

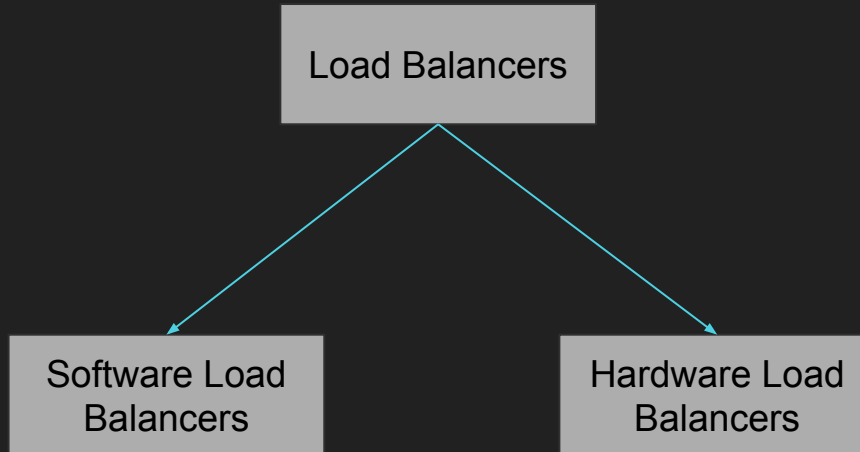
Distributed Applications

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Role of Load Balancers

- Load balancing is the distribution of load, such as software or data, evenly across systems in a distributed system.
- Load balancing is important in improving the performance of the system.
- The role of a load balancer is to improve / optimize the distribution of workload across systems.
- Load balancer optimizes resource use, increase throughput and decrease the response time.

Types of Load Balancers

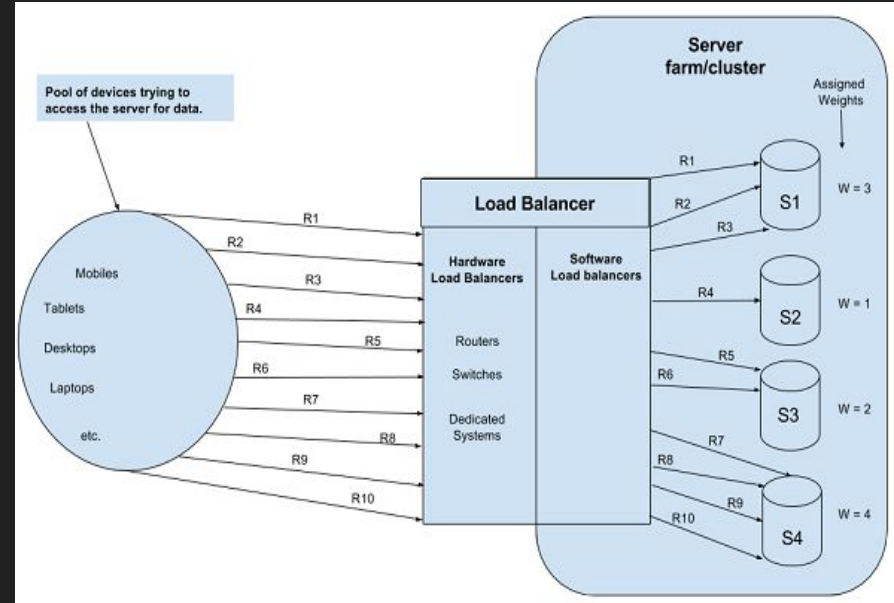


Software Load Balancers

- Software load balancers are the ones that implement a combination of one or more scheduling algorithms for high performance:
 1. Weighted Scheduling Algorithm
 2. Round Robin Scheduling
 3. Least Connection First Scheduling
- Examples of Software Load Balancers:
NGINX, Varnish, HAProxy

