Building Cisco Multilayer Switched Networks (BCMSN)

VLANs, Trunking, & VTP

http://www.INE.com

VLANs Overview

- Virtual Local Area Network
- Hosts in the same VLAN share the same broadcast domain
  - Switches create a separate CAM table per VLAN
  - Traffic inside the VLAN is layer 2 switched
  - Traffic to outside or between VLANs must be layer 3 routed
- Can span multiple physical switches
  - "VLAN Trunks" or simply "Trunks" carry traffic for multiple VLANs between switches on uplinks

VLAN Design Recommendations

- Previously, hosts in the same VLAN were grouped by role, not physical location
  - e.g. accounting, sales, etc.
- In newer designs, VLAN definitions should typically exist based on physical location
  - e.g. one VLAN per subnet per access switch
- Old 80/20 rule is really more 20/80 rule now

VLAN Numbering

- VLAN membership defined by number
- 12-bit field (0-4095)
  - 0 & 4095 reserved per 802.1Q standard
- Normal VLANs 1-1005
  - 1 – Default Ethernet VLAN
  - 1002/1004 – Default Token Ring VLANs
  - 1003/1005 – Default FDDI VLANs
- Extended VLANs 1006-4094
  - More on this later…

Creating VLANs

- Cisco IOS based switches store VLAN information in flash in the VLAN database
  - vlan.dat
- VLANs can be added, deleted, and modified in two ways
  - Exec mode VLAN database mode
    - Being deprecated but still supported on some platforms
  - Global configuration

Creating VLANs in Database Mode

```
SW1#vlan database
% Warning: It is recommended to configure VLAN from config mode,
  as VLAN database mode is being deprecated. Please consult user
  documentation for configuring VTP/VLAN in config mode.

SW1(vlan)#vlan 10 name ACCOUNTING
VLAN 10 added:
    Name: ACCOUNTING
SW1(vlan)#exit
APPLY completed.
Exiting....
SW1#
```


Creating VLANs in Global Config

```
SW1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
SW1(config)#vlan 20
SW1(config-vlan)#name SALES
SW1(config-vlan)#
SW1(config-vlan)#exit
SW1(config)#vlan 30,40,50-55
SW1(config-vlan)#end
SW1#
```


VLAN Verification

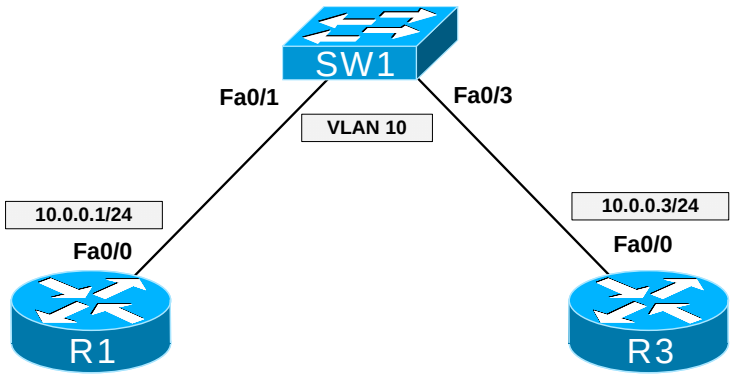
```
SW1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15, Fa0/22
                                                Fa0/23, Fa0/24, Gi0/1, Gi0/2
10   ACCOUNTING                       active
20   SALES                            active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
51   VLAN0051                         active
52   VLAN0052                         active
53   VLAN0053                         active
54   VLAN0054                         active
55   VLAN0055                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```


VLAN Membership

- Once VLANs are created, membership is assigned at the port level
- Layer 2 “switchports” generally fall into three categories
  - Access Switchports
    - One VLAN per port
  - Trunk Switchports
    - Multiple VLANs per port
  - Dynamic Switchports
    - Automatically choose access or trunk

Access Ports Example



Basic Access Port Configuration

```
R1#
interface FastEthernet0/0
 ip address 10.0.0.1 255.255.255.0

R3#
interface FastEthernet0/0
 ip address 10.0.0.3 255.255.255.0

SW1#
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 10
 switchport mode access
```


Access Port Verification

