
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

DAT217

Modernize apps with purpose-built databases, featuring Liberty Mutual

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PARTICIPATE IN SESSION POLLS ON YOUR MOBILE DEVICE

POLL: How many times have you attended re:Invent previously?



- 0: First-timer
- 1–2: Happy to be back
- 3–5: Frequent guest
- 5+: Expert re:Invent attendee

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Agenda

- Key attributes of modern database applications and modern database architecture
- Liberty Mutual’s database evolution
- Database modernization playbooks
- Typical modernization journey with purpose-built databases

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Key attributes of modern applications



Designed for
innovation
&
agility



Without limits on
performance
&
scalability



Is
highly available,
easily managed
&
cost-effective

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POLL: Do you currently have application modernization projects underway?

- Yes
- No
- Already completed

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Modern data architecture

From traditional . . .

Web servers

Presentation layers

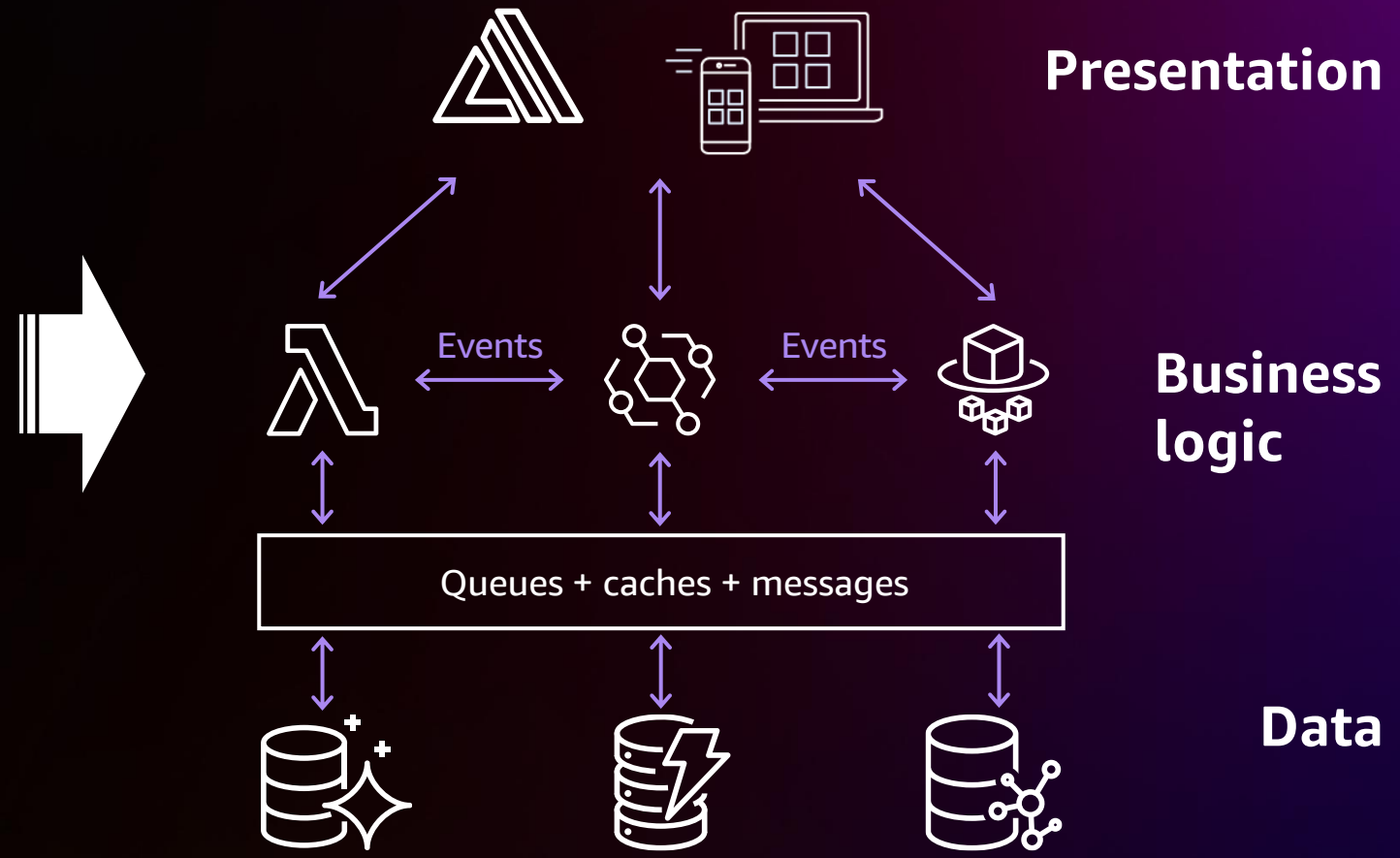
Application servers

Business logic

Database servers

Data layer

. . . to microservices, decoupled architectures



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Liberty Mutual story

About Liberty Mutual

Evolution of our database strategy

Wins and challenges

What we've learned

Next steps



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About Liberty Mutual Insurance

Liberty Mutual INSURANCE

Our purpose: We exist to help people embrace today and confidently pursue tomorrow.

Our promise: We promise protection for the unexpected, delivered with care.

