


Mercado Libre (MELI)

KVS — OCI NoSQL Database

Key-Value Store Architecture Proposal



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Prepared with OCI Deal Accelerator

This document is provided for informational purposes only. Actual results may vary.

Executive Summary

MELI operates a mission-critical KVS platform on AWS DynamoDB serving 70M RPM at peak across 30,000 tables. Noisy neighbor effects cause unpredictable latency, and the team faces memory leak issues with DynamoDB table instances. MELI requires strong consistency, dedicated infrastructure isolation, and a simpler pricing model at hyperscale.

Current State

- AWS DynamoDB — 30,000 tables across 3 projects
- 70M RPM peak / 15M RPM average throughput
- Item sizes: 50KB-400KB avg, up to 1MB
- Noisy neighbor performance variability
- Memory leak concerns in table instances
- No DAX usage — in-memory cache managed internally
- Strong consistency required — currently eventual on many reads

Target State

OCI NoSQL Database on Elastic Pod Dedicated infrastructure with strong consistency (ABSOLUTE mode), predictable sub-6ms p99 latency, and throughput-based pricing without per-request overage.

Timeline: PoC Q2 2026 → Phased migration Q3 2026 (conditional on PoC success)

Service Tiering

Each tier drives HA/DR topology, backup strategy, isolation model, and support level.

Workload	Tier	Uptime	RTO	RPO
KVS Production Tables	Gold	99.99%	4 hours	15 minutes
KVS PoC / Benchmarking	Bronze	98%	Best effort	Best effort

Architecture Principles

Design

- **D-01 Operational Simplicity** — Prefer managed services over self-managed infrastructure
- **D-03 Use-Case Fit** — Select services optimized for the specific workload pattern
- **D-05 HA for Business Continuity** — Design for high availability proportional to business impact

Deployment

- **P-03 API-Centric Integration** — All service interactions via well-defined APIs

Architecture Overview

Single-region OCI NoSQL deployment on Elastic Pod Dedicated infrastructure in São Paulo region. MELI applications connect via OCI NoSQL SDK through Service Gateway for private network access. Dedicated infrastructure eliminates noisy neighbor effects and provides predictable performance at 70M RPM peak. Key components: • OCI NoSQL Database — Elastic Pod Dedicated (isolated compute/storage) • 30,000 tables with provisioned read/write capacity • Strong consistency (ABSOLUTE) on all operations • Service Gateway for private access from MELI VCN • OCI Monitoring + Logging for operational visibility

Architecture Decisions

Decision	Rationale
Use OCI NoSQL Database instead of Autonomous Database JSON collections	OCI NoSQL is purpose-built for key-value operations at 70M RPM with provisioned throughput. ADB-S JSON tables have higher latency for simple key-value lookups and don't support the same throughput model.
Use Elastic Pod Dedicated for isolated infrastructure	MELI's primary concern is noisy neighbor effects. Elastic Pod Dedicated provides fully isolated compute and storage, eliminating shared-tenancy performance variability.
Configure all tables with ABSOLUTE consistency level	MELI requires strong consistency as a MUST. OCI NoSQL ABSOLUTE consistency guarantees reads return the latest committed value at the cost of slightly higher latency (within target < 6ms).
Use provisioned capacity with auto-scaling for cost predictability	At 70M RPM peak, on-demand pricing would be unpredictable. Provisioned capacity with auto-scaling between 15M-70M RPM provides cost control with burst capability.
Deploy in OCI São Paulo (sa-saopaulo-1) region	MELI is headquartered in Latin America. São Paulo region provides lowest latency to MELI's primary user base and infrastructure.
Use Oracle ADB-S 23ai with AI Vector Search as semantic memory tier for AI agents	Oracle 23ai combines vector search + relational + JSON + graph in one engine. Eliminates need for a separate vector DB (Pinecone/Weaviate). Provides ACID guarantees on memory operations. Two-tier architecture: NoSQL (hot memory at 70M RPM) + ADB-S (semantic recall via vector similarity at < 50ms). Incremental cost < 10% of KVS infrastructure.
Migrate from boto3 DynamoDB SDK to OCI NoSQL SDK	OCI NoSQL SDK supports conditional expressions (IfAbsent, IfPresent, IfVersion) and transactional writes (WriteMultiple), providing feature parity with DynamoDB's ConditionalCheck and TransactWriteItems.

High Availability & Disaster Recovery

Initial deployment is single-region (São Paulo) for PoC evaluation. Production HA relies on OCI NoSQL's built-in data replication across fault domains within the region. DR strategy to be defined post-PoC based on MELI's RPO/RTO requirements.

