# Real-world Performance Analysis of Ad-hoc wireless Network

Tushar G. Dangat

M.E Student, Department of Computer Engineering, Sharadchandara Pawar College of Engineering, Otur, Pune, India

**ABSTRACT:** An ad hoc community includes some of Wi-Fi hosts that briefly shape a dynamic LAN and are able to operate without the help of any constant infrastructure like get right of entry to factor Wi-Fi routers and so on. Effective dynamic routing is a project in this kind of networks. To allow conversation between hosts, each host must feature as a Wi-Fi router and probably ahead statistics traffic on behalf of others. At some point of the last few years more than 30 special ad hoc routing protocols have been proposed, broadly speaking as compared primarily based on simulation studies. The majority ad hoc routing implementation has been accomplished using simulation equipment.

In simulation the code is contended in single logical factor on different hand at the same time as imposing real phrase required system with many components such as many who have little or no documentation. For researcher need to understand no longer most effective the routing protocol, but all of the gadget components and their complex interactions additionally. Simulation research is simply supplement no longer getting real result like real word experiments.

In this paper summarized attempt and experiences to set up actual real word wireless ad hoc network infrastructure. Mentioned the demanding situations and survey the field of ad hoc routing and associated actual global experiment. Its miles beneficial to aid researchers for growing on-call for ad hoc routing protocols environment and assist customers in figuring out the implementation design that first-class fits their desires. In this paper mentioned the socket primarily based mechanism substantially once AODV routing daemon communicates modifications to the regulate path desk i.e. routing table

**KEYWORDS:** ad hoc, network, AODV, Simulation.

## I.  INTRODUCTION

*Mobile ad hoc Networks (MANETs),* arrange extensive speaking is considered as a noteworthy capability, which tries to transmit packets inside the machine to each different hub from source hub. While all is said in carried out, telecom is positioned to be extremely precious for assisting, naming and tending to multicast operations in an extensive kind of systems and furthermore treasured in locating path. So as to restrict crash of device, to restriction utilization of strength, and to reduce packets transmission delay and to optimise the throughput, a group based approach has been recommended. For broadcasting in MANETs, baseless i.e. is not a fixed infrastructure approach has been proposed.

The gadget backbone takes the advantage of bunch shape and institution heads and similarly few picked entryways are simply required preserving in mind the give up aim to propel the speak packets. Retaining in thoughts the stop purpose to propel the packets, few passages had been chosen by means of way of all the group heads at something element the packet is being sent with the useful resource of it to each group head in its scope set.

Inside the software, the hub's versatility behaviour is displayed through the arbitrary waypoint version to which hub actions to the areas of irregular are created, and the related eliminate time and speed are diagnosed at the way to manage the recurrence at which the topology of machine is modified. Collecting of manner has been consolidated via superior AODV convention amid the technique of path revelation in AODV retaining in thoughts the cease intention to accomplish greater records with admires to routing.

The flexible hubs gathering in adhoc systems those are observed arbitrarily and excitedly. The portable adhoc arrange lets in the far off establishments within the center of the taking a hobby flexible hubs without manual of base station. Inside the center of hubs consist of the interconnection and these hubs are prepared for changing on the

ceaseless premise. Proper here consist of the two hubs out of one more transmission; the midway hubs are saved up those hubs. For each hub transmit the message some of the hubs and discover a name.

The routing protocol of adhoc machine maximum critical aspiration is accurate. May deliver the messages are in a selected time way because of inside the canter of the hubs fit the path enterprise is proficient. Communicate operation is the vital rule in MANET, so the transmission of radio correspondence is in nature. Every time the dispatcher spreads the packet by way of utilising the correspondence. The aggregate hubs are stimulated in the transmission packet of sender.

The single hub transmits the packet this is the precept gain and all neighbors get this message. Upload as a good deal as neighborhood hubs are entails or encased by means of the use of utilizing the transmitting hub. The single transmission is would possibly abate with alternate transmissions happening on the horrible aspect. Anywhere the uncovered terminal with drawing near transmission consists of the crash difficulty with the "active transmission".