$43.8 billion annual consolidated revenue

#71 on Fortune 100 List

Nearly **45,000** employees

6th largest global P&C insurer

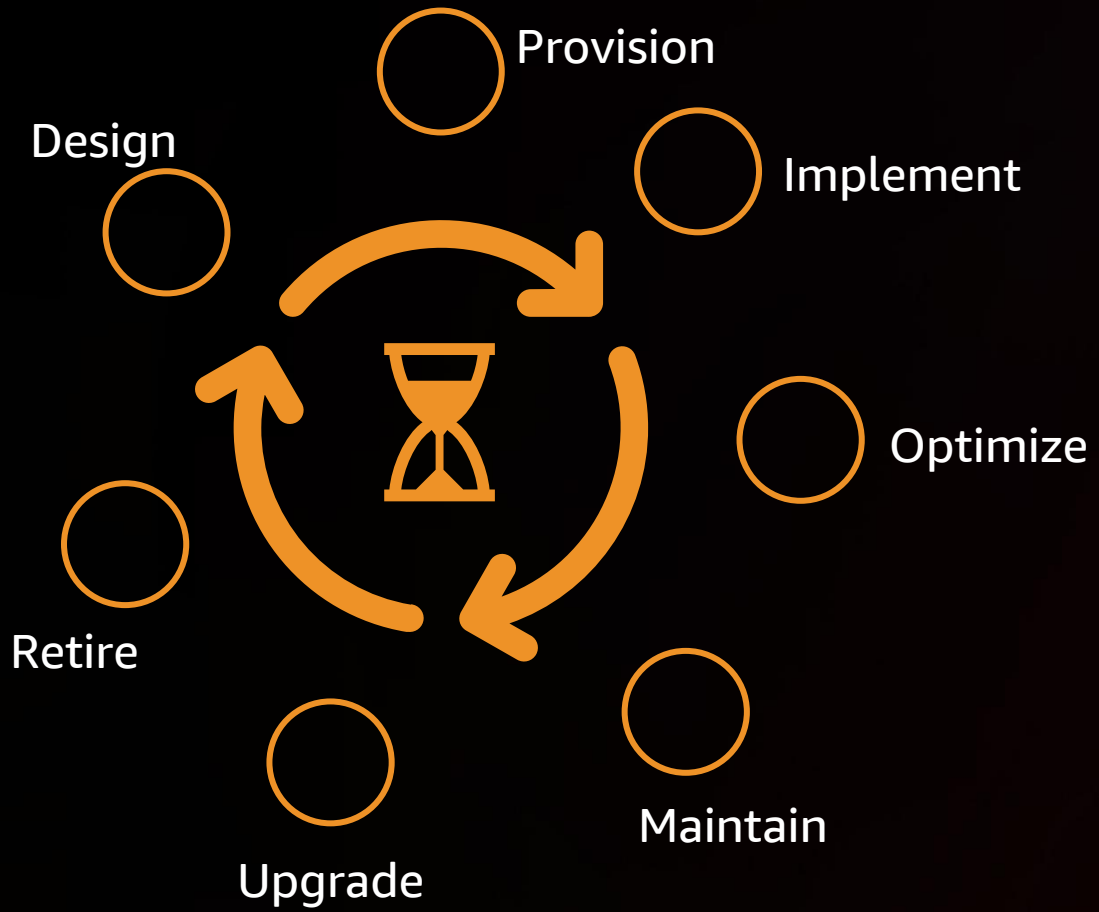
29 countries & economies globally

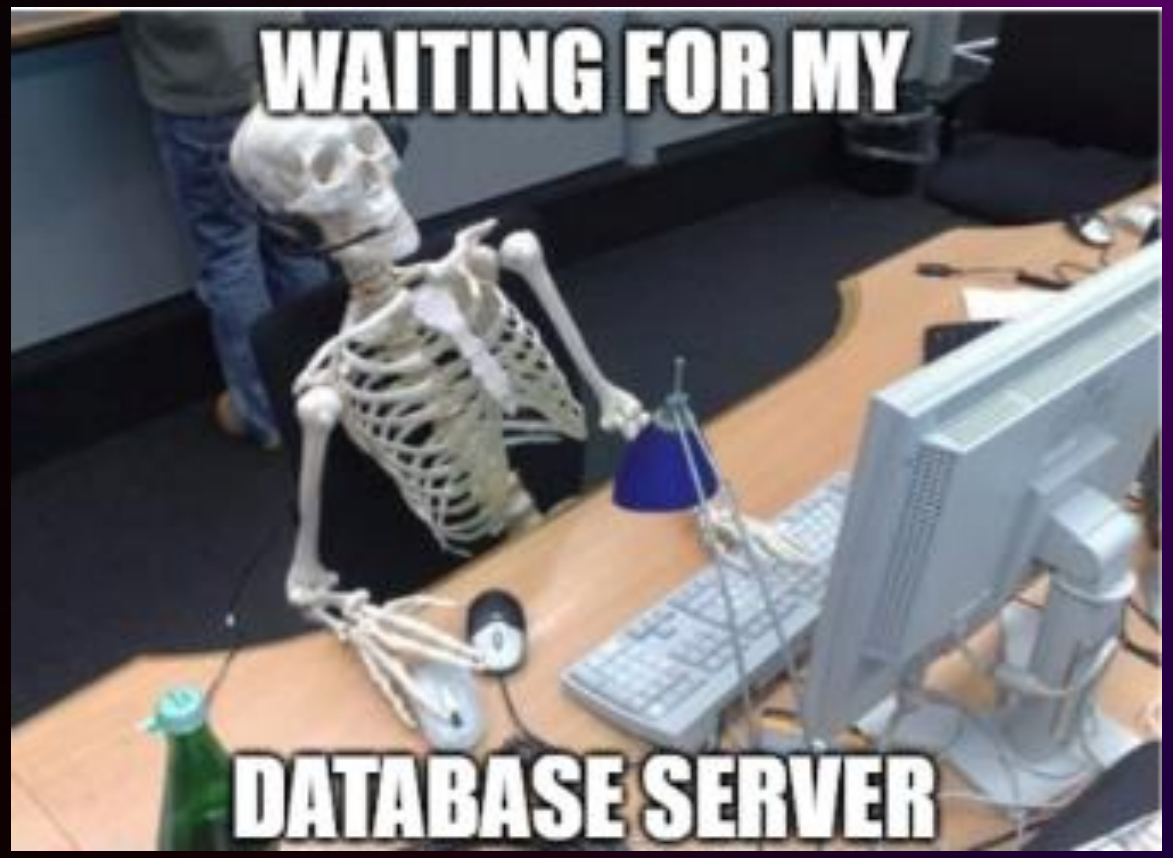
5,000+ technology employees

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Evolution of our database strategy





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Our journey





Physical servers
~4 Months

Virtual servers
~2-4 Weeks

Database as a service
~2-4 Days

AWS IaaS
~2-4 Days

Amazon RDS
~20 Minutes

Enterprise patterns
~20 Minutes

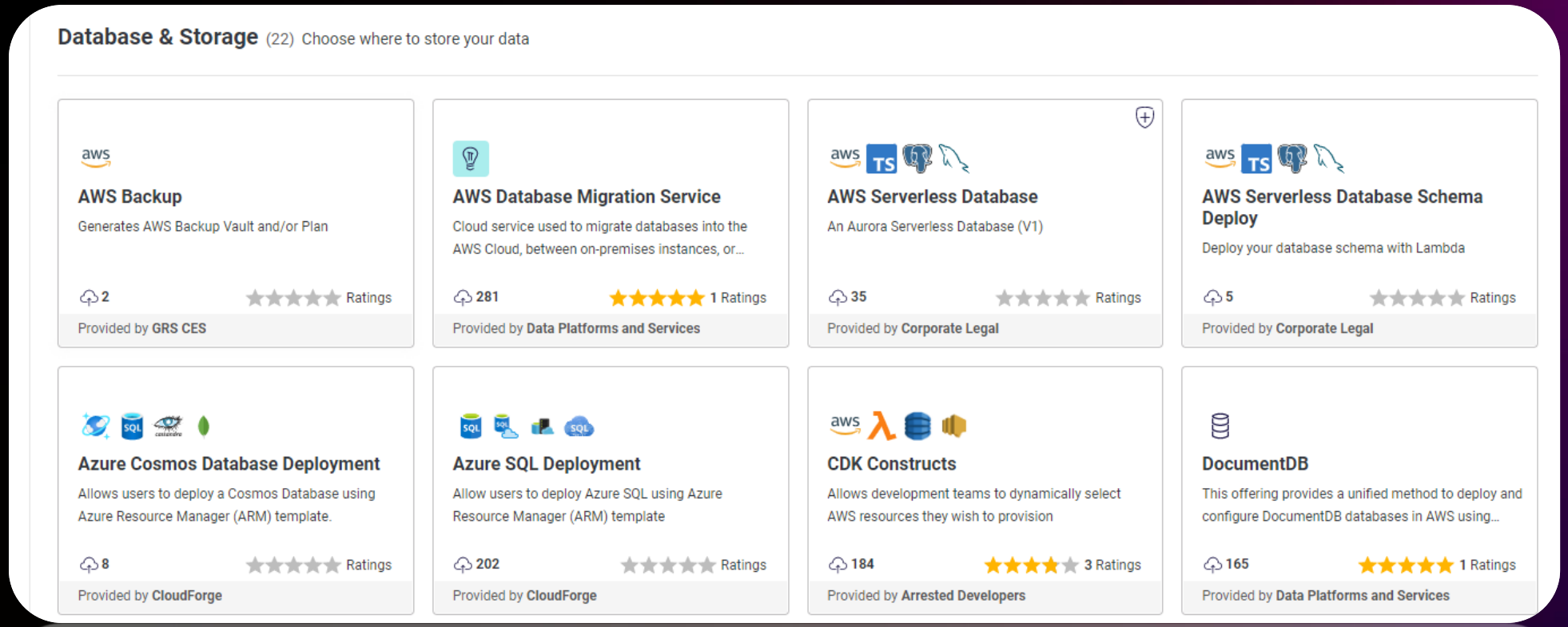
5500
6

Number of servers
Unique engine count

11000
20+

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Our current marketplace



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Diving into our journey...

