



QOS REQUIREMENTS IN WSN-SURVEY

Er. Rekha Rani¹, Dr. Sona Malhotra²

M.Tech Student¹, Asstt. Prof.²

CSE Department, UIET, Kurukshetra University, Kurukshetra
Haryana, India

Abstract: In this paper, we assess Quality of Services (QoS) requirements in wireless sensor networks (WSNs). QoS is a key component of the IMS. The QoS for a particular session is determined by a number of factors, such as the maximum bandwidth that can be allocated to the user based on the user's subscription or the current state of the network. The IMS allows operators to control the QoS a user gets, so that operators can differentiate certain groups of customers from others. Quality of service (QoS) is the overall performance of a telephony or computer network, particularly the performance seen by the users of the network. The study QoS, the QoS of any particular network can generally be considered to be its ability to deliver a guaranteed level of service to its users and/or applications. The QoS service requirements can be specified in the form of performance metric.

Keywords: Quality of Service (QoS), Quality of Service (QoS) requirements, Wireless Sensor Network (WSN).

I. Introduction

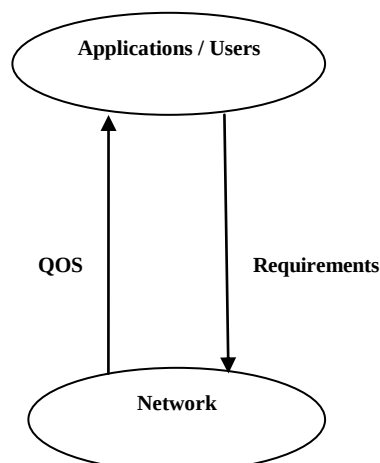
As a set of service requirements to be met by the network, while transporting a flow, QoS. Despite the slightly varying definitions that have been proposed for different types of networks, the QoS of any particular network can generally be considered to be its ability to deliver a guaranteed level of service to its users and/or applications. The service requirements can be specified in the form of performance metrics, which are typically computed in one of the three following ways: (i) concave (e.g. minimum bandwidth along each link); (ii) additive (e.g. total delay along a path); and (iii) multiplicative (e.g. packet delivery ratio along the entire route). Although some performance metrics such as throughput, delay, jitter (delay variance), bandwidth, packet delivery ratio (PDR), reliability, etc are more widely used than other metrics, each application has its own unique set of service parameters to be satisfied, while possibly compromising on other sets of metrics.

In application, QoS generally refers to the quality as perceived by the user/application while in the networking community, QoS is accepted as a measure of the service quality that the network offers to the applications/users. WSNs are application-oriented network, so different applications require different QoS metrics and approaches.

A. Traditional Data Networks for Quality of Service

Support QoS in wired networks can generally be obtained over provisioning of resources and/or traffic engineering [1],[2]. With the method of over provisioning, we add abundant resources in the network so that it can provide satisfactory services to bandwidth-hungry multimedia applications. QoS is achieved some strategies such as admission control, policy managers, traffic classes, and queuing mechanisms.

Figure 1 A simple QoS model.



QoS can be achieved in these networks in which are characterized by multi-hop communication, dynamic environments and limited resources. QoS generally refers to the quality as perceived by the user/application

while in the networking community; QoS is accepted as a measure of the service quality that the network offers to the applications/users. For instance, RFC 2386 [3] characterizes QoS as a set of service requirements to be met when transporting a packet stream from the source to its destination. QoS can be described qualitatively (relative) or quantitatively (absolute). Relative QoS definitions relate the treatment received by a class of packets to some other class of packets, while absolute definitions provide metrics such as delay or loss, either as bounds or as statistical indications. Examples of absolute bounds are statements such as “no more than 5% of the packets will be dropped” or “no packet will experience a delay of more than 100 ms”. A set of such statements, along with guarantees about reliability, are often called a Service Level Agreement (SLA). Proportional QoS [4],[5] tries to refine and quantify relative QoS.

