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A Survey on Plug-And-Play Interface Interoperability for Medical Devices

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ABSTRACT: By allowing two medical devices to interact, an entirely new medical device is produced. The resulting system may have unpredictable behaviour, making it unsafe to use without explicit validation and testing. Medical Device requires a medium to communicate with an another medical device in order to exchange the data. The medium through which they communicate is termed as Interfaces for the medical devices. One of the challenges faced by clinical engineers is to support the connectivity and interoperability of medical-electrical point-of-care devices. A system that ould enable plug-and-pay connectivity and interoperability for medical f=devices would improve patient safety, save hospitals time and money, and provide data for electronic health records. Plug-and-play interoperability is the ability to take a medical device out of its box and easily make it work with another device.

KEYWORDS: Medical devices, Interfaces, Plug-and-play interoperability, DICOM, HL7.

I. INTRODUCTION

Interoperability is all about communication. It is not just the message- it is the way the message is translated. Most people, when they think about interoperability, are thinking about devices, connectors, hardware, software, connecting devices to health information technology, and health information technology to more health information technology. More important, interoperability means connecting technology to people. Interoperable systems capture metric that can add to or improve human knowledge and wisdom around healthcare. Knowledge and wisdom also can constrain medical devices and improve patient safety-if this intelligence is built into system controls and rules that allow devices to self-monitor and operate within safe limits. Safely functioning health, it should provide easy and retrieval of data, have simple and intuitive displays, and allow data to be easily transferred among health professionals. Many features of software contribute to it's safe use, including usability and interoperability [2].

II. RELATED WORK

1. Four Dimension of Interoperability

Data interoperability: This is one of the dimension of interoperability which deals with the formatting, mapping, querying, storage and synchronization of the data. Communication interoperability: This dimension deals with the consistency in transmission and reception of the messages between two nodes. Semantic interoperability: This dimension is the agreement/consistency between two systems on the meaning of communicated information. [4] Workflow Interoperability: This dimension deals with how technology supports/shapes the processing or sequencing tasks between participants according to a set of procedural rules. It also deals with the formatting or displaying the message information and helps in penetration of the decision support.

2. Medical data exchange

DICOM, one of the biggest success stories in the domain of the medical data exchange is the Digital Imaging and Communications in Medicine standard, commonly abbreviated as DICOM. This standard addresses the formatting and

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transfer of digital images, especially radiology images. DICOM specifies a set of network protocols, message syntax and semantics, media storage services and medical directory structure for imaging systems. By complying with these specifications, devices within a hospital picture archiving and communication system can easily and efficiently interoperate. [2] DICOM does not contains the hardware or implementation details of compliant systems, instead it contains what data should be stored, how it should be configured, and what messages should be used for sharing information between systems.

Health Level 7 (HL7) is a standards developing organization that focuses on clinical and administrative data exchange. The organization's name refers to the seventh layer of the OSI model (the Application layer), which addresses data exchange structuring, semantics, message timing, and security checks. The self-titled HL7 messaging standard is the most widely adopted healthcare information standard in the world. HL7 is also developing a Clinical Document Architecture (CDA) for transferring patient data. The goal of the CDA is to provide a foundation of document types for use in electronic medical records. A competing clinical document standard is the Continuity of Care Record (CCR), developed by American Society for Testing and Materials (ASTM). The CCR is designed for exchanging patient data between healthcare institutions. [5] The issue with HL7 is that it can be interpreted widely by the implementer so that two systems using the same version of HL7 can express the same thing in very different ways. This is why the IHE was formed, to create profiles of standards (not just HL7) that try to squeeze out all the variability of interpretations for a specific use case.

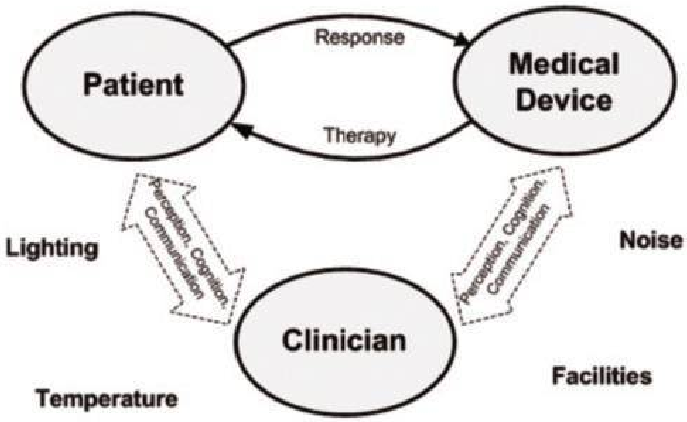

Fig 1: Medical Device in a clinical environment

3. Basic Components of clinical documentation solution for a medical device

The medical device must have the ability to export data in a digital form. This is relatively easy, as most medical devices are digital and have a serial port. An alternative is a network connection right in the medical device. A centralized computer or a server that collects the data from the medical device. This server can perform other function such as convert units of measurement, relabel data before it is pushed into the electronic health record. An HL7 interface that takes the device data, in the proprietary protocol, converts it to HL7 and sends it on to the electronic health record.

