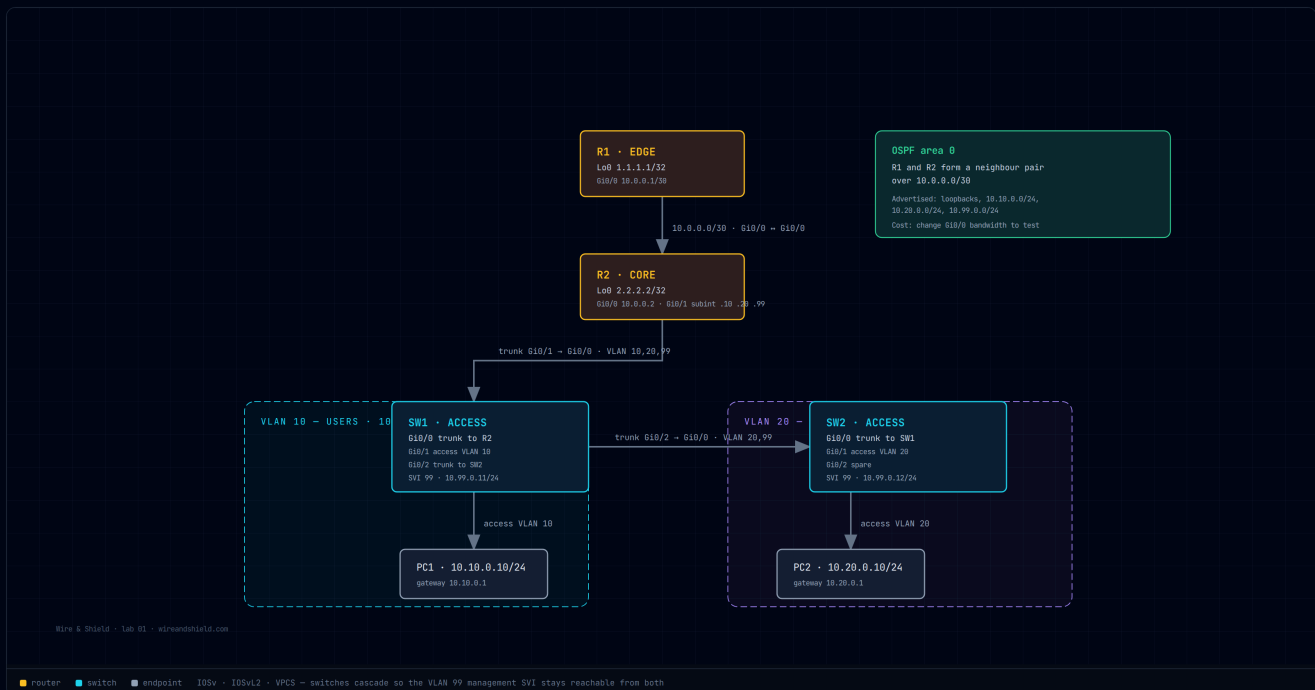


Build a two-tier network in GNS3

Six devices, two VLANs, OSPF between two routers. About 25 minutes. You will not write a single line of code – you will connect devices and paste config.

Lab 01 – two-tier network with VLANs and OSPF

6 devices • 2 routers • 2 switches • 2 PCs • 2 VLANs • about 25 minutes in GNS3 • no coding



What you are building

- Two access switches, each with its own VLAN, joined by a trunk.
- A router doing inter-VLAN routing on sub-interfaces – the way it is done in production.
- A second router reachable over a /30 link, with OSPF carrying every subnet.
- A management VLAN that can reach both switches, which is where most people get stuck.

Switches are cascaded (SW1 → SW2) on purpose. If both switched straight into the router, the VLAN 99 management address on SW2 would be unreachable – a mistake this lab is designed to teach you to avoid.

