

Course Name:	MCAN Laboratory	Semester:	VI
Date of Performance:	07 / 04 / 25	Batch No.:	B - 2
Faculty Name:	Dr. Rajashree Daryapurkar	Roll No.:	16014022050
Faculty Sign & Date:		Grade/Marks:	___ / 25

Experiment No.: 7
Title: Experiment on ZRP IARP Routing in MANET

Aim and Objective of the Experiment:
Aim: To analyze the working of ZRP with its Intra-zone Routing Protocol (IARP) in a MANET environment. Objective: To simulate and evaluate the performance of ZRP-IARP in terms of routing efficiency and network behavior.

COs to be achieved:
CO3: Understand the current topics in MANETs and WSNs, both from an industry and research point of views. CO4: Analyze how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

Books/Journals/Websites referred:
NetSim User Manual

Tools required:
NetSim software

Theory:
<p>Zone Routing Protocol (ZRP) is a hybrid routing protocol designed for Mobile Ad Hoc Networks (MANETs), combining the advantages of both proactive and reactive routing approaches. ZRP divides the network into overlapping zones centered at each node. Within each zone, the Intra-zone Routing Protocol (IARP) is used to proactively maintain up-to-date routing information about the nodes.</p> <p>IARP operates as a traditional table-driven protocol, exchanging routing information with neighbors inside the routing zone. This reduces the need for frequent route discoveries and minimizes delays for local communication. For communication beyond the zone, ZRP uses the Inter-zone Routing Protocol (IERP) reactively. The combination allows ZRP to scale efficiently</p>

and adapt to dynamic topologies in MANETs.

This experiment aims to study the behavior and efficiency of the IARP component within ZRP, focusing on its role in maintaining local connectivity and improving overall routing performance.

Implementation details:

1. Enlist all the Steps followed and various options explored.

- a. Launched NetSim simulation tool and selected the MANET scenario.
- b. Chose ZRP (Zone Routing Protocol) as the routing protocol under the MANET category.
- c. Configured simulation parameters including:
 - Number of nodes
 - Mobility model (Random Waypoint)
 - Simulation time
 - Node speed and pause time
 - Zone radius (to define the scope of IARP)
- d. Set application layer parameters (e.g., CBR traffic between source and destination nodes).
- e. Explored other routing protocols (e.g., AODV, DSR) for comparative analysis with ZRP-IARP.
- f. Ran simulations with different zone radii and node densities to observe protocol behavior.
- g. Collected and analyzed performance metrics such as Packet Delivery Ratio (PDR), End-to-End Delay, Throughput, and Routing Overhead.

