

Integration of Multi Media Telemedicine Applications into Health Services for Routine Use – State of the Art and Recommendations

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Version 1, March 2003

This is the deliverable of a workshop held at ICT conference on September 24, 2002, in Regensburg, Germany, chaired by A Horsch, S Pedersen, T Schall. It was created by collecting and editing (wording, sorting, merging of similar ideas, etc) the input from the contributors listed below from June until the workshop itself. In comparison to the handout version distributed in the beginning of the workshop, this version 1 now also includes the inputs given during the discussion. The contributors are experienced professionals working in the field of health telematics.

DISCLAIMER: The document does neither claim to be complete nor does it claim to represent the major opinion of the scientific community. It is the collection of (partly controversially discussed) opinions of the contributors who solely stand for their personal opinion as experts working as professionals in healthcare telematics.

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**Munich/Tromsø/Regensburg
March 2003**

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Minor updates

030406 Correction of some errata

A. Glossary of terms

This glossary has just to be considered as a starting point. It is still incomplete and in some parts a list of abbreviations, only. During the iterative process of updating the whole document, this glossary shall be completed, step by step. Major strategy is to use the most accepted or standardized definition that is available at the moment.

- Adm** Administrations; organizations regulating and controlling the operational business; here: addressees of recommendations
- ADT** Admission, Discharge, Transfer; basic administrative functions in patient management, especially for hospitals
- CDA** →Clinical Document Architecture
- CEN** Comité Européen de Normalisation; the European standardization body
- CEN/TC251** Technical committee 251
- client** in the context of service chains: recipient of a social or healthcare service
- client-oriented**
mainly driven by the needs of the clients
- client-centric**
considering the client in the centre of a concept or object (policy, process, planning, analysis, design, specification, application, implementation, etc.)
- communication server**
in hospital communication: a dedicated server fulfilling the task of a message broker for numerous connected subsystems (patient administration system, clinic documentation and information systems, →EPR systems, function unit subsystems like RIS/PACS, LIS, etc) through a common messaging standard (nowadays usually →HL7); examples: Cloverleaf, Datagate
- CORBA** Common Object Request Broker Architecture
- dedicated health telematics platform**
→health telematics platform which does not support any other sector than →healthcare
- desktop integration**
a form of integration where the information from different enterprise information systems is addressed by URLs and displayed in one user interface (browser) via HTML/XML-files
- DICOM** Digital Imaging and Communications in Medicine; standard for the vendor-independent exchange of medical images and related information; defines data structures (e. g. file formats) for medical imaging modalities and network services for clinical applications (e. g. image transmission, archive access, printing, workflow support)
- EHCR** →Electronic Health Care Record
- EHR** →Electronic Health Record
- Electronic Health Care Record**
(EHCR) →Electronic Patient Record
- Electronic Health Record**
(EHR) Repository of Information about the patient's health available in a computer-readable format. (T Beale)
- Electronic Health Record System**
Set of components establishing mechanisms to generate, use, store and retrieve an Electronic Patient Record (T Beale)
- Electronic Health Record Architecture**
Model of generic properties required for any Electronic Patient Record for providing commu-

nicable, comprehensive, useful, effective, and legally binding records, which preserve their integrity over the time independent of platforms and systems as well as of national specialities. (T Beale)

electronic identifier

→identifier that can electronically be processed

electronically readable card

carton or plastic card in the size of a credit card from which information can be read and imported to a computer by a suitable reading device (card reader)

Electronic Patient Record

(EPR) healthcare record stored in electronic format [centc251g]

ENV12052:1997

MEDICOM

ENV13606 European pre-standard on Electronic healthcare record communication, CEN, 2000

EPR

→Electronic Patient Record

functional interoperability

Exchange of data with agreed vocabulary and application behaviour for creating and using data.

healthcare a broad term that directly refers to different activities and means used to prevent or cure different processes of morbidity [centc251g]

healthcare service

service provided with the intention of directly or indirectly improving the health of the person or population to whom it is provided [env13606-1]

GEHR

Good European Health Record

Health Professional Card

(HPC) →electronically readable card for healthcare professionals, meant for authentication against health information systems in order to give secure access to patient data stored either in a patient data card or a remote server with security components.

HPC

→Health Professional Card

health telematics

composite term for health-related activities, services and systems, carried out over a distance by means of information and communications technologies, for the purposes of global health promotion, disease control and health care, as well as education, management, and research for health care [who98]

consists of the 4 areas →telemedicine, →tele-education for health, →telematics for health research and →telematics for health services management

health telematics platform

→telematics platform supporting the complete →healthcare sector; see also →dedicated health telematics platform

HIPAA

Health Insurance Accountability and Portability Act

HIS

Hospital Information System;

(1) ICT system for electronic storage and communication of information between departmental information systems, required for operation and management of a hospital;

(2) Integrated, computer-assisted system designed to store, manipulate and retrieve information concerned with the administrative and clinical aspects of providing services within the hospital. [centc251g]

HL7

HL7 is a specification for a health data-interchange standard designed to facilitate the transfer of health data resident on different and disparate computer systems in a health care setting. HL7 facilitates the transfer of laboratory results, pharmacy data and other information between different computer systems. HL7 is not designed to support the transfer of the entire

patient record. HL7 does not support the transfer of image data (such as from a PACS).
[centc251g]

HL7 / TC XML

Technical Committee XML of →[HL7](#)

ICD-10 International Classification of Diseases, Version 10, WHO

ICT Information and Communication Technology; technologies for acquisition, storage, processing, communication and display of electronic information

identification token

e.g. →[electronically readable card](#) containing →[identifier\(s\)](#)

identifier a chain of symbols assigned to an object (e.g. patient, professional, document) or concept (e.g. disease, organ system) in such a way that a) two different objects or concepts always have different identifiers, b) with one special identifier one always addresses the same object or concept, at any time in past, presence or future

