# CCNA Security 2.0 Study Material – Chapter 1: Modern Network Security Threats

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October 5, 2017

### Contents

## Chapter Outline:

## Section 1.1: Securing Networks

Upon completion of this section, you should be able to:

- Describe the current network security landscape.
- Explain how all types of networks need to be protected.

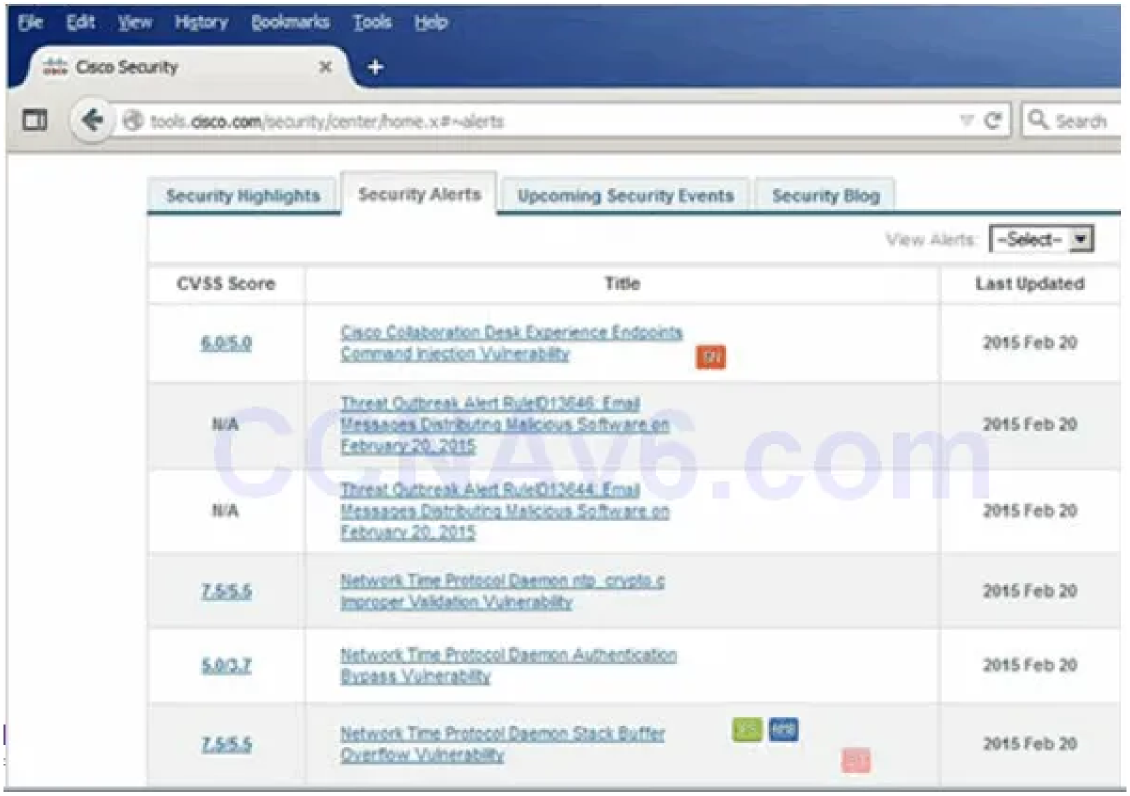
### Topic 1.1.1: Current State of Affairs

#### Networks Are Targets

## Drivers for Network Security

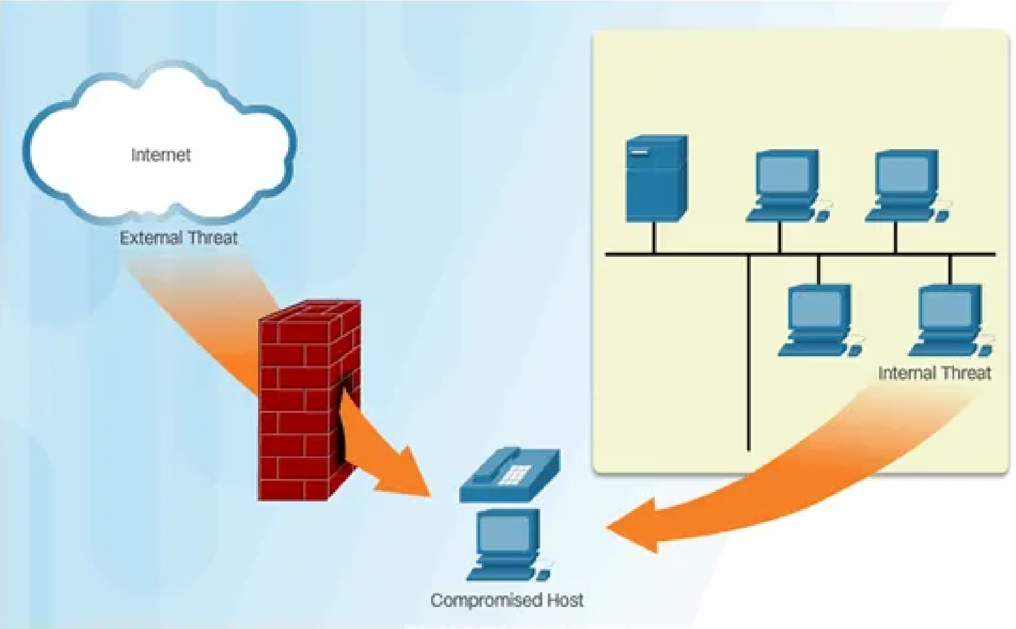
Common network security terms:

- Threat
- Vulnerability
- Mitigation
- Risk



| CVSS Score | Title | Last Updated |
|---|---|---|
| 6.0/5.0 | Cisco Collaboration Desk Experience Endpoints Command Injection Vulnerability | 2015 Feb 20 |
| N/A | Threat Outbreak Alert RuleID13646: Email Messages Distributing Malicious Software on February 20, 2015 | 2015 Feb 20 |
| N/A | Threat Outbreak Alert RuleID13644: Email Messages Distributing Malicious Software on February 20, 2015 | 2015 Feb 20 |
| 7.5/5.5 | Network Time Protocol Daemon ntp_crypto.c Improper Validation Vulnerability | 2015 Feb 20 |
| 5.0/3.7 | Network Time Protocol Daemon Authentication Bypass Vulnerability | 2015 Feb 20 |
| 7.5/5.5 | Network Time Protocol Daemon Stack Buffer Overflow Vulnerability | 2015 Feb 20 |

## Vectors of Network Attacks



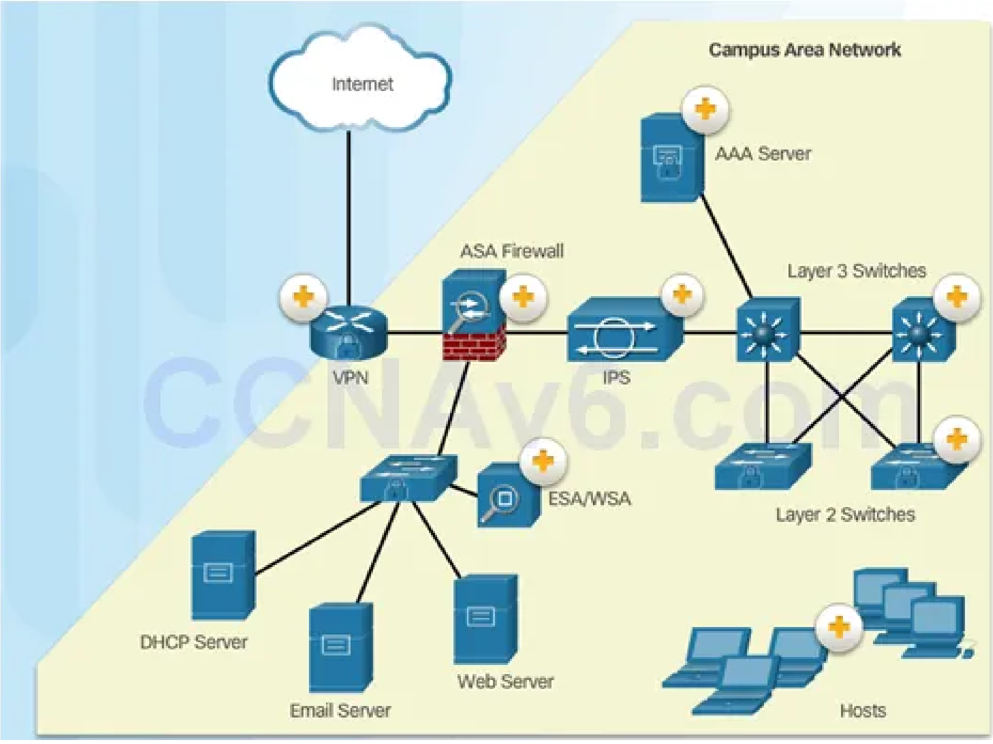
## Data Loss

Vectors of data loss:

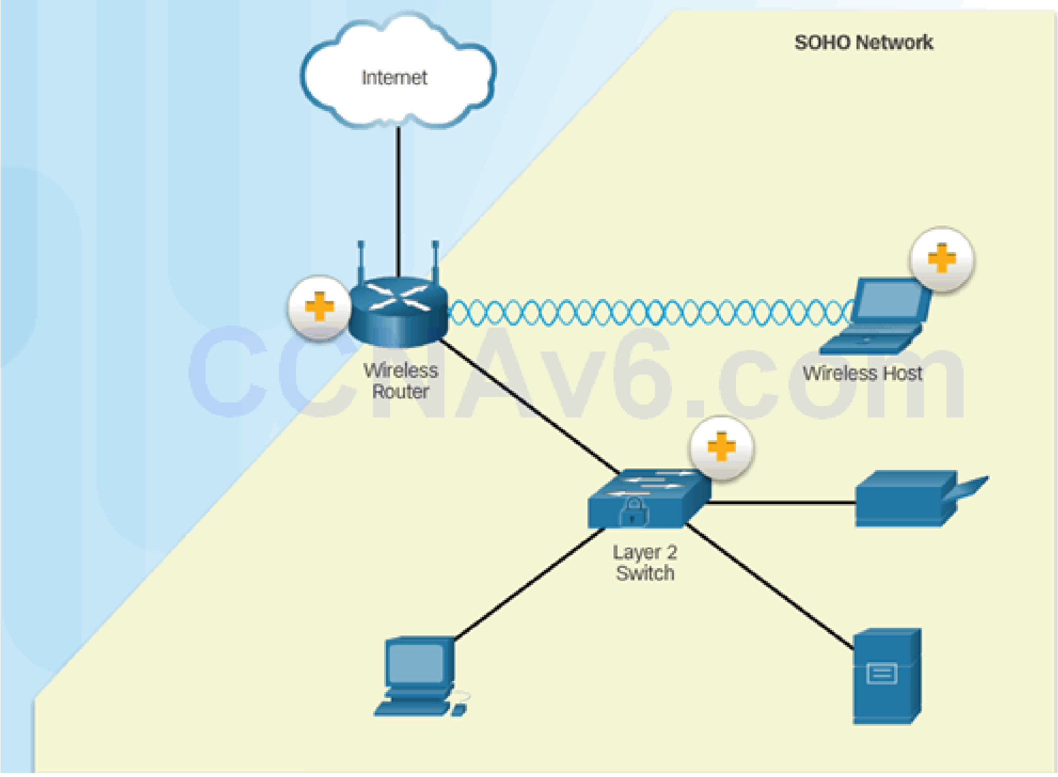
- Email/Webmail
- Unencrypted Devices
- Cloud Storage Devices
- Removable Media
- Hard Copy
- Improper Access Control

## Topic 1.1.2: Network Topology Overview

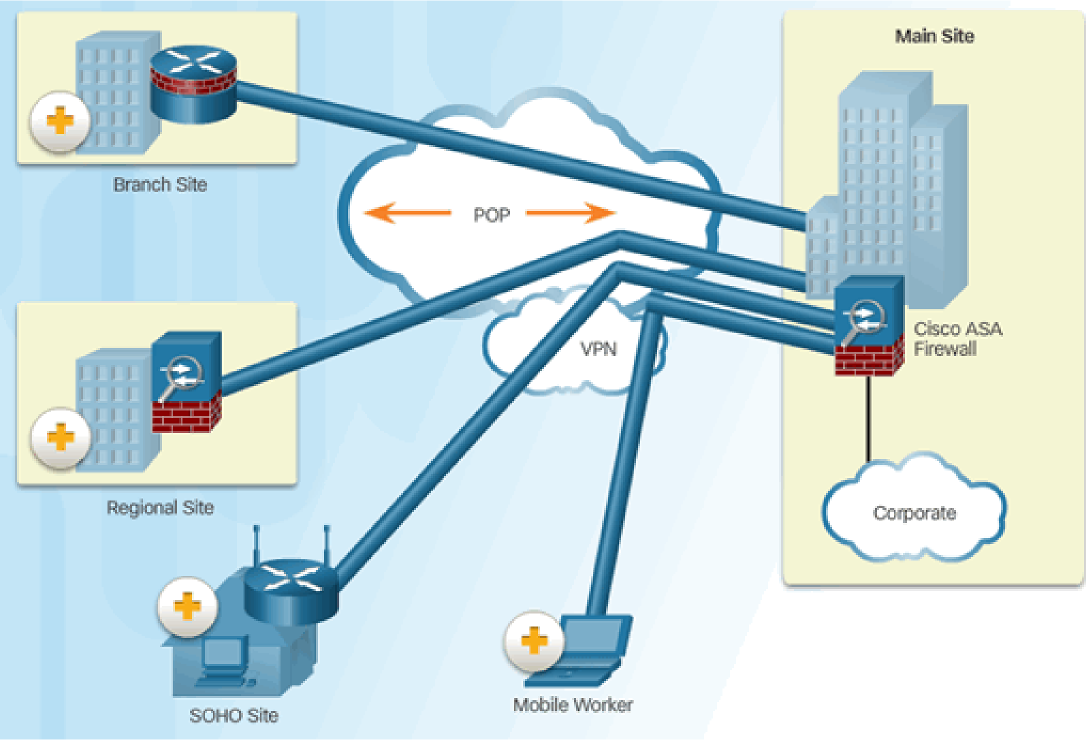
### Campus Area Networks



### Small Office and Home Office Networks



## Wide Area Networks



## Data Center Networks

- Outside perimeter security:
  - On-premise security officers
  - Fences and gates
  - Continuous video surveillance
  - Security breach alarms
- Inside perimeter security:
  - Electronic motion detectors
  - Security traps
  - Continuous video surveillance
  - Biometric access and exit sensors

### Cloud and Virtual Networks

- VM-specific threats:
  - Hyperjacking
  - Instant On activation
  - Antivirus storm
- Components of a secure data center:
  - Secure segmentation
  - Threat defense
  - Visibility

### The Evolving Network Border

Critical MDM functions for BYOD network:

- Data encryption
- PIN enforcement
- Data wipe
- Data loss prevention
- Jailbreak/root detection

## Section 1.2: Network Threats

Upon completion of the section, you should be able to:

- Describe the evolution of network security.
- Describe the various types of attack tools used by hackers.
- Describe malware.
- Explain common network attacks.

## Topic 1.2.1: Who is Hacking Our Networks?

### The Hacker & The Evolution of Hackers

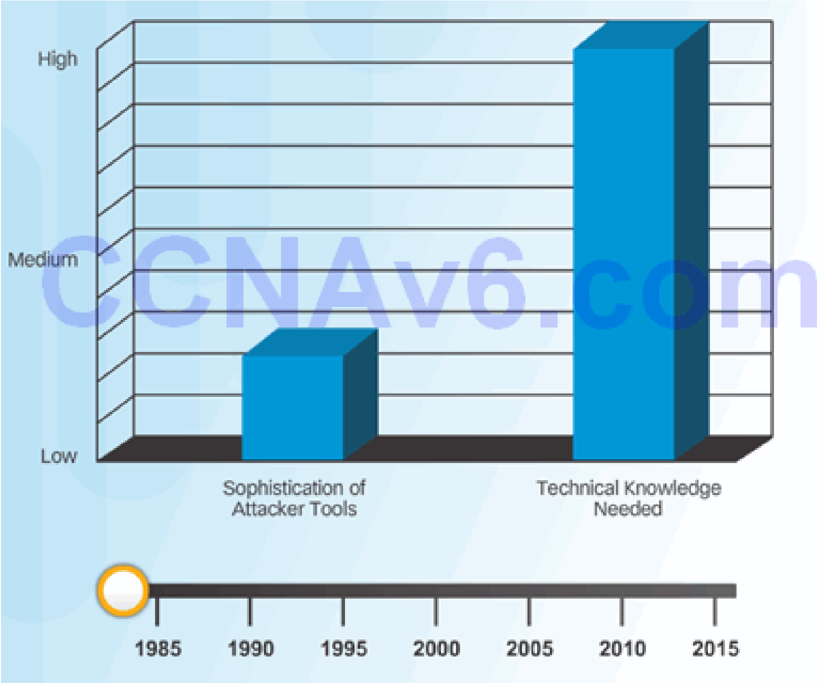
Modern hacking titles:

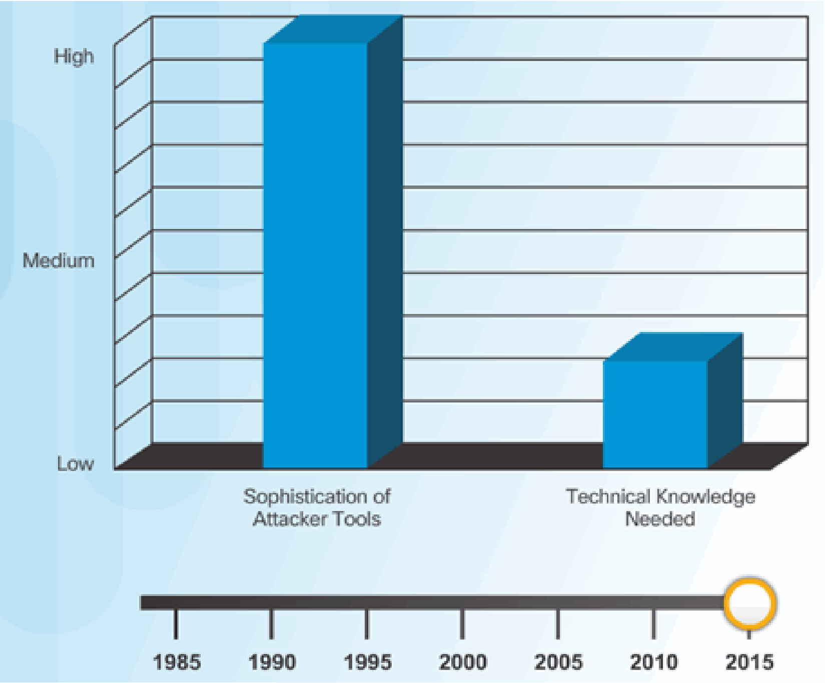
- Script Kiddies
- Vulnerability Brokers
- Hacktivists
- Cyber Criminals
- State-Sponsored Hackers

White Hat Hackers
Grey Hat Hackers
Black Hat Hackers

## Topic 1.2.2: Hacker Tools

### Introduction of Attack Tools





## Evolution of Security Tools

Penetration testing tools:

