

Homelab Workshop

Session 1: Theory & Foundation

Build production-like infrastructure from the ground up

Agenda

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

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

Hardware Selection

~10 minutes

Why Mini PCs?

	Enterprise Server	Mini PC	Raspberry Pi
Power	250-400W idle	35-65W	5-15W
Noise	60+ dB (loud)	<30 dB (silent)	Silent
Cost	\$200-800 used	\$250-400 used	\$75-100 new
CPU	Xeon (old gen)	i5/i7 8th gen	ARM (limited)
RAM	64-128GB	16-32GB	4-8GB
VMs?	Yes	Yes	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
Typical load	135W	~\$15
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

~15 minutes

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

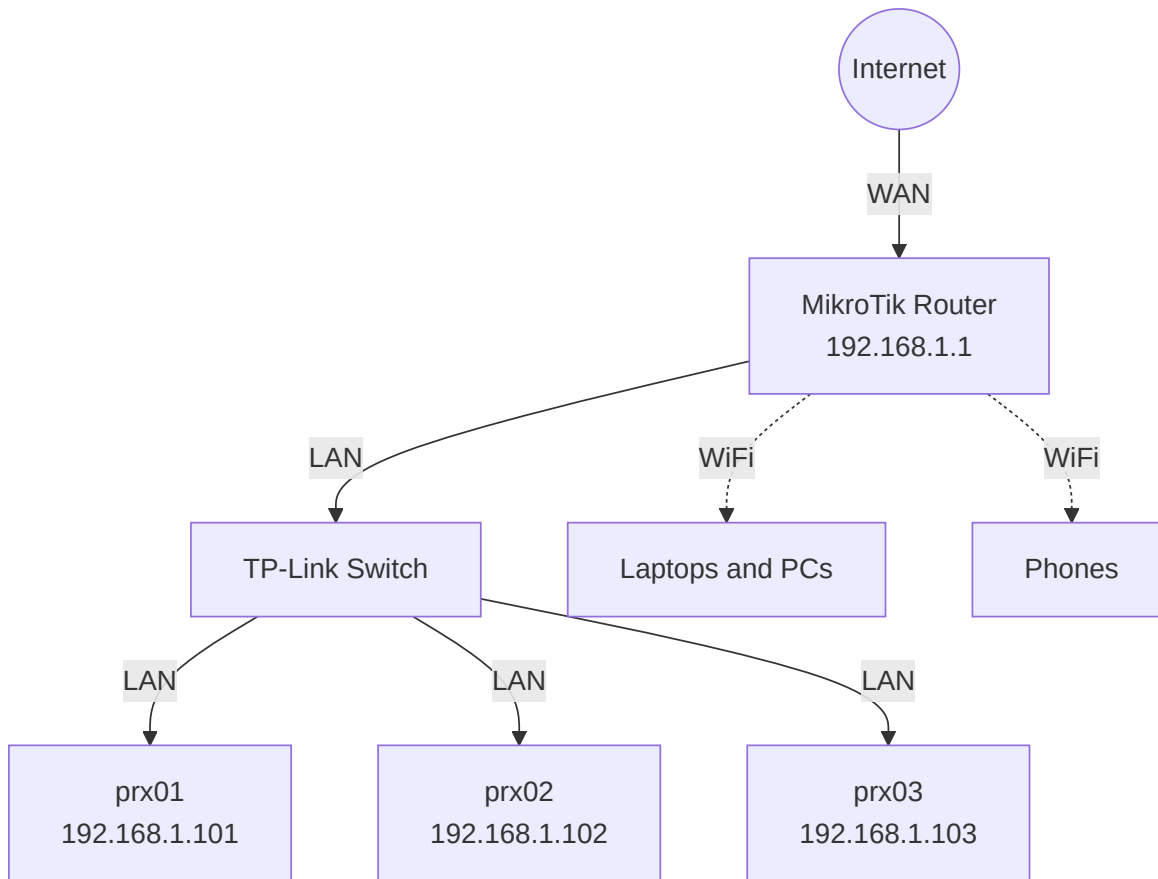
VLAN	Name	Network	Purpose	Access
10	Management	192.168.10.0/24	Proxmox, infra	Full access to all
20	Servers	192.168.20.0/24	Media, storage	From Mgmt + Trusted
30	Trusted	192.168.30.0/24	PC, phones	Internet + Servers
40	IoT	192.168.40.0/24	Smart home	Internet only
50	Guest	192.168.50.0/24	Visitors	Internet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

Router: MikroTik hAP ac3 (handles VLANs + firewall)