Ind Industry; here: addressees of recommendations

ISO International Standardization Organisation

ISO/TC215 Technical Committee 215 Healthcare of →[ISO](#)

IT Information Technology; technologies for acquisition, storage, processing and display of electronic information

IHE Integrating the Health care Enterprise

JPEG Joint Photographic Experts Group; here: the picture format

Knowledge model about reality characterised by information and constraints, i.e. content constraints, semantic constraints, structural constraints, process constraints (rules)

LIS Laboratory Information System

LOINC Logical Observation Identifier Names and Codes

modelling mean to express constraints of reality; for modelling, different vocabularies are applied; for graphical vocabularies, →[UML](#) has been standardised as the dominant way to go; we distinguish between platform-independent reference models, platform-independent domain models, platform-specific reference models and platform-specific domain models

MPI →[Master Patient Index](#)

Object Identifier

(OID) basically, strings of numbers allocated in a hierarchical manner, so that, for instance, the authority for "1.2.3" is the only one that can say what "1.2.3.4" means; are used in a variety of protocols; their formal definition comes from ITU-T recommendation X.208 (ASN.1), chapter 28, the assignment of the "top of the tree" is given in appendixes B, C and D; the encodings, i.e. how one can transfer an OID as bits on the wire, is defined in X.209

OER Order Entry / Reporting; basic functions of service enquiry and result delivering between a clinic / practice and a function unit / service provider (e.g. radiology, pathology, laboratory)

OID →[Object identifier](#)

OMG Object Management Group;

operational system

IT system supporting the operation of an enterprise (e.g. →[HIS](#), →[POS](#), →[LIS](#), →[RIS/PACS](#))

patient consent

dedicated permission given by the patient to a healthcare professional to perform a certain activity concerning his health; in the context of this document, as activity mainly the access to →[patient data](#) is addressed

patient card

Computer readable card held by or related to a patient used for some purpose connected to the receipt of health services. [centc251g]

Patient Data Card

(PDC) →electronically readable card for identification of the patient, for →consent management, for to keep medical data about the patient, and for other purposes

PKI Public Key Infrastructure

PM Project Manager; person responsible for the management of a project; here: addressee of recommendations

PMI Privilege Management Infrastructure; ...

Pol Politicians; persons responsible for making strategic decisions and the legal framework for social and health care; here: addressees of recommendations

portability the ability of a program to run on systems with different architectures [centc251g]

POS →Practice Office System

Practice Office System

(POS) →IT system for electronic storage and communication of information in a doctor's office

PS Project Sponsors; organisations financing (parts of) projects; here: addressees of recommendations

QoS Quality of Service; measurable features of a service describing its quality (e.g. maximal response time, minimal transfer capacity, minimal qualification of staff)

reference here: unique address pointing on a healthcare information entity stored in an IT system; example: URL

regional EPR

regionally comprehensive →EPR making the →EPR parts available to healthcare professionals or the patient, that are stored in the →operational systems of the healthcare providers within the region

regional information system

information system providing access to information stored in →operational systems of a region

RIS/PACS Radiology Information System / Picture Archiving and Communication System

routine use
use in operative business

SB Standardization Bodies; e.g. →CEN, →ISO; here: addressee of recommendations

scenario formal description of a class of business activities including the semantics of business agreements, conventions and information content [centc251g]

security service

service related to data security; examples: →privilege management; →access control; →electronic identifier for patients, professionals and entities; Authentication and e-signature certificates; Encryption services; Consent management services.

semantic interoperability

ability of two (or more) systems to exchange data on the basis of an agreed vocabulary guaranteeing same interpretation (semantics) of notions for the users of the interoperating systems

service a specific behaviour that a communication party in a specific role is responsible for exhibiting [centc251g]

service-oriented interoperability

interoperability with respect to invocation of services

service chain

timely sequence of services delivered for one individual in order to achieve a common goal (in healthcare e.g. curing a patient of a certain disease)

single sign-on

comfortable form of authentication of a user against a complex system with many subsystems: a single authentication action against the system (usually via a dedicated authentication server) leads to an authentication that is valid for all subsystems to which access is necessary in a certain role and situation

SCIPHOX development project; provides 100% CDA compatible document definitions developed by the →TC XML of →HL7g. It is hosted by German DIMDI. Phase I (2000-2002): CDA header and the contents 1) admission, and 2) discharge. (doctorsletter); first applications on Medica 2002. Phase II (2002/2003): Disease management (Diabetes); Electronical Prescription; Medical device interface; SCIPHOX as a standard for an EPA

Smart Card →security token typically used for identification and authorisation of the card holder; in healthcare: especially →HPC and →PDC can be realized as Smart Card; the Smart Cards can contain →references to make →EPR accessible via secure networks

SNOMED Systematized Nomenclature of Medicine

social and health care

→social care and →health care together; the common consideration of both sectors is especially important for →client-oriented and →process-oriented approaches where a client (frequently) crosses the boarder between the two sectors

