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A Study on Quality Of Service (QOS) in Ubiquitous Wireless Sensor Networks

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Abstract - ***Wireless Sensor Networks (WSNs) are extensive systems made out of little sensor hubs with constrained PC assets able for social event, information preparing and imparting. Ubiquitous registering in WSNs from the viewpoint that detected information can be utilized rather than the client without any gateway transforming available information. Ubiquitous Sensor Network for Development (USN4D) incorporates in its layers components which provide sharp information dispersal and large restriction of data to meet the prerequisites of creating view. For the creating ubiquitous sensor network TCP/IP protocol is implemented for efficient utilization of available resources with low power and available bandwidth. The main objective of this research is to improve the performance of the ubiquitous wireless sensor network environment by adopting TCP/IP protocol stack in wireless sensor network.***

Key Words: *Ubiquitous Sensor, QOS (quality of service), TCP/IP network*

I. Introduction: Wireless Sensor Networks (WSN) is promising to change the way we obtain information from the physical environment. It is envisioned that WSN will consist of thousands to millions of tiny sensor nodes, with limited computational and communication capabilities. When networked together, these unattended devices can provide high-resolution knowledge about sensed phenomena. In recent years there has been a great surge of interest in WSN, focused on developing the hardware, software, and networking architectures needed to enable such applications. In the desired 4G paradigm, all kinds of heterogeneous wireless networks and current existing IP based Internet should be integrated into one pervasive network to provide transparent accessibility for users. Sensor network as a family member of wireless networks should also be integrated.

Ubiquitous sensor systems and its application are developing quickly as an energizing new worldview to give solid and agreeable life administrations. The perpetually developing Ubiquitous sensor systems and its application will give a clever and pervasive correspondence and system innovation for tomorrow [1]. With late patterns and advancement of minimal effort sensors, scaling down of registering and hardware, incitation and control frameworks, nanotechnology, and remote correspondence, there are developing examination ranges in urban figuring with covering subjects and difficulties [2]. The customary TCP/IP convention suite is not suitable to be utilized as a part of a WSN situation. A portion of the convention modules must be uprooted because of the asset confinement of sensor hubs. Then, its gauges and instruments ought to be kept however much as could be expected, so just a subset of TCP/IP convention suite is executed in sensor hubs, which is called small TCP/IP convention stack. We can run these convention modules in a modified way; modules are accessible as APIs and it is the obligation of the clients to empower a subset of them [3].

In this paper analyzing the various methods and technique exist for connecting the wireless sensor network to TCP/IP protocol stack. Ubiquitous sensor network will be implemented to connect TCP/IP protocol for various network environments. To improve the performance of the ubiquitous wireless sensor network environment by adopting TCP/IP protocol stack in wireless sensor network. Existing methods for connecting wireless sensor network with TCP/IP protocol will be studied for efficient connection between TCP/IP protocol stack with wireless sensor network. To connect different type of network with increased quality of service (QOS) parameter novel onboard gateway approach will be adopted in ubiquitous network which uses TCP/IP protocol.

II. Need and Importance:

The numerous and important applications of wireless sensor networks demand for an integration with existing IP networks, especially the Internet. An all-IP-network will not be viable with this new technology, due to the fundamental differences in the architecture of IP-based networks and sensor networks. We foresee that the integration of sensor networks with the Internet will need gateways in most cases. We should point out that even though IP addresses are not suitable to identify every sensor node in WSN, some applications may require at least a subset of the nodes to possess a unique ID within a wireless sensor network.

Directly employing the TCP/IP protocol suite as the communication protocol in the sensor network would enable seamless integration of the sensor network and any TCP/IP network. No special intermediary nodes or gateways would be needed for connecting a sensor network with a TCP/IP network. Rather, the connection would simply be done by connecting one or more sensor nodes to the TCP/IP network. TCP/IP in the sensor network would also provide the possibility to route data to and from the sensor network over standard technologies such as General Packet Radio Service (GPRS).

The fact that we are able to run the TCP/IP stack even on tiny sensor nodes suggests that TCP/IP for sensor networks may be within reach. Sensor networks running the TCP/IP protocol suite would be very easy to connect to existing TCP/IP networks, and would also be able to benefit from the wealth of readily available applications such as file transfers using FTP or HTTP and possibly time synchronization with NTP. There are, however, a number of problems with using TCP/IP for wireless sensor networks that need to be addressed before TCP/IP is a viable alternative for sensor networks:

- The addressing and routing schemes of IP are host-centric.
- The header overhead in TCP/IP is very large for small packets.
- TCP does not perform well over links with high bit-error rates, such as wireless links.
- The end-to-end retransmissions used by TCP consume energy at every hop of the retransmission path.

