

NETWORK TROUBLESHOOTING & PERFORMANCE ANALYSIS LAB

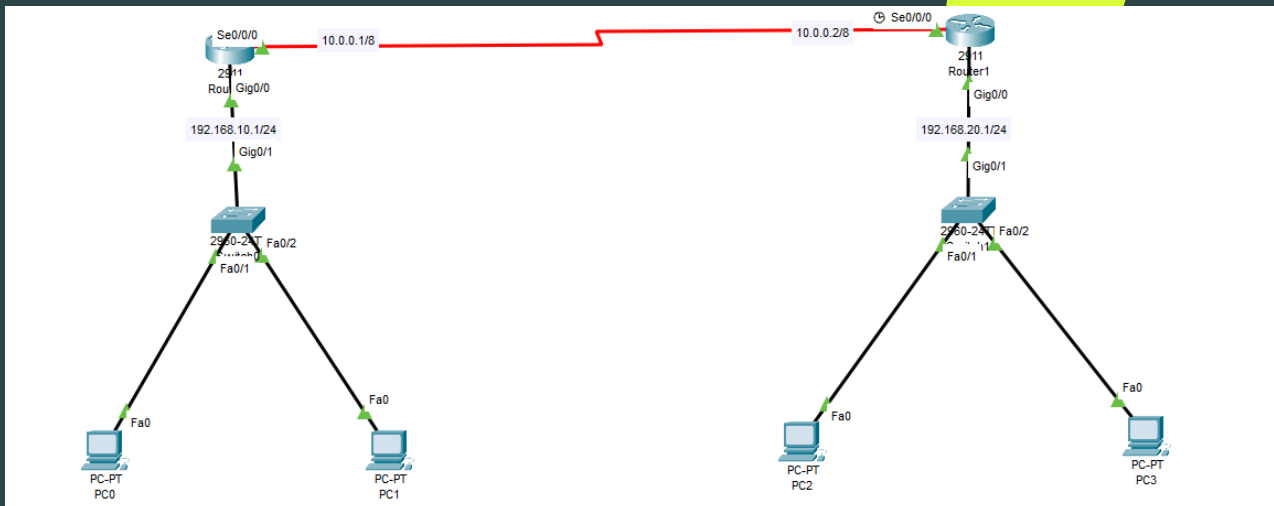
CATEGORY

NETWORKING

Author: Md Rezvee Parvez

ENVIRONMENT
CISCO PACKET TRACER





PROJECT SUMMARY

Modern enterprise networks require engineers who can not only configure devices, but also systematically diagnose and resolve network failures. This project focuses on practical troubleshooting rather than initial deployment.

In this lab, a small routed network was designed and intentionally misconfigured to simulate real-world operational issues such as interface failures, routing errors, IP conflicts, and incorrect host configurations. Each issue was diagnosed using a structured methodology and resolved with minimal corrective actions.



PROJECT OBJECTIVES

- To apply a layered troubleshooting methodology
- To identify and isolate network faults efficiently
- To perform accurate root cause analysis
- To validate network functionality after remediation
- To document issues and solutions using professional standards