SP Service Provider; provider of a telemedicine service; here: addressee of recommendations

standard (1) an accepted or approved example or technique against which other things are judged or measured, or which sets out a set of criteria that serves as a guideline for how something should be done (2) a document established by consensus and approved by a recognized body, that provides for common and repeated use rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context. – Standards can become established by a recognized body (a standards body), the process of their formation usually takes place through a process of consultation and consensus approval. Often a pre-standard is established, which is proposed as a pre-cursor to the formally approved standard. In Europe pre-standards have been put on a formal basis (see European Pre-Standard) [centc251g]

standard image formats

e.g. BMP, TIFF, JPEG, MPEG

technology-driven

driven by the capabilities of the available or planned technology intended to be used for a certain purpose

tele-education for health

dynamic process by which change can be catalyzed in attitude, knowledge, information and skills, by means of information and communications technologies, by and for consumers, health professionals and communities, for the purpose of fostering improved health [who98]

telemedicine

delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interest of advancing the health of individuals and their communities [who98]

telematics for health research

comprises a variety of scientific activities aimed at solving health problems, including: col-

laboration and networking among individuals and centres for the sharing of ideas, results and access to core competence, information and knowledge bases; development of new technologies and applications; evaluation and validation of health telematics and its effects on individuals, societies and health disciplines [who98]

telematics for health services management

the use of information and communications technologies for the planning, implementation, financing and evaluation of disease control and of the quality, efficiency and effectiveness of service provision. It also comprises surveillance and monitoring of the determinants of health as well as the management of human and technical resources [who98]

telematics platform

in →social and health care: comprehensive network for electronic communication available for all participants in social and health care, which satisfies all ethical and legal requirements of this sensitive →application area

comprises the following services and tools: a) →identification services for patients and healthcare professionals; b) →identification services for entities and documents; c) →e-signature services; d) security and confidentiality services; d) →reference services to find patient records; e) standardised EPR/EHR communication messages; f) →user directories; g) →identification tokens like →Smart Cards; h) →TTP services (e.g. →PKI services).

TTP →Trusted Third Party

UML Unified Modelling Language; mean for →modelling with graphical vocabularies.

user directory

e.g. →LDAP

WHO World Health Organization

win-win situation

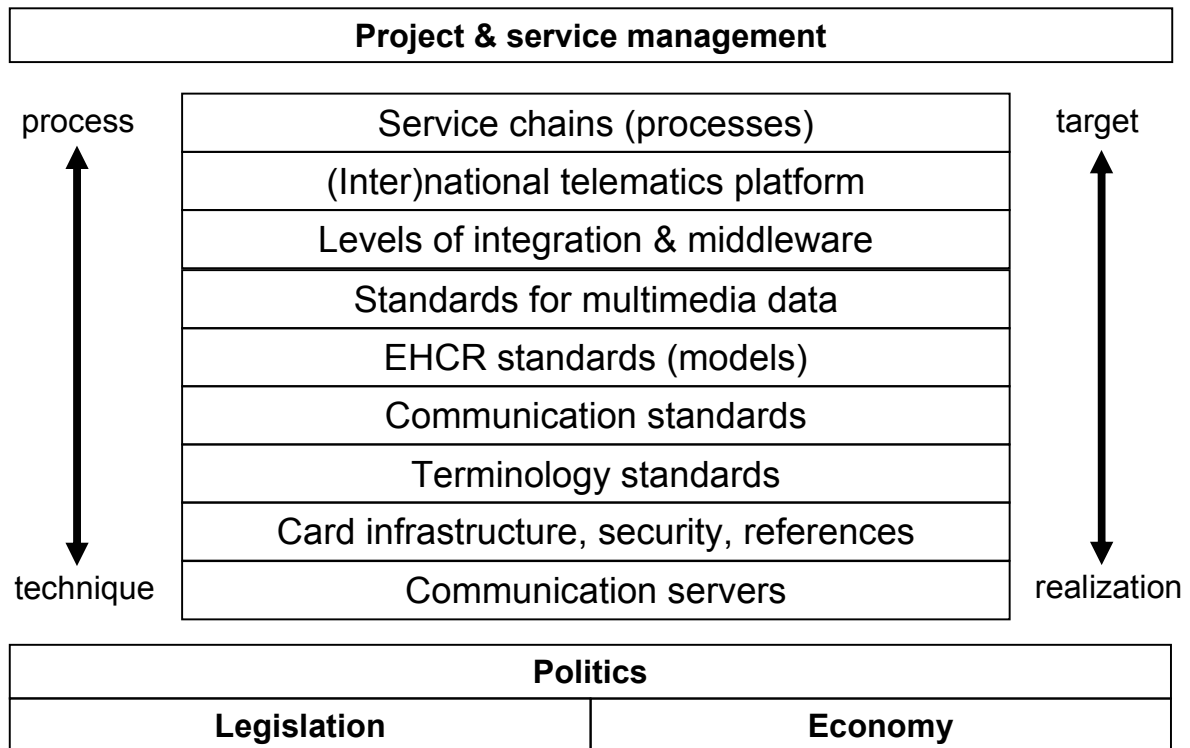
situation where all participants in a scenario do have a benefit from a certain change in their co-operation (often especially meant with respect to monetary benefit)

VITAL Vital Signs Information Representation; an international standard by CEN (ENV13734, ENV13735) and soon by IEEE; provides a) →plug-and-play capabilities for medical device communication, b) a nomenclature for vital signs instrumentation/devices, c) metrics, d) body sites, e) alerts, and other features