*AdHoc On-demand Distance Vector (AODV)* is a reactive protocol, even though it makes use of trends of a proactive protocol. It makes use of the concept of direction discovery and path upkeep of *Dynamic Source Routing (DSR)* protocol and the concept of series numbers and sending of periodic hiya messages from *Destination Sequenced Distance Vector(DSDV) protocol.* Routes want not be protected in packet headers. Nodes keep routing tables containing entries best for routes which can be in lively use. At the most one next-hop per destination maintained at each node. Collection numbers are used to keep away from antique/damaged routes and save you routing loops. Those allow also the nodes to pick out the maximum modern-day path to a given destination node.

## II. RELATED WORK

There are numerous procedures to perform the AODV directing conference AODV anticipated to accumulate the event. There might be possibilities to get activities: (1) snooping (2) Net filter (3) Kernel amendment.

Inside the accompanying, every plausibility is portrayed, and offers their focal points and inconveniences.

### 2.1. Snooping

With a selected cease intention to decide the required sports is to indiscriminately snoop all coming near and energetic packets. [3] The code to perform snooping is covered with the detail and is available to purchaser area packages. For e.g. An ARP package deal is produced at the same time as a hop does not realise the MAC layer address of the following leap. utilising this interface, if an ARP asks for bundle is seen for an obscure goal and it is commenced out by using the network has, after which a path revelation should be began. Additionally, all other AODV sports are likely controlled by searching at coming close to and energetic bundles. The most critical preferred standpoint of this association is it would not require any code to keep walking inside the component space. For that reason it takes below attention sincere established order and execution .however two burdens are overhead and reliance over ARP. [4]

### 2.2. Net filter

Net filter [5] is an affiliation of snares at a specific focuses inside the Linux conference stack. Net filter diverts packet through patron characterised code which could have an examine, drop, dispose of, regulate or line the bundles for purchaser space daemon. The use of net filter out is like snooping technique anyway it does not have the impediment of superfluous overhead or reliance on ARP. This affiliation has the extraordinary, for instance, there can be no superfluous correspondence; it is profoundly reachable, it is something however difficult to introduce and patron region daemon can determine all the required events. Alternatively, the drawback of this association is that it calls for an element module. But piece module is a good deal much less traumatic than bit modifications. A piece module is extra versatile than element alterations since it relies upon just on the internet clear out interface. This interface does now notalternate from one component form to next. [4]

### 2.3. Kernel amendment

Preserving in mind the stop purpose to determine the AODV sports is to alternate the piece. Code may be located inside the portion to carry the events to an AODV customer area daemon. For instance, to begin path revelation, code is blanketed the bit on the factor wherein direction question disappointments appear. Given this code within the bit, if direction query sadness takes region, then a technique is added inside the customer area daemon. Demonstrates the engineering of the AODV daemon and the wanted help rationale. The benefits of this association are that the sports are expressly decided and there are no squandered overhead. The precept inconveniences of this association are customer popularity quo and versatility. Repute quo of the essential element adjustments calls for an entire aspect recompilation. That may be a hard method for some customers. Likewise, bit patches are frequently not bendy amongst one element form and the subsequent. At prolonged remaining, statistics the Linux bit [6] and set up convention stack calls for reading a whole lot of commented complicated code. [4]

### III.CONFIGURATION OF WIRELESS ADAPTER IN AD-HOC MODE

Before you running "aodv" you need to configure you wireless LAN card (wlan0).Try to use static IP in every hop. Don't forget to set Netmask, Mode as "ad-hoc", ESSID, Channel, Rate.

```
stop network-manager
ifconfig wlan0 down
iwconfig wlan0 mode ad-hoc
iwconfig wlan0 channel 6
iwconfig wlan0 essid 'aodv'
ifconfig wlan0 up
ifconfig wlan0 10.0.0.4 netmask 255.255.254.0
```

### 3.1. Extended Service Set Identification (ESSID):

The *Extended Service Set Identification* (ESSID) is one in all two kinds of carrier Set identification *Service Set Identification*(SSID). In an impromptu far off device with no get to focuses, the basic provider Set identification *Basic Service Set Identification*(BSSID) is applied. In a framework remote device that contains a get to factor, the ESSID is utilized, however may additionally in any case be alluded to as SSID. A SSID is a 32-person (most extreme) alphanumeric key recognizing the name of the remote neighbourhood. Some merchants allude to the SSID as the machine name. For the far flung devices in a device to speak with each other, all gadgets should be designed with the same SSID.

