

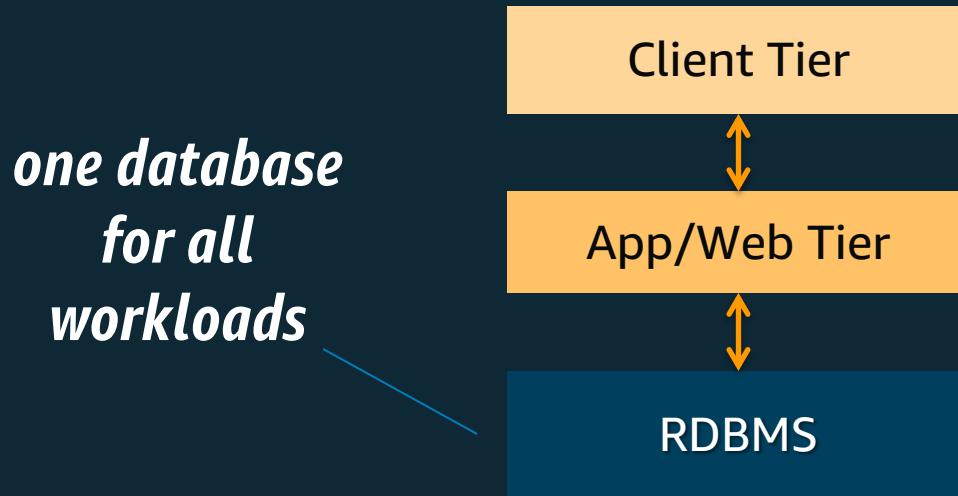


Solutions Architect Professional

Databases on AWS

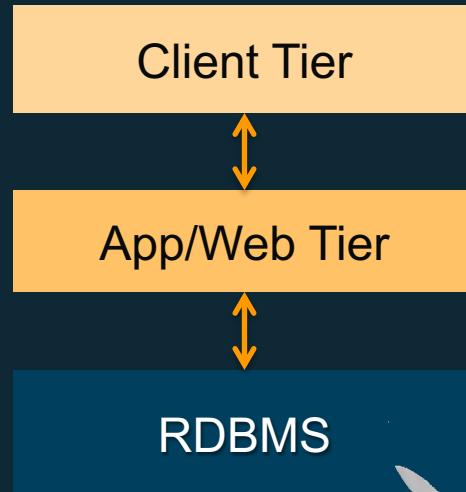


Traditional Database Architecture



Traditional Database Architecture

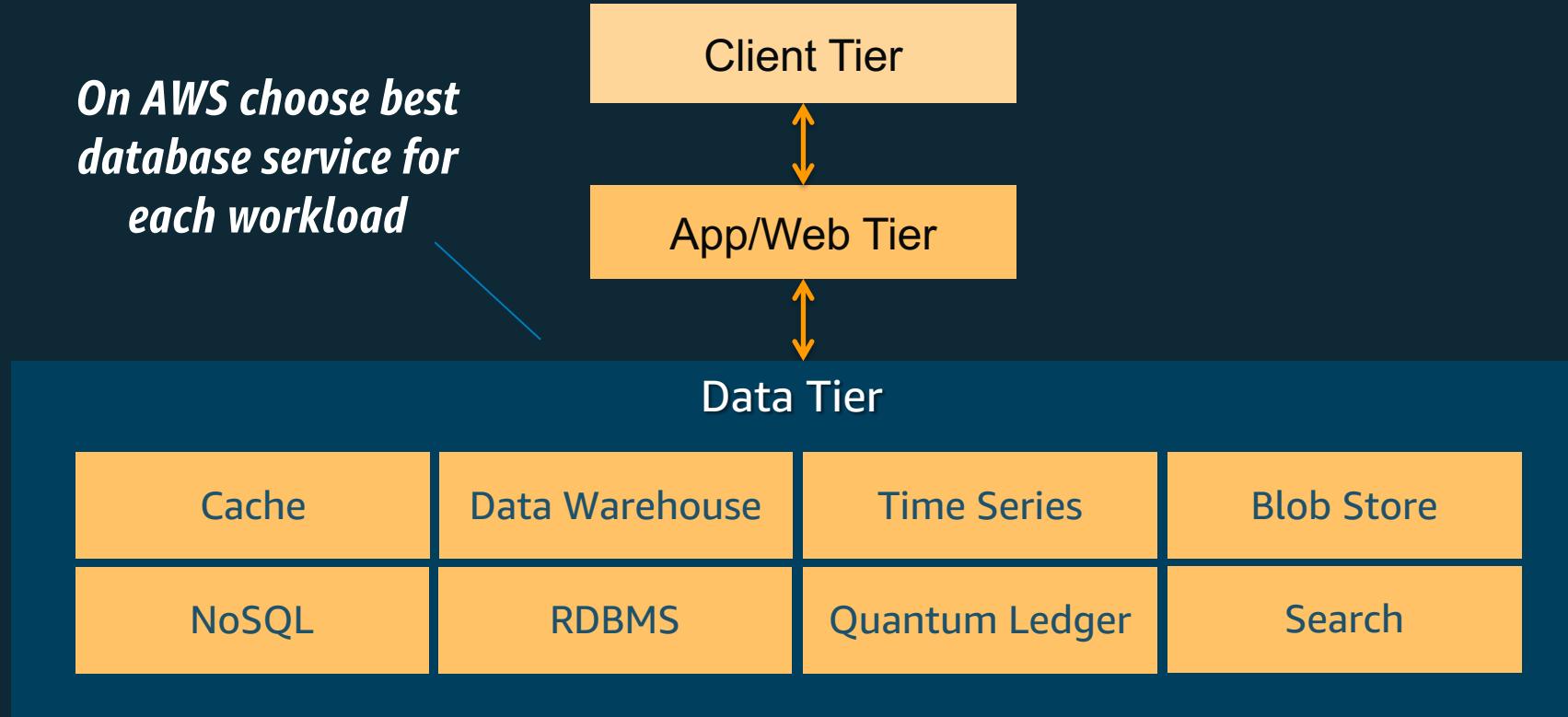
Key-value access
Complex queries
OLAP transactions
Analytics



