Practical 4

Aim:- Routing Protocols in Wireless Networks Objective: Simulate and analyze routing protocols in mobile ad-hoc networks (MANETs). Tasks: 1) Implement AODV (Ad hoc On-Demand Distance Vector) routing protocol. 2) Simulate a scenario with multiple nodes and traffic flows. 3) Analyze routing performance metrics such as packet delivery ratio, end-to-end delay, and routing overhead.

Theory :-

AODV (Ad hoc On-Demand Distance Vector) Routing Protocol

Definition: AODV is a reactive routing protocol designed for mobile ad-hoc networks (MANETs). It establishes routes between nodes only when necessary, minimizing overhead.

How It Works:

- **Route Discovery:** When a node requires a route to another node, it broadcasts a Route Request (RREQ) packet. Neighboring nodes receive the request and either forward it or respond with a Route Reply (RREP) if they have a valid route.
- **Route Maintenance:** AODV monitors active routes and maintains them. If a link fails, it triggers a new route discovery to find an alternative path.
- **Dynamic:** AODV dynamically adapts to network topology changes, making it suitable for highly mobile environments.

Simulation Environment

Definition: A simulated environment mimics real-world conditions to study the behavior and performance of routing protocols like AODV in controlled scenarios.

Key Components:

- **Multiple Nodes:** The simulation includes several nodes representing mobile devices or routers, each capable of moving independently within the network.
- **Traffic Flows:** The nodes generate data traffic, which can be of different types, such as constant bit rate (CBR) or variable bit rate. CBR generates a steady stream of packets, while variable bit rate simulates real-time applications with fluctuating demands.

Code :-

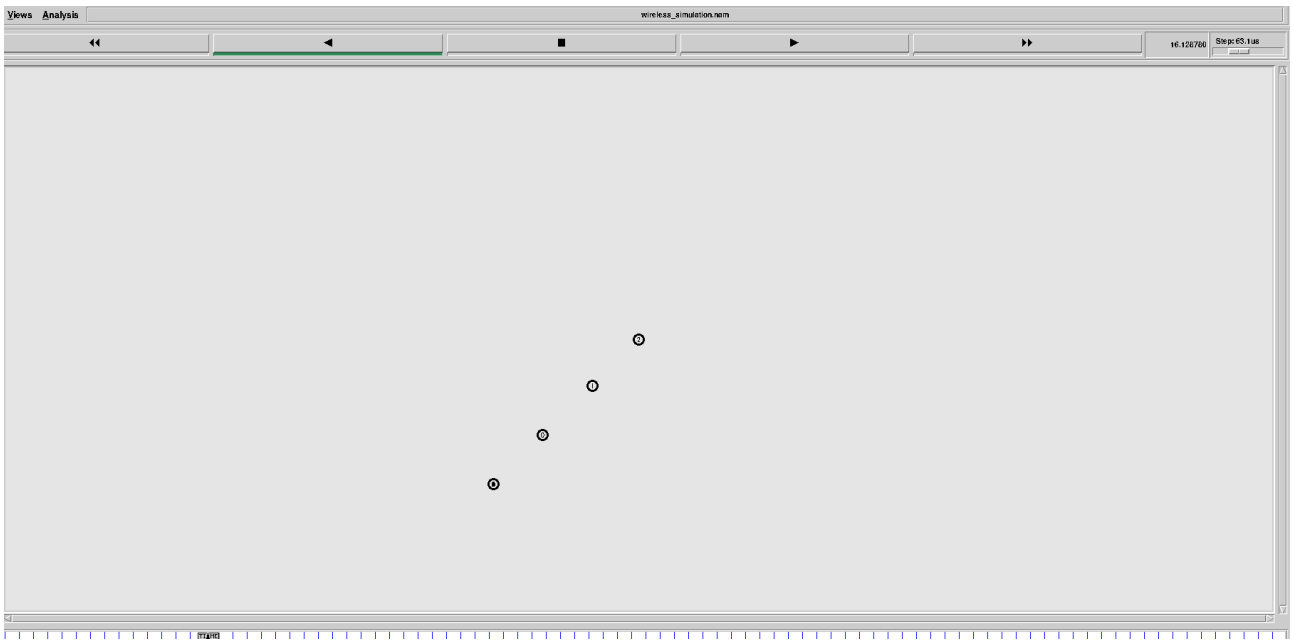
```
# Define simulator

set ns [new Simulator]


# Trace and Nam files

set tracefile [open wireless_trace.tr w]
```

```
set namfile [open wireless_simulation.nam w]
$ns trace-all $tracefile
$ns namtrace-all-wireless $namfile 500 500

# Set up topography
set topo [new Topography]
$topo load_flatgrid 500 500

# Set up god object
create-god 10

# Define the wireless channel, radio-propagation model, network interface, etc.
set val(chan)          Channel/WirelessChannel
set val(prop)          Propagation/TwoRayGround
set val(netif)         Phy/WirelessPhy
set val(mac)           Mac/802_11
set val(ifq)           Queue/DropTail/PriQueue
set val(ll)            LL
set val(ant)           Antenna/OmniAntenna
set val(ifqlen)        50
set val(nn)            10
set val(rp)            AODV
set val(x)             500
set val(y)             500
set val(stop)          100

# Node configuration
$ns node-config -adhocRouting $val(rp) \
                -llType $val(ll) \
                -macType $val(mac) \
                -ifqType $val(ifq) \
                -ifqLen $val(ifqlen) \
```

```
            -antType $val(ant) \
            -propType $val(prop) \
            -phyType $val(netif) \
            -channelType $val(chan) \
            -topoInstance $topo \
            -agentTrace ON \
            -routerTrace ON \
            -macTrace OFF

# Create nodes
for {set i 0} {$i < $val(nn)} {incr i} {
   set node_($i) [$ns node]
   $node_($i) random-motion 0
}

# Node positions
$node_(0) set X_ 50.0
$node_(0) set Y_ 50.0
$node_(1) set X_ 100.0
$node_(1) set Y_ 100.0
$node_(2) set X_ 200.0
$node_(2) set Y_ 150.0

# Traffic setup
set udp0 [new Agent/UDP]
set null0 [new Agent/Null]
$ns attach-agent $node_(0) $udp0
$ns attach-agent $node_(1) $null0
$ns connect $udp0 $null0

set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_ 512
```

```
$cbr0 set interval_ 0.1
$cbr0 attach-agent $udp0
$ns at 0.5 "$cbr0 start"
$ns at 95 "$cbr0 stop"

# Node mobility
for {set i 0} {$i < $val(nn)} {incr i} {
    $ns at 1.0 "$node_($i) setdest 250 250 10"
}

# Stop simulation
$ns at $val(stop) "finish"

proc finish {} {
    global ns tracefile namfile
    $ns flush-trace
    close $tracefile
    close $namfile
    exec nam wireless_simulation.nam &
    exit 0
}

# Run the simulation
$ns run
```

output :-


Views
Analysis
wireless_simulation.nam
16.126760
Step: 65.1us