III DATA AGGREGATION & DATA DISSEMINATION

Data gathering is the main objective of sensor nodes. The sensors periodically sense the data from the surrounding environment, process it and transmit it to the base station or sink. The frequency of reporting the data and the number of sensors which report the data depends on the particular application. Data gathering involves systematically collecting the sensed data from multiple sensors and transmitting the data to the base station for further processing. But the data generated from sensors is often redundant and also the amount of data generated may be very huge for the base station to process it. Hence we need a method for combining the sensed data into high quality information and this is accomplished through Data Aggregation [7]. Data Aggregation is defined as the process of aggregating the data from multiple sensors to eliminate redundant transmission and estimating the desired answer about the sensed environment, then providing fused information to the base station. Some design issues in data aggregation are [7,8]: 1) Sensor networks are inherently unreliable and certain information may be unavailable or expensive to obtain; like the number of nodes present in the network and the number of nodes that are responding and also it is difficult to obtain complete and up-to date information of the neighboring sensor nodes to gather information. 2) Making some of the nodes to transmit the data directly to the base station or to have less transmission of data to the base station to reduce energy. 3) Eliminate transmission of redundant data using meta- data negotiations as in SPIN protocol. 4) Improving clustering techniques for data aggregation to conserve energy of the sensors. 5) Improving In-Network aggregation techniques to improve energy efficiency. In-Network aggregation means sending partially aggregated values rather than raw values, thereby reducing power consumption. Data dissemination is a process by which data and the queries for the data are routed in the sensor network [9]. Data dissemination is a two step process. In the first step, if a node is interested in some events, like temperature or humidity, then it broadcasts its interests to its neighbors periodically and then through the whole sensor network. In the second step, the nodes that have the requested data will send the data back to the source node after receiving the request. . The main difference between data aggregation and data dissemination is, in data dissemination all the nodes including the base station can request for the data while in data aggregation all al the aggregated data is periodically transmitted to the base station. In addition, data aggregation data can be transmitted periodically, while in data dissemination data is always transmitted on demand. Flooding is one important protocol which includes data dissemination approach.

IV. TRANSPORT LAYER ISSUES

End to End reliable communication is provided at Transport layer. The various design issues for Transport layer protocols are [4, 5]: 1) In transport layer the messages are fragmented into several segments at the transmitter and reassembled at the receiver. Therefore a transport protocol should ensure orderly transmission of the fragmented segments. 2) Limited bandwidth results in congestion which impacts normal data exchange and may also lead to packet loss. 3) Bit error rate also results in packet loss and also wastes energy. A transport protocol should be reliable for delivering data to potentially large group of sensors under extreme conditions. 4) End to End communication may suffer due to various reasons: The placement of nodes is not predetermined and external obstacles may cause poor communication performance between two nodes. If this type of problem is encountered then end to end communication will suffer. Another problem is failure of nodes due to battery depletion. 5) In sensor networks the loss of data, when it flows from source to sink is generally tolerable. But the data that flows from sink to source is sensitive to message loss. (A sensor obtains information from the surrounding environment and passes it on to the sink which in turn

queries the sensor node for information) Traditional transport protocols such as UDP and TCP cannot be directly implemented in sensor networks for the following reasons: 1. If a sensor node is far away from the sink then the flow and congestion control mechanism cannot be applied for those nodes. 2. Successful end to end transmissions of packets are guaranteed in TCP but it's not necessary in an event driven applications of sensor networks. 3. Overhead in a TCP connection does not work well for an event driven application of sensor networks. 4. UDP on the other hand has a reputation of not providing reliable data delivery and has no congestion or flow control mechanisms which are needed for sensor networks. Pump Slowly, Fetch Quickly (PSFQ) proposed in [6] one of the popular transport layer protocol. Active Research Areas Developing transport protocols for sensor networks is itself a difficult task due to the previously discussed issues and not much work is reported. Existing transport layer protocols for WSNs assume that the network layer uses a single path routing and multi path routing is not considered; which opens many doors for research in this direction. Many of the transport protocols do not consider priority when routing. Since sensor nodes are placed in various types of environment, the data from different locations will have different priorities.

