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Kenya Education Network

STRENGTHENING KENYA'S CYBERSECURITY POSTURE

Security Landscape in IPv4 and IPv6

Transforming Learning, Research and Working Environments using ICT

Training Objectives

By the end of this session, you will:

✓ Identify critical **IPv4 vulnerabilities** (NAT, DHCP spoofing).

✓ Understand **IPv6-specific threats** (NDP spoofing, rogue RA).

✓ Apply mitigation strategies for hybrid (IPv4/IPv6) networks.

IPv4 Security Overview

- Widely deployed but originally not designed with security in mind
- Relies on NAT and stateful firewalls for basic protection
- Still vulnerable to multiple Layer 2 and Layer 3 threats

IPv4 Vulnerabilities

Legacy Risks Still Haunting Networks:

1. NAT Limitations:

NAT hides internal IPs but creates single points of failure

NAT also makes it difficult to find infected machines as they hide behind one IP address

Risk: State exhaustion attacks (results in DoS).

2. DHCP Spoofing:

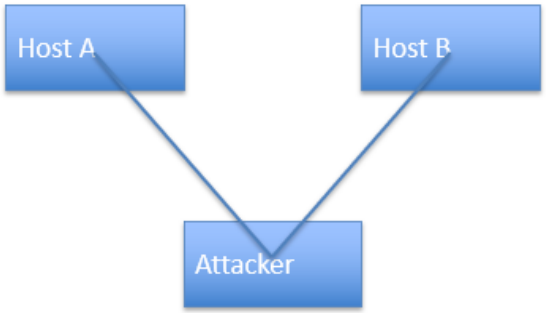
Attackers impersonate DHCP servers to redirect traffic.

Impact: Data interception (e.g., student login theft).

Demo – DHCP Spoofing in Action

Video:

https://www.youtube.com/shorts/j14Qy2hpW9k



Steps:

- Attacker sends **fake DHCP offers**
- Devices connect to **rogue gateway**.
- Traffic redirected to malicious DNS

IPv6 Security Overview

- Built-in security features like IPSec (optional, not always implemented)
- Larger address space reduces scanning risk

IPv4-4.3B addresses: Low-effort, automated, wide-scale scanning quickly
IPv6 –2^128 addresses: Automated wide-scale scanning is futile.

- Stateless Address Autoconfiguration (SLAAC) introduces new risks (RA and NDP spoofing)

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IPv6 Threats – New Challenges

IPv6 Solves Old Problems, Introduces New Ones

1. NDP Spoofing:

Fake Neighbor Advertisements poison caches.

Result: Man-in-the-middle (MITM) attacks.

2. Rogue Router Advertisements (RA):

- ✓ *Advertise fake default gateways*
- ✓ *Cause routing confusion or DoS*
- ✓ *Redirect traffic*

3. Tunneling Attacks

- ✓ Attackers encapsulate IPv6 in IPv4 (e.g., **6to4,**).
- ✓ **Bypasses** firewalls.

Side-by-Side Comparison

Threat Type	IPv4	IPv6
Spoofing	DHCP Spoofing	NDP Spoofing
Gateway Attacks	ARP Poisoning	Rogue RA
Flood Attacks	SYN Floods	ICMPv6 Floods

Dual Stack Dangers

Top Attack surfaces:

- **IPv6-enabled by default** on modern OS → Unmonitored traffic
- **Asymmetric routing:** IPv4/6 paths differ → Bypasses controls
- **DNS inconsistencies:** A vs. AAAA record poisoning

Best Practices & Mitigation Strategies

IPv4
- ❖Rate-limit NAT translations
- ❖Isolate legacy IPv4-only devices
- ❖Implement DHCP snooping
- ❖Use Dynamic ARP Inspection

IPv6
- ❖Disable unused transition mechanisms (6to4)
- ❖Deploy RA Guard on switches
- ❖Use NDP Monitoring

Dual – Stack
- ❖Synchronize ACLs for both protocols
- ❖Monitor IPv6 flow logs (often ignored!)
- ❖General Network Segmentation
- ❖Train administrators regularly

Q & A

Challenges in transitioning to or securing IPv6 ?

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Transforming education through ICT

Thank You

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