Video Conferencing Services in Healthcare: One Communication Platform to Support All

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Abstract

The paper presents a novel approach to the design of video conferencing (VC) systems, taking advantage of recent technological achievements in web-based implementations. Delivering VC functionality as a service, available over the Internet, opens new grounds for easier integration, support and application in many scenarios: hardware-agnostic ad-hoc VC connections are featured by the proposed architecture. The validity is demonstrated through latency measures in a surgical telementoring service and comparing them to the reported thresholds.

Keywords:

Telementoring; scalable; webRTC; latency

Introduction

Video conferencing (VC) is a common core technology in telemedical systems. Integration of VC into clinical workflows is associated with high complexity, which prevents exploitation of the potential in various scenarios. Platform dependency, client software installation and update, complications in traversing complex network topologies and firewalls are common issues, which often need to be taken care of by the users. The complexity of employing such systems in clinical settings, ensuring high availability, managing maintenance costs are just a few reasons of the slow progress and application of the approach, regardless the high potential.

The use of VC is still limited to the scenarios of planned meetings that are configured and tested in advance. Even the user-friendliest VC systems like Skype or Google Hangout (not to mention the advanced solutions by Cisco or Polycom) require registration, software downloads and installations. However, numerous use cases call for a more flexible and user-friendly VC interface. For instance, emergency surgical telementoring session or a GP-patient consultation over VC. Devices used on the remote side cannot be set up in advance and need to work on the fly.

Materials and Methods

Web Real Time Communication (webRTC) was selected as a backbone for implementing a general purpose VC infrastructure meeting the needs of the evolving healthcare [1]. It aims at providing a customizable VC gateway for developing platform-agnostic clinical applications featuring low usability threshold ad-hoc connections between the peers.

One-way latency of the proposed system was measured to assess the compliance with the reported thresholds in surgical telementoring [2]. VC node was started on Macbook Pro (late 2013) I5 8GB RAM machine and accessed from 10.1" Asus MeMO full HD 1GB RAM tablet computer, running Android 4.2 in a dedicated network. Two light sensors, connected to Arduino circuit board, registered the changes of the lighting on the screens of the interacting peers when a white sheet of paper was put in front of the camera. The experiment was repeated in different network loads.

Results

The generic architecture (figure 1) provided a framework for developing platform agnostic VC services. One-way video latency measures averaged at 226.7 ms under perfect network conditions, 325.7 and 338.7 under 0.5 MB/s and 1 MB/s (Megabyte per second) data traffic respectively. The use of the service added 133.2 ms delay to the native latency of the network.
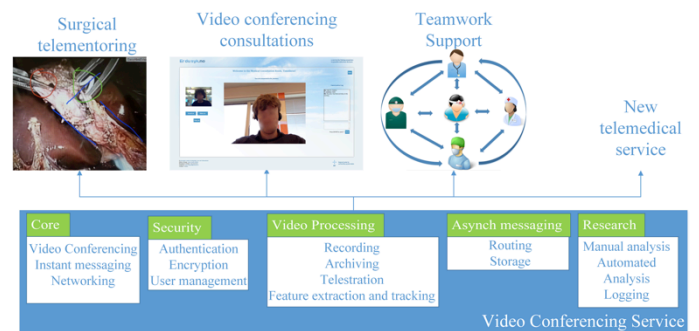

Figure 1. Generic architecture of a VC service

Conclusion

The paper presented a generic architecture, providing a secure, highly available and easy to integrate VC channel adding no maintenance and support costs on both hospital and patient ends. No matter what technical infrastructure lies between the two interacting parties, the only requirements for establishing the VC session is an updated web browser and the Internet connection. The feasibility of using the architecture to build clinical services was demonstrated and revealed promising results; one-way video transmission latency was acceptable in a surgical telementoring scenario. Assumption of lower latency requirements in less safety-critical use cases enables easy adoption of telemedical practices in a wide spectrum of scenarios within primary and secondary care, which are not supported by the existing systems.

References

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