- Password crackers
- Wireless hacking
- Network scanning and hacking
- Packet crafting
- Packet sniffers
- Rootkit detectors
- Fuzzers to search vulnerabilities
- Forensic
- Debuggers
- Hacking operating systems
- Encryption
- Vulnerability exploitation
- Vulnerability Scanners

## Categories of Attack Tools

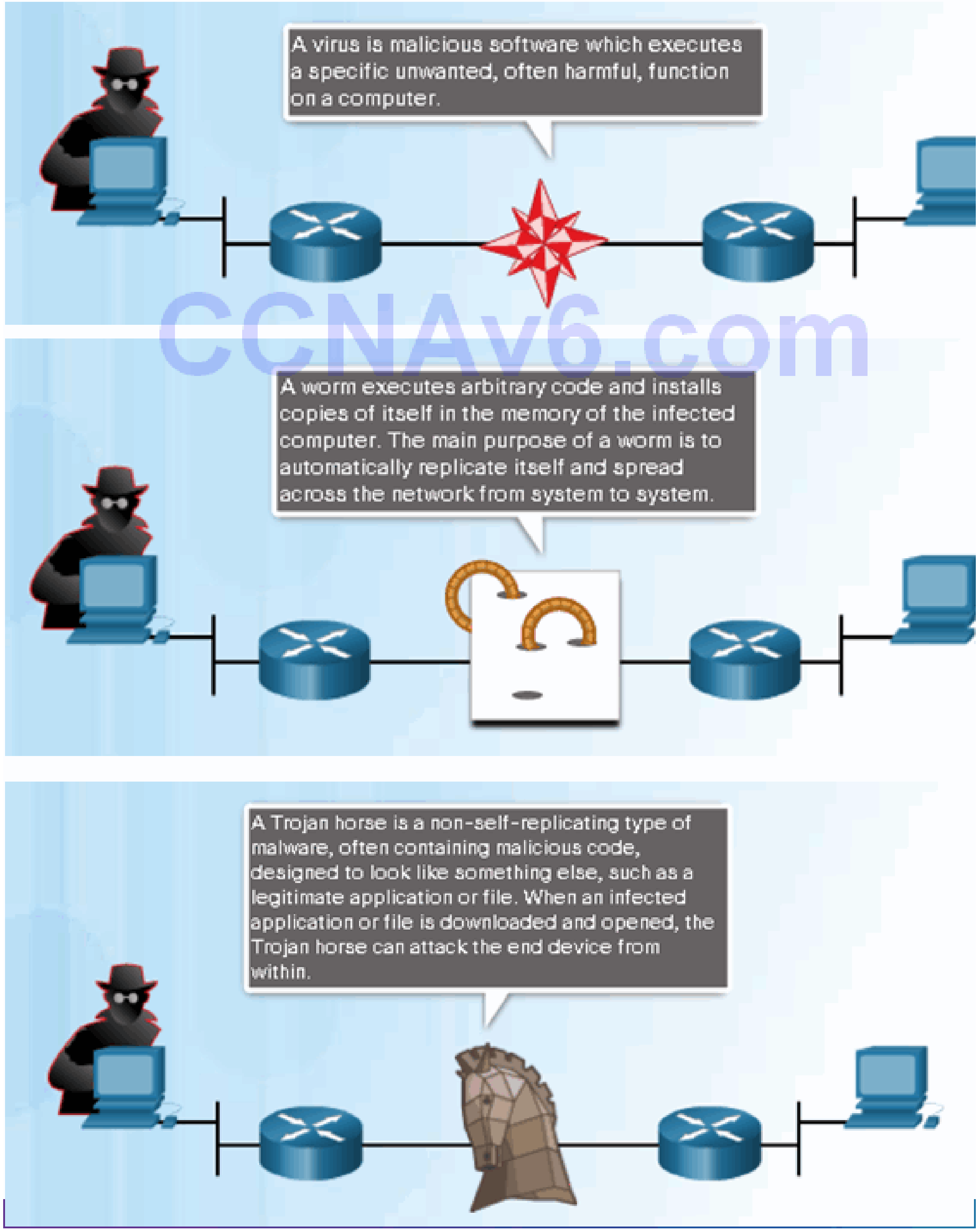
Network hacking attacks:

- Eavesdropping
- Data modification
- IP address spoofing
- Password-based
- Denial-of-service
- Man-in-the-middle
- Compromised-key

- Sniffer

## Topic 1.2.3: Malware

### Various Types of Malware



A virus is malicious software which executes a specific unwanted, often harmful, function on a computer.

A worm executes arbitrary code and installs copies of itself in the memory of the infected computer. The main purpose of a worm is to automatically replicate itself and spread across the network from system to system.

A Trojan horse is a non-self-replicating type of malware, often containing malicious code, designed to look like something else, such as a legitimate application or file. When an infected application or file is downloaded and opened, the Trojan horse can attack the end device from within.

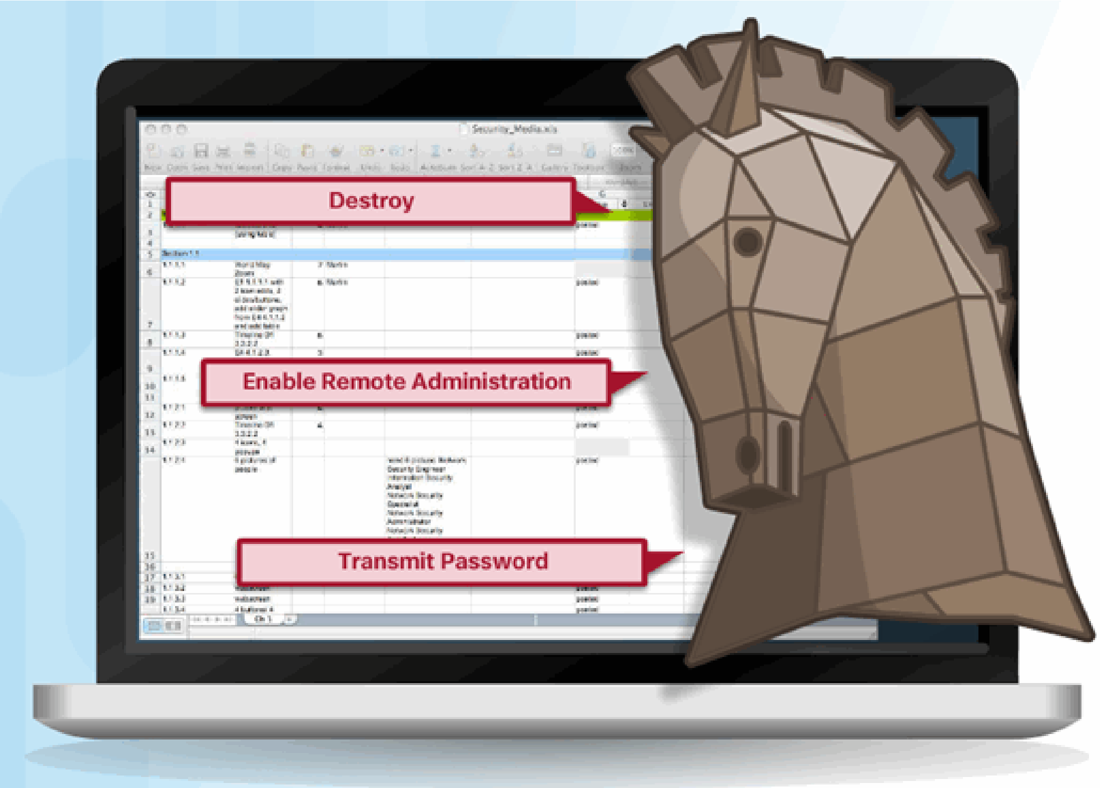
### Viruses

Virus Alert!
Warning! Threat detected!
A malicious item has been detected!

## Trojan Horse Classification

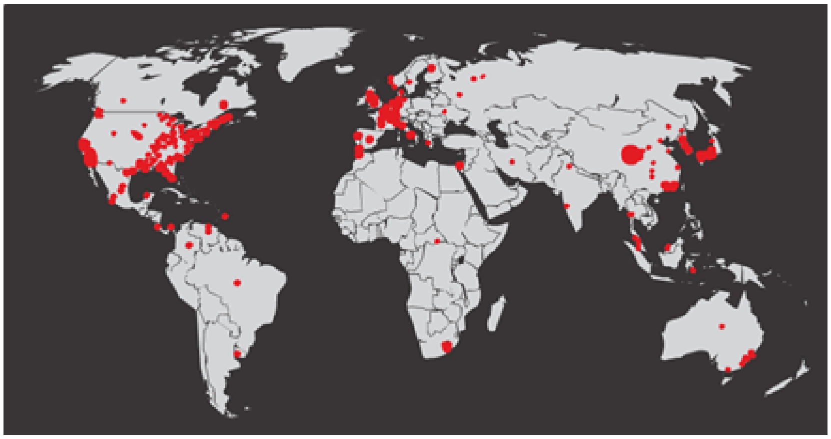
Classifications:

- Security software disabler
- Remote-access
- Data-sending
- Destructive
- Proxy
- FTP
- DoS

