Testing & Validation Summary

- ☑ All clients received DHCP addresses correctly
- ☑ HSRP failover was tested — Router2 takes over gateway role
- ☑ OSPF neighbors fully adjacent on Gi0/1 (FULL state)
- ☑ BGP session established between AS 65001 and 65002
- ☑ Inter-VLAN routing between VLAN 10 and VLAN 20, confirmed via ping tests
- ☑ Wireless client authenticated and pinged default gateway

My Approach to Redundancy at Every Layer

In critical network environments, even small outages can cause major operational disruption. I approach redundancy holistically ensuring that links, power, devices, and network paths are all designed to withstand individual failures without service interruption. True infrastructure reliability starts by expecting failure and engineering seamless recovery.

Link Redundancy

- **Multiple Physical Links:** Use of multiple cables between devices
- **EtherChannel / LAG (Link Aggregation Group):** Aggregates multiple physical links into a single logical link for redundancy and increased bandwidth.
- **STP (Spanning Tree Protocol):** Prevents loops in redundant Layer 2 networks by blocking redundant paths unless needed.

Device Redundancy

- **Dual-Homed Devices:** Devices connected to two different upstream switches or routers.
- **Redundant Switches/Routers:** Running parallel hardware for failover (e.g., core switch A and B).

Path Redundancy

- **Multiple Routing Paths:** Dynamic routing protocols (OSPF, EIGRP, BGP) automatically reroute traffic if a link or path goes down. Redundancy between different autonomous systems or ISPs. Ensures reachability through multiple upstream providers

- **MPLS Fast Reroute (FRR):** Rapid reroute of traffic in MPLS networks**.**

    Example from Project: I used OSPF between Router1 and Router2 so that dynamic routes are always up to date. If the peering link or an interface fails, the routing table adjusts automatical**ly.**

    Example from Project: I implemented eBGP between AS 65001 and AS 65002 to simulate external failover, similar to how a production network might maintain multi-provider connectivity.

Protocol and System Redundancy

- **First-Hop Redundancy Protocols (FHRP) – HSRP / VRRP / GLBP:** Default gateway redundancy. Prevents host downtime if the primary router fails.

    Example from Project: In my lab, I used HSRP to provide a shared virtual IP between Router1 and Router2 for both VLAN 10 and VLAN 20. If Router1 fails, Router2 immediately takes over as the active gateway without requiring any changes on client devices.

- **High Availability (HA) Clustering:** Firewall HA (e.g., Active/Standby or Active/Active).

- **Load Balancers:** Redundant pairs to keep web/application traffic flowing.

Power and Hardware Redundancy

- **Redundant Power Supplies (RPS):** For switches, routers, firewalls.

- **UPS and Generators:** For continued power during outages.

- **Dual Power Feeds:** Power from separate circuits.

Site-Level Redundancy

- **Data Center Redundancy:** Active/Active or Active/Standby setups across geographic locations.

- **Cloud Redundancy:** Leveraging multiple regions or availability zones (e.g., AWS Multi-AZ, Zone Redundancy).

WAN and ISP Redundancy

- **Dual ISP Links:** Failover between ISPs using policy-based routing or dynamic protocols.

- **SD-WAN:** Intelligent path selection with automatic failover and performance-based routing.

Server & Application Redundancy

- **Load Balancers:** Distribute traffic across redundant backend servers.

- **Virtualization Redundancy:** VMware HA, Hyper-V clustering.

Jeremi D. Wright
Network Reliability Engineer