Abnormal Electrical Activity (Chapter II) is understood as unusual representation of particular elements of the heart cycle in time or amplitude. Such variations of electrical parameters are caused by too fast/slow or irregular rhythms and abnormal generation or conduction of the cardiac electrical impulses.

Adaptation Delay (Chapter IX) is defined as the time period from the patient status-domain transient occurrence to the moment when the diagnostic outcome altered by the interpreting software modification starts falling into a given tolerance margin $\varepsilon$ around its final value.

Agile Software (Chapter V) is a sequence of calculation procedures having a possibility of limited changes in architecture and properties while in use. Agile software is controlled by itself (auto-adaptive) or by an external management procedure. In the case of the proposed system, the remote interpretation process is implemented as agile software and the central management process is implemented as rigid software.

Ambulatory Event Recorders (Chapter III) are portable devices smaller than Holter recorders, providing continuous buffered storage in digital memory of a specified period of the ECG. When the event button is pressed, not only electrocardiographic events from that point on are recorded, but also a period of the preceding ECG.
Ambulatory Recorders (continuous) (Chapter III) are portable devices providing between 6 and 72 hours of continuous ECG recording in 3 to 12 simultaneous channels. The raw signal is stored in digital solid state memory cards. The recorder does not contain interpretation software, and optional screening is used for signal control or messaging. Holter recordings are automatically analyzed in a workstation after the transfer of the collected data from storage media to a hard disk.

Arrhythmias (Chapter II) are specific patterns of abnormal heartbeat sequence. If ventricular beats are present, the arrhythmia is ventricular, otherwise it is supraventricular. The detection of an arrhythmia is essential to the assessment of stimulus generation and conductivity, while the frequency of an arrhythmia occurrence is the factor of conduction disease severity.

Aspects of Software Adaptation (Chapter IX) provide a qualitative description of the changes and the choice of procedures selected for modification in order to achieve overall improvement in the diagnostic quality of a given patient’s status.

Asymptotic Accuracy (Chapter IX) is the absolute value of diagnostic error when the transient-evoked software adaptation is completed. Assuming no other transient is present in the subsequent signal, it may be expressed as a limit of the difference between the received value and the reference.

Atrioventricular (AV) Node (Chapter II) is a highly specialized cluster of neuromuscular cells at the lower portion of the right atrium leading to the interventricular septum; the AV node delays sinoatrial (SA) node-generated electrical impulses momentarily (allowing the atria to contract first) and then conducts the depolarization wave to the bundle of HIS and its bundle branches.

Attention Density (Chapter VI) represents the time the eye-globe spends over a time unit in the ECG plot (recorded typically at 25mm/s) and thus is expressed in seconds per second ([s/s]). It should be noted that although scan-path and ECG time are both temporal variables given in seconds, the eyesight and ECG record are not simultaneous processes.

Autonomic Nervous System (Chapter II) is the functional division of the nervous system that innervates most glands, the heart, and smooth muscle tissue in order to maintain the internal environment of the body.

Autonomy Time (Chapter IX) is the time of device operation without the necessity of battery replacement or use of external power sources. Because power source capacity in relation to physical volume ratio is limited by technology, autonomous operation time is a compromise between the size and the current drain. Therefore, a good design of electronic circuitry should be power-saving oriented and include intelligent methods of power dissipation reduction.
**Auxiliary Information** (Chapter XI) is the data about the device status that variability is very low (e.g., battery status). Therefore it makes no difference which data packet they are appended to, and such information may fill the spare bytes in data packet.

**Baseline Estimation** (Chapter II) stems from the fact that physiologic zero voltage does not coincide with the electrical zero of the digitized ECG since the baseline may wander. In many studies found in the literature, the isoelectric level is estimated from the voltage level of a single point, the fiducial point, identified in the PR segment. One way to obtain better estimates of the baseline is to interpolate between consecutive fiducial points.

**Bedside ECG Recorders with Interpretation** (Chapter III) are stand-alone devices with a embedded specialized computer, printer, presentation screen, and digital data link. The design of the software complies with the unique task of the interpretation of the acquired ECG. The device usually provides options for digital storage, transmission, and printing of the signal and calculated diagnostic parameters.

**Cardiac Ejection Fraction** (Chapter III) is the ratio of stroke volume (SV) measured as volume of blood expelled from the heart during each systolic interval and the end-diastolic-volume (EDV). Its nominal values range from 0.5 to 0.75; lower values are symptoms of disease.

**Cardiac Functional Reporting** (Chapter IV) is a multimodal record containing voltage time series, static images, motion images, displacement time, and magnetic fields measurement time series.

**Cardiac Muscle** (Chapter II) is the involuntary muscle possessing much of the anatomic attributes of skeletal voluntary muscle and some of the physiologic attributes of involuntary smooth muscle tissue. The SA node-induced contraction of its interconnected network of fibers allows the heart to expel blood during systole.

**Cardiologists’ Preferences** (Chapter X) about the contents of the final diagnostic report in the context of the described disease were based on an investigation of the priority rules in the set parameters. The hidden poll method enabled the software to observe and record doctors’ behavior of including or excluding a randomly pre-selected parameter from the final content of the report.

