Component Breakdown

Web Server (Nginx)
Hosted on its own server to :

- Efficiently serve static content (HTML/CSS/images) using HTTP/HTTPS
- Act as a reverse proxy to forward dynamic requests to the application server
- Enable caching and compression for performance optimization

Application Server (Gunicorn/Flask)
Separated to :

- Handle business logic and generate dynamic content through Python code execution
- Connect to databases/APIs using protocols like FastCGI or WSGI
- Scale independently without impacting static content delivery

Database (MySQL)
Isolated to :

- Centralize data storage with ACID compliance
- Allow dedicated resource allocation for query optimization
- Implement security controls specific to sensitive data

HAProxy Load Balancer Cluster
Configured as an active-active cluster to :

- Distribute traffic across multiple web servers using `balance roundrobin`[36]
- Provide automatic failover using Corosync/Pacemaker and a floating IP
- Monitor server health with `option httpchk` and remove unresponsive nodes

Key Scaling Advant

Element	Purpose
Dedicated Servers	Prevents resource contention; allows specialized tuning (e.g., web server cache vs DB index optimization)
HAProxy Cluster	Eliminates single point of failure (SPOF) through redundant load balancers
Layer Separation	Enables horizontal scaling – add more web/app servers as needed without rearchitecting

Implementation Notes

1. HAProxy Configuration uses four essential sections :
    a. `Global` : Sets process limits and security policies

    b. `Defaults` : Defines timeouts and error handling
    c. `frontend`: Binds to public IP :443 for HTTPS termination
    d. `backend`: Directs traffic to web servers with cookie persistence
2. Cluster Setup requires :
    a. Synchronized configs across load balancers
    b. Reserved IP failover managed by Pacemaker
    c. Regular health checks between cluster nodes

This separation allows each layer to scale independently while maintaining high availability through redundant load balancers and dedicated service hosts.