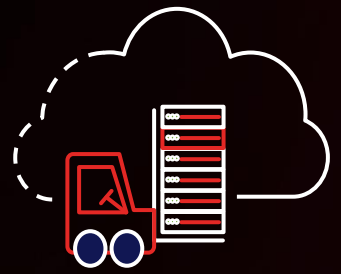
2017

Database Modernization



2019

Mainframe Data Migration



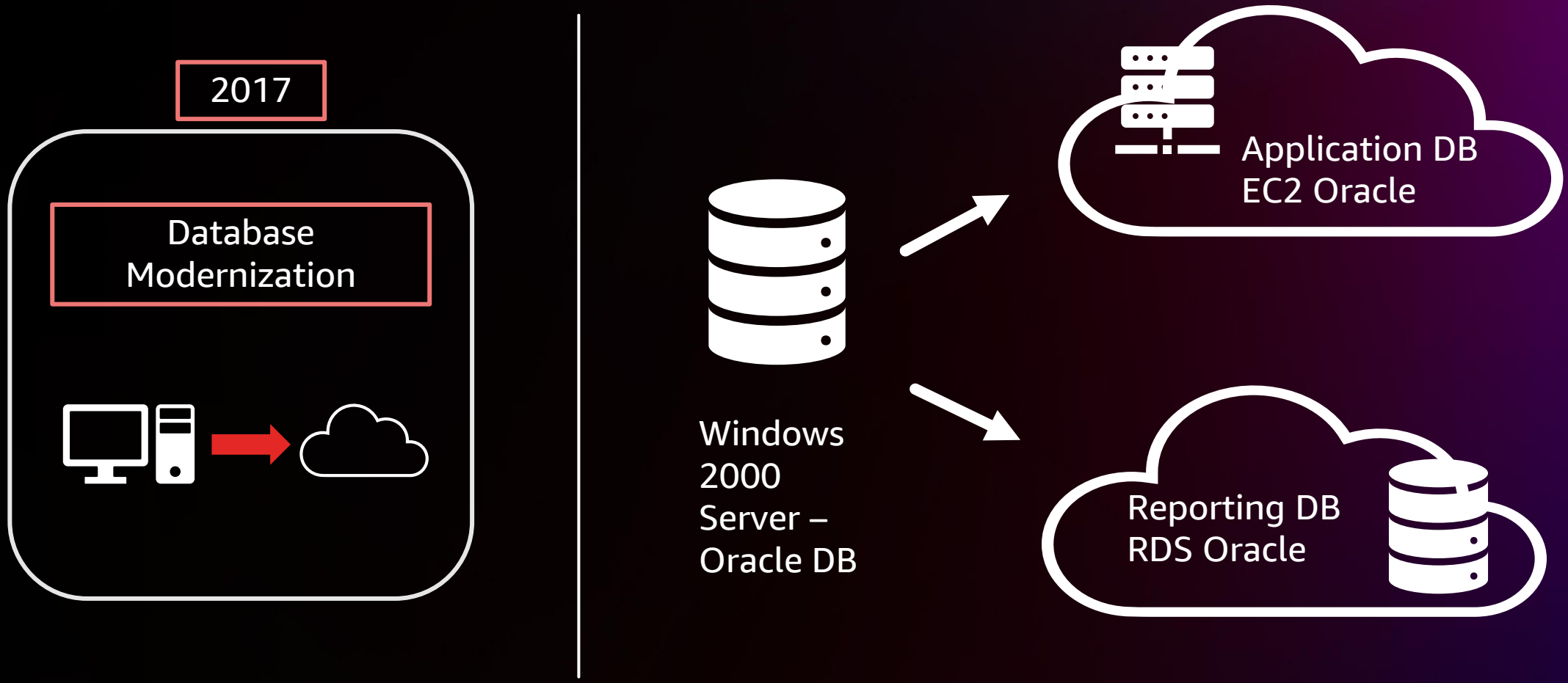
2020+

Automate Data Migration



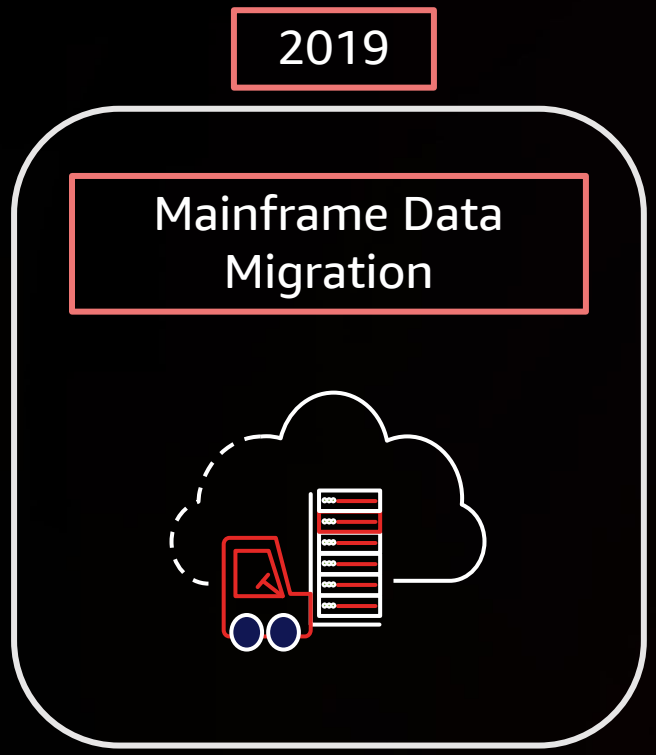
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Effort 1 – Database modernization



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Effort 2 – Mainframe data migration





Extract data from DB2 mainframe



Staged mainframe data onto S3 storage



Event-driven architecture
using Lambdas to parse data



Data migrated from S3 to Amazon Aurora

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Effort 3 – Automating data migration

2020+

Automate Midrange Data Migration



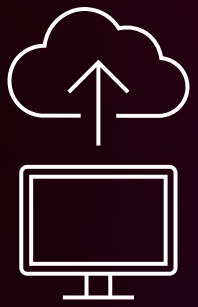


Parameterized process:

- DB source
- DB target
- Ongoing replication
- Data mapping
- Integrated security



Ongoing replication
Oracle to Aurora



One-time replication
DB2 to Aurora MySQL

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Wins and challenges

Challenges

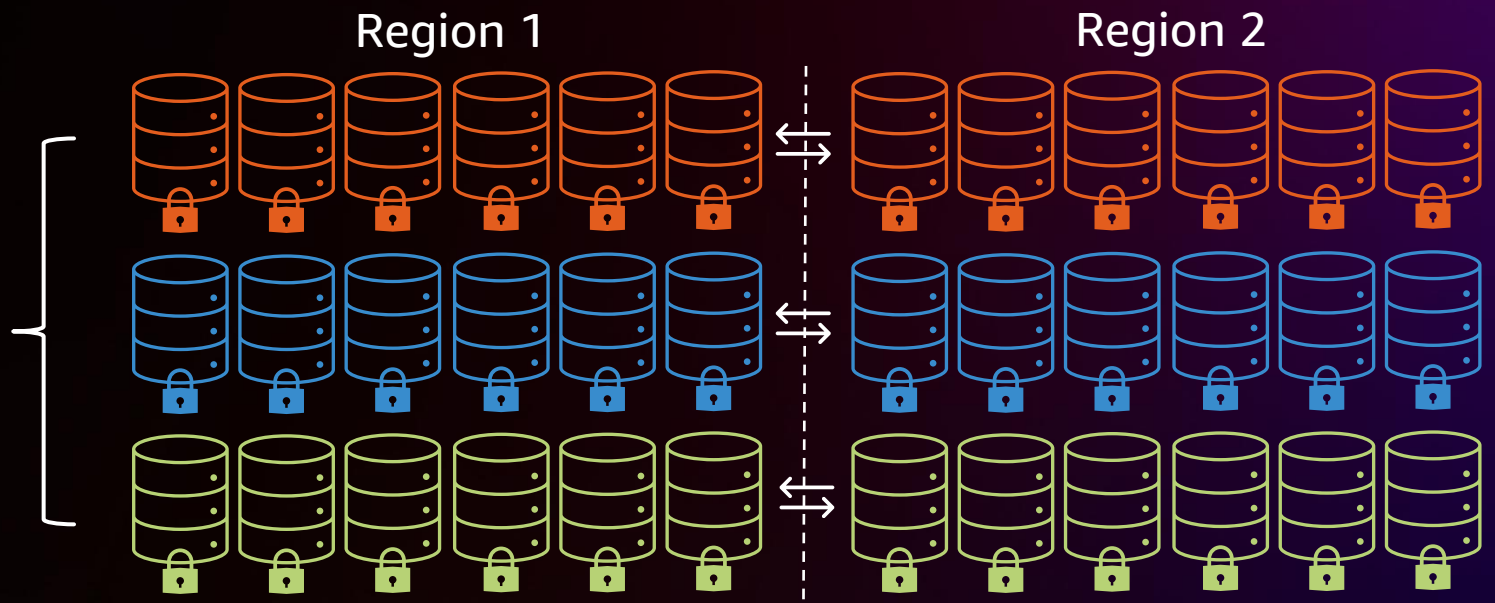
- Data migration
- Customization
- Secrets management
- So many choices



Wins

- Configuration as code
- Self-service
- Easier maintenance
- So many choices
- Resilience
- Energy efficiency
- Open source





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What we've learned

"**GREAT DISCOVERIES** AND IMPROVEMENTS INVARIABLY INVOLVE THE **COOPERATION OF MANY MINDS**"

- Alexander Graham Bell

"WITH GREAT **POWER** COMES GREAT **RESPONSIBILITY**"

- Uncle Ben

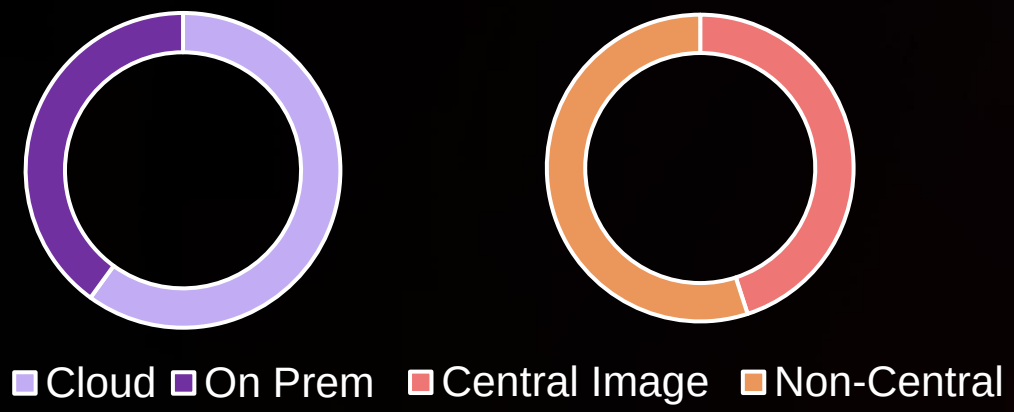


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What’s next?