```
SW1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/2, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/13, Fa0/14
                                                Fa0/15, Fa0/22, Fa0/23, Fa0/24
                                                Gi0/1, Gi0/2
10   ACCOUNTING                       active    Fa0/1, Fa0/3
20   SALES                            active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
51   VLAN0051                         active
52   VLAN0052                         active
53   VLAN0053                         active
54   VLAN0054                         active
55   VLAN0055                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```


Access Port Verification (cont.)

```
SW1#show interfaces Fa0/1 switchport
Name: Fa0/1
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 10 (ACCOUNTING)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```


VLAN Trunks

- Trunk links are used to transport traffic for multiple VLANs between devices
- Typically between two switches, but can also be…
  - Switch to router
  - Switch to server
- Traffic sent over a trunk link receives special trunking encapsulation
  - Normal Ethernet header does not have a field for VLAN number
  - ISL or 802.1Q headers are added to include this information

Trunking Encapsulations

- Both ISL and 802.1Q accomplish the same goal of encoding VLAN number in frame header to separate traffic
- The key differences are…
  - ISL
    - Cisco proprietary
    - 30-byte encapsulation for all frames
    - Does not modify original frame
  - 802.1Q
    - IEEE standard
    - 4-byte tag except for "native" VLAN
    - Modifies original frame
  - See Inter-Switch Link and IEEE 802.1Q Frame Format for more info

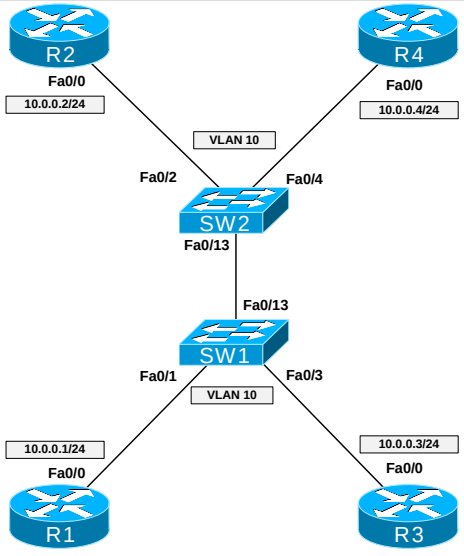
ISL Trunking

- Inter-Switch Link
- Cisco proprietary
- 30-byte encapsulation overhead
  - 26-byte header
  - 4-byte trailer (FCS)
- Supports Ethernet, Token Ring, and FDDI
  - Legacy now but originally important
- Becoming deprecated from many newer platforms

802.1Q Trunking

- AKA “dot1q”
- IEEE standard
- 4-byte tag overhead
  - Inserts 4-byte tag between src/dst MAC and len/ethertype fields
  - Rebuilds trailer (FCS) since frame is modified
- “Native” VLAN support
  - Sent as normal untagged Ethernet frames
- QinQ support
  - Multiple tags on a single frame
  - Used for layer 2 VPNs in Metro Ethernet
  - Similar logic to how MPLS VPNs work
- Generally more preferred because of interoperability

Trunking Example



ISL Trunking Configuration

```
R1#
interface FastEthernet0/0
 ip address 10.0.0.1 255.255.255.0

R2#
interface FastEthernet0/0
 ip address 10.0.0.2 255.255.255.0

R3#
interface FastEthernet0/0
 ip address 10.0.0.3 255.255.255.0

R4#
interface FastEthernet0/0
 ip address 10.0.0.4 255.255.255.0
```

```
SW1#
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/13
 switchport trunk encapsulation isl
 switchport mode trunk

SW2#
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/13
 switchport trunk encapsulation isl
 switchport mode trunk
```


ISL Trunking Verification

```
SW1#show interface trunk

Port        Mode         Encapsulation  Status       Native vlan
Fa0/13      on           isl            trunking     1

Port        Vlans allowed on trunk
Fa0/13      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      1,10

SW1#show interface Fa0/13 switchport
Name: Fa0/13
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: isl
Operational Trunking Encapsulation: isl
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```


802.1Q Trunking Configuration

```
R1#
interface FastEthernet0/0
 ip address 10.0.0.1 255.255.255.0

R2#
interface FastEthernet0/0
 ip address 10.0.0.2 255.255.255.0

R3#
interface FastEthernet0/0
 ip address 10.0.0.3 255.255.255.0

R4#
interface FastEthernet0/0
 ip address 10.0.0.4 255.255.255.0
```

```
SW1#
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport mode trunk

SW2#
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport mode trunk
```