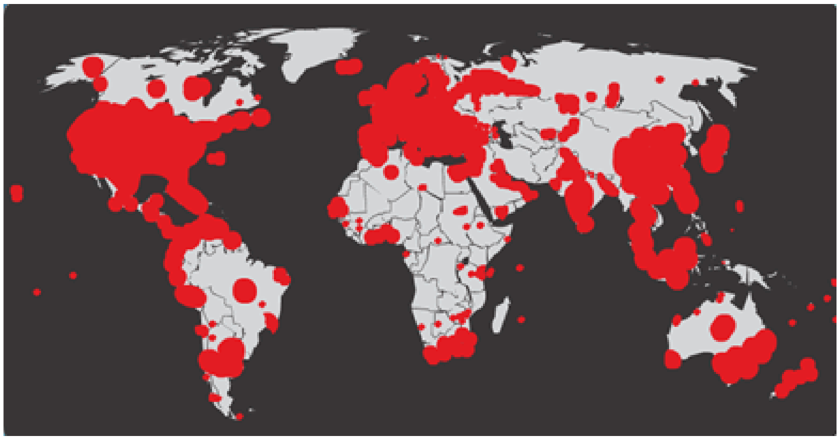


## Worms

Initial Code Red Worm Infection



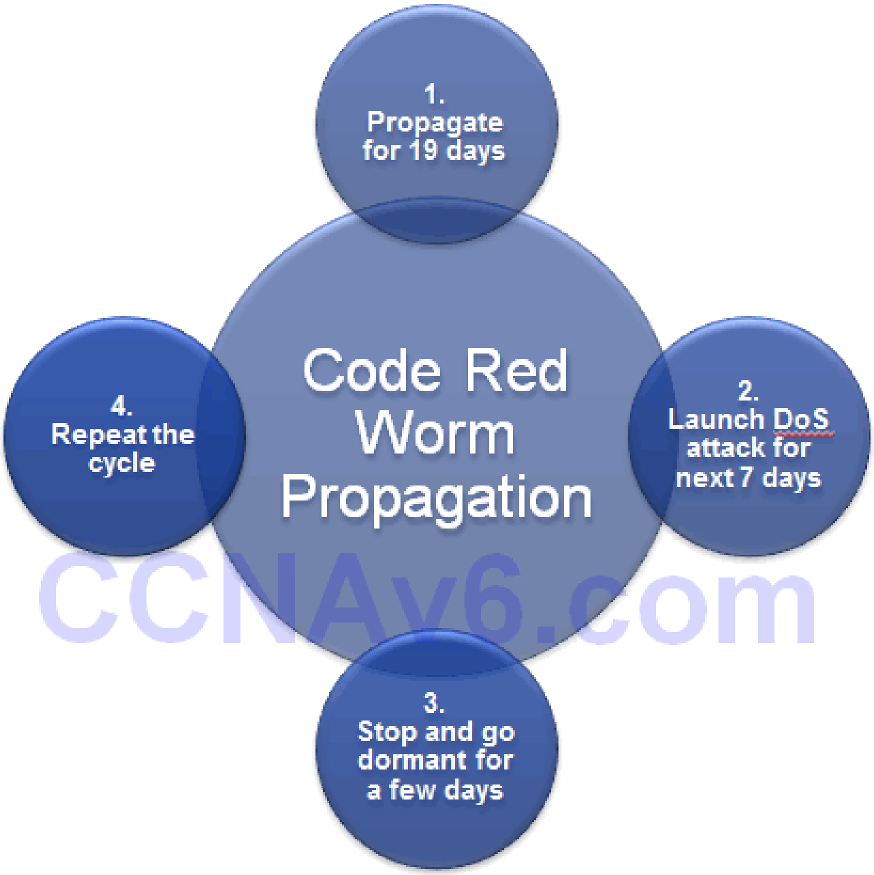
Code Red Worm Infection 19 Hours Later



## Worm Components

Components:

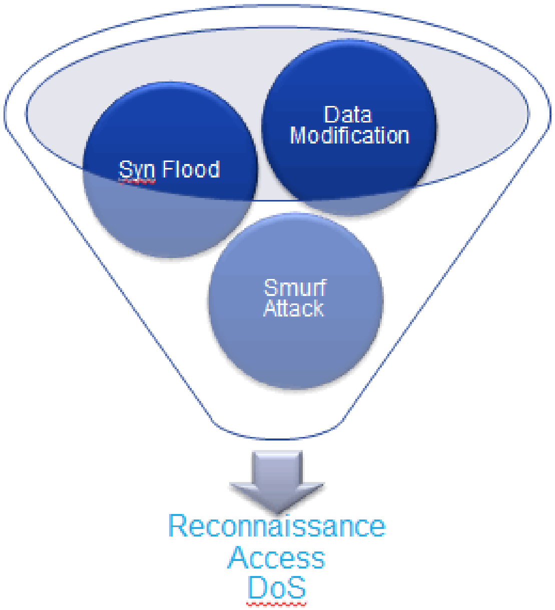
- Enabling vulnerability
- Propagation mechanism
- Payload


Code Red Worm Propagation
1. Propagate for 19 days
2. Launch DoS attack for next 7 days
3. Stop and go dormant for a few days
4. Repeat the cycle

## Other Malware

## Topic 1.2.4: Common Network Attacks

### Types of Network Attacks



### Reconnaissance Attacks

- Initial query of a target
- Ping sweep of the target network
- Port scan of active IP addresses
- Vulnerability scanners
- Exploitation tools

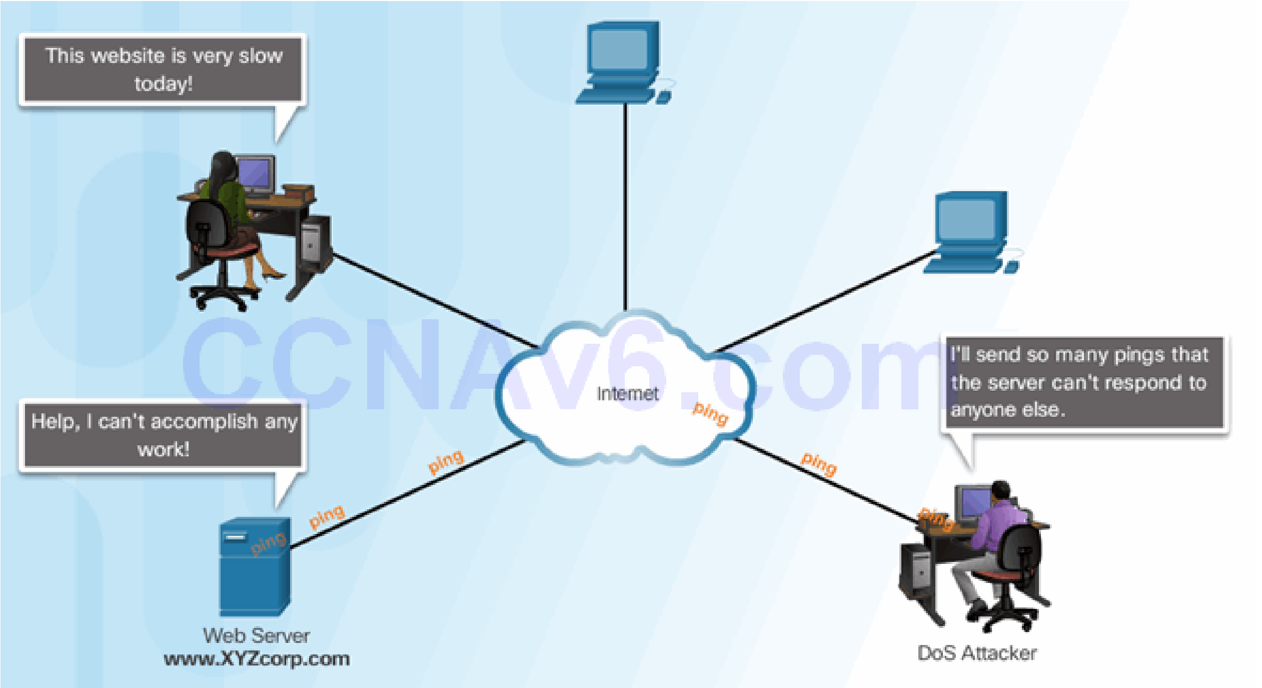
## Access Attacks

- A few reasons why hackers use access attacks:
  - To retrieve data
  - To gain access
  - To escalate access privileges
  - A few types of access attacks include:
- Password
  - Trust exploitation
  - Port redirection
  - Man-in-the-middle
  - Buffer overflow
  - IP, MAC, DHCP spoofing

## Social Engineering Attacks

- Pretexting
- Phishing
- Spearphishing
- Spam
- Tailgating
- Something for Something
- Baiting

## Denial of Service Attacks


This website is very slow today!
Help, I can't accomplish any work!
Internet
ping
I'll send so many pings that the server can't respond to anyone else.
Web Server
www.XYZcorp.com
DoS Attacker

## DDoS Attacks

1.Hacker builds a network of infected machines

- A network of infected hosts is called a botnet.
- The compromised computers are called zombies.
- Zombies are controlled by handler systems.

2. Zombie computers continue to scan and infect more targets

3. Hacker instructs handler system to make the botnet of zombies carry out the DDoS attack

## Section 1.3 Mitigating Threats

Upon completion of this section, you should be able to::

- Describe methods and resources to protect the networks.
- Describe a collection of domains for network security.
- Explain the purpose of the Cisco SecureX Architecture.
- Describe the techniques used to mitigate common network attacks.
- Explain how to secure the three functional areas of Cisco routers and switches.

