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A Review on Provisioning Quality of Service of Wireless Telemedicine for E-Health Services

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Abstract: In general, on-line medical consultation reduces time required for medical consultation induces improvement in the quality and efficiency of healthcare services. All major types of current e-health applications such as ECG, X-ray, video, diagnosis images and other common applications have been included in the scope of the study. In addition, the provision of Quality of Service (QoS) for the application of specific healthcare services in e-health, the scheme of priority for e-health services and the support of QoS in wireless networks and techniques or methods for IEEE 802.11 to guarantee the provision of QoS has also been assessed. In e-health, medical services in remote locations such as rural healthcare centers, ambulances, ships as well as home healthcare services can be supported through the applications of e-health services such as medical databases, electronic health records and the routing of text, audio, video and images. Given this, an adaptive resource allocation for a wireless network with multiple service types and multiple priorities have been proposed. For the provision of an acceptable QoS level to users of e-health services, prioritization is an important criterion in a multi-traffic network. The requirement for QoS provisioning in wireless broadband medical networks have paved the pathway for bandwidth requirements and the real-time or live transmission of medical applications. From the study, good performance of the proposed scheme has been validated by the results obtained. The proposed wireless network is capable of handling medical applications for both normal and life-threatening conditions as characterized by the level of emergencies. In addition, the bandwidth allocation and admission control algorithm for IEEE 802.16- based design specifically for wireless telemedicine/e-health services have also been presented in the study. It has been concluded that under busy traffic conditions, the proposed architecture can used as a feasible and reliable infrastructure network for telemedicine.

Key words: Quality of Service · Wireless Telemedicine · E-health Services · IEEE802.11

INTRODUCTION

Information technology (IT) is a key factor in the field of e-health as recent technological Progress in wireless networking has been mostly applied to the healthcare sector. Wireless networks play an important role in the information delivery in out-of-hospital incident mainly due to healthcare networks operation, as well as the allocation of the available resources and the assurance of QoS provisioning for the specific medical applications. By the use of such applications (medical databases, electronic health records, routing text/audio/video/photo/video medical information) healthcare services can be enhanced in underserved areas, such as rural health center, ambulances, ships, aeroplanes as well as home environments. In (D.D.Vargos) "discuss wireless healthcare information systems" in which he suggested several factors that we should take into consideration for data delivery in wireless medical network: Availability; Confidentiality and privacy; Data delivery latency; Reliability, QoS Provision and Mobility Support.

The resources sufficiency has been definitely vital in medical networks, as the generated traffic can be highly important for the patients' health and life since. Therefore,

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in order to preserve the confidentiality and privacy of the patients' data, authentication mechanisms are needed,however these mechanisms are beyond the scope of this study. Especially in emergency situations, the rapid delivery of a patient's measurements,besides, is as highly vital as reliability due to information delivery in the emergency care. Furthermore, the mobility support is as well another important issue for wireless e-health applications. For instance, through the different wireless technologies,an ambulance, which travels through different e-health domains (areas that include static or mobile type of nodes during the simulation), handling different e-health applications the connectivity between the monitoring applications as well as the medical data source may be assured.

Wireless Healthcare Information Systems: Vergados, (2007) Next generation wireless networks have been implemented to afford assistance to multimedia services, with varied traffic features and distinct sorts of Service (QoS) guarantees. Recently, a special emphasis has been put on medical broadband applications, besides, the ability of continuous healthcare monitoring for mobile patients has been introduced due to the splendid growth of wireless technologies. The bandwidth requirements and the emergency nature of medical applications can justify the need for QoS provisioning in wireless broadband medical networks. Wireless networks may assist a number of e-health applications with different traffic necessities and features, providing at the same time QoS guarantees. Resource allocation in e-health application is inherently different in many aspects such as the offered services, traffic requirements, propagation characteristics and network structure. This study suggests an adaptive resource allocation scheme for QoS provisioning in wireless medical data systems.

To enhance healthcare delivery, telecommunications and advanced data technologies have been increasingly applied mainly for clinical activities and studies. Telemedicine services usually depend on multimedia technologies and they aim to enhance multiple and varied clinical applications over diverse network topologies. Such heterogeneous environments necessitate that several applications should be afforded with diverse QoS necessities to accommodate their different sorts of services. This paper proposes a new architecture for multi-class QoS provisioning in telemedicine using wireless technology. Resource allocation schemes for e-health services networks are expected to afford compound QoS classes according to several e-health applications for high necessity services. Different classes, including expedited forwarding, assured forwarding and best effort are enhanced and resources are allocated to offer an optimum solution for each e-health application. In wireless health information systems, this process depends on a logical order that consists firstly of determining the available resources in the network, then analyzing the type, volume and QoS requirements of the data to be conveyed and lastly, tuning the applications that the network will handle. Hence, a flexible resource allocation for a wireless network with several service types and so many priorities is suggested. Prioritization is necessary in a multi traffic environment for the provision of an appropriate QoS level to the users. Besides, in order to reduce the blocking call possibilities bandwidth and to augment the system's overall performance, degradation and upgrade policies is taken into account. The simulation results validate the good performance of the suggested plan. Due the proposed wireless network, both normal and life-critical medical applications that are characterized by their urgency nature can be handled. According to the specific medical application requirements and according to the urgency of the medical incident, assigning different priority levels causes the network to intelligently drop and/or put off the packets, in order to fulfil a high service level in a wireless medical environment [1-2].

Advantages of Using IEEE 802.16/WiMAX Technology over Traditional Wireless Systems: Niyato *et al.* (2007) the application of IEEE 802.16-based broadband wireless access (BWA) technology to telemedicine services and the related protocol engineering issues are investigated. A study of the various evolutions of the IEEE 802.16 standard is implemented and some open survey matters are stated. Moreover, we provide a research on radio resource management, traffic scheduling and admission control mechanisms afforded for IEEE 802.16/WiMAX systems. We give, besides, a qualitative comparison between third-generation wireless systems and the IEEE 802.16/ WiMAX technology. Furthermore, we carry out a survey on telemedicine services using traditional wireless systems. In addition, we discuss the merits of using IEEE 802.16/WiMAX technology over traditional wireless systems, as well as the related design issues and methods. To this end, we propose a bandwidth allocation and admission control algorithm for IEEE 802.16- based BWA designed specifically for wireless telemedicine/e-health services. All in all, this algorithm tends to maximize the utilization of the radio resources while considering the quality of service requirements for telemedicine traffic. And it is by simulations that some performance evaluation results for this scheme are achieved.

Furthermore, we implement a survey on the overwhelming IEEE 802.16/WiMAX BWA technology, identify open research matters related to radio resource management protocol design, as well as review some recent works in this area. Besides, we discuss applications of this BWA access technology for wireless mobile telemedicine services and the potential deployment scenarios. In addition, we also review some current researchers on the design and application of wireless telemedicine systems and outline radio resource management protocol design issues in deploying IEEE 802.16/WiMAX-based wireless mobile telemedicine systems. To this end, we propose a bandwidth allocation and admission control framework for an IEEE 802.16/WiMAX-based wireless mobile telemedicine network. Thus, some initial performance results for the suggested platform are achieved by simulations [3].

Quality of Service Provisioning in Wireless Broadband Medical Networks: Vergados *et al*. (2006) Recently, great attention has been paid to Medical broadband applications. Besides, the introducing of the potential of continuous healthcare monitoring for mobile patients has paved the path to the splendid development of wireless technologies. Quality of Service (QoS) provisioning in wireless broadband medical networks is highly needed due to the bandwidth requirements and the real-time nature of medical applications. Thus, the adoption of Differentiated Services in Telemedicine is a great challenging decision. DiffServ may support a number of e-health applications with different traffic requirements, providing at the same time QoS guarantees. Resource Allocation in DiffServ for e-health application is inherently different in many aspects including the offered services, traffic requirements, propagation's characteristics and network structure. Hence, this research acknowledges a new promising DiffServ architecture for QoS provisioning in emergency Telemedicine.

We admit a novel architecture for multiclass QoS provisioning in Telemedicine using wireless DiffServ technology. Resource allocation schemes for E-health Differentiated Services networks tend to afford compound QoS classes correspond to different e-health applications for high requirement services. Different classes, like expedited forwarding, assured forwarding and best effort are supported and resources are allocated for providing an optimal solution for each e-health application. Thus, both normal and life-critical medical applications that are characterized by their urgency bature, can be treated due to the proposed wireless DiffServ network. According to the urgency of the medical incident, assigning different priority levels according to the specific medical application requirements leads the network to intelligently drop and/or delay the packets, so that a high service level can be accomplished. Thus, an architecture that can be considered as a survivable network which can be used as well under extreme traffic conditions as reliable infrastructure for mobile telemedicine is suggested in this paper [4].

Develop Low Cost Movable/Mobile Community E-Health System for Rural Area: Su, *et al.*, (2010) This study focuses on developing low cost movable/mobile community e-health system for rural area. Moreover, access to telecommunication and internet are made possible due to the integration of VSAT (Very Small Aperture Terminal) technology with BWA (Broadband Wireless Access). Ensuring 'connectivity' through this sort of initiatives,such as three-level medical and health service networks as this connectivity,is not only proved to be valuable for Rural areas, but it may lead also to e-learning, e-health etc. Business or service initiatives are ultimately leading towards uplifting of communities by limiting the digital division. This study, will also discuss the future perspective for the enhancement of rural communications including the applications of e-health care [5].

Telecommunication and Networking Architecture for Implementing Telemedicine: Chowdhury *et al.*, (2010) Owing to efficient telecommunication and multimedia technologies in conjunction with medical expertise, delivering affordable high-quality E-health care services will be more affordable. Moreover, to apply the future generation Telemedicine and Tele health systems, this research suggests and identifies a telecommunication and networking architecture. Furthermore, to hasten and make real-time and near real-time communication of remote health care information easier, our integrated optical wireless based network affords super broadband, ultra low latency connectivity for voice, video, image and data across various telemedicine modalities.

