A REVIEW OF WIRELESS SENSOR NETWORKS IN CLOUD COMPUTING

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Abstract: Cloud computing is growing popular as day by day in distributed computing environment. Cloud computing provides applications, platforms and infrastructure over the internet. It is a new era of referring to access shared computing resources. Wireless sensor networks have been seen as one of the most essential technologies where they distributed spatially connected sensor node automatically forms a network for data transmission and receive among themselves is popularly known as Sensor Network. For security and easy access of data, cloud computing is widely used in distributed or mobile computing environment. Wireless sensor network (WSN) is widely applied in many fields and it has limited resources of a sensor, especially limited battery life, limited bandwidth and limited processing power, are the main challenges for deploying and operating WSNs.

Keywords: - ***wireless sensor network, Data Centric Network, Cloud Computing, Sensor Node, Routing Protocols***

I. INTRODUCTION

Cloud computing can be defined by the NIST as a model for enabling convenient, on – demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction [1]. Cloud computing can be considered as a new computing paradigm with implications for greater flexibility and availability at lower cost. The term itself is often used today with a range of meanings and interpretations [1]. The cloud model is composed of five essential characteristics, three service models and four types of deployment models. Cloud computing appears as a computational paradigm as well as a distribution architecture and its main objective is to provide secure, quick, convenient data storage and computing services, with all computing resources visualized as services and delivered over the internet [2]. The cloud enhances the collaboration, agility, scalability, availability, ability to adapt to fluctuations according to the demand, accelerate development works and provides potential for cost reduction through optimized and efficient computing. Recently, a number of commercial and academic organizations have built large systems from commodity computers, disks, and networks, and have created software to make this hardware easier to program and manage. These organizations have taken a variety of novel approaches to address the challenges outlined above. In some cases these organizations have used their hardware and software to provide storage, computational, and data management services to their own internal users, or to provide these services to external customers for a fee. Cloud computing strategy can help business organizations to conduct their core business activities with less hassle and greater efficiency. Companies can maximize the use of their existing hardware to plan for and serve specific peaks in usage. Thousands of virtual machines and applications can be managed more easily using a cloud-like environment. Businesses can also save on power costs as they reduce the number of servers required.

Since Cloud computing provides plenty of application, platforms and infrastructure over the Internet; it may combined with Sensor network in the application areas such as environmental monitoring, weather forecasting, transportation business, healthcare, military application etc. Bringing various WSNs deployed for different applications under one roof and looking it as a single virtual WSN entity through cloud computing infrastructure is novel.

II. CLOUD COMPUTING OVERVIEW

The primary business service models employed are the Software as a Service. Platform as a Service and Infrastructure as a service, and common deployment models employed by service providers and users to use and maintain

the cloud services such as the private cloud, public cloud , community cloud and the hybrid cloud [2].

Public cloud Public cloud or external cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis.

Hybrid cloud A hybrid cloud environment consisting of multiple internal and/or external providers "will be typical for most enterprise". A hybrid cloud can describe configuration combining a local device, such as a Plug computer with cloud services. It can also describe configurations combining virtual and physical, co-located assets—for example, a mostly virtualized environment that requires physical servers, routers, or other hardware such as a network appliance acting as a firewall or spam filter.

Private cloud Private cloud and internal cloud are neologisms that some vendors have recently used to describe offerings that emulate cloud computing on private networks. These (typically virtualization automation) products claim to "deliver some benefits of cloud computing without the pitfalls", capitalizing on data security, corporate governance, and reliability concerns. They have been criticized on the basis that users "still have to buy, build, and manage them " and as such do not benefit from lower up-front capital costs and less hands-on management, essentially "[lacking] the economic model that makes cloud computing such an intriguing concept".