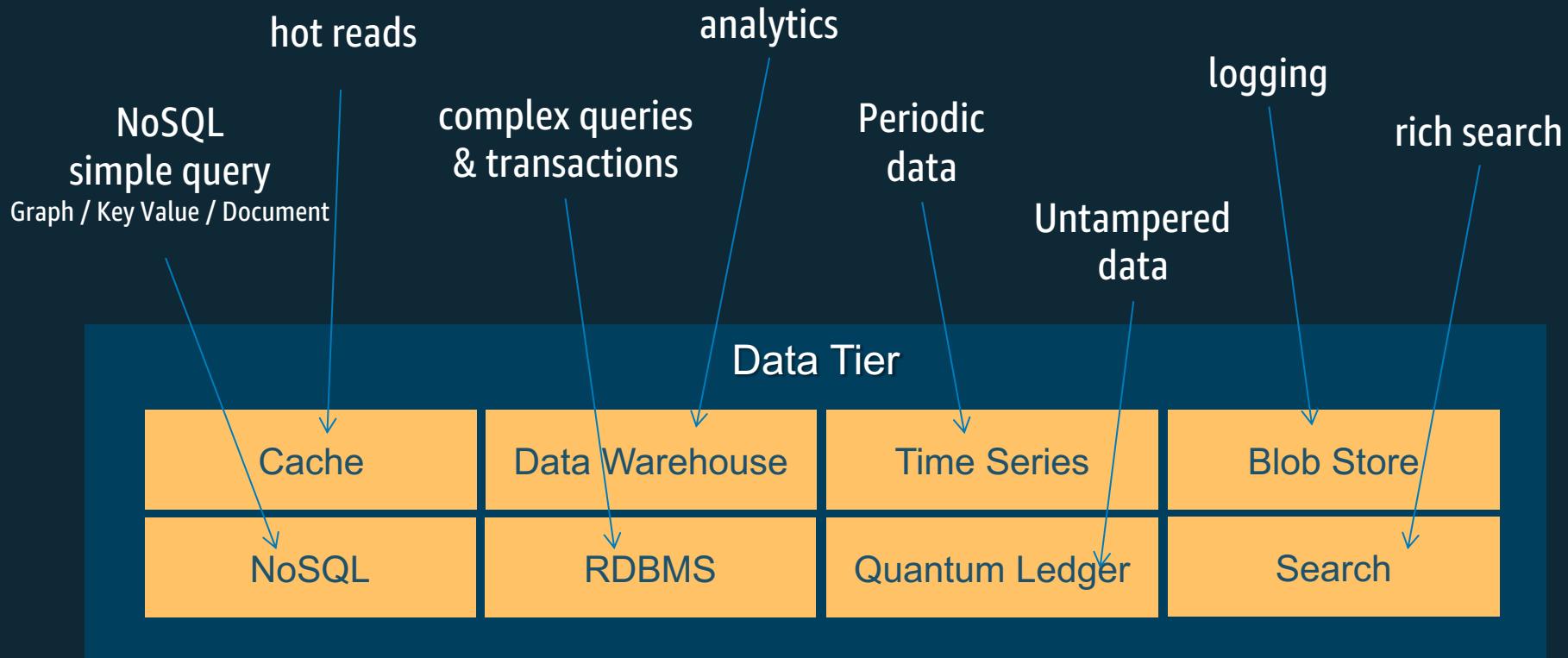
All forced into the relational database



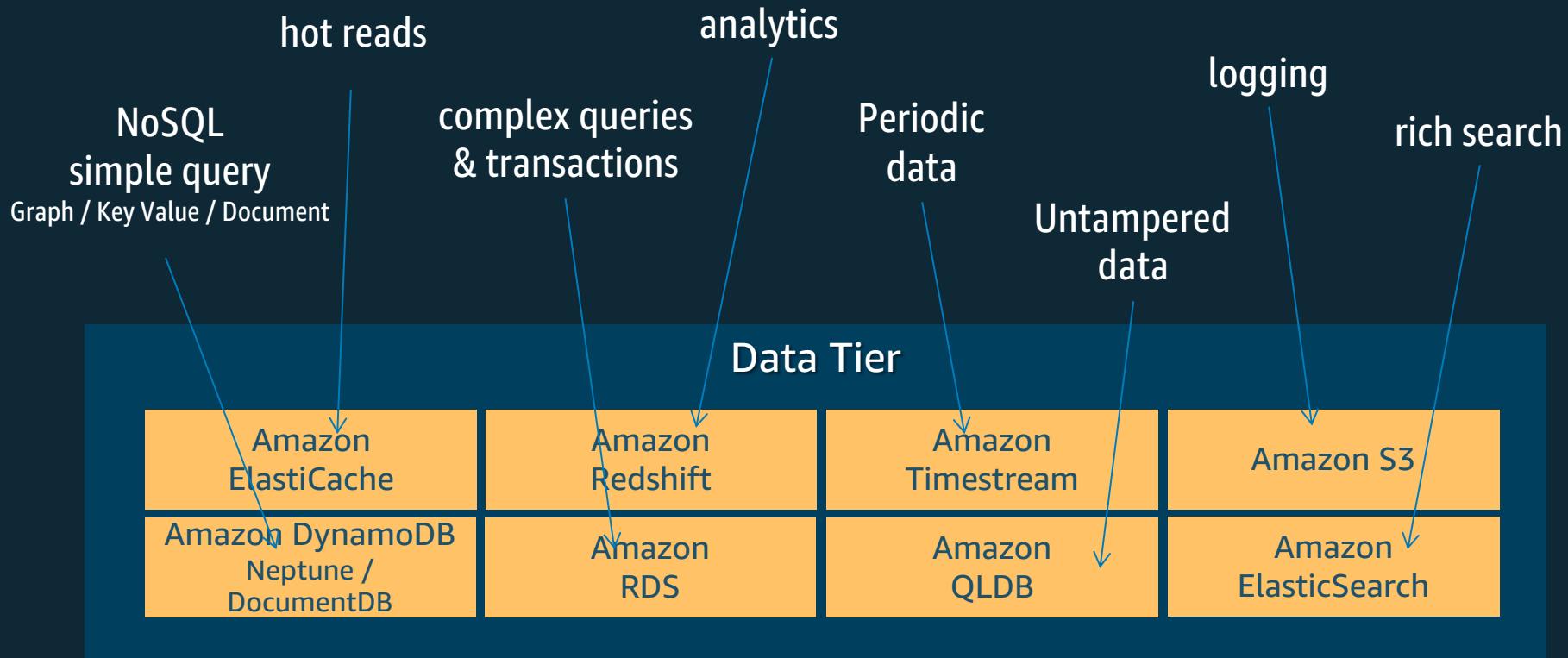
AWS Data Tier Architecture



Workload Driven Data Store Selection



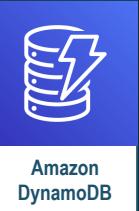
AWS Database Services for the Data Tier



AWS Database Services



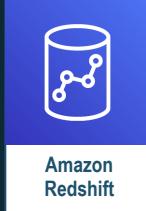
Managed Relational
Database Service



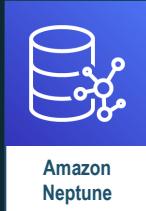
Fully Managed Key-
Value and
Document
Database



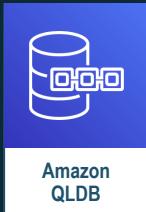
Fully Managed
Time Series
Database



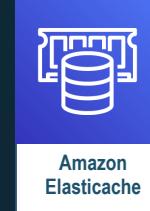
Petabyte-scale Data
Warehouse



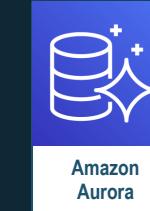
Fully Managed
Graph Database



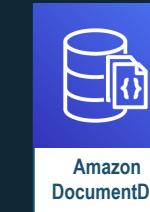
Fully Managed
Ledger Database



In-Memory Key
Value Store



Cloud-Native
Relational Database



MongoDB
Compatible
Document
Database

Amazon RDS

Managed relational database service with a choice of popular database engines

Amazon
Aurora



Microsoft SQL Server



Easy to administer

Easily deploy and maintain hardware, OS and DB software; built-in monitoring

Performant & scalable

Scale compute and storage with a few clicks; minimal downtime for your application

Available & durable

Automatic Multi-AZ data replication; automated backup, snapshots, and failover

Secure and compliant

Data encryption at rest and in transit; industry compliance and assurance programs

If you host your databases on-premises...

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



you

If you host your databases in Amazon EC2...

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



you

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



If you choose Amazon RDS...

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



you

Scaling

High availability

Database backups

DB s/w patches

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OS installation

Server maintenance

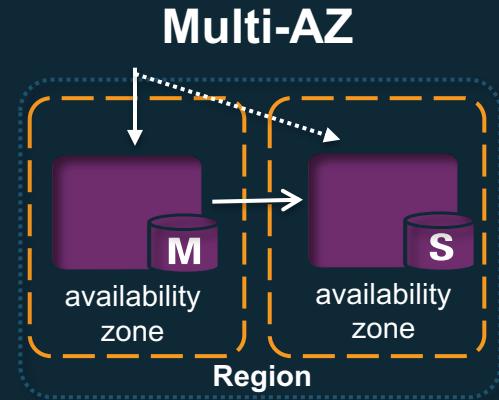
Rack & stack

Power, HVAC, net

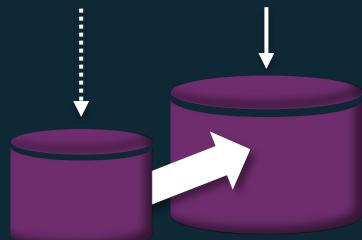


Key Amazon RDS Features

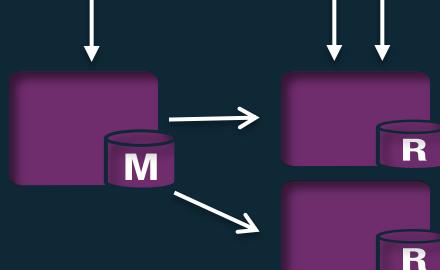
Amazon RDS Configuration	Improve Availability	Increase Throughput	Reduce Latency
Push-Button Scaling		✓	
Multi AZ	✓		
Read Replicas		✓	
Provisioned IOPS		✓	✓