**Cardiovascular System** (Chapter III) fulfills the task of a general transportation network. It is purposely organized to make available thousands of miles of access pathways for the transport to and from a different neighborhood of any given cell and any material needed to sustain life. The cardiovascular system consists of blood vessels, the heart, the blood, and the control system.
Central Intelligence (Chapter IX) assumes that the ECG interpretation model assumes that the interpretation is performed by a central server connected to each remote recorder via communication channel. The remote device continuously reports raw signals, so it needs uninterrupted carrier availability, which makes the transmission cost very high.

Circular Memory Buffer (Chapter IX) is a signal buffer rewritten according to the pointer scanning perpetually all allocated memory. When new data arrives, the oldest value is first removed from the buffer and the new data is written in its place. This technique preserves the most recent signal strip for the calculation, and in the case of a multiple software update, the original signal is still available for calculation of the diagnostic results whose quality is being optimized.

Client Identification (Chapter VIII) procedures and access control serve as substantial tools for the service usage statistics. In the case of a payable subscription, access control may be considered as a first approach to the service’s financial support.

Clinical Document Architecture (CDA) (Chapter IV) is an HL7 standard for the creation of clinical documents using XML (eXtensible Mark-up Language). XML uses non-printable characters within text documents to allow the computer system to process the text. The use of the bracket structure as <instruction> is the method of embedding instructions in the text.

Cognitive Process (Chapter V) is a sequence of logical reasoning and intuitive interpretation of perceived facts. The reasoning is usually alternated with the pursuit for additional data. The cognitive process cannot be objectively described by the subject itself, because the processes of tracking and verbalization are also cognitive processes concurrent with and influencing the process under investigation.

Commercial Tele-Diagnostic (Chapter IX) services in the United States and Europe offer the continuous monitoring of cardiac-risk patients. Such services typically use closed wireless networks of star topology. The interpretive intelligence aimed at the derivation of diagnostic features from recorded time series is implemented in the recorder or in the supervising server.

Communication Protocol (Chapter III) is a definition of data exchange rules between computers. Protocols are often subject to worldwide standards and must be implemented in a corresponding communication hardware.

Communication Standard is a collection of specific layers and implementations of corresponding protocols.
Compression Efficiency (Chapter VI) is measured as data volume ratio of the original signal and the compressed code. The denominator of this ratio should include all data necessary for a correct reconstruction of the original signal (look-up tables, etc.).

Computational Power (Chapter IX) is the measure of the microprocessor ability to perform computational (arythmetic, logic, etc.) operation in a given time unit. The computational power is usually expressed in number of instructions per second (Mips) or in number of floating point operations per second (Mflops) in the case of processors providing support for floating point arithmetics.

Control of Cardiovascular Function (Chapter III) is accomplished by two mechanisms: (1) inherent physicochemical attributes of the tissues and organs themselves (intrinsic control), and (2) attributes of the effects on cardiovascular tissues of other organ systems in the body—mainly the autonomic nervous system and the endocrine system (extrinsic control).

Controlling the Distortion (Chapter VI) is the approach to the lossy compression of the ECG that assumes the temporal variability of compression parameters allowing higher distortion in a medically less relevant part of a signal while preserving the most relevant sections undistorted.

Convergence (Chapter IX) represents the correctness of decisions made by the management procedure about the interpretation processing chain. If the software modification decisions are correct and the resulting outcome approaches the true value, the modification request signal is removed, thus decreasing error. Incorrect decisions lead to the growth of diagnostic outcome error and imply a stronger request for modification.

CSE Recommendations (Chapter II) on the precision of ECG waves delimitation may be found in the documents of the Common Standards for Quantitative Electrocardiography, a European organization that performed a 10-year worldwide project on the quality and repeatability of P, QRS, and T waves determination in the ECG by both cardiologists and computer software.

Custom Reporting Protocol (Chapter XI) is a proprietary open description of rules designed for non-uniform reporting between remote recorder and central server. This idea does not infringe on the interoperability issues, because the standard is flexible and designed for point-to-point communication between the elements of the network. The use of an existing standard of medical data interchange is restricted to regular reporting systems.
Data Bus (Chapter VII) is an inter-procedure information channel. Data busses are sorted by the value of expected throughput and by their priority level, meaning the degree of signal processing advancement. Each data flow was assigned a throughput level combining statistical parameters of the data: average datastream, frequency of usage, and probability of usage.

Datastream Reduction (Chapter VII) is a ratio of input datastream volume and output datastream volume estimated for each procedure. Most procedures have a significant data reduction ratio, therefore they are fed with a significant datastream and yield only sparse data. Putting the most reduction-effective procedures at the front of the processing chain reduces internal dataflow and resource requirements.

Decision Support Packages (Chapter IV) are elements of modern HIS implementations. They usually incorporate medical knowledge as rule sets to assist the care provider in the management of patients. A knowledge base system consists of a knowledge base and an inference engine. The knowledge base will contain the rules, frames, and statistics that are used by the inference applications to substantiate a decision.

