



# Introduction

- **Name-** Ravi Shankar Prasad
  - **Nationality-** Indian
  - **Department-** Electronic and Computer Science
  - Bachelor in Electronics and Communication
  - **Interest-** Wireless Communication
  - **Hobbies-** Playing Badminton, Hiking, Soccer.
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# Schedule-

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## Week 4

- Review research paper and understand methodologies.
- Set up NS-3 simulator environment.
- Explore sample simulations and configure environment.

## Week 6

- Analyze preliminary results.
- Checking results on wireshark and NetAnim.
- Optimize simulation code for accuracy and performance.

## Week 5

- Identify key simulation parameters.
- Draft simulation plan.
- Begin coding initial framework for NS-3 simulation.
- Initialization of p2pnodes, csmanodes and wifi nodes.

## Week 7

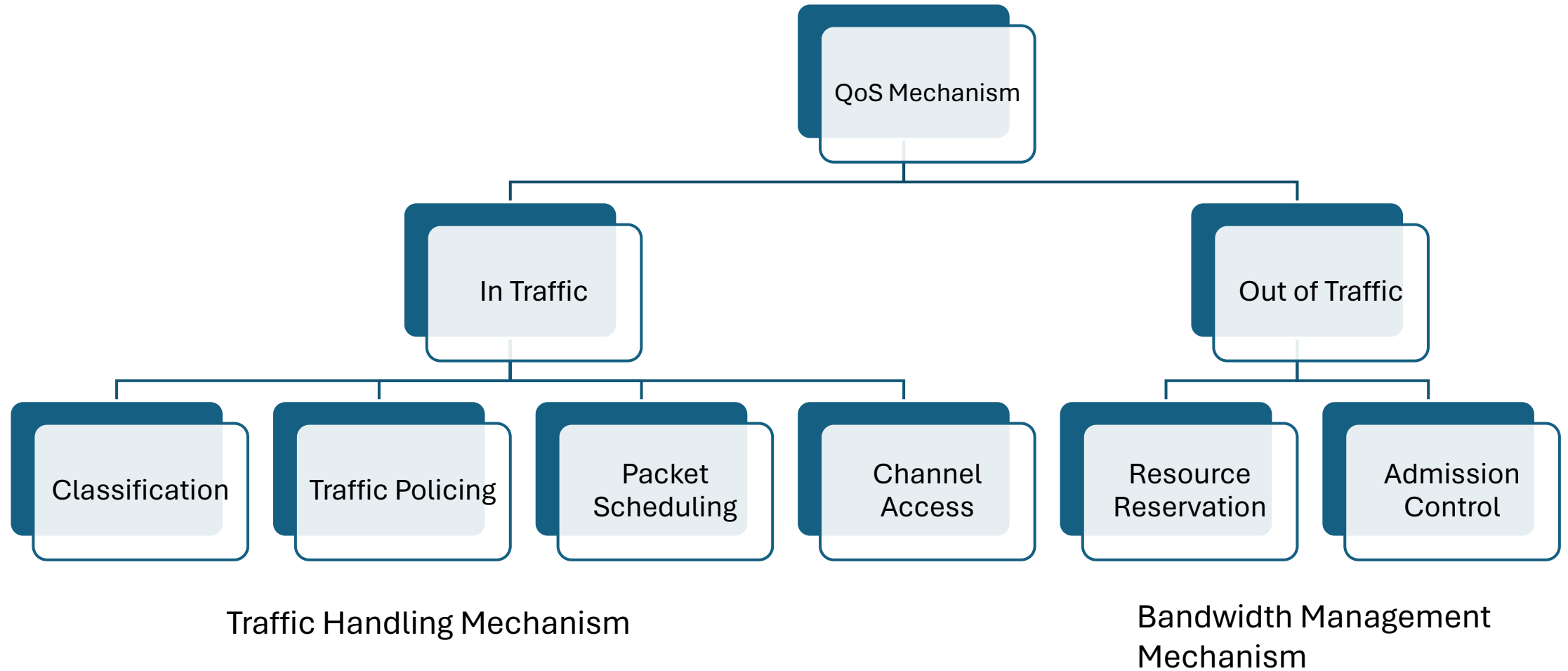
- Document simulation process and results.
- Prepare presentation slides summarizing findings.
- Finalize presentation slides and practice delivery.

