Applications of Data Transfer Standards in Home Telecare

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Contents

Overview

Data Transfer Standards

Requirements

Scope - Standards will be within the purview and scope of the objectives of the Framework. Standards must relate to health messaging and storage, cover appropriate topical areas, and standardize either data or processes to advance data sharing and minimize duplication of effort.

Capability – Standards will be capable of transferring the data required by the Framework. This includes a mix of low level un-interpreted data and higher level more complete data.

Secure and reliable - Standards will support the necessary encryption, authentication and non-repudiation and will transfer the data reliably and promptly. Standards will provide guaranteed receipt of delivery or notice of non-delivery. Standards will guarantee where appropriate that data will never be lost on delivery failure.

Audit ability – Standard will support the necessary degree of audit tracking of the data transfer. Records must be available identifying when and what data was sent or received and whether the transfer was acknowledged by the receiving party. The record must also identify the message revision number.

Appropriate – Standards will provide means of transferring data appropriate to its content and with consideration of the range of capabilities of the underlying transport media. Lightweight protocols will be available for transferring low-level data over slow transport media.

Future Focused - Future focused means that standards are intended to remove impedances to sharing information rather than changing existing successful data sharing arrangements. Standards should be developed to promote new and enhanced interaction with existing Healthcare coordinating mechanisms that have interest in the generation, collection, use, and transfer of health data. Standards need to focus on solving future problems. Standards are not intended to re-formalize existing solutions.

Structured - Standards need to be developed and presented in a structured manner that will lead to understand-ability and useability by consumers. There are many structured methodologies that can be employed by standards developers that will lead to complete and understandable standards.

Technology Independent - Standards will not constrain technology development. They will not be developed or implemented in a way that limits the use of new and emerging technologies. They also will not be written or implemented in a way that limits any vendor or technology to maximize the use of the standard.

Interoperable and Integrated – Standards will be able to transfer data between a variety of institutions and applications within the health messaging community. Standards will be integrated with one another and with related standards. This means

there will not be overlapping definitions, authorities, or procedures. Standards development will be coordinated to eliminate duplicate efforts and to maximize the efforts of the volunteers contributing to and implementing standards.

Evolving - Standards will evolve as technology and institutional mandates change. Standards will be extensible as the scope of the Framework data increases. The standards will be written to allow for evolution and will accommodate backward compatibility for information gathered under previously known standards. There will be known update and maintenance procedures that are timely and responsive to changes. The procedures will be documented as a part of the Standards.

Supported and Supportable – Standards should be well known and used in the health care community. Standards must be supportable by the vendor community. They will be developed in a manner that is supportable by known or emerging technology.

Publicly Available - Standards will have a broadly based public notice of their availability. Standards will not be developed from copyrighted or proprietary standards that would limit the ability of the final standard to be publicly available. They will not contain any copyrights or other limitations on their use or reproduction. Standards will be available electronically when ever possible.

Complete and Consistent - Standards will be complete in terms of the standards components and methodology described in these requirements. Standards will have a consistent form and format.

Existing Data Transfer Standards

Health Data Transfer Standards

HL7

HL7 is an ANSI standard for interchange of the complete set of medical information. Formed in 1987, the organisation for development of the standard is very active and has many international affiliates. HL7 is popular and supported.

HL7 compliant messages would be suitable for parts of the Framework In particular for sending the clinical documents associated with a set of measurements from the database server to the web server or to third parties.

HL7 suffers from being overly top-heavy on data transfer. A large overhead would be required to send a single event message. Furthermore the current version of HL7 messages (V.3) is specified to use XML for the presentation layer. This will dramatically increase the overhead for short messages.

See http://www.hl7.org

Medical Information Bus (ISO/IEEE 11073 Family of Standards)

The goals of the ISO/IEEE 11073 family of standards are: To enable real time plug and play communications between medical devices, and to facilitate efficient exchange of data. The primary setting is intended to be the acute and continuing care setting, for example Intensive Care Units or hospital wards. Examples are ventilator devices and ECG monitors connected, via the ISO/IEEE 11073 protocols, to a central monitoring service in the Intensive Care Unit.

The strategy is to develop open source standards and so lower the cost of development and deployment of medical devices. These efforts have been hampered by vendor preference for proprietary standards and "strategic relationships".

These standards were designed to solve two needs: plug and play technology and efficient exchange of data, i.e. real time exchange of data.

The nomenclature and domain information model standards help enable "plug and play" . They allow devices from different vendors to understand common data and provide a starting point to negotiate a shared set of capabilities.

The application profile standards help support "plug and play" and real time data exchange. They are an extension of existing remote data management protocols which is meant to be more efficient and health specific.

ISO/IEEE 11073-1x standards are complementary to HL7 in many ways. Firstly, the nomenclature standard 11073-10101 has been integrated as a nomenclature available to HL7 messages. The domain information model standard 11073-10201 provides the classes to represent the data offered by the device. The current HL7 V3 does not provide such classes.

The ISO/IEEE 11073-2x standards define the general services need to communicate the data. These seem to be mostly composed of modifications to existing generic data management services. As such, their use is questionable.

See http://www.ieee1073.org/

Security Industry of America

"This standard describes a standard format for communication between alarm system communicators and central station receivers. It defines a complete transmission and data interpretation protocol, including detailed timing and frequency, and error detection."

Used by VitalCall monitoring service to transfer data and set up a voice connection to Chubb securities.

See http://www.siaonline.org/index_sia.asp

General Data Transfer Standards

SSL

This is a transport/session layer protocol used to encrypt data and authenticate end-points. The standard is well developed, popular and supported.

See http://wp.netscape.com/eng/ssl3/

XML

XML is a presentation layer language for documents containing structured information. It is machine and human readable. It is popular and well supported

See http://www.xml.com

SOAP

"SOAP Version 1.2 (SOAP) is a lightweight protocol intended for exchanging structured information in a decentralized, distributed environment. It uses XML technologies to define an extensible messaging framework providing a message construct that can be exchanged over a variety of underlying protocols. The framework has been designed to be independent of any particular programming model and other implementation specific semantics."

See http://www.w3.org/TR/soap12-part1/

Proprietary Data Transfer Standards

Proprietary formats are quick and easy to develop and usually achieve the task at hand. They often do not carry the restrictions of formal application and presentation layer protocols. For example they can be tailored to be appropriate to slow transport media and low level data. However a proprietary format is unlikely to meet other requirements of a data standard, such as future focus, technology independence, interoperability and integration, support and completeness and consistency.

Recommendations for use of Data Transfer Standards

The Framework is divided into various components with differing needs for data transfer. Therefore *MedCare Systems* recommends different standards be used in the Framework.

Important considerations are the size of data, frequency of transmission, underlying transport media and whether the data will be human or machine read. The front end of the Framework requires small data be transferred over relatively primitive transport media. The back end of the Framework requires collated data be transferred over more sophisticated and faster transport media.

Ambulatory Monitor to Base Station

The primary data to be transferred is single event data in real time. This data is generated when the monitor detects the wearer has had a stumble or fall and may need assistance. In this sense the data is critical. Periodic energy expenditure data, event

data buffered from prior transmission failures and updated threshold parameters will be sent in delayed time.

If a user “event” occurs then the Framework must also signal to open a voice channel from the ambulatory monitor to the base station.

The transport medium is the allocated RF band.

The data will be only machine read. It must be transmitted rapidly and reliably and not be overweight for the capacity of the transport media. The remainder of the requirements are of lesser importance.

The ideal would be to use the Medical Information Bus (MIB) protocol for transferring this data. The standard easily satisfies the important requirements for this transfer. It would also satisfy the remaining but less important ones. In particular using the MIB would significantly improve the extensibility of the Framework to other classes of wireless medical devices.

However insufficient information is currently available and thus *MedCare Systems* is unable to recommend this standard now. In particular draft versions of the standard are not publicly available, the IEEE web site is out of date and lacking important information and the MDCIG web site is off-air.

Therefore *MedCare Systems* recommends a proprietary protocol for this transfer. *MedCare Systems* is also doubts the longevity of the standard given the current poor state of available information.

Base Station to Database Server

The primary data to be transferred is buffered event and energy expenditure data in batch mode. It is less critical than the data transferred from the ambulatory monitor to the base station. Updated threshold parameters will be sent in reverse.

The transport medium will be dial-up internet. The transfer will occur off peak, for example sometime after midnight. A simple microprocessor is available on the base station for implementing the protocol.

The data will by only machine read. It must be transmitted reliable and again cannot be overweight for the capacity of the transport media. Security and interoperability are more important requirements given the transport media and range of health providers that may communicate with the base station.

HL7 is a contender for the application layer protocol with SSL at the transport/session layer. However HL7 is extremely top heavy in terms of data and processing overhead. *MedCare Systems* considers this load excessive for the underlying media.

Therefore *MedCare Systems* recommends a proprietary protocol for this transfer.

Base Station to Chubb Security

This is a voice connection between the wearer of the ambulatory monitor and a response person at the VitalCall Medical Monitoring Bureau. To establish this voice connection the base station must dial the VitalCall number and then commence a short data transfer session to handshake and transfer some information about the caller.

VitalCall require the Framework use the “Security Industry of America” protocol to establish this connection.

Database Server to External Health Provider

The Framework will need to communicate patient data to ACT Health during the trial. The primary data will be periodic reports of patient observations transmitted in batch mode. Tables, graphs and information related to decision support form the data.

The transport medium is a broadband internet connection and the frequency of transmission is between daily and weekly. The data will be machine and human readable. Security, interoperability, supportability, audit ability and extensibility are the main concerns. Overhead is not.

MedCare Systems recommends using HL7 over SSL as these are the ideal standards for this application.

Capability is the main issue for achieving this goal. ACT Health currently uses HL7 version 2.2 for distribution of discharge summaries to the GP’s. This is an obsolete version of the standard and supports our needs in only a very generic way. *MedCare Systems* will work with ACT Health to either agree on a newer version of the standard or on a proprietary way of formatting the data and then wrapping it in a generic HL7 message.

Database Server to Web Client

The web site will display observations and other user information. This will be in the form of tables and graphs.

HTTP is the standard data transfer protocol for this function. This standard will be appropriate for most of the requirements.

However HTTP does not define a standard for transmitting lightweight graph data. For this application *MedCare Systems* recommends XML to transfer the data

Protocol for Use of Standards for the Framework

This section identifies the overall considerations in choosing a standard for use in the framework. There are practical considerations as well as strategic concerns.

MedCare Systems has used these guidelines to help chose the appropriate standard for each part of the framework

Practical Considerations

- Does the standard lead to an effective and efficient solution to the problem?
- Is the standard practical to implement?
- Does the standard allow for timely and rapid development of the Framework?
- Is the standard likely to fulfil any future need for the Framework?
- Is the cost of implementing appropriate open standard significantly greater than the cost of implement a proprietary standard?

Strategic Considerations

- Does the standard enable open communications?
- Is the standard widely adopted and implemented?
- Is adoption of the standard likely to lead to sustained organisational benefit?
- Does the standard satisfy a maximal set of the requirements documented in the previous section?
- Is the standard compatible with other standards the organisation may implement?

Appendix 1

ISO/IEEE 11073

ISO/IEEE 11073-1x “Device and data services” – this includes:

- 11073-10101 - A nomenclature describing the various semantics needed to communicate a devices application status and control information. For example a code defines the concept “respiratory rate”. This code along with the value of the respiratory rate can thus be communicated between independent systems.
- 11073-10201 - A domain information model describing various object classes that may be instantiated. The objects include data objects. These objects would be used for organising the data and send messages. Example data object classes are Medical Device System (MDS), Virtual Medical Device, Channel, Battery, Scanner, Alert Monitor. Example message objects A medical device could be conceptualised as a tree of objects arranged under the MDS object. Communications thus would consist of messages referencing 11073-10201 objects.
- 11073-10301 – Device Specializations allow for device specific nomenclature. For example PEEP for a ventilator device.

ISO/IEEE 11073-2x “General Application Services” – a general set of data and services needed to initiate, configure and maintain communication. This standard appears to include recommendations to use other generic communications standards. It includes:

- 11073-20101 – “Application Profile – Base Standard” This standard will define the base message syntax and data encoding for medical device application profiles. The definitions will augment and in some cases optimize related industry standards, chiefly ISO Systems Management standards (for example Common Management Information Protocol), particularly with respect to cost-performance improvements for real-time medical data communication. It is limited to upper-layer (i.e., ISO OSI Application, Presentation, and Session) services and protocols used for medical device communication. As a base standard, it neither defines application-specific content of messages nor specific application profiles.

Appendix 1

HL7 – Java SIG

The Java Special Interest Group has developed a HL7 message API.

The API comprises the following components:

- Java classes for HL7 Version 3 RIM objects. These include the getters and setters for in memory message structures produced by the message builder, below.
- Java classes for HL7 Version 3 data types. HL7 data types are semantically defined abstractions of basic medical data with many complex operations (e.g., terminology concepts, physical quantities and units), not simply integer, floating point numbers, or strings or simple data structures.
- Message parser. This tool constructs an in-memory Java object-graph, a collection of Java objects, of the HL7 RIM objects conveyed in an XML message. The parser cross-checks the RIM object classes against the HMD for the message and uses the HMD to determine what type of class or data type to instantiate in the Java object-graph as the XML message is parsed.
- Message builder. This tool builds a properly constructed, valid XML document or message content based on the HMDs provided by HL7. The input for the message builder is an in memory RIM object-graph.

References

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[4] Javvin Protocol Dictionary - http://www.javvin.com/protocolISOROSE.html