NETWORK TOPOLOGY OVERVIEW

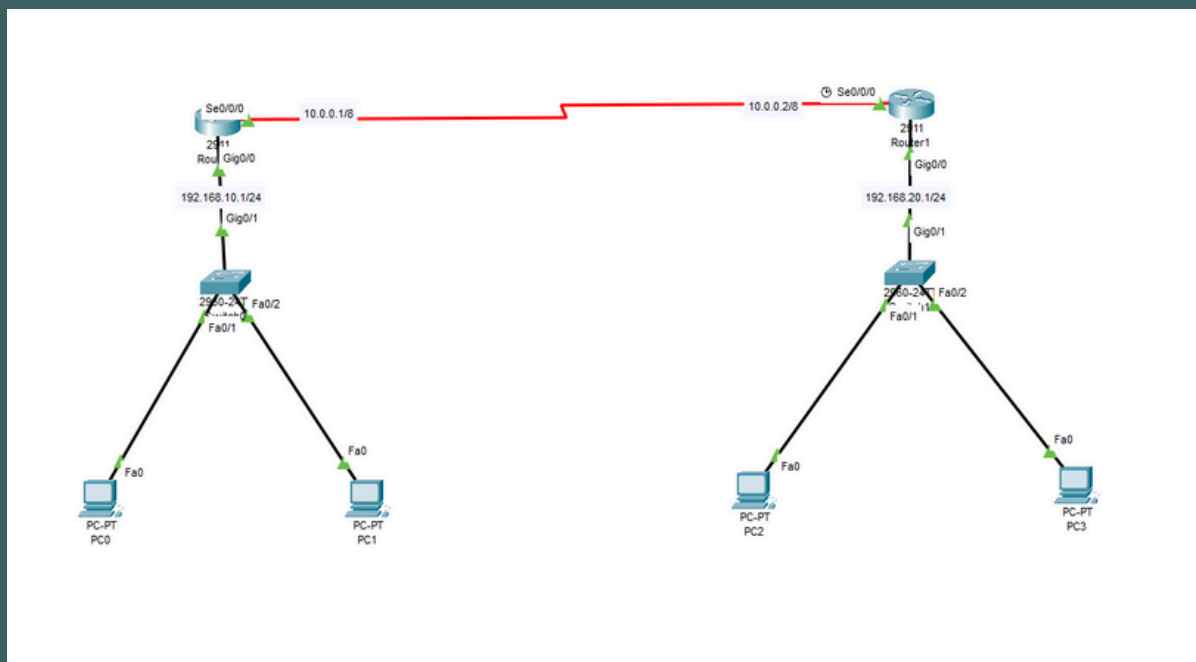
NETWORK ENVIRONMENT

- Two routers (R0 and R1)
- Two switches
- Multiple end hosts across two LAN segments
- A WAN link interconnecting the routers

THE TOPOLOGY SUPPORTS INTER-LAN COMMUNICATION AND ALLOWS TESTING OF INTERFACE STATUS, ROUTING BEHAVIOR, ARP RESOLUTION, AND ICMP-BASED CONNECTIVITY.

NETWORK VERSION

- Baseline (working)
- Faulty (issues introduced)
- Fixed (issues resolved)



FAULT SCENARIOS INTRODUCED

ADMINISTRATIVELY DOWN INTERFACE

- The LAN-facing interface on R1 was shut down
- Resulted in complete loss of gateway connectivity for LAN hosts

