International Journal of Research in Engineering, Science and Management
Volume-2, Issue-9, September-2019
www.ijresm.com | ISSN (Online): 2581-5792

Software Defined Wireless Sensor Networks for Traffic Load Minimization

Priyanka S. Kottargi[1], Pushpalata Patil[2]
[1]*PG Student, Department of Computer Science and Engineering, Sharnbasva University, Kalaburagi, India*
[2]*Asst. Professor, Department of Computer Science and Engineering, Sharnbasva University, Kalaburagi, India*

***Abstract*: Today's, prominent software is Software Defined Network (SDN), which enables the separation of control plane and data plane. It saves the resource consumption of the network. Breakthrough in this area has opened up a new dimension to the design of software defined technique in wireless sensor networks WSN. There is a limited routing strategy in SDWSN (Software defined WSN). It took the advantage in achieving the minimum traffic load. A Flow Splitting Optimization (FSO) algorithm is used for solving the problem of traffic load minimization (TLM) in SDWSN using the selection of optimal relay sensor node and the transmission of optimal splitting flow. Here we developed SDN data type model to describe how the data is transferring in SDN network. Next the TLM problem into an optimization problem which is appearing by the load of sensor nodes and the packet similarity between different sensor nodes. For solving the optimization problem of traffic load a levenberg marquardt algorithm is used. Finally, we implement the FSO algorithm simulator and give extensive simulation results to verify the efficiency of FSO algorithm in SDWSN.**

***Keywords*: SDN, SDWSN, FSO, WSN**

1. Introduction

Today's, information technologies are Wireless Sensor Networks (WSNs), which are used for modern networking and computing platform purpose.

These network computing applications are faced with a high demand of powerful network functionalities. In mobile network and cloud environment, for customer satisfaction purpose this network reached.

Due to problems, an efficient management of WSNs remains a challenge. So, for improving computing networks the recent technology proposes Software Defined Networking (SDN)

Application challenges faced by WSNs for monitored environments which is faced by proposed approaches and opportunities that can be realized on applications of WSNs using SDN is highlighted here.

While attempting to improve network functionalities purpose implementation considerations by focusing on critical aspects that should not be disregarded. For application improvement in monitored environment, we propose a strategy for SDWSN. The present limitations of the network infrastructure purpose the Software-defined networking (SDN) is an emerging networking architecture that gives the opportunity to overcome this.

It separates the network's control plane and data plane that means an intelligent controller configures forwarding elements with forwarding rules for data packets of different flows.

To fulfill that task the controller obtains sufficient information so that distributed control protocols among forwarding elements are no longer needed. The controller may interact with applications to optimize the network.

A wireless sensor network (WSN) has sensor nodes with communication, computing, and sensing capabilities. Batteries that limit their lifetimes in Sensor nodes. For monitoring purposes, they are often randomly deployed over a larger area. To ensure communication with other nodes and to cover the entire area with the desired application purpose, communication and sensing ranges are controlled.

In the past, the intuitive approach for running WSNs, a self-organized management with distributed control is used. To extend and improve the lifetime of the network, energy saving was always an important goal.

Software-Defined WSNs (SD-WSNs) is a recently proposed with the WSNs. Rather by distributed control protocols the operation of sensor nodes should be simplified to save energy and to manage the WSN through a powerful controller which has a view on the entire network.

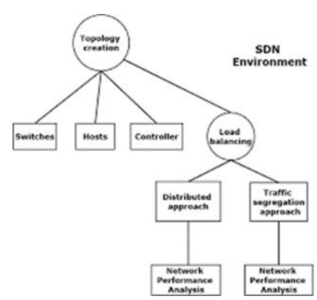

Fig. 1. Block Diagram of SDN

The controller is able to manage the network and applications while saving energy.

To maximize its lifetime, balance the residual energy of the network. A significant difference to SDN in a datacenter is that the controller in a WSN communicates with distant sensor nodes over possibly multiple hops rather than over a dedicated control network. In Section A, we discuss some of the important related works for SDWSN network. In Section B, we discussed about proposed System. Module and module description is given in Section C. Experimental results defined in Section D. Finally, we defined the Conclusion.

2. Related work

new innovation, simplicity in network management and network computing configuration is due to Software Defined Networking (SDN). Moving the control logic from the node to a central controller SDN decouples the control plane from the data plane. The joining of these two models gives us a new model i.e. Software Defined Wireless Sensor Networks (SDWSN). In the ominous Internet of Things (IoT) paradigm, the SDWSN model plays a critical role.