We suggest a broadband transport and access network architecture for next generation Telemedicine and Tele health systems using integrated optical-wireless radio-over-fiber technology. It can conveniently afford protocol-independent connectivity among various telemedicine entities which can use existing or emerging wireless services such as Public safety, 3G, 4G/LTE, WiFi and WiMAX together with future proof 60-GHz mm-waveband radio for ultra low-latency real time transmission of uncompressed super-high resolution images and video content. A proof-of-concept

experimental demonstration is identified and the transmission performance of the system for uncompressed HD video and image transmission using 60-GHz mm-wave radio over 25km single mode fiber is assessed. It is believed that when developed in close interaction with the medical and health services communities, the proposed network system can facilitate implementation of large classes of the next-generation Telehealth and Telemedicine services for high-quality and affordable remote healthcare delivery [6].

Two Major Challenges in Wireless Communications Technology in a Healthcare Environment: Phunchongharn *et al*. (2010) a variety of electronic health applications to transfer medical data and patient information is supported due to Wireless communications technologies. Two major challenges, however, can be posed when using wireless communications technology in a healthcare environment: The first one refers to the electromagnetic interference caused to bio-medical devices by wireless devices and that could critically impact on their performance. The second is related to prioritization of the access to the wireless channel by the corresponding devices, since a variety of e-health applications leads to a variety of priorities. This paper presents a new cognitive-radio-based method that addresses these obstacles in wireless communications for e-health applications in a hospital environment. First off, for a wireless communications system to be effectively used in a medical environment, we have to identify our needs,and discuss the potential applications of cognitive radio technology for e-health applications. After that, we propose a cognitive radio system for e-health applications in a hospital environment, which saves the medical devices from hazardous interference by adapting the transmit power of wireless devices based on EMI constraints. Furthermore, we suggest an EMI-aware handshaking protocol for channel access by two different types of applications with different priorities. The performance of this cognitive radio system for e-health applications is assessed through simulation.

In addition, a cognitive radio system for e-health applications is proposed. This system is concerned with the issues of EMI to healthcare devices and QoS differentiation, which play a vital role in medical environment. The cognitive capability of the system springs out of its EMI awareness to control the wireless access parameters in order to accomplish the expected QoS differentiation among different users/applications. Two e-health applications, telemedicine and a hospital information system, have been taken into consideration in this cognitive radio system. Performance evaluation results prove that the suggested plan preserves the bio-medical devices from hazardous EMI and fulfils service differentiation among different e-health applications as well. Incorporating multiple data channels help the cognitive radio system enhance its performance (i.e., delay and loss probability). Thus, we necessitate a multichannel and multi radio wireless access protocol as well as a developed optimal scheduling algorithm instead of a prioritized first-in first-out queuing policy, for the cognitive radio controller. Besides, we have to use an admission control algorithm to limit the number of secondary users in the system. Furthermore, to achieve the utmost system performance, this admission control algorithm can be jointly designed with a transmit power control method [7].

Qos in Wireless E-health and E-Emergency Services: Gama, *et al.* (2008) the reliable and effective operation of emergency healthcare (e-emergency) services poses quality demands to the systems and underlying communication infrastructures. Moreover, owing to their unreliable service delivery, most existing wireless body sensor networks fall short in meeting these demands. E-Emergency systems must provide, as well, quality of service (QoS) support including a pervasive and trustable assistance to patients under health risk. This survey examines the necessity for QoS in wireless e-health and e-emergency services. Some current and relevant e-health projects with QoS requirements are stated, besides, to justify this need. Furthermore, in this emerging field of application, this paper highlights the high importance of QoS support,and suggests a summary characterizing the e-health proposals herein presented.

Emergency healthcare networks should, as well, be totally reliable and efficient since patient´s life is priceless. Therefore these networks must enhance QoS as they clearly require reliability, guaranteed bandwidth and low delays owing to their real-time nature. Moreover, we have developed a great number of healthcare systems, although only few address QoS support. According to the representative wireless e-health projects herein surveyed, it is proved that QoS support afforded in each method is variant and treats diverse QoS levels for specific uses. We also provide a summary including their main characteristics and goals herein to better compare the studied QoS approaches. However, the QoS support and progress levels provided by these systems are not simple or satisfactory enough to achieve an assumed requirement in hospital units: providing a wireless, pervasive, valuable and totally reliable assistance to any patient with health risk abnormalities [8].

Mobile Healthcare Applications: Soomro *et al.* (2011) Owing to mobility of patient, future medical care applications will necessitate operation over heterogeneous networks, caregiver and provisioning of healthcare services anytime anywhere. In contrast with applications using protocols for specific networking technologies, a unified middleware to isolate applications from mobility management, client discovery and transport of multimedia traffic is proposed to be included. We propose an all IP-based framework depending on SIP protocol for the unified middleware. The architecture is described as well. We describe how handovers over heterogeneous networks can be carried out in this architecture which affords better QoS and low packet loss during transitions. We also identify a laboratory prototype to demonstrate the above concepts.

We suggest a framework for mobile healthcare applications which works over heterogeneous networks. Session establishment and mobility management functions of the communication stack into a middleware are included as well. The applications communicate with and address the end-points using SIP URIs. By using SIP URIs, applications are made independent of the underlying network used to carry multimedia traffic. In SIP-based middleware additional benefits are achieved, for example, network handover transparency and improved QoS. Simultaneously, by offloading the session establishment and mobility management functionality, we make applications simpler. Using these concepts for real-time patient monitoring application a laboratory prototype is built. Our results prove the merits of the architecture and justify that the continuity of sessions could be kept across heterogeneous network handover with decreased data losses than the current architecture. Further work on the prototype is also added to test discovery of usable data ports when mobile clients are behind NATs and firewalls. Also, a quantitative evaluation of variations in delay and jitter of different networks and their impacts on patient monitoring application are required to be performed [9].

Application of IEEE 802.16 (BWA) Technology to E-Health System: Su *et al*. (2010) this research examines the application of IEEE 802.16-based broadband wireless access (BWA) technology to e-health system for rural areas. We also give a qualitative comparison between third-generation wireless systems and the WiMAX technology, as well as a survey on telemedicine services depending on traditional wireless systems. Besides, we discuss the merits behind using WiMAX technology over traditional wireless systems, as well as the integration of VSAT (Very Small Aperture Terminal) with WiMAX technology. Therefore, a bandwidth allocation and admission control algorithm for WiMAX-based BWA,carried out particularly for wireless e-health services,is presented. Moreover,by simulations we achieve the performance evaluation for utilization of the resource allocation.

Furthermore, we suggest a research on the emerging WiMAX BWA technology,discuss the application of this BWA access technology for wireless mobile telemedicine services and the potential deployment scenarios and outline as well the integration of VSAT with WiMAX technology for e-health in Cinese rural areas. Therefore, we propose a bandwidth allocation and admission control framework for a WiMAX-based wireless mobile telemedicine network. We start,besides, collecting the first performance results for the suggested framework by simulations [10].

Two Crucial Issues for Wireless Communications in a Healthcare Environment: Phunchongharn *et al*. (2010) Due to the wireless communications technologies, efficient healthcare services in medical and patient-care environments can be enhanced,however, two crucial issues may arise out of this use. First off, the RF transmission may result in electromagnetic interference (EMI) to biomedical devices, which could critically malfunction. Second, the diverse sorts of electronic health (e-Health) applications need varied quality of service (QoS). To address these issues,this research admits as well a novel wireless access scheme, called EMI-aware prioritized wireless access. First of all, we identify the system architecture for the suggested scheme. After that, we suggest an EMI-aware handshaking protocol for e-Health applications in a hospital environment. By adapting transmit power of wireless devices based on the EMI constraints, this protocol affords safety to the biomedical devices from harmful interference.Besides, by two different types of applications with different priorities, we also suggest prioritized wireless access scheme for channel access. Moreover, we present a Markov chain model to examine the queuing behavior of the suggested system. After that, we use this queuing model to optimize the performance of the system given the QoS necessities. Lastly, the performance of the suggested wireless access scheme is assessed through large simulations.

We also suggest an EMI-aware prioritized wireless access scheme for e-Health applications which takes into consideration two major issues, namely, EMI to medical devices and QoS differentiation in healthcare environment. In addition, we take into account two e-Health applications, namely, clinical notifier and EMR

applications and develp a queuing analytical model to study the behavior of the suggested scheme. Performance evaluation results prove that the suggested scheme can preserve the active and passive biomedical devices from the harmful interference and also achieve service differentiation among diverse e-Health applications. The performance (i.e., delay and loss probability) of the suggested scheme can be optimized by adjusting the blocking probabilities. We can as well use the results from the queuing model to optimize the blocking possibilities to maximize the system throughput while satisfying the QoS necessities of the e-Health applications [11].

Model of a Smart Self-Care Unit as the Solution for Remote Monitoring of Patients Medical State: Rusu *et al*. (2009) To guarantee remote monitoring of patients with chronic diseases and to enhance the responsiveness and quality of medical services as well, we design a distributed e-Health system. The Smart Self-Care Unit (SSCU), besides, is considered to be a vital factor in this system as it allows remote acquisition of medical data from patients treated or monitored at home. This unit consists of a series of smart medical sensors and devices connected through a wireless network. The system guarantees mobility for patients under supervision and seamless conveyance of medical information to the medical centers (hospitals, clinics, general practitioners, etc). Patients may communicate from distance with medical personnel and access healthcare services through a distributed, multi server based application as well. In order to grant an integrated medical system, a number of autonomous healthcare applications (servers) are deployed in every healthcare center collaborate. Healthcare data of patients enrolled in this system is exchanged between medical entities and self-care units. As part of this system a portal application grants a series of useful medical services such as: information about doctors, healthcare units and their services, protege storage of individual healthcare records, discussion forum for patients and doctors or statistical processing of recorded healthcare data.

