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

Andrius Budrionis[a], Per Hasvold[a], Gunnar Hartvigsen[a], Johan Gustav Bellika[a]

[a]*Norwegian Centre for Integrated Care and Telemedicine, University Hospital of North Norway, Tromso, Norway*

Abstract

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

Keywords:

Telementoring; Scalable; WebRTC; Latency.

Introduction

Video conferencing (VC) is a common core technology in telemedical systems. The 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 updates, complications in traversing complex network topologies, and firewalls are common issues which often need to be taken care of by users. The complexity of employing such systems in clinical settings, while ensuring high availability and managing maintenance costs is just one reason for the slow progress and adoption of the approach, regardless of its high potential.

The use of VC is still limited to planned meetings that are configured and tested in advance. Even the most user-friendly VC systems – like Skype, Google Hangouts, and more advanced solutions by Cisco or Polycom – require registration, software downloads, and installation. However, numerous use cases call for a more flexible and user-friendly VC interface. For instance, emergency surgical telementoring sessions, or GP-patient consultation over VC. Devices used remotely 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 environment [1]. It aims to provide a customizable VC gateway for developing platform-agnostic clinical applications featuring low usability threshold ad-hoc connections between peers.

One-way latency of the proposed system was measured to assess compliance with the reported thresholds in surgical telementoring [2]. VC node was started on an i5 Macbook Pro (late 2013) with 8GB of RAM, and accessed from a 10.1" Asus MeMO tablet computer with 1 GB of RAM, running Android 4.2, on a dedicated network. Two light sensors connected to an Arduino circuit board registered lighting changes on the screens of the interacting peers when a white sheet of paper was put in front of the camera. The experiment was repeated under different network loads.

Results

The generic architecture in 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, and 325.7 and 338.7 under 0.5 MB/s and 1 MB/s data traffic respectively. The use of the service added a 133.2 ms delay to the native latency of the network.

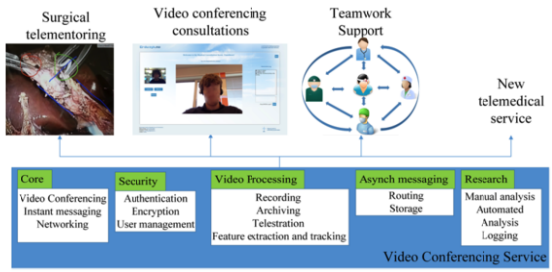

Figure 1. Generic architecture of a VC service

Conclusion

We present a generic architecture providing a secure, highly available, and easy to integrate VC channel that adds no additional maintenance and support costs to hospitals or patients. 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 an 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. Assuming lower latency requirements in less safety-critical use cases enables easy adoption of telemedical practices in a wide spectrum of scenarios within both primary and secondary care, which are currently not supported by existing systems.

References

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Address for correspondence

Andrius.Budrionis@telemed.no