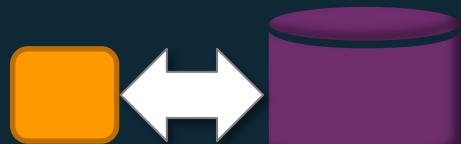
Push-Button Scaling



Read Replicas



Provisioned IOPS



Amazon Aurora

MySQL and PostgreSQL compatible relational database built for the cloud

Performance and availability of commercial-grade databases at 1/10th the cost



Performance & scalability

5x throughput of standard MySQL and 3x of standard PostgreSQL; scale-out up to 15 read replicas



Availability & durability

Fault-tolerant, self-healing storage; six copies of data across three AZs; continuous backup to S3



Highly secure

Network isolation, encryption at rest/transit

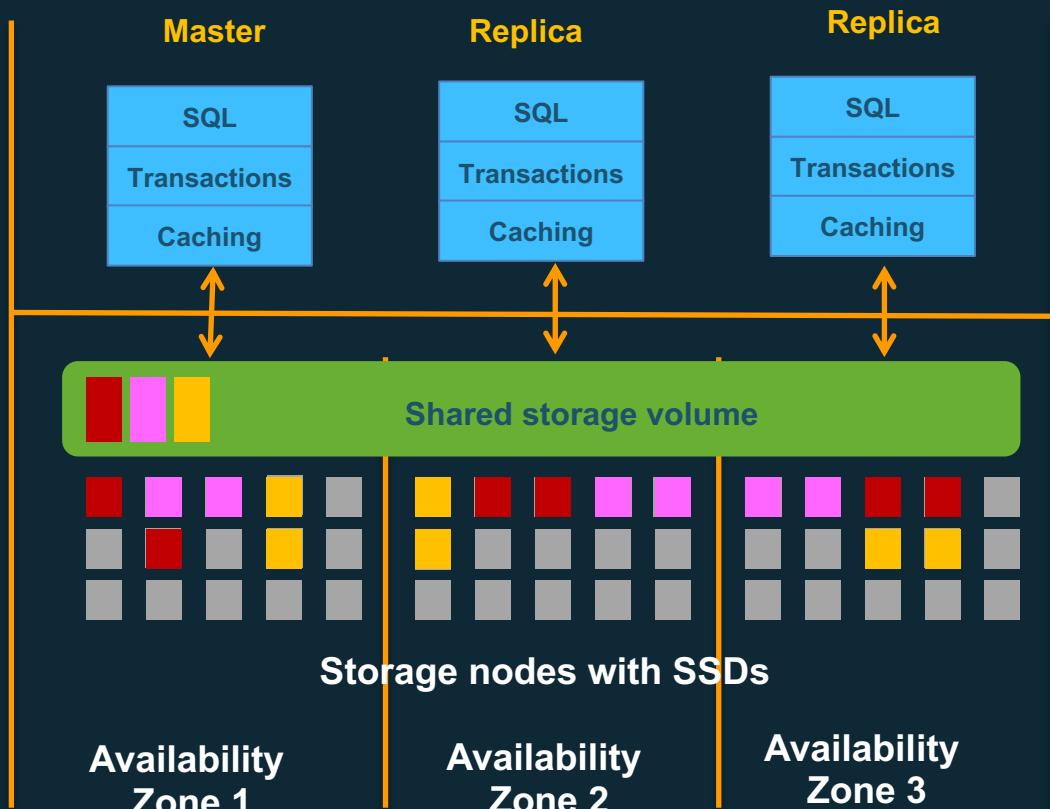


Fully managed

Managed by RDS: no hardware provisioning, software patching, setup, configuration, or backups

Scale-out, distributed, multi-tenant architecture

- Purpose-built log-structured distributed storage system designed for databases
- Storage volume is striped across hundreds of storage nodes distributed over 3 different Availability Zones
- Six copies of data, two copies in each Availability Zone to protect against AZ+1 failures
- Master and replicas all point to the same storage



Everything you get from Amazon RDS...

Managed
by you

- App optimization
- Scaling
- High availability
- Database backups
- DB software patches
- DB software installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
- Power, HVAC, net

Database on-premises

- App optimization
- Scaling
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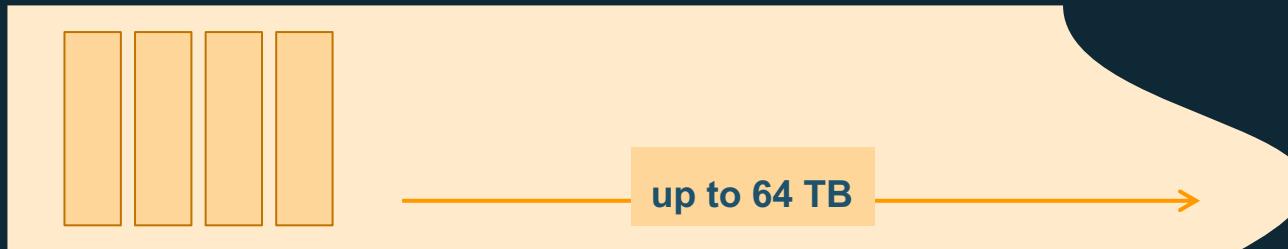
Database on EC2

- App optimization
- Scaling
- High availability
- Database backups
- DB software patches
- DB software installs
- OS patches
- OS installation
- Server maintenance
- Rack and stack
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Amazon RDS

Managed
by AWS

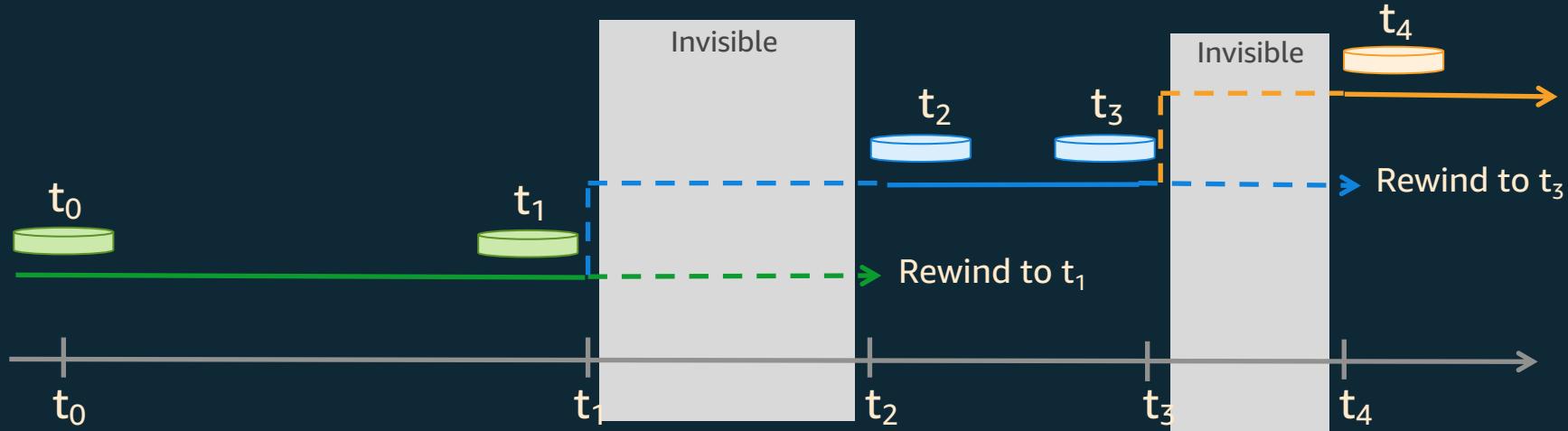
...and more



Up to 64TB of storage – auto-incremented in 10GB units

- Automatic storage scaling up to 64 TB—no performance impact
- Continuous, incremental backups to Amazon S3
- Instantly create user snapshots—no performance impact
- Automatic restriping, mirror repair, hot spot management, encryption