Continuous learning and improvement of our capabilities in order to enable our development teams to more quickly and easily create and leverage modern database offerings; increase the value and adoption of our centrally managed database images



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Modernization using purpose-built databases

. . . so, where do we start?

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POLL: Which is more important to you and your organization: innovation or cost savings?



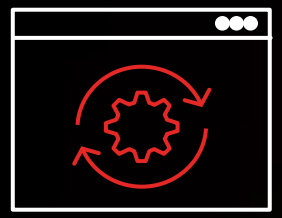
- Innovation
- Cost savings
- Other

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Database modernization playbooks



Move to managed databases

Self-managed → **AWS managed**

- Oracle
- SQL Server
- MongoDB
- Redis
- Cassandra
- …

→

- Amazon Aurora
- Amazon RDS
- Amazon DocumentDB
- Amazon ElastiCache
- Amazon MemoryDB for Redis
- Amazon Keyspaces (for Apache Cassandra)



Break free from legacy databases

Commercial → **Open source**

- Oracle
- SQL Server
- IBM Db2
- Sybase
- …

→

- Amazon Aurora
- Amazon RDS



Modernize with purpose-built databases

Monolithic → **Microservices**

- Oracle
- SQL Server
- MySQL
- PostgreSQL
- …

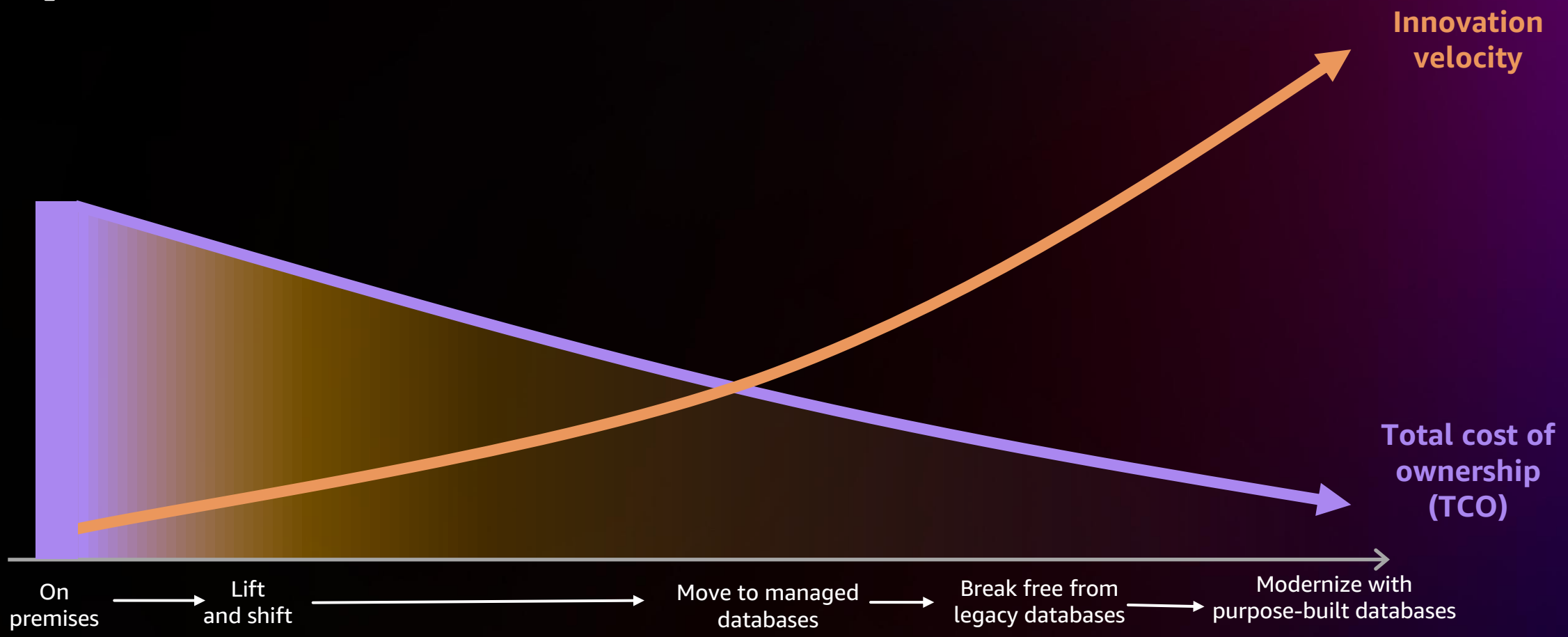
→

- Amazon DynamoDB
- Amazon Aurora
- Amazon Neptune
- Amazon DocumentDB
- Amazon Timestream
- …

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Both migration and modernization are important



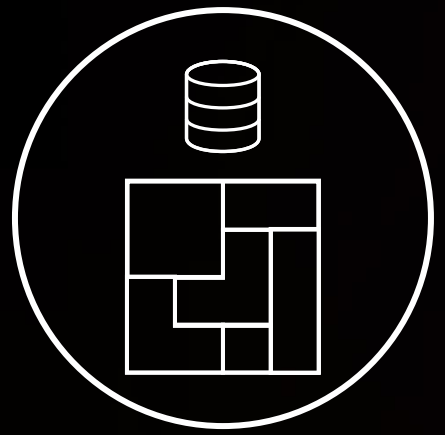
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Modernization using purpose-built databases

. . . it’s a journey!

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Typical database modernization journeys start here



Relational database application

Existing business-critical applications

- Modernization of existing applications
- Typically monolithic
- Made to fit relational databases

. . . but also

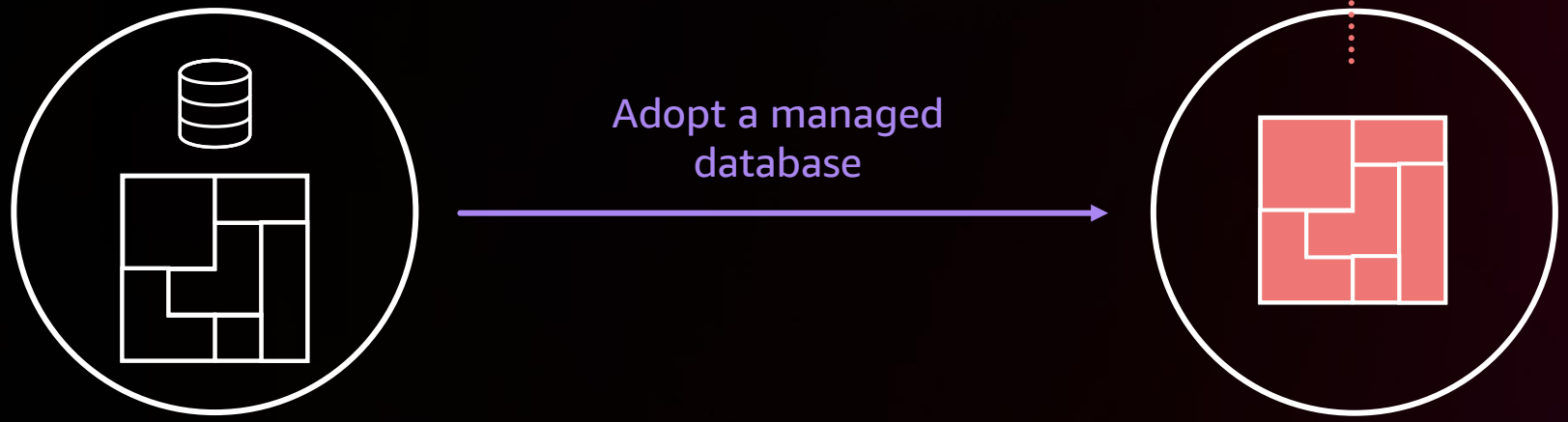
- New startup applications
- Rapid prototyping, developed locally
- ORM/ODM heavy for agility