Dependency Tree (Chapter IX) describes the dependency relation of each procedure and any other procedure in a form of aggregate variable (structure) built and updated each time the software is modified. The tree is specific for each procedure and may be generated automatically with the use of scanning the external calls in the source code. In the prototype system, the tree was fixed for each subroutine and written in the code description area.

Determination of Electrical Axes for Waves (Chapter II) is a process in which the electrical axis of a QRS vector helps estimate the correctness of stimulus conduction. If the conduction is affected by local necrosis of a heart wall tissue or by a bundle branch block, the heart axis has a permanently altered position, referred to as a right or left axis deviation.

Deterministic Sequential Machine (Chapter XI) is an automaton whose outputs being a partial description of its internal state are dependent uniquely of the inputs and the previous state. They assume that each change of the input could potentially influence the machine status and the output values.

Development in Computerized Cardiology (Chapter III) is currently made in three parallel and mutually dependent areas: medical methodology of the examination, recording electronic technology, and signal and data management and processing.

Diagnostic Data (Chapter VIII) are all the numerical values and string constants describing the final findings about patient status. Their form usually conform to
human habits and standardization rules. Diagnostic data have the most concise form. The final decision is usually a binary choice.

**Diagnostic Goal** (Chapter V) is a set of diagnostic parameters confirming or contradicting a diagnostic hypothesis. The prevalence of diagnoses are hypothesis driven, and the particular information is expected to be provided by the diagnostic process.

**Diastolic Phase** (Chapter III) of the heart cycle is that the muscle is relaxed, the inlet valves of the two ventricles are open, and the outlet valves are closed. The heart ultimately expands to its end-diastolic-volume (EDV), which is on the order of 140 ml of blood for the left ventricle.

**DICOM Services** (Chapter IV) are embedded into a standard and involve transmission of data over a network; the file format is a later and relatively minor addition to the standard. Examples of DICOM services are: store, storage commitment, query/retrieve, modality worklist, modality performed procedure step, printing, and off-line media.

**Digital Imaging and Communications in Medicine (DICOM)** (Chapter IV) is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes the definition of file format as well as the network communications protocol based on the TCP/IP standard. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format, also extensible to ECG signals.

**Disease-Domain Sensitivity** (Chapter XI) of an emergency detector is the ability to reliably detect patient status deterioration in a wide range of diagnostic states. In a perfect case the detector should provide an emergency alert with equal sensitivity and specificity for any signal change, representing patient status deterioration.

**Distributed Computing Design** (Chapter X) assumes a process is initiated by one system and during the execution transferred to other system. The task sharing in the proposed network is always asymmetrical, therefore transfer of the process back to the remote recorder is inhibited.

**Drug Dispenser** (Chapter V) is a personal-use electronic device dispensing pharmaceuticals according to the prescription written as a program or controlled remotely. The use of drug dispensers is particularly beneficial in the case of elderly patients and provides better reliability than self-service by the patient.

**Dynamically linked Libraries** (Chapter V) are libraries of executable code that may be added (linked), removed, or commuted during the run of a calling procedure. Thanks to the uniform interface between the static and dynamic pro-
cedures, the commutation is as simple as redirection of the software area in the program memory.

**ECG Interpretation Process** (Chapter V) is a sequence of conditional computation steps aimed at deriving the quantitative diagnostic information from the digital signal representation. The composition of the interpretation process is dependent on the diagnostic goal. At several stages the interpretation process branches into data-dependent processing paths.

**Electrocardiogram** (Chapter II) is the paper or digital record of cardiac electrical activity. The ECG is recorded as a temporal representation of an electrical field resulting from the electrical activity of the heart muscle tissue at the cell level.

**Electromagnetic Compatibility** (EMC) (Chapter IX) describes the PED’s ability to reduce the harm of other adjacent devices’ functions and to be immune from environmental interference. Medical electronic devices should comply with the requirements of EMC since they may work in any unpredictable configuration; they should also guarantee the reliability of functionality and issued data.

**Embedded Analysis** (Chapter VIII) is the software providing the automated ECG interpretation programmed into a stand-alone ECG recorder by the manufacturer. The embedded analysis is usually tailored for an average client and consists of standard diagnostic procedures. The upgrade of embedded analysis is possible as a service procedure provided by the manufacturer or its representative.

**Emergency Detector** (Chapter XI) is a software procedure aimed at detection of patient status deterioration of any kind. The emergency detector must be computationally as simple as possible and provide a reliable trigger for a wide range of diagnostic states interpreted as patient status deterioration requiring detailed analysis.

**Error Propagation** (Chapter VII) is observed in any processing chain when subsequent procedures are using results of previous procedures as input data. These results are of limited reliability due to input signal uncertainty and the limited quality of computation algorithms. The value of expected error at the end of the processing chain cumulates the component errors along the processing chain.

**Exercise Stress Test** (Chapter II) is a 12-lead ECG + blood pressure rest phase (5 minutes) exercise protocol defining the applied workload during the stress phase recovery phase (up to 15 minutes).

**Extended Connectivity** (Chapter VIII) is the procedure enabling the cooperation of a stand-alone electrocardiograph with multiple method-specialized remote interpretation services, including data querying, process requests, and data exchange.
at various processing levels. Most current devices already have a basic network connectivity used only for electronic patient records.