### 3.2. Wireless Channels:

Selecting the excellent Wi-Fi channel in your router facilitates to lessen interference and enhance your Wi-Fi signal. These match will assist you pick out the least congested Wi-Fi channel for your vicinity. Wireless channels overlap with close by channels. Channels 1, 6, and 11 are the most frequently used for 2.4 GHz Wi-Fi. Those 3 channels are the only ones that don't overlap with every other. As shown in figure 1.On the off chance that you need most extreme throughput and insignificant obstruction, channels 1, 6, and 11 are your best decisions. Be that as it may, contingent upon different remote systems in your region, one of those channels may be a superior alternative than the others.Selecting one or more from these channels is valuable part of setting up your wireless network correctly it reduce collision of a packets, reduce utillization of signal strength
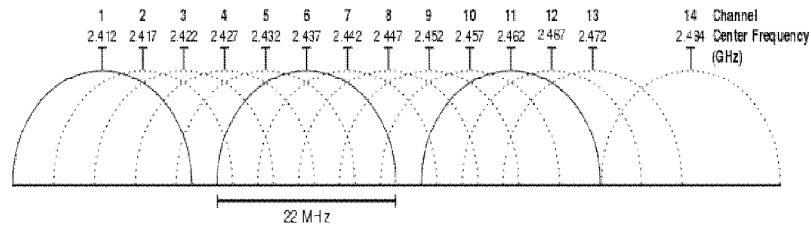
**Figure 1: Graphical representation of channels overlapping (2.4 Ghz band)**

For instance, in case you're utilizing channe11, yet somebody nearby is annoyingly utilizing channel 2, then your throughput will dive? In that circumstance, you would need to change to channel 11 to totally maintain a strategic distance from the impedance (however 6 would be really great also). It may entice to utilize a channel other than 1, 6, or 11 — yet recollect that you will then be the reason for obstruction (and everybody on 1, 6, and 11 will step on your throughput, at any rate).

In a practical world, you would converse with your neighbors and get each switch to utilize channels 1, 6, or 11. Remember that inside dividers make a quite decent showing with regards to of constricting (debilitating) a flag. On the off chance that there's a big Brick divider amongst you and a neighbor, you could most likely both utilize channel 1 without meddling with each other. Be that as it may, if it's a thin divider (or there's loads of windows), you ought to utilize diverse channels.

Open a Terminal and run the following command:
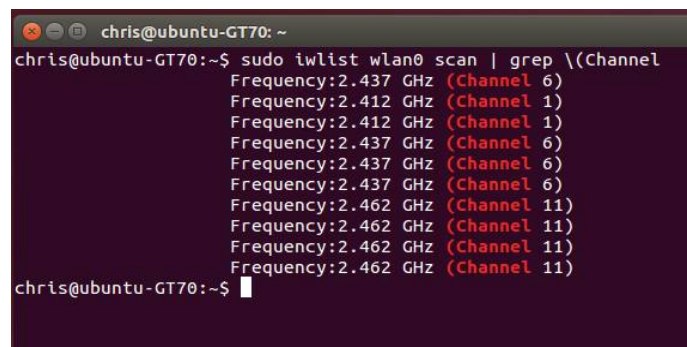
```
sudo iwlist wlan0 scan | grep \(Channel
```



**Figure 2: Channel List screenshot**

Read the output of the command to see which channels are the most congested and make your decision. In the above figure 2, channel 1 looks the least congested.

### 3.3. IP forwarding

"IP forwarding" is a synonym for "routing." it is known as "Kernel IP forwarding" because it is a feature of the Linux kernel. A router has more than one community interfaces. If site visitors are available in on one interface that fits a subnet of another community interface, a router then forwards that site visitors to the other community interface.

So, let's say you've got two Ethernet card, one (eth0) is having address 192.168.2.1/24, and the opposite (eth1) is 192.168.3.1/24. If forwarding is enabled, and a packet is available in on eth0 with a "destination deal with" of 192.168.3.8, the router will resend that packet out of the eth1. It's commonplace for routers functioning as gateways to the net to have a default path wherein any site visitors that does not healthy any eth will go through the default path's Ethernet.To enables ip_forwarding functionality of an Ethernet card; to call a script at startup all you have to do is to add a line to /etc/rc.localopen with any editor in terminal.