# Topics Covered So far

- Multimedia Applications
- QoS Fundamentals
- QoS Mechanisms
- Classification
- Channel Access Mechanism
- Packet Scheduling Mechanisms
- Traffic Policing Mechanism
- Resource Reservation Signaling Mechanisms
- Admission Control
- QoS Architecture

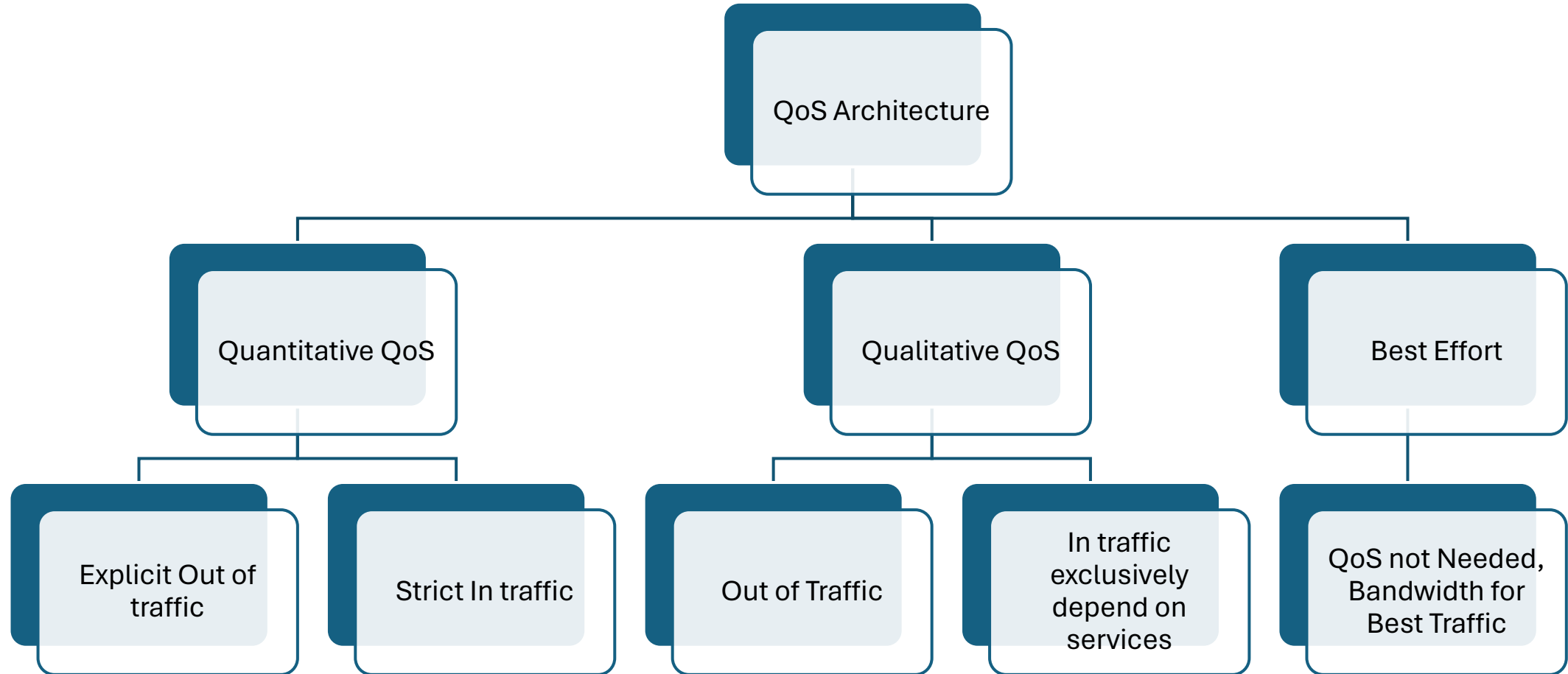


# QoS Mechanism



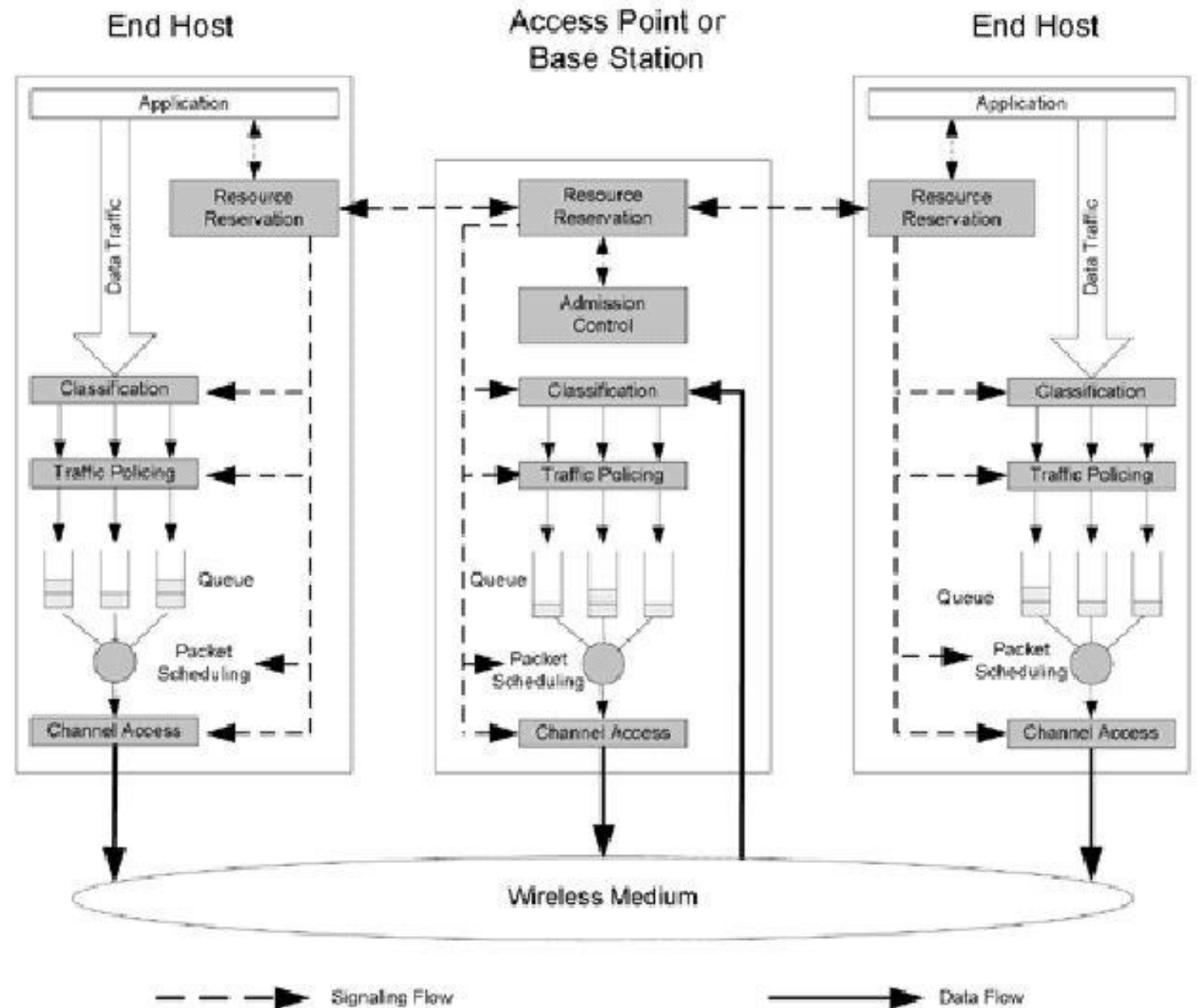