**Eyetracker** (Chapter VI) or an eyetracking device is electronic equipment used to pursue and capture a sequence of eye globe positions. Eyetrackers use various physical principles: infrared light reflexes, electrical signal induced by the eye globe dipole, or video recording of the eye image.

**FDA-Approved Device** (Chapter II) is any medical device approved by U.S. Food and Drug Administration before being marketed. The FDA provides an Investigational Device Exemption (IDE) to allow interstate distribution of unapproved devices in order to conduct clinical research on human subjects.

**Flags Area** (Chapter IX) is the separate structure of binary variables representing the status of the interpretive library usage. The main flag is the “currently used” flag that reports the procedure is being used and stored in the system stack area. This inhibits the release or commutation of such procedure until the stack data are released and the program execution is returned from the procedure.

**Flash Memory** (Chapter V) is an electrically erasable and programmable memory providing fast access and high reprogrammation durability. Flash memory is constant memory in the sense that it does not have to be powered or refreshed to maintain the information. The flash memory is available as integrated circuits and also in a mobile standards like CompactFlash or Secure Digital Cards.

**Functional-Growth Architecture** (Chapter VII) is the most common diagram of internal procedures connection and dependencies within the ECG interpretation software originating from their version histories or the upgradeable modules concept. The advantage of such an approach is the usage of previously engineered modules, but the drawback lies in not considering the optimal dataflow and error propagation.

**Half-Band Components** (Chapter VI) are the output of an elementary step of binary tree-based signal decomposition. The components are the step-down signal approximation and the detail signal. Both have half the sample count and half the bandwidth of the original signal.

**Heartbeat Clustering** (Chapter II) is a single- or multipass procedure aimed at revealing the number and contribution of extra-sinus stimulators. The clusters are assumed to contain physiologically similar but not electrically identical heartbeats. The interest of the procedure consists of representation of the group of beats by a reference pattern on which the most time-consuming processing is done.
Heartbeat Detection Algorithm (Chapter II) is the mathematical method aimed at extraction of the heartbeats from the recorded ECG. Various techniques used to implement a QRS detector include: linear digital filters, nonlinear transformations, decision processes, and template matching.

Heart Rate Variability (Chapter II) is an RR-interval-based method of assessing physiologic and pathophysiologic mechanisms governing heart rate, and its oscillations are not only complex but also substantially irregular in their periodicity. The methods are divided into time domain and frequency domain. The time-domain methods are divided into statistical and graphical; the frequency-domain methods are divided into spectral (using FFT) and autoregressive (using ARMA models).

Heuristic Subroutine (Chapter VII) is a procedure engineered with regard to its output for input elements from the learning set of a known true value. Despite the application of very thorough testing procedures, no software engineer is able to foresee all possible signal recording conditions combined with all possible heart diseases. Heuristic procedures in the ECG interpretation chain show a non-zero probability of inappropriate processing and incorrect outcome.

High Variability (Chapter X) ECG parameters are diagnostic data showing the variability of order of the heart rate. Each parameter varying in a beat-to-beat interval belongs to this category. The exact limits of frequency range are hard to define since the physiological heart rate varies from 40 up to 210 beats per minute.

HL7 (Chapter IV), first created in 1987, is a protocol to create that common communication platform for healthcare computer systems that allows healthcare applications to share clinical data with each another. Its name refers to the application level of the OSI Basic Reference Model, since the protocol contains the definition of the data to be exchanged, the interchange timing, and the error messaging to the application.

Holter Monitoring (Chapter II) is an ambulatory 3- or 12-lead ECG using a portable recorder; typically 24-hour records are obtained, covering all sorts of daily routine activities including sleeping, waking up, and moderate exercise such as walking.

Hospital Information System (HIS) (Chapter VI) integrates patients and hospital information needs. Such systems must be able to provide global and departmental information on the state of the hospital. Current HISs support financial, administrative, and clinical data in order to provide specialized and task-oriented optimization tools, as well as materials for research in medical sciences.

Human Heart (Chapter III) is a muscular organ occupying a small region between the third and sixth ribs in the central portion of the thoracic cavity of the
body. It is a unique organ propulsing the blood in the vascular system thanks to perpetual contraction. The heart is divided by a strong muscular wall—the interatrial-interventricular septum—into the right and left sides, each being a self-contained two-stage pumping device.

**Human Relations** (Chapter VIII) between cardiologists are all the applications of personal knowledge and interpersonal information exchange inspired by and resulting from the ECG interpretation process. Such relations may concern two humans of different skills or a team of coworkers (a consilium) aimed at collective interpretation of signal exchange or knowledge and education.

**Hypothesis-Driven ECG Interpretation** (Chapter XI) is usually performed by human experts and limits the diagnostic set to the most relevant results. A very general data analysis is a background for a hypothesis of the disease, and further diagnostic steps aim at confirming or denying this hypothesis.

**Instantaneous Bandwidth Function** (Chapter VI) is a time function describing local variability of the source in terms of expected bandwidth requirements for transmitting the signal undistorted. In the uniformly sampled ECG, the components using full bandwidth provided by the Shannon rule of sampling are relatively rare and the instantaneous bandwidth is significantly lower for the majority of signal.