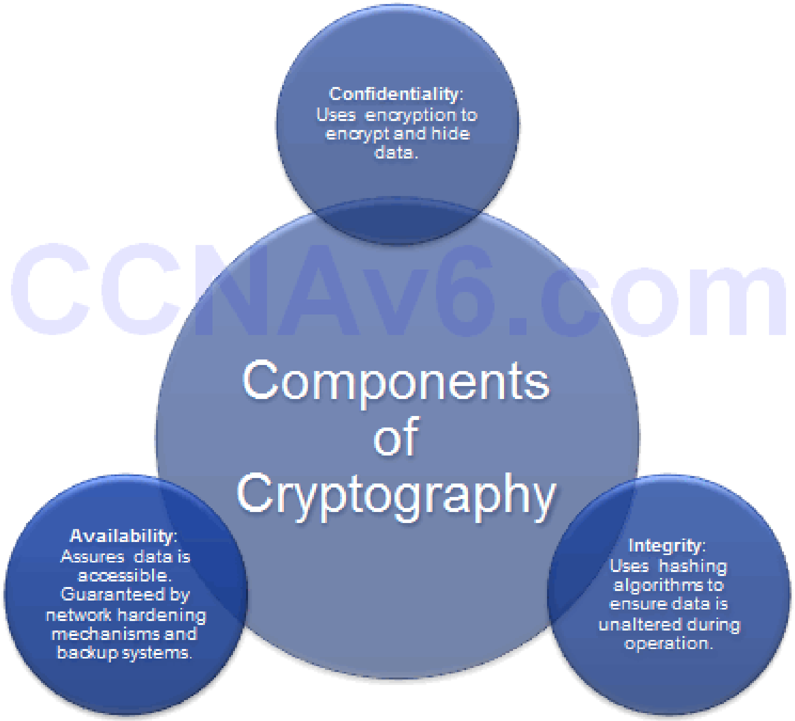
### Topic 1.3.1: Defending the Network

#### Network Security Professionals

Chief Information Officer (CIO)
Chief Information Security Officer (CISO)
Security Operations (SecOps) Manager
Chief Security Officer (CSO)
Security Manager
Network Security Engineer

#### Network Security Organizations

### Confidentiality, Integrity, Availability


Confidentiality:
Uses encryption to encrypt and hide data.
Components of Cryptography
Availability:
Assures data is accessible. Guaranteed by network hardening mechanisms and backup systems.
Integrity:
Uses hashing algorithms to ensure data is unaltered during operation.

## Topic 1.3.2: Domains of Network Security

### Network Security Domains

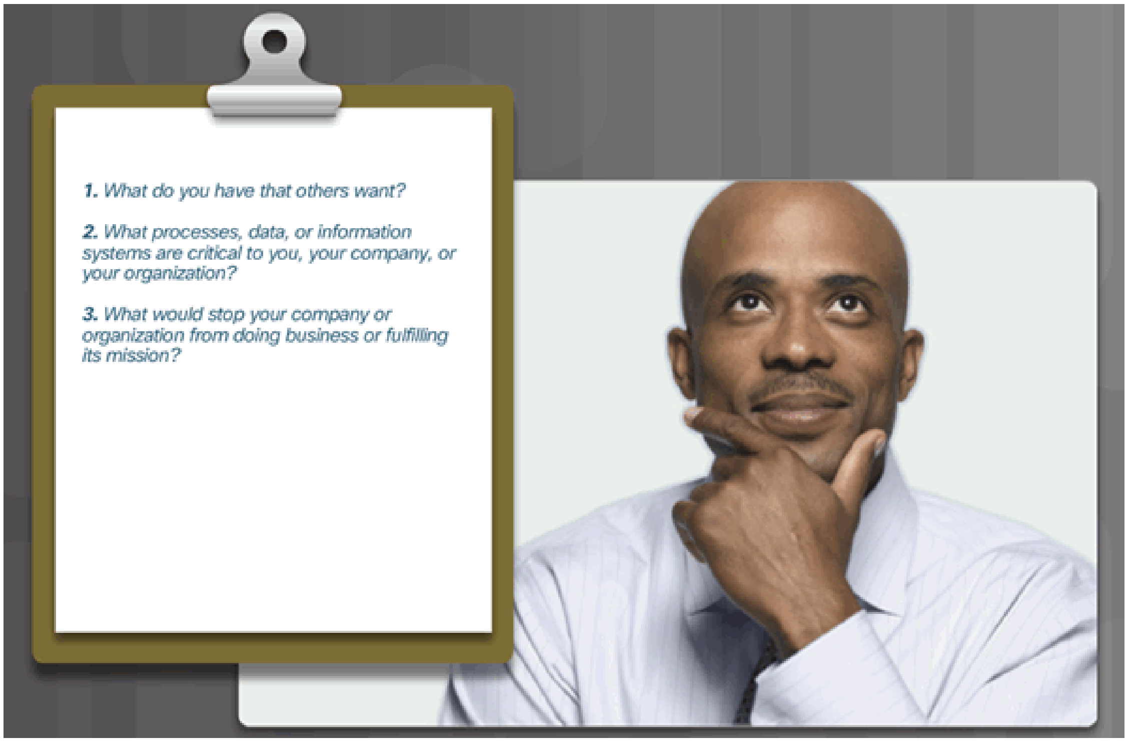
- Risk assessment
- Security policy
- Organization of information security

- Asset management
- Human resources security
- Physical and environmental security
- Communications and operations management
- Information systems acquisition, development, and maintenance
- Access control
- Information security incident management
- Business continuity management
- Compliance

### Network Security Policy

The next item on the security policy that we need to discuss is the rules for network access.
We must keep in mind that we have remote workers. They will have different access rules than our onsite employees.

### Network Security Policy Objectives



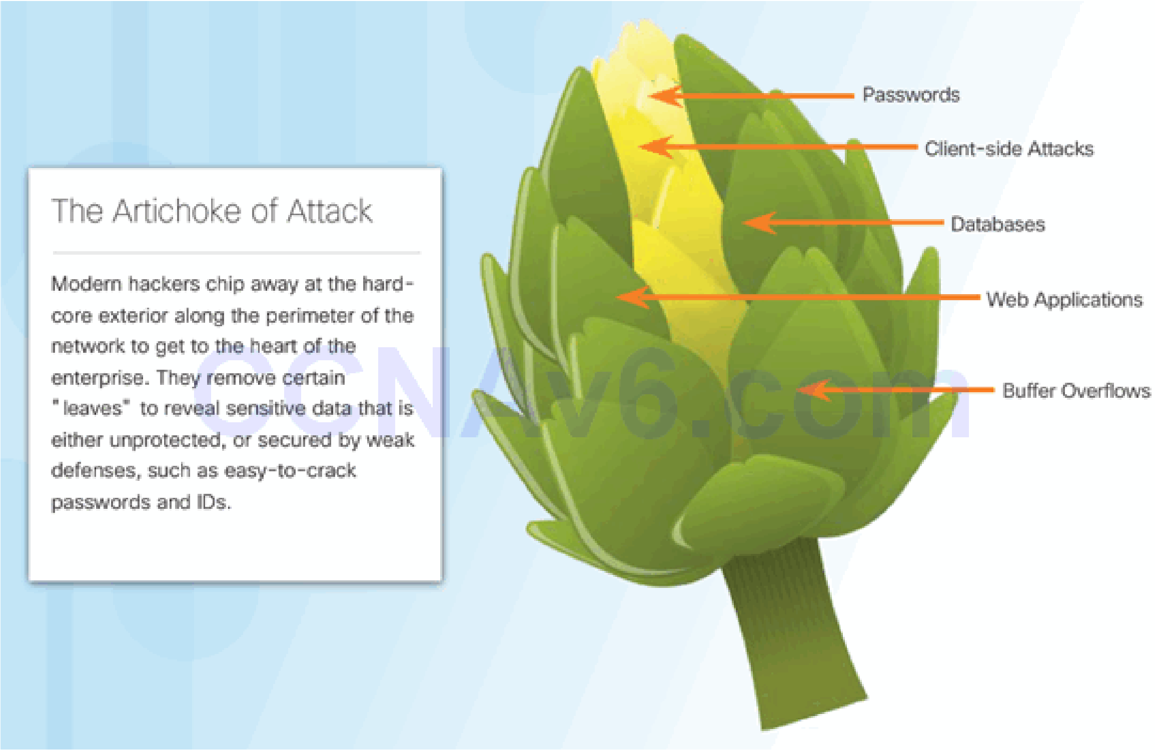
*1. What do you have that others want?*

*2. What processes, data, or information systems are critical to you, your company, or your organization?*

*3. What would stop your company or organization from doing business or fulfilling its mission?*

## Topic 1.3.3: Introducing the Cisco SecureX Architecture

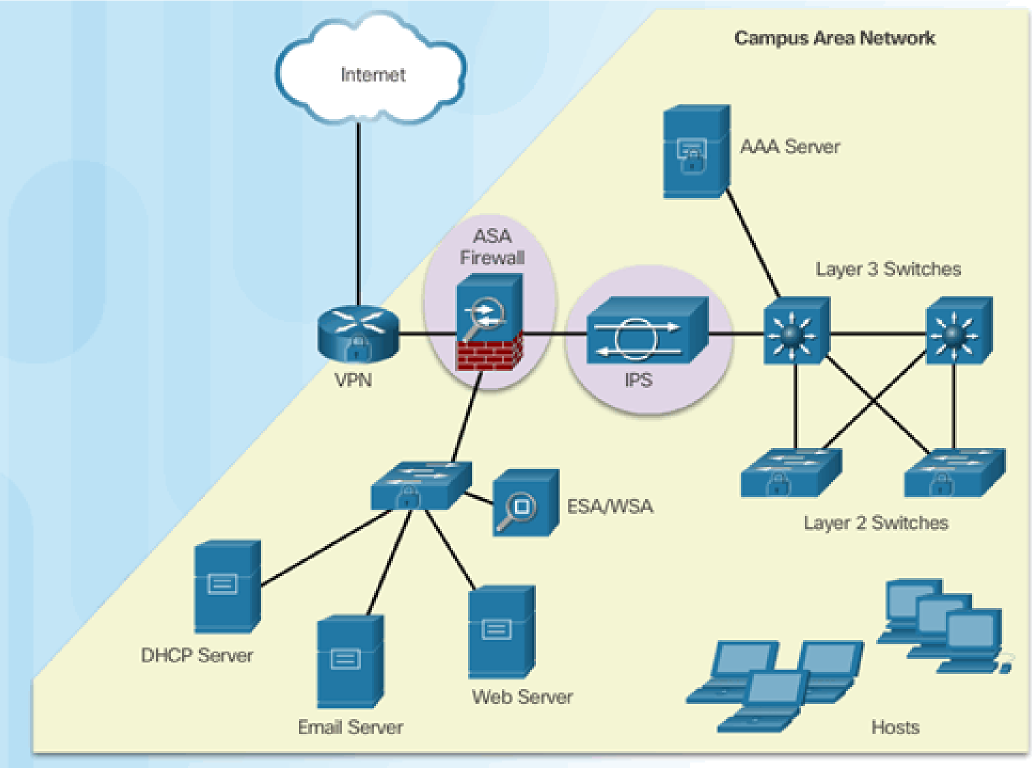
### The Security Artichoke



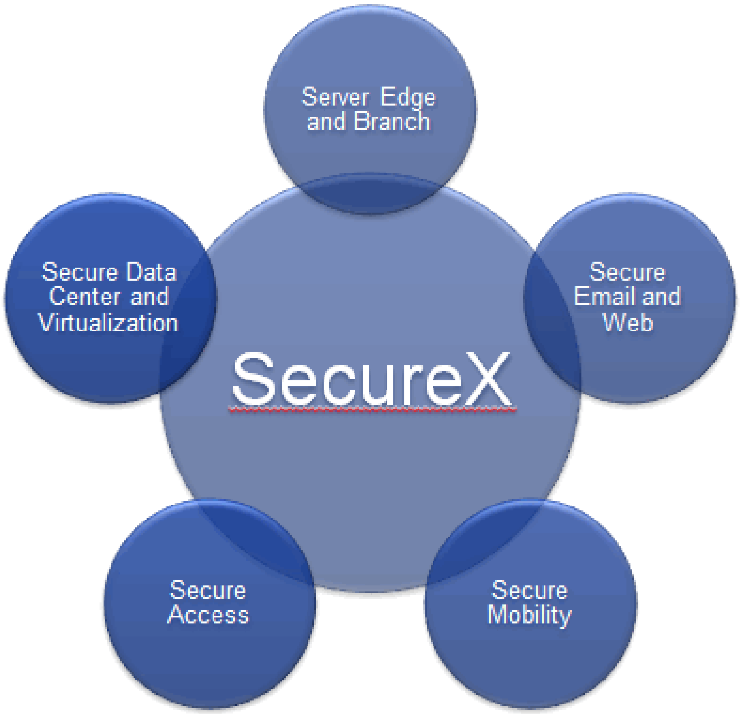
The Artichoke of Attack

Modern hackers chip away at the hard-core exterior along the perimeter of the network to get to the heart of the enterprise. They remove certain "leaves" to reveal sensitive data that is either unprotected, or secured by weak defenses, such as easy-to-crack passwords and IDs.

### Evolution of Network Security Tools



## SecureX Product Families



## SecureX Security Technology

Cisco SecureX Architecture:

- Scanning engines
- Delivery mechanisms
- Security intelligence operations (SIO)

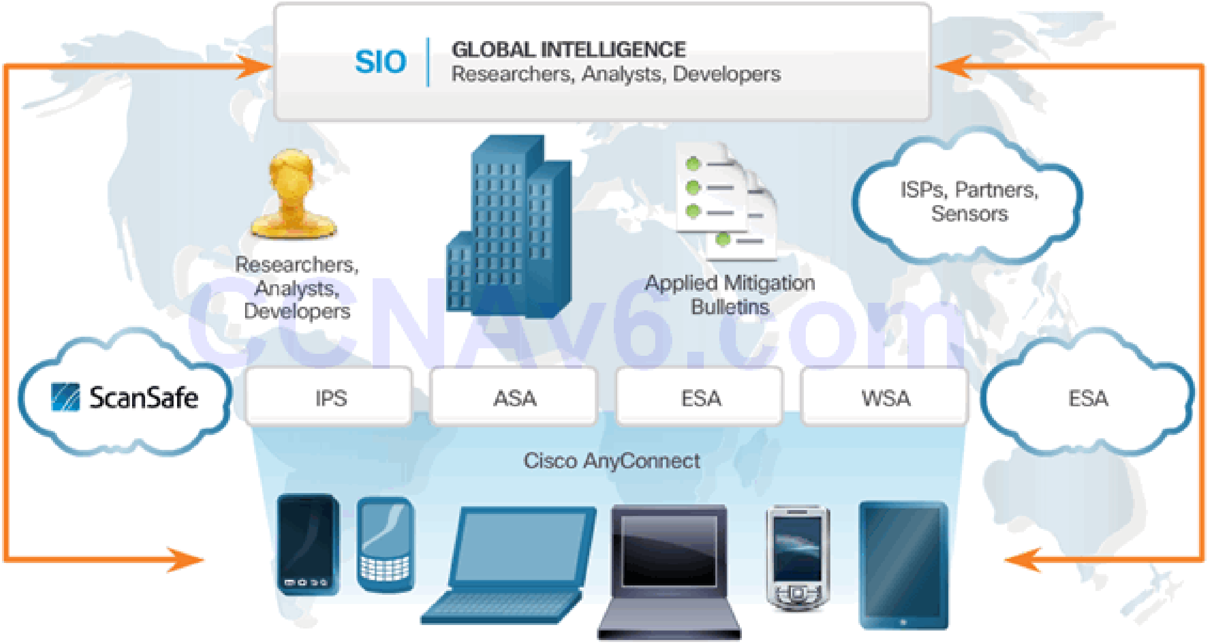
- Policy management consoles
- Next-generation endpoint

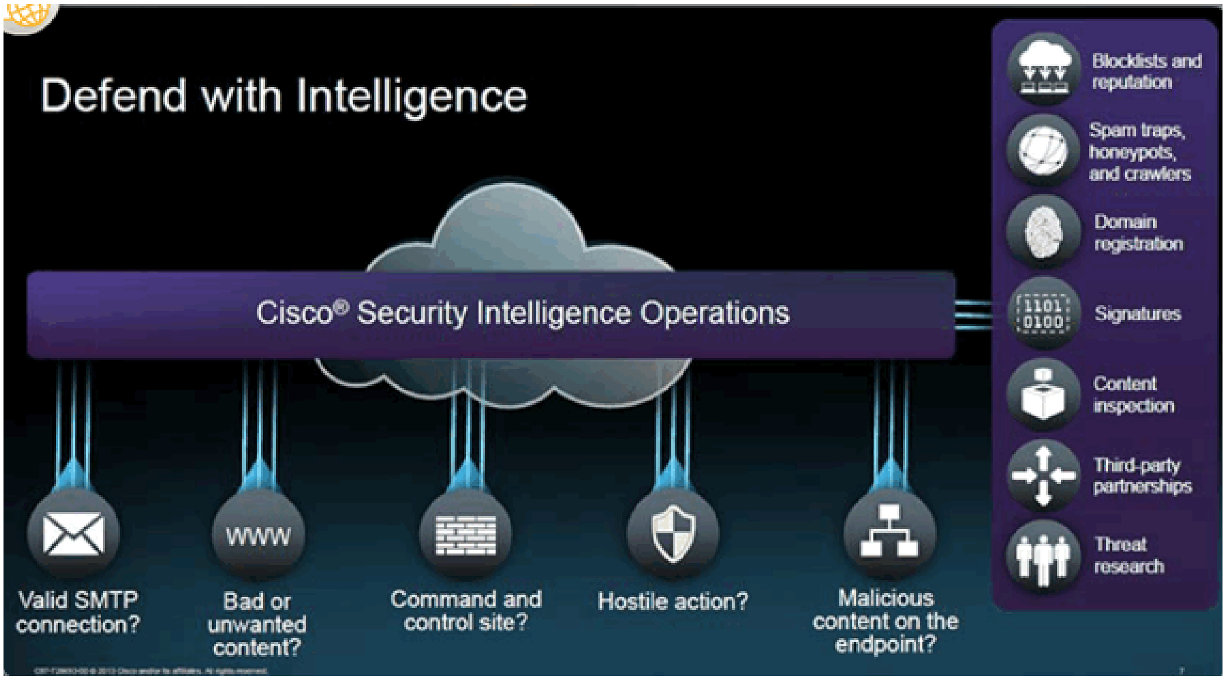
### Centralized Context-Aware Network Scanning Element

Defines security policies based on five parameters:

- Type of device being used for access
- Person’s identity
- Application in use
- Location
- Time of access

### Cisco Security Intelligence Operations


SIO
GLOBAL INTELLIGENCE
Researchers, Analysts, Developers
Researchers, Analysts, Developers
Applied Mitigation Bulletins
ISPs, Partners, Sensors
ScanSafe
IPS
ASA
ESA
WSA
ESA
Cisco AnyConnect



Defend with Intelligence

Cisco® Security Intelligence Operations
Blocklists and reputation
Spam traps, honeypots, and crawlers
Domain registration
Signatures
Content inspection
Third-party partnerships
Threat research
Valid SMTP connection?
Bad or unwanted content?
Command and control site?
Hostile action?
Malicious content on the endpoint?

