IT PROJECT
DOCUMENTATION

Network Diagnostic

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Ubuntu, Terminal

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This document is part of a personal project portfolio developed during the Google IT Support Certification. All simulations and analyses were performed in a controlled lab environment. These projects serve as a complement to the course and provide an initial hands-on experience applying its concepts to real-world scenarios

I. Project Overview

Simulate a full client-side network diagnosis, as performed by a junior IT Support Technician (L1/L2), using real tools and logic to identify and isolate common connectivity problems.

II. Environment Setup

Component	Details
OS	Ubuntu 22.0
Network Type	Internal (host-only or intnet), interface **enp0s8**
Test tools	[ping], [ip], [dig], [curl] , [Wireshark]
Capture Tools	Wireshark
Server IP	291.168.56.101
Client IP	291.168.56.102

III. Test Setup and Process

Step-by-step diagnostic (on client VM):

- **Check IP Address**

```
ip a
```

- **Check Routing Table**

```
ip route
```

- **Ping Server (Local Test)**

```
ping -c 4 192.168.56.101
```

- **Ping Public DNS (Connectivity Test)**

```
ping -c 4 8.8.8.8
```

- **DNS Resolution Test**

```
dig google.com
```

- **HTTP Access Test**

```
curl -I http://google.com
```

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4. Packet Capture and Analysis

Interface used: `enp0s8` (for local ICMP tests),

`enp0s3` (for external DNS/HTTP)

- Filters used:

[icmp || dns || http]

- Files saved as:

  - [icmp_local_test.pcapng]

  - [dns_http_test.pcapng]

ICMP (ping to server)

- Protocol: ICMP
- TTL, packet size, round-trip time
- Capture file: `icmp_local_test.pcapng`

DNS & HTTP

- DNS request to 8.8.8.8
- DNS response with A record
- HTTP GET and 200 OK response
- Capture file: `dns_http_test.pcapng`

Key Findings:

Test	Output Summary
IP Address	Assigned correctly (192.168.56.102)
Route	Default gateway via `enp0s3`
Ping to Server	✅ Success (ICMP reachable)
Ping to 8.8.8.8	✅ Success
DNS Resolution	✅ Successful response from 8.8.8.8
HTTP Access	✅ HTTP/1.1 200 OK or redirect received

- **Reasoning Process**
- This sequence reflects real-world diagnostic logic:
- If `ping` to server fails → check interface or cable
- If `ping` to 8.8.8.8 fails → no Internet gateway
- If DNS fails → test `ping 8.8.8.8` to isolate name resolution
- If HTTP fails → check DNS + confirm server response

+ DNS Comparison (Bonus Section)

- **Objective**

Compare DNS resolution speed and behavior across multiple resolvers (public and broken), to simulate real-life slow browsing or timeouts.

- **Methodology**
- **Edit `/etc/resolv.conf` to use specific DNS**
- **Run `dig google.com` and observe the query time**
- **Capture DNS traffic using Wireshark on `enp0s3**

- **Tests Performed**

DNS Server	`dig` Result	Query Time	Wireshark Packet
`8.8.8.8` (Google)	✅ Response OK	30 ms	✅ Seen
`1.1.1.1` (Cloudflare)	✅ Response OK	25 ms	✅ Seen
`192.168.56.123`	❌ Timeout	> 5 sec	❌ No response

- **Analysis**
- Public DNS servers like Google and Cloudflare return fast responses
- Using an invalid DNS results in full timeout → websites appear "frozen"
- Clear evidence that **slow DNS = slow Internet feeling** for end-users
- Wireshark confirms difference in response behavior and retry logic

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V/ Resolution / Outcome

- The diagnostic confirmed that the client machine had:
- A valid IP address and routing table
- Successful communication with the local server (ping)
- Full Internet connectivity, verified via ping 8.8.8.8
- Proper DNS resolution, with quick response times from trusted resolvers
- HTTP reachability, proving the DNS + routing stack was fully functional

The bonus DNS comparison highlighted how a misconfigured or non-responsive DNS server leads to perceived slowness or failures in browsing. This effectively simulated a common user complaint: "the Internet is slow," despite the actual connection being up — a critical insight for IT support roles.

All results were confirmed visually and forensically via Wireshark packet captures, ensuring the troubleshooting steps were not only functional but also observable and verifiable — a key skill for client support and ticket escalation documentation.

VI/ Key Takeaways & Skills Demonstrated

- Client-side network troubleshooting using a logical and layered approach (L1 → L7)
- Mastery of basic and advanced CLI tools: ip, ping, dig, curl
- Diagnosis of local network issues (IP config, route table, ICMP)
- Investigation of Internet connectivity problems (DNS resolution, HTTP reachability)
- DNS performance benchmarking and resolver testing via /etc/resolv.conf
- Capture and analysis of network packets using Wireshark with protocol-specific filters
- Understanding of protocol behavior and dependencies across ICMP, DNS, and HTTP
- Creation of structured documentation for a reproducible diagnostic methodology
- Awareness of how network misconfigurations affect user experience
- Ability to simulate and resolve real-world IT support scenarios end-to-end

VIII/ Optional Enhancements, Reflection

During the diagnostic process, I encountered an issue where dig google.com failed despite apparent Internet connectivity. This was due to the system using 127.0.0.53 (systemd-resolved stub) as its default DNS, which did not forward requests correctly in the VM setup. Manually switching to a public resolver (1.1.1.1) in /etc/resolv.confresolved the issue and allowed DNS/HTTP traffic to be captured successfully in Wireshark.
This highlighted an important point: depending on the diagnostic scenario, adjusting the DNS resolver might be necessary to ensure reliable testing, especially in isolated or virtualized environments.

Additionally, this project underlined the sensitivity of captured data (especially DNS queries and HTTP headers). In a real IT support or security context, such capture files should be stored securely, possibly encrypted, and treated as confidential, particularly if they contain internal IPs, visited domains, or credentials.
Finally, automating the diagnostic steps into a script or checklist could help streamline future troubleshooting tasks in a professional setting.

Video Recording Link

https://youtu.be/MHMeTE6mpz0