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Step 1: Move to a managed database

Adopt cloud-native relational databases
Amazon RDS, Amazon Aurora



Relational database application

Managed database

Agility, easily managed, cost-effective

- Reduce operational burden
- Take advantage of platform features

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Amazon RDS

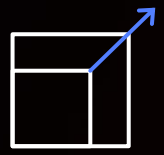
MANAGED RELATIONAL DATABASE SERVICE WITH A CHOICE OF POPULAR DATABASE ENGINES

Amazon Aurora | MySQL | MariaDB | PostgreSQL | Microsoft SQL Server | ORACLE



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



Designed to be secure & compliant

Data encryption at rest and in transit; assists customers achieve their compliance goals through tooling

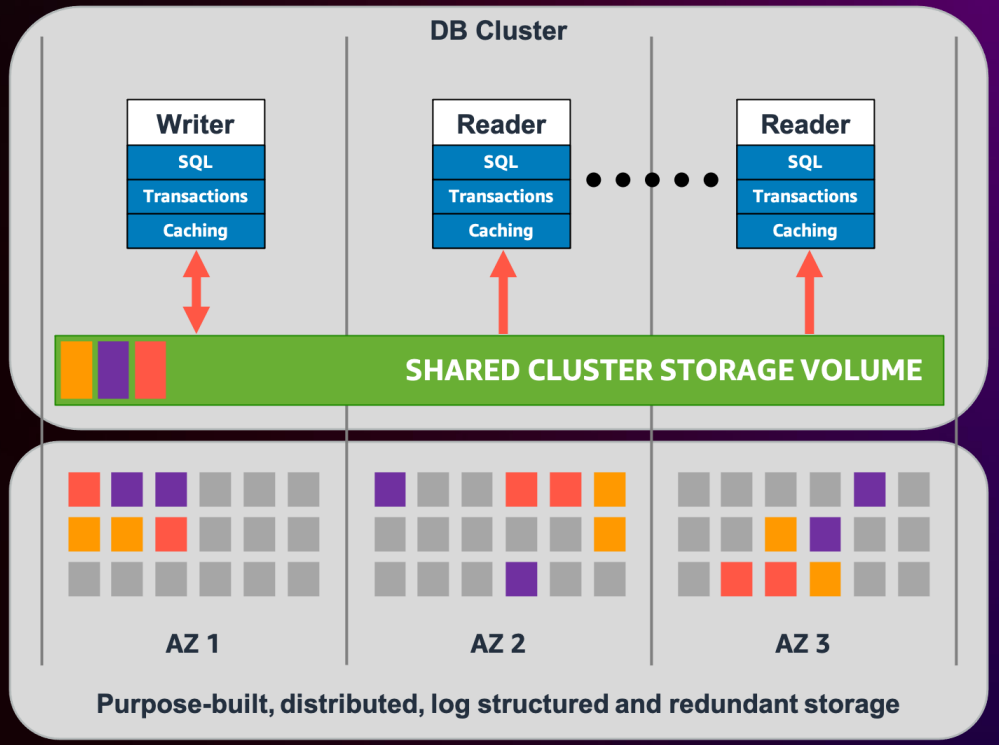
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Amazon Aurora

ENTERPRISE DATABASE AT OPEN-SOURCE PRICE, DELIVERED AS A MANAGED SERVICE

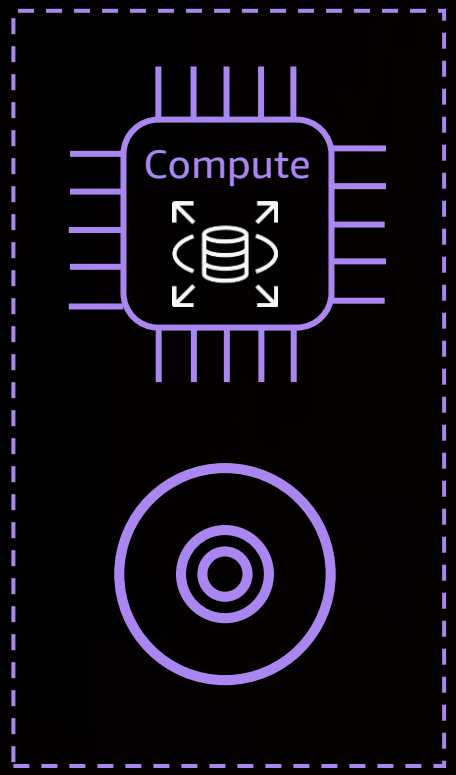
- Drop-in compatibility with MySQL and PostgreSQL
- Compatible with T-SQL (Microsoft SQL Server) using Babelfish for Aurora PostgreSQL
- Simplicity and cost-effectiveness of open-source databases
- Throughput and availability of commercial databases
- Simple pay-as-you-go pricing
- Aurora Global Database with deployment in multiple Regions
- Aurora Serverless (v2 now generally available) DB clusters that are instantly scalable



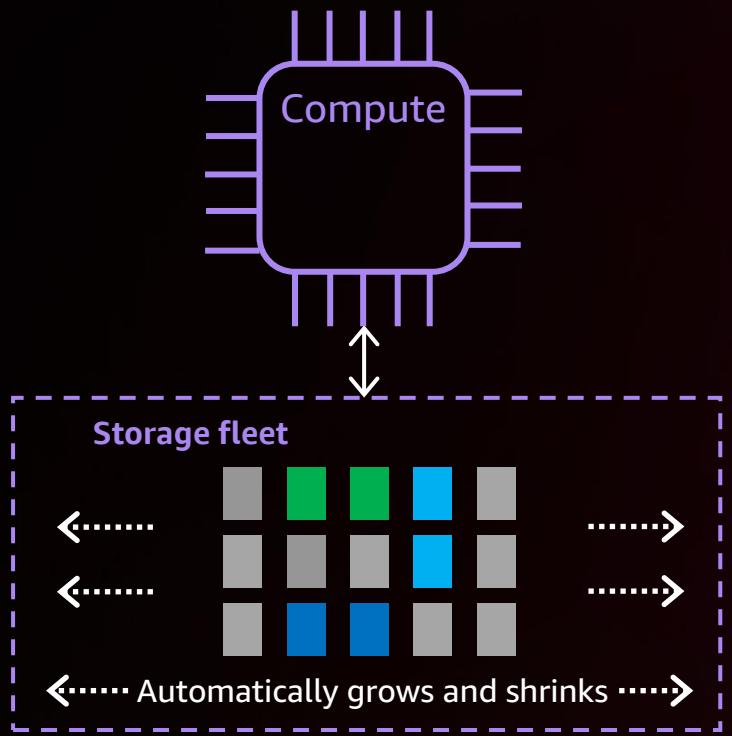
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Evolution of AWS managed relational databases

