

# **Homelab Workshop**

Session 1: Theory & Foundation

Build production-like infrastructure from the ground up

# Agenda

Time	Topic
10 min	<b>What is a Homelab?</b> Why build one, use cases
10 min	<b>Hardware Selection</b> Mini PCs, specs, budget
15 min	<b>Network Design</b> VLANs, IP scheme, security
15 min	<b>Proxmox</b> Installation, LXC vs VMs
5 min	<b>Q&amp;A</b>

**Total: ~55 minutes**

# What is a Homelab?

*~10 minutes*

# What is a Homelab?

A **personal computing environment** where you build, configure, and manage your own IT infrastructure at home.

- **Your own servers** - physical hardware you control
- **Your own network** - VLANs, firewalls, DNS
- **Your own services** - apps running 24/7
- **Your own data** - complete privacy and ownership

“ Think of it as a miniature data center in your home ”

# Why Build a Homelab?

## Learning & Career

- Hands-on practice with enterprise technologies
- Build a portfolio for interviews – DevOps skills are in demand

## Self-Hosting & Privacy

- Run your own cloud storage, password manager, media server
- Your data stays under your roof – no subscriptions needed

## It's Fun

- Tinker, break things, learn, repeat

# What Can You Run?

Category	Services
<b>DNS &amp; Security</b>	AdGuard Home, Pi-hole, WireGuard
<b>Media</b>	Plex, Jellyfin, Immich (photos)
<b>Productivity</b>	Nextcloud, Vaultwarden, Gitea
<b>Smart Home</b>	Home Assistant, Zigbee2MQTT
<b>Monitoring</b>	Grafana, Prometheus, Uptime Kuma
<b>Development</b>	CI/CD runners, staging environments
<b>Networking</b>	Reverse proxy, Cloudflare Tunnel, VPN

# Hardware Selection

*~10 minutes*

# Why Mini PCs?

	Enterprise Server	Mini PC	Raspberry Pi
<b>Power</b>	250-400W idle	<b>35-65W</b>	5-15W
<b>Noise</b>	60+ dB (loud)	<b>&lt;30 dB (silent)</b>	Silent
<b>Cost</b>	\$200-800 used	<b>\$250-400 used</b>	\$75-100 new
<b>CPU</b>	Xeon (old gen)	<b>i5/i7 8th gen</b>	ARM (limited)
<b>RAM</b>	64-128GB	<b>16-32GB</b>	4-8GB
<b>VMs?</b>	Yes	<b>Yes</b>	No (ARM)

**Mini PCs hit the sweet spot** - powerful enough for real workloads, efficient enough to run 24/7, quiet enough for your home.

# Our Workshop Hardware

## Master Node - Lenovo ThinkCentre M920q

- Intel Core **i7-8700T** (6 cores / 12 threads)
- **32GB** DDR4 RAM - 512GB NVMe SSD
- ~65W typical - ~\$400 used

## Worker Nodes (x2) - Dell OptiPlex 3060 Micro

- Intel Core **i5-8500T** (4 cores / 8 threads)
- **16GB** DDR4 RAM - 256GB NVMe SSD
- ~35W typical - ~\$250 each used

## Total

**14 cores | 28 threads | 64GB RAM | 1TB SSD | ~135W | ~\$900**

# Power & Cost

State	Power Draw	Monthly Cost*
Idle (all 3 nodes)	45W	~\$5
<b>Typical load</b>	<b>135W</b>	<b>~\$15</b>
Heavy load	220W	~\$25
Max stress	280W	~\$32

At \$0.12/kWh

## Comparison:

- Gaming PC running 24/7: **\$35/month**
- Enterprise Dell R720: **\$30/month**
- Our mini PCs (3 nodes): **\$15/month**

# Network & Infrastructure Design

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# What are VLANs?