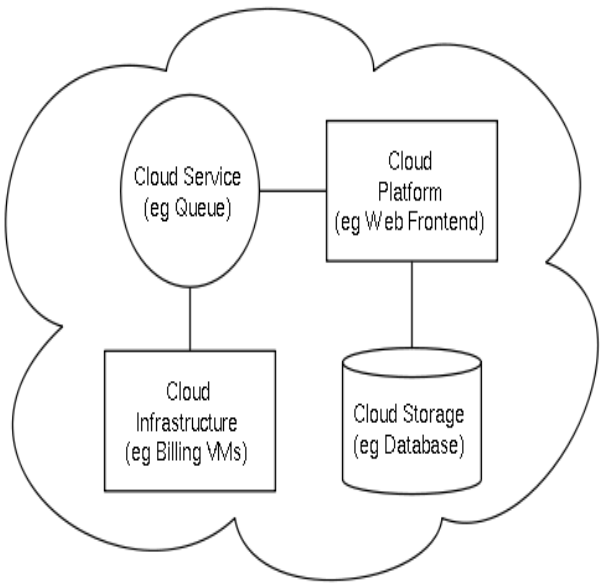

Figure 1: Service Model of Cloud

Types of cloud services

Software as a service (SaaS)

The cloud acts as a multitenant architecture, where the vendor supplies the software architecture and interacts through a portal or a browser. (SaaS) is the broadest market. In this case the provider allows the customer only to use its applications. The software interacts with the user through a user interface. These applications can be anything from web based email, to applications like Twitter or Last.fm.

Infrastructure as a service (IaaS)

The cloud provides IT infrastructures like virtual servers; these can replace a need for data center. So a company is expected to pay for as much memory they have used. (IaaS) like Amazon Web Services provides virtual servers with unique IP addresses and blocks of storage on demand. Customers benefit from an API from which they can control their servers. Because customers can pay for exactly the amount of service they use, like for electricity or water, this service is also called utility computing.

Platform as a service (PaaS)

In PaaS the provider hosts a set of software development tools and an API (Application Program Interface). The customer can build their own software in this environment. (PaaS) is a set of software and development tools hosted on the providers servers. Developers can create applications using the providers APIs. Google Apps is one of the most famous Platforms-as- a- Service providers [2]. Developers should take notice that there aren't any interoperability standards (yet), so some providers may not allow you to take your application and put it on another platform.

III. SENSOR NETWORKS FOR CLOUD COMPUTING

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors. Each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and bandwidth [3]. A sensor network is a computer network Composed of a large number of sensor nodes. [4] The development of sensor networks requires technologies from three different research areas: sensing, communication, and computing (including hardware, software, and algorithms).

Wireless sensor network (WSN) is a self-organizing network consisting of a lot of sensor devices that connect to others through wireless communication channel in multi-hop manner. Sensors collect environment parameters and transmit sensing data back to a central management node (i.e., a sink node) for further processing. Nowadays, WSN has been applied in many fields, such as environment monitoring, military, surveillance, disaster rescue and healthcare etc., and it is more widely used in the Internet of things (IoT) era. However, sensors are usually low cost devices equipped with limited resources, e.g., processing power, memory, wireless bandwidth, and battery. The design of WSN must take care of these constrains, especially the battery limitation that determines the lifetime of a sensor and a sensor network. In literature, a number of energy efficient techniques have been proposed.

Wireless sensor network is a data centric, some routes between nodes is not needed, so should not be used in the wireless sensor network routing protocol of traditional. Second, the flow of data in wireless sensor networks is many to one, the needed information is generally derived from a regional, after data fusion, to obtain the required information, and then sent to the destination node -- sink node, delivered to the user by its unity. Wireless sensor network in the physical environment [3]. The changing external environment (such as intermittent, antenna communication link incidents lead to network task load changes) can seriously affect the function of the system, which requires the sensor nodes can change with the environment and timely adjust its working state. In addition, the change of the network topology also requires the system can well adapt to the dynamic changing.

