CENTRO DE TECNOLOGÍAS DE INTERACCIÓN VISUAL Y COMUNICACIONES

INTEROPERABILITY AND MOBILITY FOR VITAL SIGNS MONITORING SYSTEMS

VICOM Tech

VISUAL COMMUNICATION TECHNOLOGIES

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VISUAL INTERACTION AND COMMUNICATIONS TECHNOLOGIES

Foundation Stiftung

INI-GraphicsNet

Med-e-Tel

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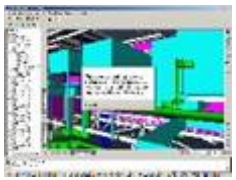
VICOMTech's APPLICATION AREAS

Digital TV and Interactive Services
(DVB-MHP standard, new interfaces, TV & Internet, …)

Medical Applications
(Telemedicine, simulation, Mixed Reality, 3D representation …)

Cultural Heritage & GIS
(Virtual Environments, Avatar Guides, Augmented Reality,…)

Education, Entertainment and Tourism
(Multimodal – multilingual interfaces, Avatars, e-Learning …)

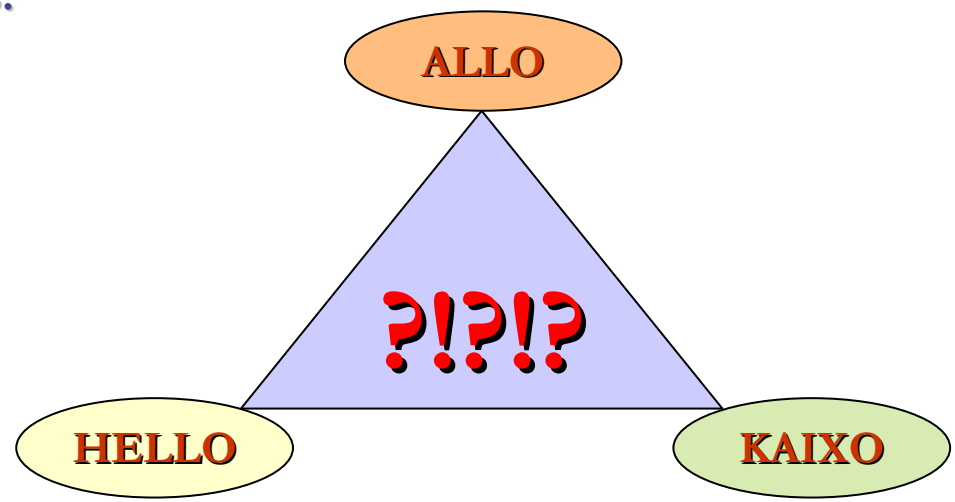


Industrial Applications
(e-Commerce, 3D Product Configuration, CSCW, Geometry Compression, Digital Security)

INTRODUCTION (I)

- The significant progress experienced by the information technologies discipline, has made it possible the incorporation of substantial advances within medical devices.

- Even though physicians work has been significantly eased and patients comfort increased, the problem of communicating devices from different manufacturers still remains, as they may possess different proprietary protocols.