**Virtual LANs** = isolated network segments on the same physical hardware

Without VLANs (flat network):

All devices → same network → everything can talk to everything  
(security nightmare)

With VLANs:

IoT devices → VLAN 40 → internet only (isolated)  
Guest WiFi → VLAN 50 → internet only (isolated)  
Your laptop → VLAN 30 → can access servers  
Proxmox nodes → VLAN 10 → management only

**Why?** A hacked smart bulb can't reach your password manager.

# Our 5-VLAN Design

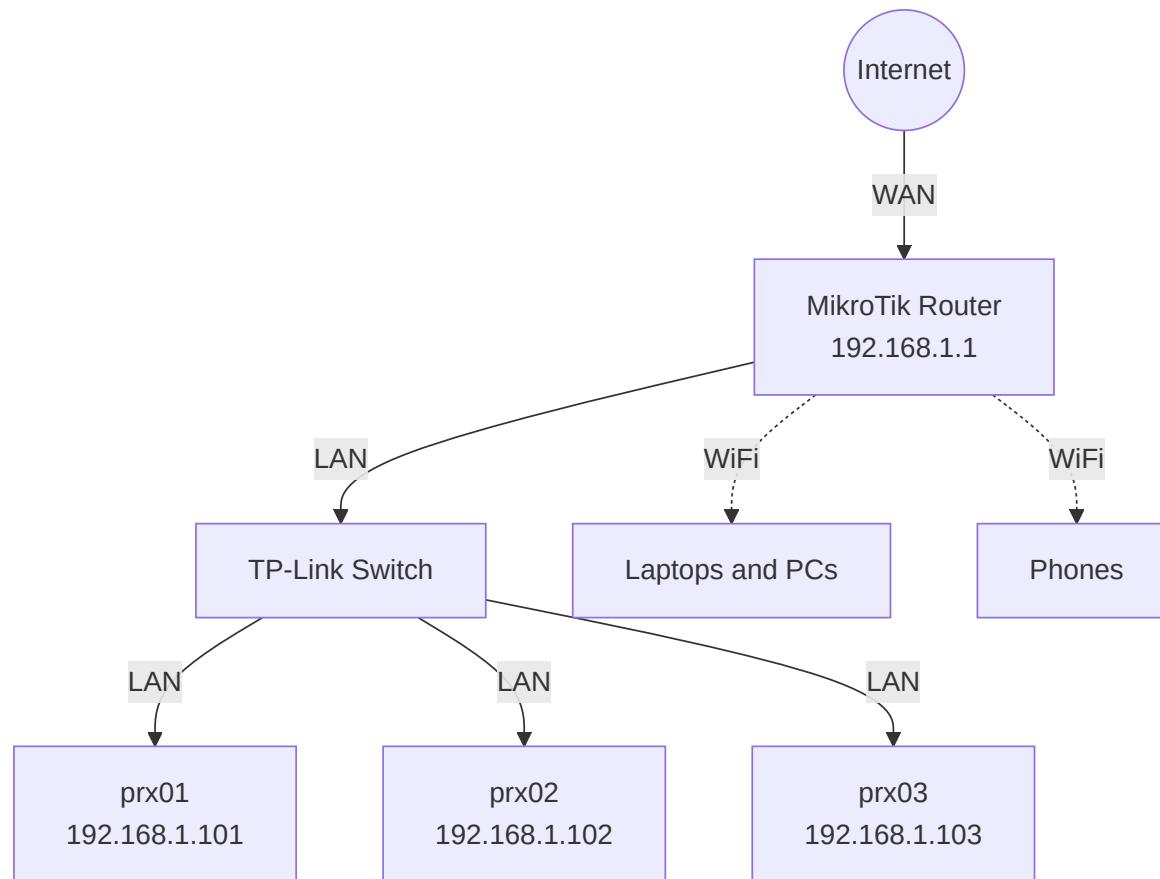
VLAN	Name	Network	Purpose	Access
10	Management	192.168.10.0/24	Proxmox, infra	Full access to all
20	Servers	192.168.20.0/24	Media, storage	From Mgmt + Trusted
30	Trusted	192.168.30.0/24	PC, phones	Internet + Servers
40	IoT	192.168.40.0/24	Smart home	Internet only
50	Guest	192.168.50.0/24	Visitors	Internet only