**International Organization for Standardization** (ISO) (Chapter IV) is a worldwide federation of national standards organizations. It has 90 member countries. The purpose of ISO is to promote the development of standardization and related activities in the world. ANSI was one of the founding members of ISO and represents the United States.

**International Standard IEC 60601-2-51** (Chapter II) specifies the testing range and conditions, as well as requirements for results provided by the automatic analysis embedded in the electrocardiographs or released as independent software packages. Requirements for amplitude measurements and for interval measurements are specified on analytical and biological signals. For the latter, the CSE database is indicated as a source of test signal.

**Internet Reference Model** (Chapter III) is a layered abstract description for communications and computer network protocol design. The five layers of TCP/IP are: the application layer (topmost), the transport layer, the network layer, the data link layer, and the physical layer.

**Interoperability** (Chapter IV) is the term describing the ability of a medical device to cooperate in a technical environment built of components from different manufacturers. Interoperability between medical devices and between host systems is a key requirement for the establishment of the electronic patient health record.
Interpretation Task Sharing (Chapter IX) is the set of software management rules describing the optimum assignment of the ECG interpretation tasks between two elements of the distributed system: the remote recorder which acquires the signal and starts the interpretation, and the central server which is responsible for issuing the diagnostic result.

Interpretation Trigger (Chapter XI) is an asynchronous event initiating the ECG interpretation process. The proposed system assumes two such events: patient status deterioration and expiry of validity period for diagnostic data.

Irregular Reporting (Chapter X) is the remote recorder operating mode characterized by irregular time intervals between consecutive reports. Irregular reporting may be a consequence of adaptive processing or may be programmed independently.

Knowledge Base Similarity Check (Chapter IX) is the method of automatic assessment of result reliability which uses diagnostic data and is performed for every received data packet. Each time a new packet arrives, the central server accesses the database for verifying the consistency of the received data by comparing it to the most similar database record and for estimating the trends of diagnostic parameters from changes observed in similar records.

Knowledge Space (KS) (Chapter VIII) is an information structure that integrates the signal with medical annotations as well as the information technology-based methods of data interpretation. KS is accessible to a wide range of medical researchers over the Internet. As a conventional database, the KS service contains downloadable reference ECG data, however its main advantage is to offer a choice of the most recent interpretation methods.

Lead Systems (Chapter II) relate to the electrical activity of the heart, which can be approximated by a time-variant electrical dipole, called the electrical heart vector (EHV). The voltage measured at a given lead is the projection of the EHV into the unitary vector defined by the lead axis. The lead set most widely used in clinical practice is the standard 12-lead system.

Levels of Software Adaptation (Chapter IX) quantitatively describe the interference of the management procedure into the ECG interpretation process. According to the adaptation level, various kinds of programming technology are used to achieve the adaptation aim.

Local Area Network (LAN) (Chapter III) topology is the layout of networking segments and their interconnections by devices such as repeaters, bridges, and routers. LANs, instead of the traditional point-to-point connections, have become
the primary medium for computer communication at healthcare practice centers to the extent that all new computers are expected to be LAN compatible.

**Local Conspicuity** (Chapter VI) is the feature of the scene determining how attractive its particular fragment to the potential observer is. The values of local conspicuity measured for each point of the image forms the conspicuity layer over the visual content of the image. The correlation of the visual content and its conspicuity is considered by visual research.

**Longitudinal Record** (Chapter IV) may contain either a complete clinical record of the patient or only those variables that are most critical in subsequent admissions. In modern systems of high-capacity storage resources, the structure of the longitudinal file contained information regarding the encounter, admitting physician, and any other information that may be necessary to view the record from an encounter view or as a complete clinical history of the patient.

**Lossy and Lossless** (Chapter VI) methods concern data compression. Lossless methods guarantee the identity of digital representations for original signals and their reconstructed copy. Despite the common belief, lossless compression methods represent a continuous real signal when it results from the digitizing parameters. Lossless compression is featured at a cost of considerably lower compression efficiency and in many countries is the only legal way for storing medical data.

**Low Variability** (Chapter X) ECG parameters are diagnostic data showing the variability lower than a few consecutive heartbeats. The values are usually measured in epochs of the length ranging from 20 seconds up to 10 minutes.

**Master Patient Index** (MPI) (Chapter IV) contains the unique identifier for the patient and other entries necessary for the admitting staff to identify the patient (name, sex, birth date, social security number). This information is used by the program to select potential patient matches in the MPI from which the administration can link to the current admission.

**Medical Waveform Format Encoding Rules** (MFERs) (Chapter IV) are used for storage of any waveforms in temporal frames. Thus their major components are sampling information and frame information. The definitions of MFER are classified into three levels: level 1 is basic specification, level 2 is extended specification, and level 3 is auxiliary specification. MFER applies data encoding rules for maximum format flexibility.

**Medium Variability** (Chapter X) ECG parameters are diagnostic data showing the variability of order of several consecutive heartbeats. These parameters are
usually measured in a beat-to-beat interval but then are averaged over a specified beat count or specified time interval.

