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Efficiency Evaluation Of Routing Techniques In Wireless Networks

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Abstract---Routing is a tedious task in communication networks. A big challenge has to be faced when nodes and network size are not fixed in wireless networks. In this paper we have analyzed three routing protocols AODV, DSR, and DSDV. Using simulator NS-2.35, a performance comparison is also implemented. Performance comparison is graphically presented using gnuplot. Based on the simulation results, we can decide which one is better for a particular wireless network.

Keywords—AODV, WMN, latency, DSDV, DSR, wireless networks

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1. INTRODUCTION

Different types of Wireless networks are used for communication purposes. Wireless Mesh Network(WMN), Mobile Ad-hoc Network, Vehicle Ad-hoc Network etc. Routing is main concept in these wireless networks for performing communication. For routing in such type of networks, a number of routing protocols such as AODV, TORA, DSDV, DSR, and AODV etc. are used. Here question arises that for which type of protocol would be most suitable for which type of wireless network in respect of performance and better results. Thus it is necessary to have a better knowledge about these protocols so that one can easily implement a suitable protocol for his network and can get best results. Taking this concept, in this paper we have analyzed three routing protocols AODV, DSR, and DSDV. Also a performance comparison is implemented using different metrics in network simulator-2.35.

This paper is partitioned into six sections. In section 1, a brief introduction of wireless networks and communication is described. Section 2 gives us a brief introduction about routing protocols (AODV, DSR, and DSDV). Section 3 presents a literature survey of routing protocols and their comparison. Section 4 gives a detail of methodology and simulation work taken place in this paper. Section 5 describes about the results and comparison details. Section 6 concludes this paper.

2. ROUTING PROTOCOLS IN WIRELESS NETWORKS

2.1The Ad hoc On-Demand Distance Vector (AODV)

- ✓ AODV acronyms for Ad-hoc on demand distance vector routing protocol.
- ✓ AODV is the source –initiated on-demand driven routing protocol.
- ✓ AODV routing protocol is used for routing the information in MANET (Mobile Ad-hoc Network).
- ✓ AODV is used to broadcast discovery packets during route discovery phase.
- ✓ It minimizes the control overhead.
- ✓ Sequence number and broadcast id are two separate counters which are used by the each node (while using AODV).
- ✓ Path discovery, route table maintenance and path maintenance are the phases which are followed by AODV routing protocol during routing process.
- ✓ In path discovery phase, RREQ and RREP are the route request and route reply packets which are generated for making route request and route reply process.
- ✓ In AODV, a routing path between nodes is not maintained at all the time, but it is built only when required.

2.2. DSR (Dynamic Source Routing)

Dynamic Source Routing (**DSR**) is a routing protocol for wireless networks. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.

- ✓ DSR refers for Dynamic Source Routing protocol.
- ✓ DSR is also the source initiated on-demand driven routing protocol.
- ✓ In DSR, route is established only when needed.
- ✓ Mostly DSR is used in MANET (a wireless ad-hoc network).
- ✓ In dynamic source routing protocol, the sender of a packet determines the complete sequence of nodes through which the node has travel.
- ✓ Route discovery and route maintenance are the two important phase in DSR.
- ✓ A route discovery process is activated only when the source wants to send a packet to a destination.
- ✓ When a node receives a RREQ packet, it checks about source address. Destination address.
- ✓ Every node has its route cache which is used for storing the route details.
- ✓ Route maintenance phase is activated when a link breakage has been occurred. An intermediate node sends a RERR message which indicates that a route error has been occurred in between the route.
- ✓ More than one routing paths can be produced by the source to the destination.

2.3 .DSDV(Destination-Sequenced Distance-Vector Routing)

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman–Ford algorithm. It was developed by C. Perkins and P.Bhagwat in 1994. The main contribution of the algorithm was to solve the routing loop problem.

- The properties of the ad-hoc network routing protocol
  - Simple
  - Less storage space
  - Loop free
  - Short control message (Low overhead)
  - Less power consumption
  - Multiple disjoint routes
  - Fast rerouting mechanism

DSDV modified Distance-vector protocol

- ❖ Distance-vector:
- ❖ Packets are transmitted by using “Route Table”
- ❖ To Maintain Route Table

☞Each node broadcasts its Route Table Entries

❖Periodically

❖Immediately

☞When a node receive new routing information

❖More recent Sequence Number is used
❖With the same Sequence Number, the smallest metric will be used
☞Metric+1 then broadcast its route information

❖ The route information broadcast by each node contain
☞Its new Sequence Number
☞Each route
❖The Destination's address
❖The number of hops required to reach the destination
❖The Destination Sequence Number
❖Responding to Topology Change
☞Any route through the broken link is immediately
❖Building information to describe broken links
☞Assign an ∞ metric
☞Assign an updated Destination Sequence Number (+1)
❖Broadcast the Route information packet

3.LITERATURE SURVEY

A lot of work has been done in respect of comparison of routing protocols in wireless networks. In [1] this paper, three routing protocols DSDV, AODV, and DSR are compared in respect of performance metrics packet delivery fraction (PDF) end to end delay and NRL (normalized routing load). Network simulator-2 was used for simulation purposes. Based on results, AODV is considered superior routing protocol as compared to DSR and DSDV but has a higher routing load comparatively than DSDV.

