

UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE
"IULIU HAȚIEGANU", CLUJ-NAPOCA

UNIVERSITE JOSEPH FOURIER
GRENOBLE

UNIVERSITY OF DUNDEE
SCOTLAND

NET BRINEL COMPUTERS

ROMANIAN SOCIETY FOR APPLIED
MEDICAL INFORMATICS

UNIVERSITATE CĂTOLICĂ DE LOUVAIN
BELGIQUE

4-14 June 2000

PHARE Tempus JEP S-12530-97



Teletransmission
for
Medical Imaging

Editura SRIMA
2000

HEALTHCARE TELEMATICS

Ramona GĂLĂTUȘ, Andrei ACHIMAȘ

1.1. INTRODUCTION

The following provides an overview of the current situation about standardisation on healthcare telematics.

There are a great variety of standards applicable to healthcare telematics systems development and usage. They can be classified into two main categories :

- generic standards, not dependent on healthcare application field
- specific healthcare field standards

Generic telematic systems are complex and may also be considered in relation with the source being from the "informatics" side (ISO, IEC, JTC, CEN-CENELEC) or from the "telecommunications" world (ITU-T, ETSI).

Specific Healthcare Telematic standards present an additional degree of complexity. It is not easy to provide a comprehensive view in a few lines. The current standardisation scenario is the result of many contributions from many organisations over several years. First contributions can be traced to more than twenty years ago, when IEEE launched standardisation activities on the inter-connection of medical devices. The list of items addressed by standardisation bodies has been significantly enlarged over the last few years. The discussions generated by European fora at the beginning of the 90's, in order to establish the working programme for the CEN TC251, illustrate the difficulties in identifying not only the priorities but also the scope of standardisation matters.

The standardisation scenario is moving in line with global expansion of the information technologies and telecommunications as well as the deep organisational changes which healthcare systems are suffering.

Any health system must take into account standards related with bitways and services layers. In this context ,OSI standards profiles are crucial and basic for any designer. However, it seems reasonable that a major focus will be placed on standards concerning the specific "Applications" layer.

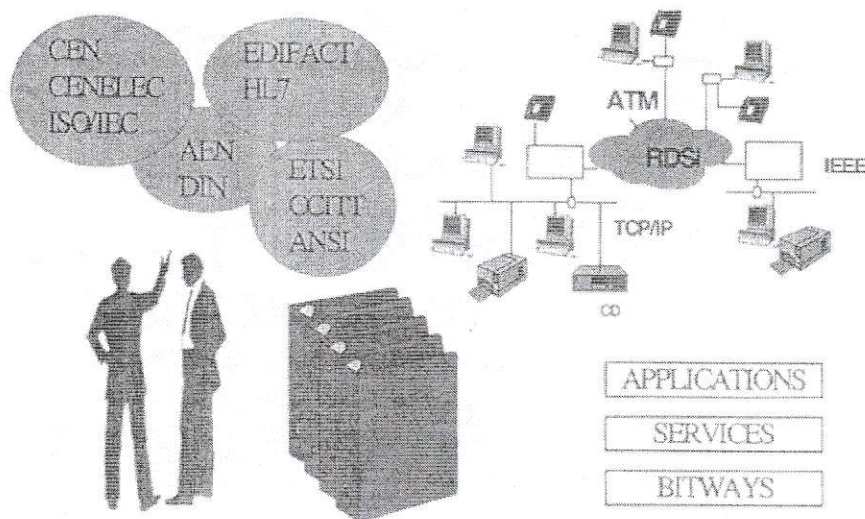


Figure 1.1.- The development of healthcare telematic systems requires the consideration of a number of complex issues related with standards.

1.2. SCOPE OF AREAS COVERED BY HEALTH TELEMATICS STANDARDS

Taking into account the state of the art, and in order to facilitate a description of the field, a division into the following areas has been taken :

- Healthcare Information System
- Health Records
- Terminology
- Electronic Data Interchange
- Communication of Medical Images
- Biomedical Instrumentation and Biosignals
- Multi-media
- Security
- Data Cards
- Other issues

This taxonomy is based on a practical view of current available standards and the main work in progress. The following sections intend to cover main developments in each area, offering an overview of current standards.