MISCONFIGURED STATIC ROUTES

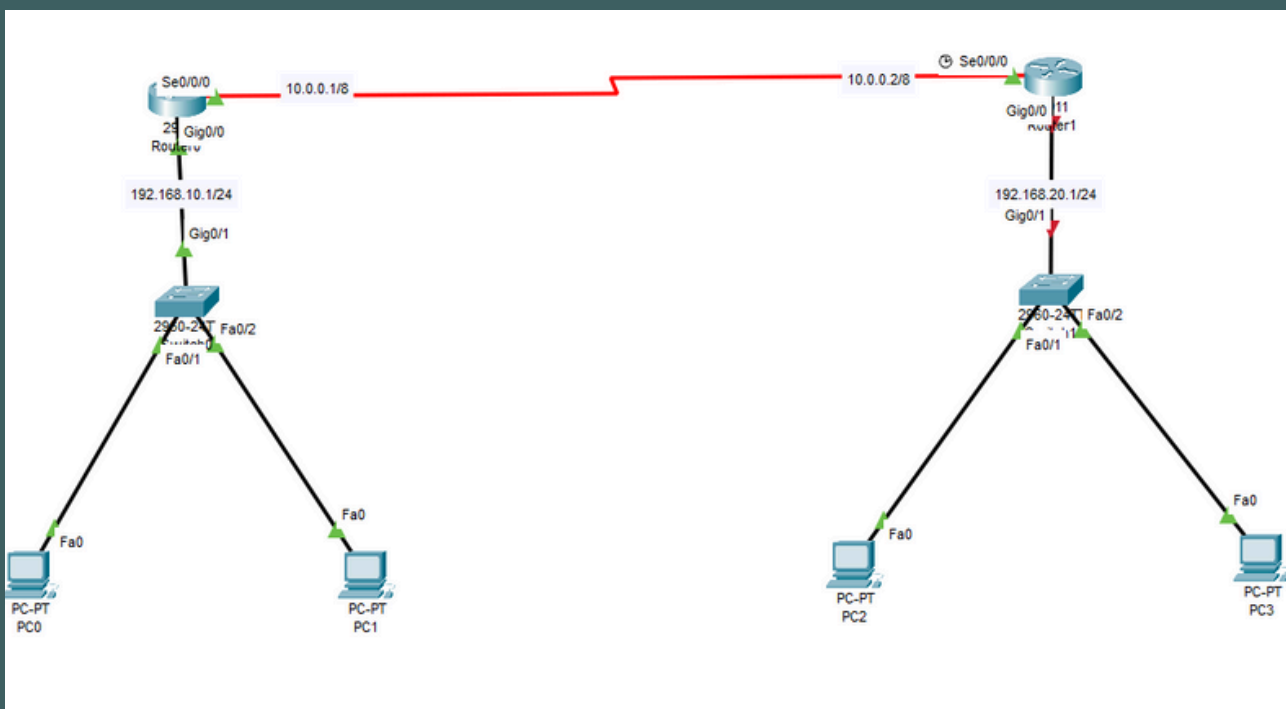
- An incorrect next-hop address was configured
- Prevented inter-LAN communication despite active links

IP ADDRESS CONFLICT

- Duplicate IP addresses were assigned to hosts
- Caused intermittent connectivity and ARP instability

INCORRECT DEFAULT GATEWAY

- End host configured with an invalid gateway
- Blocked access to remote networks



Note : Each fault was isolated to ensure clear symptom analysis.

TROUBLESHOOTING METHODOLOGY

A structured, OSI-aligned troubleshooting approach was followed for every issue:

PROBLEM IDENTIFICATION

Defined source, destination, and scope of failure

LAYER 1 – PHYSICAL

- Verified link status and connectivity in the topology
- Inspected interface operational state

LAYER 2 DATA LINK

- Analyzed ARP behavior using Simulation Mode
- Detected duplicate IP and MAC inconsistencies

LAYER 3 NETWORK

- Validated IP addressing and default gateways
- Inspected routing tables and next-hop configuration

CORRECTIVE ACTION

- Applied only the necessary fix
- Avoided unrelated configuration changes

VALIDATION

- Verified end-to-end ICMP connectivity
- Confirmed interface and routing stability

Note: The network was fully restored to operational state after each fault was resolved.

ISSUE PERFORMANCE TESTING & RESOLUTION

Similar structured analysis was performed for all other faults, with detailed mappings documented separately.

ISSUE ANALYSIS

- Symptoms: Hosts unable to reach default gateway
- Diagnosis: Interface shown as administratively down
- Root Cause: Interface shutdown
- Resolution: Interface enabled using no shutdown
- Validation: Interface state changed to up/up; connectivity restored

VALIDATION AND PERFORMANCE TESTING

- ICMP connectivity was tested between all LAN segments
- Interface status was confirmed as operational
- Routing tables were verified for correctness
- Packet Tracer Simulation Mode was used to observe ARP and ICMP flows

RESULTS

- Reliable end-to-end connectivity
- Stable ARP behavior
- Correct routing between LAN segments
- Improved understanding of fault isolation techniques

SKILLS DEMONSTRATED

- Network troubleshooting and fault isolation
- Interface and routing diagnostics
- ARP and ICMP analysis
- Structured problem-solving
- Professional technical documentation

THANK YOU

.... This lab reinforces the importance of methodical
.... troubleshooting in network operations. Rather than
.... relying on guesswork, issues were resolved through
.... structured analysis, minimal corrective actions, and
.... proper validation.

Author: Md Rezvee Parvez

contact me:

rezvx@proton.me <https://www.linkedin.com/in/rezvx>