Code:

```
#vi  /etc/rc.local

# echo 1 > /proc/sys/net/ipv4/ip_forward
```

After enabling ip_forwarding in each wireless host, hosts acts as a router and forward the packet at desired destination host by preserving routing information in routing table.

## IV. ADHOC ON DEMAND VECTOR (AODV)

AODV is one of the reactive (on-demand) routing protocol that developed by Uppsala University dan University of Basel.[7] Before installation, you'd better check for 'development tools' and kernel configuration on your Ubuntu OS. And also check compatibility with the operating system like code will suitable for their device driver in some cases OS not supported with wireless adaptor due to which at the time of compilation will get an error and stuck the process .While configuring kernel check kernel source in operating system Ubuntu 10.04 Desktop 32 bit OS is compatible with Dlink G510 series wireless adapter, now a daysUbuntu 10.04 is no longer supported.Due to the setup and device compatibility requirement Ubuntu 10.04 is used, to use old releases by using this address:
`http://old-releases.ubuntu.com`
To achieve this, open the `/etc/apt/sources.list` file with a text editor, and replace `archive.ubuntu.com`with `old-releases.ubuntu.com`. You should prepare host first and make ready for installation. AODV-UU compilation is performed by 'make' utility from Ubuntu OS. The make file will create an aodv daemon (aodvd) and a kernel module (kaodv.o). The installation is as follows:

1. First, install build-essential correctly. If not, use this command:
   `apt-get install build-essential`
2. After that, download the setup file.[7]
3. And then extract the file.
4. Enter to the file using:
   `cd aodv-uu-0.9.x`
5. Install it using command:
   `make && make install`
6. After that, load the kaodv modul on Ubuntu, using:
   `modprobe kaodv`
7. After all the step finish, activate aodv using command:
   `aodvd -l -d -D -r 3`

***Command-l*:** mean write a output of this command in the `/var/log/aodvd.log`
***Command -D:*** mean non-activate waiting time (15 second) as a reboot delay when the protocol fail to run
***Command -d:*** mean run the protocol in background
***Command -r 3***:mean save the routing table in the `/var/log/aodvd.log` every 3 second

And sooner or later, aodv has run. After which should decide the IP cope with statically. To check that AODV is correctly run, try and ping other machines within the set up ad hoc network. Seeing that in a LAN all of the machines are inside the reception variety of every other (i.e., any pair of machines can talk directly with every different), applies the subsequent technique to simulate multihop communique.
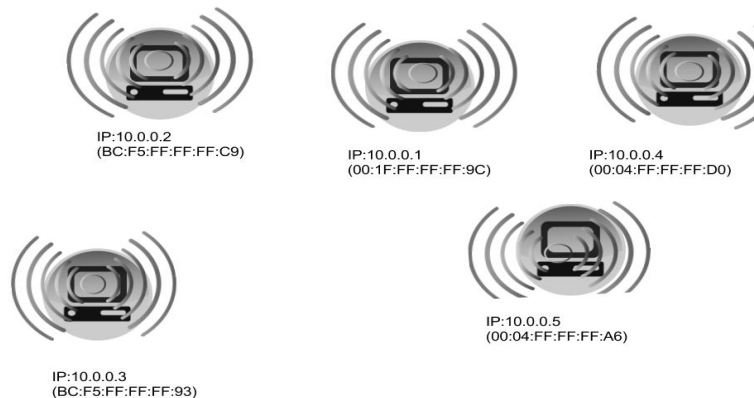


IP:10.0.0.2
(BC:F5:FF:FF:FF:C9)

IP:10.0.0.1
(00:1F:FF:FF:FF:9C)

IP:10.0.0.4
(00:04:FF:FF:FF:D0)

IP:10.0.0.5
(00:04:FF:FF:FF:A6)

IP:10.0.0.3
(BC:F5:FF:FF:FF:93)