# QoS Architecture

Applications may require different combinations of QoS mechanisms.



# QoS Architecture for Infrastructure Wireless Networks

- Resource Reservation
  - Classification
  - Traffic Policing
  - Packet Scheduling
  - Channel Access
- Wireless Medium

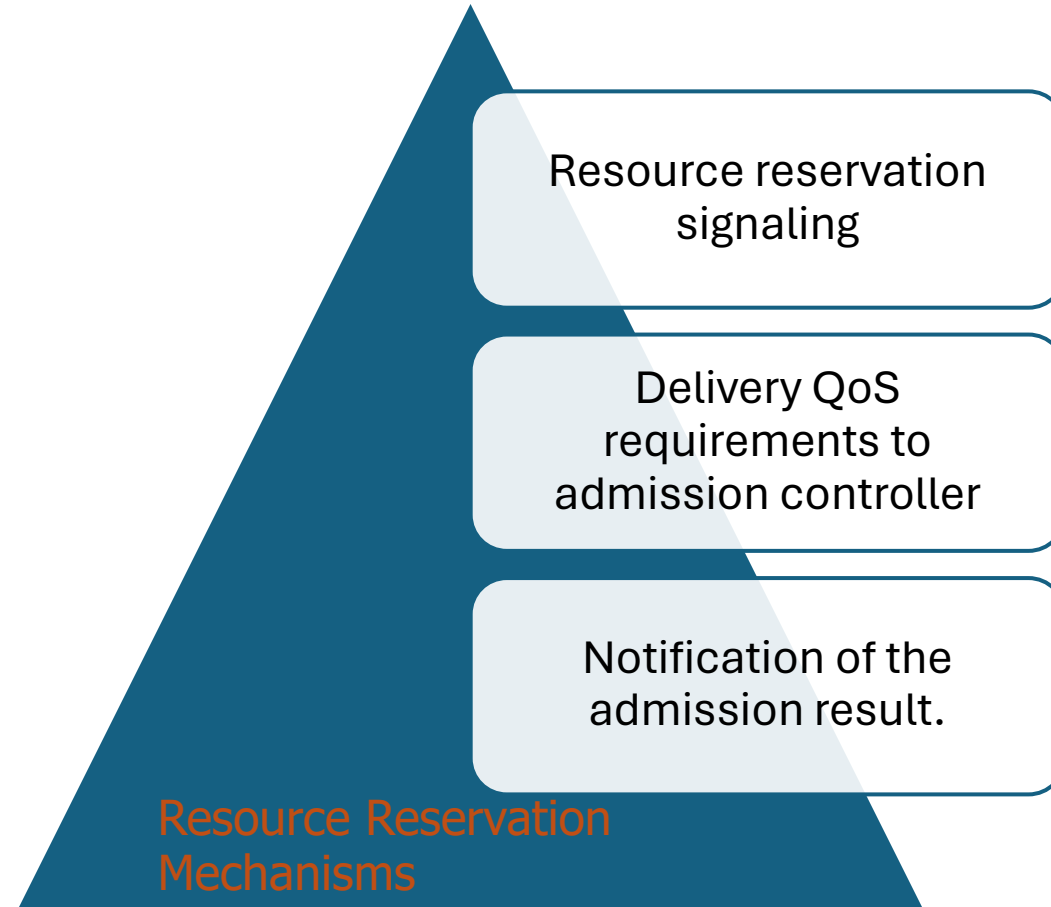


# Out of Traffic Mechanism- Resource reservation

RSVP operates on top of IP, in the transport layer

- Resource Reservation Protocol (RSVP)