802.1Q Trunking Verification

```
SW1#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      none

SW1#show interfaces fa0/13 switchport
Name: Fa0/13
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```


Dynamic Switchports

- Dynamic switchports automatically choose whether to run in access or trunking mode
- Runs Dynamic Trunking Protocol (DTP) to negotiate, in order…
  - ISL trunk
  - 802.1Q trunk
  - Access port
- Configured as **`switchport mode dynamic [auto|desirable]`**
- Disabled with **`switchport nonegotiate`** or **`switchport mode access`**

Dynamic Trunking Config & Verification

```
SW1#
interface FastEthernet0/13
 switchport mode dynamic desirable

SW2#
interface FastEthernet0/13
 switchport mode dynamic auto

SW1#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      desirable    n-isl          trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      none

SW2#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      auto         n-isl          trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      none
```


Dynamic Trunking Verification (cont.)

```
SW1#show interfaces fa0/13 switchport
Name: Fa0/13
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: trunk
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: isl
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```


Dynamic Trunking Verification (cont.)

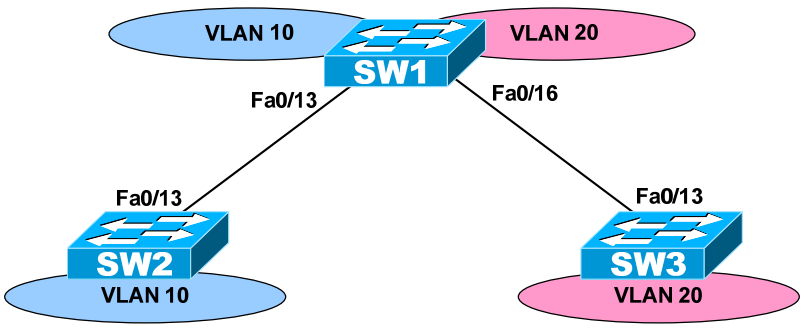
```
SW2#show interfaces fa0/13 switchport
Name: Fa0/13
Switchport: Enabled
Administrative Mode: dynamic auto
Operational Mode: trunk
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: isl
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```


Trunk Port VLAN Membership

- By default, trunk ports carry traffic for all VLANs
  - Called trunk “allowed list”
- VLANs can be manually filtered off the trunk by removing from the allowed list
- Used to reduce…
  - Broadcast transmission
  - Unknown unicast/multicast transmission
  - Spanning-Tree overhead
    - More on this later…

Allowed List Example



Allowed List Configuration

```
SW1#
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 10
 switchport mode trunk
!
interface FastEthernet0/16
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 20
 switchport mode trunk

SW2#
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 10
 switchport mode trunk

SW3#
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 20
 switchport mode trunk
```


Allowed List Verification

```
SW1#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      on           802.1q         trunking      1
Fa0/16      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/13      10
Fa0/16      20

Port        Vlans allowed and active in management domain
Fa0/13      10
Fa0/16      20