vocabulary e.g. ICD, ICPM, SNOMED, Read Code

XML Extensible Markup Language

B. Topic map



Topics related to the workshop

C. State of the art

C.01. Statements on political, legal and organizational issues

- S-01.1 The →health care sector does not need any more projects. The health care sector needs solutions, and it urgently needs leaders that have the will and the power to introduce ICT, at all levels, into the production of health care services.
- S-01.2 In →health care there still does not exist a consequent →process-oriented thinking. This situation is comparable to the situation in industry about one decade earlier.
- S-01.3 All over the world, there exists a big number of tailored →pilot applications with a very limited number of users and very often with the problem how to assure →sustainability.
- S-01.4 There are too many projects without migration into →routine use due to a wrong →strategy emphasizing automation of existing working methods, →technology-driven development and planning of the service processes without appropriate consideration of the features that are newly introduced by ICT support.
- S-01.5 The need for a →health telematics platform has been recognized in many European countries.
- S-01.6 The political, legal and economical preconditions for a profitable and broad use of →health telematics have not yet been created in most European countries.
- S-01.7 Always ask for the →patient consent when looking at his/her data, except in emergency when this is impossible without taking a significant risk for the life or health of the patient.
- S-01.8 In most European countries, attempts to establish →managed care on basis of ICT are in the very beginning.
- S-01.9 In order to exploit the potential benefit of healthcare telematics with respect to better quality and reasonable costs of care, it is mandatory to model / remodel the care chains with all possible / relevant / significant care paths as well as the appropriate corresponding data flows and communication processes.

C.02. Statements on projects

- S-02.1 Only in a minority of projects, clear analyses of the existing communicative structures as well as the needed ones are made.
- S-02.2 Many projects ignore the necessity of all the different integration needs.
- S-02.3 Projects still tend to re-invent the wheel without taking into account what has been accomplished elsewhere.

C.03. Statements on technology

- S-03.1 Existing →ICT is mature enough for the realization of almost any required application in the field of →health telematics.
- S-03.2 The →IT world will also in the future be a heterogeneous one.
- S-03.3 Today, synchronous audio-visual communication is most common. In many telemedicine scenarios, this is not really needed and asynchronous communication could meet the requirements more efficiently and more economically.
- S-03.4 The health care does not have a common architecture. It is nowadays characterized by tailored systems (e.g. →POS, →HIS, →LIS) without or without sufficient features for integration (e. g. standard interfaces).

- S-03.5 Very often, isolated solutions prevail, therefore hard-to-integrate →proprietary communication protocols and data formats are still quite common.
- S-03.6 Standardisation efforts are on the way, open protocols and formats emerge. However, too many such initiatives exist. Instead, more co-ordination would be necessary.

C.04. Statements on financial issues

- S-04.1 Many telemedicine approaches failed due to the lack of a →win-win situation for all participants.
- S-04.2 Usually, significant investments are necessary in order to establish a →telemedicine service for →routine use.
- S-04.3 In most →scenarios that can be realized on basis of the existing legal and financial regulations, too few or too small incentives exist for most of the (potential) users.
- S-04.4 Costs often are not adequately distributed: parties with great benefits have little investments and costs, most of the costs would have to be covered by the parties with little benefits, the same situation often applies for reimbursement.
- S-04.5 Currently, applied systems often are too clumsy to really cope with efficient and cost-saving telemedicine use.
- S-04.6 The investments in information systems in social and health care will increase. This means that information systems will be more widespread and data exchange will get higher priority.

C.05. Statements on supporting client-oriented service chains in social and health care

- S-05.1 There is a need to plan and follow-up a patient's service chain across organizational boundaries using patient data stored in the organizations' →operational systems.
- S-05.2 Patients have to be identified with the same person number in different systems (life-long unique patient identifier; e.g. like in Finland the →national person identification number by Central Citizen Register).
- S-05.3 In many countries the preconditions of →client-oriented approach do not exist (e.g. legal and financial barriers, lack of →national patient identifier). For example, healthcare sectors often are sharply separated.
- S-05.4 The need for →client-centric approach and general platform are recognized and the work has started: the national organizations will take more active role in coordination; the usage of standards will increase.
- S-05.5 More →specialized systems will be developed instead of large →administrative systems. Therefore, the general →operational architecture and integration and the quality of the data and common understanding become necessary.
- S-05.6 'Publishing' the client data to →regional information systems, like e.g. a →regional EPR, for different kind of situations is the main effort during the next years to make the information from different information systems accessible for the professional.

C.06. Statements on approaches to health telematics platforms

- S-06.1 So far, no European country has a →national health telematics platform established for →routine operation.

C.07. Statements on levels of integration

- S-07.1 The future will bring pragmatically oriented integration similar to e-business with →desktop integration as the main form of integration.
- S-07.2 There will be →single sign-on functionality for the clients. For example by use of a (national) →HPC
- S-07.3 Integration moves from data exchange over →semantic interoperability and →functional interoperability towards →service-oriented interoperability.
- S-07.4 For →modelling with graphical vocabularies, →UML has been standardised as the dominant way to go.
- S-07.5 The domain model describes the →domain-specific constraints resulting from domain-specific requirements and representing the domain-specific knowledge for all the views mentioned. This concerns medical knowledge as well as legal basics, organisational relationships and the specific →workflow.

C.08. Statements on middleware

- S-08.1 →Middleware concepts have been specified covering all →interoperability levels.
- S-08.2 →CORBA specifies the most advanced, sophisticated and comprehensive →middleware approach.
- S-08.3 The quality of middleware is defined by the reflection of the →ISO RM-ODP views.
- S-08.4 Existing →middleware solutions still are quite limited.
- S-08.5 The →middleware approaches are under steady development.
- S-08.6 Approaches with different history and different maturity state like →CORBA, →HL7, →GEHR / →openEHR, →HARP move convergent.