For example, the controller will make the decision to redirect the flow of traffic and order the devices to update their flow tables accordingly in case of data congestion.

In traditional networking models this feature of traffic management is not possible. Changes to the routing paths cannot be implemented directly. SDN refers as the software driven networks. Some parts of the network are managed by the controller, while others are still managed by the more traditional control plane, so they present a SDN as middle approach.

[1] Kgotlaetsile Mathews Modieginyane currently doing PhD in Electronics at University of Pretoria. Obtained MSc in Computer Science 2015, Hons Computer Science, 2012 and BSc in Computer Science and Electronics, 2010 all at the North West University. Research Interests: WSNs, SDN, Signals Processing, Parallel Programming and Cloud Computing.

[2] Babedi Betty Letswamotse received BSc Computer Science and Mathematics in 2011, Honors Computer Science in 2012 and MSc Computer Science in 2014, from North West University. Currently doing PhD in Electronics at University of Pretoria. Research interests: GPU general purpose computing, Automatic Speech Recognition, WSNs and SDN.

[3] Reza Malekian is an Associate Professor at the Department of Electrical, Electronic, and Computer Engineering, University of Pretoria. His current research interests include advanced sensor networks, Internet of Things, and mobile communications. Reza is a Chartered Engineer and also an associate editor for the IEEE Internet of Things Journal and IEEE Access as well as editor of the IET Networks.

[4] Adnan Abu-Mahfouz received MEng and PhD degrees in computer engineering from the University of Pretoria. His research interests are software-defined wireless sensor networks, network management, network security, low-power and long-range wireless sensor networks.

3. Proposed system

We propose a flow splitting optimization (FSO) algorithm for solving the problem of traffic load minimization (TLM) in SDWSNs by considering the selection of optimal relay sensor node and the transmission of optimal splitting flow.

Our system works as:

1. Establishing the model of SDN Controller packet types and describes the TLM problem.
2. Expressing the TLM problem into an optimization problem which is appearing by the load of sensor nodes and the packet similarity between different sensor nodes.
3. Presenting a Levenberg–Marquardt algorithm for solving the optimization problem of traffic load. Also giving convergence analysis of the Levenberg–Marquardt algorithm.
4. Finally, we implement the FSO which gives simulation results to verify the efficiency of FSO algorithm in SDWSNs.

Advantages of proposed system

- Heterogeneity of nodes: all nodes do not have to contain the same brand or the same characteristics.
- Energy harvesting: power consumption constraints for nodes using batteries.
- Durability: ability for resilience hard environmental conditions.
- Scalability: big deployments of nodes do not interfere in the performance of the network.
- Fault tolerant: nodes have the ability to cope with node failures.

4. Modules

- Packet Type Model
- TLM Problem
- Optimization problem
- Levenberg–Marquardt algorithm
- FSO Algorithm

A. Module description

- Packet Type Model: We first establish the model of different packet types
- TLM Problem: limited routing strategy in software defined WSNs (SDWSNs) imposes a great challenge in achieving the minimum traffic load.
- Optimization problem: We then formulate the TLM problem into an optimization problem which is constrained by the load of sensor nodes and the packet similarity between different sensor nodes.
- Levenberg–Marquardt algorithm: We present a Levenberg–Marquardt algorithm for solving the optimization problem of traffic load. We also provide the convergence analysis of the Levenberg–Marquardt algorithm.
- FSO Algorithm: Finally, we implement the FSO algorithm in the Matlab simulator and give extensive simulation results to verify the efficiency of FSO algorithm in SDWSNs.