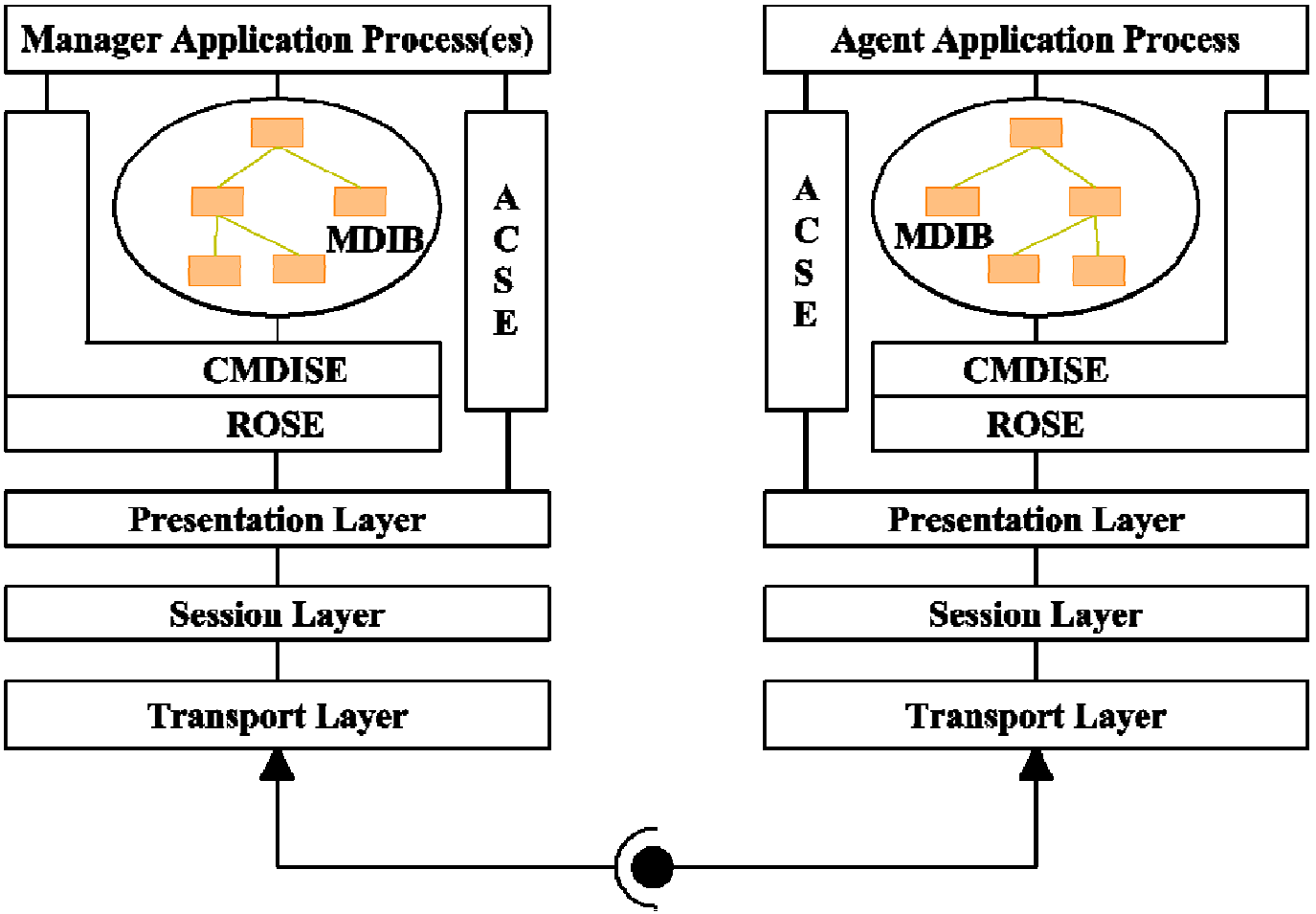
- Hence, it seems necessary to devise some basic rules for data exchange between different medical devices and medical management elements.

INTRODUCTION (II)

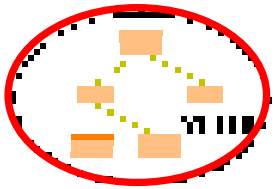
- Several standardization attempts have been made.
  - The Committee for European Normalization (CEN) TC251 Working Group IV defined a standard called VITAL.
  - IEEE —Medical Device Communications — defined the set of standards IEEE 1073.
- Over the last few years, there has been an international harmonization in the area of medical device communications standardization, resulting in both groups coming together under ISO TC215 WG2.1.
- The resulting standards, named CEN/IEEE/ISO 11073, have been developed in close coordination with other standards development organizations including HL7, DICOM, …
- Initially, when implementing off-line data exchange, this work was solely based on VITAL standard, but for on-line data exchange CEN/IEEE/ISO standards have also been taken into account.

