

medical devices, via protocols and message contents and formats for the communication between the involved eHealth parties, up to the semantics of the medical and care related data to be communicated, stored and presented.

Also dedicated standards exist for various security aspects of the data communication in general, which are also applicable for the communication of eHealth data in particular, covering different technologies for encryption and access control.

What is missing are clear interoperability guidelines for the development and compliancy testing of complete end-to-end scenarios, in order to facilitate that medical devices from different vendors can work smoothly together with EHR storage systems from different vendors and also with devices and software solutions for the medical service providers as doctors and hospitals.

Standardization bodies to be addressed

About 10 years ago the entertainment industry has founded the Digital Living Network Alliance (DLNA), which standardizes guidelines focusing on the interoperability between networked entertainment and media devices that involve digital content in form of images, audio and video. Analog to that, clear interoperability guidelines should be developed and specified for the interoperability of networked eHealth devices, appliances, and software components. For that a standardization body or dedicated interoperability organization with a holistic view on end-to-end scenarios involving eHealth devices and appliances is required.

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References

- [1] "Renewing Health". Deliverable D6.1 Use Cases Version 1.1. 2010.
- [2] Thorp J. "Europe's e-health initiatives". *J AHIMA*. 2010;81:56-8.
- [3] Trigo JD, Alesanco A, Martínez I, García J. "A review on digital ECG formats and the relationships between them". *Information Technology in Biomedicine, IEEE Transactions on*. 2012;16(3):432-44.
- [4] Trigo JD, Chiarugi F, Alesanco A, Martínez-Espronedada M, Serrano L, Chronaki CE, et al. "Interoperability in digital electrocardiography: harmonization of ISO/IEEE x73-PHD and SCP-ECG". *Information Technology in Biomedicine, IEEE Transactions on*. 2010;14(6):1303-17.
- [5] Bond RR, Finlay DD, Nugent CD, Moore G. "A review of ECG storage formats". *Int J Med Inf*. 2011;80(10):681-97.
- [6] ISO/TS 11073-9201:2007. "Health informatics - Medical waveform format - Part 92001: Encoding rules (MFER)" 2007 [cited 2013 June]. Available from: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=41602.
- [7] Health Level 7 annotated ECG. FDA XML Data Format Design Specification. 2002.
- [8] DICOM Supplement 30. Waveform Interchange 2011 [cited 2013]. Available from: http://medical.nema.org/Dicom/supps/sup30_lb.pdf.
- [9] Brenner M, Musa Unmehopa. "The Silo Syndrome and its Solution". *The Open Mobile Alliance: Delivering Service Enablers for Next-Generation Applications*: 7-20.
- [10] Eugster PT, Felber PA, Guerraoui R, Kermarrec AM, "The many faces of publish/subscribe," *ACM Computing Surveys (CSUR)*, vol. 35, no. 2, pp. 114-131, 2003.
- [11] Fielding RT, "Architectural Styles and the Design of Network-based Software Architectures," Ph.D. dissertation, University of California, 2000.
- [12] Braa J, Sundeep S, "Integrated health information architecture: power to the users", Matrix Publishers, New Delhi, 2012.
- [13] Carlile PR, "Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries", *Organization Science* September/October 2004 15:555-568.
- [14] EU-project HITCH, "Establishing Quality Management for Interoperability Testing", Lisbon 2011, <http://hitch-project.eu/sites/www.hitch-project.eu/files/EHR-Q-HITCH-Presentation-20110616.pdf>.
- [15] Trinugroho YBD, Rasta K, Nguyen TH, Gerdes M, Fensli R, Reichert F, "A Location-Independent Remote Health Monitoring System utilizing Enterprise Service Bus". In: *IADIS International Journal on WWW/Internet*, Volume 10, Number 2, 2012, pp. 88-106.
- [16] Hiraia M, Masudab G, (editors) "ECG description in MFER and HL7 version 3". *APAMI&CJKMI-KOSMI Conf*; 2003.
- [17] Marcheschi P, Mazzarisi A, Dalmiani S, Benassi A, (editors), "ECG standards for the interoperability in patient electronic health records in Italy". *Computers in Cardiology*, 2006; 2006: IEEE.
- [18] Shepherd Platform from Telenor Objects, <http://telenorobjects.com/shepherd/>
- [19] Microsoft HealthVault, <https://www.healthvault.com>
- [20] Caradigm Intelligence Platform, <http://www.caradigm.com/en-us/products/caradigm-intelligence-platform/>