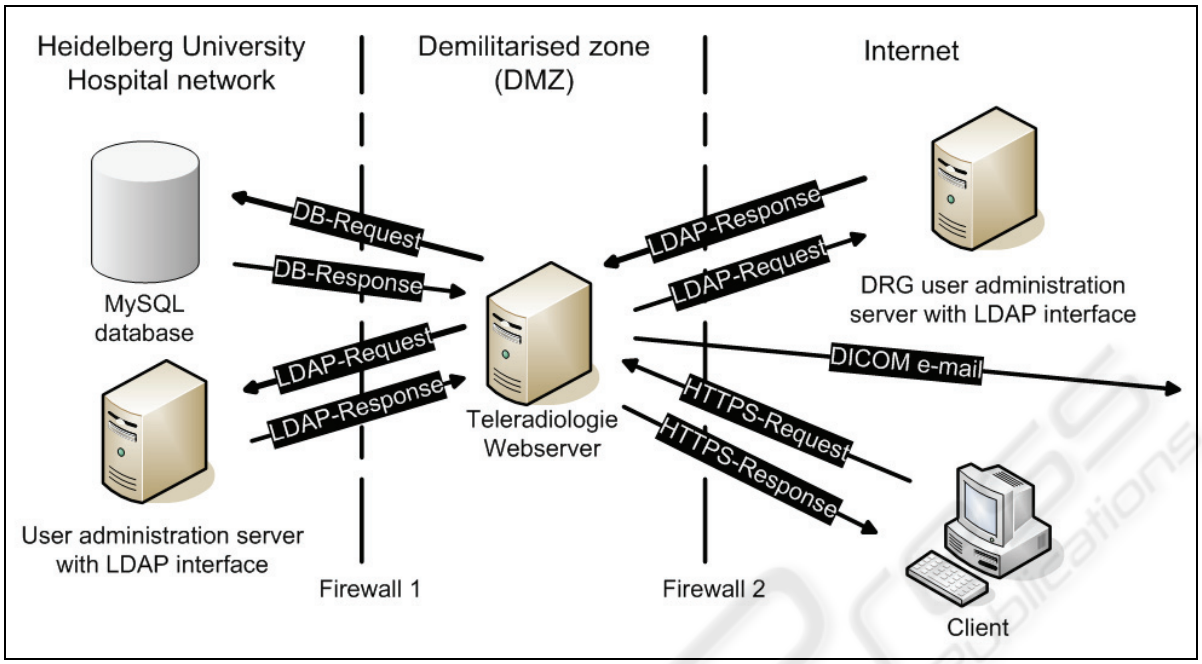

Figure 1: architecture of the portal.

hence "excludes" them from the Teleradiology/Emergency Medicine Network.
An open source teleradiology web portal, allowing a secure and simple alternative to the DICOM e-mail clients, should be developed to address this issue and promote the expansion of the regional Teleradiology/Emergency Medicine Network.

3 METHODS AND MATERIALS

For a preferably optimal result the specification of the functional requirements were discussed with radiologists as well as medical informatics during the development of the web portal. The technical implementation is based on Java, Java Server Pages (JSPs) and Java Servlets. The open DICOM e-mail standard is used for the data transmission within the Teleradiology/Emergency Medicine Network. The basic requirement of the portal will be that the used elements are all open source because several partners will install the portal in separate installations. Important components of the portal are the MySQL database and a directory server (in the following called Lightweight Directory Access Protocol (LDAP) server) with all partner information of the Teleradiology/Emergency Medicine Network. At the moment the Deutsche Röntgengesellschaft (DRG) plans to build such an LADP server and they will provide this server for the users of the network in future. Additionally the portal offers the possibility to integrate an LDAP server for the internal user management.

4 RESULTS

The portal offers the possibility to send medical information (images and other information) via DICOM e-mail to any partner within the Teleradiology/Emergency Medicine Network absent any prior software installation by the sender. The architecture of the portal (figure 1) provides three network areas with different portal components:

The users which want to use the portal as well as the LADP server from the DRG are located in the internet (first area). The DICOM e-mails will also be sent via the internet using the Simple Mail Transfer Protocol (SMTP) to a partner within the Teleradiology/Emergency Medicine Network. The teleradiology web portal itself is located in a special DMZ of the Heidelberg University Hospital network. That means there is a firewall between the portal and the internet. The portal communicates over the LDAP, Hypertext Transfer Protocol Secure (HTTPS) and DICOM e-mail protocol with the actors in the internet area. It communicates also with the optional LADP server and the MySQL database which are located in the third area, the internal Heidelberg University Hospital network. There is

Table 1: web portal vs. DICOM e-mail client.

	Web portal	**DICOM e-mail client**
Installation	Central installation of the portal	Local software installation required
Application access	HTTPs protocol is used	Local installed application
User administration	Central user administration	Local user administration
Configuration	Central Administrator configures the portal	Local configuration
Administration	Central Administrator configures the portal	Local administration
Maintenance	Central Administrator maintain the portal	Local maintenance
Send DICOM e-mails	Yes	Yes
Receive DICOM e-mails	No	Yes (product-dependent)

also installed a firewall between the internal network and the DMZ. The LDAP server in the internal network can be used for a central user administration, but it is optionally. A MySQL database saves all data of the portal.

The send workflow will be described in the following: The user calls the URL of the portal; if he is already registered he can log on and use the functionality of the portal. Otherwise he has to register first and the administrator of the portal has to check the data given by the user. An alternative is the login via an account at the medical authentication service DocCheck. This service enables enrolled physicians to use the portal without any prior registration. A logged in user can select a recipient within the Teleradiology/Emergency Medicine Network and upload any image to the web server. Prior to transmission all files are digitally signed and encrypted on the client side. The web server wraps the received file data into a standard DICOM e-mail, which then will be sent to the recipient.

The teleradiology web portal will be published under an Open Source licence. The project partners are very happy about this fact, because every partner can install his own portals and expand them to address special requirements.

5 CONCLUSIONS

The web portal of the Teleradiology/Emergency Medicine Network offers general practitioners and other low-frequent users within the Metropolitan Rhine-Neckar region the possibility to use the advantages of this network for free and to connect to all partners with a minimal effort.

Table 1 compares the centralized web portal solution with a local installed DICOM e-mail client. The comparison of the two solutions show that the maintenance of the portal is no less sophisticated than the maintenance of a single client, but the portal offers the advantage that this effort must be done once on a central application by a specialist. Afterwards users of the Teleradiology/Emergency Medicine Network can use the service without a complex installation, configuration and maintenance of a local client. But the portal offers only the possibility to send DICOM e-mails; it is not possible to receive e-mails, this functionality is reserved for the DICOM e-mail clients.

The web portal is an important milestone for the expansion of the network and thus improves patient care in the Rhine-Neckar Region substantially. But the concept as well as the open source software of the portal can also be employed within other regions.

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