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Energy Efficiency Analysis in Wireless Sensor Network for Chunk Based Distributed Control System

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ABSTRACT

With the expansion use of internet among people around the world carry many questions on how the storage of data, networking, management of the systems used must be improved to meet all demands. Software-Defined Networking (SDN) has been proposed to be utilized in WSN with more focus on the architecture, routing protocols, topology discovery, management, SDN controllers. In this paper we proposed a chunk based distributed control system is proposed in this paper to address issues arising from and pertaining to the centralized controller. Our simulated result shows better results than the centralized controller and existing approach.

Keywords: Software Defined Networking, Wireless Sensor Network, Software Defined Wireless Sensor Networks, Internet of Things, Distribution.

INTRODUCTION

Wireless sensor networks (WSN) is a self-organizing network composed of a set of sensor nodes. The nodes perceive and collect the sensing objects' information in the monitoring area, and then transfer them to the user. However, the development and application of traditional network architecture are more and more difficult with the rapid development of computers and Internet technology. Traditional TCP/IP protocol in the new form of network environment cannot give full play to its advantages, which restricts the development for computer network technology. On the other hand, the hardware and information distribution strategy in WSN based on the traditional network architecture are all solidified. If the network bursts, the routing strategy will not change correspondingly [3].

Wireless sensor networks (WSNs) consist of individual nodes that interact with the environment by sensing and controlling physical parameters such as temperature, pressure and volume. The nodes also have to interact with each other through wireless communication to achieve the sensing task, and are autonomous although some user-driven data collection is also possible. These nodes contain computation, sensing, actuation and wireless communication functions. Therefore, WSNs are continuously becoming important especially with the advent of Internet of Things (IoT) essential for monitoring several objects in applications such as smart cities, smart health care, smart water networks, smart power grids, smart farming and intelligent transport systems. Furthermore, wireless sensor nodes are usually not tethered to a power source as they require a minimum amount of energy which is usually supplied by integrated batteries.

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WSNs are very flexible in their applications but also pose a research challenge due to their resource constrained and application specific architecture. With increased demand in the application of WSNs, the extent to which the technology can be applied is limited by their resource constrained nature. The main weakness of wireless sensor networks is related to the resource limitations of the sensor hardware namely processing, memory, energy and communication capabilities, although they are widely used due to the increased number of embedded devices available making deployment easier [4].

The software-defined networking (SDN) is a new emerging networking and computing paradigm earmarked as a potential resolve of most of the above-mentioned challenges. SDN advocates for a common standardized protocol to avoid the challenge of vendor locking. The SDN model separates the control and data forwarding on the networking elements; thus, it removes the control logic from the network devices and centralizes it on a controller. The adoption of SDN has gained traction in both the industry and the academia. Software-defined wireless sensor networks (SDWSNs) are an emerging model formed by applying the SDN model in WSNs.

The energy efficiency is one of the fundamental considerations for mobile wireless terminals. Network energy lifetime is related to many factors including protocol, architecture, topology, routing, and QoS. However, the main factor is the energy consumption of each sensor. Unlike other networks, WSNs mostly work using an ad hoc topology based on multi hop transmission. Therefore, the network will be fragmented if some nodes die before others. Thus energy efficiency relies on the specific characteristics of WSNs and is one of the fundamental considerations for mobile wireless terminals. Compared to other technologies, battery development has not kept up with the demand for high-bandwidth service such as multimedia applications, which continue to grow rapidly.

The rest of this paper is organized as follows in the first section we describe an introduction of about the software defined wireless sensor network. In section II we discuss about the Software defined networking framework, In section III we discuss about the proposed work and simulated results. Finally in section IV we conclude and discuss the future scope.

II SDN FRAMEWORK

Large networks also become heterogeneous due to the use of different proprietary protocols, which fundamentally means they consist of different network islands that only cooperate at lower levels of communication. This makes it difficult to implement any policy changes, upgrades, and patches. Traditional networks are also mostly hierarchical, tree based and static, which leads to what most have termed ``ossification''. Ossification refers to a phenomenon of conforming to the conventional way of networking where everything is coupled on the network device. A SDN network typically consists of a centralised control plane and highly dispersed data plane (depending on the deployment). The control plane houses the decision making intelligence of the network, responsible for control and management. After the process of decoupling the routers become more like data forwarding switches, with routing decisions made by the controller within the control plane.

III PROPOSED WORK & RESULTS

Software-defined WSNs (SD-WSNs) have been recently proposed with the objective that WSNs can particularly profit from SDN. Software-Defined Networking (SDN) is an emerging network architecture where network control is decoupled from forwarding and is directly programmable. Per this definition, SDN is defined by two characteristics, namely decoupling of control and data planes, and programmability on the control plane. Nevertheless, neither of these two signatures of SDN is totally new in network architecture. The controller enables ad hoc management, easier implementation of new policies, seamless protocol upgrades or changes, global visualization and the avoidance of middle-boxes such as firewalls, load balancers, intrusion detection systems, etc.

