Homelab Network Infrastructure (In Progress)

Overview

This project is a personal homelab designed to model **small-to-medium enterprise network architecture** within a residential environment. The primary goal is to gain hands-on experience with **network design, VLAN segmentation, routing, firewalling, and infrastructure planning**, while building a scalable foundation for future services such as virtualization, containerized workloads, and internal tooling.

Objectives

- Design and implement a **VLAN-segmented network**
- Enforce **clear separation of routing, switching, access, and wireless layers**
- Practice real-world concepts including:
    - Firewall policy design and inter-VLAN routing
    - Managed switching and VLAN trunking
    - Network isolation and security boundaries
- Create a platform that supports future expansion (virtualization, CI/CD, NAS)

Architecture Summary

The network follows a **layered enterprise-style design**:

- **Routing & Firewall:** Dedicated OPNsense appliance handling internet access, DHCP, firewall rules, and inter-VLAN routing
- **Core Switching:** VLAN-aware core switch aggregating all network traffic and providing trunk links
- **Access Switching:** Managed PoE switch for wired endpoints and wireless infrastructure
- **Wireless:** Wi-Fi 6 access point broadcasting multiple VLAN-mapped SSIDs
- **Compute:** Dedicated system planned for Proxmox, containers, and internal services

Routing is performed exclusively by the firewall, while all switches operate at Layer 2 to maintain clear separation of concerns.

Network Segmentation

The network is segmented to improve security, reliability, and clarity:

VLAN	Name	Purpose
99	Management	Network device management only
10	Trusted	Personal devices, servers, virtualization
30	IoT	Isolated smart devices
40	Guest	Internet-only access

Inter-VLAN communication is explicitly controlled at the firewall. Guest and IoT networks are isolated from trusted resources by design.

Design Principles

- No reliance on default VLANs
- Explicit, documented configuration
- Management traffic isolated from user traffic
- Incremental, test-driven build process
- Designed for rebuildability and future growth

Current Status & Next Steps

The lab is currently undergoing a **clean rebuild** to ensure consistency and correctness. Upcoming work includes finalizing firewall policies, completing VLAN trunking across switches, deploying virtualization infrastructure, and expanding internal services and monitoring.

Project Value

This homelab functions as both a **hands-on learning environment** and a **living portfolio project**, demonstrating practical experience with modern networking concepts, disciplined system design, and infrastructure best practices.