**Metadata** (Chapter VIII) are all intermediate results yielded by interpretation procedures. Metadata are characterized by free data-forms, dependent only upon the requirements of the interfaced procedures, limited reliability, and average dataflow and volume. Metadata are usually not readable by humans.

**Minnesota Code Classification System** (Chapter IV) for Electrocardiographic Findings is a list of one- to three-digit codes attributed to the record as a diagnostic outcome according to a tree of finding relevance.

**Modalities in Cardiology** (Chapter IV) include various examination techniques based on different phenomena triggering the action, directly included in the action, resulting from the action, or accompanying the action of the heart.

**Modulation of Remote Recorder Functionality** (Chapter IX) is performed by the software and consists of deep modification of the external behavior (accessible via user interface) and the internal functionality (e.g., software architecture). The software modulation functionality is particularly interesting in a remote mode when the supervising server modifies the interpretive procedures on the run according to changes in patient status.

**Modulation of Report Content** (Chapter X) uses a flexible data report format, including raw signal strips, metadata, and diagnostic parameters. It may consist of inclusion or exclusion of automatically selected parameters, attributing the parameters with priority and validity period parameters, and/or continuous regular reporting.

**Multimedia Communications** (Chapter III) are technologies and standards ranging from application-specific digital signal processors and video chip sets to videophones and multimedia terminals, and relying on digital signal processing. Biomedical signals are integrated with other patient information and transmitted via networked multimedia.

**Multithreading Operating System** (Chapter V) is an operating system that allows the sharing of resources in a way to perform several independent tasks at the same time. The multithreading OS can also have multi-user access, and therefore an independent instance of the ECG interpretation process may run for each user, supporting cooperation with a corresponding remote recorder.

**Non-Uniform Reporting** (Chapter X) is the remote recorder operating mode characterized by irregular time intervals between consecutive reports and variable contents from one report to another. The non-uniform reporting best optimizes the
use of a transmission channel if the processing is patient adaptive, but it also requires more computational power for the management of the contents of data packets.

**OpenECG** (Chapter IV) is a European-funded initiative with global reach, aiming to lower the barriers for seamless integration of ECG devices in e-health services and electronic health record systems. The means the consortium is achieving its goals of promoting ECG interoperability standards, providing input on global trends and developments, and ensuring conformance testing services addresses ECG records and electrocardiographs.

**Optimal Patient Description** (Chapter V) is a set of diagnostic parameters most wanted in the current patient state. In a technical implementation, for every possible patient state there is a list of mandatory, desirable, and optional diagnostic parameters with the attributes of priority, tolerance of value, and validity time.

**OSI Basic Reference Model** (Chapter III) is a layered, abstract description for communications and computer network protocol design. The seven OSI layers are, from top to bottom: application, presentation, session, transport, network, data link, and physical. A layer is referred to as a collection of related functions that provides services to the layer above it and receives service from the layer below it.

**Pacemaker** (Chapter VII) is an implantable electronic device generating pacing pulse for the heart. Pacemakers today have a wide adaptivity thanks to the embedded microprocessor programmed according to the patient’s needs. Long-term recording is a valuable tool in assessing pacemaker malfunction due to electronic circuit failures or inappropriate programming.

**Patient Health Record** (Chapter IV) is a description of all parameters necessary to identify the patient and reveal his or her diagnostic data. PHRs are currently stored in digital databases and are printed in paper form when the patient is discharged. The electronic form of a PHR is the condition of applying automatic data management, storage, and retrieval systems.

**Percent Root-Mean-Square Difference** (PRD) (Chapter VI) is one of the most common distortion estimators, despite it is not reflecting the variability of signal importance in medical examinations. Such a technical parameter is therefore hardly interpretable in terms of medical diagnosis.

**Perfect Reconstruction Property** (Chapter VI) is the feature of a reversible signal transform (here referred to as a time-frequency transform) that yields a bit-accurate digital signal and originates from the combination of the forward and inverse transforms. The perfect reconstruction property is necessary in lossless data
compression methods, but here is important to guarantee that all the changes in the output signal result from the manipulations in the time-frequency domain.

**Personal Cardiac Prevention Program** (Chapter V) is a preventive healthcare procedure ordered to healthy people individually in order to reduce their risk of cardiac diseases by change in diet, lifestyle, and medication.

**Physiological Stimulation** (Chapter II) is defined as when, in a physiological case, a heartbeat is electrically initialized by a group of cells located in the upper part of the right atrium, known as sinoatrial node (SA), having the ability of spontaneous discharge.

**Raw Signal** (Chapter VIII) is unprocessed digital representation of electrical measurements of the surface ECG and synchronous other phenomena (respiration, blood pressure, patient motion, oxygen saturation, acoustic, and many others). Various data-types follow their proper technical specification of measurement (sampling frequency, amplitude scale, etc.).

**Read-Only Memory** (ROM) (Chapter IX) is the section of the system memory for storage of the executable code. The name is justified because it is opposite the random access memory (or data memory); the software itself reads the code and does not use the program memory as storage space for variables. Nevertheless, using flash technology, the ROM may be rewritten multiple times by an external procedure.