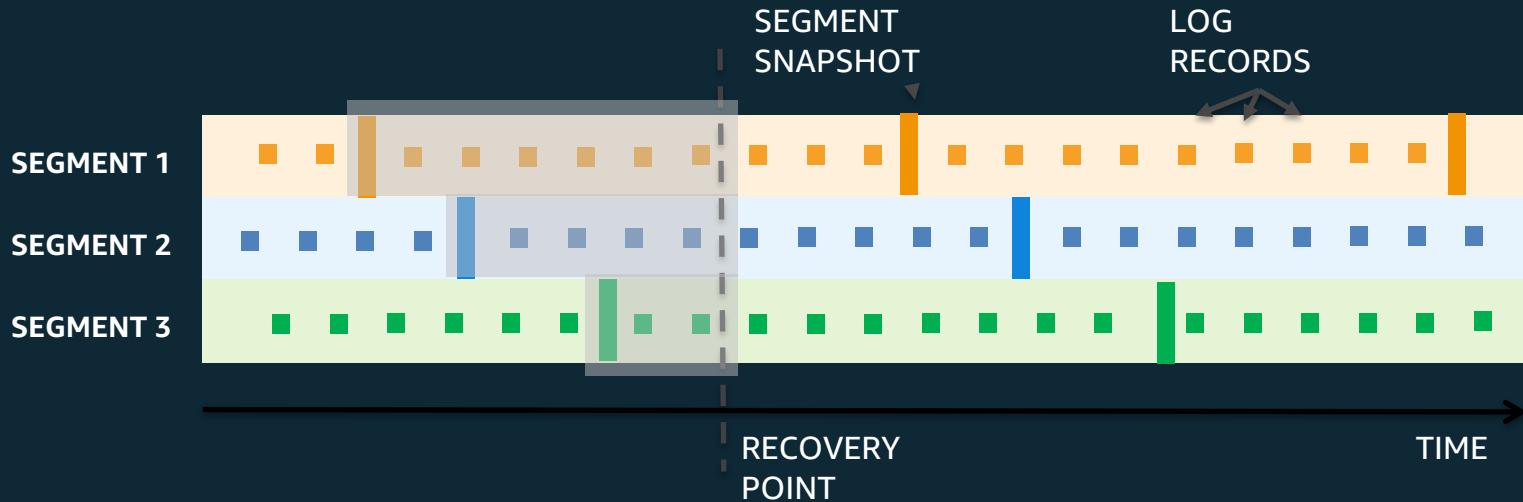
Database backtrack



Backtrack brings the database to a point in time without requiring restore from backups

- Backtracking from an unintentional DML or DDL operation
- Backtrack is not destructive. You can backtrack multiple times to find the right point in time

How does backtrack work?



We keep periodic snapshot of each segment; we also preserve the redo logs
For backtrack, we identify the appropriate segment snapshots
Apply log streams to segment snapshots in parallel and asynchronously

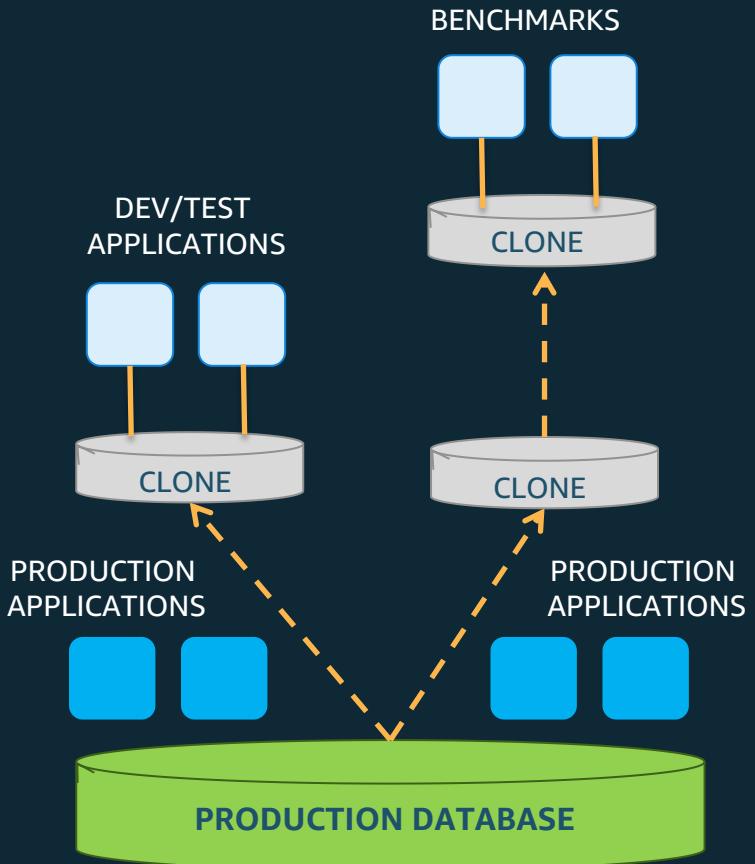
Fast database cloning

Clone database without copying data

- Creation of a clone is nearly instantaneous
- Data copy happens only on write – when original and cloned volume data differ

Example use cases

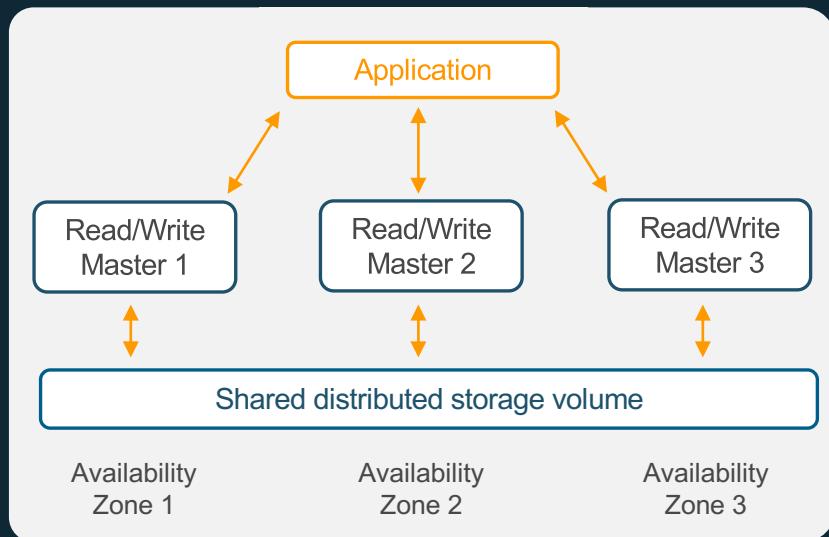
- Clone a production DB to run tests
- Reorganize a database
- Save a point in time snapshot for analysis without impacting production system.