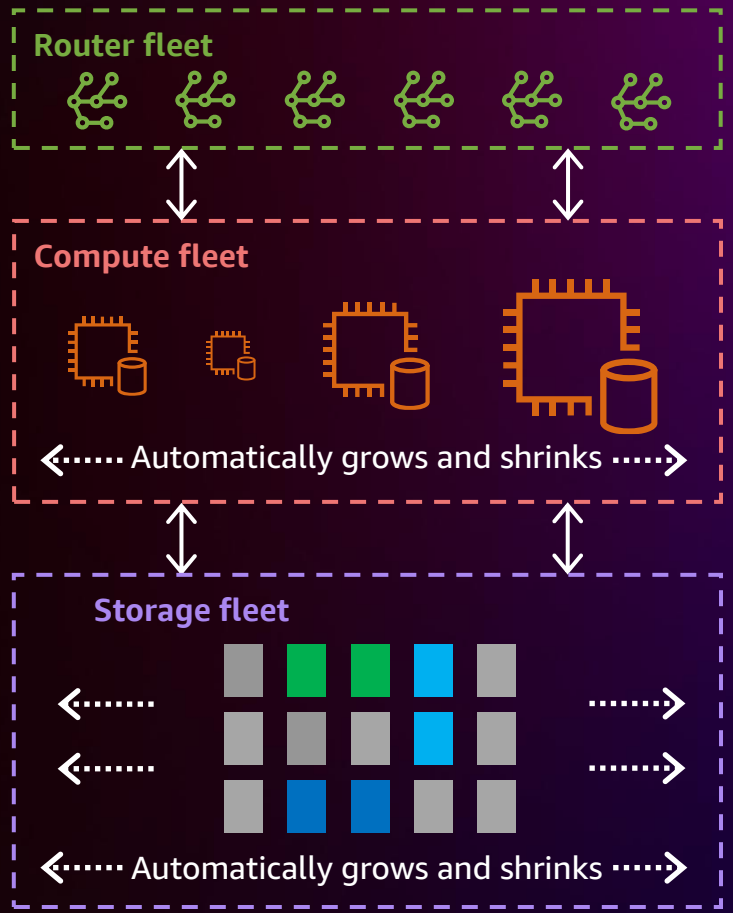
Amazon RDS DB instance



Aurora provisioned DB cluster



Aurora Serverless



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Reddit was founded in 2005 and ranks as the 17th most visited website in the world. The social media company was experiencing hyperscale growth, with its monthly active users surging 30 percent year over year.

Challenge

A substantial operational burden associated with self-managing its relational database was constraining Reddit's team and putting quality service delivery to its users at risk.

Solution

Migrating from self-managed PostgreSQL on Amazon EC2 to Aurora was a key component of Reddit's success. It has resulted in not only higher database reliability, faster backup restoration and point-in-time recovery, and fast automated failovers but also improved productivity for engineers.

> "Using Aurora, we could build a longer-term strategy for how we were dealing with data and do more strategic thinking for long-term projects."

Jason Harvey
Principal Engineer
Reddit

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POLL: Do you use caching solutions or have you added them to your stack?



- Yes
- No
- Some caching
- In the process of adding

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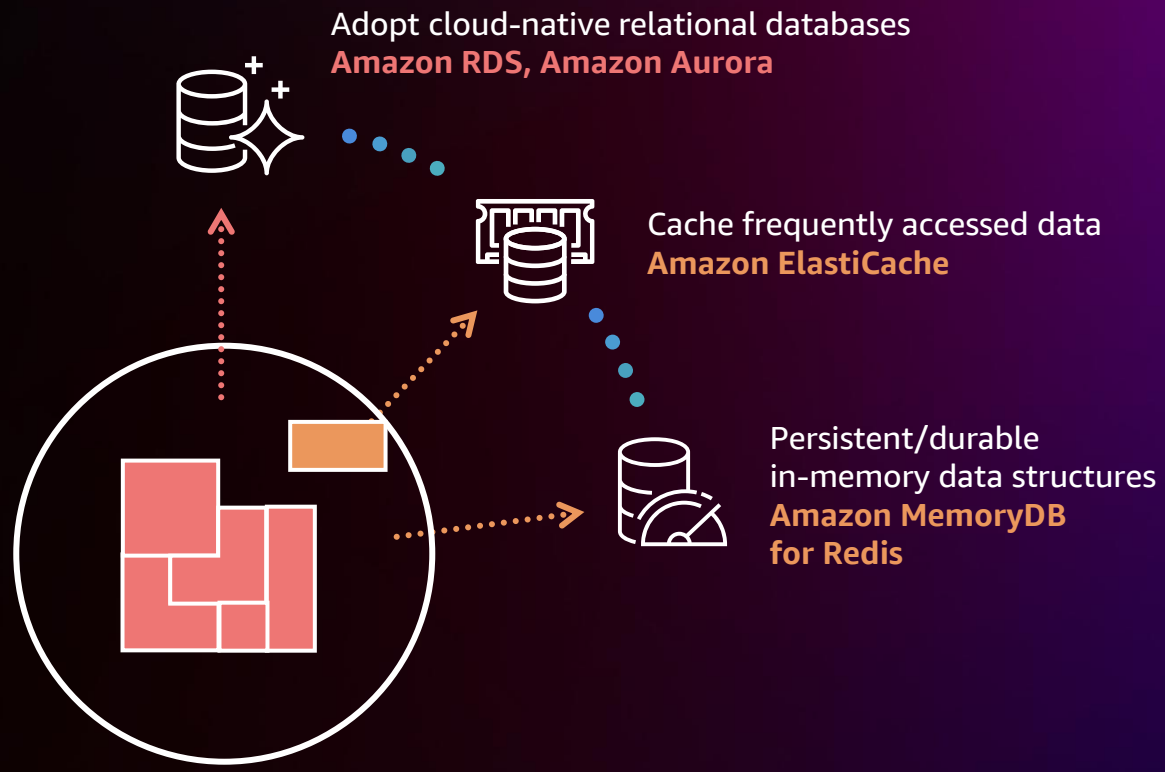
Step 2: Cache and persistent in-memory data

Address scaling pain

- “Low-hanging fruit,” easy to adopt
- Offload repetitive read operations
- Offload session state
- Caching

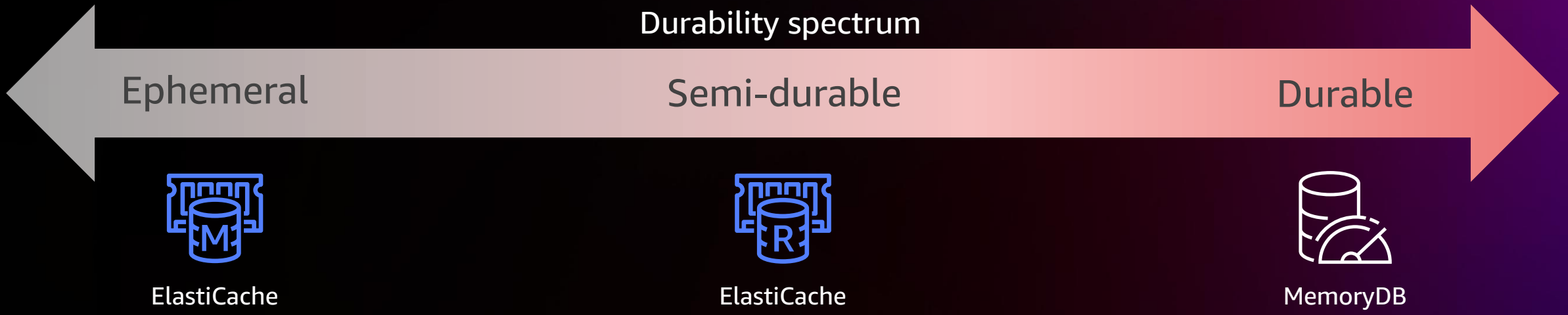
Increase performance

- Frequent counters
- Fast-changing rankings
- Submillisecond data access



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AWS in-memory managed solutions



	ElastiCache for Memcached	ElastiCache for Redis	MemoryDB
Maximum size	20 nodes/13 TiB	500 nodes/340 TiB	500 nodes/128 TiB
Replication	No	Yes	Yes
Failover	Not available	Automatic	Automatic
Data types	1	Many	Many
Commands	9	100+	100+

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PayPay Corporation is one of Japan's leading mobile payments applications, with more than 30 million users completing millions of cashless transactions every day. PayPay has been using Amazon ElastiCache for Redis both as a distributed cache and a low-latency persistent data store.

Challenge

The team was asked to build the QR Code Payment Service in a short period of 3 months.

Solution

PayPay adopted a microservices architecture on AWS designed to support the growth of the business. Each microservice team can choose the right database solution according to the application requirements.

> "We chose ElastiCache because we needed a fully managed and highly scalable distributed Redis cluster for numerous microservices. For example, our authentication service is based on access tokens stored in ElastiCache for Redis. Because every API call requires authentication, this service handles a huge amount of traffic per second and requires submillisecond performance. ElastiCache for Redis makes this possible."