C.09. Statements on standard formats for multimedia medical data

- S-09.1 The →DICOM standard is under permanent development, with new editions being published yearly. Development is driven both by vendors and medical professional user groups (ACR, ECR, ACC, ESC etc.)
- S-09.2 There is no alternative standard to →DICOM in the field of medical imaging that would have an even remotely similar importance and acceptance as →DICOM. In particular, the ISO committee for health care informatics has deliberately decided not to develop a competing standard for medical imaging.
- S-09.3 →DICOM has originally been developed for →PACS applications in radiology but today also covers fields such as cardiology, pathology, ophthalmology, dentistry, dermatology.
- S-09.4 In addition to medical imaging, →DICOM also covers the management of 1D signals (ECG, EEG, Ultrasound audio etc.) and structured information (reports, measurements, →CAD).
- S-09.5 The European pre-standard →MEDICOM is identical to the 1993 edition of the →DICOM standard, with the exception of the historical →ACR-NEMA interface which has not been included in the →CEN standard.

C.10. Statements on EHCR standards

- S-10.1** Commercial →EHCR systems available on the market do not or almost not regard any available open →EHCR models or (pre)standard. One of the reasons is that the available open standards are not mature enough for being applied on market solutions.
- S-10.2** The CEN TC251 →EHRcom taskforce is working on the refinement and practice-oriented modification of the European pre-standard ENV13606 to make it a European full-standard →EN13606 in 2004. It shall include also the models for how to integrate →multimedia medical data into the →EHCR.
- S-10.3** Aspects of the →EHCR comprise a) legal and ethical aspects, b) content aspects, c) functional aspects, d) architectural aspects, e) strategic aspects, and f) technological aspects.
- S-10.4** →Interoperability for shared care needs means a) to define information according to the shared care business models of the communication and co-operation partners involved, b) to harmonize syntax, semantics and exchange formats, c) to manage →interoperability-establishing information, d) to harmonize the modelling, e) to harmonize the infrastructure.
- S-10.5** System requirements for the (cross-organization →EHCR) are a) →openness, b) →scalability, c) →portability, d) distribution / access at Internet level, e) conformance to standards, f) →service-oriented interoperability, g) appropriate security and privacy services.
- S-10.6** Major problems are a) →EHCR one model approach against →EHCR multiple models approach, b) →EHCR message-based approach against →EHCR service-based approach.
- S-10.7** Important references are a) →ENV13606, b) →GEHR Australia / →openEHR, c) →G-CPR; d) →HARP; e) →HL7; f) →CORBA, g) →model summits.
- S-10.8** Security-related needs with respect to →EHCR comprise a) →PKI, b) →PMI, c) role- and rule-based access control, d) vocabulary, e) component repository, f) policy definition and management infrastructure, g) tool sets.

C.11. Statements on communication standards

- S-11.1** First HIS and POS vendors start to develop →SCIPHOX implementations in 2002.
- S-11.2** →PACS implementation requires a use of both →HL7 and →DICOM standard since none of the standards covers all fields of application needed for →PACS.
- S-11.3** The →IHE initiative examines how →HL7 and →DICOM can be combined to provide interoperable solutions for medical application scenarios. The →IHE Technical Framework specifies application-specific actors (devices) and transactions based on →HL7 and →DICOM services.
- S-11.4** Communication standards define a purely →syntactical interoperability, whereas →semantic interoperability is not covered, in general.
- S-11.5** The relationship between →CDA and →DICOM Structured Reporting is currently an open issue. A joint working group of →DICOM WG21 and →HL7 IMSIG is working in this field.
- S-11.6** →DICOM includes specifications for secure data transmission over insecure networks or storage media interchange.
- S-11.7** Modern →PACS systems nowadays provide features for Web-based distribution of medical images (without the need of a dedicated separate →communication server).

For these distribution purposes, usually the size and quality of the images is reduced and other →standard image formats than →DICOM are also utilized.

S-11.8 Several →VITAL implementations in C++ and Java are done and available as libraries.

S-11.9 Interfacing of →VITAL with →HL7 will be possible in the future; studies about this have already been finished.

C.12. Statements on terminology standards

S-12.1 Existing international →vocabularies with features (→domain completeness, etc.) and conditions (licence conditions, etc) are changing dynamically.

S-12.2 Different approaches of representing and standardizing terminology are useful for different tasks and must carefully be taken into consideration, e.g. →GALEN & →UMLS.

S-12.3 Communication and documentation standards will be more and more connected to terminology standards, e.g. →HL7 to →LOINC, →DICOM to →SNOMED.

S-12.4 Standardization bodies, especially →CEN/TC251, are working mainly on communication and documentation standards, but there is an increasing interest in the terminological topic.

C.13. Statements on card infrastructures, security and references

S-13.1 Most European countries do not have an identification of their citizens by means of an →electronic card infrastructure that is (at least technically) suitable for to server as a mean for →authentication in →social and health care.

S-13.2 There are different approaches to tackle the problem of →data security and →privacy across Europe. Maybe, a →"HIPAA Europe" should be created in order to harmonize the efforts.

S-13.3 There is a need for unique →identification of patients, documents, providers/organizations, payers, medical devices, applications, knowledge bases, etc at national and international level.

C.14. Statements on communication servers

S-14.1 During the next 2 years, there is no alternative to →communications servers.

S-14.2 Major problem with →communication servers is the semantic mapping between the different systems connected to the server.

S-14.3 A major advantage of →communications servers is their ability to distribute messages according to rules that can be customized to the need of the enterprise (e.g. broadcasting of patient data inside a hospital information system by the trigger event patient admission).

S-14.4 So far, there is no comprehensive HIS (comprising →ADT, →OER, internal communication and an →EPR including images, lab data, etc) available on the market. However, there is a trend in this direction, so that →communication servers will be of decreasing importance in the future.

S-14.5 Advantages of solutions with communication server are: a) only one interface per system needed; b) strict keeping of standards (→HL7, →EDIFACT, →DICOM) becomes easier; c) simple to define requirements for new system providers with respect to interfaces; d) no new interface design necessary in case of replacement of an old by a new subsystem.

