CLOUD COMPUTING APPLICATIONS

LOAD BALANCER SCHEMES

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What Does a Server Load Balancer (SLB) Do?

- Gets user to needed resource
  - Server must be available
  - User’s “session” must not be broken
    - If user must get to the same resource over and over, the SLB device must ensure that happens (i.e., session persistence)
- In order to do work, SLB must
  - Know servers – IP / port, availability
  - Understand details of some protocols (e.g., FTP, SIP)
- Network Address Translation (NAT)
  - Packets are rewritten as they pass through the SLB device

Reasons to Load-Balance

- Scale applications / services
- Ease of administration / maintenance
  - Easily and transparently remove physical servers from rotation in order to perform any type of maintenance on that server
- Resource sharing
  - Can run multiple instances of an application / service on a server; could be running on a different port for each instance; can load-balance to different port based on data analyzed

Load-Balancing Algorithms

- Most predominant
  - **Least connections**: Server with fewest number of flows gets the new flow request
  - **Weighted least connections**: Associate a weight / strength for each server and distribute load across server farm based on the weights of all servers in the farm
  - **Round robin**: Round robin through the servers in server farm
  - **Weighted round robin**: Give each server “weight” number of flows in a row; weight is set just like it is in weighted least flows
- There are other algorithms that look at or try to predict server load in determining the load of the real server

How SLB Devices Make Decisions

- The SLB device can make its load-balancing decisions based on several factors
  - Some of these factors can be obtained from the packet headers (i.e., IP address, port numbers)
  - Other factors are obtained by looking at the data beyond the network headers. Examples:
    - HTTP cookies
    - HTTP URLs
    - SSL client certificates
- The decisions can be based strictly on flow counts, or they can be based on knowledge of application
- For some protocols, like FTP, you must have knowledge of protocol to correctly load-balance (i.e., control and data connection must go to same physical server)

