Performance Evaluation of Dynamic Routing Protocols for Large-Scale Wireless Mesh Networks in Rural Areas of Bangladesh.

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Abstract

Rural locations usually do not have enough internet connection and consistent power supply, making large-scale wireless mesh network implementation difficult.Understanding and addressing these difficulties using improved routing protocols has the potential to significantly enhance internet access and communication services in these remote regions.The focus is on evaluating the efficacy of protocols such as AODV, DSR, and OLSR in dynamic and challenging network environments and encompasses various network scenarios, considering factors like node density, mobility, and network topology.The research is utilizing simulation tools like ns-3. Performance metrics such as throughput, latency, and packet loss are carefully analyzed to measure the protocol efficiency under different conditions. The research contributes to optimizing the performance and reliability of wireless communication in dynamic network environments by determining the most appropriate protocol for various conditions.

**Keywords :** wireless mesh networks, routing protocols , AODV routing protocol (Ad hoc On-demand Distance Vector , Dynamic Source Routing protocol , Optimized link state routing,Performance metrics , Rural areas , Performance Evaluation ,

1. Introduction

Bangladesh, with its vast rural landscape around 60.29%[1]. Still, the network quality in these areas is poor. People in these areas can not use the internet properly or some places not at all. In some places, the network is not available at all. So people of rural areas are getting left behind compared to the city people.To solve this network issue implementing wireless mesh networks(WSNs) in these rural areas is very important. However, Implementing Large-Scale Wireless Mesh Networks (WSNs) in rural areas of Bangladesh faces several unique challenges.Rural areas often lack robust internet infrastructure, making it challenging for dynamic routing protocols to establish and maintain efficient communication.54% rural households in Bangladesh stil do not have access to internet[2].The limited availability of stable internet connections may result in increased latency, packet loss, and unreliable routing information dissemination. Dynamic routing protocols typically require continuous power for networking devices.Only about 40% of the rural households in Bangladesh have access to grid electricity[6].Power outages can cause network disruptions and threaten the stability of routing mechanisms.Because of concerns such as a lack of knowledge, education, and technical expertise, rural areas may be unwilling to adopt new networking technologies, particularly dynamic routing protocols.The benefits of dynamic routing protocols may be foreign to communities, and the move to these technologies necessitates education and training.Large-scale wireless mesh network deployment shows considerable potential in overcoming these constraints, providing a decentralized and cost-effective solution to extending network access to rural places.This research aims to fill this gap by conducting a thorough evaluation of three prominent dynamic routing protocols—AODV[3], DSR[4], and OLSR—in[5] large-scale wireless mesh networks.

* 1. Literature Review

This assessment demonstrates that the primary purpose of the material utilized to construct this proposal was to investigate, how to enhance the performance of Dynamic Routing Protocols for Large-Scale Wireless Mesh Networks in Rural Areas. Ad-hoc networks, such as Wireless Mesh Networks (WMNs), are rapidly evolving in telecommunications and internet systems. WMNs, consisting of mesh routers, clients, and gateways, are used to improve performance in these networks. Resource management, including routing protocols, is crucial in WMNs. Three protocols, Advanced on Demand Vector (AODV), Dynamic Source Routing (DSR), and Optimized Link State Routing (OLSR), have been tested under specific parameters, including end-to-end delay, throughput, and network load, using the Riverbed modeler.[7]

WMNs are versatile for rural environments, providing broadband and communications services. Routing protocols, such as AODV, OLSR, OSPF, and BATMAN, are crucial for efficient performance in resource-constrained rural areas. An objective evaluation of protocols is necessary for rural deployment, considering metrics like protocol overhead, convergence time, and topology control. Simulation experiments can help modify and synthesize reliable protocols.[8]

REFERENCES

1. Leander von Kameke, "Share of rural population in Bangladesh from 2013 to 2022," Statista, Oct 4, 2023. [Online]. Available: https://www.statista.com/statistics/760934/bangladesh-share-of-rural-population/#:~:text=In%202022%2C%20the%20share%20of,unchanged%20at%20around%2060.29%20percent. Accessed: Nov. 11, 2023.
2. A. Author et al., "54% Bangladeshi rural households lack internet access: survey," The Daily Star, Sun Sep 13, 2020 08:11 PM. [Online]. Available: https://www.thedailystar.net/country/news/54-bangladeshi-rural-households-lack-internet-access-survey-1960661 Accessed: Nov. 11, 2023.
3. Chakeres, Ian D., and Elizabeth M. Belding-Royer."AODV routing protocol implementation design." In Distributed Computing Systems Workshops, 2004.Proceedings. 24th International Conference on, pp. 698-703. IEEE, 2004.
4. Johnson, D., Y. Hu, and D. Maltz. The dynamic source routing protocol (DSR) for mobile ad hoc networks forIPv4. RFC 4728, February, 2007.
5. Clausen, Thomas, Philippe Jacquet, Cédric Adjih, Anis Laouiti, Pascale Minet, Paul Muhlethaler, Amir Qayyum,and Laurent Viennot. "Optimized link state routingprotocol (OLSR)." (2003).
6. Arne Hoel, "Bangladesh: Lighting Up Rural Communities" The world Bank, 2023. [Online]. Available: https://www.worldbank.org/en/results/2013/04/15/bangladesh-lighting-up-rural-communities. Accessed: Nov. 11, 2023.Chelsea Finn. 2018. Learning to Learn with Gradients. PhD Thesis, EECS Department, University of Berkeley.
7. Waqas Ahmad\*, Awais Salman Qazi, "Comparison of Routing Protocols in Wireless Mesh Network on the Basis of Performance" . International Journal of Networks and Communications, 2018, 8(2): 29-33. DOI: 10.5923/j.ijnc.20180802.01
8. Ayomide Olanrewaju Ajayi, Adebisi Abimbola Adigun , Wasiu Oladimeji Ismaila, "A Review of Routing Protocols for Practical Rural Wireless Mesh Networks (WMNs),". International Journal of Computer Applications (0975 – 8887), vol. 114 – No. 16, March 2015.