V METHODOLOGY

TCP/IP Protocol Stack:

Sensor networks as a family member of wireless networks should be integrated with TCP/IP network to provide meaningful services. To present a new solution to connecting ubiquitous sensor networks with TCP/IP network. After the integration of sensor networks and TCP/IP networks IP based designing model is adopted for analyzing the sensor ID since the internet user and sensor network does not have information about working model by hiding the sensor ID. Since it deploy virtual IP addresses in gateway rather than bring any modification to sensor networks protocols, sensor networks can still freely choose the optimized routing protocol which is Node-Centric or Location-Centric based. Furthermore, Internet users can easily and directly access some special sensor nodes via virtual IP addresses. Sensor networks which are physically located in different locations may use totally different routing protocols for their specific applications. If these sensor networks have gateways which have virtual IP addresses, then it is very easy to integrate them into one virtual network without modification on existing protocols.

GATEWAY APPROACH

This is the common solution to integrate sensor networks with an external network by using *Application-level Gateways* as the interface. Different protocols in both networks are translated in the application layer as

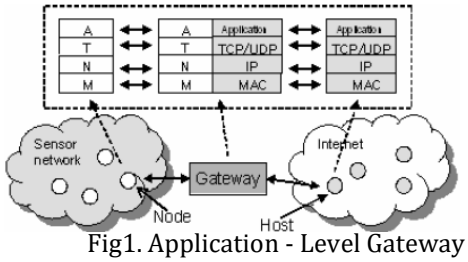

Fig1. Application - Level Gateway

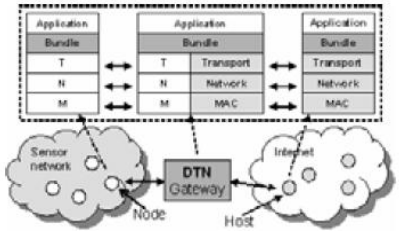

Fig 2. Delay Tolerant Network

the Figure 1 shows. The advantage is: the communication protocol used in the sensor networks may be chosen freely. However, the drawback is: Internet users cannot directly access any special sensor node. Another research work, *Delay Tolerant Network*, also follows this *Gateway-based approach*. The key different point from is that a *Bundle Layer* is deployed in both TCP/IP network and non-TCP/IP network protocol stacks to store and forward packets, as Figure 2 shows. It is very easy to integrate with different heterogeneous wireless networks by deploying this *Bundler Layer* into their protocol stacks. But the drawback also comes from the deployment of *Bundle Layer* into existing protocols, which is a costly job.

After receiving the packets from sensor networks, gateway first bases on packet's Sensor ID/Location to find out the created packet, then through the mapping between the created packet and the original packet gateway can easily find out the original packet. By analyzing the original packet, gateway can get the User IP and then create the new packet. Before sending this new packet, gateway will delete the corresponding original and created packets to save the storage space of the database.

In this mechanism, the onboard gateway is used to assist TCP sources to decouple the performances of congestion control and error control in TCP. The onboard gateway serves to eliminate congestion and assign bandwidth resource while the TCP source acts to retransmit the lost packets only. The onboard gateway has the duty of collecting information about the bandwidth delay product (BDP) of the satellite link and the number of

TCP flows as well as carrying out a fair assignment of the bandwidth to each flow. The window size of each TCP source is defined by the onboard gateway, does not reduce in case of packets dropping. Because the sum of window sizes of all active TCP sources in the onboard network equals to the BDP, the utilization of network resources can be maximized resulting in avoidance of any congestion. As this onboard-gateway-based mechanism (OGBM) is only concerned in the onboard network, it is well compatible because it dispense with the need for modification of the protocols in the satellite and ground networks

Conclusion

The various and vital utilizations of wireless sensor networks interest for an incorporation with existing IP systems particularly the Internet. An all-IP-system won't be practical with this new innovation, because of the key contrasts in the structural engineering of IP-based systems and sensor systems. TCP/IP has turned into the true standard convention suite for wired systems administration. Utilizing TCP/IP is the best and helpful approach to interface TCP/IP systems and sensor systems. Be that as it may, because of the confinement of assets and handling capacity, numerous individuals trust it is unimaginable and impracticable to utilize the TCP/IP convention suite in sensor systems. This research analyzing the various methods and technique exist for connecting the wireless sensor network to TCP/IP protocol stack. To improve the performance of the ubiquitous wireless sensor network environment by adopting TCP/IP protocol stack in wireless sensor network. Existing methods for connecting wireless sensor network with TCP/IP protocol will be studied for efficient connection between TCP/IP protocol stack with wireless sensor network. To connect different type of network with increased quality of service (QOS) parameter novel onboard gateway approach will be adopted in ubiquitous network which uses TCP/IP protocol.

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