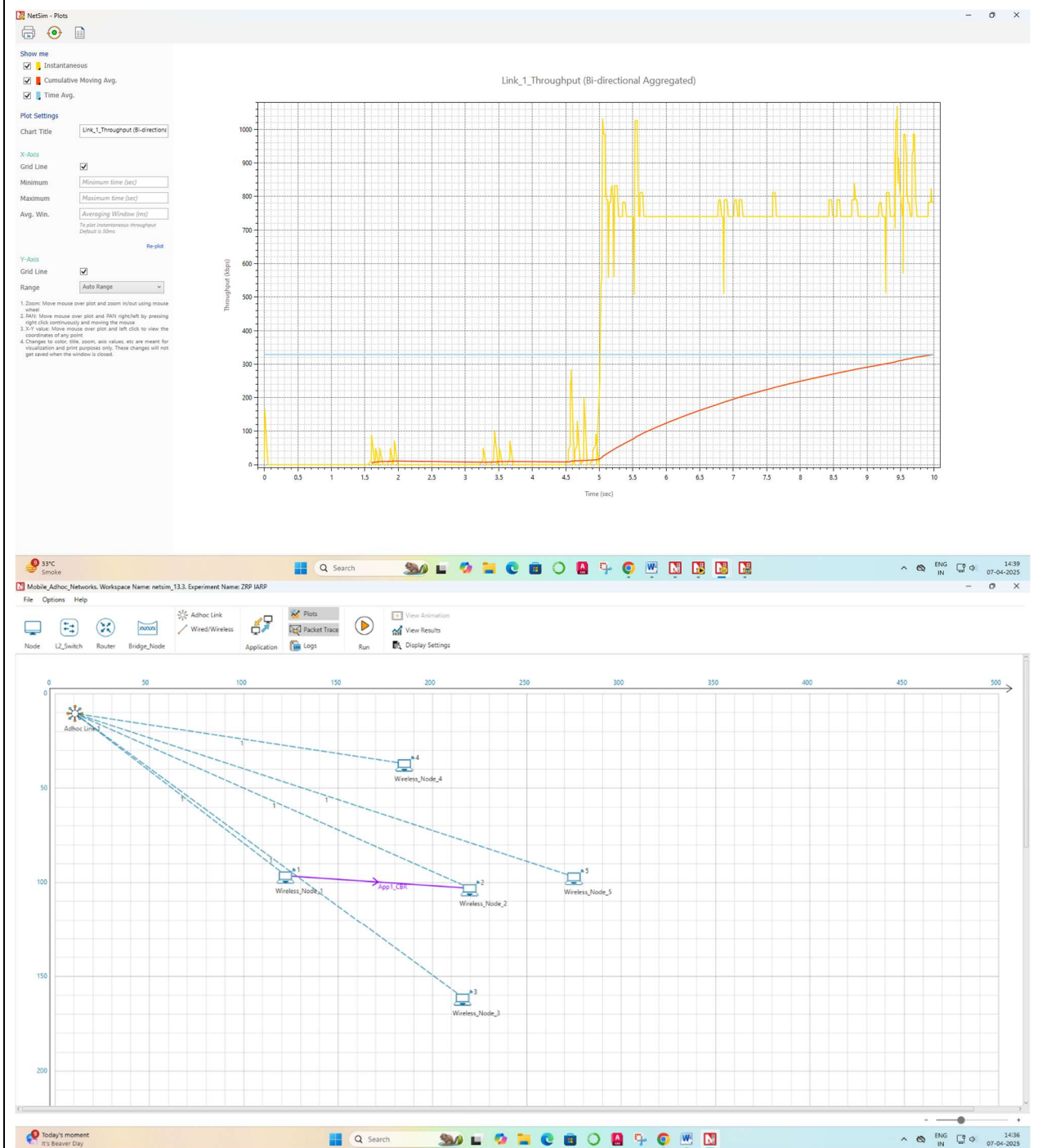
2. Explain your program logic and methods used.