The control plane also offers a high level of abstraction and provides an interface to the application plane. The data plane on the other hand is responsible for packet forwarding. The data plane devices store the rules that guide them on how to handle the packets when they receive them. The rules are implemented and enforced at the control plane. The SDN architectural framework consists of three layered components, as shown in below Fig. These components are interconnected by various APIs and described below [5]:

➢ Application Plane: The application plane interfaces with the various network applications. The application layer can flexibly program the network resource concerned by providing the global or local network abstract view which is provided by the control layer and control network flow flexibly. The application plane comprises a set of network applications that are input to the controllers to install appropriate rules on the data paths. Examples of network applications are routing, firewalling, load balancing, network address translation, etc.

➢ Control Plane: It houses the control software. Controllers are usually implemented by network operating system (NOS). The controllers have an overview of the network, compute suitable forwarding behaviour of all data paths, and configure them with appropriate forwarding rules.

➢ Data Plane (Infrastructure Plane): This consists of the network devices. The communication between the control and the application planes is defined by APIs referred herein as the northbound (NB) interface, while the southbound (SB) interface refers to the communication between the control and the data plane.

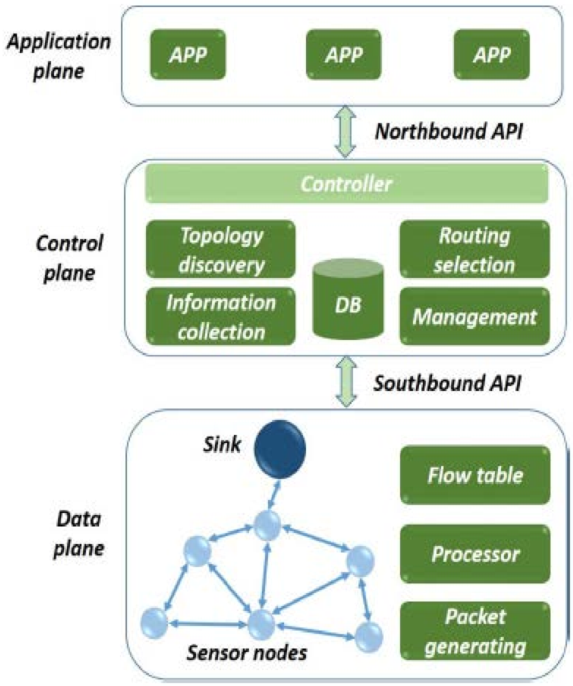

Fig 1: The basic SDN framework with the three planes and a central controller.

In this section we discuss the time varies spectrum resources of chunks have been formulated mathematically. Each chunk is assumed to have n sub-carriers that support a certain frequency range. Due to the time-varied spectrum environment, each sub-carrier can be in one of two states, busy or idle, and the number of idle sub-carriers in each chunk changes over time. We consider the number of available idle sub-carriers in a chunk as the chunk state; then, based on the properties of the state transition model, we can derive the opportunistic capacity for the chunk. When the number of subcarriers per chunk is given, both energy efficiency and spectrum efficiency increase when the coherence bandwidth increase from a very small value. The performance of chunk-based resource allocation is very close to that of single-subcarrier-based allocation scheme when the bandwidth of each chunk is smaller than coherence bandwidth.

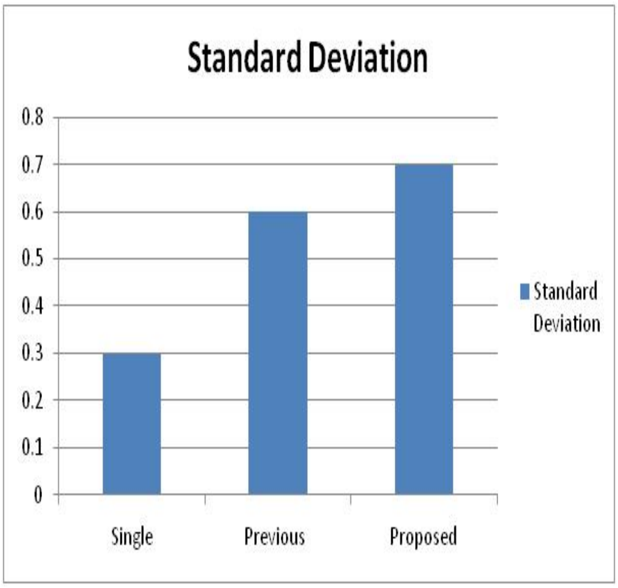

Fig 2: Show the Comparative performance evaluation for the Standard deviation.

IV CONCLUSION AND FUTURE SCOPE

WSN is becoming more popular due it's usage in IoT hence, many proposals are emerging to expand it despite the challenges on the management of networks and heterogeneous node networks which remain a burden. The combinations of SDN with WSN have been given different names such as SDWSN. The purpose of this paper is to investigate the viability of using chunk as a method of distribution for SDWSN controller, and enhance the performance of network by improving the quality of services by software programmable nodes in wireless sensor networks.

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