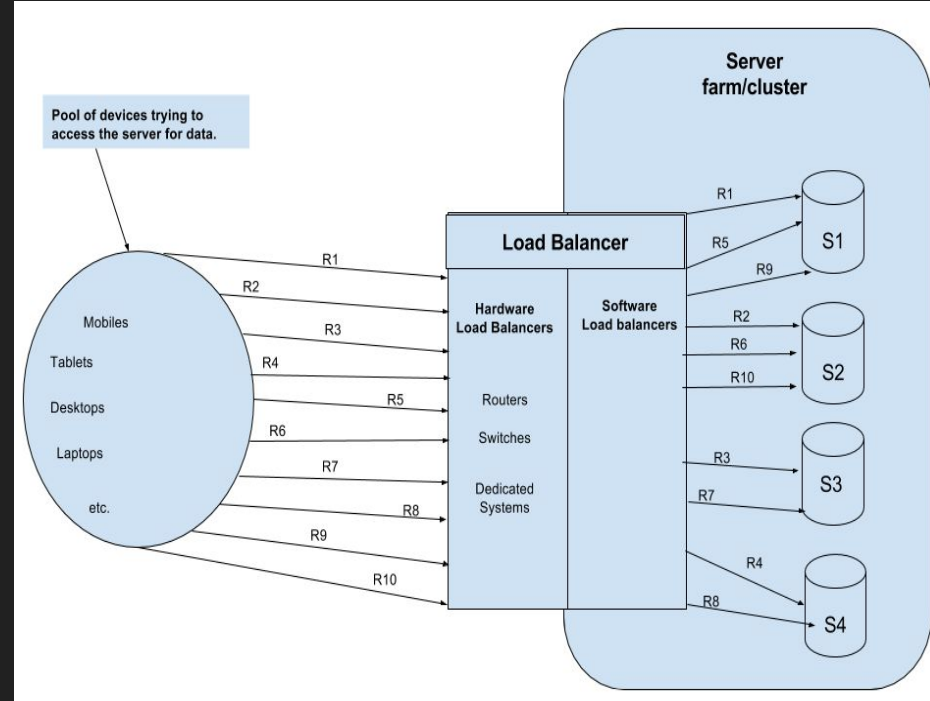
Weighted Scheduling Algorithm

- Work is assigned to each server based on the load that the server is designed to handle
- Weight is assigned to each server based on the hardware capabilities of that server
- Efficient in managing the load when we have low capability servers along with high capability servers



Round Robin Scheduling

- Requests are served by the server one after the other sequentially
- After sending the request to the last server, it starts from the first server again
- This algorithm is used when servers are of equal specification

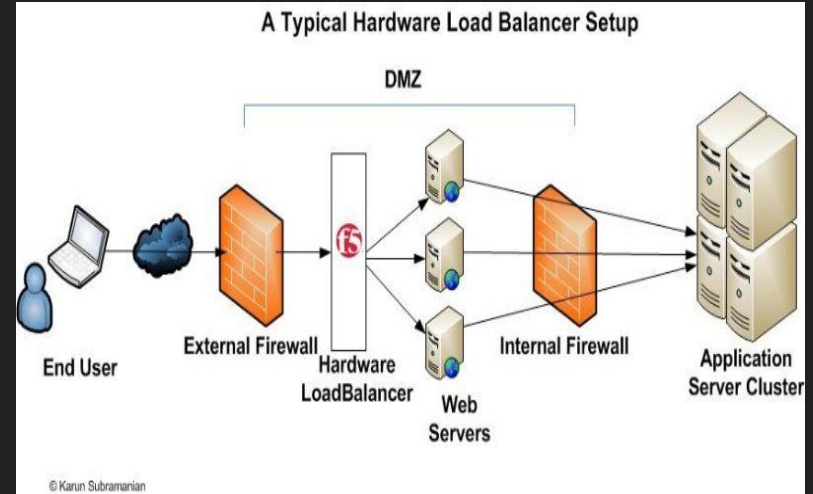


Least Connection First Scheduling

- Requests are served first by the server which is currently handling least number of persistent connections at that point
- This algorithm is used when we have large number of persistent connections in the traffic
- All the requests related to a session are sent to the same server to maintain the session state and synchronization

Hardware Load Balancers

- Hardware load balancers are specialized routers or switches, deployed between the servers and the clients.
- Implemented on Transport Layer (Layer 4) and Application Layer (Layer 7) of the network OSI model.



Layer 4 Hardware Load Balancing

- Works on Transport Layer of OSI Model.
- Uses transport layer protocols like TCP, UDP and SCTP to decide on which server the load balancing is to be done.
- They are mostly Network Address Translators (NATs).
- They translate every response data packets coming from servers to be coming from same IP address.
- During a request, they reverse translate the IP address using mapping table.

Layer 4 Hardware Load Balancing

- **DNS Load Balancing:**

- These return different IP addresses for different systems.
- A load balancing effect is created when there is a DNS lookup.

