1st Jan 2008

MFER - The next big WAVE in Standards?

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The problems associated with the lack of cross-vendor connectivity for medical equipment has plagued virtually every discipline within healthcare and has hindered the speed of effective healthcare informatics adoption. This however, may soon be an issue of the past for vendors dealing with waveform.

Touted as the 'one standard' for all kinds of waveform, ***MFER*** (Medical Waveform Encoding Rules) is an ISO approved standard (*ISO/TS 11073-92001*) that claims to an ***open format*** that is an ***efficient*** yet ***affordable*** way to incorporate waveforms into existing industry accepted standards like HL7 and DICOM.

The Current State of Affairs

The problems with the lack of a common waveform standard have resulted in ECG management systems currently deployed in the industry to support only ECG / data acquisition devices supplied from the same vendor. To resolve this issue, some vendors utilize 3rd party software like DatamedFT's "Format Translator" to interpret the waveform acquired (from other vendors) into a format supported by the targeted ECG management system.

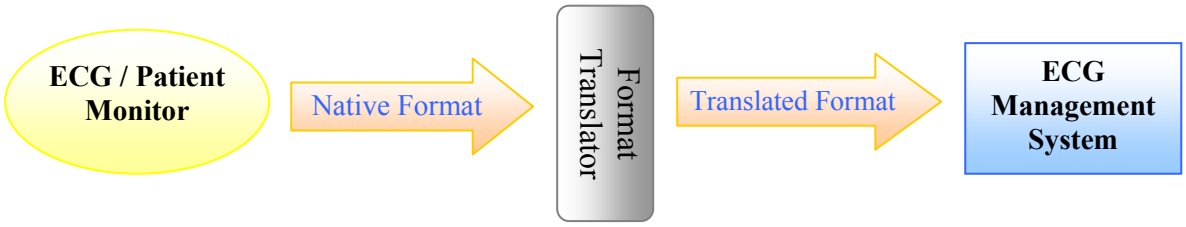

Fig 1.0 Illustration on 3rd Party File Translator

While this approach has been proven to be 'workable', it does add an additional layer which effectively translates to;

- Additional effort (setup, verification, upgrade and maintenance)
- Another point of failure (for errors to occur, troubleshooting)
- Additional cost (initial cost, license, maintenance effort)

The lack of a common waveform standard has also render data migration between ECG management systems virtually impossible or extremely expensive by using 3rd party tools similar to the "File Translator" described above.

MFER – The Answer to All Problems?

MFER's supports extends all waveforms such as ECG, EEG, respiratory waveforms (including spirometryand),12 lead ECG, HolterECG, Stress ECG, Monitoring ECG and many more. Fundamentally speaking, MFER is used to describe the following attributes;

- Structure of Waveform Data (Frame attributes)
- Waveform data (Sampling attributes)
- Frame Structure and
- Encoding Rules

The following example illustrates the ease and efficiency of the standard with an example on the Standard 12 lead ECG - where only nine tags is used to provide a complete description;

Data	Type	Length	Contents
08 01 01	08 Waveform identifier	1	Standard 12 lead ECG
0B 04 01 FD 00 01	0B Sampling frequency	4	Sampling interval=1ms
0C 04 00 F7 03 E8	0C Sampling resolution	4	Resolution(volt)=1μV
04 04 00 00 00 01	04 Data block length	4	Block length=1
05 04 00 00 00 08	05 Channel number	4	Channel=8
06 04 00 00 27 10	06 Sequence number	4	Sequence=10000
3F 00 03 09 01 01	3F Channel(0) attribute	3	
09 01 01	09 Waveform or lead name	1	Lead I
3F 01 03 09 01 02	3F Channel(1) attribute	3	
09 01 02	09 Waveform or lead name	1	Lead II
3F 02 03 09 01 03	3F Channel(2) attribute	3	
09 01 03	09 Waveform or lead name	1	Lead V1
3F 03 03 09 01 04	3F Channel(3) attribute	3	
09 01 04	09 Waveform or lead name	1	Lead V2
3F 04 03 09 01 05	3F Channel(4) attribute	3	
09 01 05	09 Waveform or lead name	1	Lead V3
3F 05 03 09 01 06	3F Channel(5) attribute	3	
09 01 06	09 Waveform or lead name	1	Lead V4
3F 06 03 09 01 07	3F Channel(6) attribute	3	
09 01 07	09 Waveform or lead name	1	Lead V5
3F 07 03 09 01 08	3F Channel(7) attribute	3	
09 01 08	09 Waveform or lead name	1	Lead V6
1E 84 00 02 71 ...	1E Waveform	160000	Waveform data=80000