Aurora Multi-Master

First relational database service with scale-out reads and writes across multiple data centers

Scale out both reads **and writes**



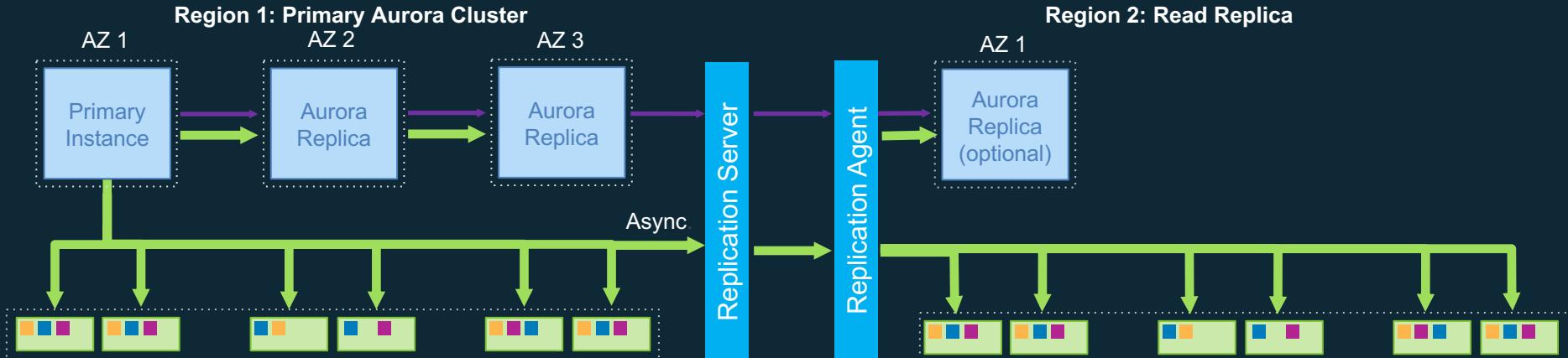
Zero application downtime from ANY instance failure

Zero application downtime from ANY AZ failure

Faster write performance and higher scale

Sign up for single-region multi-master preview today;
multi-region multi-master **coming in 2019**

Global database – physical replication

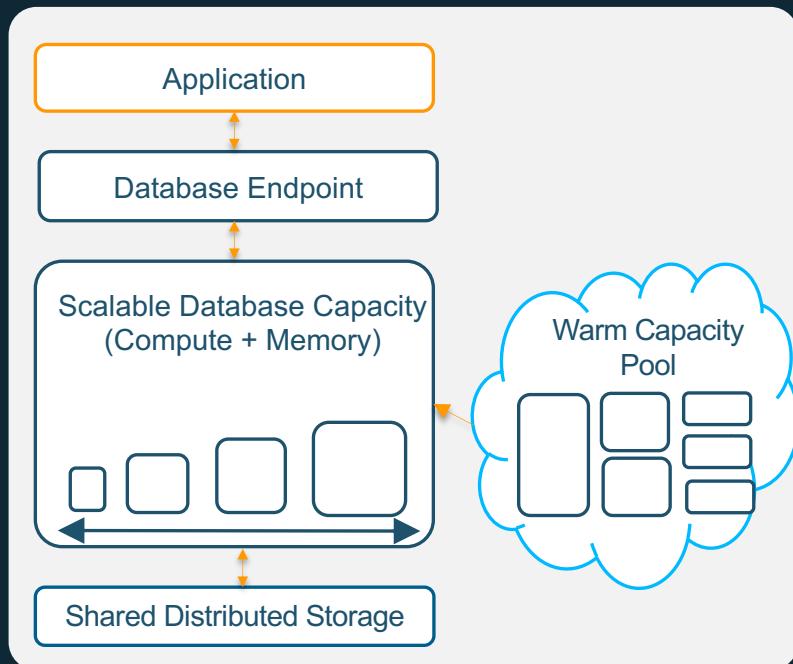


Consistently fast, low-lag, high-performance replication for global relational databases

- Global-scale replication in seconds or less
- Dedicated replication infrastructure ensures unconstrained performance
- Local reads, faster recovery, tighter DR objectives, and seamless cross-region migration

Aurora Serverless

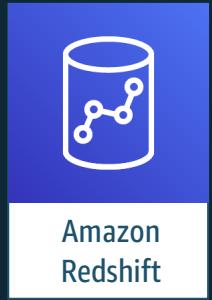
On-demand, auto-scaling database for applications with variable workloads



Starts up on demand, shuts down when not in use

Automatically scales with no instances to manage

Pay per second for the database capacity you use



*for as low as
\$934/TB per year*

Petabyte scale

Massively parallel

Columnar Store

Relational data warehouse

Fully managed = no admin

Redshift cluster architecture

Massively parallel, shared nothing architecture

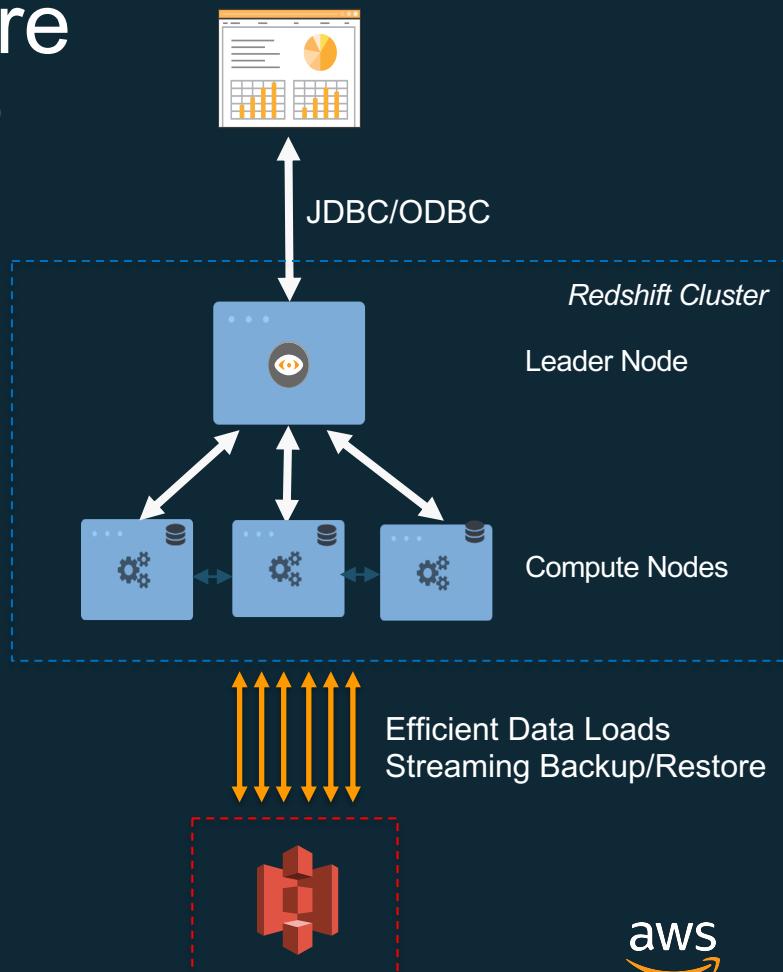
Streaming Backup/Restore from S3

Leader node

- SQL endpoint
- Stores metadata
- Coordinates parallel SQL processing

Compute nodes

- Local, columnar storage
- Executes queries in parallel
- Load, backup, restore
- 2, 16, or 32 slices

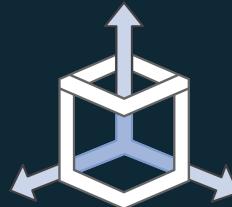


Redshift Spectrum

Run SQL queries directly against data in S3 using thousands of nodes



High concurrency: Multiple clusters access same data



No ETL: Query data in-place using open file formats



Full Amazon Redshift SQL support



Fast at exabyte scale



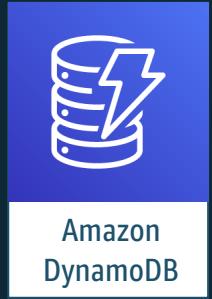
Elastic and highly available



On-demand, pay-per-query

Highlights

- Redshift is a managed data warehouse intended for analytics workloads
- Patching, backup/restore, and resize are fully managed by the service
- It uses a distributed, massively parallel architecture that scales horizontally to meet throughput requirements
- Redshift uses a c-store architecture, but still supports ANSI SQL including Transactions and Foreign Keys
- You can implement any type of data model on Redshift, but some types of data models scale better than others
- Redshift is extremely cost effective, and can offer similar performance for 1/10th the cost of Oracle, Teradata, or Netezza (as low as \$1000/TB)