VITAL STANDARD OVERVIEW (I)

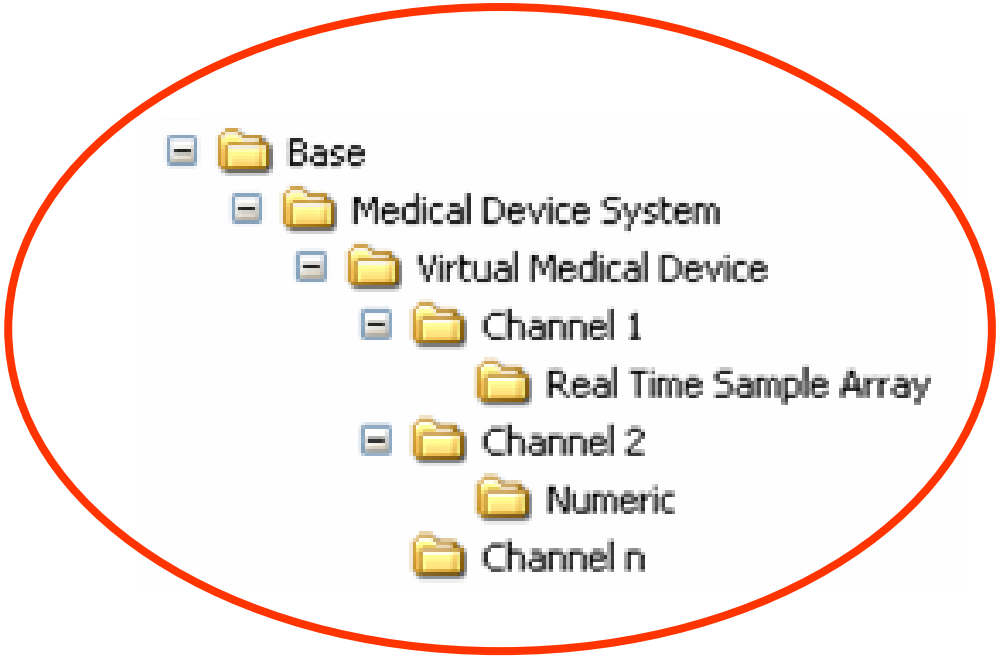
- VITAL is based on the ISO/OSI seven layer system management model. Its principal goal is to provide both a plug and play connectivity, and a "shared" representation for every medical device. As a result, a Manager-Agent structure is defined:



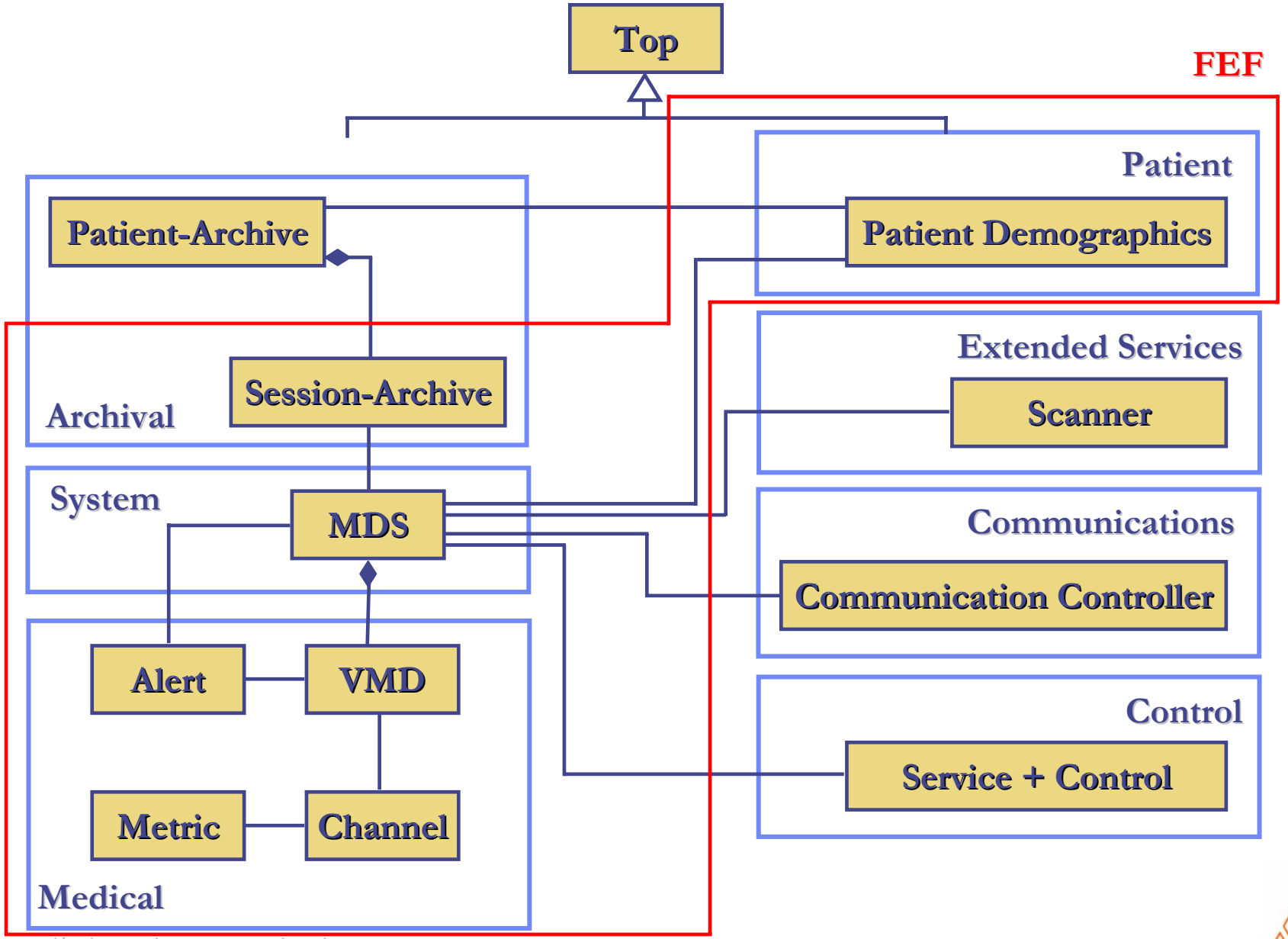
VITAL STANDARD OVERVIEW (II)



- The Medical Data Information Base (MDIB) is an object-oriented database which contains a structured collection of managed medical objects, representing the vital signs information provided by a particular medical device.



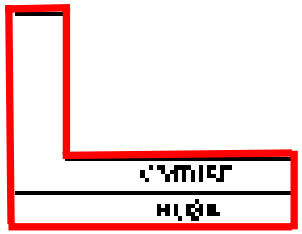
VITAL STANDARD OVERVIEW (III)



