AWS Pricing Analysis: Product API System

Executive Summary

This document provides a comprehensive cost analysis for the Product API system, a serverless architecture built on AWS Lambda, API Gateway, and DynamoDB. The analysis includes multiple usage scenarios and detailed cost breakdowns for each service component.

Architecture Overview

The Product API system consists of: - **API Gateway**: REST API endpoints for product data access - **AWS Lambda**: Serverless compute for business logic (Node.js 18.x runtime) - **DynamoDB**: NoSQL database with on-demand billing - **Global Secondary Indexes**: Category and Brand indexes for efficient querying

Service Pricing Breakdown

1. AWS Lambda Pricing (US East 1)

Request Pricing: - $0.0000002 per request (all requests)

Compute Pricing (GB-Second): - Tier 1 (0-6B GB-seconds): $0.0000166667 per GB-second - Tier 2 (6B-15B GB-seconds): $0.0000150000 per GB-second
- Tier 3 (15B+ GB-seconds): $0.0000133334 per GB-second

Free Tier: - 1M requests per month (first 12 months) - 400,000 GB-seconds per month (first 12 months)

2. API Gateway Pricing (US East 1)

REST API Request Pricing: - First 333M requests/month: $3.50 per million requests ($0.0000035 per request) - Next 667M requests/month: $2.80 per million requests ($0.0000028 per request) - Next 19B requests/month: $2.38 per million requests ($0.0000023800 per request) - Over 20B requests/month: $1.51 per million requests ($0.0000015100 per request)

Free Tier: - 1M API calls per month (first 12 months)

3. DynamoDB Pricing (US East 1)

On-Demand Request Pricing: - Read Request Units: $0.125 per million RRUs ($0.0000001250 per RRU) - Write Request Units: $0.625 per million WRUs ($0.0000006250 per WRU)

Storage Pricing: - First 25 GB: Free - Beyond 25 GB: $0.25 per GB-month

Free Tier: - 25 GB storage per month (always free) - 2.5M read requests per month (first 12 months) - 1M write requests per month (first 12 months)

Usage Scenarios & Cost Analysis

Scenario 1: Low Usage (Development/Testing)

Monthly Usage: - API Requests: 50,000 - Lambda Invocations: 50,000 (512MB, 500ms avg) - DynamoDB: 40,000 reads, 10,000 writes - Storage: 5 GB

Cost Breakdown: - **API Gateway**: $0.00 (within free tier) - **Lambda**: $0.00 (within free tier) - **DynamoDB**: $0.00 (within free tier) - **Storage**: $0.00 (within free tier)

Total Monthly Cost: $0.00

Scenario 2: Medium Usage (Production - Moderate Traffic)

Monthly Usage: - API Requests: 2,000,000 - Lambda Invocations: 2,000,000 (512MB, 500ms avg) - DynamoDB: 1,600,000 reads, 400,000 writes - Storage: 50 GB

Cost Breakdown: - **API Gateway**: - 2M requests × $0.0000035 = $7.00 - **Lambda**: - Requests: 2M × $0.0000002 = $0.40 - Compute: 2M × 0.5GB × 0.5s = 500,000 GB-seconds × $0.0000166667 = $8.33 - Total Lambda: $8.73 - **DynamoDB**: - Reads: 1.6M × $0.0000001250 = $0.20 - Writes: 400K × $0.0000006250 = $0.25 - Storage: (50GB - 25GB) × $0.25 = $6.25 - Total DynamoDB: $6.70

Total Monthly Cost: $22.43

Scenario 3: High Usage (Production - Heavy Traffic)

Monthly Usage: - API Requests: 10,000,000 - Lambda Invocations: 10,000,000 (512MB, 500ms avg) - DynamoDB: 8,000,000 reads, 2,000,000 writes - Storage: 200 GB

Cost Breakdown: - **API Gateway**: - 10M requests × $0.0000035 = $35.00 - **Lambda**: - Requests: 10M × $0.0000002 = $2.00 - Compute: 10M × 0.5GB × 0.5s = 2.5M GB-seconds × $0.0000166667 = $41.67 - Total Lambda: $43.67 - **DynamoDB**: - Reads: 8M × $0.0000001250 = $1.00 - Writes: 2M × $0.0000006250 = $1.25 - Storage: (200GB - 25GB) × $0.25 = $43.75 - Total DynamoDB: $46.00