**Figure 3: Multihop wireless network**

Assume that  to simulate a situation in which machines with MAC addresses bc:f5:ff:ff:ff:93 and 00:04:ff:ff:ff:d0 cannot transmit directly to each other (see the figure above). However, both machines can hear machine 00:04: ff: ff: ff: 9c.To achieve this uses the iptables utility [5]. Iptables gives the functionality of packet filtering. This is done on the network layer. The command to use to drop packets arriving from a specific machine is:

```
#iptables -A INPUT -m mac --mac-source bc:f5:ff:ff:ff:93 -j DROP
```

Where bc: f5: ff: ff: ff: 93 is the MAC address of the hop which messages should be dropped. To see the list of MAC addresses that are blocked type: iptables -L, for help iptables --help.
For example, on machine bc:f5:ff:ff:ff:93, execute the following command:
```
#iptables -A INPUT -m mac --mac-source 00:04:ff:ff:ff:d0 -j DROP
```
After the establishing setup try to trace rout from IP 10.0.0.4 to 10.0.0.1 the output screenshot shown in below figure 4.



**Figure 4: Traceroute Output**

The traceroute command output shows multihop output from hop 10.0.0.4 to hop 10.0.0.5 destination hop is 10.0.0.1 the IP packets flows from 10.0.0.4 =>10.0.0.5 => 10.0.0.1 refer figure 4. With the aid of commentary traceroute command output, easy desktop computer operating as Wi-Fi router and ahead information visitors on behalf of others.

## V. METHODOLOGY OF PERFORMANCE EVALUATION

To evaluate the performance of AODV completely different experiments were performed underneath variable conditions. Our interests were:

- **Route Discovery Time:** Total time taken from while a RREQ is assembled till the RREP is received
- **Packet Loss performance:** the share of misplaced applications at some stage in one thousand ping
- **Source-to-Destination Delay Performance:** The time taken from while a sure packet is sent with the aid of the source node until it's far received by using the destination node

The various situations had been extraordinary route duration, varying packet sizes and mobility.

**5.1. Route Discovery Time:**ever new instance node desires to speak with every other node and no entry in the routing table for this particular destination node exists, a path discovery is initiated. The time taken to find out this path is a crucial first-rate of a routing protocol. AODV takes from whilst a RREQ is assembled till a RREP is obtained, what's called the *Route Discovery Time* (RDT). This time is in characteristic of the space to the vacation spot and the size of the network (the quantity of nodes within the network), but does no longer depend on the dimensions of the records packet to be transmitted.If you want to measure the RDT the AODV-UU turned into started and its output became logged as shown in figure 5. AODV waits after reboot a positive time period, known as DELETE-length, earlier than transmitting any direction discovery messages, this is executed considering that series numbers may be lost and routing loops may be created. Also after this era of time no neighboring node of the rebooted node can be using it as an energetic next hop any greater.

```
16:08:26.563 rreq_process: ip_src=10.0.0.1 rreq_orig=10.0.0.5 rreq_dest=10.0.0.2 ttl=34
16:08:26.563 rreq_record_insert: Buffering RREQ 10.0.0.5 rreq_id=882 time=5600
16:08:26.563 log_pkt_fields: rreq->flags: rreq->hop count=1 rreq->rreq_id=882
16:08:26.563 log_pkt_fields: rreq->dest_addr:10.0.0.2 rreq->dest_seqno=221
16:08:26.563 log_pkt_fields: rreq->orig_addr:10.0.0.5 rreq->orig_seqno=884
16:08:26.563 rreq_process: Creating REVERSE route entry, RREQ orig: 10.0.0.5
16:08:26.563 rt_table_insert: Inserting 10.0.0.5 (bucket 10) next hop 10.0.0.1
16:08:26.563 nl_send_add_route_msg: ADD/UPDATE: 10.0.0.5:10.0.0.1 ifindex=3
16:08:26.563 rt_table_insert: New timer for 10.0.0.5, life=5440
16:08:26.563 rrep_create: Assembled RREP:
16:08:26.563 log_pkt_fields: rrep->flags: rrep->hcnt=0
16:08:26.563 log_pkt_fields: rrep->dest_addr:10.0.0.2 rrep->dest_seqno=221
16:08:26.563 log_pkt_fields: rrep->orig_addr:10.0.0.5 rrep->lifetime=6000
16:08:26.563 rrep_send: Sending RREP to next hop 10.0.0.1 about 10.0.0.5->10.0.0.2
16:08:26.563 aodv_socket_send: AODV msg to 10.0.0.1 ttl=255 size=20
```