II. Quality of Service Requirements in WSNs

Wireless Sensor Networks consists of individual nodes that are able to interact with their environment by sensing or controlling physical parameter; these nodes have to collaborate in order to fulfill their tasks as usually, a single node is incapable of doing so; and they use wireless communication to enable this collaboration [6]. The definition of WSN, according to, Smart Dust program of DARPA is: “A sensor network is a deployment of massive numbers of small, inexpensive, self powered devices that can sense, compute, and communicate with other devices for the purpose of gathering local information to make global decisions about a physical environment” [6].

Many Different communities may interpret QoS of WSNs in separate ways. For example, in applications including event detection and target tracking, the failure to detect or extracting wrong or incorrect information according to a physical event may arise from many reasons. It may be due to the deployment and network management, i. e. , the location where the event comes may not be covered by any active sensors. Intuitively, we can define coverage or the number of active sensors as parameters to measure the QoS in WSNs.

We can also define some things about transportation that related parameters to measure QoS. However, our differences of QoS perspectives is not absolute since a common application requirement such as the performance measure associated with event detection may involve all of them. Here, our aim is to focus on how the underlying network can provide the QoS to applications, in terms of which parameters we can map application requirements into the network infrastructure and measure the QoS support accordingly.

In Quality of Service in Wireless Sensor Networks, Wireless Sensor Networks (WSNs) consists of groups of tiny sensor nodes that are placed for target such as environmental monitoring, surveillance. Due to the small size of the nodes, they are typically deployed in large numbers and communicate via multiple hops through a wireless shared communication channel.

A. Quality of Service Property Model

Let us consider a web service S with a set of QoS parameters defined as $fq_1; q_2; q_3g$. We would like to define a relation between quality parameters and aggregated QoS. Having defined the relation, it is possible to estimate an overall quality degree that can be used for further analysis. we consider three quality parameters: Response Time (R_t), Availability (A_{va}) and Throughput (T_p).

_ Response-time: the expected delay in milliseconds between the time when the request is sent and the time when the result is received.

_ Availability: the percentage of the time in which a web service is available.

III. Related Work

Barbara Pernici *et al* [8], Evaluating Web Service QoS: A Neural Fuzzy Approach. In Service-Based Applications (SBA), evaluated Quality of Service (QoS) values was an important issue.

In Environmental Wireless Sensor Networks, Peter Corke *et al* [9], This paper was concerned with the application of wireless sensor network (WSN) technology to long-duration and large-scale environmental monitoring. They present our views as to why this field has progressed less quickly than many envisaged it would over a decade ago. They used real examples taken from our own work in this field to illustrate the technological difficulties and challenges that were entailed in meeting end-user requirements for information gathering systems. Adaptive power management strategies that efficiently manage these activities without compromising performance quality also remain an open direction for continued investigation.

In Development of a Mote for Wireless Image Sensor Networks, Ian Downes *et al* [10] presents the design of a new mote for distributed image sensing applications in wireless sensor networks. This paper was presented the development of a new mote platform for wireless image sensor networks. A proposed network of these motes was used to enable further research on wireless image sensor networks.

Luiz H. A. Correia *et al* [11] present Issues on QoS Schemes in Wireless Sensor Networks. Quality of Service (QoS) was an important requirement for the well-functioning of traditional and new networks. This work

presents a preliminary study on the use of QoS in WSN. They focus their research on QoS techniques applied to medium access control (MAC). They presented the key issues faced in the design of QoS protocols, namely MAC protocols.

Dazhi Chen and Pramod K. Varshney [12] present QoS Support in Wireless Sensor Networks. They assess the state of the art of Quality of Services (QoS) support in wireless sensor networks (WSNs). They first review the techniques for QoS support in traditional networks, analyze new QoS requirements in WSNs from a wide variety of applications classified by data delivery models, and propose some non-end-to-end collective QoS parameters. They analyzed the QoS requirements imposed by the main applications of WSNs. They were convinced that the QoS support in WSNs should also include QoS control besides QoS assurance mechanisms.