5. Experimental results

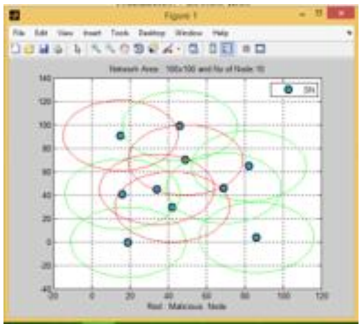

Fig. 2. Deploy of Nodes

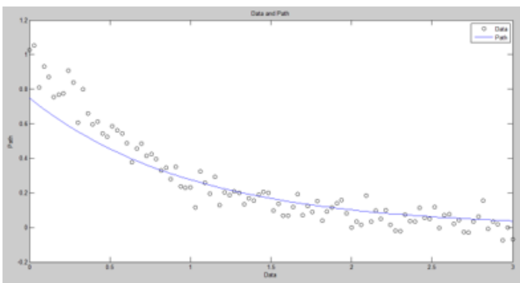

Fig. 3. Levenberg-Marquardt

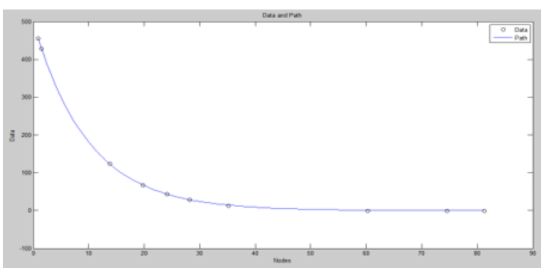

Fig. 4. Levenberg-Marquardt

Fig. 5. FSO

6. Conclusion

The SDWSN model is very challenging, as it comprises of 2 models (SDN and WSN) which are still entangled in their own complexities. The WSN networks are resource constrained, therefore restricting all research efforts to be energy conscious. In spite of several efforts, this is yet to be fully realized and reach its optimal efficacy. The introduction of SDN in WSN presents a new and progressive step in leveraging the challenges of resources in WSN. Likewise, SDN model brings along its own challenges namely the trade-off between functionalities that need to be retained on the sensor device and the blow on common network factors like latency, congestion, etc. In software defined WSNs (SDWSNs) there is a limited routing strategy which imposes a great challenge in achieving the minimum traffic load. In this paper, we propose a flow splitting optimization (FSO) algorithm for solving the problem of traffic load minimization (TLM) in SDWSNs by considering the selection of optimal relay sensor node and the optimal splitting flow transmission.

References

[1] Kgotlaetsile Mathews Signals Processing, Parallel Programming and Cloud Computing. (2012)
[2] Babedi Betty Letswamotse general purpose computing, Automatic Speech Recognition, WSNs and SDN. (2014)
[3] Reza Malekian IET Networks. (2016)
[4] Adnan Abu- software-defined wireless sensor networks, network management, network security, low-power and long-range wireless sensor networks. (2013)
[5] Schwartz, B.; Jackson, A.W.; Strayer, W.T.; Zhou, W.; Rockwell, R.D.; Partridge, C. Smart Packets for Active Networks. In Proceedings of the 1999 IEEE Second Conference on Open Architectures and Network Programming Proceedings, New York, NY, USA, 26–27 March 1999; pp. 90–97.
[6] Schwartz, B.; Jackson, A.W.; Strayer, W.T.; Zhou, W.; Rockwell, R.D.; Partridge, C. Smart Packets: Applying Active Networks to Network Management. ACM Trans. Compute. Syst. 2000, 18, 67–68.
[7] Sherwood, R.; Gibb, G.; Yap, K.K.; Appenzeller, G.; Casado, M.; McKeown, N.; Parulkar, G. Flowvisor: A Network Virtualization Layer. Open Flow Switch Consort. 2009, 1, 132.
[8] Barona López, L.I.; Valdivieso Caraguay, A.L.; Garcia Villalba, L.J.; López, D. Trends on Virtualization with Software Defined Networking and Network Function Virtualization. IET Netw. 2015, 4, 255–263.
[9] Ofelia Consortium. Available online: http://www.fp7-ofelia.eu
[10] Open Networking Foundation. http://www.opennetworking.org
[11] Bonomi, F.; Milito, R.; Zhu, J.; Addepalli, S. Fog computing and its role in the internet of things. In Proceedings of the First Edition of the MCC Workshop on Mobile Cloud Computing, Helsinki, Finland, 13–17 August 2012, pp. 13–16.
[12] Yi, S.; Li, C.; Li, Q. A survey of Fog Computing: Concepts, Applications and Issues. In Proceedings of Workshop on Mobile Big Data, Hangzhou, China, 22–25 June 2015.
[13] Gupta, H.; Nath, S.B.; Chakraborty, S.; Ghosh, S.K. SDFog: A Software Defined Computing Architecture for QoS Aware Service Orchestration over Edge Devices. arXiv 2016, arXiv:1609.01190.
[14] Taleb, T.; Samdanis, K.; Mada, B.; Flinck, H.; Dutta, S.; Sabella, D. On multi-access edge computing: A survey of the emerging 5G network edge cloud architecture and orchestration. IEEE Commun. Surv. Tutor. 2017, 19, 1657–1681.