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      10
Fa0/16      20
```


VLAN Administration

- In order for devices to be in the same broadcast domain, VLAN numbers must be consistent and inter-switch links must run trunking
- As layer 2 network size grows, managing VLAN numbers and trunk allowed lists involves large administrative overhead
- VTP solves this administration problem

VTP Overview

- VLAN Trunk Protocol
- Cisco proprietary
- Used to dynamically…
  - Advertise addition, removal, modification of VLAN properties
    - Number, name, etc.
  - Negotiate trunking allowed lists
    - "VTP Pruning"
- Does not affect actual VLAN assignments
  - Still manually needed with **`switchport access vlan [`*`vlan`*`]`**

How VTP Works

- VTP Domain
  - To exchange information, switches must belong to the same domain
- VTP Mode
  - Controls who can advertise new/modified information
  - Modes are…
    - Server
    - Client
    - Transparent
- VTP Revision Number
  - Sequence number to ensure consistent databases
  - Higher revision indicates newer database

VTP Domains

- VTP domain name controls which devices can exchange VTP advertisements
- *VTP domain does not define broadcast domain*
  - Switches in different VTP domains that share same VLAN numbers hosts' are still in the same broadcast domain
- Configured as **`vtp domain [`*`name`*`]`**
- Defaults to null value
  - Switch inherits VTP domain name of first advertisement it hears

VTP Server Mode

- Default mode
- Allows addition, deletion, and modification of VLAN information
- Changes on server overwrite the rest of the domain
- Configured as **`vtp mode server`**

VTP Client Mode

- Cannot add, remove, or modify VLAN information
- Listens for advertisements originated by a server, installs them, and passes them on
- Configured as **`vtp mode client`**

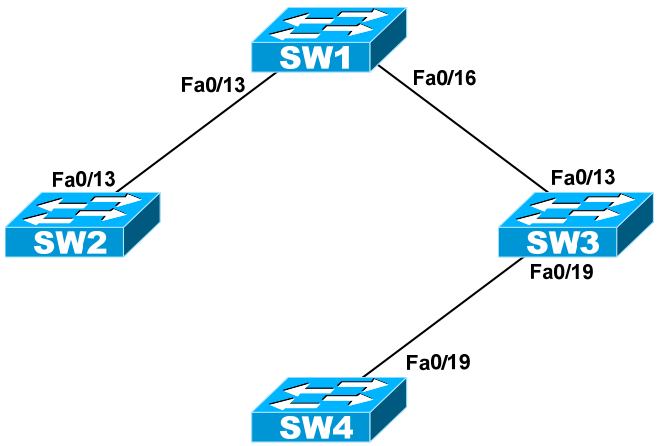
VTP Transparent Mode

- Keeps a separate VTP database from the rest of the domain
- Does not originate advertisements
- “Transparently” passes received advertisements through without installing them
- Needed for some applications like Private VLANs
- Configured as **`vtp mode transparent`**

VTP Security

- VTP susceptible to attacks or misconfiguration where VLANs are deleted
  - Access ports in a VLAN that does not exist cannot forward traffic
- MD5 authentication prevents against attack
  - **`vtp password [`*`password`*`]`**
- Does not prevent against misconfiguration
  - VTP transparent mode recommendation

VTP Example



VTP Configuration

```
SW1#
vtp mode server
vtp domain CISCO
vtp password VTPPASS
vlan 10,20,30,40,50-55

SW2#
vtp mode client
vtp domain CISCO
vtp password VTPPASS

SW3#
vtp mode client
vtp domain CISCO
vtp password VTPPASS

SW4#
vtp mode client
vtp domain CISCO
vtp password VTPPASS
```

VTP Verification

```
SW1#show vtp status
VTP Version                     : 2
Configuration Revision          : 7
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Server
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xB0 0x6D 0xC8 0xD8 0x1C 0x45 0xD8 0x60
Configuration last modified by 0.0.0.0 at 3-1-93 13:30:42
Local updater ID is 0.0.0.0 (no valid interface found)

SW2#show vtp status
VTP Version                     : 2
Configuration Revision          : 7
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xB0 0x6D 0xC8 0xD8 0x1C 0x45 0xD8 0x60
Configuration last modified by 0.0.0.0 at 3-1-93 13:30:42
```


VTP Verification (cont.)

```
SW3#show vtp status
VTP Version                     : 2
Configuration Revision          : 7
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xB0 0x6D 0xC8 0xD8 0x1C 0x45 0xD8 0x60
Configuration last modified by 0.0.0.0 at 3-1-93 13:30:42

SW4#show vtp status
VTP Version                     : 2
Configuration Revision          : 7
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xB0 0x6D 0xC8 0xD8 0x1C 0x45 0xD8 0x60
Configuration last modified by 0.0.0.0 at 3-1-93 13:30:42
```


VTP Verification (cont.)

```
SW1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/2, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/14, Fa0/15
                                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                Gi0/1, Gi0/2
10   VLAN0010                         active    Fa0/1, Fa0/3
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
51   VLAN0051                         active
52   VLAN0052                         active
53   VLAN0053                         active
54   VLAN0054                         active
55   VLAN0055                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```


VTP Verification (cont.)

```
SW4#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                Fa0/17, Fa0/18, Fa0/20, Fa0/21
                                                Fa0/22, Fa0/23, Fa0/24, Gi0/1
                                                Gi0/2
10   VLAN0010                         active
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
51   VLAN0051                         active
52   VLAN0052                         active
53   VLAN0053                         active
54   VLAN0054                         active
55   VLAN0055                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```


VTP Transparent Configuration