**Recipient Request** (Chapter XI) is a data query present in a transfer mode initiated by a data recipient and not by a data source. The recipient request usually also triggers several calculation procedures in order to update the data whose validity expired.

**Redundant Signal Re-Interpretation** (Chapter IX) is the method of automatic assessment of result reliability that uses bi-directional transmission and begins with the raw signal request issued by the central server. The remote recorder does the interpretation independently, and besides the diagnostic result, returns the raw electrocardiogram as well.

**Refractory Period** (Chapter II) (approximately 200 ms) represents the biologically possible minimum interval between two heartbeats. After the depolarization the cells are not immediately able to receive or transmit new electrical stimuli. Consequently, the stimulation wavefront dies down after achieving the latter cell of the heart muscle tissue.

**Relevance Coefficients** (Chapter V) are numerical values determining the medical significance of the corresponding diagnostic parameter with reference to a
given scale. The relevance sets the ordering relation translating the set of diagnostic parameters to a prioritized list. The list contains the most important parameters at its beginning and the least meaningful data at its end.

**Report Content Optimization** (Chapter XI) is a computational process of “reservation” space in the nearest report for irregularly appearing data. The optimization selects between two contradictory criteria: calculate each diagnostic parameter as late as possible and fill the data packet by the values within their validity periods.

**Reporting Frequency** (Chapter IX) is the frequency that data packets with particular content are sent by the remote recorder. This frequency can be set as constant and common for all the data, can be controlled by the server according to the patient status, and can be independently set for each diagnostic parameter. Continuous reporting is a real-time variant of constant reporting in which the remote recorder issues only basic diagnostic parameters and raw signal.

**Resources Report** (Chapter IX) is included in the remote device status word or independent record pooled by the server-issued request. The resources report contains a few variables representing battery use and status, ambient temperature, connection quality, processor usage, memory allocation, and codes of linked libraries. Receipt of this information is for the server a background for the estimation of available resources and software modification.

**Rest ECG** (Chapter II) is a 12-lead short-time recording of simultaneous ECG leads in a lying-down position.

**Rigid Software** (Chapter V) is the sequence of determined calculation procedures of the architecture and data flow defined uniformly for all data. The software is usually required to provide predictable results and thus the common definition of its behavior guarantees the unique dependence of the process state (partly manifested at its output) on the inputs and the previous state.

**Scan-Path** (Chapter VI) is the visual representation of the eyeglobe trajectory acquired during the investigated human-performed visual task. The superposition of the scan-path over a displayed scene reveals the zones of particular interest represented by the gaze time and the visual strategy of the observer represented by the order of gazing.

**SCP Compliance Testing** (Chapter IV) identifies the records resembling the SCP specifications; compliance testing is necessary. The compliance tests cover the following areas: the content of the record, the format and structure of the record, and the messaging mechanisms if records are communicated according to the SCP specifications.
Serial Communication Protocol ECG (Chapter IV) is a standard specifying the interchange format and a messaging procedure for ECG cart-to-host communication and for retrieval of SCP-ECG records from the host (to the ECG cart). In 1993 the Standard Communication Protocol was approved by CEN as a pre-standard ENV 1064. The SCP standard specifies that the information be structured in mandatory and optional sections.

Shannon Theorem (Chapter XI) is a basic theorem of the signal theory restricting the bandwidth of digital signal representation to a half of the sampling frequency.

Signal Decomposition (Chapter VI) is the representation of the digitized time series by the coefficients of the analytical function family. In the case of the Fourier Transform, such analytical function is a unitary spiral in the complex domain. In the case of wavelet transform, the role of analytical functions play wavelets of different scale and dilation values.

Signal Quality Assessment (Chapter VII) is an automated procedure working on the raw signal aiming at detecting the features of the desired signal and the features of the most probable interferences in order to compare them. The procedure issues a signal quality estimate, which is a background for optimization of channel information use in the ECG and for assessment of the reliability of diagnostic outcome.

Signal Quality Verification (Chapter VIII) is an initial step of the ECG signal processing by the subscriber service. Its purpose is to correct estimation of diagnostic outcome reliability, since in the case of weak amplitude, noisy signals, spikes, or baseline wander, the analysis may end with incorrect results. Suspicious input signals are identified, and a warning message is issued together with the diagnostic outcome.

Sinoatrial (SA) Node (Chapter II) is a neuromuscular tissue in the right atrium near where the superior vena cava joins the posterior right atrium (the sinus venarium); the SA node generates electrical impulses that initiate the heartbeat, hence its nickname the cardiac “pacemaker.”

Social Impact of Cardiovascular Disease (Chapter III) manifests itself as the leader on the list of most frequent mortality causes. In other words, for many years in the United States and other developed countries, cardiovascular diseases have been the most frequent cause of death. This fact garners great attention from researchers and also considerable funds for the prevention, diagnosis, therapy, and prosthetic of cardiology.

Software Layers (Chapter IX) are defined in the remote recorder in order to distinguish the unalterable modules: data acquisition and wireless communication services as well as fundamental user interface procedures and the flexible overlay

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include all interpretation and report formatting procedures programmed as diagnosis-oriented dynamic libraries, which may be charged and released upon request.

