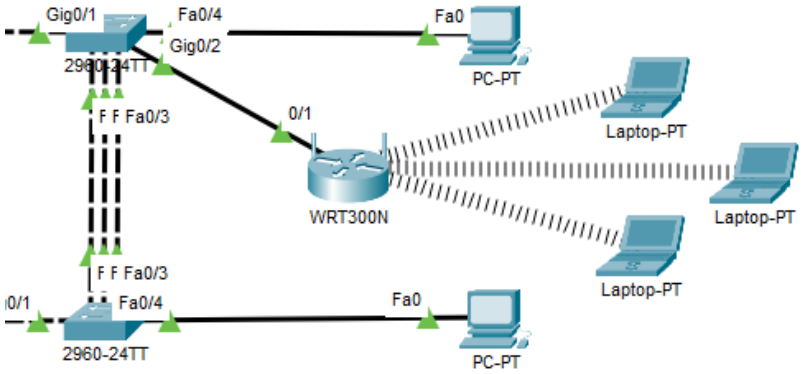
Sometimes Layer 2 redundancy is needed to increase bandwidth. EtherChannel allows link aggregation, combining multiple physical links into a single logical link to increase bandwidth and provide redundancy. EtherChannel supports two protocols for link aggregation: PAgP (Port Aggregation Protocol) and LACP (Link Aggregation Control Protocol). Unlike STP (Spanning Tree Protocol), which would block redundant links to prevent loops, EtherChannel combines the links, allowing all bundled links to be active simultaneously, effectively increasing bandwidth and ensuring redundancy without causing loops.

Configuring Link Aggregation between two switches



Commands:

```
Switch(config)#interface range fastEthernet 0/1-3
Switch(config-if-range)#switchport mode trunk
Switch(config-if-range)#
%LINK-3-UPDOWN: Interface Port-channel1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel1, changed state to down
interface range fastEthernet 0/1-3
%LINK-5-CHANGED: Interface Port-channel1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface P
Switch(config-if-range)#channel-group 1 mode desirable
Switch(config-if-range)#
%LINK-3-UPDOWN: Interface Port-channel1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channel1, changed state to down

Switch(config-if-range)#no shut
```

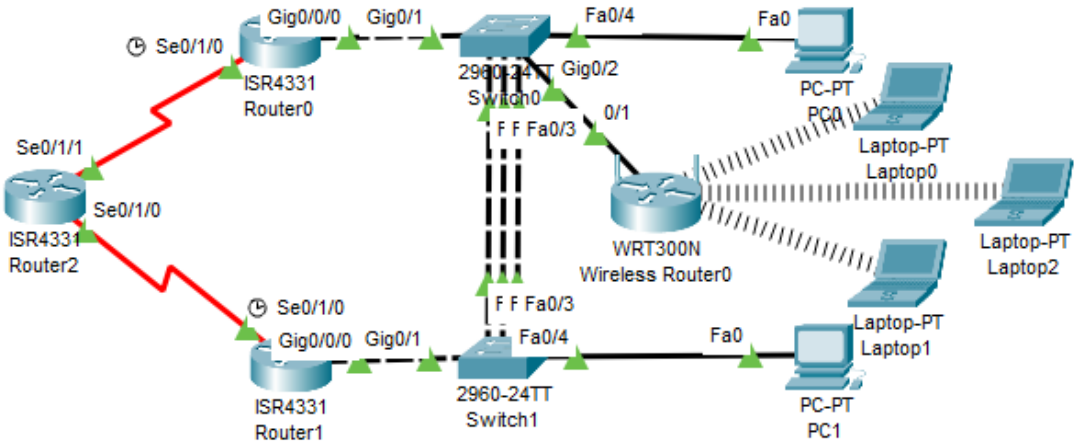
Explanation: (For both switches)

1. interface range fastEthernet 0/1-3 (Interface the ports to make logical link)
2. switchport mode trunk (Set ports to trunk if needed after creating vlans)
3. channel-group 1 mode desirable (Using PAgP in desirable mode)
4. no shut

After this, the ports fa/1-3 will work as single logical link with better bandwidth.

Configuring HSRP (Hot Standby Router Protocol) in Cisco Router

HSRP (Hot Standby Router Protocol) ensures reliable network connectivity by creating a virtual gateway that can withstand router failures. In a typical network, a single router acting as the default gateway can be a single point of failure. HSRP solves this by designating one router as active, while another serves as a standby backup. The active router handles all traffic for the virtual IP address used by connected devices, but if it goes down, the standby router takes over seamlessly, without interrupting network connectivity. This failover process is automatic and invisible to users, maintaining high availability for critical network paths.



For router0,

```
Router(config)#interface GigabitEthernet 0/0/0
Router(config-if)#ip ad
Router(config-if)#ip address 192.168.0.1 255.255.255.0
Router(config-if)#sta
Router(config-if)#standby 1 ip 192.168.0.254
Router(config-if)#stand
Router(config-if)#standby 1 pri
Router(config-if)#standby 1 priority 100
Router(config-if)#sta
Router(config-if)#standby 1
%HSRP-6-STATECHANGE: GigabitEthernet0/0/0 Grp 1 state Speak -> Standby

%HSRP-6-STATECHANGE: GigabitEthernet0/0/0 Grp 1 state Standby -> Active
% Incomplete command.
Router(config-if)#stand
Router(config-if)#standby 1 pr
Router(config-if)#standby 1 pree
Router(config-if)#standby 1 preempt
Router(config-if)#
```

Explanation:

1. interface GigabitEthernet 0/0/0 (The network gateway port)
2. ip address 192.168.0.1 255.255.255.0 (This is the ip of 1st gateway)
3. standby 1 ip 192.168.0.254 (This is virtual gateway ip)
4. standby 1 priority 100 (Setting high priority)
5. standby 1 preempt (Allow high priority router to go active)

For router1, the commands will be the same except

1. ip address 192.168.0.2 255.255.255.0 (This is the ip of 2nd gateway)
2. standby 1 priority 99 (Setting 2nd highest priority, if 1st router goes standby, this will go active)

In this configuration, we set up a virtual IP address of 192.168.0.254 as the default gateway for devices on the network. All packets destined for the internet will use this virtual IP, ensuring redundancy and failover.

How It Works:

1. Router0 and Router1 are both part of the HSRP group (group 1) with the virtual IP of 192.168.0.254.
2. Router0 has an IP of 192.168.0.1 and a higher priority (100), making it the active router initially, while Router1 has an IP of 192.168.0.2 and a priority of 99.
3. Preemption is enabled, so if Router0 (the higher-priority router) recovers after a failure, it will automatically resume its role as the active router.
4. Failover occurs if Router0 goes down; Router1 takes over as the active router due to its next-highest priority setting.