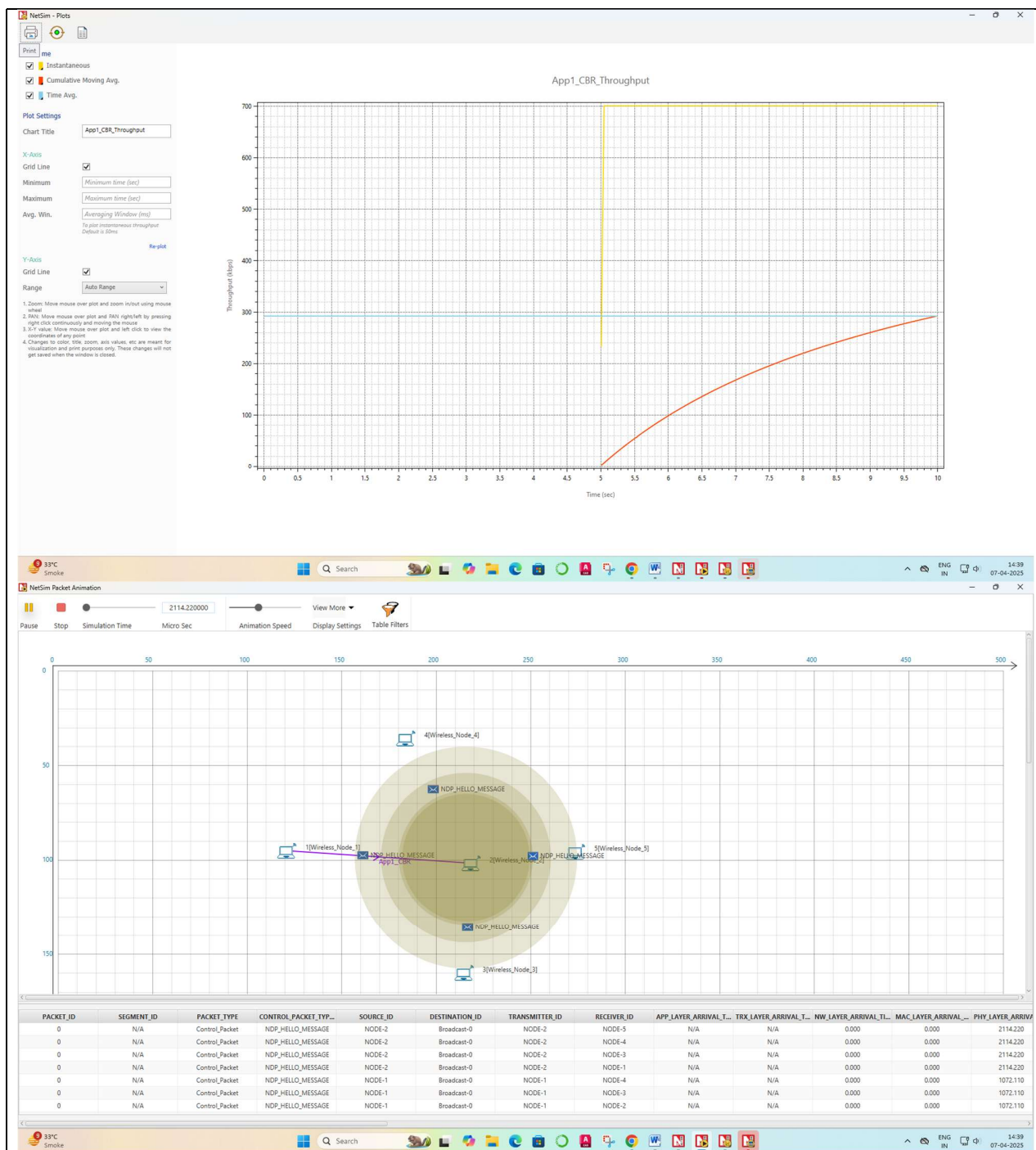
- a. NetSim internally implements ZRP by combining IARP (proactive) for intra-zone routing and IERP (reactive) for inter-zone routing.
- b. IARP proactively maintains routing tables within each node's local zone using periodic updates.
- c. During simulation:
 - If the destination node is within the source's zone, IARP is used to deliver packets directly.
 - If the destination is outside the zone, IERP is triggered to find a route reactively.
- d. The zone radius was varied to observe the influence of IARP's coverage on routing efficiency.
- e. After simulation, NetSim's Analyzer was used to evaluate metrics and compare ZRP performance under different configurations.

