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LAN Security

Security attacks in LAN (1/2)

- The classical attack in a LAN is the **MAC Address Flooding**.
- It exploits the security weakness of MAC forwarding table learning mechanism:
  - If an incoming frame with a new MAC source address is received, the switch add a row in the forwarding table
  - If an incoming frame has a destination MAC address not present in the forwarding table, the switch acts as an hub
  - The forwarding tables have a limited size
- MAC Address Flooding:
  - Frames with artificial source MAC address → the forwarding table is saturated → frames with new MAC destination address are forwarded in broadcast

Security attacks in LAN (2/2)

- **DHCP Spoofing:** a malicious DHCP server is inserted in the LAN, so that fake info (default gateway) are notified to LAN hosts. This is a man-in-the-middle attack

- **DHCP starvation:** attack to the DHCP servers, sending a huge amount of DHCP requests so that to use all the available IP addresses.

Port Security (1/4)

- **Port Security**: option to be configured on switch interface/s to increase the security level of the network
- The idea of Port Security is to limit the end devices that can be connected to a specific switch interface
- The security policy is based on the source MAC address of incoming packets and on the number of different source MAC addresses allowed on the interface.

Port Security (2/4)

- If a frame having a MAC source address not allowed is received, the interface switch to ***Violation Mode:***
  - ✓ Shutdown by default (*error disabled state*).
  - ✓ To recover from the *error disabled state* it is necessary to manually shutdown the interface
- It is possible to allow the access to a single MAC address or to a range of MAC addresses.
- The association among the interface and the allowed MAC address/es can be dynamic or static
- First step of the configuration:

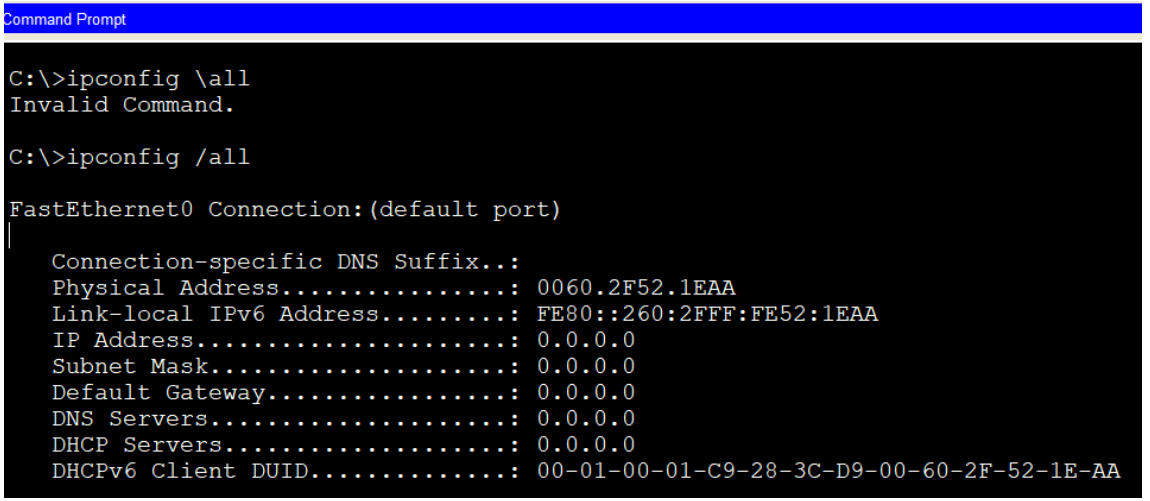
Switch(config-if)# switchport port-security

Port Security (3/4)

- Three different Port Security configuration modes:
  - Static: the allowed MAC address/es are statically configured by the LAN administrator with the command

Switch(config-if)# switchport port-security mac-address *mac-address*

- To look at the MAC address of a PC, from the Command Prompt: **ipconfig /all**



Port Security (4/4)

- Dynamic: the allowed MAC addresses are learned dynamically up to a fixed number (1 by default) and saved only in the secure MAC address table
- Sticky Dynamic: the allowed MAC addresses are learned dynamically up to a fixed number and saved in the secure MAC address table and in the running configuration file.

```
S1#configure terminal
S1(config)#interface fastEthernet 0/18
S1(config-if)#switchport mode access
S1(config-if)#switchport port-security
S1(config-if)#switchport port-security
maximum 50
S1(config-if)#switchport port-security mac-
address sticky
S1(config-if)#end
```

Port Security: violation

- Once a violation occurs on a port, the port will transition to an error disabled state.
- To recover from an error disabled state, a ***shutdown*** command and then a ***no shutdown*** on the interface (manual intervention by an administrator) must be executed.
- Error disabled ports can be configured to automatically recover from port security violations:

S1(config-if)# errdisable recovery interval *Time_Interval*

- The *Time_Interval* is an integer value in the range [30-86400] seconds.