Applying a distributed e-Health system is a so difficult duty that includes: remote data acquisition and monitoring, data logging and information exchange between medical entities, applications and users. In the following study, we examine a model of a Smart self-care unit as the solution for remote monitoring of patients' medical state. According to a sensor network, patient and environment parameters are collected by the unit, then send to a medical entity (e.g. general practitioner, clinic, etc.). The unit also permits far away communication between patients and healthcare personnel. The data collected is saved in a specific database built upon a domain ontology. This method criticizes sophisticated relations between variant meanings included in a health care act (episode). The interoperability and transparent exchange of information between different medical applications is guaranteed by the ontology-based solution. Moreover, the support for better medical diagnoses and treatment is granted by Medical plans associated with the domain-specific ontology. Owing to these plans,medical personnel in the process of patient's evaluation, diagnosis and treatment may avoid mal-practice cases. To assess and treat patients with cardio-vascular diseases,the suggested solutions are carried out as well. This theory significantly helps patients decrease the time they spend in hospitals, permits to continuously assess patients with lingering diseases and eases flexible online communication between patient and doctor. As far as the future plan, the authors intend to add more elements of intelligence to the system through data mining procedures, statistical evaluation facilities and alternative decision support services[12].

Low Power Consumption of LPRT in E-Health Systems: Gama, *et al*. (2009) to provide a reliable assistance to patients, emergency and intensive care systems have increased demands for quality of service at different levels, including at the MAC layer. The Low Power Real Time (LPRT) MAC protocol proposes appropriate features to address these demands owing to its efficient bandwidth allocation, low energy consumption and bounded latency. However, this MAC protocol may still constitute a significant packet loss ratio in a wireless channel affected by errors. We also suggest and test a solution based on short size beacons in order to enhance its robustness to bit error conditions. Results prove that we achieve tremendous progress regarding packet loss ratio and energy saving. We suggest as well a new reconstructed plan so that a WSN using this solution may communicate optimally in accordance with the patients' clinical state.

The progress of LPRT in e-health systems results in low power consumption, controlled latency and throughput efficiency. However, as simulations prove, LPRT performance is significantly affected by bit errors. In order to have a MAC protocol more robust than LPRT, the iLPRT based on short size beacons and implicit slots allocation are suggested and assessed. Results prove that iLPRT causes splendid progress regarding packet loss ratio and energy consumption. However, the short size beacon strategy is valid only if it does not compromise the reconfiguration of the e-health system. Hence, iLPRT involves also an efficient reconstructed plan. It is argued

that the methods endorsed by iLPRT are valuable to improve the QoS provisioning in e-health networks [13].

Hybrid Networks Is a True Solution in Telemedicine Technology: KHAN, N *et al* (2009) the hybrid optical-wireless broadband network (HOW-B) presents promissing expectations for medical communication systems and networks. The marvel innovations in free space optics (FSO) based wireless communication, medical sensors and mobile network technologies are associated with emerging biological fields of telemedicine and bioinformatics. On the other hand, the progressive developments in optical based wireless technology paves a promising path for life-saving network services. The wireless network along with advance modeling technique of patient-care facilitates in monitoring of the physiological data, the treatment optimization and continuous patient-care, all of these, help to afford a progress of care as well as quality of patient's life without interrupt circulation in everyday life activity. This paper introduces the FSO and RF networks viable connectivity and low-cost optical wireless tele-monitoring network system. Moreover, it grants review of the interoperability and QoS assurance issue and compares diverse characteristics of optical wireless with (RF) wireless network.

The WLAN-WiFi system can be used for short-range e-health monitoring application with 95-98% efficiency. Thus, the tele-monitoring communication network can benefit from the short range for local area monitoring as it is separated by the major reason of distance. Then, the challenge of future research is that the interoperability issues must be arisen during the transfer connectivity between FSO and RF network. Thus, interoperability issues to assist research community for a high interoperable solution for hybrid network. Broadband FSO network technologies afford better practical solutions for healthcare application. The FSO in our experimental field eliminated the core healthcare communication issues like bandwidth, security and bottleneck and installation time. Besides, these are highly effective and compatible to existing RF infrastructure. All in all, as RF broadband networks does not ensure reliability owing to low bandwidth and interference, the suggested idea of hybrid networks is a true solution in telemedicine technology[14].

Mobile Telemedicine: Batistatos *et al.* (2012) recent researches agree that patient survival during a health emergency situation relies on the efficient pre-hospital medical care. To tackle this problem, mobile telemedicine exploits different wireless network technologies. This survey examines the case of mobile telemedicine service provision in a moving vehicle (ambulance). The special features and necessities of this operational scenario are discussed in terms of merits and demerits in conjunction with the application of existing wireless communication systems in this case. Besides, emerging wireless broadband communication systems and spectrum access technology are taken into consideration as well in the same context, trying to further develop service provision and overcome future challenging times.

Mobile telemedicine is a demanding application with special characteristics. The basic pre-hospital care requires two way real time audio and video communication, high quality image and healthcare information transfer, seamless and simultaneously. In a real operational scenario of a moving vehicle (ambulance) from a rural to an urban area, the network application needs compilation of technologies and techniques adhered to each specific scenario [15].

Wireless Multimedia Sensor Networks (WMSN): Cobo *et al.* (2010) Most routing protocols, in wireless sensor networks, identify energy savings as the main goal and expect data traffic with unlimited delivery necessities to be a given. The introduction of video and imaging sensors, however, uncovers further challenges. The transfer of video and photo information needs both energy satisfactionary efficiency and QoS assurance (end-to-end delay and packet loss requirements), in order to guarantee the effective use of sensor resources as well as the integrity of the collected data. In addition, this research affords a QoS routing model for Wireless Multimedia Sensor Networks (WMSN). Besides, an ant-based multi-QoS routing metric (AntSensNet) is proposed based on the traditional ant-based algorithm. Before choosing suitable ways to meet various QoS needs from diverse sorts of traffic, the AntSensNet protocol erects an online hierarchical structure and therefore, this leads to increase network utilization, but improves its performance. Furthermore, in order to get minimum video distortion transfer, AntSensNet is able to use an effective multi-path video packet scheduling. Lastly, to evaluate the efficiency of this new solution, we conduct extensive simulations and provide a detailed discussion regarding the impacts of diverse system parameters. This new algorithm has better convergence compared to typical routing algorithms in sensor networks and the traditional ant-based algorithm, as it affords more important QoS for multiple kinds of services in wireless multimedia sensor networks.

The splendid speed of technological progress results in the design of sensors capable of sensing and

producing multimedia information. Although, multimedia information includes pics, video, audio and scalar data - each deserves its own metrics, these features of multimedia sensor networks rely on effective approaches in order to meet QoS needs. Given such motivation, this study suggests a QoS routing algorithm such as AntSensNet for WMSNs depending on an Ant Colony optimization platform and a biologically inspired clustering process. The routing algorithm, besides, grants diverse categories of traffic submitted to the applications requirements. To guide the selection of CHs in a totally interrupted manner, the clustering element depends on specific agents (ants). Another ant-based clustering algorithm and in comparison with T-ANT, this new clustering process fulfils CH connection forever with lower energy costs. Routing comprises both reactive and proactive components. In a reactive path setup aimed at the classes of traffic in the multimedia sensor networks, the algorithm can choose methods to satisfy the application QoS needs, hence, this will enhance network performance. Multimedia information is transferred through the found paths. Over the course of the session, paths are continuously assessed and enhanced in a proactive way. Simulation results present that the performance of AntSensNet outperforms the standard AODV in terms of delivery ratio, end-to-end delay and routing overhead. Simulation results adhere to the idea that the suggested distortion reduction mechanism adopted to transport video packets leads to better quality video than other protocols for multimedia transport (TPGF and ASAR) [16].

Mobile TLM Architecture: Rashvand *et al.* (2008) A general study of the emerging wireless and networking technologies and their use to enhance the utmost aim of international health through ways of deployment of a telemedicine paradigm is discussed. To accomplish their goals, the authors carry out a state-of-the-art research of present wireless and medical sensor technologies in conjunction with investigation of continuously increasing pressures for a better medical service all over the world triggered by the era of population growth, social changes. The research conveys that despite available superior technological solutions, the services are mainly so costly, totally insufficient to meet the increasing demand. Besides, it suggests a flagship solution to ensure the best use of the future generation of 'wireless computing' for building a new harmonized medical infrastructure for which the authors try to enhance researchers in the progress of an innovative media-independent ubiquitous wireless telemedicine system for more cost effective superior quality medical services.

According to a study of TLM development, this research examines the new available wireless technological abilities to recognize the key chances to remove the critical pitfalls dealing with e-health and TLM. The 'ubiquitous wireless' function, then,will play a key role in future TLM as it can take over access, information and communication processing of healthcare information that can benefit from recent potential sensors and wearable systems for continuous medical support services. The suggested solution of UWTM aims at improving a ubiquitous e-health platform depending on solution that can assist the deployment of our purpose, TLM paradigm: 'Any Content, Any Service Anytime, Anywhere, on any Device [17].