- Supports Per class and Per flow reservation



# Admission Control

- *Explicit admission control*
  - decision is based on QoS requirements, available
  - resources, performance criteria, and network policy
- *Implicit admission control*
  - relies on bandwidth over-provisioning and traffic control



# In Traffic Mechanism- Classification

Can be per-user, per-flow, or per-class depending on the type of QoS services provided

OSI Layer	Classification Techniques
Application	User/Application Identification
Transport	Flow (5-tuplet IP Address)
Network	IPTOS, DSCP
Data Link	802.1p/Q Classification
Physical Layer	

# Research Paper

Wifi 10.1.3.0

AP

\* \* \* \*

| | | | 10.1.1.0 point-to-point

n5 n6 n7 n0 ----- n1 n2 n3 n4

| | | |

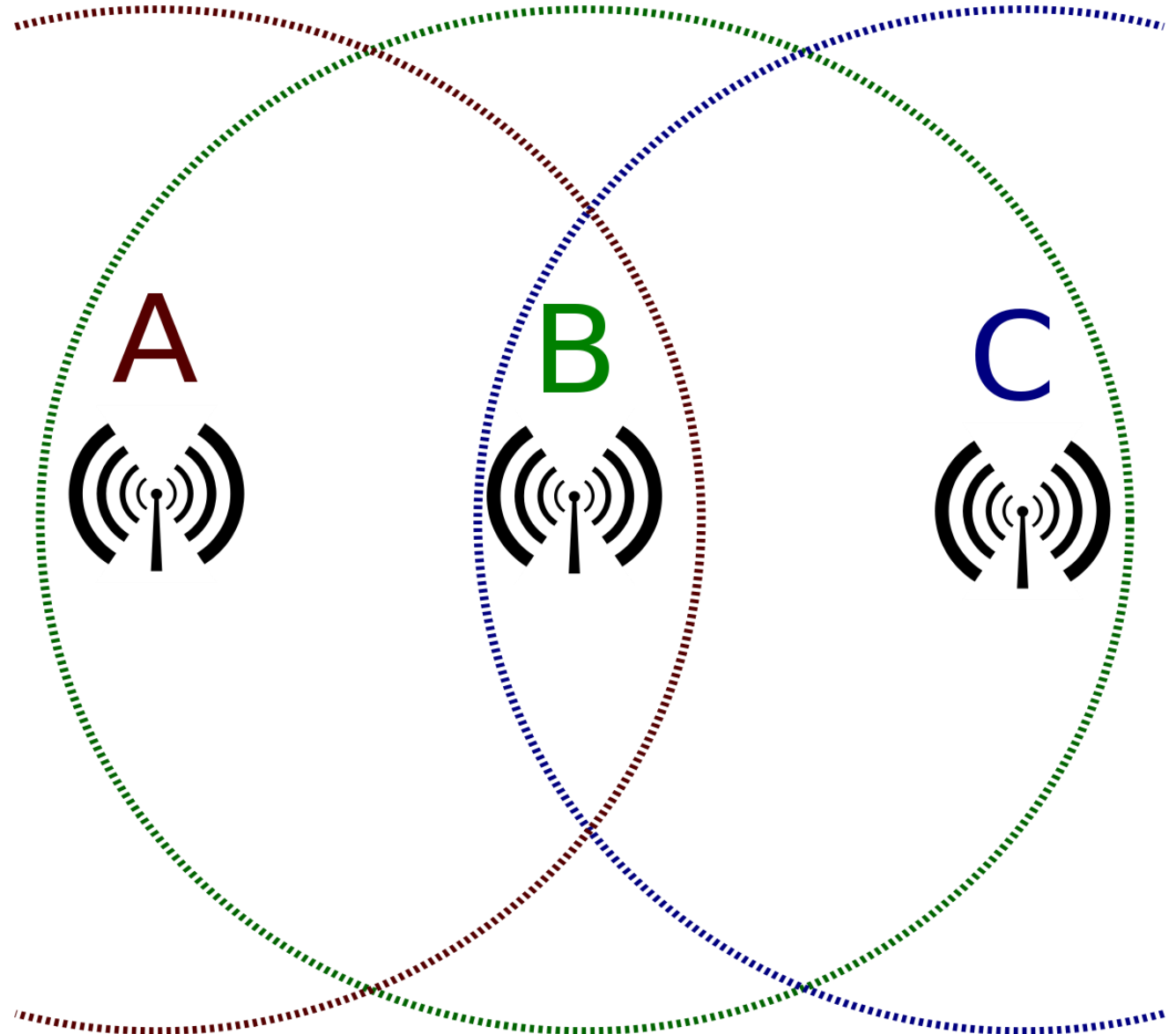
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LAN 10.1.2.0

