Securing Networks

AP Cybersecurity ▪ Unit 3

AP Cybersecurity

What we will cover

1 Network attacks

The classic network attacks

ARP poisoning 地址解析投毒
fake ARP messages divert traffic – an **on-path attack** 中间人攻击

MAC flooding 物理地址泛洪
floods a **switch** 交换机 into broadcast mode – **eavesdropping** 窃听

DNS poisoning 域名投毒
a fake record redirects users – **credential harvesting** 凭据收集

Smurf attack
ICMP to the broadcast address – a **DoS** 拒绝服务; many at once = **DDoS** 分布式拒绝服务

> Pair each attack with its tell-tale sign: ARP poisoning = one IP with two MACs; MAC flooding = a surge of new MACs; DNS poisoning = an unexplained drop in web traffic.

Why weak networks fall

Adversaries exploit weak networks to flood, map, or spoof devices.

- a physical data port with no port security lets an attacker plug in
- an open port lets them install a **rogue access point** 非法接入点 that bypasses the firewall entirely

Network switches

2 Policies & wireless

Policies come first

Written policies set a minimum standard:

- router & switch policies – ban local accounts, require port security
- a VPN policy – authentication rules, and no **split tunneling** 分离隧道
- a wireless policy – strong encryption, authenticated access

disable beacon frames – harder to find

control signal strength – no leak outside

WPA3 无线加密协议 – the current strongest

MAC filtering – known devices only

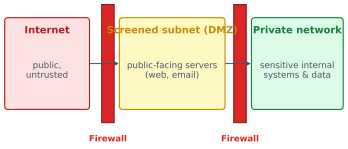
> WPA3 is strong; WEP and the original WPA are broken – never accept them in an answer.

3 Segmentation

Segmentation and the screened subnet

Network segmentation 网络分段 divides one network into isolated **subnets** 子网. If one is breached, the damage is contained.

> Build segments by subnetting (IP) or with **VLANs** 虚拟局域网 (logically, on one switch). Each gets its own policy.



public servers between two firewalls

> Name the **screened subnet** 屏蔽子网 (DMZ) whenever a question separates public services from internal data.

4 Firewalls

Three kinds of firewall

Stateless 无状态
filters on headers alone – IP, port, protocol

Stateful 有状态
also tracks each connection's state – finer control

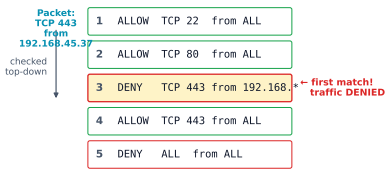
Next-generation
adds intrusion prevention, deep packet inspection

> Firewalls belong at every point where data crosses between zones – each segment, and every gateway to the internet.

The access control list – first match wins

A firewall follows an **ACL** 访问控制列表 – an ordered set of rules. Each names a direction, a filter (IP, port, service) and an action.

> Rules are checked in order, and the first match wins – so rule order, not just rule content, decides what gets through.



checked top to bottom

Worked example – why the ALLOW rule fails

Rule 3: `DENY TCP 443 from 192.168.*`
Rule 7: `ALLOW TCP 443 from ALL`

A user at `192.168.45.37` cannot reach port 443 – even though Rule 7 would allow them – because Rule 3 matches first. The fix: move the ALLOW rule above the DENY.

> Read ACLs top-to-bottom and stop at the first match. A Deny above an Allow blocks the traffic, however many Allows sit below it.

5 Detection

When prevention fails – detection takes over

Automated tools read the **log files** 日志文件 that record network activity:

- **NIDS** 网络入侵检测系统 – alerts, does not block
- **NIPS** 网络入侵防御系统 – can also stop an attack
- **SIEM** 安全信息与事件管理 – gathers many sources to spot patterns

The D in NIDS is detect; the P in NIPS is prevent.

Two detection methods – memorise the trade-off

Signature-based 基于特征
matches known attack signatures
✓ fast, few false positives
✗ blind to brand-new attacks

Anomaly-based 基于异常
compares to a normal **baseline** 基线
✓ catches novel attacks
✗ costs more, more false positives

> A hybrid approach combines both – and is the safe answer when a question asks for the best of each.

6 Recap

Unit 3 – key takeaways

1. **The tells** – ARP = one IP two MACs; MAC flood = a surge of MACs
2. **DMZ** – public servers between the internet and the private network
3. **ACL order** – first match wins – a Deny above an Allow blocks
4. **Detection** – signature is fast but blind; anomaly catches new, cries wolf

Check yourself

1. A DENY sits above an ALLOW for the same traffic. What happens?
2. Which detection method misses brand-new attacks?
3. Which wireless encryption is currently strongest?
4. NIDS or NIPS: which can block an attack?

Answers **1.** it is denied – first match wins **2.** signature-based **3.** WPA3 **4.** NIPS