Reducing communication-related complexity in heterogeneous Networked Medical Systems considering non-functional requirements

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Abstract: Networked Medical Systems (NMS) promise better data exchange in medical infrastructures such as operating rooms in hospitals and clinics. However, the heterogeneous interfaces of medical systems and varied requirements on NMS such as real-time constraints, increase the communication complexity considering network architectures, communication protocols and software/hardware components. In this paper, a robot-assisted eye surgery is used as a clinical use case. Based on this use case and its communication types, non-functional requirements on NMS are derived.

An approach for abstraction is proposed which targets at reducing the communication-related complexity in NMS. Complexity reduction in this case means that a multi-interface middleware in NMS abstracts the detailed knowledge required for implementation of different communication types such as real-time communication. The middleware architecture is divided into two main parts: Communication Abstraction Provider (CAP) and Communication Abstraction Bridge (CAB). CAP is the central component of the middleware which connects the medical systems using CABs.

In this paper, the focus is on the complexity reduction of the real-time communication part. For this purpose, real-time communication protocols are investigated and evaluated for application in the CAP/CAB architecture. The result of the evaluation shows that Ethernet POWERLINK is the most suitable real-time communication protocol for the CAP/CAB architecture.

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