Addressing

Device	Interface	Address	Purpose
R1	Loopback0	1.1.1.1/32	OSPF router-id
R1	Gi0/0	10.0.0.1/30	Link to R2
R2	Gi0/0	10.0.0.2/30	Link to R1
R2	Gi0/1.10	10.10.0.1/24	VLAN 10 gateway
R2	Gi0/1.20	10.20.0.1/24	VLAN 20 gateway
R2	Gi0/1.99	10.99.0.1/24	Management gateway
SW1	Vlan99	10.99.0.11/24	Switch management
SW2	Vlan99	10.99.0.12/24	Switch management
PC1	eth0	10.10.0.10/24	VLAN 10 host
PC2	eth0	10.20.0.10/24	VLAN 20 host

Build it – click by click

1. GNS3 → File → New blank project. Name it lab-01.
2. From the device panel drag in: 2 × IOSv routers, 2 × IOSvL2 switches, 2 × VPCS.
3. Right-click each and rename: R1, R2, SW1, SW2, PC1, PC2.
4. Connect them with the cable tool:
 - R1 Gi0/0 → R2 Gi0/0
 - R2 Gi0/1 → SW1 Gi0/0
 - SW1 Gi0/2 → SW2 Gi0/0
 - SW1 Gi0/1 → PC1 eth0
 - SW2 Gi0/1 → PC2 eth0
5. Start all six devices. Right-click a device → Console.
6. Wait for the switches to finish booting – the prompt appears before the device is ready. Give IOSvL2 a full minute.
7. Paste the configs on pages 3 to 6, one device at a time.

Do not paste into a console that is still booting. If characters disappear, press Enter once, wait for the prompt, then paste.

R1 – edge router

IOSv · console

```
enable
configure terminal
hostname R1
no ip domain-lookup

interface Loopback0
 ip address 1.1.1.1 255.255.255.255
 no shutdown
exit

interface GigabitEthernet0/0
 description to R2
 ip address 10.0.0.1 255.255.255.252
 no shutdown
exit

router ospf 1
 router-id 1.1.1.1
 network 1.1.1.1 0.0.0.0 area 0
 network 10.0.0.0 0.0.0.3 area 0
 network 10.10.0.0 0.0.0.255 area 0
 network 10.20.0.0 0.0.0.255 area 0
 network 10.99.0.0 0.0.0.255 area 0
exit

username admin privilege 15 secret Cisco123!
line vty 0 4
 login local
 transport input ssh
exit
ip ssh version 2
crypto key generate rsa modulus 2048
end
write memory
```

The `crypto key` command runs in enable mode, not config mode. If it errors, type `end` first.

R2 – core router

IOSv · console

```
enable
configure terminal
hostname R2
no ip domain-lookup

interface Loopback0
 ip address 2.2.2.2 255.255.255.255
 no shutdown
exit

interface GigabitEthernet0/0
 description to R1
 ip address 10.0.0.2 255.255.255.252
 no shutdown
exit

interface GigabitEthernet0/1
 description trunk to SW1
 no ip address
 no shutdown
exit

interface GigabitEthernet0/1.10
 description VLAN 10 gateway
 encapsulation dot1Q 10
 ip address 10.10.0.1 255.255.255.0
exit

interface GigabitEthernet0/1.20
 description VLAN 20 gateway
 encapsulation dot1Q 20
 ip address 10.20.0.1 255.255.255.0
exit

interface GigabitEthernet0/1.99
 description management gateway
 encapsulation dot1Q 99
 ip address 10.99.0.1 255.255.255.0
exit

router ospf 1
 router-id 2.2.2.2
 passive-interface GigabitEthernet0/1.10
 passive-interface GigabitEthernet0/1.20
 passive-interface GigabitEthernet0/1.99
 network 2.2.2.2 0.0.0.0 area 0
 network 10.0.0.0 0.0.0.3 area 0
 network 10.10.0.0 0.0.0.255 area 0
 network 10.20.0.0 0.0.0.255 area 0
 network 10.99.0.0 0.0.0.255 area 0
exit
end
write memory
```

Passive interfaces stop OSPF hellos going to hosts, but still advertise the subnet. Without them you get neighbours on a VLAN full of PCs.

