# **Can you give me a functional discussion of the hierarchical network design with the addendum of edge router? Discuss the purpose of each level and the configurations that can be done in them.**

Great question 👍. Let’s walk through the **Hierarchical Network Design** (the industry-standard three-layer design) and then add the **edge router** into the discussion. I’ll keep it both conceptual and functional so you can imagine how this would be built and configured (including in a simulation like Cisco Packet Tracer or real deployments).

## **Hierarchical Network Design (Core, Distribution, Access)**

The hierarchical model divides the network into **layers,** each with specific role. This modular design improves scalability, manageability, performance, and security.

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### Access Layer (Edge of the LAN)

* **Purpose**
* Provides **end device connectivity** (PCs, IP phones, printers, IoT).
* First line control for **port security**, **VLAN assignment**, and **QoS** (for things like IP Phones).
* Ensures **reliability** with redundant uplinks to distribution.
* **Key Configurations**
* **VLANs & trunking**: Assign switchports to VLANs, configure uplinks as trunks.
* **Port Security**: Limit number of MAC addresses, protect against CAM table flooding.
* **QoS Marking**: Trust DSCP/Cos for IP Phones.
* **Spanning Tree adjustments**: Portfast for end devices, BPDU Guard.
* **Sample Configurations**

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| **Int fa0/1**  **Switchport mode access**  **Switchport access vlan 10**  **Switchport voice vlan 20**  **Spanning-tree portfast**  **Spanning-tree bpduguard enable**  **Switchport port-security**  **Switchport port-security maximum 2**  **Switchport port-security violation shutdown**  **Switchport port-security mac-address sticky** |

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### Distribution Layer (Aggregation & Policy)

* **Purpose**
* Aggregates access switches.
* Enforces **policies, ACLs,** and **inter-VLAN routing (Layer 3 switching)**.
* Provides redundancy (HSRP/VRRP/GLBP) for gateway availability.
* Manages **load balancing** and **broadcast domain control**.
* **Key Configurations**
* **SVIs** for inter-VLAN routing.
* **ACLs** for filtering traffic between VLANs.
* **HSRP/VRRP** for first-hop redundancy.
* **DHCP relay** if DHCP server is elsewhere.
* **Sample Configurations**

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| **Int vlan 10**  **Ip add 192.168.10.1 255.255.255.0**  **Standby 10 ip 192.168.10.254**  **Standby 10 priority 110**  **Standby 10 preempt**  **Int vlan 20**  **Ip add 192.168.20.1 255.255.255.0**  **Standby 10 ip 192.168.20.254**  **Standby 10 priority 110**  **Standby 10 preempt**  **Ip dhcp relay information trust-all** |

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### Core Layer (High-Speed Switching Backbone)

* **Purpose**
* Provides **fast and resilient forwarding** between distribution blocks and external networks.
* Focuses on **speed**, **redundancy**, and **uptime** (not policy enforcement).
* Must be designed to **handle high traffic loads** with minimal latency.
* **Key Configurations**
* Keep configurations **light**: focus on high-speed routing/switching.
* Use **dynamic routing protocols** (OSPF, EIGRP, or IS-IS).
* Ensure **redundant links and load balancing.**
* **Sample Configurations**

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| --- |
| **router ospf 1**  **network 192.168.0.0 0.0.255.255 area 0**  **!**  **interface g1/0/1**  **ip address 10.1.1.1 255.255.255.252**  **ip ospf 1 area 0** |

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## **The Addendum: Edge Router (WAN Edge/Internet Gateway)**

The **edge router** sits at the network boundary, connecting the internal enterprises network to external networks (ISP, partnet networks, cloud).

* **Purpose**
* Provides **WAN access** (internet, MPLS, leased lines).
* Acts as a **security boundary** (firewall, NAT, VPN termination).
* Manages **QoS** and **traffic shaping** for WAN links.
* Implements **routing policies** (BGP, static routes, redistribution with OSPF/EIGRP).
* **Key Configurations**
* **NAT** for internal clients accesssing the internet.
* **ACLs** to filter inbound/outbound traffic.
* **Routing**: Default route toward ISP, redistribute into IGP.
* **VPNs** (IPSec/GRE) for secure banch/remote connectivity.
* **Sample Configurations**

|  |
| --- |
| **Int g0/0/0**  **Ip add 201.0.113.2 255.255.255.252**  **No sh**  **Int g0/0/1**  **Ip add 192.168.100.1 255.255.255.250**  **No sh**  **Ip route 0.0.0.0 0.0.0.0 201.0.113.1**  **access-list 1 permit 192.168.0.0 0.0.255.255**  **Ip nat inside source list 1 interface g0/0 overload**  **crypto isakmp policy 10**  **encr aes**  **authentication pre-share**  **group 2** |

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## **Putting It All Together**

Here’s the **flow of traffic** in this design:

* **Access**: Users connect, get VLAN assignment, security enforced.
* **Distribution**: VLANs are routed, access policies applied, redundancy maintained.
* **Core**: Fast forwarding, dynamic routing across campus backbone.
* **Edge Router**: Connects enterprise to WAN/Internet, enforces external security, applies NAT, VPN, and WAN QoS.