# Wifi Hidden Nodes-

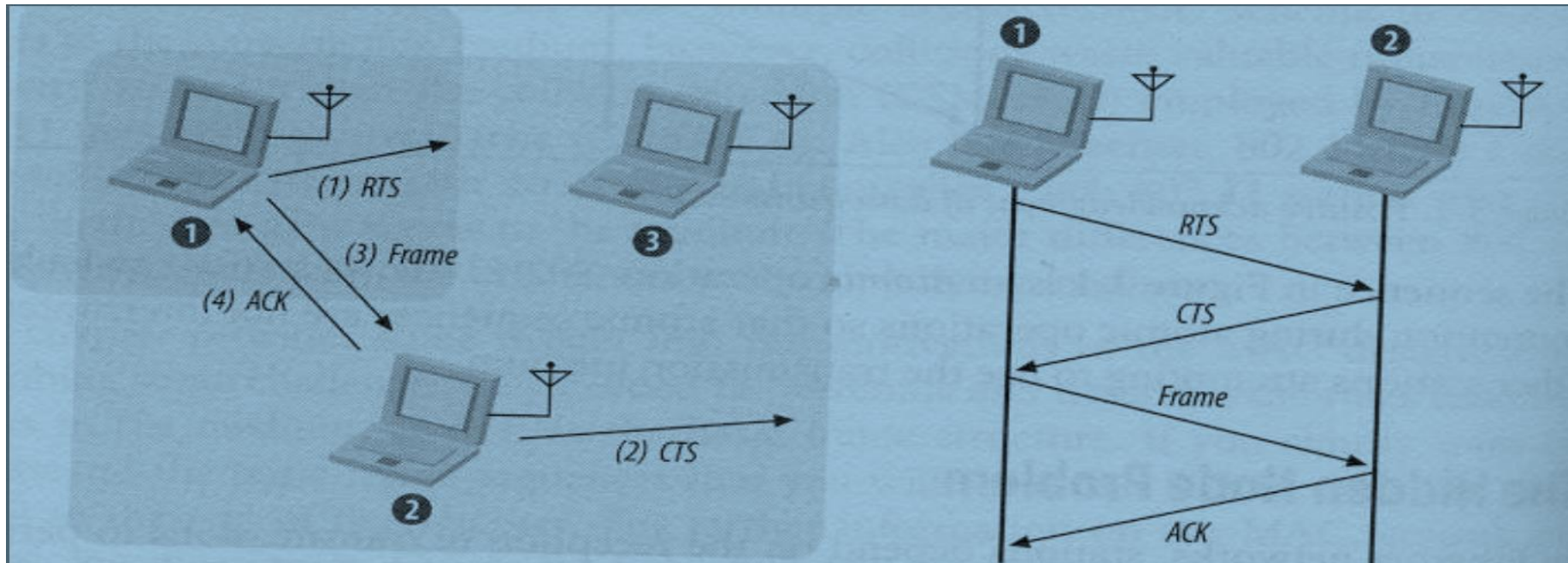
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- Topology-