- **Direct Routing:**

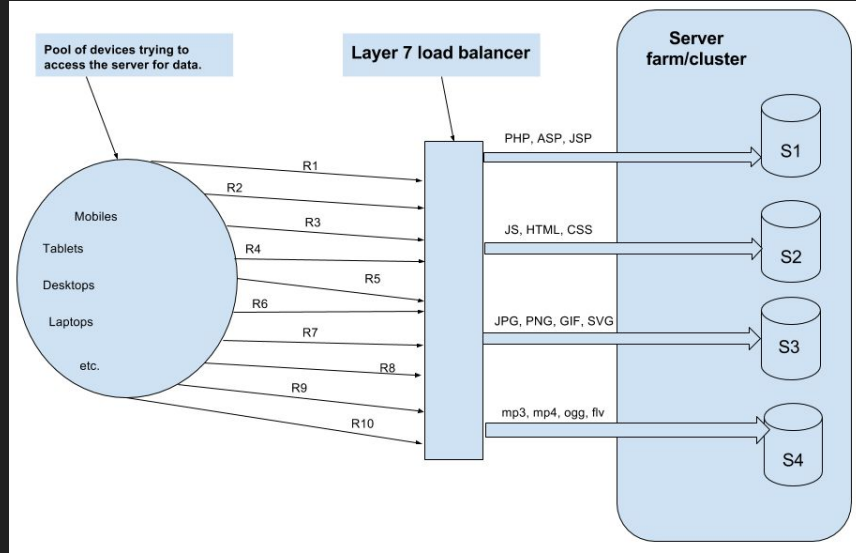
- This is another configuration of hardware load balancing.
- The routers are aware of the server mac addresses and Address Resolution Protocol (ARP) disabled.
- All incoming traffic is routed by the load balancer but outgoing traffic reaches the client directly.
- Hence, very fast

Layer 4 Hardware Load Balancing

- **Tunnel or IP Tunneling:**

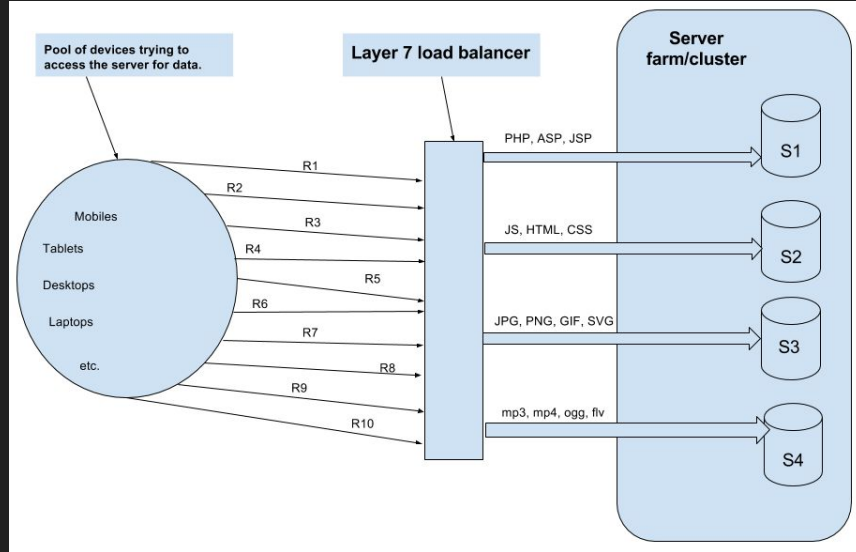
- It is similar to Direct Routing but the traffic between the router and the server can be routed.
- A request from the client is sent to the virtual IP address of the load balancer and it stores a hash table.
- The load balancer encapsulates the packets and distributes to different servers based on the configured load balancing technique.
- When a response is received by the server, it decapsulates and sends directly to the client, based on the hash table entries.

Layer7 Hardware Load Balancing



- This type of load balancer takes the decision according to the actual content of the message (URLs, cookies, scripts) since HTTP exists on the layer7
- Layer7 hardware form an Application delivery network (ADN)
- Here, load balancing is achieved by distributing load according to the type of content requested.

Layer7 Hardware Load Balancing



Layer 7 load balancing uses the following three techniques:

1. URL parsing: To know the type of content.
2. Cookie sniffing: This helps in session aware routing.
3. HTTP reading: This is used to look for HTTP header information.

Examples of Load Balancers

- Software Load Balancers:
 - HAProxy - A TCP load balancer
 - NGINX - A HTTP load balancer with SSL termination support
 - Mod_athena - Apache based http load balancer
 - Varnish - A reverse proxy based load balancer
- Hardware Load Balancers:
 - F5 BIG-IP load balancer
 - CISCO system catalyst
 - Barracuda Load Balancer
 - Coytepoint Load Balancer