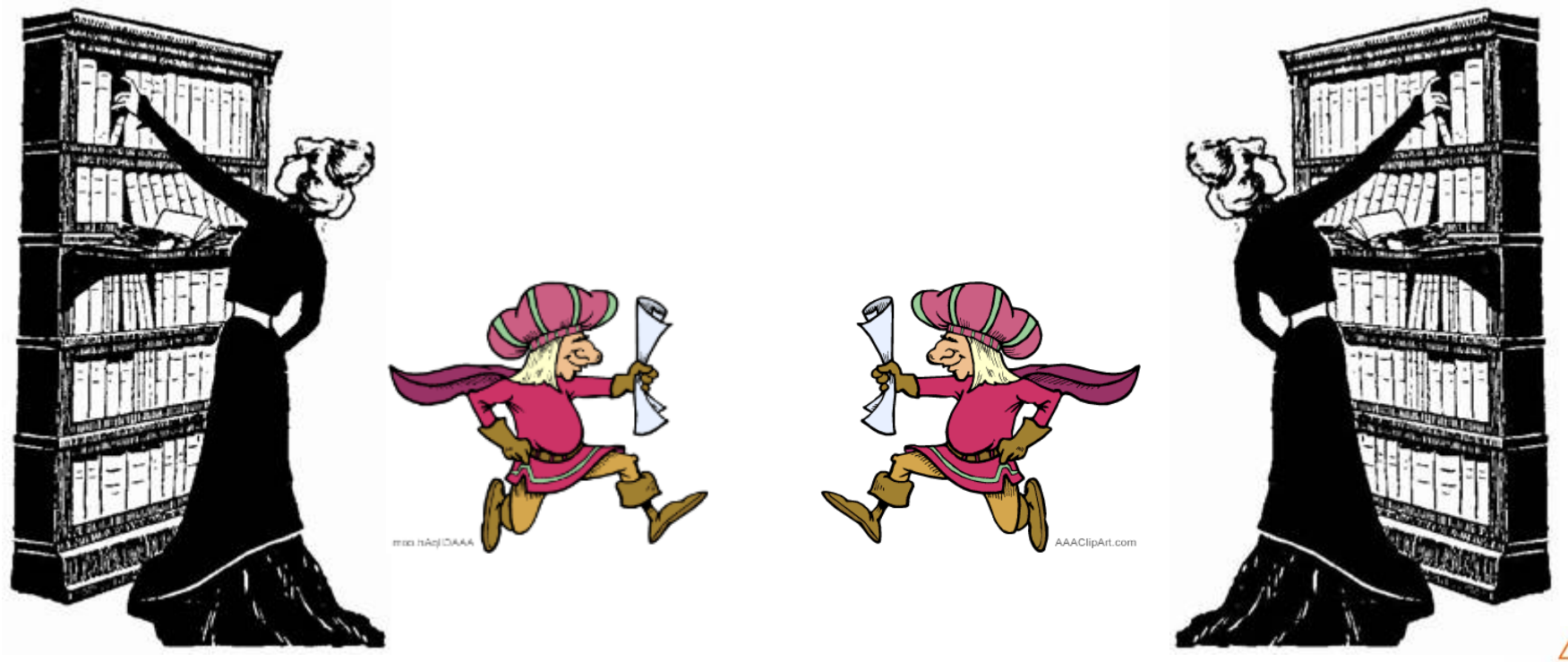
VITAL STANDARD OVERVIEW (IV)

- Association Control Service Element (ACSE). As an standard protocol, it not only provides the set of methods for establishing logical connections between medical device systems —association —, but also a flexible tool to adopt future requirements.

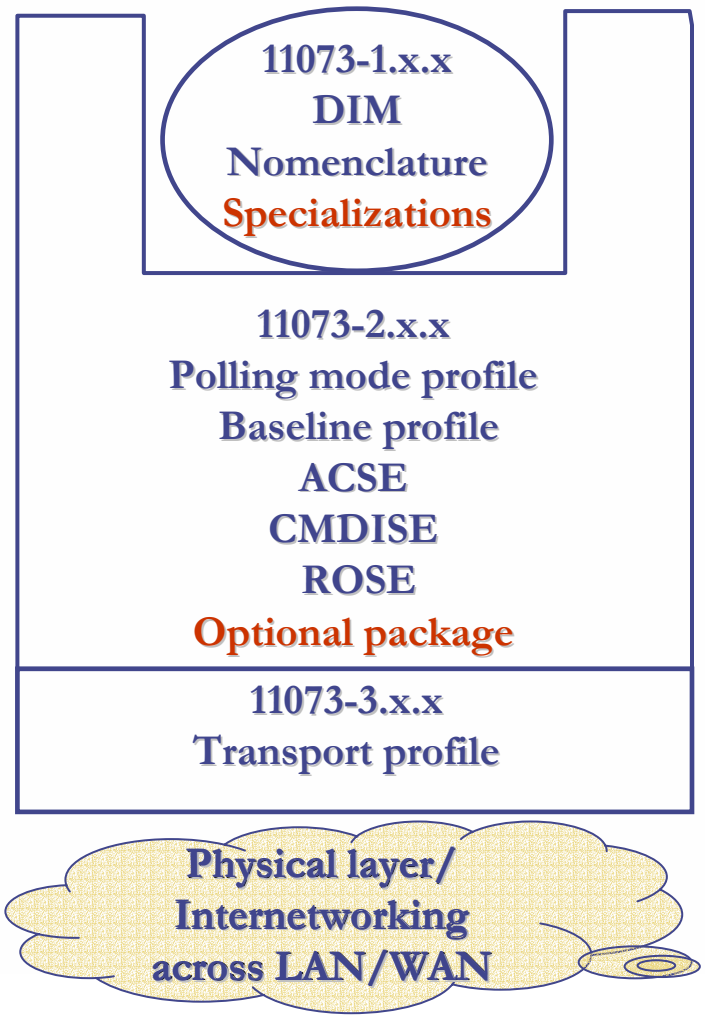
VITAL STANDARD OVERVIEW (V)