# RTS and CTS

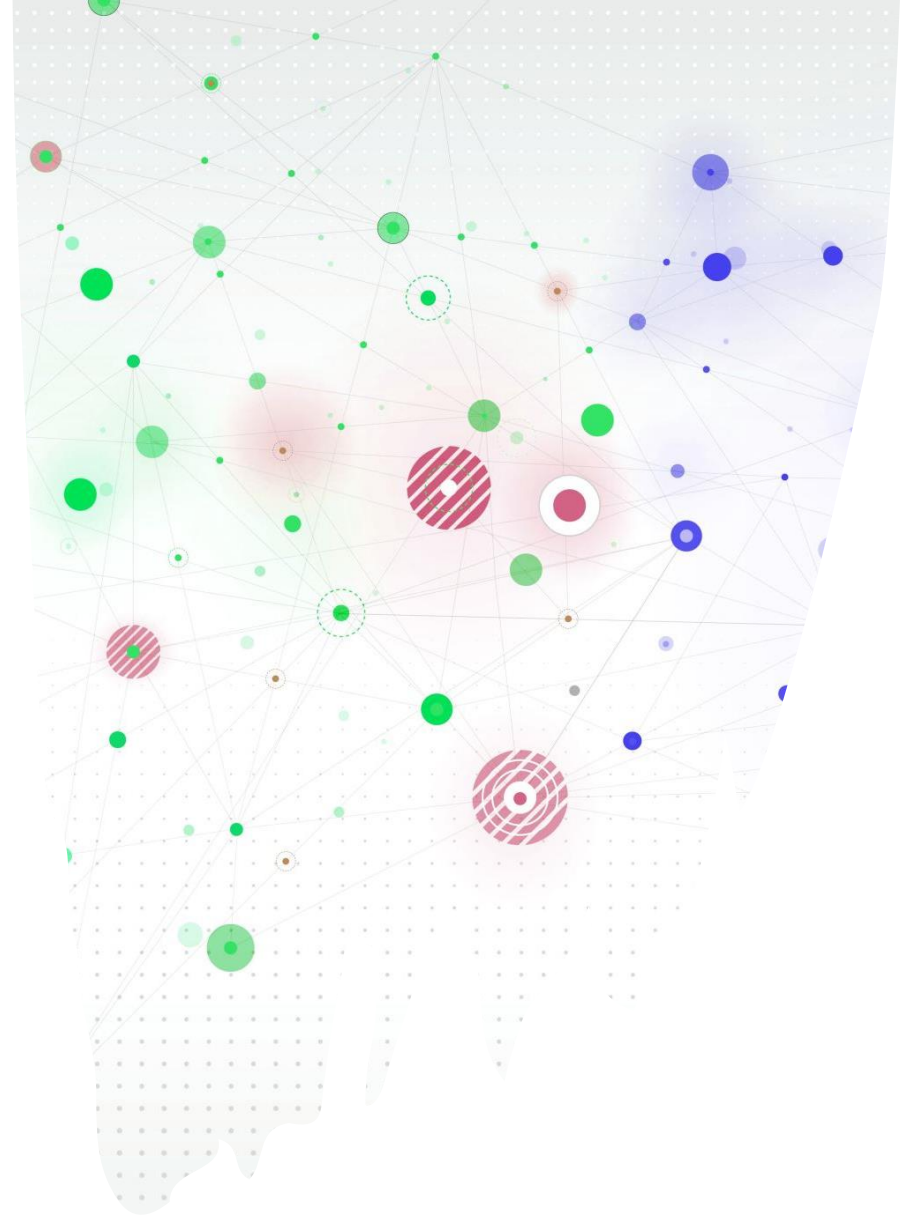
- Request to send (RTS) and Clear to send (CTS) procedure.



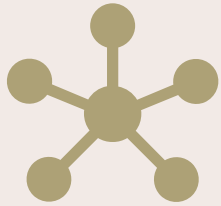
# Analyzing wireless Network 802.11 Using NS-3