Port Security checking (1/2)

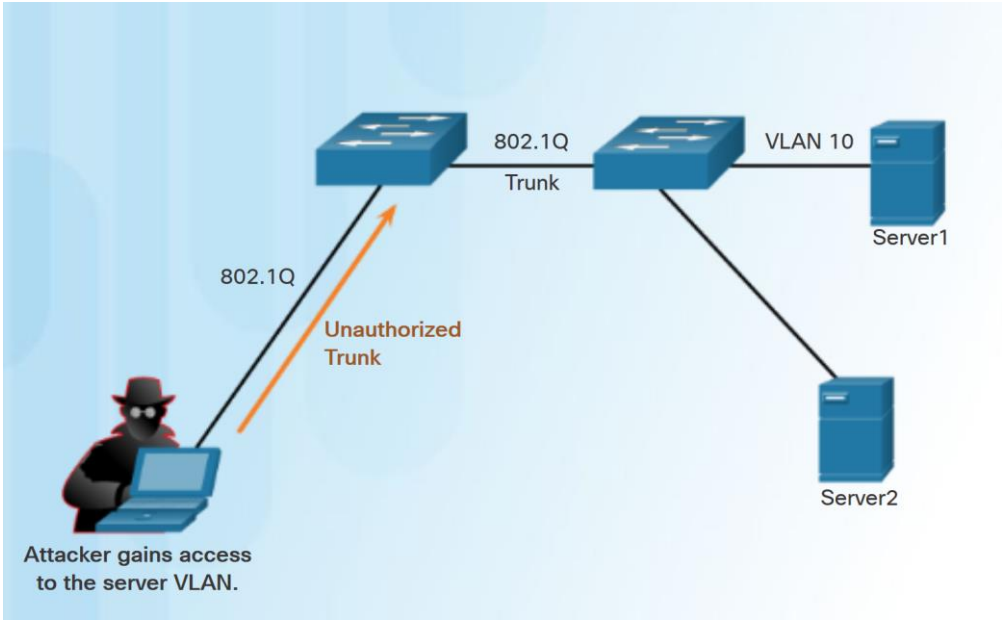
```
switch#show port-security interface fastEthernet 0/18
Port Security              : Enabled
Port Status                : Secure-down
Violation Mode             : Shutdown
Aging Time                 : 0 mins
Aging Type                 : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 0
Sticky MAC Addresses       : 0
Last Source Address:Vlan   : 0000.0000.0000:0
Security Violation Count   : 0
```

Port Security checking (1/2)

```
switch#show port-security address
          Secure Mac Address Table
------------------------------------------------------------------------
Vlan   Mac Address       Type                  Ports     Remaining Age (mins)
99     0050.BAA6.06CE    SecureConfigured      Fa0/18    -
------------------------------------------------------------------------
Total Addresses in System (excluding one mac per port)     : 0
Max Addresses limit in System (excluding one mac per port) : 8320
```

VLAN Attacks

- Attacker can gain VLAN access by configuring a host to spoof a switch:
  - Creating a trunk with an "unsecured" switch
  - Exploiting the "auto trunking" (DTP) configured by default on switch ports



VLAN Attacks

- Methods to mitigate VLAN attacks:
  - Explicitly configure access ports.
  - Disable auto negotiate on trunks.
  - Manually enable trunk links.
  - Disable unused ports, make them access ports, and assign to a black hole VLAN.
  - Change the default native VLAN.
  - Implement port security.

VLAN Attacks

- **To prevent basic VLAN attacks:**
  - Disable DTP (auto trunking) negotiations on trunking and non-trunking ports using **switchport nonegotiate**.
  - Manually enable trunk links using **switchport mode trunk**.
  - Change the native VLAN from VLAN 1.
  - Disable unused ports and assign them to an unused VLAN.

DHCP Attacks

- DHCP spoofing attack - An attacker configures a fake DHCP server on the network to issue IP addresses to clients.
- DHCP starvation attack - An attacker floods the DHCP server with bogus DHCP requests and leases all of the available IP addresses. This results in a denial-of-service (DoS) attack as new clients cannot obtain an IP address.
- Methods to mitigate DHCP attacks:
  - Configure **DHCP snooping**
  - Configure **port security**

DHCP Snooping

- **With DHCP snooping enabled on an interface, the switch will deny packets containing:**
  - Unauthorized DHCP server messages coming from an untrusted port.
- **DHCP snooping recognizes two types of ports:**
  - **Trusted DHCP ports** - Only ports connecting to upstream DHCP servers should be trusted.
  - **Untrusted ports** - These ports connect to hosts that should not be providing DHCP server messages.

DHCP Snooping configuration

- Step 1. Enable DHCP snooping globally

```
S1(config)# ip dhcp snooping
```

- Step 2. Enable DHCP snooping on selected VLANs

```
S1(config)# ip dhcp snooping vlan vlan-id
```

- Step 3. Configure trusted interfaces, since untrusted is default

```
S1(config-if)# ip dhcp snooping trust
```