Shilei Long
Senior Software Architect
PayPay Corporation

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Amazon MemoryDB for Redis

REDIS COMPATIBILITY WITH MULTI-AZ DURABILITY

Ultra-fast performance

Lowest-latency database offered by AWS

Redis compatibility

Flexible and friendly Redis APIs and data structures

Fully managed

AWS managed hardware and software setup, configuration, monitoring, and snapshots

High scalability

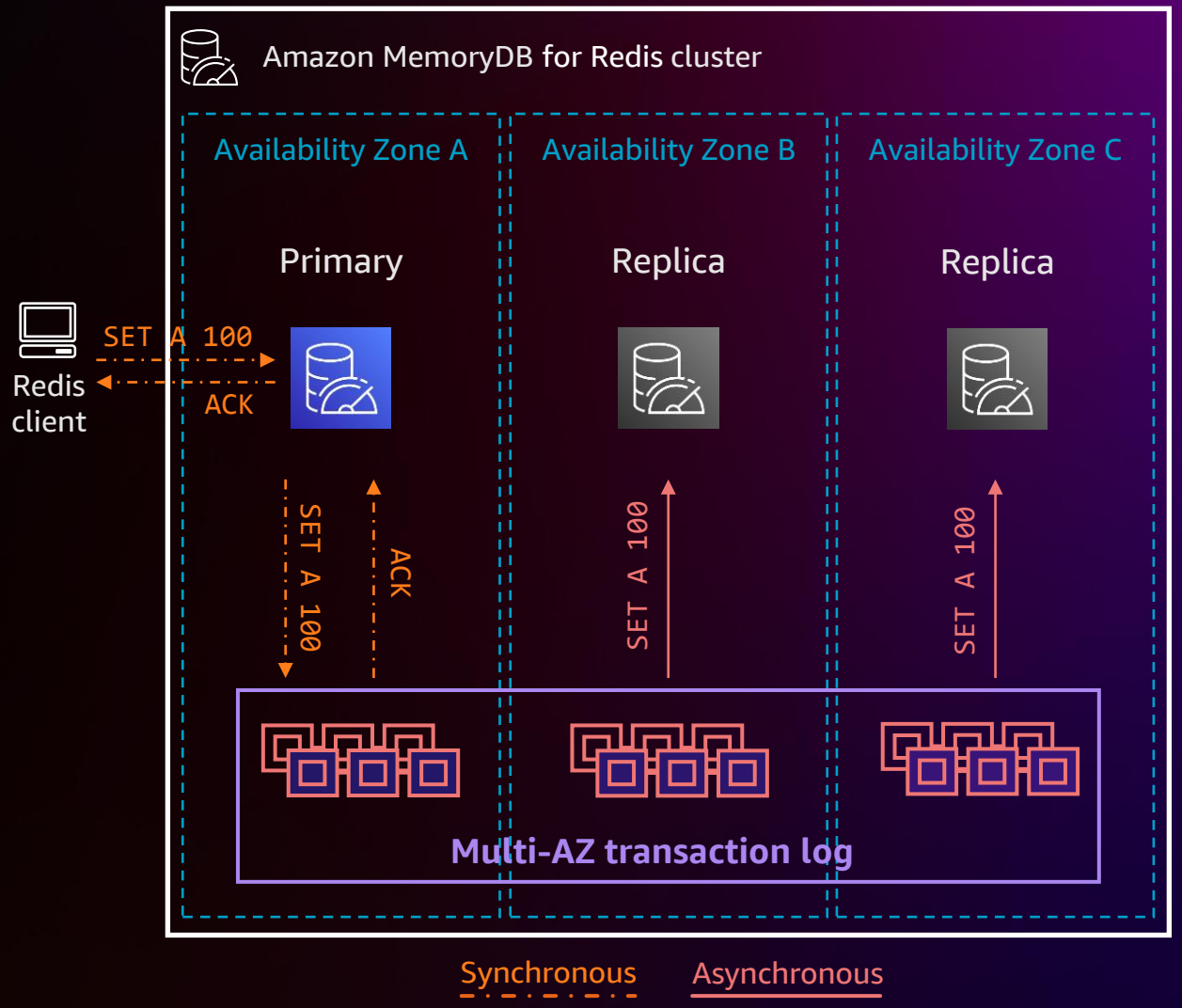
Up to 500 nodes and 128 TiB of in-memory storage per cluster (with 1 replica per shard)

Durability and high availability

Multi-AZ transactional log for durability and replicas for high availability

Security

Amazon VPC, encryption at rest and in transit, access control lists (ACLs)



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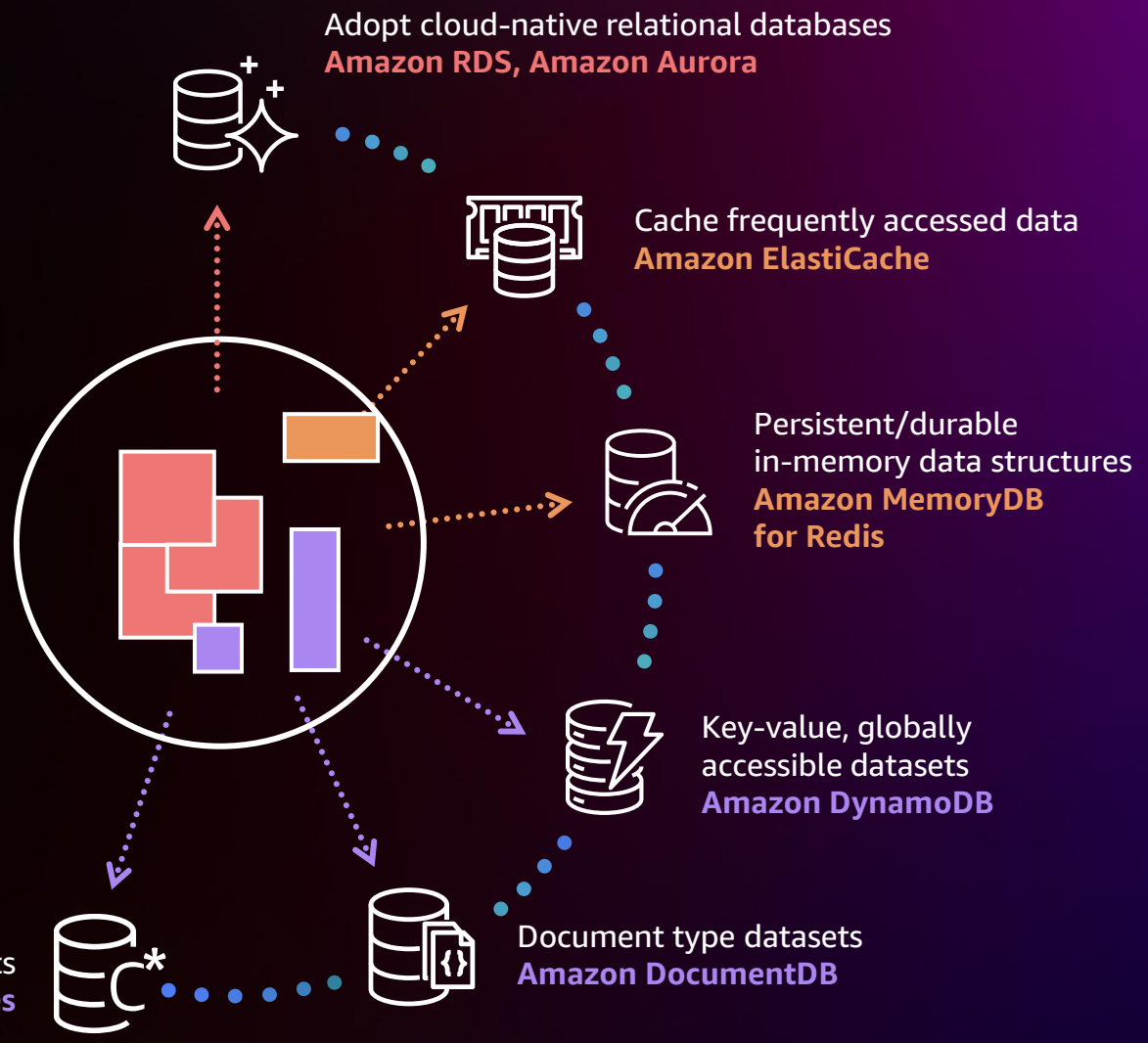
Step 3: Non-relational query patterns

Breaking down the monolith

- Right tool for the job
- Microservice access pattern drives data store decision

Benefits

- Agility
- Scalability
- Performance



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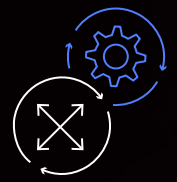
Amazon DynamoDB

FAST AND FLEXIBLE NOSQL DATABASE AT ANY SCALE



Performance at scale

- Delivers consistent, single-digit millisecond latency
- Handles millions of requests per second



No servers to manage

- Maintenance free
- Auto scaling
- On-demand capacity mode
- Up to 99.999% SLA



Enterprise ready

- ACID transactions
- Encryption at rest
- Continuous backups, on-demand backup and restore
- Integration with other AWS services



Global tables

- Build global applications
- Get fast access to local data
- Automated global replication

Amazon DynamoDB is ideal for

Serverless and event-driven architectures • Globally resilient services • High-throughput workloads

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Zoom Video Communications, Inc. provides videotelephony and online chat services through a cloud-based peer-to-peer software platform and is used for teleconferencing, telecommuting, distance education, and social relations.