1.3. HEALTHCARE TELEMATIC STANDARDS SOURCES

The information presented in this Product about current standards on healthcare telematics have been compiled and assimilated from numerous sources. Section 3 offers a detailed description of the most relevant standards organisations being active in this area. However, the main sources are obviously the CEN Technical Committee TC251 on Medical

Informatics and Standard Development Organisations (SDOs) recognised by ANSI. This is not casual. It is a response to the following main reasons:

- they [CEN/TC251] are actually the main sources of standardisation work
- European health telematic users and developers must be aware of CEN standards, in as far as they are obliged to be adopted by national standard bodies
- US-generated standards must be carefully noticed as far as their considerable impact on US-based multinational company products

This product offers a vision of the current development of healthcare telematic standards but it must also rely on basic references of a horizontal nature, such as e-mail, multi-media, or compression tools. The author is aware that there are other types of standards relevant to healthcare telematic systems, where they are also of general application. Examples are standards related with quality control, or usability compliance for handicapped people. They are not examined because of logical limitations to this Product. The interested reader can address ISO, CEN, and ETSI references on these matters.

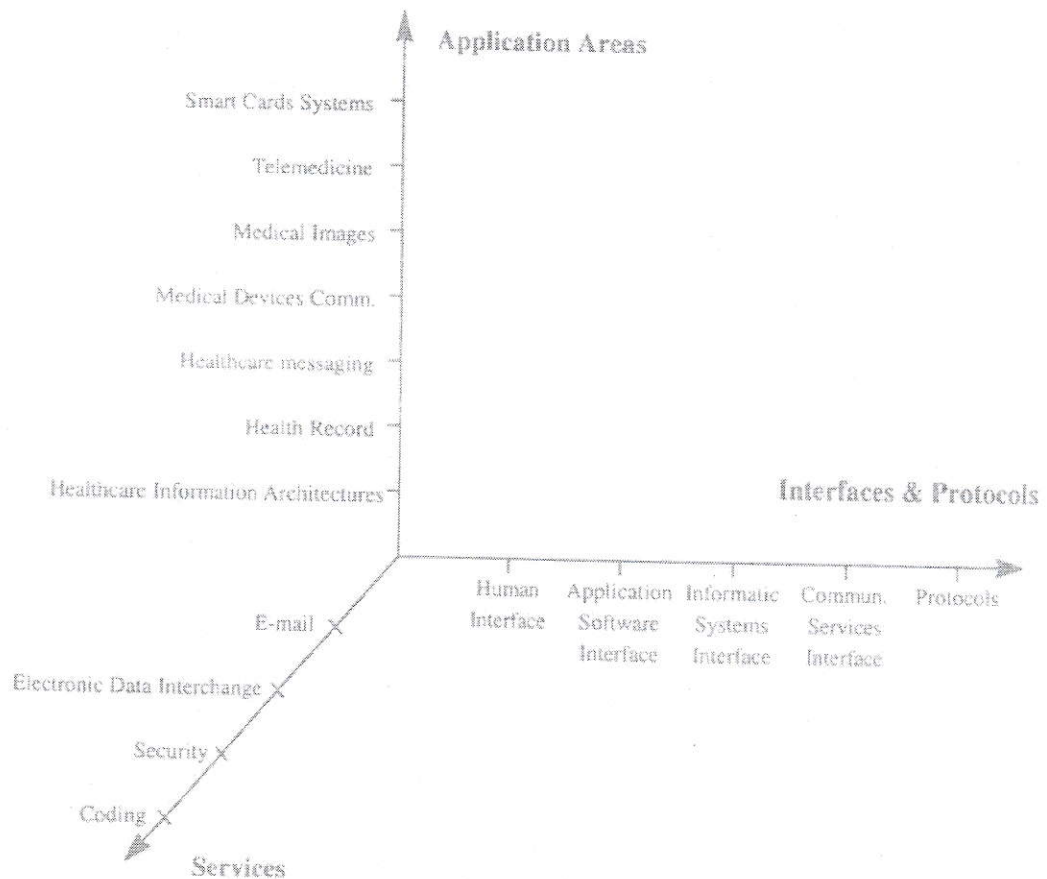


Figure 1.2.- Domain space of the Health Telematic Standard.

2. STANDARDS RELATING TO THE ARCHITECTURE OF HEALTHCARE INFORMATION SYSTEMS

2.1. HEALTHCARE INFORMATION SYSTEMS

Systems are interacting entities, united to perform a larger function. Information can be viewed as a set of symbols (data) and logical processes that serves to support cognitive functions.

Information systems can be defined as the set of facilities and processes interacting to perform a synergistic function not realisable by individual components. Often, this synergy is realised by facilitating complex decisions overcoming barriers of representation and / or facilitating communication and overcoming barriers of space and time. In particular, Healthcare Information Systems are those systems that focus on supporting the needs derived from healthcare operational reality.

2.2. MODELS AND ARCHITECTURES

A model is a simplified representation of a real system. Humans use models in their intellectual activity. There are multiple kind of models, depending on their nature and their purpose.

