Design challenges for Quality of Service aware communication protocol for sensor grid

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Abstract—The emerging computing paradigm called sensor grid extends the grid computing paradigm to the sharing of sensor resources and data from wireless sensor networks in a grid network. Sensor grid promise to transform the way we interact with the physical world. However before this vision comes to reality a number of challenges have to be addressed. Quality of Service management is among those issues. This work explore grid network, wireless sensor network, sensor grid network communication challenges to design a Quality of Service (QoS) aware sensor grid communication protocol. This paper further outlines those issues and challenges that need to be address in designing a QoS-aware communication protocol for sensor grid.

Keywords— grid computing, sensor grid, wireless sensor network

I. INTRODUCTION AND BACKGROUND

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, etc at different locations [1]. Wireless sensor network was originally used by military applications such as battlefield surveillance. However, wireless sensor networks are now used in many industrial and civilian application areas. WSN can be regarded as distributed computing resources that can be shared by different users or applications [3]. Grid computing has also regarded as a technology that facilitates resource sharing.

Grid computing is a distributed computing environment where disparate resources such as computer CPUs, storage, applications and data, often spread across different physical locations and administrative domains, are utilized through virtualization and collective management. The common communication protocol in grid services enabled environment is (Simple Object Access Protocol over Hypertext Text Transfer Protocol) SOAP/HTTP. SOAP is an Extensible Markup Language (XML) based application layer protocol for web and grid services. Web Services Description Language (WSDL) is a specification to describe networked XML-based services and how to access them.

A sensor grid network is the integration of wireless sensor network and grid computing network to enable real-time sensor data collection, processing and the sharing of computational and storage resources for sensor data. Sensor grid technology enable building of large-scale infrastructures, integration of heterogeneous sensor, data and computational resources deployed over a wide area. Figure 1 show the architecture of sensor grid. The vast amount of data collected by the sensors get processed, analyzed, and stored using the computational and data storage resources of the grid. Sensor grid improves topology brake down and wireless sensor network life time form the fact that a lot of computing is done using the grid resources that are not constrained in terms of power. A Sensor Grid architecture can be utilized by different types of applications [4] such as 1) environmental and habitat monitoring, 2) healthcare monitoring of patients, 3) weather monitoring and forecasting, 4) military and homeland security surveillance, 5) tracking of goods and manufacturing processes, 6) safety monitoring of physical structures and construction sites, 7) smart homes and offices. Military and homeland security surveillance applications are our targeted applications for this research work. The fact that this research area is new, challenges like scheduling, inter communication, coordinated QoS still need to be addressed. This research work centered on modeling QoS communication protocol for sensor grid through identifying information sharing challenges in sensor grid networks. Issues about scheduling and inter communication that affect QoS communication will be also addressed.

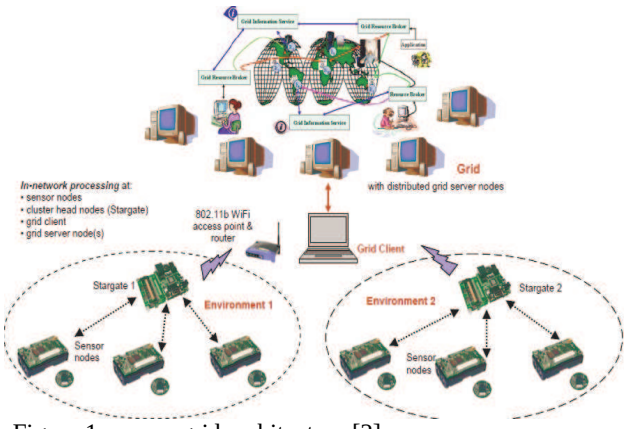

Figure 1: sensor grid architecture [2]

The rest of this paper is structured as follow: section 2 discus communication and interfacing challenges that affect QoS in sensor grid network. It also a discus different type of sensor grid computing approaches. The goal of this research work is also presented in this section. Section 3 presents the process of coming up with the solution. Section 4 presents the conclusion of this paper, while section 5 presents references.

II. QOS COMMUNICATION PROTOCOL CHALLENGES

The simple way to achieve sensor grid is to connect and interface sensor network to the grid network as shown in figure 1. In [2] different type of sensor grid computing approaches has been proposed which are centralised and distributed sensor grid computing approaches. Centralised Sensor Grid Computing Approach (CSGCA) is executed on centralised sensor grid architecture while Distributed Sensor Grid Computing Approach (DSGCA) on distributed sensor grid architecture. Scalable Proxy-based aRchItecture for seNsor Grid [3] is an example of CSGCA. This work will use the DSGCA based on the advantages that it is having over the CSGCA. CSGCA drawbacks include single point of failure, delay and excessive communication while DSGCA overcome them.

Communication challenges in sensor grid are from the combination of the mismatch in communication protocols between WSN and grid network and also WSN communication challenges. WSN is resource constraints from the fact that sensor nodes have limited processing capability, low-power, limited memory size and limited bandwidth. This leads to dynamic network topology, limited transmission capability, network partitioning, and low transmission rate. There is also a need to transform communication between these networks from the fact that grid network communication protocol is based on standard Internet protocols like TCP/IP, HTTP, and FTP. On the other hand, wireless sensor network are based on proprietary protocols, like the MAC protocol and routing protocol. Communication transformation needs also to address the issue of different sensor data types from heterogeneous sensors. Sensor grid need to manage data request through the use of advance scheduling and load balancing mechanism to improve sensor resource utilization, sensor job throughput and sensor grid life time . The sensor grid communication protocol that will take into consideration the above mention WSN and sensor grid challenges is needed in order to offer quality of service communication to sensor grid applications. This research work aims to take into consideration all of the above challenges in the process of model a QoS-aware communication protocol for distributed sensor grid to enhance sensor grid resource utilization.

IV. RESEARCH METHODOLOGY

A. Literature Search and Analysis

Literature search for existing QoS mechanisms in both grid computing and wireless sensor network will be conducted. Existing frameworks and standards for QoS that can be usefully in modelling a QoS-aware communication protocol will be adopted. The survey for efficient modelling framework will be conducted together with the analysis of those frameworks with the aim of modelling QoS-aware communication protocol for distributed sensor grid

B. Model Development

The identified literature will be analysed with the aim of figuring out drawback and its strong points as far as the goal of this research is concern. The strong points of the existing work will be then compared or merged with each other and the result will be then combined with the solution to the short comes of the existing literatures that this research will proposes. In the process of analysing the existing literatures one standard will be adopted for the model through comparison that will address distributed sensor grid challenges.

C. Proof of Concept

The proposed model will be implemented and tested in a distributed sensor grid environment. The performance evaluation of the model will then take place. Evaluation of how the model behaves from different conditions of the network will be conducted.

III. CONCLUSION

The integration of wireless sensor networks and grid computing, sensor grids greatly enhance the potential of these two technologies. In this paper, we have examined QoS communication challenges and communication protocol design issues for sensor grid. We have further identified courses of those challenges. This research work is in a process of modelling the QoS-aware communication protocol for distributed sensor grid. This research work will improve military panning and decision making especially in performing peace support operation from the fact that real time processed information useful for planning and decision making will available.

V. REFERENCES

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