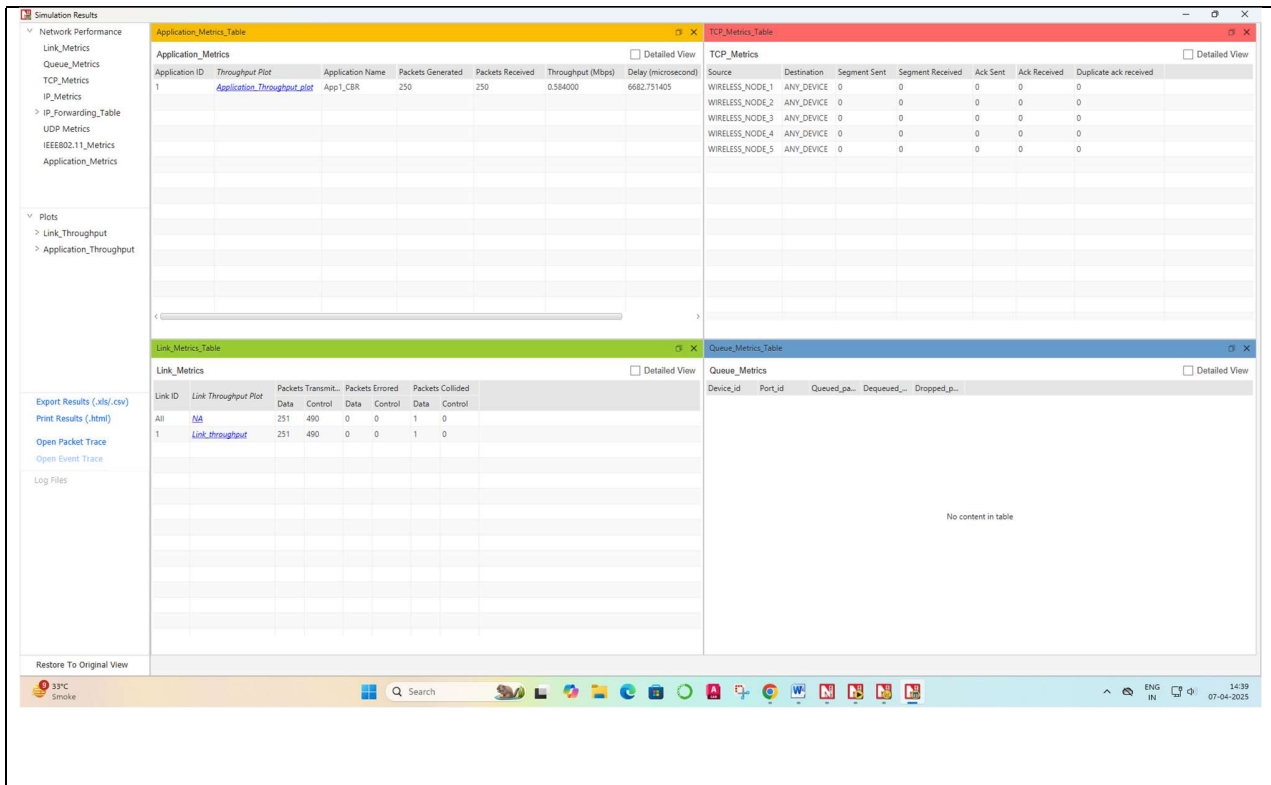
Procedure:

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Output/ results after execution:







Post Lab Subjective/Objective type Questions:

1. List hybrid routing protocols. Explain ZRP routing concept.

Hybrid routing protocols combine features of proactive and reactive routing strategies to balance the trade-offs between routing overhead and delay. Common hybrid routing protocols include:

- ZRP (Zone Routing Protocol)
- HSR (Hierarchical State Routing)
- TORA (Temporally Ordered Routing Algorithm)
- CBRP (Cluster Based Routing Protocol)
- SHAODV (Secure Hybrid AODV)
- OMSR (Optimized Multicast Source Routing)

2. Explain how IARP protocol works with suitable example.

ZRP is a hybrid routing protocol specifically designed for Mobile Ad Hoc Networks (MANETs). It divides the network into zones around each node. The size of the zone is determined by a zone radius (in hops).

- Within a zone (intra-zone): Routing is handled proactively using IARP (Intra-zone Routing Protocol). Each node maintains up-to-date routing information for all nodes within its own zone.
- Between zones (inter-zone): Routing is done reactively using IERP (Inter-zone Routing Protocol), which discovers routes only when needed.

Conclusion:

The experiment successfully demonstrated the performance of the IARP protocol in a mobile ad-hoc network. The network's throughput and delay were analyzed under varying conditions, highlighting the effects of node mobility and density on the overall performance. The simulation results suggest that while IARP is effective for routing, its performance can degrade with high mobility due to frequent route updates and changes.

Signature of faculty in-charge with Date: