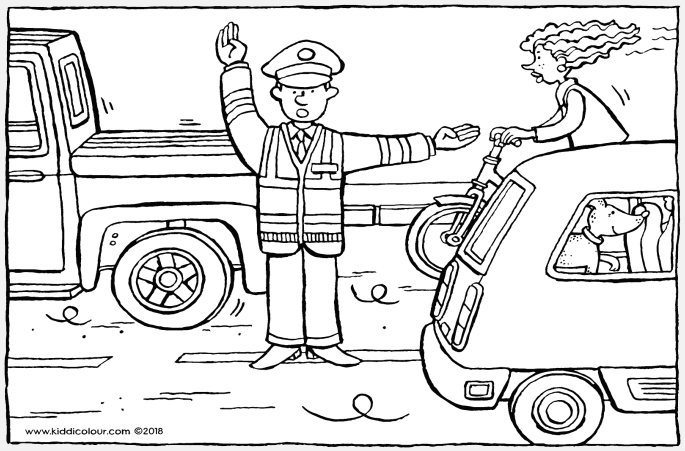
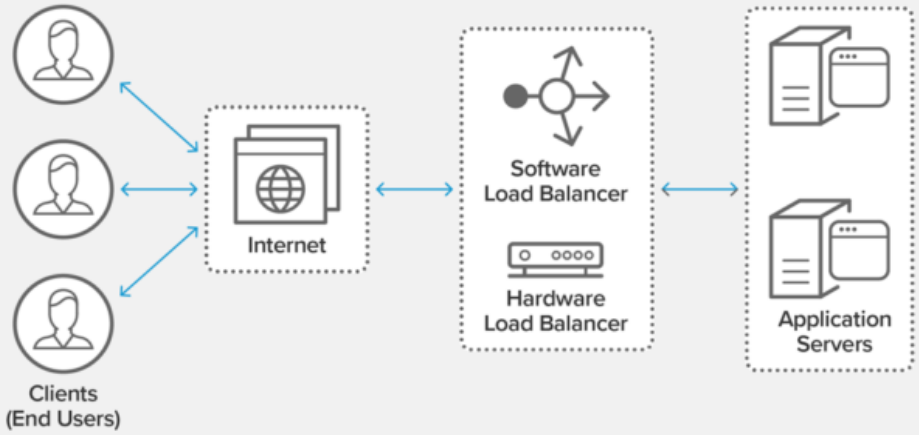
Load Balancer



