

WireGuard VPN Project Report

Project Overview

Title: WireGuard VPN — Secure Site-to-Site Communication
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Objective: Design, implement, and analyze a secure VPN tunnel using WireGuard, and compare its performance against IPsec.

Completed Milestones

Phase	Description	Status
Environment Setup	Two physical/virtual networks configured (Mac client and Ubuntu PC server).	■ Done
WireGuard Installation	Installed via Homebrew (Mac) and APT (Ubuntu).	■ Done
Key Generation & Configs	Automation script `gen-keys.sh` produces valid keypairs.	■ Done
Tunnel Bring-up	Both peers bring up interfaces and handshake verified.	■ Done
Connectivity Test	Ping successful (10.10.10.1 ↔ 10.10.10.2).	■ Done
Automation & Reproducibility	`setupUbuntu.sh` and `setupMac.sh` handle automation.	■ Done
Traffic Capture	`captureTunnel.sh` automates tcpdump, iperf3, result storage.	■ Done
Performance Benchmarking	10-second TCP throughput test achieved ~130 Mb/s.	■ Done
Artifact Verification	Artifacts stored in `experiments/perf/raw/`.	■ Done

Performance Summary

Metric	Value
Throughput (avg)	128–131 Mb/s
Duration	10 seconds
Packet Loss	0%
CPU Utilization	1.3% client / 3.5% server
Encryption Type	ChaCha20 (WireGuard default)

Validation Against Proposal Criteria

All key milestones from the project proposal have been achieved up to the WireGuard validation stage. The tunnel is stable, reproducible, and supported by performance metrics and packet captures.

Captured Test Artifacts

All Wireshark capture files, JSON performance logs, and tcpdump outputs from multiple runs are archived here:

■ **CLICK ME to view all WireGuard Captures and Logs**

This archive includes packet captures (.pcap), tcpdump logs, and iperf3 JSON output files for multiple test runs.

Next Steps

1. NAT Traversal Testing (hotspot scenario).
2. Mirror setup for IPsec using strongSwan.
3. Visualize throughput and CPU utilization from JSON logs.
4. Document and automate artifact pulling from Ubuntu server.

Conclusion

All objectives related to WireGuard deployment, automation, verification, and performance measurement have been successfully achieved. The team now has a stable, measurable, and reproducible WireGuard VPN tunnel with validated metrics, marking the WireGuard phase of the project as complete.