```
SW1#
vtp mode server
vtp domain CISCO
no vtp password
vlan 10,20,30,40,50-55

SW2#
vtp mode client
vtp domain CISCO
no vtp password

SW3#
vtp mode transparent
vtp domain CISCO
no vtp password
no vlan 10,20,30,40,50-55
vlan 3,33,333,3333

SW4#
vtp mode client
vtp domain CISCO
no vtp password
```


VTP Transparent Verification

```
SW1#show vtp status
VTP Version                     : 2
Configuration Revision          : 9
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Server
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xD3 0x41 0xF1 0x21 0x12 0xF7 0x11 0xBF
Configuration last modified by 0.0.0.0 at 3-1-93 13:35:59
Local updater ID is 0.0.0.0 (no valid interface found)

SW2#show vtp status
VTP Version                     : 2
Configuration Revision          : 9
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xD3 0x41 0xF1 0x21 0x12 0xF7 0x11 0xBF
Configuration last modified by 0.0.0.0 at 3-1-93 13:35:59
```


VTP Transparent Verification (cont.)

```
SW3#show vtp status
VTP Version                     : 2
Configuration Revision          : 0
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 8
VTP Operating Mode              : Transparent
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x15 0x07 0xC0 0x68 0xA7 0xCD 0xCC 0xD2
Configuration last modified by 0.0.0.0 at 3-1-93 13:30:42

SW4#show vtp status
VTP Version                     : 2
Configuration Revision          : 9
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 15
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xD3 0x41 0xF1 0x21 0x12 0xF7 0x11 0xBF
Configuration last modified by 0.0.0.0 at 3-1-93 13:35:59
```


VTP Transparent Verification (cont.)

```
SW1#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/2, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, Fa0/12, Fa0/14, Fa0/15
                                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                Gi0/1, Gi0/2
10   VLAN0010                         active    Fa0/1, Fa0/3
20   VLAN0020                         active
30   VLAN0030                         active
40   VLAN0040                         active
50   VLAN0050                         active
51   VLAN0051                         active
52   VLAN0052                         active
53   VLAN0053                         active
54   VLAN0054                         active
55   VLAN0055                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
```


VTP Transparent Verification (cont.)

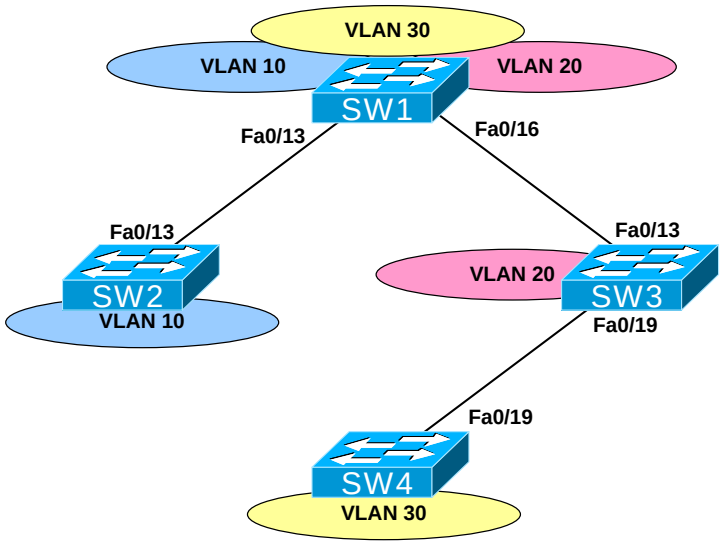
```
SW3#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                                Fa0/18, Fa0/20, Fa0/21, Fa0/22
                                                Fa0/23, Fa0/24, Gi0/1, Gi0/2
3    VLAN0003                         active
33   VLAN0033                         active
333  VLAN0333                         active
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
3333 VLAN3333                         active
```


VTP Pruning

- Broadcasts and unknown unicast/multicast frame are flooded everywhere in the broadcast domain
  - Includes trunk links
- Editing allowed list limits this flooding, but large administrative overhead
- VTP pruning automates this procedure
  - Switches advertise what VLANs they need
  - All other VLANs are pruned (removed) off the trunk link
- Does not work for transparent mode

VTP Pruning Example



VTP Pruning Configuration