S-14.6 As a central →information broker, a communication server has the following capabilities: a) it enables access to all flowing information; b) it allows an →MPI to be inte-

grated; c) it implies central management and control: the →IT unit exactly knows which connections are established and used in operative business, and it also can check the functional status (the system even can produce an alert in case that a connection breaks down).

- S-14.7** Disadvantages of solutions with →communication server are: a) synchronous communication (patient →QRY) becomes a little slower; b) very high availability necessary, because a breakdown terminates the workflow of the whole enterprise (e.g. by Hi Availability Clustering and 24 hours/7 days standby service).
- S-14.8** In the long run, →communication servers will disappear in favour of desktop integration via open standard interfaces to information systems on the basis of →HTTP / →XML services provided by the vendors of such systems (e.g. →SAP supports this form of integration, already today).
- S-14.9** Most →communication servers offer Web interfaces, but nevertheless the trend goes towards solutions without such problematic servers.
- S-14.10** The concept of →clearing databases (known from e-business solutions) can be used in health care for cross-referencing between system-internal →patient identifiers and →case identifiers from →HIS, →POS, →LIS, etc. National or international →patient identifiers can easily be integrated as soon as they are available.

D. Recommendations

D.01. Recommendations on political and legal issues

- R-01.1** Pol, Adm: Make the necessary laws and regulations and then organize the creation of a nationally / internationally unique patient identifier!
- R-01.2** Pol: Implement policy bridging on national level and harmonize these efforts on international level.
- R-01.3** Pol: Politicians of a country, state, region: Decide the level of trust that is politically wanted in the health care system.
- R-01.4** Pol: Launch a 'HIPAA Europe' and adopt the ISO 17799 security management standard to European health care.
- R-01.5** PM: Always be aware of political reasons for certain obstacles you don't understand when making health telematics projects.
- R-01.6** PS: There should guidelines be created for health telematics projects (e.g. for how to handle the patient identification problem, the problem of a missing health care telematics platform or the problem of reimbursement for telemedicine added values).
- R-01.7** PM: Identify and resolve legal issues as early as possible and do it safe and sound from the ground up.
- R-01.8** PM: Integrate data security, access control, and proof of use into your concepts right from the beginning.
- R-01.9** PM: Take into account that the political and medico-legal situation concerning telemedicine use might change significantly and in an unforeseen manner during your project or product realisation phase (export restrictions, data security acts, etc).
- R-01.10** PM, Adm: A routine health service application must log data for statistical purposes in order to have a sound basis for evaluation.

D.02. Recommendations on organizational issues and processes

- R-02.1** PM: Obey the rules "think big, act small" and "think globally, act locally"!
- R-02.2** PM: Pay attention to the fact that with applications of telematics in health care one usually does not develop production processes, but service processes.
- R-02.3** PM: Point out very clearly: What is the core process of the enterprise? What is the bottle neck there?
- R-02.4** PM: Analyse the structure of the communication, i.e. clearly identify all communication partners and describe every type of message.
- R-02.5** PM: Except in the case of emergency, prefer asynchronous over synchronous communication, in order not unnecessarily to interrupt the workflow of the communication partners. Provide synchronous communication as a fallback, if reasonable.
- R-02.6** PM, SP, Adm: For emergency and other urgent cases, establish synchronous helpdesk services for certain specialties (e.g. radiology, dermatology, pathology) with a guaranteed QoS (reaction time, qualification of the board of experts, etc) and a standardized data exchange with the (regional / national / international) EPR.
- R-02.7** PM, SP, Adm: Establish comprehensive asynchronous consultation services with a guaranteed QoS for a broad variety of social and medical specialties and a standardized data exchange with the (regional / national / international) EPR.

- R-02.8** PM: Incorporate users from the very beginning of the development. Start with few users and generalize the scenario to gain models. Use these very first users as “show case users” for to have a strong “selling argument”.
- R-02.9** SP, PM: Provide regular news, information and feedback to the users.
- R-02.10** SP, PM: If You have a project intended to come into routine use, always create seamless services for customers / users, i.e. make business plan, make implementation plan, support concept for new operational models, make sure that You have the budget for to finance the service.

D.03. Special recommendations on project management

- R-03.1** PM: Make a concrete and efficient work plan for the project: operational goals with numbers; the owners of the project, resources, decision making; small working groups with active discussion and information exchange.
- R-03.2** PM: Carefully search for related work that has been done already before your project and use the results where possible and reasonable.
- R-03.3** PM: Organize Your health telematics projects more efficiently and increase the investments in development, implementation and usage of information systems.
- R-03.4** PM: Do not re-invent the wheel, or: Build solutions from existing components whenever possible.
- R-03.5** PM: Conduct a broader research of telemedicine efforts. Someone may have addressed a different problem of a similar kind, so that you can profit from a solution for a different problem. For example, solutions for e-banking or e-business might be adapted to healthcare.

D.04. Recommendations on technological aspects

- R-04.1** PM: Design solutions purpose-driven, not technique-driven. Ask: “What is the purpose of the design of an application / of a service?”
- R-04.2** PM: Be aware of the whole landscape of state-of-the art approaches, standards and tools, even if You follow a very restricted approach in a project.
- R-04.3** PM, SP: Do not rely on one single technology (hardware components, networking technologies like terrestrial or satellite communication, operating systems, applications, server technologies, etc). The better the telemedicine software product, the more independent from base technology it is.
- R-04.4** PM: If You develop a health telematics application, always follow a modular design approach.
- R-04.5** PM: In a project, the decision for the use of standards should be made as soon as possible. Plan the use of standardised data formats and communication protocols once they become available.
- R-04.6** PM: Build your special developments upon established technologies like TCP/IP, CORBA, SQL Database Engines, XML, PKI, Java, etc.
- R-04.7** SP, PM: Always establish a fallback mechanism in case of unexpected functional problems (hardware and software). Even provide a set of escalation steps for technical and service failures, in order to achieve the level of quality that is needed in healthcare.