**Specialized Interpretation Centers** (Chapter VIII) are in a computer network the analogy to regional or national specialists and are realized as Unix-based multitask and multi-user servers scaled to the estimated demand for particular interpretation tasks. In particular, each heart disease may be supported by several physical interpretation nodes using independent interpretation methods and located in different parts of the world.

**Spread Intelligence** (Chapter IX) ECG interpretation model assumes that the recording device interprets the signal and issues an alert message in case of abnormalities. Although the spread interpretation intelligence reduces communication costs, the diagnostic quality is affected due to resource limitations typical to a wearable computer.

**Standardization of Data** (Chapter IX) is the process of preparing two sets of non-uniformly reported data for comparison. The standardization is also necessary when a non-uniform result of an adaptive interpretation system is to be compared to a uniform reference. As a data standardization tool, we used the cubic spline interpolation.

**Standardized Interpretation Criteria** (Chapter IX) are interpretation guidelines and parameter threshold values formulated by the professional organizations of medics. The criteria are uniform for all patients, regardless of diagnostic goals and patient status, and are believed optimal for the most expected patient.

**ST Segment Analysis** (Chapter II) is the analysis of the ST segment, which represents the period of the ECG just after depolarization, the QRS complex, and just before repolarization, the T wave. The possible abnormalities include displacements of the ST segment either above the isoelectric line (elevation) or below it (depression), and reflect metabolism and oxygenation disorders in the cells heart muscle tissue.

**Subscriber Service** (Chapter V) is a payable data processing task performed for a limited group of registered users by the remote center, and ordered and accounted for via the computer network. The subscription is based on a given period or given credit of a financial nature. The ECG interpretation processes may also be implemented as subscriber services of territorially unlimited range.

**Subscriber Service Supervision** (Chapter VIII) is provided to control the automated interpretation process in both medical and technical ways by the medical expert assistant and server administration. Help from a qualified cardiologist
is crucial at the prototyping stage, because he or she not only resolves conflicts or misinterpretations, but also gathers and qualifies information on errors.

**Support Compact** (Chapter VI) is a support of the analytical function that is equal to zero except for a single compartment of a countable number of samples. The transformations using the support compact are designed similarly to digital filters and are able to represent the signal in a lossless way in a finite number of coefficients in the transformation domain.

**Systolic Phase** (Chapter III) of the heart cycle is the electrically induced vigorous contraction of cardiac muscle which drives the intraventricular pressure up, forcing the one-way inlet valves closed and the unidirectional outlet valves open as the heart contracts to its end-systolic-volume (ESV), which is typically on the order of 70 ml of blood for the left ventricle.

**Temporal Distortions’ Distribution** (Chapter VI) is a time function of statistical difference measure between the original and the distorted signal. The distortion distribution is a much more elegant and meaningful way of compression quality estimation than a commonly used global coefficient like PRD.

**Usability** (Chapter IX) of a wearable recorder is understood as the influence of the device on the patient’s comfort. Low usability, difficult maintenance, complicated operation, or continuous attention requirement will lower the acceptance of the recorder by the patient and leads to the failure of continuous surveillance.

**Usage Probability** (Chapter VII) is the estimator of frequency of calling of a particular procedure. Some procedures are mandatorily called, while others are called in very rare cases of specific diseases. Since the processing chain is switched conditionally on the metadata, the usage probability varies with the patient status. The usage probability is used for estimating the contribution of a procedure quality coefficient to a global quality coefficient of the software.

**Validity Time** (Chapter V) is for a diagnostic parameter the longest period in which the value should be updated in order to maintain continuity. The validity time is longer for diagnostic parameters of lower expected variability or bandwidth.

**Vulnerability of Medical Data** (Chapter VI) is the parameter referring to the change in manually derived or automatically calculated diagnostic outcomes as a response to the ECG signal distortion.

**Wave Detection and Delimitation** (Chapter II) relate to the three main waves in the heart evolution, whose temporal order is P, QRS, and T, following the consequent action of a single isolated stimulus propagating through the heart. Primary ECG diagnostic parameters are based on temporal dependencies between the
waves, here representing the conduction of stimulus through a specified tissue or contraction of muscle.

**Wearable ECG Recorders** (Chapter IX) are electronic devices designed for digitally recording the ECG signal from the body surface that are small enough and lightweight enough to be worn continuously by the patient without affecting his or her usual behavior. The principal advantage of wearable recorders is that their seamless companionship in the everyday activity increases the probability of capturing the context of sudden events.

**Wide Area Networks** (WANs) (Chapter III) are applied by healthcare centers to connect networks at physically distant buildings, offices, clinics, or with different organizations. Recently data interconnections through WANs have exploded among care facilities, private physicians’ offices, nursing homes, insurance agencies, health maintenance organizations, research institutions, and state and federal regulatory agencies.

**Wireless Communication** (Chapter III) uses different technologies depending on required bandwidth, range, and acceptable costs. These technologies include: WiFi, connecting a wireless local area network to the wide area network; WiMAX, providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access; and GPRS, a packet-switched GSM protocol allowing multiple users to share the same transmission channel.