Propose a new reliable transport scheme (ESRT) for WSNs by Y. Sankarasubramaniam *et al.* in [13]. ESRT is a novel transport solution developed to achieve reliable event detection in WSN with minimum energy expenditure. Note that their solution is based on a non-end-to-end concept. The solution involve a congestion control component that serves the dual work of achieving reliability and conserving energy, and the reliability of event detection is controlled by the sink which has more powerful than sensors. It is worth noting that this paper brings up the concept of non-end-to-end service. Howe their solution only resides in a single transport layer. After this, it does not consider other important QoS factors.

Po-Lung Tien and Bo-Yu Ke [14], Parallel QoS Scheduling for WDM Optical Interconnection System Using a New Ranked Hopfield Neural Network. They propose a parallel QoS scheduler for a WDM optical interconnection system (WOPIS), used a new ranked Hopfield neural-network (RHNN). They were proposed a new parallel scheduler, RHNN, for a WDM optical interconnection system, WOPIS.

Weibin Zhao *et al* [15] present Internet Quality of Service, Covering motivation and considerations for adding QoS to Internet. Basic router mechanisms for supporting QoS, including queue management and scheduling, constraint-based routing and multiprotocol label switching (MPLS). They found some important design principles and open issues for Internet QoS. All supporting mechanisms can be kept unchanged. Although important technical progress has been made, much work needs to be done before QoS mechanisms will be widely deployed.

Fan Zeming *et al* [16], proposes WTRP-S, a Medium Access Control (MAC) protocol based on WTRP and for wireless sensor networks. It guarantees QoS and controls the energy consumption which was required in WSNs. Check the performance of WTRP-S, WTRP and IEEE802.15.4 MAC in the same network, and shows that WTRP-S provides a better QoS and was more suitable for energy-limited wireless sensor network. This paper combining with WTRP protocol proposes a new protocol algorithm-WTRP-S on QoS and the energy consumption in wireless sensor network. WTRP-S guarantees QoS and achieves the sleep of nodes, For the characteristic of WSN, new protocol is more suitable and can increase overall performance of network.

Dilip D. Chaudhary and Dr. L. M. Waghmare [17] presented Quality of Service Analysis in Wireless Sensor Network by Controlling End-to-End Delay, They analyzed the delay sensitive industrial control applications like Industrial process control, Environmental control, Gas leakage monitoring, etc. in this a reliable communication between sensor and base station were highly essential. In this work, They confirmed that for, delay-sensitive applications, Proposed multi-sink model was highly suitable since it reduces the delay significantly, as compared with single-sink node model. These conclusions may be immensely useful to the designers and engineers for deployment of actual wireless sensor network in industrial automation and control.

Mahsa Mohaghegh *et al* [18] designed Cross-layer Optimisation for Quality of Service Support in Wireless Sensor Networks. Wireless sensor networks need to deliver real-time services such as video, audio and traditional data services therefore providing efficient quality of services (QoS) support is essential. Their aim to address the time-delay parameter of QoS. They present results from simulations of the new cross layer design and traditional OSI model using the OMNET++ software. They show that the cross layer design provides a feasible and flexible approach to solving the conflict between different layers in a standard OSI model. Mahsa Mohaghegh *et al* [18] examined the application of the Cross model in a sensor network. This was achieved by implementing a sensor network with OMNET++ software applying the OSI and Cross models separately in each node and comparing the average time of packet transmission in both cases. In all of the designed experiments the Cross model outperforms the OSI model in the time delay criteria (one of the QoS parameters).

Prof. P. Rajan *et al* [19], Network Supporting Multilayered Quality of Service Routing in Wireless Sensor Networks. In this paper WSNs comprise of groups of tiny sensor nodes that were deployed for collaborative missions such as environmental monitoring, target tracking and surveillance. They identify some key performance metrics for WSN QoS and outline some mechanisms to achieve QoS in the sensor network. Finally, They propose WISER - a framework to enhance QoS in WSNs.