NoSQL database

Seamless scalability

Zero admin

Single-digit millisecond latency

Multi-Master

Multi-Region

Highly available and durable



Backup and restore

The only cloud database to provide on-demand and continuous backups



On-demand
backups for long-
term data archival
and compliance



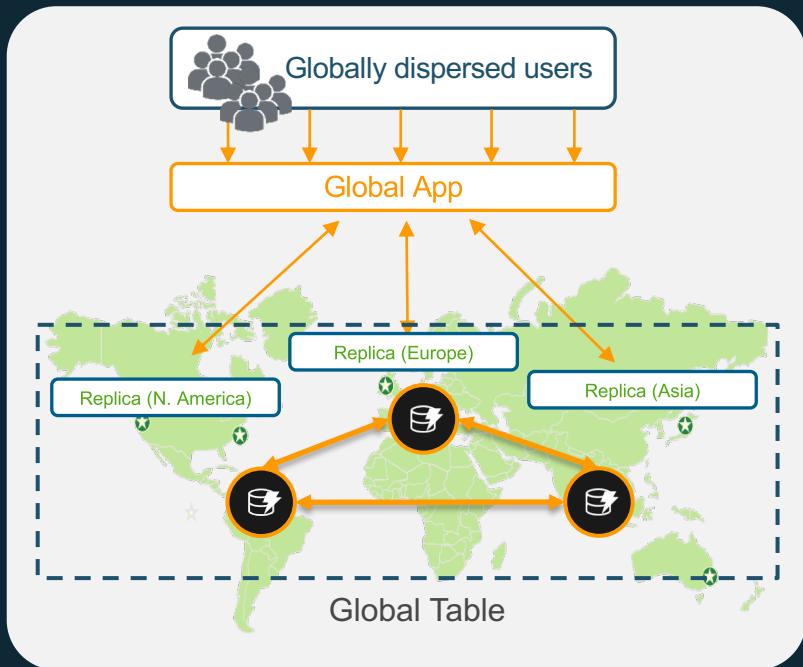
Point in time restore
for short term
retention and data
corruption protection
(35 days)



Point in time recovery with
restore times in a few hours
depending on table size

Global Tables

The first fully-managed, multi-master, multi-region database



Build high performance, globally distributed applications

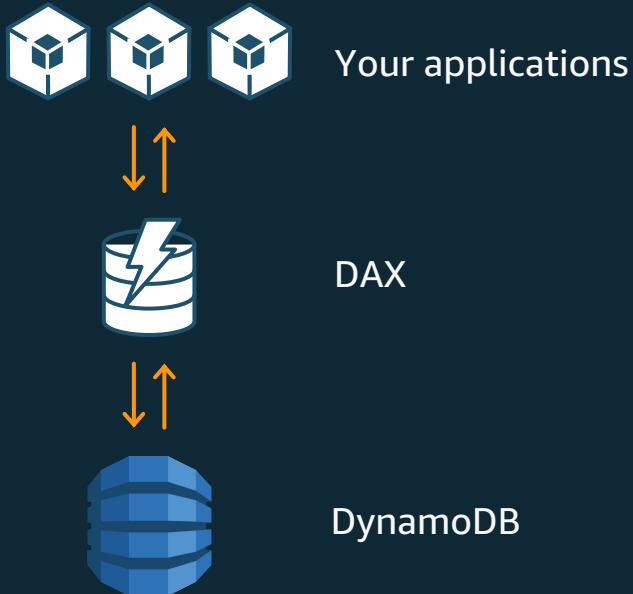
Low latency reads & writes to locally available tables

Disaster proof with multi-region redundancy

Easy to setup and no application re-writes required

DynamoDB Accelerator (DAX)

High performance



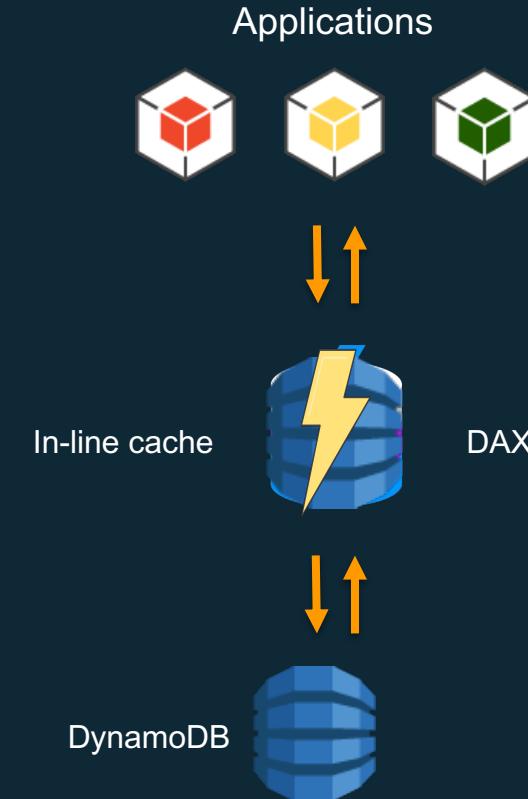
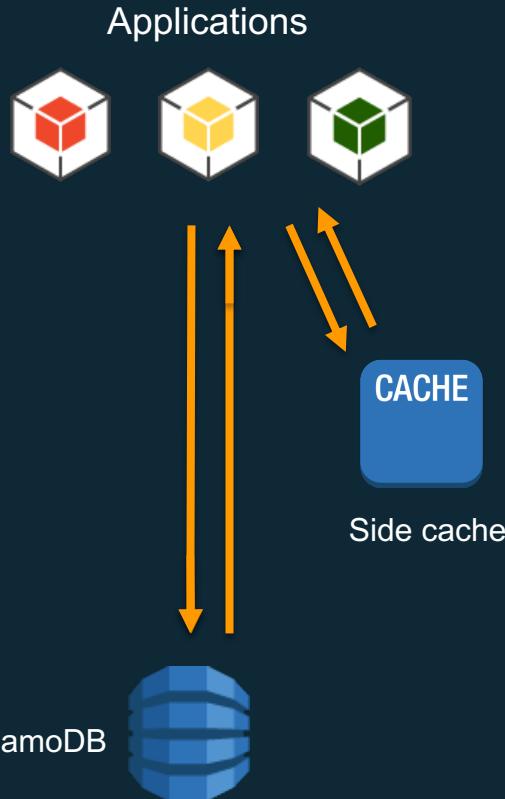
Fully managed, highly available cache for DynamoDB

Even faster—microsecond latency

Scales to millions of requests per second

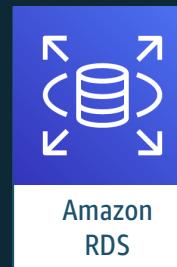
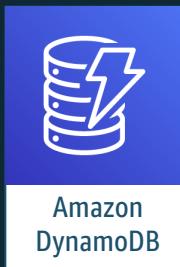
API compatible

Traditional cache vs. DAX



NoSQL vs. SQL for a new app: how to choose?

- Want simplest possible DB management?
 - Want app to manage DB integrity?
 - Focus on performance and availability at any scale
- Need joins, transactions, frequent table scans?
 - Want DB engine to manage DB integrity?
 - Team has SQL skills?