Load Balancers

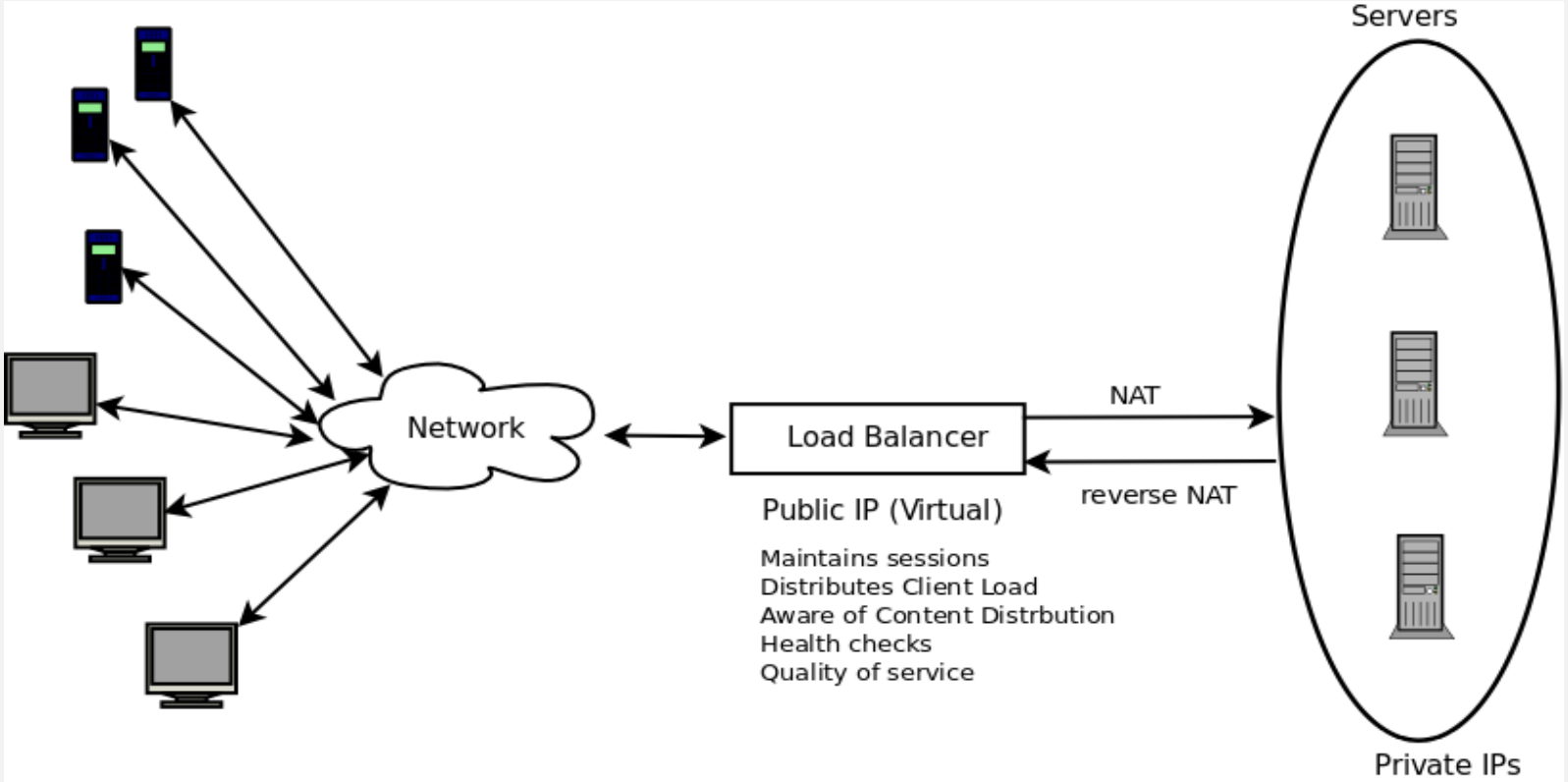
- Load balancers are the bridge between the servers and the network.
- Load balancers understand many many higher-layer protocols, so they can communicate with servers intelligently.
- Load balancers also understand network protocols, so they can integrate with networks effectively.



Load Balancer Functionality

- What does a load balancer do?
  - Distributes client requests efficiently across multiple servers
  - Ensures high availability and reliability by sending requests only to servers that are online
  - Provides the flexibility to add or remove servers as demand dictates
  - Improves security by protecting against denial-of-service attacks
- Types of load balancers
  - Software load-balancers
  - Hardware load-balancers 
  - Switches with extended functionality

Load Balancers: The Big Picture



Load Distribution Methods (1)

- Stateless load balancing: The load balancer uses some algorithm to distribute all incoming traffic to available servers but does not keep track of any individual session.
  - Simple hashing based on source IP (we can also include source port for better distribution). Or we can use Hash Buckets for a two-tier distribution method, which is better if a server goes down as only those packets get redistributed to other servers.
- Stateful load balancing: The load balancer keeps track of state information for every session and makes load balancing decisions for each session.
  - A session is identified by the (source IP, destination IP, source port, destination port). Easier to identify for TCP than for UDP (why?)
  - Keeps a session table. We also need an idle timer to remove entries so the table doesn't fill up.

Load Distribution Methods (2)

- Round robin
- Least connections
- Weighted distribution
- Response time (in-band monitoring versus out-of-band monitoring)
- Server probes (that run on servers)
- Server load thresholds

Scalability Options

- Direct server return
- Use two load balancers: either in Active-Standby or in Active-Active configurations. We an also duplicate routers and switches to get even higher bandwidth
- Global server load balancing.
  - Use standard DNS that allows multiple addresses for the same host address
  - Use HTTP Redirect
  - Make the load balancer be the authoritative DNS server
  - Make the load balancer be the forward DNS proxy server

References

- *Load Balancing Servers, Firewalls, and Caches*. Chandra Kopparapu. Wiley.