Long Zhaohua *etal* [20] presented Research on Quality of Service in Wireless Sensor Networks. They found WSNs was a key area of new investments and investigations. They proposed the existence of QoS issue on both network layer and MAC layer, as well as the existence of solutions, especially to MAC layer. They proposed a network topology and a MAC communication scheme to better support QoS. This may significantly decrease delay and increases throughput.

Anis Koubâa *et al* [21] show H-Name, a very simple yet extremely efficient hidden-node avoidance mechanism for WSNs. H-Name—eliminates hidden node collisions in synchronized single or multiple cluster WSNs using contention-based MAC protocols. The implementation of H-Name will be available as an open-source, within our open-ZB tool suite [22]. The feasibility and effectiveness of the H-Name mechanism was implemented, tested, validated and demonstrated both in a dedicated test-bed.

In Quality of Service for IEEE 802. 15.4-based Wireless Body Sensor Networks, Jose Javier Garcia *et al* [23] show mechanism was implemented and validated on the AquisGrain WBSN platform. Their results show that the QoS performance of the IEEE 802.15.4 standard can be considerably improved in terms of reliability and timeliness for intra-node as well as inter-node scenarios. They have also validated that our QoS improvements can be used to establish a differentiation among nodes within a network.

Budhaditya Deb *et al* [24] presented Quality of Service In Wireless Sensor Networks through the Connectionless Scheduling Protocol. The Connectionless Scheduling Protocol used a cross layer media access protocol. They describe how Qos differentiation can be easily applied to this protocol by providing simple message length or schedule availability constraints. For nodes that do not have GPS signal or atomic clock capability they will also look at opportunistic synchronization paradigm, building on the method introduced in [25]. This paper provides a mathematical framework for these enhancements to provide QoS using CSP.

Tommaso Melodia *et al* [26] presented Wireless Multimedia Sensor Networks (WMSNs)

were networks of wirelessly interconnected devices that allowed Retrieved video and audio streams, still images, and scalar sensor data. WMSN require the sensor network paradigm to be rethought in view of the need for mechanisms to deliver multimedia content with a pre-defined level of quality of service (QoS). They have described our preliminary design of a cross layer communication architecture to provide QoS in wireless multimedia sensor networks based on time hopping impulse radio UWB communications.

Improving Shared Awareness and QoS Factors in AntNet Algorithm Using Fuzzy Reinforcement and Traffic Sensing. Pooia Lalbakhsh *et al* [27]. The paper describes a novel method to introduce new concepts in functional and conceptual dimensions of routing algorithms in swarm-based communication networks. This method used a fuzzy reinforcement factor in the learning phase of the system and a dynamic traffic monitor to analyze and control the changing network conditions.

IV. Conclusion

After study several papers of QOS in WSN, Found that different authors use QOS in WSN for separation way. some efforts have been made in the research field of QOS support in WSNs so far. In this survey paper, we analyzed the QoS requirements imposed by the important applications of WSNs, and The QOS term used in traditional networks may not be sufficient in WSNs. Some QOS factors are envisioned due to this significant change. Further, we list many challenges posed by the unique characteristics of WSNs and report on the state of the art in terms of a few current research efforts in this field. Finally, we are convinced that the QOS support in WSNs should also include QOS control besides QOS assurance mechanisms, and some exciting open issues are identified in order to stimulate more creative research in the future.