4. Four types of Interoperability

There are four different types of interoperability: connect, transport, translate and interpret. All the types of interoperability are connected and dependent on each other. Connect interoperability is defined as simply plugging two devices or systems together, on the other hand things can go wrong if the plugs are not compatible. In transport interoperability, once the devices or systems are physically connected, the next step is sending information between them. Ethernet standards and TCP/IP, for example provides communications protocols and rules that allow signals and data to move back and forth over computers, routers, and networks. In translate interoperability, the connected devices

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or system becomes more useful when they can understand the signals and data that they are transmitting to one another. This means that the signal and data have to be translated/formatted, in ways that each can understand. In interpret interoperability, the data and the signals to become more useful, the information gathered from the data has to be coded for interpretation, so each device or system gets the same image or meaning. [8]

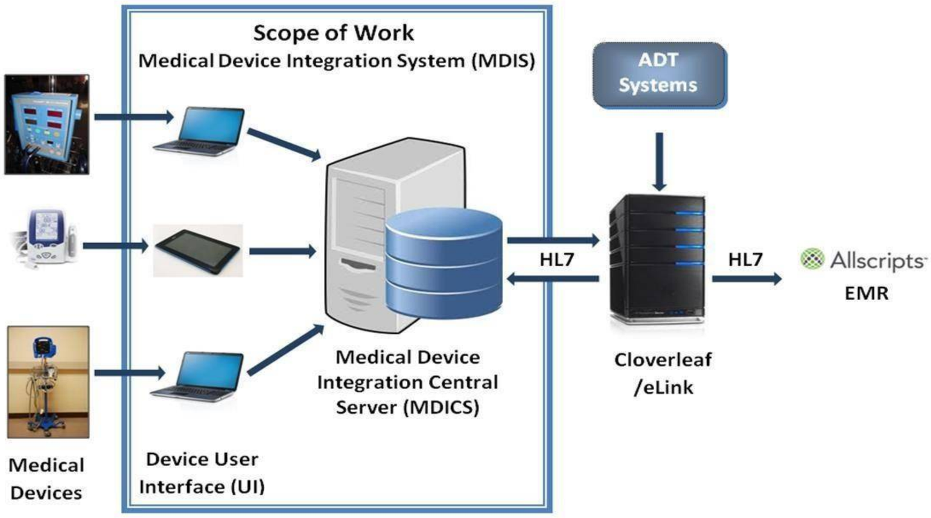

Fig 2: Medical Device Integration System

III. CONCLUSION

This paper describes about the medical device interface with the plug-and-play interoperability in health information technology domain. It also describes the dimension and types of interoperability and defines how interoperability helps the data to get exchange within the interface provided for the medical device. It also discusses the different message data exchange. Therefore, plug-and-play interoperability is only possible through the proper application of constraints. By standardizing the hardware, messaging protocol, and semantics used by a connection, it becomes relatively straightforward to implement a plug-and-play system.

REFERENCES

[1] Y. Alsafadi, O.R.L. Sheng, and R. Martinez. Comparison of communication protocols in medical information exchange standards. In Computer-Based Medical Systems, 1994., Proceedings 1994 IEEE Seventh Symposium on, pages 258–263, June 1994.

[2] N. Cain. Standardizing Computer Interfacing to Medical Devices. The Healthcare IT Guy, January 2006. Available: http://www.healthcareguy.com/index.php/archives/154/.

[3] J.M. Ferranti, R.C. Musser, K. Kawamoto, and W.E. Hammond. The Clinical Document Architecture and the Continuity of Care Record: A Critical Analysis. JAMIA, 13(3), May 2006.

[4] Medical Device Interoperability. 2012. Available at: www.aami.org/interoperability/Materials/MDI_1203.pdf. Accessed Dec. 11, 2012.

[5] A Short History of Interoperability. Available at: www.mdpnp.org/uploads/1_Robkin_26Jan.pdf. Accessed Dec. 11, 2012.

[6] IEEE Standard for Medical Device Communications–Overview and Framework, October 1996.

[7] ISO/IEEE 11073 - Health informatics - Point-of-care medical device communication - Part 10201: Domain information model, 2004.

[8] Jeff Rothenberg. Interoperability as a semantic cross-cutting concern. Interoperabiliteit: Eerlijk zullen we alles delen, 2008.

BIOGRAPHY

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