

CMPE351 COMPUTER NETWORKS

PROJECT REPORT

Course Project #1

**Usage of Ten Different Well-known Ports over TCP and/or UDP in
WAN**

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1 INTRODUCTION

The objective of this project is to analyze the behavior of well-known ports in a Wide Area Network (WAN). Understanding port usage is critical for network security and traffic management. As stated in the project guidelines [1], we focus on ten distinct ports.¹

Network communication relies heavily on the Transport Layer protocols, specifically TCP and UDP. The fundamental theory of communication was established years ago [2], but modern applications require more complex handling as discussed in recent studies [3].

¹This footnote demonstrates the custom footnote formatting with adjusted spacing and rule.

2 METHODOLOGY

2.1 Experimental Setup

We set up a client-server architecture to test port accessibility. The detailed topology is illustrated in Figure 2.1. We used packet sniffing tools to capture the traffic data.

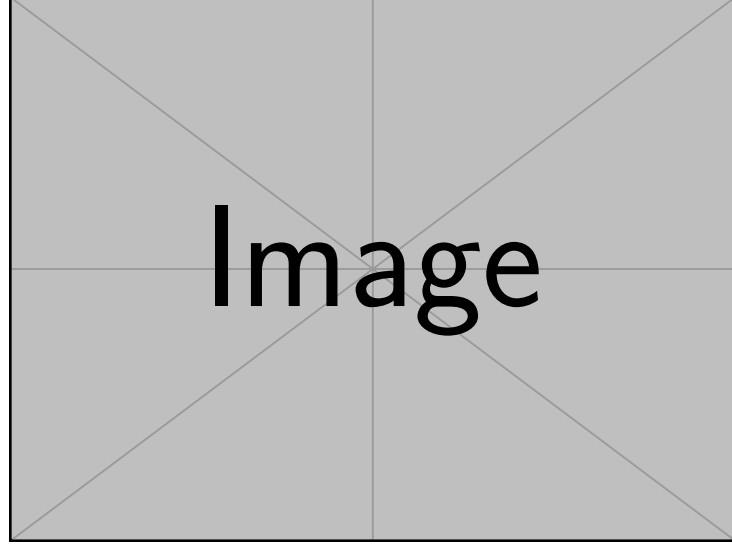


Figure 2.1: Network topology used for port scanning

As seen in Figure 2.1, the client connects through a firewall. The configuration ensures that only specific packets are allowed.

2.2 Mathematical Model

To calculate the round-trip time (RTT), we used the standard formula. Equation 2.1 shows the calculation for the estimated RTT:

$$RTT_{new} = (1 - \alpha) \cdot RTT_{old} + \alpha \cdot RTT_{sample} \quad (2.1)$$

where α is the weighting factor. We referenced Equation 2.1 throughout our analysis to determine network latency.

$$\text{Throughput} = \frac{\text{Data Size}}{\text{Transfer Time}} \quad (2.2)$$

2.3 List Examples

The following items were considered in our experimental design:

- Network topology configuration
- Firewall rule definitions

- Packet capture methodology
- Data analysis procedures

Enumerated steps for the experiment:

1. Configure the test environment
2. Deploy monitoring tools
3. Execute port scanning procedures
4. Analyze collected data
5. Generate final report

3 MAIN FINDINGS

3.1 Port Analysis Results

The results of our scan are summarized below. We compared TCP and UDP performance across different services.

Table 3.1: Status of well-known ports during the WAN scan

Port	Service	Protocol	Status
20	FTP Data	TCP	Closed
21	FTP Control	TCP	Open
22	SSH	TCP	Open
53	DNS	UDP	Filtered
80	HTTP	TCP	Open
443	HTTPS	TCP	Open

Table 3.1 clearly indicates that secure ports (like 22 and 443) were left open for administration and web services, while legacy ports like 20 were closed.

3.1.1 Detailed Comparison

Comparing the data from Table 3.1 with the theoretical values in [2], we observe a significant deviation in UDP packet loss.

3.2 Algorithm Example

The scanning algorithm used in this project is presented below:

```

FOR each port in target_port_list DO
  SEND TCP SYN packet to target_host:port
  WAIT for response with timeout
  IF SYN-ACK received THEN
    Mark port as OPEN
  ELSE IF RST received THEN
    Mark port as CLOSED
  ELSE
    Mark port as FILTERED
  END IF
END FOR

```

Algorithm 3.1: Port Scanning Algorithm

Algorithm 3.1 demonstrates the basic port scanning methodology employed in Section 2.

4 CONCLUSIONS

In this project, we successfully analyzed ten well-known ports. The results show that firewall rules significantly impact the visibility of UDP ports compared to TCP. Future work should focus on IPv6 compatibility.

REFERENCES

- [1] F. of Engineering, *Guidelines for Preparing a Technical Report*. Kadir Has University, 2025.
- [2] C. E. Shannon, “A mathematical theory of communication,” *The Bell System Technical Journal*, vol. 27, no. 3, pp. 379–423, 1948.
- [3] Y. LeCun, Y. Bengio, and G. Hinton, “Deep learning,” *Nature*, vol. 521, no. 7553, pp. 436–444, 2015.

APPENDIX A: ADDITIONAL DATA

This appendix contains raw data logs captured during the experiment.

Table APPENDIX A:.1: Raw packet capture statistics

Metric	TCP	UDP
Total Packets	15,432	8,921
Dropped Packets	23	156
Average Latency (ms)	45.2	52.7

APPENDIX B: CONFIGURATION FILES

This appendix includes sample configuration files used during the experiment.