μs is the new ***ms***

Amazon ElastiCache

Fully-managed, Redis or Memcached compatible, low-latency, in-memory data store



Extreme Performance

In-memory data store and cache for sub-millisecond response times



Fully Managed

AWS manages all hardware and software setup, configuration, monitoring



Easily Scalable

Read scaling with replicas. Write and memory scaling with sharding. Non disruptive scaling

ElastiCache Redis

#1 Key-Value Store*

Fast in-memory data store in the cloud. Use as a database, cache, message broker, queue

Fully Managed & Hardened

AWS manages hardware, software, setup, configuration, monitoring, failure recovery, and backups

Secure & Compliant

VPC for cluster isolation, encryption at rest/transit, HIPAA compliance

Highly Available & Reliable

Read replicas, multiple primaries, multi-AZ with automatic failover

Easily Scalable

Cluster with up to 6.1 TiB of in-memory data

Read scaling with replicas

Write and memory scaling with sharding

Scale out or in

ElastiCache Memcached



Fully Managed Memcached

Fast in-memory data store in the cloud. Use as a cache to reduce latency and improve throughput

Secure & Hardened

VPC for cluster isolation

Easily Scalable

Sharding to scale in-memory cache with up to 20 nodes and 8.14 TiB per cluster

Choosing between Redis and Memcached

	Memcached	Redis
Sub-millisecond latency	Yes	Yes
Developer ease of use	Yes	Yes
Data partitioning	Yes	Yes
Support for a broad set of programming languages	Yes	Yes
Advanced data structures	-	Yes
Multithreaded architecture	Yes	-
Snapshots	-	Yes
Replication	-	Yes
Transactions	-	Yes
Pub/Sub	-	Yes
Lua scripting	-	Yes
Geospatial support	-	Yes

When to use ElastiCache vs DAX?

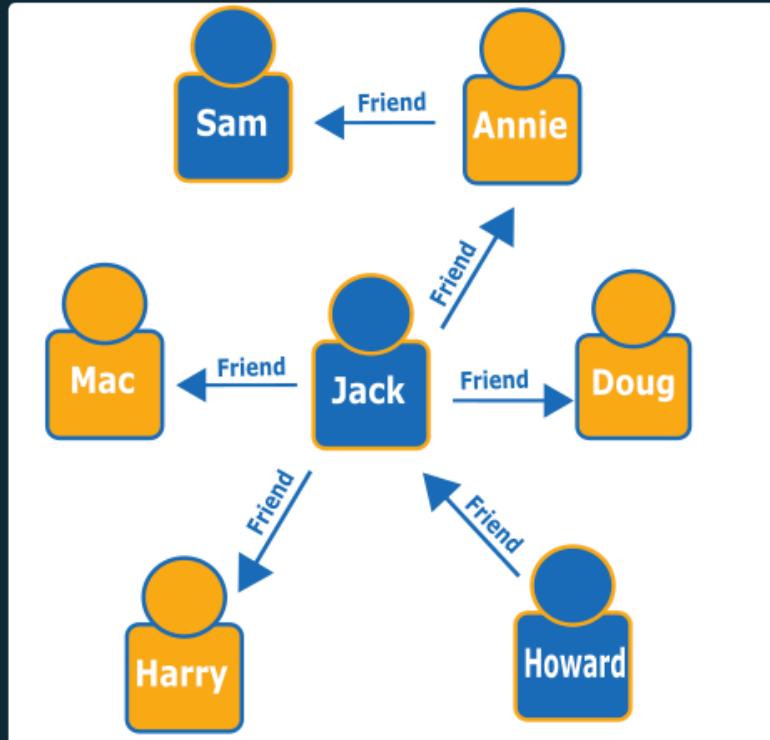
ElastiCache	DAX
Redis/Memcached Open Source	Easy Cache compatible with DynamoDB API
Cache Compatible with all Databases	DynamoDB only
6+ TiB (6000+ GiB)	488 Gib (vertically scaled)
200+ Commands	Get, Put, Update, Query, Scan
Data Structures (String, Lists, Sets, Sorted Sets, Hashes, Bit Arrays, HyperLogLogs)	DynamoDB Data Types
Advanced Eviction Policies No Eviction, allkeys-lru, volatile-lru, allkeys-random, volatile-random, volatile-ttl	Time-to-Live Cache (TTL), Least Recently Used (LRU), Write-Through Eviction
More Control on Cache Content	Plug & Play Cache
Durability (RoadMap 2018)	Durability with DynamoDB
Cost for Cache (cheaper)	Cost for Cache (more expensive)



Fully managed graph database
Supports open graph APIs
Scalable
ACID compliant
Multi-AZ

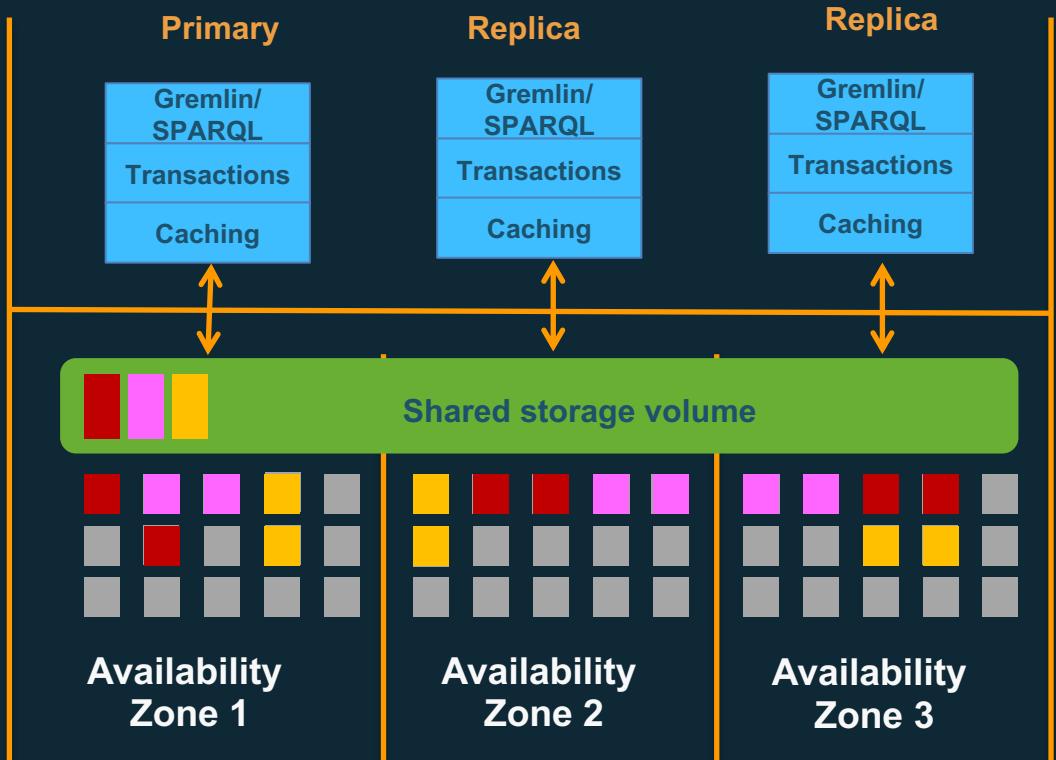
Use cases for highly connected data

- Social networking
- Recommendations
- Knowledge graphs
- Fraud detection
- Life sciences
- Network and IT operations



Distributed storage architecture

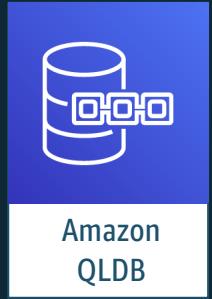
- Performance, availability, durability
- Scale-out replica architecture
- Shared storage volume with 10 GB segments striped across hundreds of nodes
- Data is replicated 6 times across 3 AZs
- Hotspot rebalance, fast database recovery
- Log applicator embedded in storage layer
 - Ship only the log
 - Less work on engine
 - Minimizes network traffic



Delivered as a managed service

Fully managed service

- Easily configurable via the console
- Multi-AZ high availability
- Up to 15 read replicas
- Supports encryption at rest
- Supports encryption in transit (TLS)
- Backup and restore, point-in-time recovery



Fully managed ledger database
Immutable and transparent
Cryptographically verifiable
Scalable
Serverless

Common use cases



Banking & Finance

Keeping track of transactions, trades and accounts



E-Commerce

Where's my stuff?



Transport & Logistics

Tracking transportation of goods



HR & Payroll

Tracking changes to an individual's profile



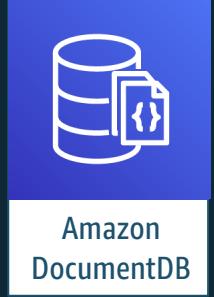
Manufacturing

Recording components used in manufacturing



Government

Tracking vehicle title history



Fully managed document database
MongoDB-compatible
Multi-AZ
Performance at scale

Why use a document database?

