VLAN and Basic Configuration — Step‑by‑Step Solution

*Source: Assignment prompt “VLAN and Basic Configuration”.*

# 0) Overview

Base network: 192.168.112.0/22 (covers 192.168.112.0 – 192.168.115.255).

Goal: Use VLSM to serve these host counts and then configure VLANs, trunking, inter‑VLAN routing, and management as required.

Required VLANs & Sizes: Faculty/Staff (240), Students (240), Guest (120), Native (10), Management (10).

# 1) VLSM Design

Allocate largest subnets first, then smaller ones. Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **VLAN** | **Subnet** | **Mask** | **Usable Host Range** | **Broadcast** |
| VLAN 10 (Faculty/Staff) | 192.168.112.0/24 | 255.255.255.0 | 192.168.112.1 – 192.168.112.254 | 192.168.112.255 |
| VLAN 20 (Students) | 192.168.113.0/24 | 255.255.255.0 | 192.168.113.1 – 192.168.113.254 | 192.168.113.255 |
| VLAN 30 (Guest) | 192.168.114.0/25 | 255.255.255.128 | 192.168.114.1 – 192.168.114.126 | 192.168.114.127 |
| VLAN 88 (Native) | 192.168.114.128/28 | 255.255.255.240 | 192.168.114.129 – 192.168.114.142 | 192.168.114.143 |
| VLAN 99 (Management) | 192.168.114.144/28 | 255.255.255.240 | 192.168.114.145 – 192.168.114.158 | 192.168.114.159 |

Remaining space (192.168.114.160 – 192.168.115.255) is free for future subnets.

# 2) Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device** | **Interface / VLAN** | **IP Address** | **Subnet Mask** | **Notes** |
| R1 | G0/1.10 | 192.168.112.1 | 255.255.255.0 | 1st usable of VLAN 10 |
| R1 | G0/1.20 | 192.168.113.1 | 255.255.255.0 | 1st usable of VLAN 20 |
| R1 | G0/1.30 | 192.168.114.1 | 255.255.255.128 | 1st usable of VLAN 30 |
| R1 | G0/1.88 | 192.168.114.129 | 255.255.255.240 | 1st usable of VLAN 88 (native) |
| R1 | G0/1.99 | 192.168.114.145 | 255.255.255.240 | 1st usable of VLAN 99 |
| S1 | VLAN 99 (SVI) | 192.168.114.147 | 255.255.255.240 | 3rd usable of VLAN 99 |
| PC1 | NIC (VLAN 10) | 192.168.112.10 | 255.255.255.0 | 10th usable of VLAN 10; GW 192.168.112.1 |
| PC2 | NIC (VLAN 20) | 192.168.113.10 | 255.255.255.0 | 10th usable of VLAN 20; GW 192.168.113.1 |
| PC3 | NIC (VLAN 30) | 192.168.114.10 | 255.255.255.128 | 10th usable of VLAN 30; GW 192.168.114.1 |

# 3) VLAN and Port Assignments

|  |  |  |
| --- | --- | --- |
| **VLAN ID** | **Name** | **Interface / Role** |
| 10 | Faculty/Staff | F0/11 |
| 20 | Students | F0/18 |
| 30 | Guest (Default) | F0/7 |
| 88 | Native | G0/1 |
| 99 | Management | SVI (VLAN 99) |

# 4) Step‑by‑Step Configuration (Cisco IOS)

## 4.1 Switch S1

*Set hostname, create VLANs with exact names, assign access ports, build trunk on G0/1 with native VLAN 88, configure management SVI on VLAN 99, and set default gateway.*

enable  
conf t  
 hostname CSE-S1  
  
vlan 10  
 name Faculty  
vlan 20  
 name Students  
vlan 30  
 name Guest (Default)  
vlan 88  
 name Native  
vlan 99  
 name Management  
exit  
  
interface FastEthernet0/11  
 switchport mode access  
 switchport access vlan 10  
 no shutdown  
exit  
  
interface FastEthernet0/18  
 switchport mode access  
 switchport access vlan 20  
 no shutdown  
exit  
  
interface FastEthernet0/7  
 switchport mode access  
 switchport access vlan 30  
 no shutdown  
exit  
  
interface GigabitEthernet0/1  
 switchport mode trunk  
 switchport trunk native vlan 88  
 switchport trunk allowed vlan 10,20,30,88,99  
 no shutdown  
exit  
  
interface Vlan99  
 ip address 192.168.114.147 255.255.255.240  
 no shutdown  
exit  
  
ip default-gateway 192.168.114.145  
  
end  
wr

## 4.2 Router R1 — Router‑on‑a‑Stick

*Create one subinterface per VLAN. Native VLAN 88 must be 'native' on the router subinterface and match the switch.*

enable  
conf t  
 hostname CSE-R1  
  
interface GigabitEthernet0/1  
 no shutdown  
  
interface GigabitEthernet0/1.10  
 encapsulation dot1Q 10  
 ip address 192.168.112.1 255.255.255.0  
  
interface GigabitEthernet0/1.20  
 encapsulation dot1Q 20  
 ip address 192.168.113.1 255.255.255.0  
  
interface GigabitEthernet0/1.30  
 encapsulation dot1Q 30  
 ip address 192.168.114.1 255.255.255.128  
  
interface GigabitEthernet0/1.88  
 encapsulation dot1Q 88 native  
 ip address 192.168.114.129 255.255.255.240  
  
interface GigabitEthernet0/1.99  
 encapsulation dot1Q 99  
 ip address 192.168.114.145 255.255.255.240  
  
end  
wr

## 4.3 PCs — Static IP Configuration

• PC1 (VLAN 10, port F0/11): IP 192.168.112.10, Mask 255.255.255.0, Default‑GW 192.168.112.1

• PC2 (VLAN 20, port F0/18): IP 192.168.113.10, Mask 255.255.255.0, Default‑GW 192.168.113.1

• PC3 (VLAN 30, port F0/7): IP 192.168.114.10, Mask 255.255.255.128, Default‑GW 192.168.114.1

# 5) Verification

Run in this order for fast isolation:

! On S1  
show vlan brief  
show interfaces trunk  
show ip interface brief  
ping 192.168.114.145   
ping 192.168.112.10   
ping 192.168.113.10   
ping 192.168.114.10   
  
! On R1  
show ip interface brief  
ping 192.168.114.147   
ping 192.168.112.10  
ping 192.168.113.10  
ping 192.168.114.10  
  
! On each PC (Command Prompt)  
ping <its default gateway>  
ping 192.168.114.147   
ping other PCs across VLANs

# 6) Quick Troubleshooting

• If PC can’t reach its gateway: check the PC’s subnet mask, gateway, and that its switch port is in the correct access VLAN (show vlan brief).

• If inter‑VLAN pings fail but same‑VLAN works: confirm S1 trunk (native 88, allowed 10,20,30,88,99) and R1 subinterfaces’ encapsulation VLAN IDs match.

• If SVI Vlan99 is down/down: ensure the trunk carries VLAN 99; in some lab images, simply no‑shutdown on the SVI suffices.

• Always verify G0/1 on R1 is up and each subinterface shows up/up with the correct IP (show ip interface brief).