Mechanism for Telemedicine Traffic Transmission over Wireless Cellular Networks: Qiao *et al*. (2009) For the last few years, Telemedicine traffic transmission over wireless cellular networks has witnessed tremendous development. It is also worth mentioning that in comparison to all other types of traffic in the cellular network, multimedia telemedicine traffic has highest transmission priority mainly due to the fact that this type of traffic carries critical information regarding the patients' condition. The necessity for expedited and adequate transmission of telemedicine traffic calls, however, for an ensured bandwidth to telemedicine users. This creates a tradeoff between the satisfaction of the very strict Quality of Service needs of telemedicine traffic and the loss of the ensured bandwidth in the numerous cases when it is left unused, owing to the infrequent nature of telemedicine traffic. Furthermore, this study suggests a fair scheduling mechanism for telemedicine traffic transfer over wireless cellular networks. While offering full priority to telemedicine traffic,the system fulfils high channel bandwidth use [18].

Infrastructure to Provide Voice and Data Network: Zambrano *et al.* (2012) A design methodology for a pilot communications infrastructure to enable Telemedicine services in ambulatory primary health care centers located within "Baruta" and "El Hatillo" municipalities in Venezuela's Miranda state. The main goal of the suggested infrastructure is to afford voice and data network connectivity between these primary healthcare centers and a chief facility, a local major hospital. The design of the infrastructure is based on a prior evaluation of the physical infrastructure and medical resources available at the ambulatory centers, as well as the features of their surroundings. After considering several other alternatives, a wireless IEEE 802.11 technology is selected as being the most appropriate for this specific application.

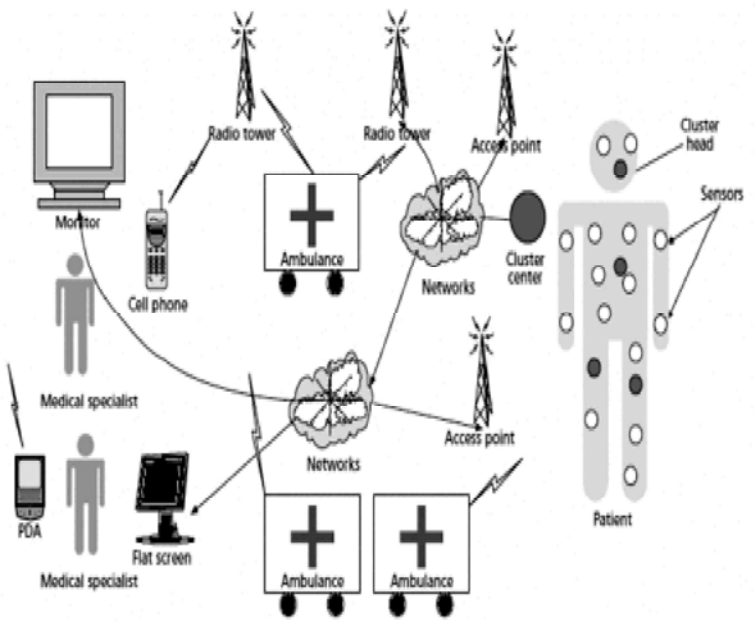

Fig. 1: Mobile TLM architecture

The used "selection criteria" included characteristics such as technical adequacy, ease and cost of installation and operation, etc... Both physical and logical aspects of the infrastructure are as well included in the design. The design's performance is testified under the simultaneous use of diverse applications regarding quality of service, bandwidth and delay parameters. Simulations results prove the practicality of the suggested communication infrastructure for this type of primary medical centers [19].

Two Techniques to Solve Loss Bandwidth: Qiao, *et al*. (2011) Telemedicine traffic conveys critical data regarding a patients' condition; thus, compared with all other types of traffic in the cellular network, it needs the highest transfer priority. The requirement for expedited errorless transmission of multimedia telemedicine traffic calls for an ensured bandwidth to telemedicine users. However, this condition results in a tradeoff between the satisfaction of the very strict quality-of-service (QoS) needs of telemedicine traffic and the loss of this ensured bandwidth in the numerous cases when it is left unused due to the infrequent nature of telemedicine traffic. This research suggests and compiles the following two techniques to resolve this complex problem: 1) an adaptive bandwidth reservation plan depending on road map information and on user mobility and 2) a fair scheduling scheme for telemedicine traffic transmission over wireless cellular networks

The importance of errorless and expedited telemedicine traffic transmission over wireless cellular networks quickly becomes a very important issue mostly due to the actual systems' capability to afford high QoS to transmissions from mobile telemedicine terminals. Current studies have been only interested in the transmission of telemedicine traffic over the cellular network, without considering the equally important fact that regular traffic has strict QoS needs as well. Hence, we should practically focus on the effective integration of the two traffic categories to get adequate solution. Moreover, this research suggests, for the first time in the relevant literature to the best of our knowledge, the combination of a fair and effective scheduling scheme and an adaptive bandwidth reservation scheme that allows the integration of highest priority telemedicine traffic transfer with regular wireless traffic over cellular networks. Our extensive simulation study includes also all major sorts of recent telemedicine applications (i.e., ECG, X-ray, video and medical still images), as well as the most well-known "regular" applications (i.e., voice, video, e-mail and web). Due to distance based data reports to fulfill seamless handoff, as well as new scheduling ideas, our proposal, which is evaluated over a hexagonal cellular structure, affords full priority and satisfies the very strict QoS needs of telemedicine traffic without violating the QoS of regular traffic, even in the case of high traffic loads [20].

Experiments for Wireless (Audio and Video) Communication and Quality of Service: Liu *et al.* (2009) The Auxiliary Telemedicine System (ATS) is considered

as a novel promising industry. The study integrates a lot of features in the system mostly owing to the aging population trends and the needs of the chronically ill. For instance, to enable patients living in the home to have more complete care, measurement equipment and information system should be integrated. Moreover, the doctor can make use of audio and video chat online diagnosis when the patient necessitates an online consultation. Then, according to the data records in the storage system,doctors can discuss and judge. In the ATS, audio and video quality is very important for the video calls for interaction. Hence, three experiments for wireless audio and video communication Quality of Service (QoS) are respectively suggested in this paper, besides, NS2 simulation software are used in the three experiments. According to the final experimental results, it is proven that viral intensity of factors impact on the network quality of service,including GOP (Group of Picture) pattern, compressed quantitative parameters (quantization value), length of the packet (packet size) and packet error rate (packet error rate).

This used far from diabetes patient's monitoring system and patient interactive and can lead to a more convenient and more efficient medical course. Due to this system the patient`s taking medicine will be enhanced. Blood glucose monitoring remind improves the measuring patient`s habit. It can also grant more detailed materials for doctor's reference while seeking healthcare advice, besides can increase self- management. The system judges tentatively first, can offer patient and doctor further treat while finding abnormality. On-site appointment or On-line healthcare consultation can decrease a lot of time and cost and can effectively enhance healthcare quality and efficiency. In addition,in a simulated of this study, On-line medical consultation or On-line meeting improves distributed channel access(EDCA) mode and Differentiated Service(DiffServ) network model and in the transmission of information under the EDCA mode is similar to 802.11b distributed coordination function (DCF), difference is that queue from a queue into four, so when the channel is idle queue waiting time of the queue, which is decision by the Arbitration Inter Frame Space (AIFS) and if additional time is required, waiting for back off, then because of the higher priority queue to send its competitive small window, the back off value randomly generated is smaller, that is a greater chance of competition as it has the right to use the channel. The real-time information services can be immediate; DdiffServ model and have a low latency, low packet loss rate, such as nature, so that multimedia data transmission through the network will not have more time than the phenomenon of packet transmission delay. It is not easy during transmission of a small number of lost packets. Multimedia transmission is therefore able to maintain a certain quality of service standards. According to the above three experiments, various factors can influence the network quality of service, including the group of picture pattern, compression quantization value, the length of packet and packet error rate. In a GOP, if the I-frame re-transmission of the packet loss process, resulting in the receiver inability to decode correctly, then all the P-frame and B-frame will be unable to decode it, so that would lead to admit that all GOP in the screen become useless and image quality is obviously lower. Hence, in the network to send video images, we must take into consideration the situation of the network to decide to adopt the GOP pattern; an image coding can be selected to a different quantization scale for image compression, the coding of the quantization scale will be affected by the smaller amount of data, but the image will become of poor quality. The amount of data will affect the size of each frame that will be divided by the number of packets; in image transfer, the packets will affect the length of each frame a number of separate packets. On the Internet for video conferencing, the packet error rate will change the probability of packet loss and affect the image quality [21].

Telemedicine System Requires an Acceptable Network Quality of Service and Cost: Putra, *et al*. (2009) Telemedicine system requires an acceptable network quality of service and cost. IEEE 802.11 wireless LAN technology has been developed to provide scalable and low cost network. For telemedicine applications however, the technology does not meet the quality of service requirement yet. A new cross layer design of wireless LAN is suggested in order to solve this problem. The design depends on IEEE 802.11g standard with modification in data link and physical layer. This is carried out in NS2 simulation environment. The simulation is implemented to deliver the video data for telemedicine application. Simulation result proves that the new cross layer design has better network quality of service for PSNR (Peak Signal Noise Ratio) and delay values than the conventional wireless LAN. Thus, the new design has a potential to be used in telemedicine system.

A new cross layer design of wireless LAN is applied and simulated in NS2 environment. The simulation is implemented to deliver the multimedia telemedicine data over IEEE 802.11g wireless LAN. Simulation result shows that the new cross layer design can deliver better quality of service than the conventional wireless network. This affords an early indication that the new cross layer design is suitable for telemedicine applications [22].

End-to-end QoS in an Environmental Monitoring Network: Balakrishnan *et al.* (2010) Information prioritization would be crucial for several emerging applications of wireless and sensor networks (WSNs) that necessitate real-time event monitoring (disaster/intrusion monitoring, industrial automation, telemedicine). The actual Quality-of-Service (QoS) literature for sensor applications is still premature, since most of the development efforts are focused on energy efficiency and sensor mote development. In this study, we propose a system configuration of end-to-end QoS in an environmental monitoring network comprising local sensor and back-haul Wi-Fi network technologies. We also identify the performance gains accomplished through rated bandwidth allocation for the sensor information flow across the integrated WSN.

