# 3D E-COMMERCE PLATFORM ON AWS — ARCHITECTURE & COST OVERVIEW (CAPETOWN REGION)

# KEY AWS SERVICES & WHY

**Edge & Security:** Route 53, CloudFront, WAF & Shield, Cognito — global caching and security.

**Compute & Routing:** Two ALBs (web/app tiers), Auto Scaling EC2, Lambda + SQS/EventBridge for background tasks.

**Data Layer:** S3 for 3D assets, DynamoDB for session/cart data, Aurora (multi-AZ) for orders, ElastiCache Redis, OpenSearch.

**Monitoring & Security:** CloudWatch, X-Ray, CloudTrail, Trusted Advisor, KMS, Secrets Manager, Subnets & VPC controls.

# WHY THE CAPETOWN REGION?

- Low Latency for Southern Africa: Hosting in Cape Town significantly reduces network latency for users in Botswana, South Africa, Namibia, and neighboring countries. This is critical for a 3D e-commerce platform, where rendering and asset loading must be seamless.
- Data Residency & Compliance: Some industries and jurisdictions in Southern Africa prefer or require data to be stored within the region. Using the Cape Town region ensures compliance with local data protection laws and eases privacy concerns for customers.
- Customer Trust & Brand Reputation: Customers feel more secure knowing their data is hosted locally rather than offshore. This builds trust — especially important for handling transactions and payment information.
- Improved Availability & Support: AWS Cape Town offers multiple Availability Zones, providing high availability and disaster recovery within the same region. Easier to integrate with regional ISPs and content delivery networks.
- Economic & Strategic Alignment: Supporting a local AWS region demonstrates commitment to African markets, aligning with your mission to create technology solutions for Africa.
- Lower data-transfer costs for regional traffic compared to hosting in Europe or the US.

# ESTIMATED MONTHLY COST(CAPETOWN)

| Service | Monthly Estimate (USD) |
|---|---|
| EC2 Web/App Fleet (4 × t3.medium) | $160 |
| Aurora DB (multi-AZ) | $220 |
| S3 Storage (2 TB) | $55 |
| Data Transfer Out / CloudFront (5 TB egress) | $770 |
| Application Load Balancers (2) | $70 |
| ElastiCache (2 nodes) | $130 |
| OpenSearch | $330 |
| DynamoDB | $40 |
| Misc (Lambda, SQS, SNS, EventBridge, Cognito, monitoring) | $140 |
| Total Baseline | ~$1,950 / month |

# JUSTIFICATION OF THE MONTHLY BASELINE

1. EC2 Web/App Fleet ($160) We chose a small but scalable fleet (4 × t3.medium instances) to provide predictable baseline performance for 3D rendering and API traffic. Using the Cape Town region ensures data residency for African users, but prices are slightly higher than US/EU regions. $160/month is modest for a globally reachable app.

2. Aurora DB (multi-AZ) ($220) Aurora Global Database gives strong consistency for orders/payments. Multi-AZ redundancy is essential for high availability, and $220/month is competitive for enterprise-grade reliability.

3. S3 Storage (2 TB) ($55) Storing 3D models and static assets in S3 with lifecycle policies and Intelligent-Tiering keeps storage costs extremely low relative to reliability (99.999999999% durability).

4. Data Transfer Out / CloudFront (5 TB egress) ($770) Data transfer is the largest line item because 3D assets are bandwidth-intensive. Using CloudFront edge caching dramatically reduces direct S3/EC2 egress costs. This figure is reasonable given global distribution.

5. Application Load Balancers (2) ($70) Splitting web and app tiers ensures better security and routing. Two ALBs across multiple AZs cost ~$70/month — necessary for a production-grade platform.

# JUSTIFICATION CONTINUED

6. ElastiCache Redis ($130)

Caching is critical to reduce DynamoDB/Aurora load and speed up rendering. Two nodes for high availability and low latency is cost-effective.

7. OpenSearch ($330)

Full-text search across thousands of products requires a dedicated cluster. This price reflects a small production cluster with high availability.

8. DynamoDB ($40)

Session/cart data stored serverlessly. Pay-per-request pricing keeps this cost very low.

9. Miscellaneous Services ($140)

Lambda for event processing, SQS/SNS/EventBridge for decoupling, Cognito for authentication, CloudWatch + X-Ray + CloudTrail for observability — all cost pennies individually but total about $140/month

# OVERALL REASONABLENESS

**Production-grade:** This is not a hobby app but a global, 3D-intensive e-commerce platform.

**High availability & security built-in:** Multi-AZ Aurora, DynamoDB Global Tables, ALBs, CloudFront, Cognito MFA, WAF, Shield.

**Balanced cost:** We've used serverless where possible (Lambda, SQS), caching (ElastiCache), and Intelligent-Tiering (S3) to control costs.

**Cape Town region:** Prices are 10–15% higher than US/EU regions, but improve latency for African users and ensure data sovereignty.

# ELEVATOR SUMMARY

Requests first hit Route 53 for DNS resolution, then pass through CloudFront, which delivers content via a global CDN and enforces security rules through WAF. Cognito handles user authentication and access management. Two Application Load Balancers (ALBs) route traffic separately for web and application layers to auto-scaled EC2 instances, ensuring high availability and elastic scalability. Background processing runs on Lambda functions triggered via SQS and EventBridge, enabling serverless, event-driven workflows. S3 stores 3D assets, DynamoDB manages session and cart data, and Aurora (multi-AZ) handles orders and payments with strong consistency. Frequently accessed data is cached in Redis (ElastiCache), while OpenSearch powers fast search and discovery.

This architecture balances performance, reliability, and predictable scalability even in the Cape Town region, with a baseline cost of ~$1,950/month, which can be further optimized via reserved capacity, caching strategies, and asset compression.

# OPTIMIZATION TIPS

- Maximize CloudFront caching and use asset versioning to reduce data transfer and egress costs.
- Store static assets in S3 Intelligent-Tiering for automated cost-efficient storage.
- Leverage Reserved Instances or Savings Plans for EC2 and Aurora to lower predictable compute costs.
- Adopt serverless solutions (Lambda) for intermittent or burst workloads to avoid overprovisioning.
- Monitor and minimize data transfer, as it is a primary cost driver in the Cape Town region.

# THANKS