Total Monthly Cost: $124.67

Scenario 4: Enterprise Usage (High-Scale Production)

Monthly Usage: - API Requests: 50,000,000 - Lambda Invocations: 50,000,000 (512MB, 500ms avg) - DynamoDB: 40,000,000 reads, 10,000,000 writes - Storage: 1,000 GB

Cost Breakdown: - **API Gateway**: - 50M requests × $0.0000035 = $175.00 - **Lambda**: - Requests: 50M × $0.0000002 = $10.00 - Compute: 50M × 0.5GB × 0.5s = 12.5M GB-seconds × $0.0000166667 = $208.33 - Total Lambda: $218.33 - **DynamoDB**: - Reads: 40M × $0.0000001250 = $5.00 - Writes: 10M × $0.0000006250 = $6.25 - Storage: (1000GB - 25GB) × $0.25 = $243.75 - Total DynamoDB: $255.00

Total Monthly Cost: $648.33

Cost Optimization Recommendations

Immediate Optimizations

1. **Lambda Memory Optimization**: Test with different memory configurations (256MB, 1024MB) to find optimal price/performance ratio
2. **DynamoDB Query Optimization**: Implement efficient query patterns to minimize RRU/WRU consumption
3. **API Gateway Caching**: Enable caching (5-minute TTL as specified) to reduce Lambda invocations
4. **Batch Operations**: Implement batch read/write operations for DynamoDB to reduce request units

Long-term Optimizations

1. **Reserved Capacity**: Consider DynamoDB reserved capacity for predictable workloads (up to 53% savings)
2. **Lambda Provisioned Concurrency**: For consistent performance requirements (additional cost but predictable)
3. **Multi-Region Strategy**: Evaluate regional pricing differences for disaster recovery setup
4. **Data Archival**: Implement lifecycle policies for old product data using DynamoDB IA storage class

Monitoring and Alerting

1. **CloudWatch Billing Alarms**: Set up alerts at $25, $100, and $500 monthly spend
2. **Usage Metrics**: Monitor API Gateway throttling, Lambda duration, and DynamoDB consumed capacity
3. **Cost Anomaly Detection**: Enable AWS Cost Anomaly Detection for unexpected spend patterns

Assumptions and Exclusions

Assumptions

- All services deployed in US East (N. Virginia) region
- Standard ON DEMAND pricing model
- Lambda functions configured with 512MB memory

- Average Lambda execution time of 500ms
- DynamoDB on-demand billing mode
- No provisioned throughput or reserved instances
- Standard storage class for DynamoDB
- 80% read operations, 20% write operations for DynamoDB
- No cross-region data transfer costs

Exclusions

- Data transfer costs between regions
- CloudWatch Logs storage and analysis costs
- X-Ray tracing costs
- Development and maintenance costs
- Third-party monitoring tools
- SSL certificate costs (using AWS Certificate Manager free certificates)
- Route 53 DNS costs
- VPC costs (not applicable for serverless architecture)
- Support plan costs

Regional Pricing Considerations

While this analysis focuses on US East (N. Virginia), costs may vary in other regions: - **US West (Oregon)**: Typically 5-10% higher - **EU (Ireland)**: Typically 10-15% higher
- **Asia Pacific (Tokyo)**: Typically 15-25% higher

Conclusion

The Product API system offers excellent cost efficiency for serverless workloads: - **Development/Testing**: Essentially free within AWS Free Tier - **Production (Medium)**: ~$22/month for 2M requests - **Production (High)**: ~$125/month for 10M requests - **Enterprise Scale**: ~$648/month for 50M requests

The serverless architecture provides automatic scaling and pay-per-use pricing, making it cost-effective for variable workloads. Key cost drivers are API Gateway requests and DynamoDB storage, with optimization opportunities through caching and efficient data access patterns.

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Region: US East (N. Virginia)