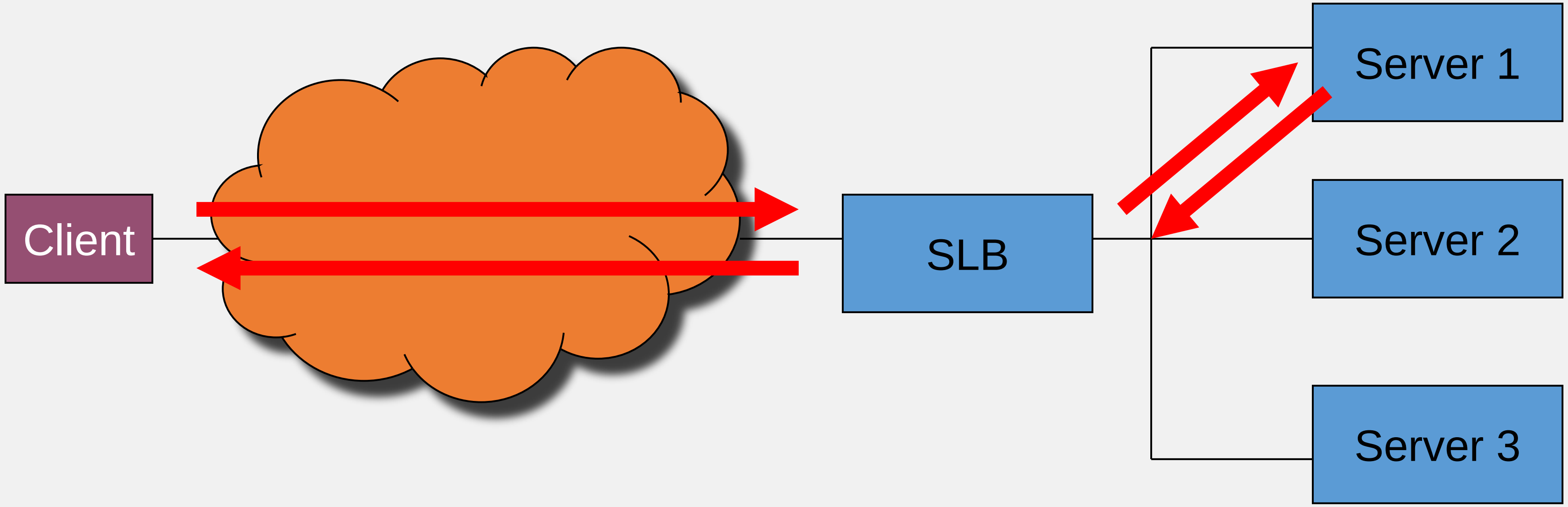
When a New Flow Arrives

- Determine whether virtual server exists
  - If so, make sure virtual server has available resources
  - If so, then determine level of service needed by that client to that virtual server
    - If virtual machine is configured with particular type of protocol support of session persistence, then do that work
  - Pick a real server for that client
    - The determination of real server is based on flow counts and information about the flow
    - In order to do this, the SLB may need to proxy the flow to get all necessary information for determining the real server; this will be based on the services configured for that virtual server
- If not, the packet is bridged to the correct interface based on Layer 2

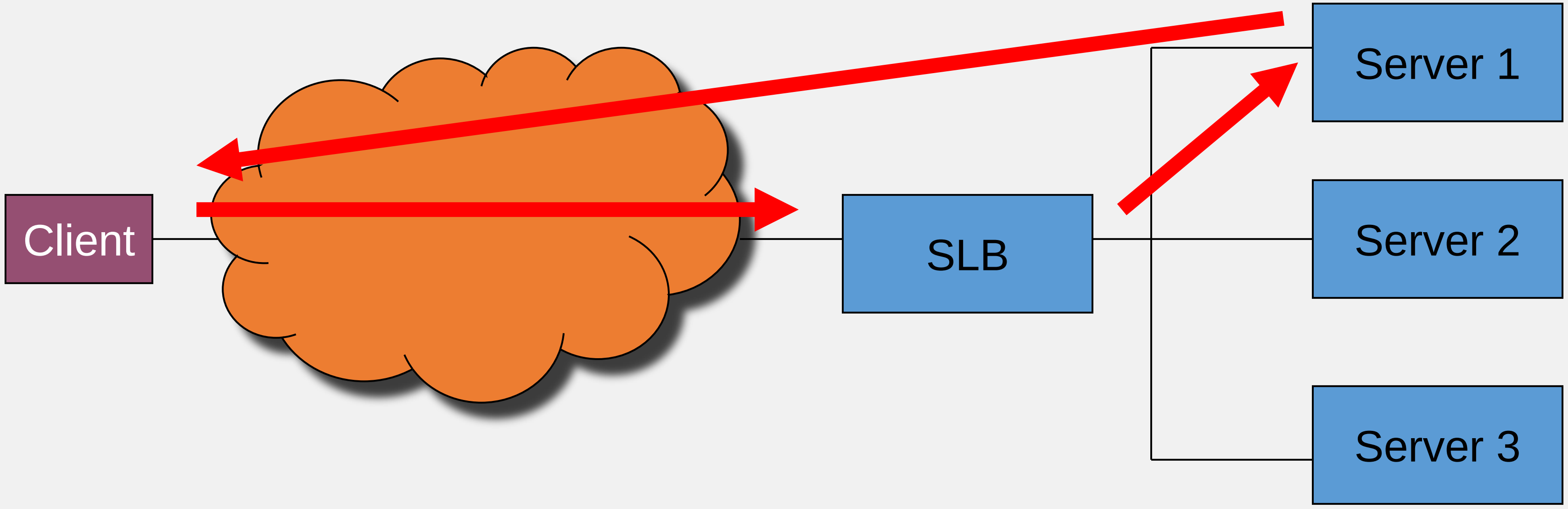
SLB: Architectures

- Traditional
  - SLB device sits between the Clients and the Servers being load-balanced
- Distributed
  - SLB device sits off to the side and only receives the packets it needs to, based on flow setup and teardown