V. References

- [1] Z. Demetrios, "A Glance at Quality of Services in Mobile Ad-Hoc Networks", <http://www.cs.ucr.edu/~csyiazti/cs260.html>, November 2001.
- [2] D. Zeinalipour, S. Aristeidou, S. Kazeli, "IP Quality of Services (in Greek)", <http://www.cs.ucr.edu/~csyiazti/downloads/papers/ipqos/papers/ip-qos.pdf>, 1999.
- [3] E. Crawley, "A Framework for QoS-Based Routing in the Internet," RFC 2386, <http://www.ietf.org/rfc/rfc.2386.txt>, Aug. 1998.
- [4] Constantinos Dovrolis and Parameswaran Ramanathan. A case for relative differentiated services and the proportional differentiation model. *IEEE Network*, 13(5):26–34, September/October 1999.
- [5] Constantinos Dovrolis, Dimitrios Stiliadis, and Parameswaran Ramanathan. Proportional differentiated services: Delay differentiation and packet scheduling. *ACM Computer Communication Review*, 29(4):109–120, October 1999.
- [6] Stephan Olariu, "Information assurance in wireless sensor networks", Sensor network research group, Old Dominion University.
- [7] S. Meguerdichian, F. Koushanfar, G. Qu, and M. Potkonjak, "Exposure in Wireless Ad-hoc Sensor Networks," in *Mobile Computing and Networking*, 2001, pp. 139-150.
- [8] Barbara Pernici and Seyed Hossein Siadat, "Evaluating Web Service QoS: A Neural Fuzzy Approach" Politecnico di Milano, Dipartimento di Elettronica e Informazione, p.zza Leonardo Da Vinci, 32-20133, Milano, Italy, fpernici,siadatg@elet.polimi.it.
- [9] By Peter Corke, Fellow IEEE, Tim Wark, Member IEEE, Raja Jurdak, Member IEEE, Wen Hu, Member IEEE, Philip Valencia, Member IEEE, and Darren Moore, Member IEEE, *Environmental Wireless Sensor Networks*, Vol. 98, No. 11, November 2010 | *Proceedings of the IEEE*.
- [10] Ian Downes, Leili Baghaei Rad, and Hamid Aghajan, 'Development of a Mote for Wireless Image Sensor Networks', Wireless Sensor Networks Laboratory, Department of Electrical Engineering, Stanford University, Stanford, CA 94305, Email: downes@stanford.edu, leili@ieee.org, aghajan@stanford.edu, In *Proc. of Cognitive Systems and Interactive Sensors (COGIS)*, Paris, March 2006.
- [11] Luiz H. A. Correia, Daniel F. Macedo, Aldri L. dos Santos, Jos'e M. Nogueira, Partially supported by CNPq, Brazil, process number 55.2111/2002-3, *Issues on QoS Schemes in Wireless Sensor Networks - DCC/UFMG - Technical Report:RT.DCC.004/2005*.