**Router:** MikroTik hAP ac3 (handles VLANs + firewall)

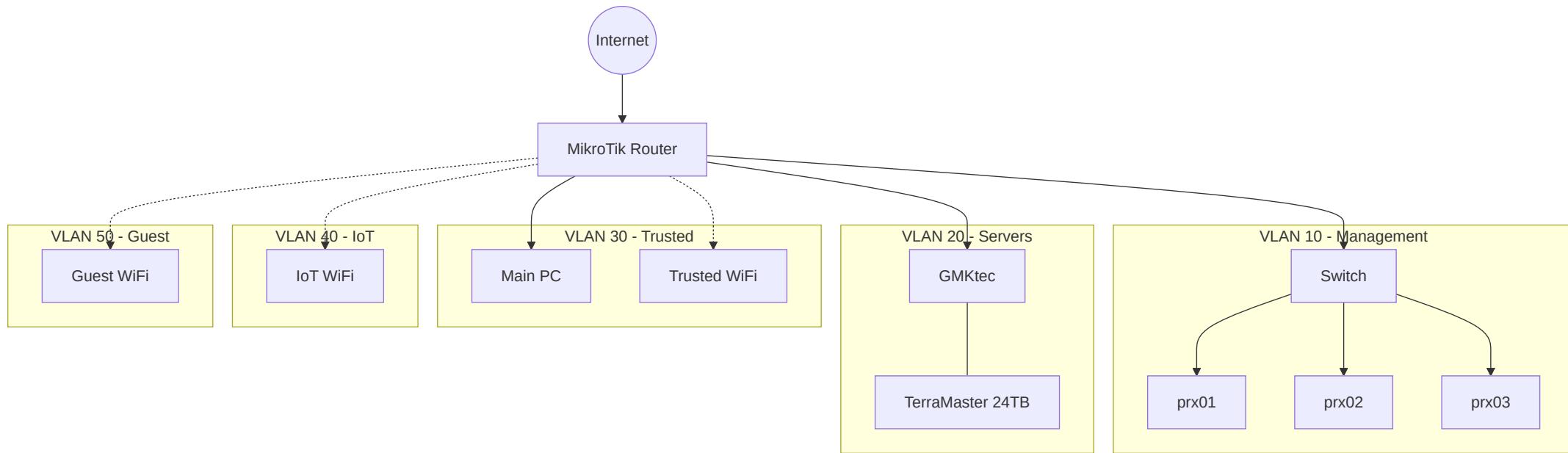
**Switch:** TP-Link LS108G (8-port gigabit, ~\$25)

# Simple Topology (No VLANs)

All devices on **one flat network** – simple, works fine for getting started.