## Topic 1.3.4: Mitigating Common Network Threats

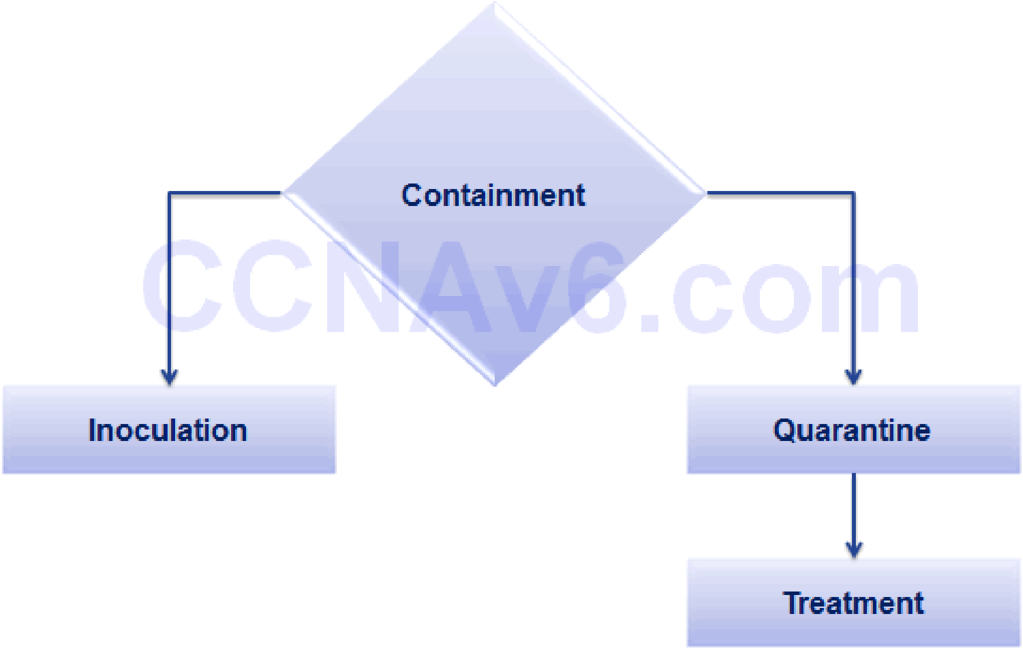
### Defending the Network

Best practices:

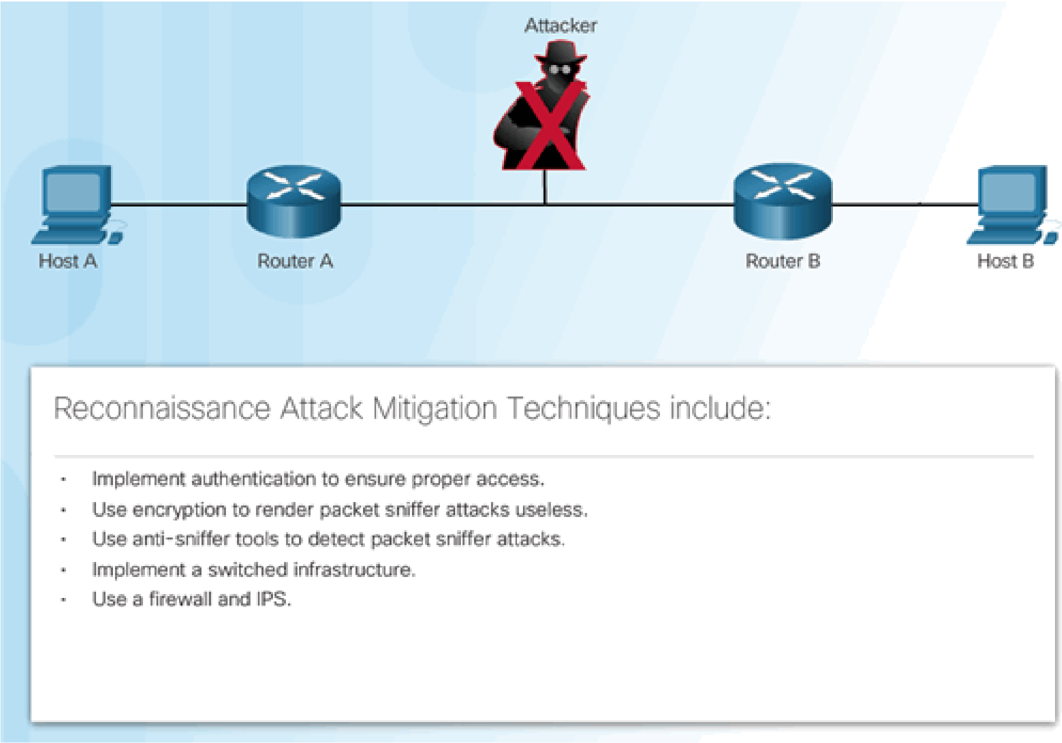
- Develop a written security policy.
- Educate employees about the risks of social engineering, and develop strategies to validate identities over the phone, via email, or in person.
- Control physical access to systems.
- Use strong passwords and change them often.
- Encrypt and password-protect sensitive data.
- Implement security hardware and software.
- Perform backups and test the backed up files on a regular basis.
- Shut down unnecessary services and ports.
- Keep patches up-to-date by installing them weekly or daily to prevent buffer overflow and privilege escalation attacks.
- Perform security audits to test the network.

### Mitigating Malware

## Mitigating Worms



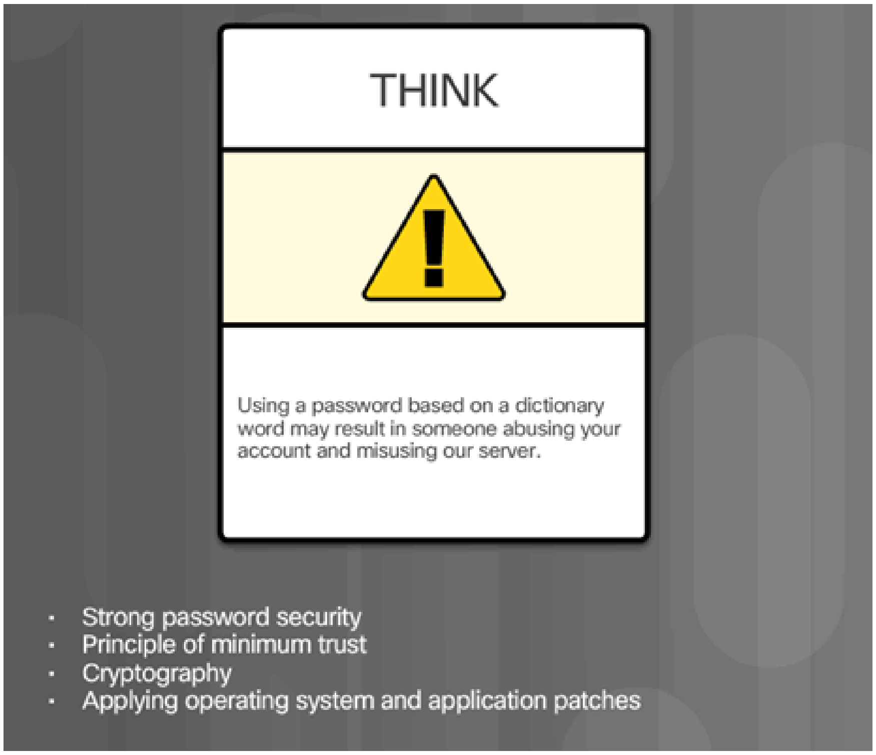
## Mitigating Reconnaissance Attacks



Reconnaissance Attack Mitigation Techniques include:

- Implement authentication to ensure proper access.
- Use encryption to render packet sniffer attacks useless.
- Use anti-sniffer tools to detect packet sniffer attacks.
- Implement a switched infrastructure.
- Use a firewall and IPS.

## Mitigating Access Attacks



THINK

Using a password based on a dictionary word may result in someone abusing your account and misusing our server.

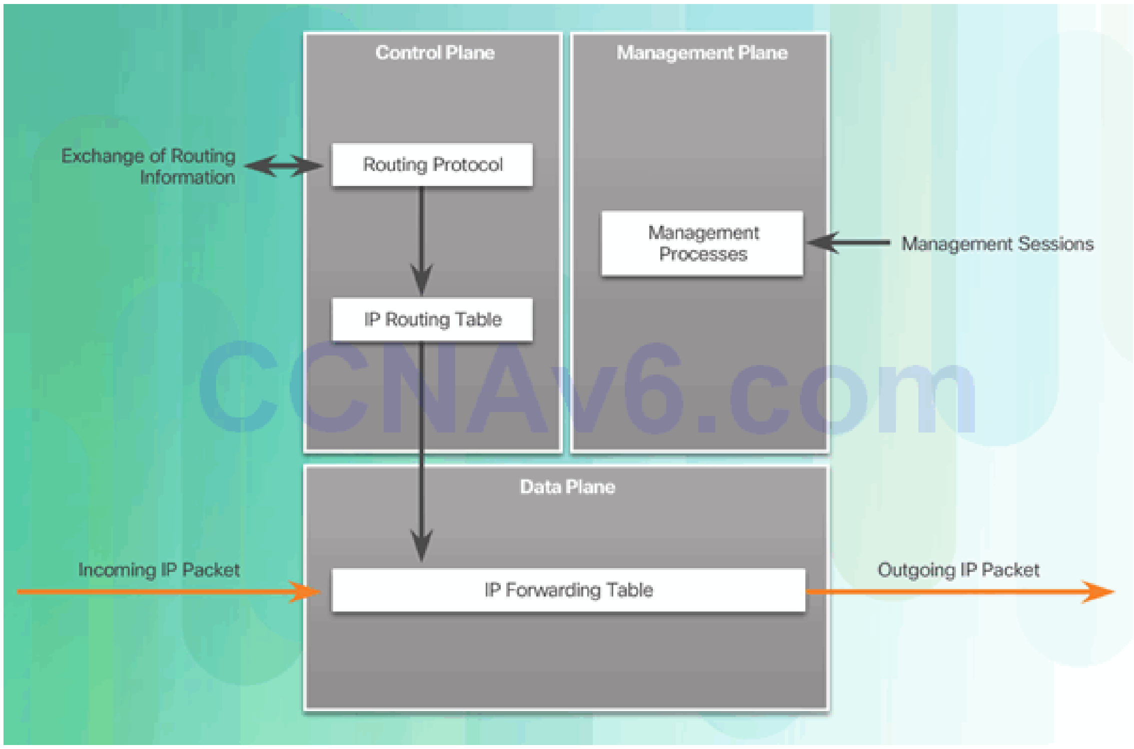
- Strong password security
- Principle of minimum trust
- Cryptography
- Applying operating system and application patches