**Figure 5: AODV log (10.0.0.2)**

| Number of nodes | Average RDT(ms) |
|---|---|
| 2 Node | 71.49 |
| 3 Node | 167.24 |

**\*Average RDT taken of 10 repetitions**

**Table 1: *Route Discovery Time* (RDT)**

**5.2. Packet Loss Performance:** Any other crucial satisfactory in communique is the packet loss overall performance of a communication. Its miles motivated via elements like interference, more than one hops and channel conditions.to assess the packet loss performance PING become used with a hard and fast rate of one

message according to second and a consistent packet size of sixty four bytes. The PING summaries have been taken for the results. As implementation inside the experiments AODV-UU was used. For every route duration we send more than one thousand packets. This turned into repeated three times for each state of affairs inside the laboratory.

The outcomes received are represented in table:

| Number of nodes | Test No. | Packet Transmitted | Packet Received | Packet Loss |
|---|---|---|---|---|
| 1 | 1 | 1023 | 1023 | 0% |
| | 2 | 1056 | 1056 | 0% |
| | 3 | 1089 | 1089 | 0% |
| 2 | 1 | 1078 | 954 | 10% |
| | 2 | 1069 | 651 | 39% |
| | 3 | 1068 | 431 | 60% |
| 3 | 1 | 1045 | 855 | 58% |
| | 2 | 1068 | 584 | 45% |
| | 3 | 1054 | 261 | 75% |

**Table2: Packet Loss Performance**

**5.3. Source-to-Destination Delay Performance:**The *Source-to-Destination Delay* (SDD) is the amount of time taken from while a message has been dispatched by way of the supply node until it is received by means of the destination node. It's far the sum of the transmission, propagation, processing and queuing postpone skilled by means of the message at every node of the network. This time is crucial for the reason that shorter the SDD of a message of a fixed length is, the higher the throughputThe SDDs were evaluated the use of NetPIPE. For each route period and scenario we repeated the experiments twenty times, this so as to get a better common. From the consequences of those experiments we could not most effective take the SDD.

| Number of nodes | Packet Size(bytes) | |
|---|---|---|
| | **64** | **1024** |
| 1 | 2.56 | 4.56 |
| 2 | 5.49 | 9.64 |
| 3 | 8.87 | 12.67 |

**Table3: The Average Source-to-Destination Delay.**

## VI. CONCLUSION AND FUTURE WORK

In this paper discussed the trial setup to implement the real-world AODV-UU Protocol on Ubuntu 10.04 Linux kernel 2.4 model. Besides, examinations multihop coordinating with traceroute command result. Help, the depiction upgrading the handy AODV-UU execution to as of now latest new Linux kernel model.

## REFERENCES

1. Charles E. Perkins, *Destination- Sequence Distance- Vector Protocol,* Ad Hoc Networking,ISBN 0-201-30976-9, pp. 53- 74
2. C.-K. Toh, *Associativity- Based Routing,*IEEE Transactions on wireless communications, Vol. 1, No. 3, July 2002
3. C. Perkins, E. Royer, and S. Das. *Ad hoc On-Demand Distance Vector Routing*. IETF MANET Draft, 2002.
4. Nikiket N. Mhala & N. K. Choudhari "*An Implementation Possible For AODV Rounting Protocol in Realworld*", November2010, International Journal of Distributed and Parallel Systems (IJDPS).Vol.1, N0.2
5. Iptables. https://www.netfilter.org/.
6. http://www.kernel.org
7. "AODV-UU" https://sourceforge.net/projects/aodvuu/

**BIOGRAPHY**

**Tushar Gulab Dangat** is a Master Engineering Student in the Computer Engineering Department, Sharadchandra Pawar college of Engineering, Otur, Pune University. He received Batchelor of Computer Engineering (B.E) degree in 2010 from Mumbai University, Mumbai, MS, India. His research interests are Computer Networks (wireless Networks), Network Management and Monitoring System, Network Security, Firewall, etc.