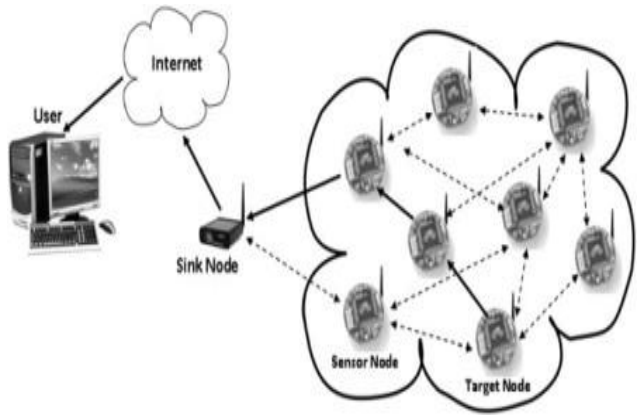

Figure 2: Wireless Sensor Networks

IV. CLOUD COMPUTING BASED WIRELESS SENSOR NETWORK

Architecture

A number of special nodes (sink points) distributed across the WSN area constitute a cloud. We refer this type node as "cloud node", which is equipped with more resources. Furthermore, a cloud node acts as a sink for sensors nearby. Therefore, the architecture is naturally cluster based. In order to differentiate from the term "cluster" in traditional WSN, we refer a cluster as a "zone" in this paper. These sensors in a zone are organized as independent local WSNs (LWSN), and all LWSN are integrated together by the cloud [5]. The cloud can be viewed as a "virtual sink" for the whole sensor network.

Sensor Cloud

Sensor-Cloud infrastructure has been evolved and proposed by several IT people in the present days. Sensor- Cloud infrastructure is the extended form of cloud computing to manage the sensors which are scattered throughout the network (WSN). Due to the increasing demand of sensor network applications and their support in cloud computing for a number of services [6]. Sensor-Cloud service architecture is introduced as an integration of cloud computing into the WSN to innovate a number of other new services. When WSN is integrated with cloud computing environment, several shortfalls of WSN like storage capacity of the data collected on sensor nodes and processing of these data together would become much easier.

Since cloud computing provides a vast storage capacity and processing capabilities, it enables collecting the huge amount of sensor data by linking the WSN and cloud through the gateways on both sides, that is, sensor gateway and cloud gateway. Sensor gateway collects information from the sensor nodes of WSN, compresses it, and transmits it back to the cloud gateway which in turn decompresses it and stores it in the cloud storage server.

An infrastructure that allows truly pervasive computation using sensors as an interface between physical and cyber worlds, the data-compute clusters as the cyber backbone and the internet as the communication medium According to Micro Strains's Sensor-Cloud definition "it is a unique sensor data storage, visualization and remote management platform that leverage [sic] powerful cloud computing technologies to provide excellent data scalability, rapid visualization, and user programmable analysis[11].

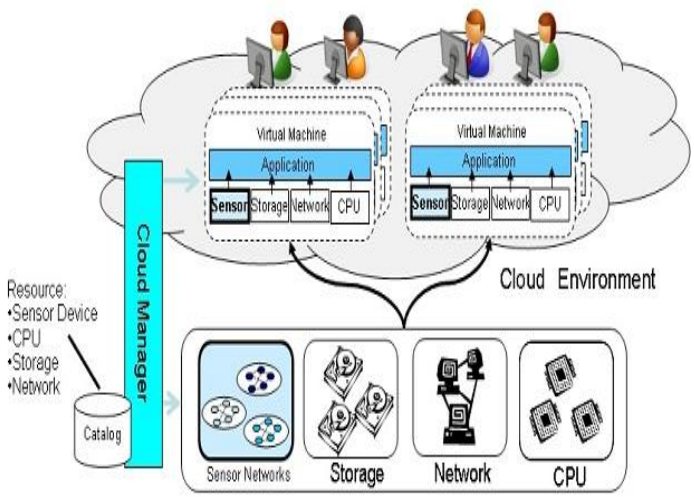

Figure 3: Sensor Cloud Architecture

It is originally designed to support long-term deployments of Micro Strain wireless sensors, Sensor-Cloud now supports any web connected third party device, sensor, or sensor network through a simple Open Data API" .A Sensor-Cloud collects and processes information from several sensor networks, enables information sharing on big scale, and collaborates with the applications on cloud among users[8].

