NIH/NIBIB U01 QMDI Project Demonstrations
by the MGH Medical Device Plug-and-Play (MD PnP) Program & Collaborators
August 21-22, 2013 at NIH EPN Building, Rockville, Maryland

The QMDI program on medical device interoperability is working to improve patient safety and reduce healthcare cost by defining open-source, standards-based medical device interoperability infrastructure. We will be presenting a series of demonstrations to illustrate the progress we have made in the first three years of our five-year NIH/NIBIB U01 grant. These demonstrations show real, commercially available medical devices including patient monitors, ventilators, and infusion pumps together with our prototype interoperability platform. These are used to construct and deploy medical apps for example, prototype smart alarms, safety interlocks, and closed loop control to improve patient safety.

PCA Safety Interlock (Clinical Scenario #1)
This will demonstrate a safety interlock for a patient-controlled analgesia (PCA) infusion system. Patients receiving PCA are in danger of opioid overdose. We monitor the patient using several complementary modalities, detect the early onset of a problem, and stop the infusion pump, locking out additional doses. The demo uses real patient monitors, including capnography, and an infusion pump. All of the open-source code and documentation for this demo is available at mdpnp.sourceforge.net.

Preparing ICU to Receive Patient from OR (Clinical Scenario #2)
This demonstration shows connectivity between two ICE systems (standards-based Integrated Clinical Environments, in OR and ICU) and the NwHIN to automatically read OR device settings and pre-set ICU equipment. The demo will show smart checklists, reading and changing of device settings, external query via CONNECT to TATRC test EMR, coordination between multiple apps, and coordination via CONNECT between a commercial ICE implementation (DocBox, Inc.) and a research / rapid prototyping ICE implementation (Kansas State's Medical Device Coordination Framework).

Tools for rapidly prototyping ICE Apps using Matlab and DDS
MATLAB and Simulink are widely used for data collection, analysis, and device control for medical research. The DocBox and MD PnP teams have developed an ICE implementation using MatLab and DDS to leverage these capabilities in the ICE platform for data acquisition, device control, and decision support. MatLab code for ICE can be openly shared.

Architecture Safety
Demonstration of features required for the safe assembly and operation of systems made up of interoperable medical devices, including demonstration of safety features inherent in the ASTM 2761 ICE "Hub and Spoke" Architecture; the hazards of, and the potential risk mitigation strategies for, assembled systems made up of different combinations and configurations of medical devices and clinical applications; hot swapping of medical device sensors; the clinical and end-user value of Plug-and-Play interoperability, by Anakena Solutions, Inc.

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Data Logger
This prototype system, built by NIST engineers in collaboration with MD PnP, enables logging and playback of comprehensive de-identified, high-fidelity, multi-channel clinical data (analogous to a "flight data recorder") from medical devices. This data includes time-synchronized physiological signals, video, and other data.

Clinical Scenario Repository
This is a website for capturing and documenting clinical scenarios where interoperability could improve patient safety. This includes documenting real situations with potential or actual patient harm as well as hypothetical situations where a clinician or layperson sees room for improvement.

Medical Device and Network Security: ICE Authentication Framework
A proposal from Kansas State University for an ICE Authentication Framework that utilizes a framework of digital certificates to enable heterogeneous ICE components (e.g., devices, apps, and infrastructure) to be integrated at the point-of-care in a trustworthy manner. Security of networked medical devices is a growing challenge. This demonstration will illustrate some of the challenging problems and some proposed solutions that support building interoperable medical device systems.

ICE Device Model Framework
A proposal from Kansas State University for an ICE Device Model Framework that addresses gaps in existing interfacing technologies such as IEEE 11073, and provides formal, machine-readable declarative descriptions of medical device capabilities and clinical application requirements to enable flexible automated interoperability checking between ICE apps and devices.

MIDAS Real-Time Middleware
MIDAS is a real-time middleware and task scheduling system being developed at the University of Pennsylvania. This system ensures that clinical applications receive the necessary resources to guarantee real-time performance.

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