Affords a practical system application of end-to-end QoS in integrated sensor-Wi-Fi network using off-the shelf hardware/software solutions. With emerging applications of wireless and sensor networks in emergency tracking (disaster) and real-time monitoring (intrusion), there is a strong need to prove QoS abilities in sensor networks. Also, preserving the data priority across heterogeneous wireless interfaces to fulfil true end-to-end, QoS will be crucial, since sensor deployments would inherently involve long-range wireless technologies for back-haul support [23].

Telemedicine and Telehealth Systems Using Optical-Wireless Radio-Over-Fiber Technology: Chowdhury *et al.* (2011) Development of system technology for effective networking infrastructure for next generation e-health applications is addressed. In addition, we propose an integrated optical wireless access architecture depending on radio-over-fiber technology in order to afford super broadband, ultra low latency connectivity among several telemedicine modalities to facilitate real-time and near real time communication for remote medical services.

We suggest a broadband transport and access network architecture for next generation telemedicine as well as telehealth systems using integrated optical-wireless radio-over-fiber technology. This can conveniently afford protocol independent connectivity among diverse telemedicine entities with existing or emerging wireless services such as public safety, 3G, 4G/LTE, Wi-Fi and WiMAX together with future-proof 60-GHz mm-waveband wireless as well as PON based wired services for ultra low-latency real-time transfer of uncompressed super-high resolution images and video contents. A proof-of-concept experimental demonstration is implemented to established gigabit wireless over fiber link between the high resolution pathological image repository server and remotely located interactive client terminal. Furthermore,we believe that, when developed in close collaboration with the medical and health services communities, the suggested converged network system can facilitate new classes of next-generation telehealth and telemedicine services for timely high-quality and affordable remote medical delivery [24].

Chowdhury *et al*. (2010) Delivering affordable high-quality E-health care services necessitates efficient telecommunication and multimedia technologies in conjunction with medical expertise. A telecommunication and networking architecture for carrying out next generation Telemedicine and Telehealth systems is suggested and proved in this paper. Our integrated optical wireless based network provides super broadband, ultra low latency connectivity for voice, video, image and data across various telemedicine modalities to facilitate real-time and near real-time communication of remote medical data.

Depending on integrated optical-wireless radio-over-fiber technology,we suggest as well a broadband transport and access network architecture for next generation Telemedicine and Telehealth systems. It can conveniently provide protocol-independent connectivity among diverse telemedicine entities which can utilize existing or emerging wireless services such as Public safety, 3G, 4G/LTE, Wi-Fi and WiMAX together with future proof 60-GHz mm-waveband radio for ultra low-latency real time transfer of uncompressed super-high resolution images and video content. A proof-of-concept experimental demonstration is suggested and the transfer performance of the system for uncompressed HD video and image transfer using 60-GHz mm-wave radio over 25km single mode fiber is evaluated. We believe that the suggested network system, when developed in close interaction with the medical and health services communities can facilitate application of large classes of next-generation Telehealth and Telemedicine services for high-quality and affordable remote medical delivery [25].

Focus on the Analysis of Recent Satellite-Based Telemedicine Networks: Cova *et al.* (2009) E-Health applications necessitate communications systems and user interfaces with high technical skills to meet the needs of the overwhelming technological progress in the healthcare sector. This proposal is interested in analysing current satellite-based telemedicine networks, making emphasis in its technical characteristic, e-health applications and services. Gives an overview of the actual trends of the state-of-the art wireless technologies according to the guidelines of the Global Economics

Forum and to different workgroup's workshops of International Telecommunication Union (ITU) and presents a perspective of network architecture to provide e-health applications and Services according with emerging state-of-the-art wireless technologies. Lastly, a survey of some future applications that take advantage of the network capacity is proposed.

A perspective of network architecture depending on state-of-the-art wireless technologies and the analysis of recent satellite-based telemedicine networks. The suggested network will take advantage of the technical abilities of each technology permitting developers and scholars to establish a diversity of e-health applications that are able to meet the requirements of the springing technologies, resources and techniques of the medical field. These new applications and services must give additional value over the existing due to the improved performance of the network's resources. Ultra Mobile devices are the key tools that will pave the path to access Ubiquitous Broadband connections, to have Mobility and to be used as the main framework of personal e-health application and services [26].

E-Health Wireless Sensor Networks: Gama *et al*. (2010) For e-health wireless sensor networks shown significant traffic loads, MAC protocols based on deterministic scheduling algorithms are consensually considered more adequate than protocols based on random access algorithms. TDMA-based MAC protocols,indeed, can control the delay bound and save power by eliminating collisions. However, these protocols always necessitate some expedite scheme to assign the super frame time-slots to the network devices that need to transfer information. As proven in this research, we can accomplish knowing that patients of an e-health wireless network are normally monitored by the same number and types of motes, originating a regular traffic pattern and a simple collaborative time-slot allocation algorithm. The announcement of time-slot allocation by the network coordinator is avoided in the proposed algorithm, which may lead to enhance the packet delivery ratio and decrease the energy consumption in the e-health wireless network.

For the sake of energy saving and packet delivery ratio improvement, protocols using short size beacons, such as iLPRT, are valuable. A collaborative link scheduling algorithm may be adopted by the motes of the WSN as time-slot allocation cannot be announced by a BS transferring short size beacons. Taking advantage of the regular traffic pattern found in e–health wireless networks, as well of the homogeneity regarding the number and types of motes found in the BSNs of an e–health WSN, a simple collaborative time-slot scheduling algorithm can accomplish this aim. As the proposed algorithm is computationally non-intensive, it is adequate for motes with very limited computational resources. Preliminary experimental tests prove a reduction in the packet delivery ratio, however it is significantly more effective to augment the number of retransmissions than to decrease the beacon frame size. When compared with a single retransmission, two retransmissions reveal a remarkable progress in the QoS of the e-health WSN regarding the packet delivery ratio [27].

Regulatory Framework and Key Issues Concerning Telemedicine and E-Health Systems Development: LE GLEDIC, *et al.* (2011) How to incorporate new technologies into the current regulatory framework remains a long standing challenge for regulators. This is especially applicable to telemedicine and e-health systems. Thus, this survey studies the regulatory framework and a key issue linked to telemedicine and e-health systems progress and suggests potential solutions.

Once considered futuristic technology, telemedicine however a reality is now and is a growing necessity in healthcare practices. Facing user interfaces, technological and reimbursement issues, effective means and adjusted regulatory platform to accompany progress and innovations as well as the assessment of services in telemedicine, are all still needed. Diverse programs have been recently directed or being prepared to better understand requirements, restraints and goals of the different stakeholders (developers, users [patients and professionals], regulators…) applied for the progress of these very particular healthcare products. Intimate relationship and interaction between these stakeholders are key to enhance a tailored regulatory platform permitting innovation [28].

Some Guidelines the Success of Implementing New ICT Initiatives in E-Health: SULTAN, S *et al* (2009) New Information and Communication Technology (ICT) solutions for e-Health are increasingly being carried out and effectively used. A great deal of studies interested in this venture usually include market research, usability studies and testing. The management of the change process is one of the more important aspects which is often overlooked, however it directly affects the sustainability of the new technology. This proposal shows some guidelines grounded in the Social Sciences that could foster the success of implementing new ICT initiatives in e-Health. A case study is conducted on the introduction of a mobile medical care management system

called myDR (my Daily Record). The research aims further to stress the value of the change management process and its key role in the progress of new medical initiatives. The case study shows that when the proper change management mechanisms are in their appropriate place, people tend to use the new system.

As illustrated in this paper, change management highly impacts on the sustainability of new e-Health initiatives. New habits and routines can best enhance personal change. This study is mostly interested in a mobile telemedicine system that gives an aid to acquire new self-care rituals depending on the availability and accessibility of patient medical data. Change management involves a number of issues including assessment, challenge, support, results and the context and we present how these issues can be handled when designing a mobile telemedicine system, guaranteeing greater chance of success. The key imperative here is personalizing to the patient's needs as well as affording feedback that is both timely and relevant. The crafting of new rituals is built on this understanding [29].

Using Mobile Computing Devices: ROS, *et al.* (2008) To enhance patient care, there has been recently a need to incorporate the use of mobile computing devices in hospital or clinical applications. The development of wireless technology invent a unique system of communication that can submit the requirements of e-health system robustness, reliability and accuracy needs. This proposal shows an interactive wireless mechanism for medical data that permits patient to access instrumentation output data and healthcare practitioners using mobile computing devices to enter patient details. Furthermore,mobile and wireless information technology concepts that can be used to interact with a medical information system for controlling real-time data streaming medical instruments are examined.

Suggests an integrated networked ECG monitoring system that uses mobile computing devices as a means of communication. The MISN is composed of medical information nodes (MINs) networked to a central server. We can have access to each MIN through a mobile computing device via a Bluetooth connection. The MIN also allows the output of an ECG instrument to be viewed using web browser and to record the ECG instrument's output into a file that is saved on a central server. This means that the ECG Instrument's output can be immediately classified into a patient database without further human interaction. Two methods for displaying real-time waveforms using a conventional image formats such as JPEG or a custom data format are analyzed. Besides,we realize that using a custom data format is to represent an ECG waveform that does not need a high data rate but a custom program to view the ECG waveform. One of the merits of using Bluetooth is that its short range guarantees that only when the user is within a specific location,that the MIN can be accessed. This permits the MIN to afford location particular access to healthcare instruments based on the user`s location. We also analyze the Bluetooth Serial Port and Dialup profiles for streaming the real-time ECG waveform data. We recognize that Bluetooth Serial Profile is ideal to be used because it permits further information rate and necessitates less complexity of establishing a connection between the MIN and the MCD [30].

