Domain Information Model for the Patient Centric Integrated Clinical Environment (ICE DIM)

Presenting Author: Steven Dain MD, FRCPC University of Waterloo

Co-Authors: Tracy Rausch, DocBox Inc, Julian M. Goldman MD, Mass. General Hospital/HMS

Introduction: Part 1 of ASTM F2761-09 laid out the general requirements for the patient-centric integrated clinical environment (ICE) and ISO/IEEE 11073-10201 described an abstract object-oriented domain information model (11073 DIM) that specifies the structure of exchanged information, as well as the events and services that are supported by each object. However we feel that the 11073 DIM provides a device-centric paradigm, whereas modern highly networked data-rich environments, such as ICE, require standards and technology that can support a device-centric paradigm.

Methods: The data interactions of patients and medical devices were analyzed from first principles and a new DIM was created based on the concepts of sensor and actuator "components" interacting with the patient rather than complete (multi-component) devices. The DIM then created additional categories to describe clinical context such as physician actions and observations. This approach facilitates post-coordination of data elements thereby reducing the number of defined data required in a data dictionary. We have developed Medical Device Interface Data Sheets (MDIDS) for most sensors and actuators currently in use which will be published on an open website that manufacturers will be able to easily access. Each term is being rigorously defined, which adds important information to the often limited information that is included in standards, such as ISO 11073 Part 10101. Data centric communications is enabled by the OMG DDS standard in a publish/subscribe environment. (http://portals.omg.org/dds/)

Results: We chose the Data-Distribution Service for Real-Time Systems (OMG DDS), an open international middleware standard that implements publish-subscribe communications for real-time and embedded systems. It has the advantages of being a readily available, secured, fault-tolerant protocol. Several companies support the open standard to aid in its deployment. Several new data objects have been added to the DIM in order to support applications (Apps) These applications can be, for example, decision support systems, closed loop controllers, displays that integrate information and provide new information from other sensors, Virtual Medical Devices and Virtual Medical Systems on the communications bus. The complete DIM will be presented at the meeting and will be available at www.openice.info.

Conclusion: We feel that this model is easily applied to current and future devices. Communication topology methods considered included wired, wireless, patient centric integrated clinical environments, body area networks, sensor networks, virtual medical device networks, medical device systems and medical device systems of systems interacting with non-medical device networks.

References:

ASTM F2761-09 Medical Devices and Medical Systems — Essential safety requirements for equipment comprising the patient-centric integrated clinical environment (ICE) — Part 1: General requirements and conceptual model

ISO/IEEE 11073-10201 Health informatics — Point-of-care medical device communication — Part 10201: Domain information model

ISO/IEEE 11073 Health informatics — Point-of-care medical device communication — Parts 10101 (Nomenclature) and 10201 (Domain information model)