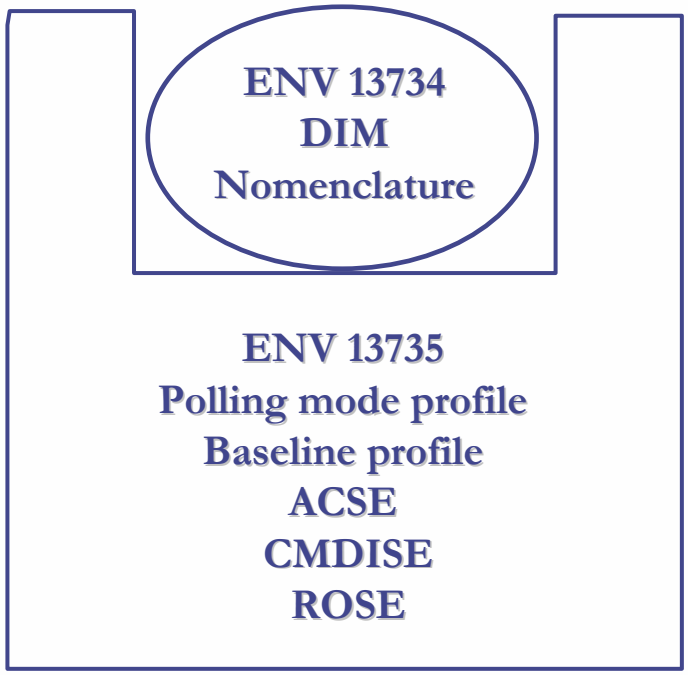


- CMDISE, Common Medical Device Information Service Element. It offers access services to data stored in MDIB instanced objects.
- The Remote Operation Service Element (ROSE) provides basic services used by the CMDISE to invoke operations to be performed by a remote application.



VITAL STANDARD OVERVIEW (VI)





DEVELOPED PROTOTYPES (I)

FEF IMPLEMENTATION

- CEN/TS 14271 pre-standard deals with the off-line communications and provides the specification for an universal file exchange format (FEF) for vital signs.
- Inside VITAL project (collaboration with Fraunhofer's Computer Graphics Institute, *@Home European Project*).

IMPLEMENTATION FEATURES

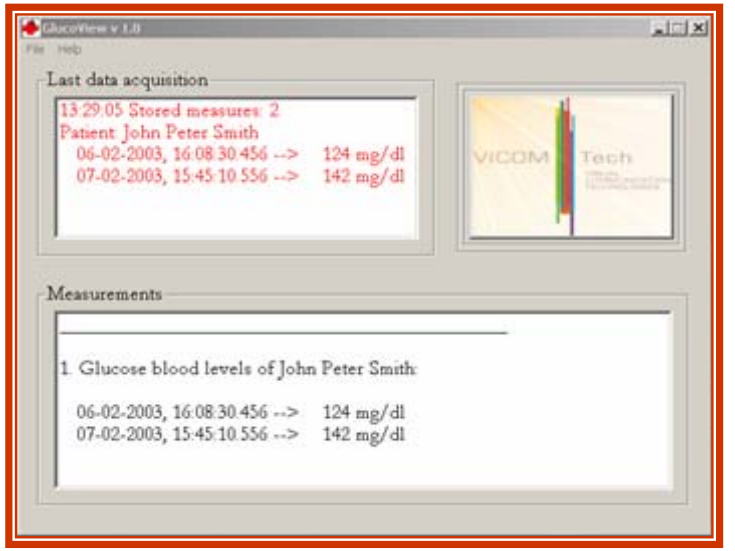
- Object-oriented database implemented in C++. Mandatory objects for SPO2, ECG, Blood Pressure and Glucometer devices.
- Abstract Notation One (ASN.1) internationally standardized notation, vendor, platform and language independent, for specifying data-structures at a high level of abstraction.
- FEF proposes Basic Encoding Rules (BER).