V. ROUTING PROTOCOLS IN WSNS

Routing protocols in WSNs are broadly divided into two categories: Network Structure based and Protocol Operation based. Network Structure based routing protocols are again divided into flat-based routing, hierarchical-based routing, and location-based routing. Protocol Operation based are again divided into Multipath based, Query based, QoS based, Coherent based and Negotiation based. The survey of various routing algorithms that are employed in the wireless sensor networks, cloud communication link, optical network for the grid and the cloud computing applications, unicast and multicast routing algorithms used for the purpose, the shadow – routing algorithm[12] based on dynamic traversal, and other algorithms and their significance.

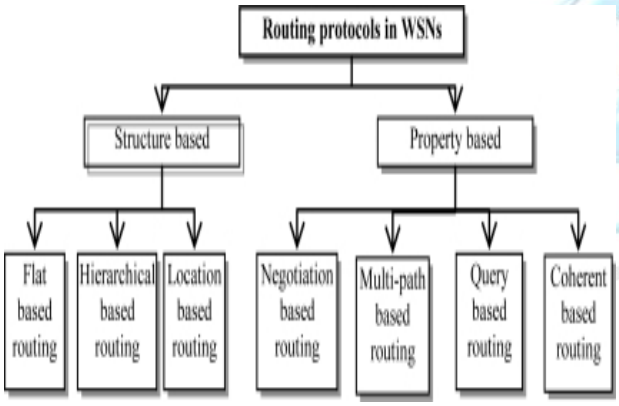

Figure 4: Routing Protocols of WSN

VI. APPLICATION OF WIRELESS SENSOR NETWORK

The terms Sensing as a Service (SaaS) and Sensor Event as a Service (SEaaS) are coined to describe the process of making the sensor data and event of interests available to the clients respectively over the cloud infrastructure [9]. Merging of two technologies makes sense for large number of application. Some applications of sensor network using cloud computing are explained below:

Transport Monitoring

Transport monitoring system includes basic management systems like traffic signal control, navigation, automatic number plate recognition, toll collection, emergency vehicle notification, dynamic traffic light etc. [9]. In transport monitoring system, sensors are used to detect vehicles and control traffic lights. Video cameras are also used to monitor road segments with heavy traffic and the videos are sent to human operators at central locations. Sensors with embedded networking capability can be deployed at every road intersection to detect and count vehicle traffic and estimate its speed.

Weather Forecasting

Weather forecasting is the application to predict the state of the atmosphere for a future time and a given location. Weather monitoring and forecasting system typically includes- Data collection, Data assimilation, Numerical weather prediction and Forecast presentation [41]. Each weather station is equipped with sensors to sense the following parameters—wind speed/direction, relative humidity, temperature (air, water and soil),barometric pressure, precipitation, soil moisture, ambient light (visibility), sky cover and solar radiation.

Health Care

Sensor networks are also widely used in health care area. In some modern hospital sensor networks are constructed to monitor patient physiological data, to control the drug administration track and monitor patients and doctors and inside a hospital. In the above scenario, the data collected from the patients are very sensitive and should be maintained properly as collected data are required by the doctors for their future diagnosis. In traditional approach the patient's history database is maintained in the local nursing home.