SLB: Traditional View with NAT



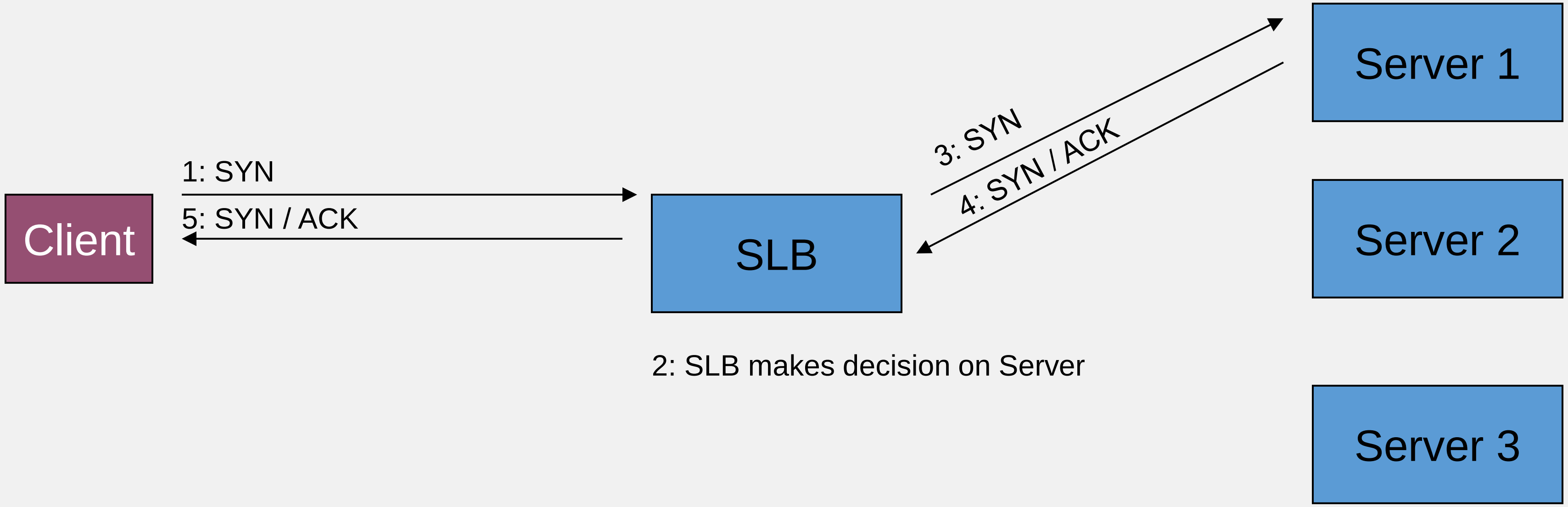
SLB: Traditional View without NAT



Load-Balance: Layer 3 / 4

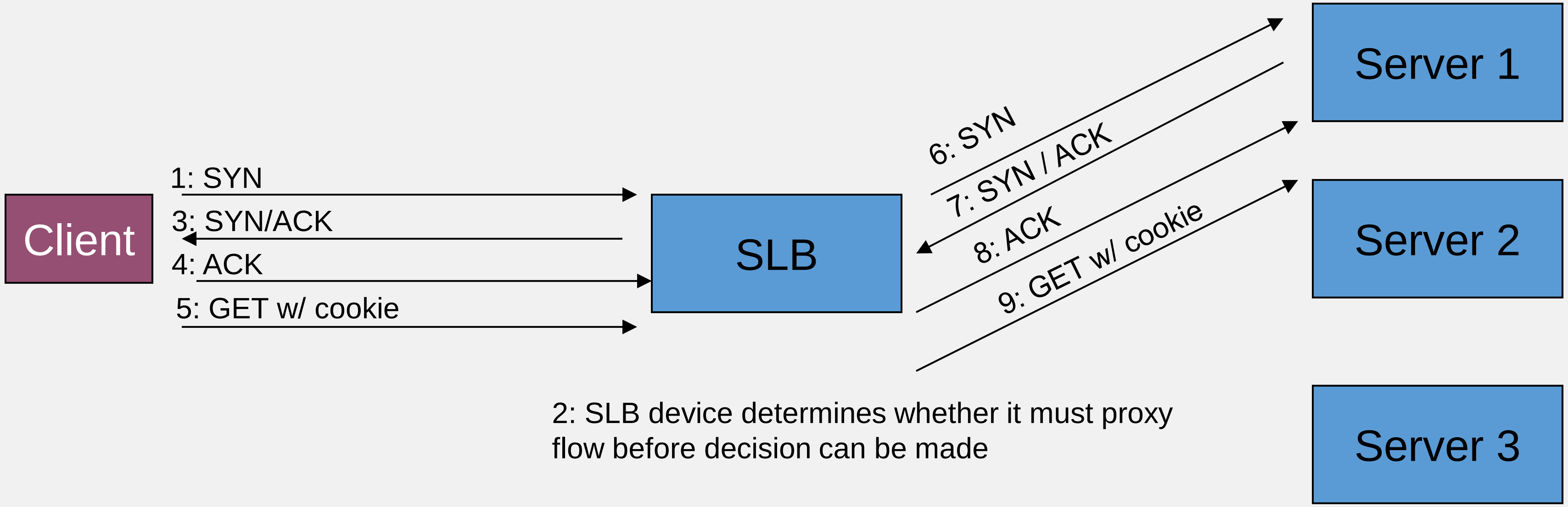
- Look at the destination IP address and port to make a load-balancing decision
- In order to do that, you can determine a real server based on the first packet that arrives