In [2] this paper, a detailed simulation analysis of AODV, DSR and DSDV has been done. A step by step presentation of the work is pointed out here. Installation detail of NS-2, and implementation detail for AODV, DSR, and DSDV at the platform of network simulator is presented. At the end of the paper a comparison based on throughput, delay, packet loss is implemented using MATLab 7.0.

In [3] master thesis, OLSR (Optimized Link-State-Routing) and AODV routing protocols are studied. Also a comparative study has been done here. Based on network size, type of traffic, type of mobility, performance comparison is done.

This paper [4] presents an analysis of reactive and proactive protocols based on a number of metrics. A detailed classification of reactive and proactive protocols in MANET is presented. For comparison, a number of metrics such as packet delivery ratio, throughput, and control overhead, end-to-end delay are used.

A comparative study [5] has been done based on the performance metrics such as NRL (Normalized Routing Load), PDR (Packet Delivery Ratio), throughput, end-to-end delay. For simulation NS-2.33 is used. At end of paper, AODV is considered superior when network size and number of nodes are small.

A detailed study of DSDV and AODV routing protocols is done in [6]. Also classification of ad-hoc routing protocols; advantages and disadvantages are also covered in this work. Throughput, average end-to-end delay, jitter, performance metrics are used. Based on simulation results, DSDV gives better jitter performance as compared to AODV. At the condition of high mobility, AODV gives higher efficiency and performance.

Detailed classification and comparison is done in [7]. In respect of power usage, data aggregation, scalability query based, overhead, data delivery model, QoS, classification is presented.

WRP (Wireless Routing Protocol) is elaborated in detail including proofs and theorems in [9]. Path-finding algorithm has been applied for WAP. AS per this work, WRP is better than DUAL(a loop free distance vector algorithm)

In [10], using NS-2 simulator environment, comparison of AODV, DSDV, DSR, and TORA (Temporally ordered routing algorithm) is described. Several performance parameters has been considered here such as PDF(packet delivery fraction), throughput, end-to-end delay. Path optimality, routing traffic generated. This paper concludes that DSr outperforms as compared to DSDV, TORA, and AODV routing protocols.performance evaluation of AODV, DSR, OLSR, and ZRP is done. ZRP and Aodv are declared as best as compared to DSR and OLSR. A brief overview of ZRP (Zone Routing Protocol) is described shortly. QualNet 4.0 simulaor is used for creating a simulation environment. Packet delivery ratio and throughput are considered as main metrics.

4.METHODOLOGY

In this paper, for simulation of routing protocols, we have applied network simulation 2.35. the network size for simulation is 1800×840. We have used here Omni antenna as a antenna model. Radio propagation model is Two Ray Ground model. We have used here 22 nodes in wireless network. Simulation based evaluation/comparison is done for AODV, DSR, and DSDV routing protocols.

Network size for simulation is taken as 1800×840. Antenna model for simulation is selected as Antenna/OmniAntenna. For comparison of results by simulation, GNUPlot is used in this work. We have written three tcl scripts (22-aodv.tcl, 22-dsr.tcl,22-dsdv.tcl) for network simulator-2.35. By executing the tcl scripts written for NS-2.35, three nam files (22-aodv.nam, 22-dsr.nam, 22-dsdv.nam) are generated. Also trace files (22-aodv.tr, 22-dsr.tr, and 22-dsdv.tr) are generated after execution of tcl scripts in NS simulator. Sample of nam file and trace file contents are described as under:

When we execute the tcl script (22-aodv.tcl) in ns-2.35 command window, nam window will open. After pressing start button of nam window, simulation will start as shown in figure 1.