Mendez-Rangel *et al.* (2012) this research studies a Network Design Methodology proposal for E-Health in Rural Areas of Developing Countries. Besides the technical parameters that have interaction with the common design of communications networks, in this methodology we take into consideration social (population distribution, population morbidity indices, population mortality indices, region epidemiology indices, among others) and regulatory parameters resulting from the particular requirements of rural zones. Hence, the main phases of the suggested methodology are: to delimit the network coverage area, select the available services, analyze traffic flows, design network architecture and validate the network design. Lastly, the methodology validation is displayed through a case study of Cundinamarca department of Colombia.

While analyzing the Related Works,we have not recognize a completely methodological guide that includes the entire E-Health network design steps, even some authors have explained that after carrying out the E-health networks, some changes needs to be applied because some technical, economic and social parameters have not been taken into consideration. For this reason,the network design methodology for E-Health in rural areas for developing countries suggested in the study differs from other studies in this area because we have taken into consideration the social and regulatory parameters. These parameters are involved and we obtain a proposal those results in providing an E-Health network that enhances health services according to requirements of the coverage network area [31]

Telemedicine Information Monitoring System: CHIH-JEN, *et al.* (2008) This project aims mainly to develop a telemedicine monitoring data system, the composition of which primarily contains wireless vital sign monitoring devices, a healthcare gateway and a health services information platform. The healthcare gateway, as one of these three pillars, plays the

intermediary function. The mechanism also endorses the Open Services Gateway Initiative (OSGi) platform, which may grant individual patients dynamically adjusted healthcare service programs. Besides, ZigBee-built in wireless modules are used in the data transfer between vital sign monitoring devices and the healthcare gateway. Vital sign data parameters, including ECG, SPO2, blood pressure, glucose and body temperature, can be transferred to the healthcare gateway via ZigBee and then are conveyed through the Internet to the health services information platform. This integrated healthcare system is depended on the Service-Oriented Architecture (SOA) concept, affording a mechanism that enables the healthcare management for individuals. Therefore, persons with chronic illnesses as well as the elderly can benefit from round-the-clock telemedicine services that are afforded [32].

System for Remote Monitoring Blood Pressure and Heart Rate: Rotariu, *et al.* (2011) The realization of a remote blood pressure and heart rate monitoring system, is also examined in this study,based on wireless devices that are capable to measure and transmit patient's arterial blood pressure and heart rate. The use of the suggested mechanism is suitable for continuous long-time patient monitoring as a part of a diagnostic procedure. The patient can receive healthcare aid of a chronic condition, or it can be control during recovery from a terrible event or surgical procedure. Commercially available devices, low power microcontrollers and RF transceivers are used in order to perform the measurements and transmit them to the patient monitoring device. The patient monitoring device, in form of a PDA that running a personal heart monitor application, receives the blood pressure systolic and diastolic values and heart rate, activates the alarms when these values exceed the preset limits and interacts regularly with the central monitoring server by using WiFi or GSM/GPRS connection. A graphical user interface running on the central monitoring server for displaying the measurements is developed. Power consumption is also reduced by the used devices.

The highlights a prototype of a system for remote monitoring of blood pressure and heart rate. The system tries to satisfy the users` requirements, redesigning cost and augmenting extensibility and reliability. Despite their main role of collecting data, blood pressure and heart rate monitors still remains the most used device. Data processing and analysis are performed offline, making the device impractical for continual monitoring and early detection of medical disorders. Such devices may limit the patient's activity and their comfort, due to the unwieldy wires between the sensors and the monitoring device. For the suggested mechanism information recording and processing are carried out in real time. Moreover, the suggested mechanism uses devices with low power consumption suitable for battery operation and high peak performance. The integrated system affords continuous healthcare for patients, through Internet network infrastructure. With the presence of wireless healthcare systems and telemedicine services, continuous and pervasive medical monitoring is now available [33].

Framework for Mobile Patient Monitoring Systems: Pawar, *et al.* (2012) A mobile patient monitoring system makes use of mobile computing and wireless communication technologies for continuous or regular measurement and analysis of bio signals of a mobile patient. In a number of trials these mechanisms have proved their user-friendliness, accuracy and efficiency for both patients and healthcare professionals. A generic architecture, associated terminology and a classificatory framework for comparing mobile patient monitoring systems are also suggested in this research. Then, this comparison framework is implemented to classify six mobile patient monitoring systems selected according to the following criteria: use of diverse mobile communication techniques, evidence of practical trials and availability of sufficient published scientific information. Using the example of epilepsy monitoring, we also explain how to use this framework to identify characteristic sets of prospective real-time mobile patient monitoring systems. Moreover, this survey studies not only healthcare professionals, but also computer professionals. Therefore, it affords, for healthcare professionals, an overall understanding of technical aspects of the mobile patient monitoring systems and identifies a number of issues suggested by the use of these systems. Healthcare professionals can use the suggested framework for comparing mobile patient monitoring systems to determine characteristic sets of prospective mobile patient monitoring systems to address particular medical requirements. It is assumed that computer professionals can benefit by gaining a better understanding of the latest inventions in the important prevailing application area of mobile patient monitoring systems.

Suggests a generic architecture, associated terminology and a classificatory framework for mobile patient monitoring systems. From the literature, six mobile patient monitoring systems are classified due to the suggested framework. Most of the systems are acknowledged to be user-friendly and convenient to use for both patients and healthcare professionals; however where there is system instability or technical problems

this not surprisingly leads to annoyance and decreases acceptance. The main problems/observations are framed as follows: (1) reported wireless network demerits are linked to the bandwidth insufficiency for bio signals transmitting, high delay and unavailability of wireless network coverage. (2) QoS requirements are highly (clinical) application-specific. The bandwidth requirements need to accomplish the demanded bio signals delivery rate and quality are explicitly affirmed in some of the articles, however network delay and jitter requirements also need to be determined for critical healthcare applications. (3) Most of the surveyed mobile patient monitoring systems are in strong need for urgent solutions to guarantee end-to-end security of bio signals data. (4) The systems to restrict loss of bio signals during their change from the sensors to the back-end system are necessary, so that the healthcare professionals access high quality bio signals [34].

Wireless Communication Technologies Currently Used in E-Health Systems: Delmastro, (2012) the evolution of wireless communication technologies paves the way to the definition of innovative e-Health systems that aims at affording a continuous and remote assistance to patients and novel means to enhance the achievements of the healthcare personnel. This proposal shows a current survey of wireless communication technologies implemented in e-Health systems, deeply analyzing communication standards, protocols and performance results are accomplished in this sector. The definition of new research issues and possible solutions for future e-Health system are also introduced due to the analysis of advantages and drawbacks of current technologies.

Tends also to present a current survey of wireless communication technologies used in e-Health systems and possible future scenarios involving new standards and networking protocols. Currently, a research on e-Health systems and necessities stress the need to define even more personal and pervasive solutions and tends to enhance the quality of life and care of patients in their daily life, as well as the optimization of medical personnel productivity and work flow. We mainly examine the goals and application scenarios of e-Health systems, by suggesting a full description of both patient-centered and hospital-centered system architectures, detecting the information flows, their needs and the best interaction technologies that they can carry out. This analysis and mainly the presentation of practical solutions suggested in literature, stresses the strong recent research activity conducted in this field, as well as a set of open issues that make it one of the hottest ICT research area. However, currently, most of the solutions are mainly depending on proprietary implementations, based on particular devices available on the market. Even if using the same communication technology, this leads to a huge need of interoperability between different e-Health systems and services. Jointly with industrial partners, the research community works to define standards and application profiles dedicated to e-Health systems in order to overcome this obstacle. All in all, the results obtained so far consist the basis for a common definition of Pervasive Healthcare, gathering users' requirements, technological innovations and the final development of effective solutions to optimize the current health services [35].
Healthcare delivery systems through telemedicine.

Raju *et al.* (2012) Information and communication technology (ICT) enables telemedicine to become an efficient model for medical delivery. Regardless their location for remote monitoring and timely diagnosis, patients can network with this technology. In this survey,we elaborate on our telemedicine experiences and endorse methodologies,and stress the diverse design aspects to be taking into consideration for making telemedicine efficient. Hence, it is worth mentioning that according to our study, this technology can be utilized as an accurate screening means for patients at remote centers and undertakes preventive measures for potential patients at risk of cardiovascular disease.

Accurate healthcare delivery systems through telemedicine are mainly due to the communication technology progress which can help patients to be always networked regardless their location. In fact, this leads to remote monitoring and diagnosis for patients with multiple disease conditions and it involves even patients with implantable devices. A splendid advantage of telemedicine by having networked patients is the availability of timely diagnosis. It is well known that the distance decay effects, i.e., distance in terms of cost and distance acting as a deterrent to people consulting is one important factor that telemedicine overcomes. In rural areas,Telemedicine can not bring about cure to all the existing problems, but it will certainly assist in handling the vast range of difficulties. A rise in the general awareness of good health across the region can also be guaranteed by Telemedicine owing to the availability of specialist opinions. Our initiatives also bring into realization that the same network link serves as an effective way for training of paramedics and nurses,and updating healthcare professionals at remote centers with the latest inventions in healthcare sciences through CME programs [36].