```
SW1#
vtp domain CISCO
vtp mode server
vtp pruning
vlan 10,20,30
!
interface FastEthernet0/1
 switchport mode access
 switchport access vlan 10
!
interface FastEthernet0/3
 switchport mode access
 switchport access vlan 20
!
interface FastEthernet0/5
 switchport mode access
 switchport access vlan 30
!
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface FastEthernet0/16
 switchport trunk encapsulation dot1q
 switchport mode trunk

SW2#
vtp domain CISCO
vtp mode client
!
interface FastEthernet0/2
 switchport mode access
 switchport access vlan 10
!
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport mode trunk
```

```
SW3#
vtp domain CISCO
vtp mode client
!
interface FastEthernet0/3
 switchport mode access
 switchport access vlan 20
!
interface FastEthernet0/13
 switchport trunk encapsulation dot1q
 switchport mode trunk
!
interface FastEthernet0/19
 switchport trunk encapsulation dot1q
 switchport mode trunk

SW4#
vtp domain CISCO
vtp mode client
!
interface FastEthernet0/4
 switchport mode access
 switchport access vlan 30
!
interface FastEthernet0/19
 switchport trunk encapsulation dot1q
 switchport mode trunk
```

VTP Pruning Verification (cont.)

```
SW1#show vtp status
VTP Version                     : 2
Configuration Revision          : 12
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 8
VTP Operating Mode              : Server
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Enabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xF6 0x11 0xDA 0x50 0x99 0x7B 0x17 0x0F
Configuration last modified by 0.0.0.0 at 3-1-93 13:45:40
Local updater ID is 0.0.0.0 (no valid interface found)

SW2#show vtp status
VTP Version                     : 2
Configuration Revision          : 12
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 8
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Enabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xF6 0x11 0xDA 0x50 0x99 0x7B 0x17 0x0F
Configuration last modified by 0.0.0.0 at 3-1-93 13:45:40
```


VTP Pruning Verification (cont.)

```
SW3#show vtp status
VTP Version                     : 2
Configuration Revision          : 12
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 8
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Enabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xF6 0x11 0xDA 0x50 0x99 0x7B 0x17 0x0F
Configuration last modified by 0.0.0.0 at 3-1-93 13:45:40

SW4#show vtp status
VTP Version                     : 2
Configuration Revision          : 12
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 8
VTP Operating Mode              : Client
VTP Domain Name                 : CISCO
VTP Pruning Mode                : Enabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0xF6 0x11 0xDA 0x50 0x99 0x7B 0x17 0x0F
Configuration last modified by 0.0.0.0 at 3-1-93 13:45:40
```


VTP Pruning Verification (cont.)

```
SW1#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      on           802.1q         trunking      1
Fa0/16      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094
Fa0/16      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10,20,30
Fa0/16      1,10,20,30

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      1,10
Fa0/16      1,20,30

SW2#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10,20,30

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      1,10,20,30
```


VTP Pruning Verification (cont.)

```
SW3#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/13      on           802.1q         trunking      1
Fa0/19      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/13      1-4094
Fa0/19      1-4094

Port        Vlans allowed and active in management domain
Fa0/13      1,10,20,30
Fa0/19      1,10,20,30

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/13      1,10,20,30
Fa0/19      1,30

SW4#show interfaces trunk

Port        Mode         Encapsulation  Status        Native vlan
Fa0/19      on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/19      1-4094

Port        Vlans allowed and active in management domain
Fa0/19      1,10,20,30

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/19      1,10,20,30
```


VTP Pruning Verification (cont.)

```
SW1#show interfaces Fa0/13 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/13      20,30

Port        Vlan traffic requested of neighbor
Fa0/13      1,10,20,30

SW1#show interfaces Fa0/16 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/16      10

Port        Vlan traffic requested of neighbor
Fa0/16      1,10,20,30

SW2#show interfaces Fa0/13 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/13      none

Port        Vlan traffic requested of neighbor
Fa0/13      1,10
```


VTP Pruning Verification (cont.)

```
SW3#show interfaces Fa0/13 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/13      none

Port        Vlan traffic requested of neighbor
Fa0/13      1,20,30

SW3#show interfaces Fa0/19 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/19      10,20

Port        Vlan traffic requested of neighbor
Fa0/19      1,10,20,30

SW4#show interfaces Fa0/19 pruning

Port        Vlans pruned for lack of request by neighbor
Fa0/19      none

Port        Vlan traffic requested of neighbor
Fa0/19      1,30
```


VLANs, Trunking, & VTP Q&A