ET5907701-MULTIMEDIA  
WIRELESS NETWORKS

RAVI SHANKAR PRASAD



# Main Objective



Number of Nodes



Implementation of  
RTS/CTS

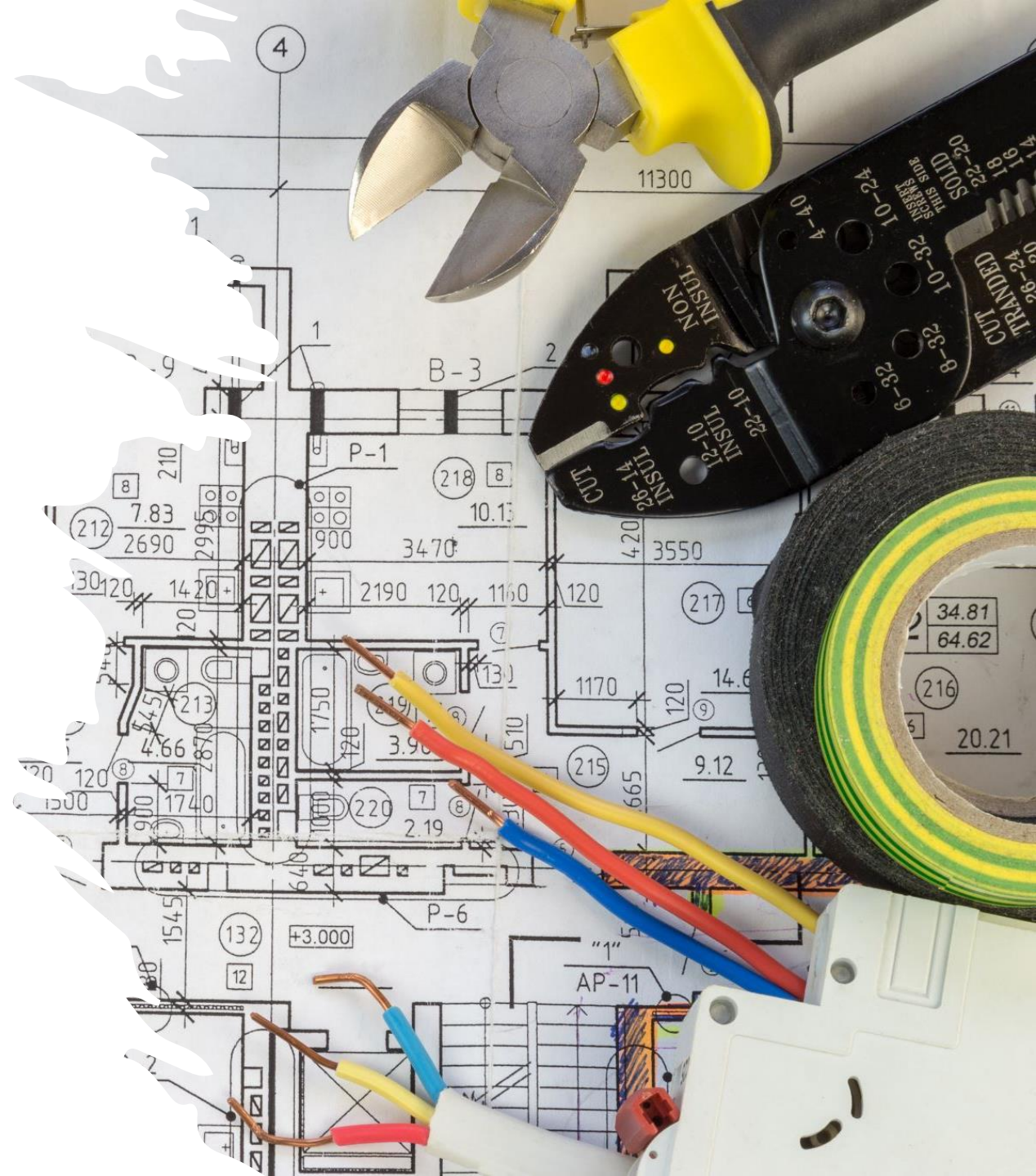


Distance between  
Nodes.



# Tools Used

- Ubuntu 22.04
- NS-3.41
- Wireshark
- NetAnim
- ASCII



# Throughput Calculation

- $\text{Throughput} = (\text{Total number of Packets} * \text{Packet size}) / \text{Total Time}$
- First Simulation Results

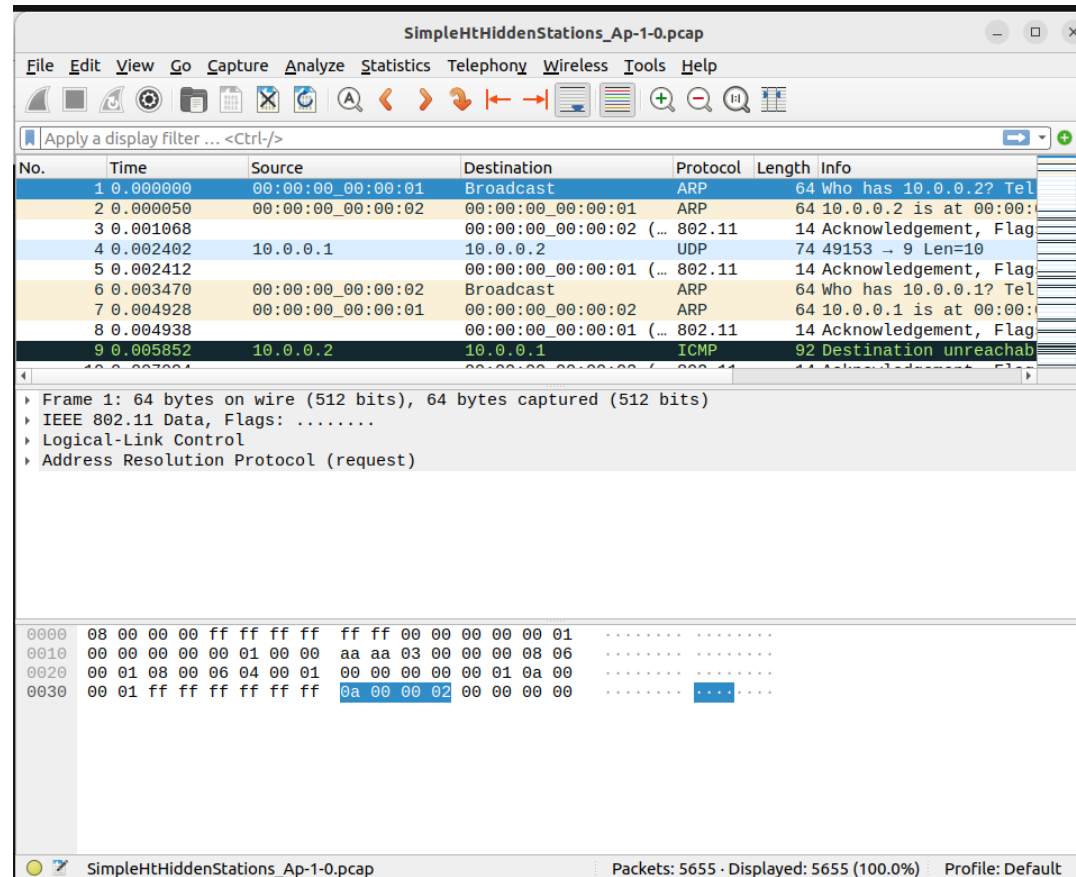
```
ubuntu2024@Ubuntu2024:~/ns-allinone-3.41/ns-3.41$ ./ns3 run scratch/wifi-hidden-terminal
[0/2] Re-checking globbed directories...
[2/2] Linking CXX executable ../build/...ch/ns3.41-wifi-hidden-terminal-default
Hidden station experiment with RTS/CTS disabled:
Flow 1 (10.0.0.1 -> 10.0.0.2)
  Tx Packets: 2410
  Tx Bytes: 3441480
  TxOffered: 3.05909 Mbps
  Rx Packets: 93
  Rx Bytes: 132804
  Throughput: 0.118048 Mbps
Flow 2 (10.0.0.3 -> 10.0.0.2)
  Tx Packets: 2411
  Tx Bytes: 3442908
  TxOffered: 3.06036 Mbps
  Rx Packets: 113
  Rx Bytes: 161364
  Throughput: 0.143435 Mbps
-----
Hidden station experiment with RTS/CTS enabled:
Flow 1 (10.0.0.1 -> 10.0.0.2)
  Tx Packets: 2410
  Tx Bytes: 3441480
  TxOffered: 3.05909 Mbps
  Rx Packets: 572
  Rx Bytes: 816816
  Throughput: 0.726059 Mbps
Flow 2 (10.0.0.3 -> 10.0.0.2)
  Tx Packets: 2411
  Tx Bytes: 3442908
  TxOffered: 3.06036 Mbps
  Rx Packets: 474
  Rx Bytes: 676872
  Throughput: 0.601664 Mbps
ubuntu2024@Ubuntu2024:~/ns-allinone-3.41/ns-3.41$
```



