Telemedicine Reference Architecture Project

Enabling the Next Generation of Telemedicine Devices

Telemedicine and Improving Health Care

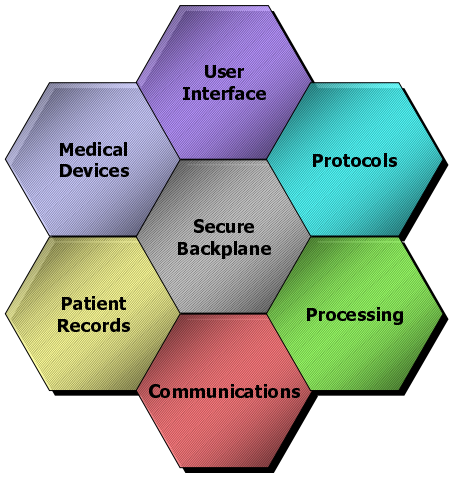
In a 1995 "Prosperity Game" hosted by Sandia National Laboratories, leaders from all parts of the healthcare community identified telemedicine as a technology that could significantly impact the cost of healthcare delivery (for the final report from this event see ***http://www.tatrc.org/pages/library/papers/role-tech.pdf***). As a centerpiece of future healthcare delivery systems, telemedicine has the potential to improve both the quality and accessibility of health care with its ability to deliver "anywhere, anytime" access to needed care. At the same time, before this promise can be realized, certain barriers must be overcome. Some of the barriers to realizing telemedicine's full potential identified in the Prosperity Games include device incompatibilities, high system costs, and patient data security and privacy issues in an Internet-enabled world.

Sandia's Project Objective

To address these technology-related barriers to telemedicine and to accelerate its use, Sandia began the development of a "Telemedicine Reference Architecture" that would address both hardware and software interoperability and standardization issues. The purpose of the architecture is to improve device compatibility and telemedicine information security. By improving telemedicine reliability, quality, and cost effectiveness, health care delivery can be significantly enhanced.

An Overview of the Architecture

Commercial telemedicine systems are increasingly functional, incorporating diagnostic and therapeutic peripherals, video-conferencing, patient education, medication reminders, and a host of other services. Current systems typically do not address interoperability and security issues, due to factors such as limited use and closed system designs. This will not be the case as these sort of systems become more heavily used and begin to be built around leading edge information technologies. However, as telemedicine systems begin to take on distributed designs and to rely on the same technologies used in the Internet, they will inherit many of the same security problems facing the Internet. Finally, Telemedicine interoperability and commercialization issues are similar to those faced in the 1980's by the personal computer industry. An architecture is needed.



Architecture Service Areas

Architecture Goal: Standardization

In defining a reference architecture for telemedicine, Sandia partitioned the functionality found in current systems into seven ***service areas*** (shown above). Each service area represents

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specific types of elements (components or building blocks) from which telemedicine systems can be composed. These elements may be hardware, software, or both.

Sandia is currently working to define the architectural interfaces between each of the outer six service areas and the "Backplane". The Backplane is a collection of hardware and software building blocks that allow the various elements within a telemedicine device to interact with one another. When connected together, either directly (i.e., physically) or by a network, the elements are able to confederate their services in order to fulfill a clinical task.

The goal of the architecture is to standardize the interfaces, allowing needed plug-and-play mechanisms and distributed operations to be built into system elements. Then it becomes possible to create a range of telemedicine devices from a common set of building blocks. This should significantly improve the cost effectiveness and improve the quality and security of telemedicine devices and systems.

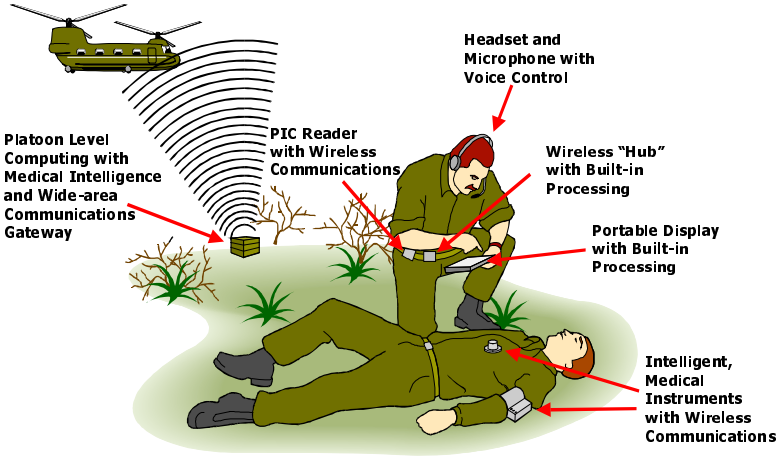
Project Description and Schedule

Preliminary Telemedicine Reference Architecture documents have been developed and are available for review and comment. Initial security architecture concepts have also been developed. For the purpose of exploring architectural and interoperability issues, the project plans to build three prototype systems, called "builds". Each Build will implement increasing levels of system functionality and security of the Telemedicine Reference Architecture.

Build 1 – Implemented and to be displayed at ATA 2000. Addresses issues associated with plug-and-play medical devices and the basic infrastructure needed for a component-based telemedicine system architecture. The Build 1 system will be evaluated by Ochsner Medical Foundation (Sandia's clinical partner) for system reliability, clinical quality, and cost effectiveness.

Build 2 – Focuses on architecture and interoperability issues associated with communications infrastructure and distribution of processing across multiple fixed nodes. Implements sophisticated access control policies and communications security. New clinical capabilities will include videoconferencing, remote control of instruments, ECG and still and video cameras, and "smart" instruments.

Build 3 – Will demonstrate a "virtual telemedicine device" (see scenario below). The security focus will address negotiation of policy amongst confederated nodes and certification of non-monolithic medical devices. New clinical capabilities will include true "smart" instruments, volumetric sensors, and environmental monitors.



Sandia National Laboratories and the Telemedicine Program are interested in Industry, Government, and University partnering opportunities.

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Visit our web site at http://www.sandia.gov/CIS/6200/Telemedicine/

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