The JSON document model maps naturally to application data



Each document can have a different data structure and is independent of other documents



Index on any key in a document, and run ad hoc and aggregation queries across your data set



Use cases for document databases



Content
Management



Mobile



Personalization



Catalog



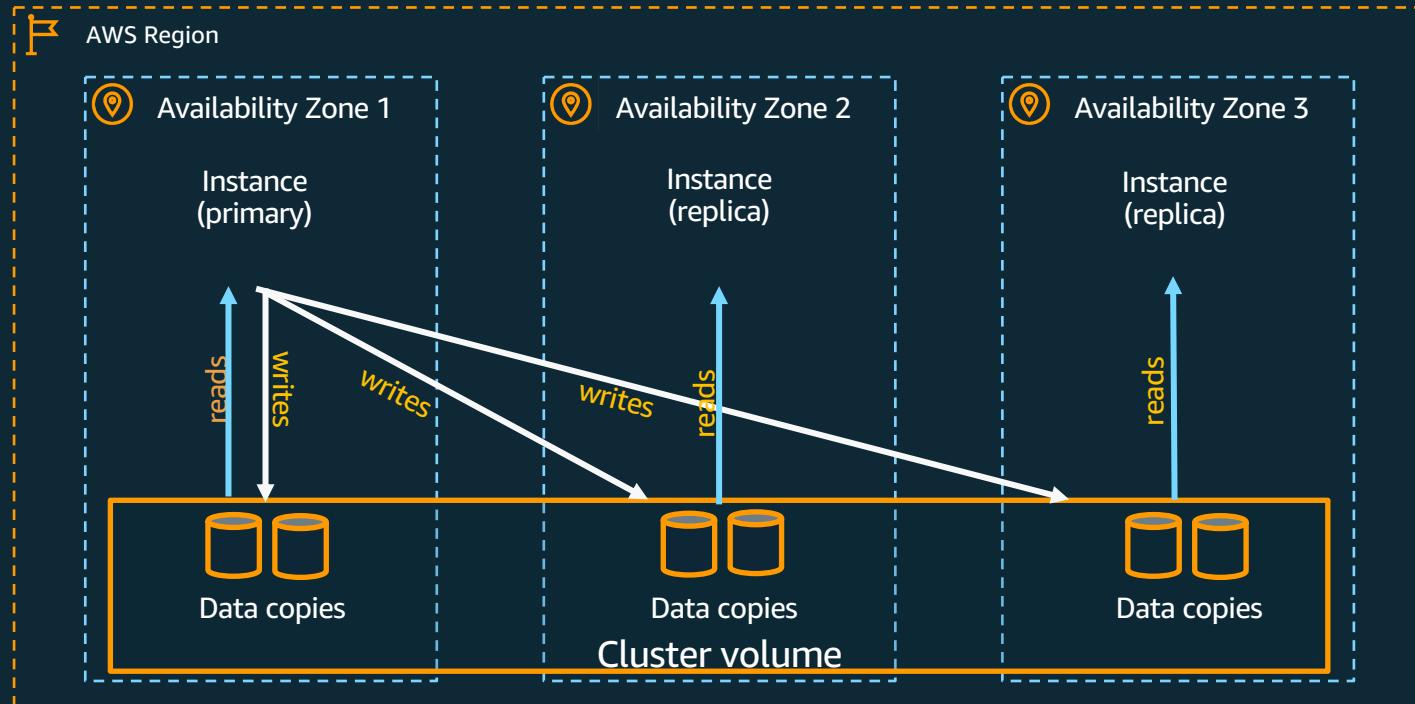
Retail and
Marketing



User profiles

DocumentDB Architecture

Separate compute and storage provide 2x throughput of current MongoDB managed services



Database Migration Service & Schema Conversion Tool

AWS Database Migration Service (DMS) easily and securely migrates and/or replicate your databases *and* data warehouses to AWS



AWS Schema Conversion Tool (SCT) converts your commercial database and data warehouse schemas to open-source engines or AWS-native services, such as Amazon Aurora and Redshift



Modernize



Migrate



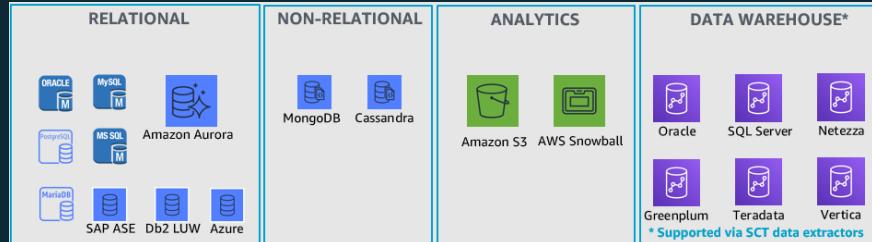
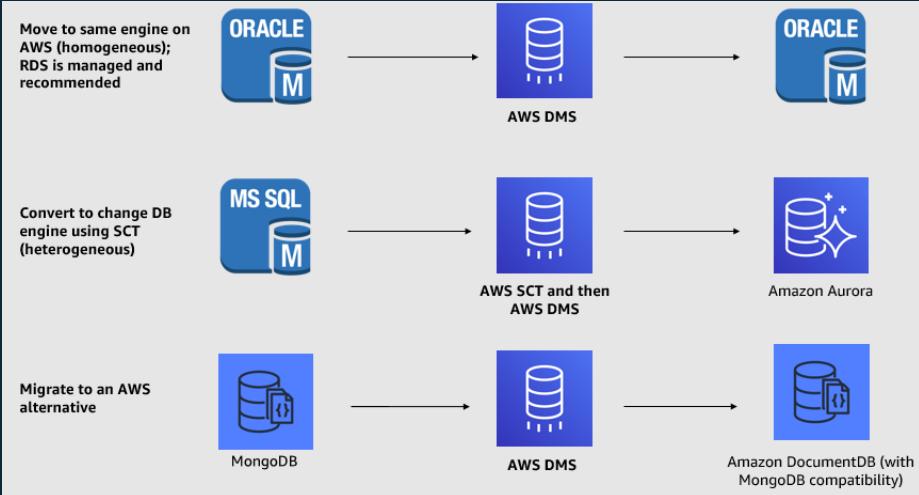
Replicate



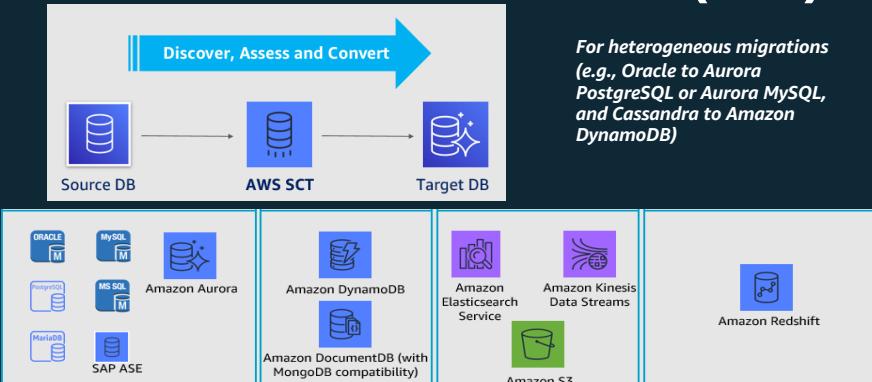
Flexible, powerful migration tooling

Most sources and targets, higher conversion automation

Database Migration Service (DMS)



Schema Conversion Tool (SCT)



AWS database services

Purpose-built databases, the right tool for the right job

Relational



Aurora

MySQL



PostgreSQL



RDS

MySQL



PostgreSQL



MariaDB

ORACLE



Microsoft SQL Server

Non-relational



DynamoDB

Key value



ElastiCache

In-memory



Neptune

Graph



DocumentDB

Document



Timestream

Time series



QLDB

Ledger



Database Migration Service