D.05. Recommendations on financial and organisational aspects

- R-05.1** Pol, Adm: Invest at least 6-10% of the health care budgets into IT (instead of about 2% invested nowadays)!

- R-05.2** PM, PS, SP: Every health telematics project should make a business plan before starting its work. Have a base set of criteria respective criteria (valid evaluation plan, reasonable business model, escalation plan in case of failures, use of standards, scalability, relevance for the users and the stakeholders in the healthcare system, etc).
- R-05.3** PM, PS, SP: Work out a plan to integrate financing of the service into regular reimbursement models, if possible for medical and technical/organisational parts of the service; base and modify this integration on already existing reimbursement schemes, if applicable.
- R-05.4** PM, SP: Make a detailed marketing plan for the project and business service in order to win users, convince professional associations, politics, and public.
- R-05.5** PM, SP: Try not to re-invent the wheel: Use common products if they are reasonable and can be integrated.
- R-05.6** PM, SP: Allow for use/reuse of existing assets/investments at the user sites, if possible.
- R-05.7** PM, SP: Open (at least) protocols and data formats, i.e. license these parts without fees.
- R-05.8** PM, SP: Design a reasonable licensing scheme if you develop software to be sold commercially.
- R-05.9** PM, SP: Identify and communicate benefits for all participating parties: there should be an added value for each party. The added value should exceed the (additional) effort for each party.
- R-05.10** PM: Take established workflows into account, you might have to consider groups of professionals you originally did not intend to address, e.g. nursing, administration, or office staff.

D.06. Recommendations on aspects of integration

- R-06.1** PM, PS: Take integration into account from the very beginning of your project.
- R-06.2** PM: Develop a common open interface which can be used for different operational systems and regional information systems.
- R-06.3** PM, Adm: Do not buy any systems that do not have open standard interfaces for integration. Take care especially of an interface to patient identification.
- R-06.4** PM: Do not make copies of patient data into other systems but create references to patient data and store the references into a regional reference database. Use references to get an overall view of a patient's situation and to follow-up the patient's service chain.
- R-06.5** PM: Retrieve referenced content in HL7 CDA XML format and format it for display using XSLT transformation.
- R-06.6** PM: If You develop a telematics application with multimedia, provide integration (at least limited import/export) via standard media formats (e.g. jpeg, tiff, mpeg, wav). This may eventually be the least common denominator for exchange with legacy systems.
- R-06.7** PM: Point out clearly for any activity or requirement: What is the driving force? This especially holds for the integration requirement.
- R-06.8** PM: The purpose should drive the integration, because different purposes and users imply different use cases: process-driven (e.g order entry and reporting, OER), management-driven (statistics-relevant data sent from every participating to data warehouse), user-driven (desktop integration), patient-driven (RISF)
- R-06.9** PM, SP, Adm: If you buy a new system, assure that there is desktop integration, i.e. one interface to different application (single sign-on).

- R-06.10** PM, SP, Adm: Design a training program for the users, do not only plan to have one initial training session at a site.

D.07. Recommendations on supporting client-oriented service chains in social and health care

- R-07.1** PM: Start the work by analyzing the existing service processes: How can the processes be optimized? In what situations is it useful to use ICT?
- R-07.2** PM: Make the plans for the new services, for the business models, for the data security. Thereby, take into account the preconditions and limitations: politics, legislation, regional circumstances, etc.
- R-07.3** PM: Make the plans for the solutions needed as a part of the operational architecture and make the list of the operational demands for the products and integration.
- R-07.4** PM: Use general products with open interfaces already available on the market.
- R-07.5** PM: Make the plan for the implementation and routine use. Analyze the risks and make plans how to avoid them.
- R-07.6** PM: Make clear contracts with companies and use lawyers in complicated cases: What are the responsibilities of the company? What are the results?
- R-07.7** PM: Estimate the costs (development, implementation, routine use) and benefits (for the client, organizations, municipalities) for a period of 3-5 years!
- R-07.8** PM: Analyze the results of the project against the plan.
- R-07.9** PM: Provide an infrastructure investment plan for the clients. Ideally provide a program for this purpose.

D.08. Recommendations on national / international health telematics platform

- R-08.1** Pol, Adm, SP, PM: Develop a national standard for a patient's service chain identifier (like a passenger record locator in the airline industry to link all services included in one trip like flight, car, hotel etc.) so that all systems can use the same service chain identifier.
- R-08.2** Pol, Adm, SP, PM: Develop a uniform mechanism to measure the costs and results associated in a patient's service chain. The data should be put into a regional data warehouse for analysing all the different service needs and their results.
- R-08.3** Pol, Adm, SP, PM: Develop an e-business infrastructure within health care and social care for ordering and delivering services.
- R-08.4** Pol, Adm, SP, PM: Develop a national standard for content within different patient documents, structures and vocabularies.

D.09. Recommendations on levels of integration & middleware

- R-09.1** PM: Realize access to data from a PACS system by means of Web-technology via URLs.

D.10. Recommendations on standards for multimedia medical data

- R-10.1** SB: Harmonize and streamline existing standards for a more convenient implementation by projects and industry.
- R-10.2** PM, Adm: There is no alternative to using DICOM for multimedia medical data. Do not purchase imaging devices without DICOM interface.