SW1 – access switch, VLAN 10

IOSvL2 · console

```
enable
configure terminal
hostname SW1
no ip domain-lookup

vlan 10
  name USERS
vlan 20
  name VOICE
vlan 99
  name MGMT
exit

interface GigabitEthernet0/0
  description trunk to R2
  switchport trunk encapsulation dot1q
  switchport mode trunk
  switchport trunk allowed vlan 10,20,99
exit

interface GigabitEthernet0/2
  description trunk to SW2
  switchport trunk encapsulation dot1q
  switchport mode trunk
  switchport trunk allowed vlan 20,99
exit

interface GigabitEthernet0/1
  description PC1
  switchport mode access
  switchport access vlan 10
  spanning-tree portfast
exit

interface Vlan99
  ip address 10.99.0.11 255.255.255.0
  no shutdown
exit
ip default-gateway 10.99.0.1
end
write memory
```

On IOSvL2 the `switchport trunk encapsulation dot1q` line is required before `mode trunk`. On real Catalyst it usually is too.

SW2 – access switch, VLAN 20

IOSvL2 · console

```
enable
configure terminal
hostname SW2
no ip domain-lookup

vlan 20
  name VOICE
vlan 99
  name MGMT
exit

interface GigabitEthernet0/0
  description trunk to SW1
  switchport trunk encapsulation dot1q
  switchport mode trunk
  switchport trunk allowed vlan 20,99
exit

interface GigabitEthernet0/1
  description PC2
  switchport mode access
  switchport access vlan 20
  spanning-tree portfast
exit

interface Vlan99
  ip address 10.99.0.12 255.255.255.0
  no shutdown
exit
ip default-gateway 10.99.0.1
end
write memory
```

PCs – VPCS consoles

```
PC1> ip 10.10.0.10/24 10.10.0.1
PC1> save

PC2> ip 10.20.0.10/24 10.20.0.1
PC2> save
```

Prove it works

Where	Command	You should see
R1	show ip ospf neighbor	10.0.0.2 · state FULL
R1	show ip route ospf	0 2.2.2.2/32 and 10.10/10.20/10.99 via 10.0.0.2
SW1	show interfaces trunk	Gi0/0 and Gi0/2 trunking, allowed 10,20,99 / 20,99
SW2	show vlan brief	VLAN 20 active with Gi0/1
PC1	ping 10.20.0.10	five replies – inter-VLAN routing works
PC1	ping 2.2.2.2	replies – OSPF is carrying the loopback
R2	ping 10.99.0.12	replies – management VLAN reaches SW2

When it does not work

Symptom	Most likely cause	Check
OSPF stuck in INIT or EXSTART	MTU or network type mismatch	show ip ospf interface Gi0/0
No OSPF routes on R1	Missing network statement, or interface down	show ip ospf interface brief
PC1 cannot ping its gateway	Wrong access VLAN, or trunk missing VLAN 10	show vlan brief · show interfaces trunk
SW2 management unreachable	VLAN 99 not allowed on SW1↔SW2 trunk	show interfaces trunk
Sub-interface up, no traffic	encapsulation dot1Q missing or wrong id	show run interface Gi0/1.10
Worked, then stopped	Config never saved; lab reloaded	write memory on every device

Three things to try next

1. Shut Gi0/2 on SW1 and time how long PC2 takes to recover. That is spanning tree, not OSPF.
2. Add `bandwidth 10000000` to R1 Gi0/0 and watch the cost change in show ip route.
3. Add VLAN 30 on both switches and a matching sub-interface on R2. If you can do that unaided, you own the pattern.

Once this topology exists, the scripts at wireandshield.com/kit stop you rebuilding it by hand. The course goes further: templated rollouts, drift detection, and what to do when a change goes wrong at 2am.