Examples of models have been used previously in this Product when dealing with the OSI (Open Systems Interconnection) Model. Another example is the simplified three-layer model of bitways, services and applications as presented with some detail in Section 5 .

2.3. HEALTHCARE INFORMATION SYSTEMS MODELLING

Relevant groups have highlighted the importance of healthcare information modelling as the basis for constructing a reference framework. The work performed in the field has been aimed at developing a common model, reflecting the core activities of the healthcare delivery processes and the information systems required to support them.

The complexity of healthcare systems is well known. The associated information systems are also extremely complex. It seems reasonable to search for a common conceptual framework that would allow them to share the same reference frame, guiding the development of health informatics standards.

Healthcare Information models intended for standardisation are required to be pragmatic. Thus this kind of models needs to adapt to the complexity and evolutionary nature of healthcare systems and information technology. Healthcare information systems can be described in terms of loosely coupled heterogeneous systems. Therefore one of the basic approaches is to

consider that the model is only concerned with how heterogeneous systems communicate with each other, not how they work.

Most of Healthcare Information standardisation works have relayed on, or has been overlapped with Electronic Health Records concepts and models.

2.4. OVERVIEW OF STANDARDISATION ACTIVITIES ON HEALTHCARE INFORMATION MODELLING

There are a lot of suggestions and ideas in the field of healthcare information architectures. Regarding standardisation bodies, the activities developed by the CEN-TC251 WG1 must be mentioned. This working group has produced the European pre-standard *CEN-ENV 12443:1996. The Healthcare Information Framework*, that is intended to become a basic reference guide for developers of health informatics standards. Also the CEN-TC251 WG1 has been working on a European pre-standard dealing with Standard Architecture for Healthcare Information Systems. This document is intended as a basis for comparisons, evolution and the integration of existing systems as well as for the planning and high-level design of new open and modular systems. The proposed architecture is based on Object Oriented Modelling (OOM).

Considering the importance of a common terminology, CEN-TC251-WG1 have also devoted a significant effort to establishing a reference vocabulary (MIVoC - ENV12017) to serve all CEN -TC251 standardisation activities.

2.5. MESSAGING ORIENTED INFORMATION MODELS

Other relevant modelling efforts in the standardisation field are:

- the MEDIX Information Model
- the Health Level 7 Reference Information Model
- the Enterprise Communication Framework model proposed by the Andover Working Group

These models are more practically oriented than the CEN-TC251 WG1 approach, which is more theoretical.

All of them are briefly outlined in following paragraphs.

2.6. EUROPEAN STANDARDS

***CEN-ENV 12443:1996. The Healthcare Information Framework**

This pre-standard is intended to provide a basic framework to guide developers of health informatics standards. It aims to be a first step in standardising architectures.

The scope of the pre-standard has been limited to very basic principles, in order to gain consensus at this time.

- **CEN pr ENV: The Standard Architecture for Healthcare Information Systems**

The aim of this CEN pre-standard is to enable the developers of modular open systems to support healthcare systems. Also it is intended to be used to link existing systems to construct healthcare information systems from currently isolated sub-systems. The level of this pre-norm is between that of the Healthcare Information Framework and the Systems Implementation Architecture.

- **CEN-ENV 12017: 1995. The Medical Informatics Vocabulary**

The Medical Informatics Vocabulary (MIVoc) pre-standard is a foundation for the development of a vocabulary of terms used in medical informatics. The initial target is the set of terms required by the definition clause in each European pre-standard.

The Vocabulary provides definitions of terms that label key concepts in medical informatics standards and describes their inter-relationships in a systematic index. The first vocabulary is restricted to the English languages

2.7. OTHER MODELS

Also considered are three other models : MEDIX, HL7 and the Enterprise Communication Framework.

MEDIX Information Model

The IEEE MEDIX working Group developed the first object-oriented model for use in health data interchange standardisation. It permits the representation of all types of medical data , including text, images, graphs, signals and voice. IEEE MEDIX is discussed with some detail in section 12 .

Health Level 7 Reference Information Model

This is an object-oriented information model of the classes present in the healthcare domain, about which Health Level 7 messages are transmitted. Its purpose will be to provide the precise definition of the content of HL7 messages. The Reference Information Model will be part of a set of models that include a Use-Case Model, the Reference Information Model, an Interaction Model, and a Message Specification Model. Each of these is linked and inter-dependent.

Enterprise Communication Framework

The Andover Working Group has created a model called the Enterprise Communication Framework. It is an object-oriented, pre-built module of code that encapsulates standards-based healthcare data-interchange formats and communication profiles for the seamless integration of different computing systems.