- R-10.3** PM: It is not sufficient to demand "DICOM conformance" of a device. Either compare conformance statements of individual components or follow the general recommendations from IHE or professional organisations such as the DFG (Deutsche Forschungsgemeinschaft) regarding required DICOM services.
- R-10.4** PM: For medical device communication, especially in real-time, VITAL fits best: Almost every medical device can be built up by VITAL because of its object oriented design; the plug-and-play capability of VITAL minimizes administration.

D.11. Recommendations on EHCR standards

- R-11.1** SB: Fuse the existing approaches (ENV13606, GEHR, etc) to one mature and straightforward to use open standard for projects and the health care market.
- R-11.2** Ind: Build future-proof EHR architectures, modelled as a multi-model approach at the meta-model level. The future-proof secure EHR system is a virtual, at runtime self-organising architecture consisting of certified components which exchange digitally signed and attributed XML messages. For this purpose, reference models, constraint models, terminology, and methodology have to be standardised.

D.12. Recommendations on communication standards

- R-12.1** SB: Make the message-oriented standards (HL7/CDA, EDIFACT, etc) and the media-oriented standards (DICOM, VITAL, etc) converge (or at least seamlessly fit together) in order to achieve the comprehensively standardized representation and communication of all information needed in health care.
- R-12.2** PM, SP: As a routine health service application You should be able to provide a CDA Level 1 header for information that might be exchanged with another health care service provider.
- R-12.3** PM, SP: As a routine health service application You should be able to provide content in CDA format for information that might be exchanged with another health care service provider.
- R-12.4** PM: Try to utilize the 100% CDA compatible SCIPHOX document definitions, as far as available, in order to perform data exchange across the inpatient/outpatient border and on a regional, national or international level.
- R-12.5** SP, PM: Develop a mechanism for viewing mixed XML and binary data object content within CDA documents.
- R-12.6** Adm, PM: Consider the IHE specifications and recommendations when implementing or purchasing HL7/DICOM equipment.
- R-12.7** Adm, PM: Secure communication requires a Public Key Infrastructure (PKI) and security policies to be established. Do not take this for granted.

D.13. Recommendations on terminology standards

- R-13.1** PM: Regard national regulations with respect to coding systems for diagnoses and procedures (e.g. German SGB V with respect to ICD10).

D.14. Recommendations on card infrastructures, security and references

- R-14.1** SB: Create a world wide standard for the identification of organisations in social and health care (hospitals, practices, laboratories, assurances, etc) based on the OID ISO standard.
- R-14.2** Pol: Make a European decision that citizen will have the ownership of his/her EHR.

- R-14.3** SB, PM: Make definitions for a Europe-wide secure health care platform, based on a PKI.
- R-14.4** Pol: Design and pass national and Europe-wide security policy bridging rules.
- R-14.5** Pol: Establish a national cross certification authority.
- R-14.6** Pol: Define the level on which all health information systems have to be certified with respect to data security, and regulate the way how this has to be done.
- R-14.7** Pol: Make the decisions necessary for a Europe-wide identification of health professionals and entities.
- R-14.8** Pol: Incorporate interoperability as one of the mandatory requirements for the HPC.
- R-14.9** Pol, SP: Install PKI services for e-signatures and notary archives.
- R-14.10** Pol, SP, PM: Foster the Europe-wide acceptance of ISO OID codes.
- R-14.11** Adm, SP, PM: Make Your systems capable to create links/references to find the distributed patient information (ISO TC215 WG5).
- R-14.12** Pol, Adm, SP, PM: Establish a unique health care identity for citizens.
- R-14.13** Pol, Adm, SP, PM: Support the health care adaptation of ISO 17799 security management standard.
- R-14.14** Pol, PM: Create a European HIPAA definition.
- R-14.15** Pol, Adm, SP, PM: Create common rules for remote access to EHR over organisations and borderlines.
- R-14.16** SB, Pol, PM: Create and apply a European standard for EHCR communication messages.
- R-14.17** Pol, SB: Work on harmonisation of terminology and classifications at European level.
- R-14.18** Pol, Adm, PM: Define and make mandatory a minimum interoperable European health data set as a part of any EPR/EHR all over Europe.

D.15. Recommendations on communication servers

- R-15.1** PM: For telemedicine projects with hospitals involved: If the hospitals have communication servers in operation, then try to connect your application to this server for exchange of all those data that is relevant for the telemedicine service and can be provided through the communication server. This connection can be technically simple (e.g. by means of files containing HL7 messages).

E. References

This small list of references has to be considered as a starting point. During the iterative process of updating the whole document (especially in connection with the completion of the glossary) it shall be completed, step by step. The strategy is to use most accepted and normative references in order to discuss on a sound terminological basis.

- [centc251] CEN, European Standardization Organisation, Technical Committee 251 Medical Informatics www.centc251.org
- [centc251g] CEN TC251 Glossary www.centc251.org/GInfo/glossary
- [env13606] European prestandard on Electronic healthcare record communication, CEN, 2000
- [who98] WHO: A Health Telematics Policy. Report of the WHO Group Consultation on Health Telematics, 11-16 Dec, Geneva, 1997. WHO 1998

F. Appendix

Table 1: Comparing capabilities of EHCR-related standards

	ENV 13606	G- CPR	HL7/ CDA	GEHR/ openEHR	CORBA3	HARP
Business view supported	x	x	x	x	(x)	x
Information view supported	x	x	x	x	(x)	x
Computational view supported						
Engineering view supported					(x)	x
Technology view supported			(x)		(x)	x
Reference model defined	x	x	x	x		x
Health domain models defined	x	x	x	x		x
Terminology defined	x		x	x		x
Methodology defined		x	x		x	x
Specification tools available			x			x
Implementation tools available						x