## Mitigating DoS Attacks

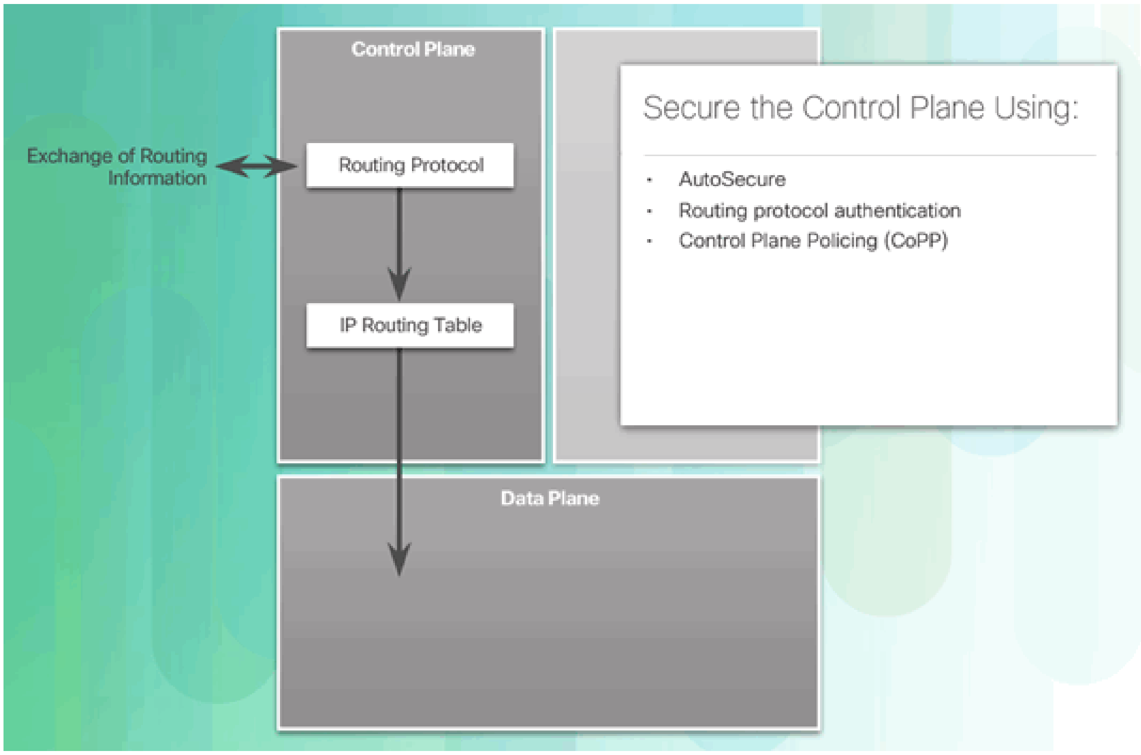
- IPS and firewalls (Cisco ASAs and ISRs)
- Antispoofing technologies
- Quality of Service-traffic policing

## Topic 1.3.5: Cisco Network Foundation Protection Framework

### NFP Framework



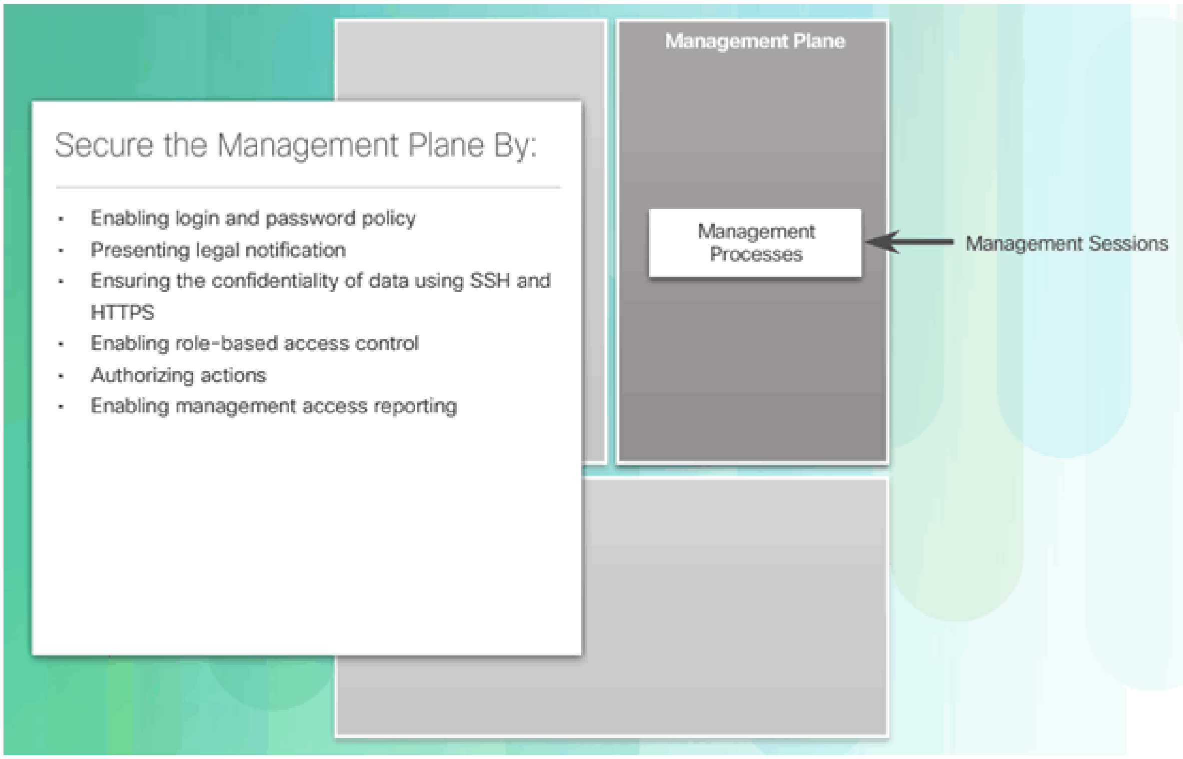
### Securing the Control Plane



Secure the Control Plane Using:

- AutoSecure
- Routing protocol authentication
- Control Plane Policing (CoPP)

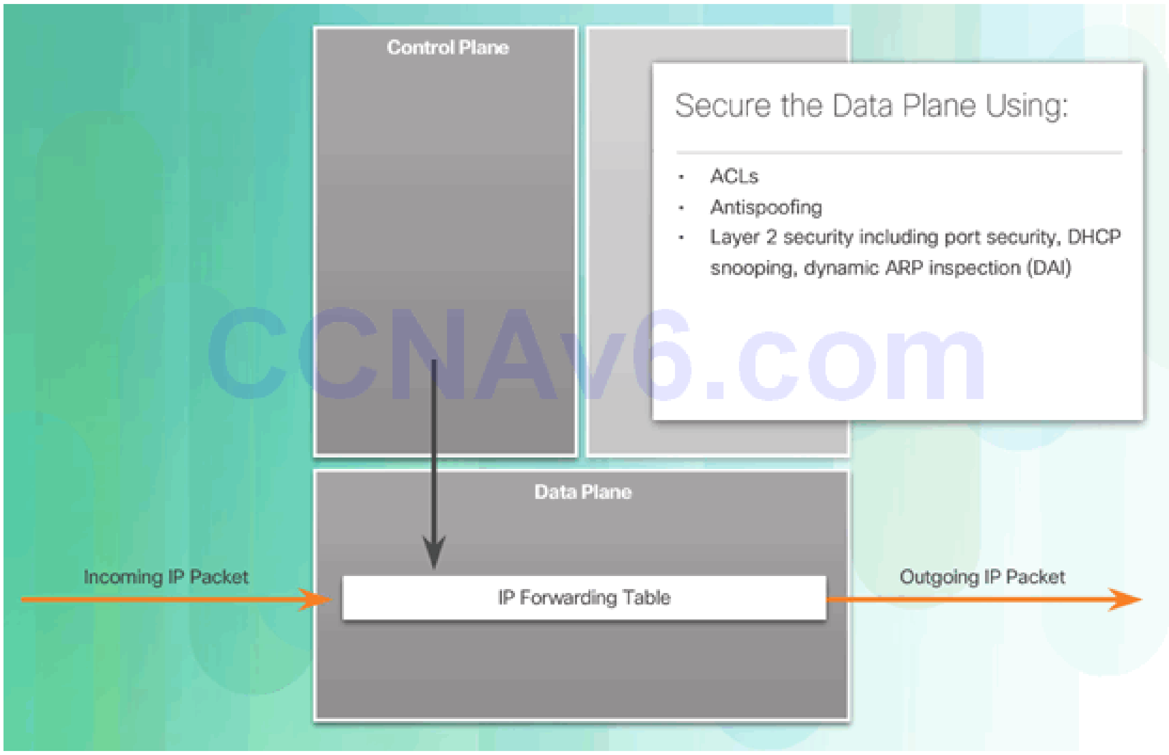
## Securing the Management Plane



Secure the Management Plane By:

- Enabling login and password policy
- Presenting legal notification
- Ensuring the confidentiality of data using SSH and HTTPS
- Enabling role-based access control
- Authorizing actions
- Enabling management access reporting

## Securing the Data Plane



Control Plane

Secure the Data Plane Using:

- ACLs
- Antispoofing
- Layer 2 security including port security, DHCP snooping, dynamic ARP inspection (DAI)

Data Plane

Incoming IP Packet

IP Forwarding Table

Outgoing IP Packet

## Section 1.4: Summary

Chapter Objectives:

- Explain network security.
- Describe various types of threats and attacks.
- Explain tools and procedures to mitigate the effects of malware and common network attacks.

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