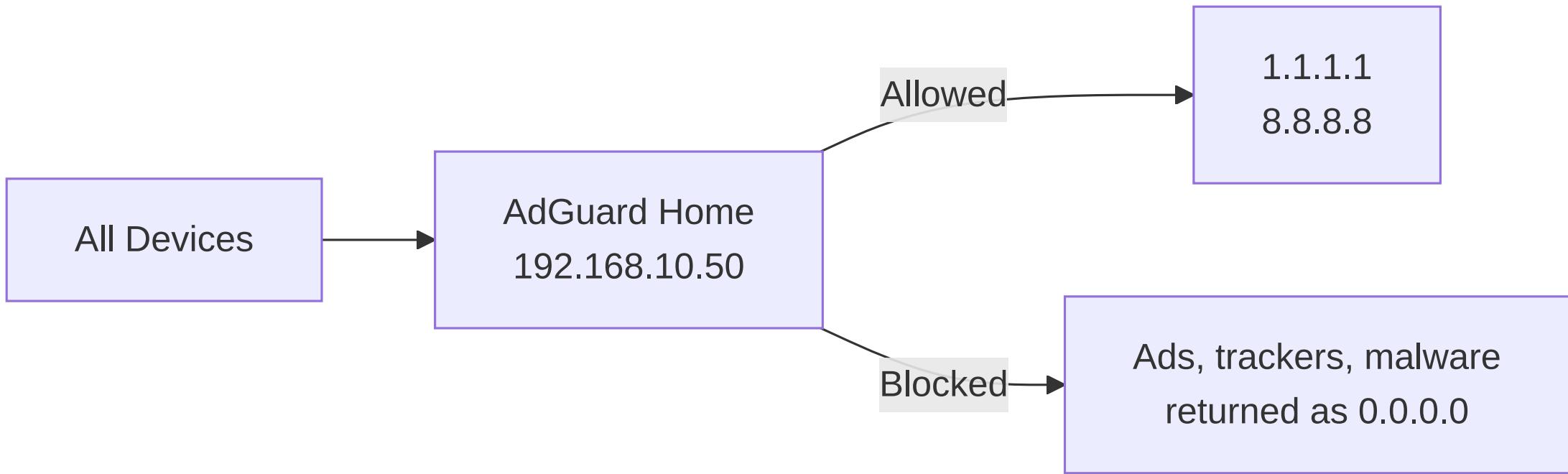


# Advanced Topology (With VLANs)



Each port/SSID maps to a VLAN – **isolated networks** for security.

# DNS & Ad Blocking



- **AdGuard Home** on Docker host – network-wide ad blocking
- All VLANs use AdGuard as DNS server via DHCP
- ~30% of DNS queries blocked (ads, telemetry, trackers)

# Proxmox VE

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# What is Proxmox VE?

**Open-source virtualization platform** (free, based on Debian Linux)

- Run **VMs** and **LXC containers** (lightweight)
- Web-based management UI at <https://node-ip:8006>
- Built-in snapshots, backups, massive community

	Proxmox	VMware ESXi	Hyper-V
Cost	Free	\$\$\$	Windows license
Linux	Excellent	Good	OK
Community	Huge	Enterprise	Enterprise

# LXC Containers vs VMs

	LXC Container	Virtual Machine
<b>Startup</b>	<b>2-5 seconds</b>	30-60 seconds
<b>RAM overhead</b>	<b>~50MB</b>	512MB-1GB
<b>Isolation</b>	Shared kernel	Full isolation
<b>Use case</b>	<b>Services, Docker</b>	Windows, untrusted code
<b>Performance</b>	Near-native	~95% native

## Rule of thumb:

- **Use LXC** for Linux services (Docker host, web servers, DNS)
- **Use VMs** for Windows, Kubernetes nodes, or untrusted workloads

We'll deploy a **Docker host as an LXC container** in Session 2.

# Proxmox Setup

**Each group gets their own Proxmox server**

Group	Server	IP
Group 1	prx01	192.168.10.101
Group 2	prx02	192.168.10.102
Group 3	prx03	192.168.10.103

**Setup steps:**

1. Install Proxmox on each node (USB boot, ~15 min each)
2. Create **API token** for Terraform: Datacenter → Permissions → API Tokens

**API Token** bridges us to **Session 2** → Infrastructure as Code

# Q&A

*5 minutes*

# Questions?

## What we covered today:

- **Homelabs** – personal infrastructure for learning & self-hosting
- **Hardware** – mini PCs: efficient, quiet, affordable (~\$900 total)
- **Network** – 5 VLANs for security segmentation
- **Proxmox** – free virtualization platform

## Coming up in Session 2 (Hands-on):

1. Deploy infrastructure with **Terraform**
2. Create LXC containers and VMs
3. Setup **Tailscale** VPN for remote access
4. Deploy services with **Docker Compose**