Self-Study Guide: Load Balancing Concepts

L4 vs L7 Load Balancing

Layer 4 (Transport Layer) Load Balancing

- Works at: TCP/UDP level
- Decision based on: IP addresses and ports
- Pros: Faster, less overhead
- Cons: Cannot inspect application content
- Use cases: Simple TCP services, database load balancing

Layer 7 (Application Layer) Load Balancing - What we implemented

- Works at: HTTP/HTTPS level
- Decision based on: URL, headers, cookies, content type
- Pros: Smart routing, content awareness, SSL termination
- Cons: More overhead, slower than L4
- Use cases: Web applications, API gateways

Sticky Sessions (Session Persistence)

What are sticky sessions?

- Mechanism that ensures a user's requests go to the same backend server
- Important for applications that store session data on servers

When to use sticky sessions:

- Applications with server-side session storage
- Shopping carts, user authentication sessions
- When session data isn't shared between servers

Configuration example:

```
apache

# Enable sticky sessions with cookie-based persistence

ProxySet stickysession=JSESSIONID
```

Alternative: Use shared session storage (Redis, database) instead of sticky sessions

Monitoring and Maintenance

Check Balancer Status

```bash
# Enable balancer manager (for monitoring)
sudo a2enmod status

# Access via: http://<LB-IP>/balancer-manager
```

Common Issues and Solutions

1. Web servers not receiving traffic
    - Check security groups allow LB IP
    - Verify web servers are running Apache
    - Check load balancer configuration syntax
2. Uneven traffic distribution
    - Adjust `loadfactor` values
    - Consider different `lbmethod`
    - Monitor server resource usage
3. Session persistence issues
    - Implement sticky sessions if needed
    - Use shared session storage

Security Considerations

Security Group Configuration

- LB Security Group: Allow HTTP/HTTPS from internet (0.0.0.0/0)
- Web Server Security Groups: Allow HTTP only from LB security group
- Database Security Group: Allow MySQL only from web server security groups

Additional Security Measures

apache

```
# Restrict access to balancer manager
<Location /balancer-manager>
    Require ip 192.168.1.0/24  # Your admin network only
</Location>
```

Final Architecture Verification

Complete Setup Checklist

- Load Balancer responds to public IP
- Traffic distributes evenly between web servers
- Web servers can access NFS shares
- Web servers can connect to MySQL database
- Application functions correctly through LB
- Logs show requests distributed to both servers

Performance Testing

bash

```bash
# Simple load test (install apache2-utils first)
sudo apt install apache2-utils
ab -n 1000 -c 10 http://<LB-IP>/index.php

# Purpose: Test how the load balancer handles concurrent requests
```