DEVELOPED PROTOTYPES (II)

AGENT SIDE

- Glucometer
- RS-232 to Bluetooth converter
- PDA (built-in bluetooth)
- GSM bluetooth mobile phone
- Application (developed using ms eVC++ 3.0)

GLUCOSE LEVEL DIAGNOSING



MANAGER SIDE

Care-centre diagnosing-system simulation by means of:

- Personal Computer
- GSM bluetooth mobile phone
- Application (developed using ms VC++ 6.0)
- FTP server

DEVELOPED PROTOTYPES (III)

VITAL TR IMPLEMENTATION

- VITAL TR project (Financially supported by Basque Government).

IMPLEMENTATION FEATURES

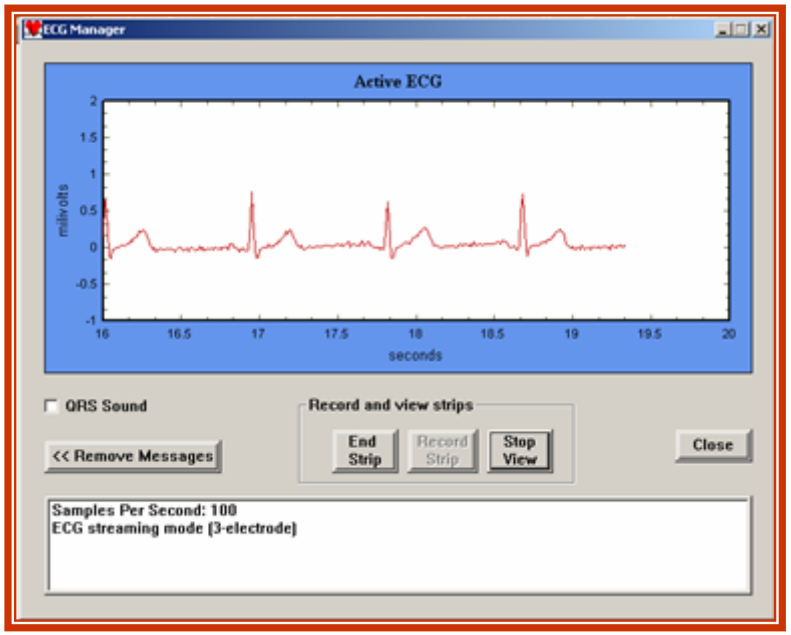
- C++ Object oriented data base for ECG devices. We have made use of ENV 13735 and ISO/IEEE/CEN 11073-10306 standard (Device specialization).
- Medical Device Encoding Rules (MDER) defined in CEN/IEEE/ISO 11073-20101, which optimize formatting and parsing performance as well as minimizes bandwidth utilization.
- ASN.1 restricted set for MDER.

DEVELOPED PROTOTYPES (IV)

ECG SIGNALS MONITORING

AGENT SIDE

- 3 lead ECG
- PDA (built-in bluetooth)
- GSM bluetooth mobile
- Application (developed using ms eVC++ 4.0)



MANAGER SIDE

Care-centre simulations by means of:

- Personal Computer
- GSM bluetooth mobile phone
- Application (developed using ms VC++ 6.0)

CONCLUSIONS

- Each medical device manufacturer implements its own proprietary communications protocol, what makes technicians manage a large amount of protocols.
- Standardization has widely benefited diverse areas.
- In telemedicine, standardization would facilitate the interoperability between medical devices since it provides both, a "plug and play" connection and a "shared" representation for vital signs.
- As an approach to standardization in home-care scenarios, two basic mobile prototypes for off-line and on-line data exchange have been developed aiming at offering interoperability, mobility and portability.
- Encouraging standard implementations.

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