Military Use

Sensor networks are used in the military for Monitoring friendly forces, equipment and ammunition, Battlefield surveillance, Reconnaissance of opposing forces, Targeting, Battle damage assessment and Nuclear, biological and chemical attack detection reconnaissance etc [9]. The data collected from these applications are of greatest importance and needs top level security which may not be provided using normal internet connectivity for security reason. Cloud computing may be one of the solution for this problem by providing a secure infrastructure exclusively for military application which will be used by only Defense Purpose

Agriculture

WSANs combined with cloud computing may be applied to tackle many problems related to an agriculture. The main activities of the sensors are to sense and measure the environmental data from the fields and process the data with the help of decision making unit for actuating the process [10]. Sensor nodes that sense the data of the environment and a group of actor nodes. The use of WSAN and Cloud services in agricultural field provides high potential benefits which are economically worth in the field of agriculture. In this paper we have proposed and outline an agricultural WSAN Cloud for providing assistance to farmers during crop cultivation.

VII. CONCLUSION

The communication among sensor nodes using Internet is a challenging task since sensor nodes contain limited band width, memory and small size batteries. The issues of storage capacity may be overcome by widely used cloud computing technique. In this paper, we have discussed some issues of cloud computing & sensor network .To develop a

new protocol in sensor network, the specific application oriented scenarios are of important consideration. As a consequence, this works can be further enhanced by implementing the new protocols for the optimized routing service in the deployment models itself

VIII. REFERENCES

[1] P.Mell, T.Grance, The NIST definition of Cloud Computing , Version 15, National Institute of Standards and Technology, October 7, 2009..

[2] Zhao G, Liu, Tang Y.Sun,W.Zhang F, Ye X,Tang N (2009) Cloud Computing : A statistics aspect of users. In: First International Conference on Cloud Computing (CloudCom), Beijing, Springer,Berlin, Hiedelberg,pp 347 – 358

[3] G. H. Raghunandan and B. N. Lakshmi, "A comparative analysis of routing techniques for wireless sensor networks," in 2011 National Conference on Innovations in Emerging Technology (NCOIET), 2011, pp. 17-22

[4] C. Ulmer, L. Alkalai and S. Yalamanchili, Wireless distributed sensor networks for in-situ exploration of mars, Work in progress for NASA Technical Report. Available in: http://users.ece.gatech.edu

[5] Akyildiz, I.F., W. Su, Y. Sankarasubramaniam, E. Cayirci, "A Survey on Sensor Networks", IEEE Communications Magazine, August, 102-114(2002).

[6] Zhao G, Liu, Tang Y.Sun, W.Zhang F, Ye X, Tang N (2009) Cloud Computing : A statistics aspect of users. In: First International Conference on Cloud Computing (Cloud Com), Beijing, Springer, Berlin, Hiedelberg, pp 347 – 358.

[7] K. T. Lan, "What's Next? Sensor+Cloud?" in *Proceeding of the 7th International Workshop on Data Management for Sensor Networks*, pp. 978–971, ACM Digital Library, 2010.

[8] Sensor-Cloud, defines URL of an http://sensorcloud.com/system-overview.

[9] V. Rodoplu and T. H. Meng,\Minimum Energy Mobile Wireless Networks", IEEE Journal Selected Areas in Communications, vol. 17, no. 8, Aug. 1999, pp. 133344

[10] Kang, B.J.; Park, D.H; Cho, K.R.; Shin, C.S.; Cho, S.E.; Park, J.W. A Study on the Greenhouse Auto Control System Based on Wireless Sensor Network. In Proceedings of the International Conference on Security Technology, Sanya, China, 13–15 December 2008; pp. 41-44.

[11] Akyildiz, I.F., W. Su, Y. Sankarasubramaniam, E. Cayirci, "A Survey on Sensor Networks", IEEE Communications Magazine, August, 102-114(2002).

[12] R. C. Shah and J. Rabaey, \Energy Aware Routing for Low Energy Ad Hoc Sensor Networks", IEEE Wireless Communications and Networking Conference (WCNC), March 17-21, 2002, Orlando, FL.