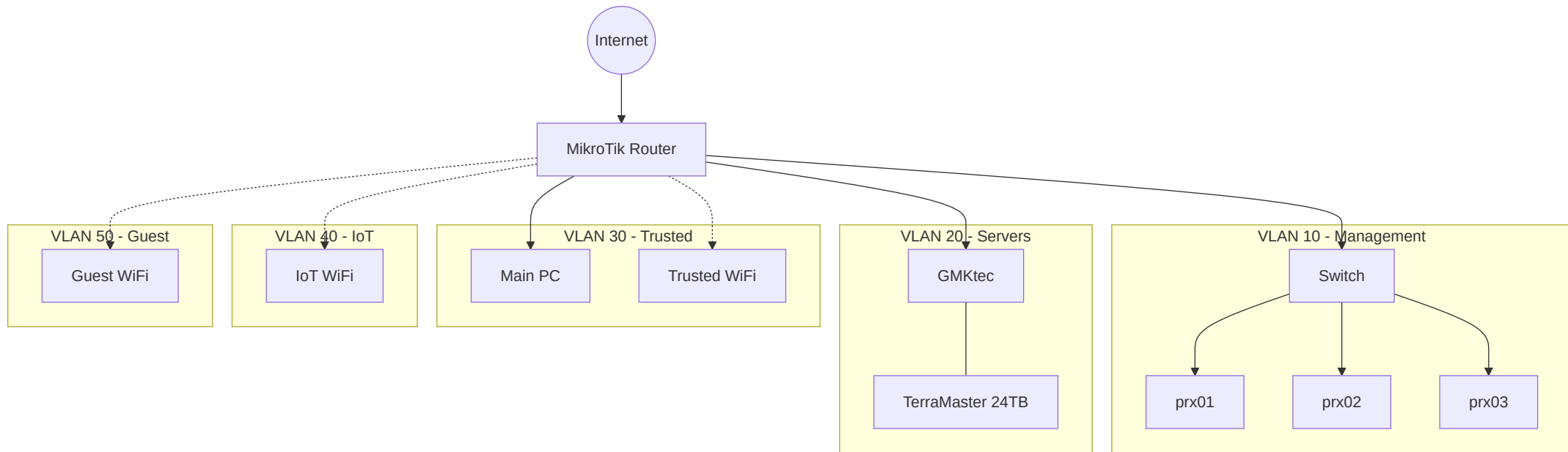
Switch: TP-Link LS108G (8-port gigabit, ~\$25)

Simple Topology (No VLANs)

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

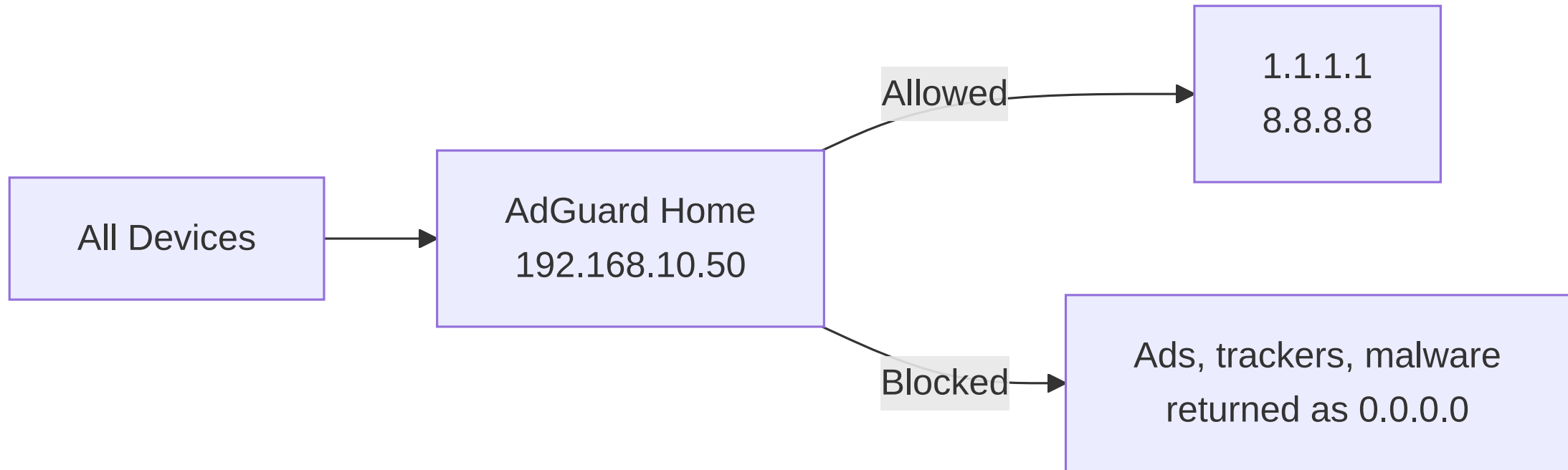


Advanced Topology (With VLANs)



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

~15 minutes

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
Startup	2-5 seconds	30-60 seconds
RAM overhead	~50MB	512MB-1GB
Isolation	Shared kernel	Full isolation
Use case	Services, Docker	Windows, untrusted code
Performance	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**