Chang *et al.* (2011) In the information society and within the prevailing electronic medical service (e-health), the new concept of healthcare treatment is identified to

enhance health and healthcare. Moreover,we focus on the improvement of internal service systems in order to deliver e-Health more efficiently. Furthermore, we divide the e-Health delivery system into three parts depending on service blueprinting: 1. support processes, 2. intra-organization communication and 3. contact employees. We hypothesize that a good e-Health support processes in terms of staff training and IT support activities can highly contribute to higher levels of contact employees' service quality, which in turn enhances the quality of customer actions. We are also interested in investigating the role of intra-organizational communication in the e-Health service delivery. We identify four types of intra-organizational communication in e-Health and explore their effects on employee service quality as well [37].

Mobile Information System for Healthcare: Bai *et al*. (2010) To enhance total quality of services, knowledge sharing has become a highly challenging issue in the E-health field. However, to have shared concepts, vocabulary plus a specification of its intended meaning, namely an ontology, can hinder developing e-health system,and this is mainly because the E-health subject is a multidisciplinary and cross-organizational area. A knowledge sharing ontology on the basis of Activity Theory is presented in this paper. It is undeniable that Activity Theory can help attain high level and rich ontology for the developers of E-health system to encompass the multidisciplinary and cross-organizational knowledge. Lastly, by displaying our project IMIS (Integrated Mobile Information System for Healthcare) that utilizes the activity theory as ontological architecture for the construction of the whole system, we validate our method [38].

Satellite/Terrestrial Interactive E-Health System: Ronga, *et al.* (2010) In this study, we investigate the integrated satellite/terrestrial interactive e-health system, which has been developed within the framework of the European Space Agency (ESA) project telemedicine Services for HEALTH (TESHEALTH) in collaboration among industry, academia and hospitals. The implementation of a secure scalable and fiexible heterogeneous network capable of providing the appropriate infrastructure is analyzed, focusing on the end to end QoS solution, that satisfies the quality level required by the telemedicine applications. Moreover the developed interactive Service Platform, which aims at sharing health information among the different applications and services (Self-Care and Assisted Services) and includes real time audio and video interactions among patients, specialists and health service providers, is described.

The suggested integrated satellite/terrestrial interactive e-health system paves the path to a new way of relating people to their health, their lifestyle and well-being in general. TESHEALTH system provides a technological platform that permits: to examine the personal health conduct and healthcare history of each individual, to enhance care and outcomes on a patient-by-patient basis, to enable connected health programs and to meet patients where they live, with means and services that support them when dealing with their own health, leveraging the healthcare system. The implemented heterogeneous network architecture enables the user especially to have access to the Service Platform through different kind of technologies, affording the adequate infrastructure that meets the quality level needed by the telemedicine applications and that enhances the implementation of satellite communications [39].

Chang *et al.* (2011) this study tends to establish and ameliorate an evaluation criterion that considers both service providers' and patients' value perspectives in assessing e-Health service performance. The research framework extends the service-profit chain by integrating service triangle concept, emphasizing the relationships among three stakeholders: the firm, the customers and the employees. Hence, it is assumed that this research may contribute the literature by providing an e-Health service performance evaluation platform, which systematically develops a scale to assess e-Health service quality that concerns value perspectives of multiple stakeholders and their interactions [40].

E-Health Interconnection Infrastructure: Liu *et al*. (2011) The research highlights the great demand for a national e-Health interconnection infrastructure and for the needs of supporting design guidelines. This proposal demonstrates our method towards an e-Health processing QoS framework for network infrastructure management in order to design and implement e-Health communication quality of service guarantees.

In order to guarantee communication and processing quality of e-Health messages, this survey proposes a new method towards desired digital health networking services through a QoS platform for network infrastructure management. For the first time, a list of e-Health QoS needs is published in this proposal which contains interaction services, processing flows and integrated management. A futuristic workflows and e-Health messaging fields are also listed as well as the layers of underlying processing infrastructure. This study submits the much needed guidelines for a leap from digital healthcare trials into the design and implementation of a national level e-Health interconnection infrastructure [41].

E-Health and Related Opportunities: Khalifehsoltani, *et al.* (2010) Nowadays,quality of services and people's lifestyle have changed owing to information systems and web technologies, namely Electronic Health which is a new and efficient approach for affording medical and healthcare services in the society and improving relations between specialists, patients and all of health system users. Unlucky, although E-health is not a new phenomenon as it was quite likely adhered to the most special healthcare areas, this technology is still considered far from the main stream of medical process. Developing Countries are especially facing many problems in the healthcare and medical services such as financial needs, resources, proficiency, lack of physician and other healthcare professionals. All in all, this study discusses the importance of E-health and related Opportunities in Developing Countries. Besides, it handles challenges of applying Telemedicine in these countries. The result has been shown in a new model called "e-Health Challenges in Developing Countries". Furthermore, we will address the e-Health Strategy model for Developing Countries after studying and classification the proposed strategies. Lastly, in this area, we are going to mention some experiences of these countries.

Broadly speaking, this paper also discusses the diverse dimensions of using the modern Information Technologies and Electronic Commerce including advantages and problems of the E-health system. Developing Countries must take into consideration the E-health services in their strategic plan. This study, therefore, addresses the Challenges and Opportunities in a way that enhances E-health in these countries. It will assist policy makers to have better strategies regarding these points. In the future,we can examine existing plans and design proper strategy for enhancing the Telemedicine in Developing Countries depending on obtained experiments from this research [42].

Development of Remote Medical Services: Noimanee *et al.* (2012) this article aims to publish research, development of remote medical services. Also known as e-Health for medical application National Broadband Project. The prototype HRH Princess Maha Chakri Sirindhorn Medical Center Nakhon Nayok Province. This project integrates other sciences such as Biomedical Engineering, Telecommunications Engineering, Electronic Engineering and Computing Engineering and includes both direct medical and so on. This project is interested in affording medical services to around communities who live within the radius of radio wave propagation in the area of 2,500-2,520 MHz for spread to Thailand based on international standards of wireless broadband technology.

Even though it is still hard to design systems which have a WiMAX as base station delays the import of radio communications, coordination between the organizations, etc, especially with the first year of research funding, researchers have strived to accomplish this mission and to find a solution to the project in order to continue their research. The proposal tries to investigate the budget process to guarantee maximum gain,as the first recipient of research grants from the NTC to operate such a project would have difficulty to understand the structure of the high-speed wireless broadband network [43]

Wireless Telemedicine Components of an Integrated System for E-Medicine: Chorbev *et al*. (2008) This paper suggests a deep analysis of the wireless telemedicine components of an integrated system for e-medicine that we present and carry out in the Republic of Macedonia. The implementation of new wireless broadband technologies ensures creation of telemedicine services previously only via cable connections. To accomplish implementing our telemedicine functionalities, WiMAX and Wi-Fi are our adopted wireless technologies. They are, besides, shortly described and a number of proposed and afforded services are explained. Moreover, to implement the services, advanced web programming technologies are extensively used. Guidelines are given for further enhancement and application. The gained experience implies that it can be valid in areas or countries with similar natural or economical conditions.

Before it could compete with developed countries, the growing information society in the Republic of Macedonia has a long way to go. E-medicine follows step along with other growing IT areas. However, in this paper, according to the suggested framework as well as the steps already taken to implement it, we can assume a fast trip toward a modern system that could develop the quality of medical services, decrease costs and augment patients satisfaction and health. Due to specific circumstances, the use of wireless technologies for various applications is emphasized in the Republic of Macedonia, besides, owing to modern wireless telecommunication technologies like WiMAX, the provision of telemedicine services to places previously unreachable by landlines is highly accessible. Hence, it is worth mentioning that thanks to the constantly new prevailing telecommunication technologies and the software progress, the implementation of novel telemedicine services that were previously only imaginable can be now valid. Web services and XML

enable the integration of diverse Medical Information Systems into an Integrated System for E-Medicine. High bandwidth and reliability of WiMAX assist the integration with bringing remote hospitals ever closer [44].

Comparison Between IEEE 802.11/WLAN and IEEE 802.16/WiMAX: Zhang *et al.* (2010) Wireless telemedicine, also refers to as mobile health, which capitalizes on advances of wireless technologies to deliver medical care and share medical knowledge anywhere and anytime, overcomes most of geographical, temporal and even organizational barriers to facilitate remote diagnosis and monitoring and exchange of medical data and records. Hence, the application of integrated IEEE 802.16/WiMAX and IEEE 802.11/WLAN broadband wireless access technologies,as well as the related protocol issues for telemedicine services are investigated in this proposal. First off, we check IEEE 802.11/WLAN and IEEE 802.16/WiMAX technologies and make a comparison between IEEE 802.11/WLAN and IEEE 802.16/WiMAX. After that, we discuss some open proposal issues in the integrated IEEE 802.16/WiMAX and IEEE 802.11/WLAN networks, mainly depending on QoS aid, radio resource management, scheduling and connection admission control schemes, as well as handover and mobility management. Lastly, applications and deployment scenarios of integrated IEEE 802.16/WiMAX and IEEE 802.11/WLAN for telemedicine services are further deliberated.

In addition, the implementation of integrated WiMAX and WLAN broadband wireless access technologies for telemedicine services and the related protocol issues are discussed in this article. A survey of WLAN and WiMAX networks is, besides, afforded and followed by a comparison of WLAN and WiMAX. The proposal, moreover, examines open research issues related to QoS support, radio resource management, scheduling and connection admission control, as well as handover management in the WLAN and WiMAX heterogeneous networks. Lastly, potential applications and deployment scenarios of WLAN and WiMAX heterogeneous networks for telemedicine services are, besides, treated and elicited [45].

Wireless Home Monitoring System of Health Care Monitoring Tasks: Marko *et al.* (2007) Cost effectiveness becomes the main reason behind the quality health care in aging populations. Information technology can enhance the productivity of health care facilities when applied with care. One area where savings can be made is patient monitoring in situations where hospitalization is not otherwise needed. This study deals with a secure wireless home monitoring system that can be implemented in diverse health care monitoring tasks.

