A Real Time Teleconsultation System for Sharing an Oncologic Web-based Electronic Medical Record

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Abstract
This poster presents an innovative real-time Teleconsultation System for synchronized navigation of the pages of a web-based Oncological Electronic Medical Record, designed to provide clinicians a cooperative work tool supporting the oncologic patient management between different hospitals. The system embeds additional tools supporting the discussion: digital whiteboard, chat and a digital audio channel.

Background
To ensure the best therapeutic path for each oncologic patient is the main aim in the provision of oncologic care. In our Province, only the central hospital of Trento (North Italy) has an Oncology ward, although chemotherapy sessions are also provided in Medicine wards of rural hospitals. Thus, peripheral clinicians need a continuous and effective support from the oncologists of the central hospital. To improve communication between oncologists and geographically distant clinicians, we designed, developed and evaluated a Teleconsultation system (TS) [1], allowing them to receive support by participating in multi-disciplinary virtual meetings. The core of TS is an Oncologic Electronic Medical Record (OEMR) acting as a shared repository of clinical data structured by a central relational database and a series of web pages structured like paper clinical record folders. OEMR is accessible form all the connection points (different departments of different hospitals) by using a web browser. To conduct teleconsultation sessions on the OEMR clinical data off-the-shelf CSCW software was not suitable due to conflicting requirements: mainly the necessity to limit the bandwidth, to share clinical images with a sufficient quality (although not comparable to that required by tele-radiology), and to navigate synchronously the OEMR pages avoiding annoying download delays. For this reason we adopted an innovative approach and designed custom TS by which clinicians can navigate synchronously the pages of the OEMR, share clinical data and images and discuss the ongoing care process in real time.

Methods
The software solution we designed and developed is based on a client-server paradigm: a custom application wrapping the web browser Microsoft Internet Explorer on clients and a teleconsultation server (TCS) able to manage multiple simultaneous sessions with several clients per session. Each client is connected to the TCS by a TCP/IP socket. On the TCS side, upon a client connection event an internal client object holding the client identity, its role, and the connection socket address is created. A client can participate to an ongoing teleconsultation session or start a new one becoming the “master” of that session. In the latter case TCS creates a new teleconsultation object and adds to it all the “slave” clients waiting for the connecting “master”. A client requiring a consultation with a “master” that has already started a session is added to the corresponding object. At each time, one clinician guides the discussion by navigating the OEMR pages. The guiding client application intercepts mouse and keyboard navigation operations on OEMR pages and sends the corresponding commands to TCS that redistributes it to the other clients in the session, so that the same pages are simultaneously displayed in the users’ applications connected in the same session. In this way, multimedia clinical data are downloaded by each client from the web server minimizing the network traffic between the clients (in fact, navigation commands are composed by a few tenths of bytes) and maintaining the maximum resolution of the displayed information. At any time every client can request to guide the navigation to the current guiding user.

Additional tools supporting the discussion are embedded in the client application. A shared digital whiteboard with several drawing tools allows clinical images in the OEMR to be visualized by all participants and annotated with explicative text and geometric shapes for delineating region of interests. Participants can use a telephone-like tool relying on an audio channel over IP. An integrated chat allows the exchange of text messages. Chat messages are encrypted and stored for documentation.

Results & Conclusions
TS was deployed during the last phase of the project in 2000 and since then it has been using in the oncologic activity in the involved hospitals (8000 patients present in the OEMR so far). Teleconsultation service is routinely provided to the rural hospital of our Province by the central hospital Oncology ward.

References