Layer 3 / 4: Sample Flow



Rest of flow continues through HTTP GET and Server response

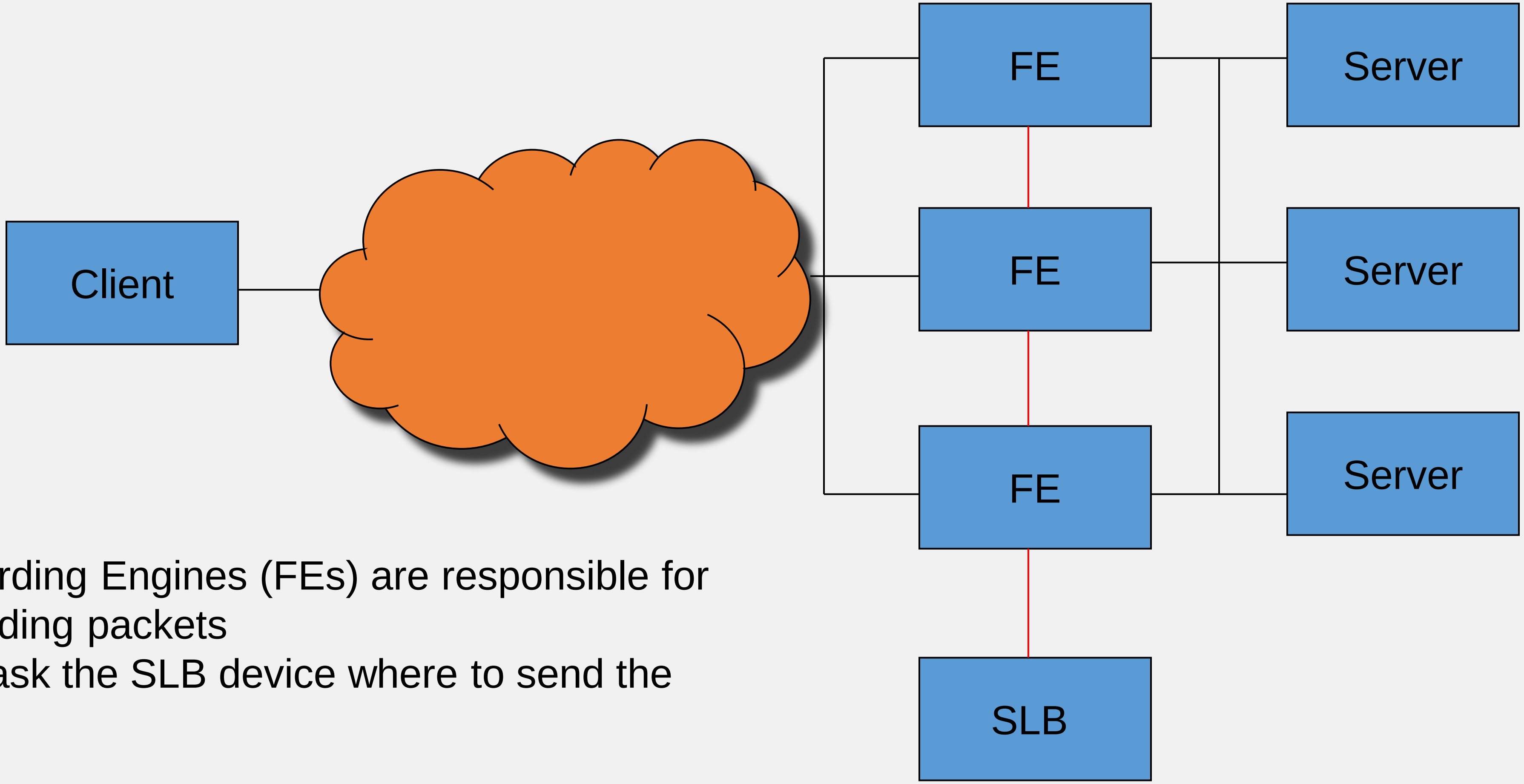
Layer 5+: Sample Flow



2: SLB device determines whether it must proxy flow before decision can be made

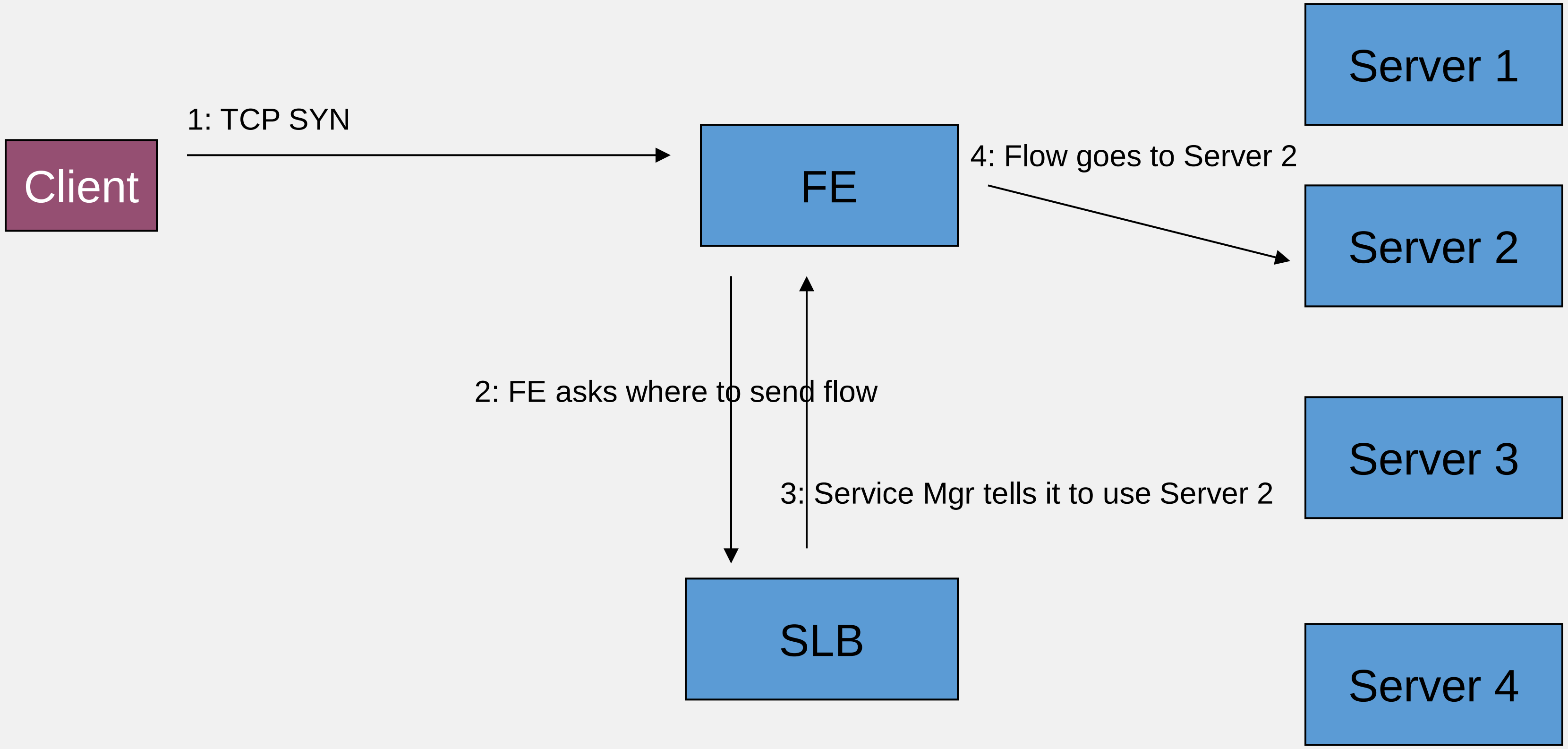
- Rest of flow continues with Server response
- Note that the flow can be unproxied at this point for efficiency

SLB: Distributed Architecture



- Forwarding Engines (FEs) are responsible for forwarding packets
- They ask the SLB device where to send the flow

Distributed Architecture: Sample Flow



- Subsequent packets flow directly from Client to Server 2 through the FE
- The FE must notify the SLB device when the flow ends