The overall cost of health care is skyrocketing, as the populations, especially in western countries, are aging. This development helps scholars to discover new technological solutions to enhance the efficiency as well as the quality of care. Solutions that can reliably and safely relocate patients from the hospital to their homes are welcome, as each hospitalized person highlights the resources of already understaffed facilities. This study provides a system for patient home monitoring that not only can relocate the monitoring process to free hospital occupancies,but also make the monitoring results more reliable under certain conditions. Moreover, to ensure patients' privacy,great attention is paid to develop adequate security measures. At the same time the system is built with good traceability which can be seen beneficial for the legal protection of both the patient and the physician. Furthermore, it is undeniable that not only the technological solutions are capable to ensure security, but the personnel must also be instructed so that they know how to use systems in a secure manner. All in all, the technological readiness for our suggested system is good and the tool itself is relatively inexpensive [46].

Mechanism to Provide QoS for Telemedicine Applications: Chigan *et al.* (2006) Wireless LANs will play a key function in affording whenever and wherever connectivity for ubiquitous telemedicine applications. This survey is interested in granting QoS over the wireless channel between the Body Sensor Network (BSN) Gateway and the wireless Access Points (e.g., wireless hotspots in various locations). In the telemedicine application, it usually requires the periodic data and the data related to the occurrence of emergencies to be reported to the remote health care in a timely manner. The traditional QoS techniques support voice and data applications; however the sporadic nature of the emergency data in telemedicine systems makes it nontrivial to afford sufficient QoS support. This research, firstly, examines several alternative schemes for emergency QoS support in the telemedicine systems. It suggests as well an express dual channel (EDC) based QoS provisioning mechanism. The suggested mechanism is not only simple and full of efficient resources, but it also grants the minimum delay for the unexpected emergency information transfer. Simulation results show that the proposed EDC based solution provides satisfactory QoS for ubiquitous telemedicine applications.

Besides, this study suggests a promising mechanism to afford QoS for telemedicine applications. Designing a protocol to afford QoS depending on conventional methods is a highly important matter due to the highly erratic nature of these events. Solutions cannot be used for telemedicine application because traffic pattern depending on scheduling traditional QoS. But it will result in a highly inefficient method, if resources are saved. Therefore, our suggested dual channel based method, where the slim express secondary channel is dedicated for transmitting short Emergency Alert Message (EAM), can be a very efficient and clear way of providing QoS in ubiquitous telemedicine applications. The proposed solution uses the IEEE 802.11e standard as its baseline mechanism. The simulation results prove that this mechanism is not only simple and effective, but it also results in the minimum delay demanded by the erratic information transfer in telemedicine applications [47].

Efficient Transmission of Telemedicine Traffic: QIAO, L *et al* (2008) recently, cellular networks have been adopted as a testbed for the assessment of the quality of low-bandwidth telemedicine traffic transfer. The correct and rapid transfer of telemedicine traffic is of utmost importance, thus telemedicine video, audio and information cannot be treated similarly to regular traffic, but rather need to be offered absolute priority for transmitting over the wireless channel. On the other hand, if a portion of the bandwidth is dedicated to telemedicine traffic, this bandwidth will often be left unused as there is no constant need for transmission of telemedicine traffic in the network. This study, therefore, highlights the integration of telemedicine traffic with other traffic types in a cellular network, besides it suggests new planning ideas for the effective transfer of telemedicine traffic. [48]

Mapping of E-Health Service: Skorin-Kapov *et al*. (2010) E-Health services consists of a broad range of healthcare services delivered by using data and interaction technology. There is a need for network QoS control mechanisms that meet the often stringent necessities of such services in order to enhance existing as well as emerging e-Health services over converged next generation network (NGN) architectures. Furthermore, this paper assesses the QoS support for e-Health services in the context of the Evolved Packet System (EPS), specified by the Third Generation Partnership Project (3GPP) as amulti-access all-IP NGN. It also classifies heterogeneous e-Health services depending on context and network QoS needs and suggests a mapping to existing 3GPP QoS Class Identifiers (QCIs) that serve as a basis for the class-based QoS concept of the EPS. The suggested mapping tends to afford network operators with guidelines for meeting heterogeneous e-Health service necessities. For instance, it proposes the QoS needs for a prototype e-Health service supporting tele-consultation between a patient and a doctor and demonstrates the use of the suggested mapping to QCIs in standardized QoS control procedures

Owing to a possibly high effect on human life and wellbeing, e-Health services constitute a category of services for which the study on QoS necessities has moved beyond the well-known properties of individual media flows. It is proven that the actual classification and prioritization of flows may be determined thanks to the context in which the service is invoked. Our paper affords some general outlines and suggests mapping of e-Health service types to standardized QCIs in EPS as a next-generation communication technology. A use case of the E-consult service demonstrates how the mapping can be implemented [49].

End-to-End Communication Systems as a Medium of Delivery for Electronic Healthcare: Ullah (2012) With respect to its reliability leading to hesitation in acceptance of such services, the use of end-to-end communication systems as a medium of delivery for electronic medical (e-Health) services is considered to be uncertain. Besides,diverse influential dimensions that constitute stringent necessities on end-to-end communication systems, impact on user perception and might hamper user acceptance does exist. The later is referred to as Quality of Experience (QoE), which among others relies on the Quality of Service (QoS) of the end-to-end communication system. QoE is considered as a key component determining user acceptance. This research emphasizes and examines features of a set of e-Health services and the influential dimensions resulting in different QoS needs and potential effect of QoS on QoE. It highy stresses the function of QoS and QoE for acceptance of these services. The issue of non-uniform views regarding QoS parameter specifications and related requirements, clinically acceptable thresholds and their qualitative representation in e-Health literature is reviewed and presented.

Though different forms of e-Health systems have progressively shown their merits over traditional healthcare, acceptance of such systems is still a challenging issue. User perception represented by user experience level (QoE) needs to be enhanced to improve user acceptance of e-Health services. Provision of service quality (QoS) in e-Health applications has been examined

for ages, however the lack of thresholds for QoS parameters is evident from literature. This non-uniformity regarding the QoS parameter thresholds does not contribute to quality evaluation of the effect of QoS on the end-user QoE. Therefore, a systematic classification of medical services considering all influential dimensions, their corresponding QoS and QoE parameters and their clinically acceptable thresholds should be identified and subsequently assessed in order to enhance user perception of the delivered e-Health services and guarantee user acceptance. Moreover, an appropriate methodology that incorporates the proposed guidelines for conducting QoE studies in e-Health, user involvement and other dimensions of QoE, are required to be considered and their relation with QoS should be identified. To sum-up [50].

Uses of Broadband for Improve Quality of Service in Telemedicine: Salatian *et al.* (2011) Broadband is a popular way of telecommunication used for Intensive Care Unit (ICU) telemedicine. However, in rural areas, bandwidth demand can easily outstrip the revenue realizable that is needed to pay for the network infrastructure investment so lower bandwidth is normal. A consequence of restricted bandwidth on access pipes is service contention at the customer site. Moreover,handling these challenges needs to consider Quality of Service issues before a successful ICU telemedicine system can be effeciently deployed. Quality of Service refers to the set of technologies and techniques for managing network traffic that aims at affording a certain level of performance to a data flow in a network. This paper,besides, discusses the use of data wavelets as a form of data compression of ICU data,made for better use of broadband in rural areas and, in turn, enhances Quality of Service in telemedicine.

Broadband is the common form of telecommunication used for ICU telemedicine. However, in rural areas, bandwidth demand can easily reduce the revenue realizable that is required to pay for the network infrastructure investment ; so lower bandwidth is normal. A consequence of restricted bandwidth on access pipes is service contention at the customer site. Hence,handling these challenges needs to consider Quality of Service issues before a successful ICU telemedicine system can be effeciently deployed which will necessitate to process large amounts of continuous information. This proposal proves that the Quality of Service for information transfer in telemedicine can be enhanced if data wavelets is used. Data wavelets is a lossy data compression technique and they permit more effective use of network resources such as storage and bandwidth since smaller files take up less space and are faster to be transmitted over a network. Our system proves to be potential owing to its encouraging results. We agree that it paves the way to the development of an ICU telemedicine system for compressing and transferring high volume ICU monitor data where bandwidth is limited at the rural site. [51]

CONCLUSION

Quality of service can be identified as the ability to submit the client`s needs (constraints) with the best criteria (preferences) established by the client. It is calculated depending on the non-functional characteristics of the service, Telemedicine and relates medical technologies main objectives of affording effective medical care remotely. It should promote the patients health conditions and help needy people to consult medical expertise at a lower cost at the appropriate time. Telemedicine has various potential uses including clinical, educational and administrative. It can, for instance, afford high quality healthcare service to under-served locations. Perspectives prove that telemedicine can bring solutions to a great deal of difficulties including: allowing access to medical care to the mass population, reducing medical fees, bringing experience and expertise closer to patients and solving uneven geographic distribution of service quality. It can enhance quality resulting from providing coordinated and continuous care for patients, targeted and highly effective continuous education for providers and highly effective means for decision support. Wireless telemedicine is a rather new emerging area. Advanced telemedicine services are discouraged by the low bandwidth or high costs of previous wireless technologies. The new wireless broadband technologies enabled creation of telemedicine services which are previously only possible via cable connections. Furthermore, rural areas or areas stricken with disasters, otherwise unreachable by cable connections, can benefit from advanced medical services very quickly and with fraction of the previous cost. Hence, wireless telemedicine is especially suitable for areas lacking proper cable connections or places where installing cable links is difficult, economically unavailable or simply impossible. For instance, installing WiMAX wireless links is the only possible way to establish interaction and afford healthcare service in cases of natural disasters such as earthquakes, hurricanes and tsunami.

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