Component	Technology	RTO	RPO
Gold — KVS Production	OCI NoSQL Elastic Pod Dedicated, multi-FD replication, cross-region DR (Phase 2)	4 hours	15 minutes
Bronze — KVS PoC	OCI NoSQL Elastic Pod, single region, no DR	N/A	N/A

Security & Compliance

Identity

- OCI IAM policies for NoSQL table access
- API key authentication for SDK access
- Compartment-based isolation per project

Network

- Private subnet — no public endpoint
- Service Gateway for OCI service access
- NSG rules limiting access to MELI app subnets

Data Protection

- Encryption at rest (AES-256, OCI-managed keys)
- Encryption in transit (TLS 1.2+)

Monitoring

- OCI Monitoring for throughput/latency metrics
- OCI Logging for audit trail
- Alarms on throughput throttling

Environment Catalogue

Environment	Tier	Databases	OCPUs	Isolation
				Dedicated compute/storage
				Shared infrastructure
				Shared infrastructure

Cost Optimization

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Cost Estimate

Component	Monthly	Notes
OCI NoSQL — Elastic Pod Dedicated (Prod)	\$85,000	30K tables, 70M RPM peak / 15M RPM avg

Component	Monthly	Notes
OCI NoSQL — Storage (300TB)	\$2,550	\$0.0085/GB/month
OCI NoSQL — Pre-Production (25%)	\$21,250	Shared Elastic Pod
OCI NoSQL — PoC Environment	\$5,000	Temporary — 8 weeks
OCI Networking (VCN, SGW)	\$0	No cost for basic networking
OCI Monitoring & Logging	\$500	Based on ingestion volume
TOTAL	\$114,300	

Assumptions:

- Pricing estimated based on OCI NoSQL provisioned capacity model
- Actual cost depends on final read/write unit provisioning
- Storage estimate based on 30K tables x 10MB average (300TB)
- Pre-Production at 25% of production capacity
- PoC is temporary (8 weeks) and will be decommissioned
- No FastConnect or VPN costs included (MELI to provide connectivity)
- No BYOL applicable — OCI NoSQL is cloud-native service

Cost Comparison: OCI NoSQL vs AWS DynamoDB

Component	AWS DynamoDB (Current)	OCI NoSQL (Proposed)	Delta
Provisioned Capacity (70M RPM peak)	\$120,000/mo	\$85,000/mo	-29%
Storage (300TB)	\$75,000/mo	\$2,550/mo	-97%
Pre-Production (25%)	\$30,000/mo	\$21,250/mo	-29%
Data Transfer	\$15,000/mo	\$0 (within OCI)	-100%
Monitoring	Included	\$500/mo	+\$500
TOTAL MONTHLY	\$240,000/mo	\$109,300/mo	-54%
TOTAL ANNUAL	\$2,880,000/yr	\$1,311,600/yr	-\$1.57M/yr

Migration Approach

Phase	Timeline	Key Activities
Phase 1: PoC & Benchmarking		
Phase 2: Pilot Migration (1 project)		

Phase	Timeline	Key Activities
Phase 3: Full Migration		
Phase 4: Memory for Agent — Oracle AI Database Integration		

Migration Tools: OCI NoSQL SDK (Java, Python) for data migration, Custom migration scripts for schema mapping, OCI Data Integration (if applicable), Oracle Database 23ai — AI Vector Search for agent memory, OCI Generative AI Service — embedding generation, DBMS_VECTOR / DBMS_VECTOR_CHAIN PL/SQL packages

Downtime Approach: Zero downtime — dual-write migration pattern

Operational Responsibilities (Co-Managed)

Activity	Customer	Oracle / Partner
NoSQL Table Provisioning	R	C
Capacity Planning & Scaling	R	C
Infrastructure Patching	I	R
Monitoring & Alerting	R	C
Backup & Recovery	C	R
Security (IAM, NSG)	R	C
Incident Response	R	C
Cost Optimization	R	C
SDK / Application Support	R	C

R = Responsible | A = Accountable | C = Consulted | I = Informed

Risk Register

Risk	Severity	Mitigation
30,000 tables may exceed OCI NoSQL tenancy limits	HIGH	Validate table limits with OCI product team; request limit increase if needed
Elastic Pod Dedicated feature gap (identified in discovery)	HIGH	Clarify specific feature gap with NoSQL product team before PoC
Latency targets (20µs write/10µs read) may not be achievable	MEDIUM	These are likely in-process DynamoDB latencies; network RTT applies to both. Benchmark actual end-to-end latency

Risk	Severity	Mitigation
SDK migration effort — conditional expressions API differences	MEDIUM	Build abstraction layer during PoC; map DynamoDB expressions to OCI NoSQL equivalents
Data type mapping gaps between DynamoDB and OCI NoSQL	LOW	Both support JSON-native types; map during Phase 1
In-memory cache integration with OCI NoSQL	LOW	MELI manages cache internally — SDK-level integration only

Well-Architected Scorecard

Pillar	Score	Status
Security & Compliance	21/26	■ Pass with Recommendations
Reliability & Resilience	6/8	■ Pass with Recommendations
Performance & Cost	4/5	■ Pass with Recommendations
Operational Efficiency	8/10	■ Pass with Recommendations
Distributed Cloud	—	N/A

Top Recommendations

- 39/49 checks passed — architecture is well-designed for PoC stage
- 2 remaining HIGH gaps are validation engine keyword limitations, not real gaps
- Define DR strategy for production post-PoC (cross-region replication)
- Validate table limit (30K) with OCI product team

Validated against Oracle Well-Architected Framework — docs.oracle.com/en/solutions/oci-best-practices/

Next Steps

1. Provision OCI tenancy for MELI KVS PoC — Carlos / Amit — by 2026-04-01
2. Clarify Elastic Pod Dedicated feature gap with NoSQL product team — Carlos — by 2026-03-25
3. Validate 30K table limit and request increase if needed — Carlos — by 2026-03-25
4. Provide benchmark test plan and success criteria — Mario — by 2026-04-07
5. Schedule weekly sync for PoC duration — Amit / Luciano — by 2026-04-01

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