- [12] Dazhi Chen and Pramod K. Varshney, Department of EECS, Syracuse University, Syracuse, NY, U.S.A 13244, QoS Support in Wireless Sensor Networks.
- [13] Y. Sankarasubramaniam, B. Akan and I. F. Akyildiz, "ESRT: Event to Sink Reliable Transport in Wireless Sensor networks," In *MobiHoc 2003*, Annapolis, Maryland, June 2003.
- [14] Po-Lung Tien, Member, IEEE, and Bo-Yu Ke, Student Member, IEEE, Parallel QoS Scheduling for WDM Optical Interconnection System Using a New Ranked Hopfield Neural Network, *Journal of Lightwave Technology*, Vol. 29, No. 16, August 15, 2011.
- [15] Weibin Zhao, David Olshefski and Henning Schulzrinne, Columbia University, fzw, dp01, hgsg@cs.columbia.edu, Internet Quality of Service: an Overview.
- [16] Fan Zeming, Fu Dianyu, Guo Yue, The School of Automation, Northwestern Polytechnical University, Xi'an 710129, PR China, fudianyu@163.com, 'Implementation of Medium Access Control Protocol to Improve Quality of Service in Wireless Sensor Network', 2012 Second International Conference on Instrumentation & Measurement, Computer, Communication and Control, 2012 IEEE, DOI 10.1109/IMCCC.2012.275.
- [17] Dilip D. Chaudhary, Sinhgad Institute of Technology Lonavala. MS. India., (Ex. Research scholar at Aalborg University, Denmark), dipra1987@gmail.com, Dr. L. M. Waghmare, Shri Guru Govind Singhji Institute of Technology, Nanded, M.S. India., lmwaghmare@sggs.ac.in, 'Quality of Service Analysis in Wireless Sensor Network by Controlling End-to-End Delay', 2011 IEEE.
- [18] Mahsa Mohaghegh (Massey University IS EAT, Auckland, New Zealand; Email: M.Mohaghegh@massey.ac.nz), Chris Manford (Department of Computing, Unitec, Auckland, New Zealand; Email: Cmanford@unitec.ac.nz), Abdolhossein Sarrafzadeh (Department of Computing, Unitec, Auckland, New Zealand; Email: h.sarrafzadeh@unitec.ac.nz), 'Cross-layer Optimisation for Quality of Service Support in Wireless Sensor Networks', 2011 IEEE.
- [19] Prof. P. Rajan (Dept. of Computer Applications, PSN College of Engineering and Technology, Tirunelveli, India. Email: prajan1968@gmail.com) and S. Varatha Rajan (Lecturer, Dept., of Computer Applications, PSN College of Engineering and Technology, Tirunelveli, India. Email: varatharajansr@gmail.com), 'Network Supporting Multilayered Quality of Service Routing in Wireless Sensor Networks', PROCEEDINGS OF ICETECT 2011.
- [20] Long Zhaohua (Dept. of Computer Science and Technology, ChongQing University of Posts & Telecommunications, ChongQing, China longzh@cqupt.edu.cn) and Su Meijun (Dept. of Computer Science and Technology ChongQing University of Posts & Telecommunications, ChongQing, China, Sumeijun_2008@126.com), 'Research on Quality of Service in Wireless Sensor Networks', 2010 IEEE.
- [21] Anis Koubâa, Ricardo Severino, Mário Alves, and Eduardo Tovar, Improving Quality-of-Service in Wireless Sensor Networks by Mitigating "Hidden-Node Collisions", *IEEE Transactions on industrial informatics*, Vol. 5, No. 3, August 2009.
- [22] An Open-Source Toolset for the IEEE 802.15.4/ZigBee Protocol Stack. [Online]. Available: <http://www.open-zb.net> 2006.
- [23] Jose Javier Garcia (Universitat Politècnica de Catalunya, Barcelona, Spain, josejavierrg@yahoo.com), and Thomas Falck (Philips Research Europe, Eindhoven, the Netherlands thomas.falck@philips.com), Quality of Service for IEEE 802. 15.4-based Wireless Body Sensor Networks, Digital Object Identifier: <http://dx.doi.org/10.4103/ICST.PERVASIVEHEALTH2009.6054>.
- [24] Budhaditya Deb, Scott C. Evans, Harold W. Tomlinson, Suresh Iyer and Giri Kuthethoor, {deb, evans, Tomlinson}@research.ge.com, {suresh.iyer, giri.kuthethoor}@lmco.com), 'Quality of Service In Wireless Sensor Networks through the Connectionless Scheduling Protocol', 1 1-4244-1488-1/08/\$25.00 © 2008 IEEE. 2 IEEEAC paper #1605, Version 6, Updated December 17, 2007.
- [25] Lundelius, J. and Lynch, N. 1984. "A new fault-tolerant algorithm for clock synchronization." In *Proceedings of the Third Annual ACM Symposium on Principles of Distributed Computing* (Vancouver, British Columbia, Canada, August 27 - 29, 1984). PODC '84. ACM Press, New York, NY, 75-88.
- [26] Tommaso Melodia (Department of Electrical Engineering, State University of New York at Buffalo, Buffalo, NY 14260, tmelodia@eng.buffalo.edu) and Ian F. Akyildiz (Broadband Wireless Networking Laboratory, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332, ian@ece.gatech.edu), 'Cross-layer Quality of Service Support for UWB Wireless Multimedia Sensor Networks', IEEE INFOCOM 2008 proceedings.
- [27] Pooia Lalbakhsh, 2Bahram Zaeri and Mehdi N. Fesharaki, pooia_acm@yahoo.com, bahram_z521@yahoo.com, mehresharaki@yahoo.com, Improving Quality-of-Service in Wireless Sensor Networks by Mitigating "Hidden-Node Collisions", *IEEE Transactions on industrial informatics*, Vol. 5, No. 3, August 2009.