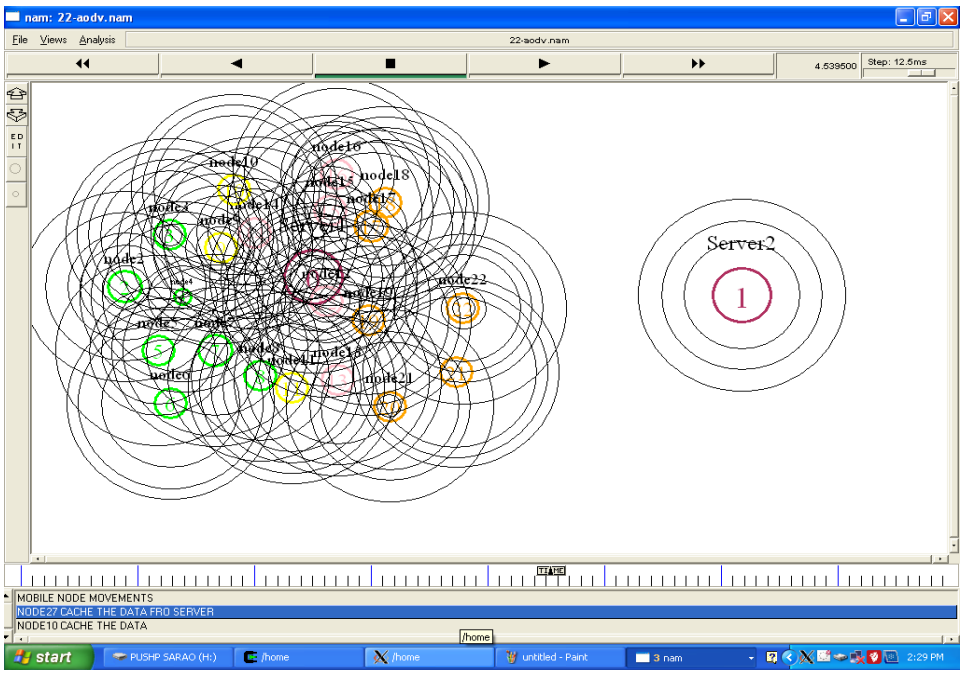

Figure 1: Simulation in nam window during communication

5.RESULTS AND DISCUSSION

We have written awk and perl scripts for finding the performance metrics such as PDF, average throughput, latency, dropped packets, sent packets, average end-to-end delay, routing overhead, average path length. After execution the awk and perl scripts in ns-2, we have results as detailed in tables 2, 3, and 4.

For example, by executing the following command:

Administrator@abc /home

$ perl performancemetrics.perl 22-aodv.tr

We will get the results in command window of NS-2.35 as given below:

sent packets= 606

packets dropped=110/nrouting overhead= 1.320132

Packet delivery ratio 0.818482

Average path length 1.016129

And after executing the following command of awk script in command window of NS-2.35, we will get the results as given below:

Administrator@abc /home

$ awk -f genthroughput.awk 22-dsdv.tr

Average Throughput[kbps] = 316.37 StartTime=0.00 StopTime=5.01

Table 2: Performance Comparison

	Received Packets	Total Dropped Packets	Average E2E Delay(in ms)
AODV	5381	2710	80.1018
DSR	3228	1533	9.20256
DSDV	2633	427	501.15

Table 3: Performance Comparison

	Sent Packets	Routing Overhead	Packet-Delivery Ratio	Average-path length
AODV	606	1.320132	0.818482	1.0161229
DSR	606	41.089109	0.830033	1.495030
DSDV	606	0.00000	0.63534	1.000000

Table 4: Performance Comparison

	Average throughput	Start Time	Stop Time
AODV	369.20 kbps	0.00	5.50

DSR	307.99 kbps	0.00	6.69
DSDV	316.37 kbps	0.00	5.01

Average E2E delay and average throughput of DSR is minimum as compared to AODV and DSDV. But DSR has the maximum routing overhead. Average throughput of AODV is maximum.

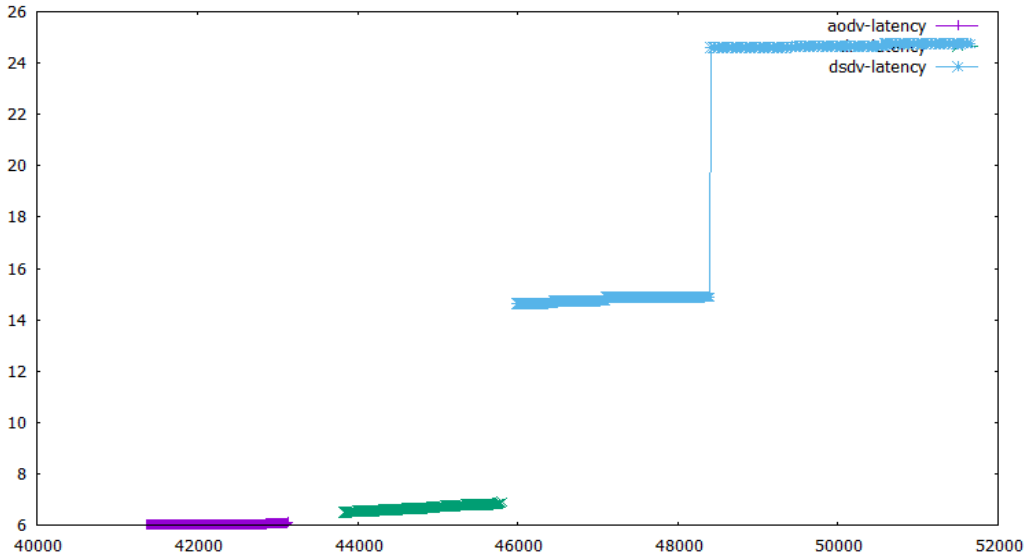

Figure 2: Latency comparison of AODV, DSR, DSDV

Latency comparison of AODV, DSR, and DSDV is graphically presented in figure2 using gnuplot.

6.CONCLUSION

Wireless networks are widely used networks, but complexity has to be faced when networks are large. Also communication in such networks gives us a challenge. Routing in these networks takes a great role in respect of performance. In this work a detailed simulation results are included. By considering several performance metrics (such as latency, throughput), we have analyzed three routing protocols AODV, DSR, and DSDV. Based on these results we can select a suitable protocol for our wireless network. We have analyzed a performance comparison using NS-2.35. AODV routing protocol is better when network size is not large.

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