## 2<sup>nd</sup> Simulation Throughput

```
ubuntu2024@Ubuntu2024: ~/ns-allinone-3.41/ns-3.41
ntu2024:~/ns-allinone-3.41/ns-3.41$ ./ns3 run scratch/wifi-hidden
ing globbed directories...
CXX executable ../build/scratch/ns3.41-wifi-hidden-terminal-defau
experiment with RTS/CTS disabled:
.1 -> 10.0.0.2)
2410
3441480
3.05909 Mbps
93
132804
0.118048 Mbps
.3 -> 10.0.0.2)
2411
3442908
3.06036 Mbps
113
161364
0.143435 Mbps
-----
experiment with RTS/CTS enabled:
.1 -> 10.0.0.2)
2410
3441480
3.05909 Mbps
452
645456
0.573739 Mbps
.3 -> 10.0.0.2)
2411
3442908
3.06036 Mbps
626
893928
0.794603 Mbps
ntu2024:~/ns-allinone-3.41/ns-3.41$
```

# Wireshark output



The image shows a Wireshark window titled "SimpleHtHiddenStations\_Ap-1-0.pcap". The interface includes a menu bar (File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help), a toolbar with icons for file operations, capture, and analysis, and a display filter bar showing "Apply a display filter ... <Ctrl-/>".

The main pane displays a list of captured packets with the following columns: No., Time, Source, Destination, Protocol, Length, and Info. The packets are as follows:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	00:00:00_00:00:01	Broadcast	ARP	64	Who has 10.0.0.2? Tel
2	0.000050	00:00:00_00:00:02	00:00:00_00:00:01	ARP	64	10.0.0.2 is at 00:00:
3	0.001068		00:00:00_00:00:02 (...)	802.11	14	Acknowledgement, Flag
4	0.002402	10.0.0.1	10.0.0.2	UDP	74	49153 → 9 Len=10
5	0.002412		00:00:00_00:00:01 (...)	802.11	14	Acknowledgement, Flag
6	0.003470	00:00:00_00:00:02	Broadcast	ARP	64	Who has 10.0.0.1? Tel
7	0.004928	00:00:00_00:00:01	00:00:00_00:00:02	ARP	64	10.0.0.1 is at 00:00:
8	0.004938		00:00:00_00:00:01 (...)	802.11	14	Acknowledgement, Flag
9	0.005852	10.0.0.2	10.0.0.1	ICMP	92	Destination unreachab

Below the packet list, the details pane for the selected packet (No. 1) shows the following structure:

- Frame 1: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)
- IEEE 802.11 Data, Flags: .....
- Logical-Link Control
- Address Resolution Protocol (request)

The packet bytes pane at the bottom shows the raw data in hexadecimal and ASCII:

```
0000 08 00 00 00 ff ff ff ff ff ff 00 00 00 00 00 01 .....
0010 00 00 00 00 00 01 00 00 aa aa 03 00 00 00 08 06 .....
0020 00 01 08 00 06 04 00 01 00 00 00 00 00 01 0a 00 .....
0030 00 01 ff ff ff ff ff ff 0a 00 00 02 00 00 00 00 .....

```

The status bar at the bottom indicates: SimpleHtHiddenStations\_Ap-1-0.pcap | Packets: 5655 · Displayed: 5655 (100.0%) | Profile: Default

# Wireshark I/O graph