Fig 2.0 MFER Tags required for 12 lead ECG
Source: www.mfer.org

Complement, not Competition

Now one might argue that existing standards are already available, namely ***DICOM*** and ***SCP-ECG***, hence there is no real need for yet another waveform standard to complicate matters. Let's take a look at them.

- **DICOM Waveform Standard** (Supplement 30)

  DICOM waveform standard (Supplement 30) is a common format for the communication of time series data including vital signs and ECGs. Design to facilitate digital ECG interoperability and contribute to the harmonization of ECG standards, the waveforms are

not only to be stored as images but also includes all raw data in digital format to ensure post processing quality remains the same.

The DICOM standard supports **waveform storage and communication**: this includes hemodynamic curve data, cardiac electrophysiology, ECG (including 12 lead ECG) and audio signals (WAV files).

- **Standard Communications Protocol for Computer-Assisted Electrocardiography** (SCP-ECG)

  Approved as an ISO Standard, SCP-ECG is the result of an EU supported project that European, American and Japanese Manufacturers and Users have jointly worked and agreed on. It is currently a new work item proposal to IEC TC/SC 62 WG1 and ISO TC215.

  However, SCP-ECG does not support other cardiology examinations such as stress ECG, Holter, and ECG monitoring.

So where does MFER fit in to all these established standards? To begin with, it is important to understand that MFER is designed not to interfere with the procedure or acquisition context, rather, MFER is concerned with the encoding rules pertaining to the actual waveforms (like JPEG is to Images), other information / data (e.g. patient demographics, results) should be described using exisitng standards, such as HL7, DICOM.

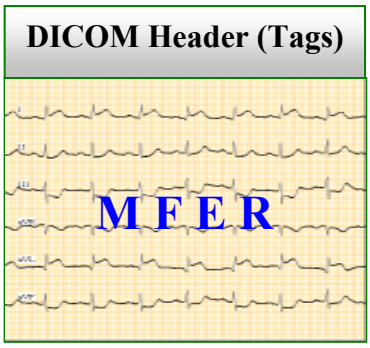

Fig 3.0 Pictorial illustration of MFER working together with DICOM

MFER is not a 'competitor'; it is a 'complementary' standard.

Drivers for Adoption

It takes more than just good concepts and urgent technology needs to propel the acceptance of standards, there must be motivation from the commercial aspect.

Now DICOM and HL7 were created by voluntary bodies and professional societies, in addition to having similar collaborations, it is interesting to note that MFER's committee is made up of several governmental bodies in Japan.

Governmental Agencies	Industry Players
• The Japanese Society of Electrocardiology • MEDIS-DC(The Medical Information System Development Center) • Laboratories of Image Information Science and Technology • Ministry of Economy, Trade and Industry • Japanese Circulation Society • Ministry of Health, Labor and Welfare	• GE Marquette Medical Systems • Nihon Kohden • Fukuda Denshi • Colin Medical technology • Phillips Medical Systems Japan • Suzuken • Terumo • Yokogawa Electric

Japan is a high income, technologically advanced developed country with a rapidly aging population, the involvement of governmental bodies and leading industry players in the development of MFER reflects two key factors for the adoption of MFER

- The **demand** for the standard (by the governmental bodies through regulations / preferences
- The **supply** from the vendors as they have invested the resources to develop the standard as well as to ensure level playing field - If they don't implement it, a rival company will

Having said the above, MFER was approved as an ISO standard only in September 2007 (although the work started as early as 2002), as such, there are no industrial implementations of the standard (yet). However, with the strong backing of the Japanese government and vendors who dominate the ECG / patient monitoring market, it will be only a matter of time before MFER benefits healthcare in the areas of research, education and most importantly, in a clinical setting.

Contact

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