Challenge

Beginning in early 2020, Zoom's software usage saw a significant global increase after quarantine measures were adopted in response to the COVID-19 pandemic.

Solution

Amazon DynamoDB global tables using on-demand capacity allowed Zoom to scale and meet that global increase in demand for their services.

> "On the backend, we were able to manage this surge with Amazon DynamoDB for Zoom Meetings. Using DynamoDB global tables in conjunction with on-demand mode enabled us to scale nearly infinitely with no performance issues, even with our sudden spike in usage."

Yasin Mohammed
Engineering Manager, Cloud Operations
Zoom Video Communications, Inc.

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Amazon DocumentDB

FAST, SCALABLE, AND FULLY MANAGED MONGODB-COMPATIBLE DATABASE SERVICE



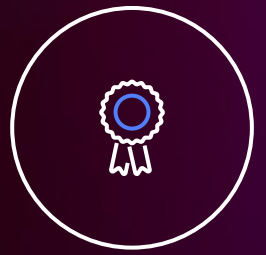
Fast and scalable

- Scale compute in minutes
- Storage and I/O auto scaling
- Storage scales to 64 TB
- Scale out to 15 replicas for millions of reads
- Globally distributed



Enterprise ready

- Built-in high availability
- Backups enabled by default
- Durable by default
- Security best practices by default
- Automatic patching
- Monitoring and alerting



MongoDB compatible

- Applications, drivers, and tools can be used with little or no change
- Supports hundreds of APIs, operators, and stages
- Continually working backward from customers to deliver the capabilities they need

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Amazon DocumentDB is ideal for

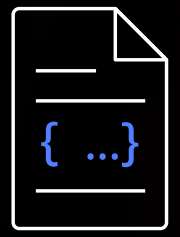
Content management • Real-time big data • User or product profiles

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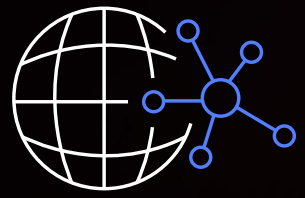
Amazon Keyspaces

FULLY MANAGED APACHE CASSANDRA–COMPATIBLE DATABASE SERVICE



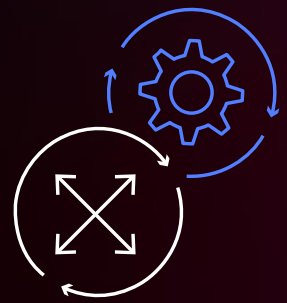
Compatible with Apache Cassandra

- Existing applications
- New applications
- Developer skill sets



Performance at any scale

- Handles millions of requests per second
- Delivers single-digit millisecond latency



Serverless

- No compaction
- Fully managed
- Auto scaling



Enterprise ready

- Point-in-time recovery backups
- Encryption at rest
- IAM integration

Amazon Keyspaces is ideal for workloads with

Schema validation • Multiple independent sorts • Rows up to 1 MiB in size

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POLL: Which specialized databases (such as graph, time series, ledger) do you use?



- Graph
- Time series/device
- Ledger
- Other nonrelational

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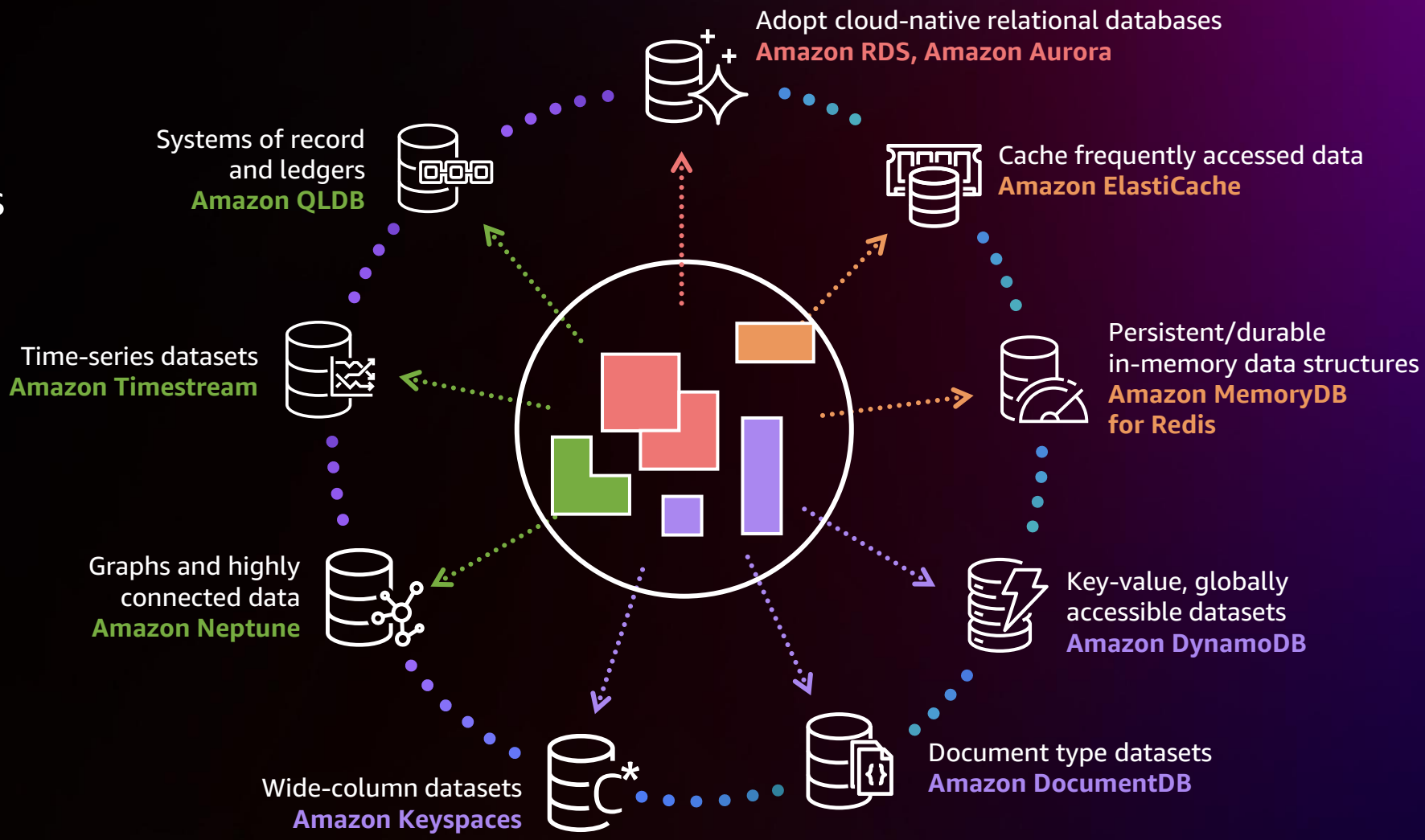
Step 4: Specialized data interactions

Specialized datasets

- Social graphs
- Recommendation engines
- Measurements
- Systems of record
- Digital records

Benefits

- Agility
- Scalability
- Performance



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Amazon Neptune

FAST, RELIABLE GRAPH DATABASE BUILT FOR THE CLOUD

Open



Supports Property Graph & W3C RDF graph models

Fast



Query billions of relationships with millisecond latency

Reliable



6 replicas of your data across 3 AZs with full backup and restore

Easy



Build powerful queries easily with Gremlin and SPARQL

Useful when

Relationships matter as much as the data
Results depend on the *strength*, *weight,* or *quality* of relationships

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Amazon Neptune is ideal for

Social networking • Recommendations • Fraud detection • Life sciences

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Dream11 Fantasy Sports Social Network Service

Dream11, the flagship brand of Dream Sports, is the world's largest fantasy sports platform, with more than 100 million users. Their Social Network Service helped them evolve as a social sports platform.

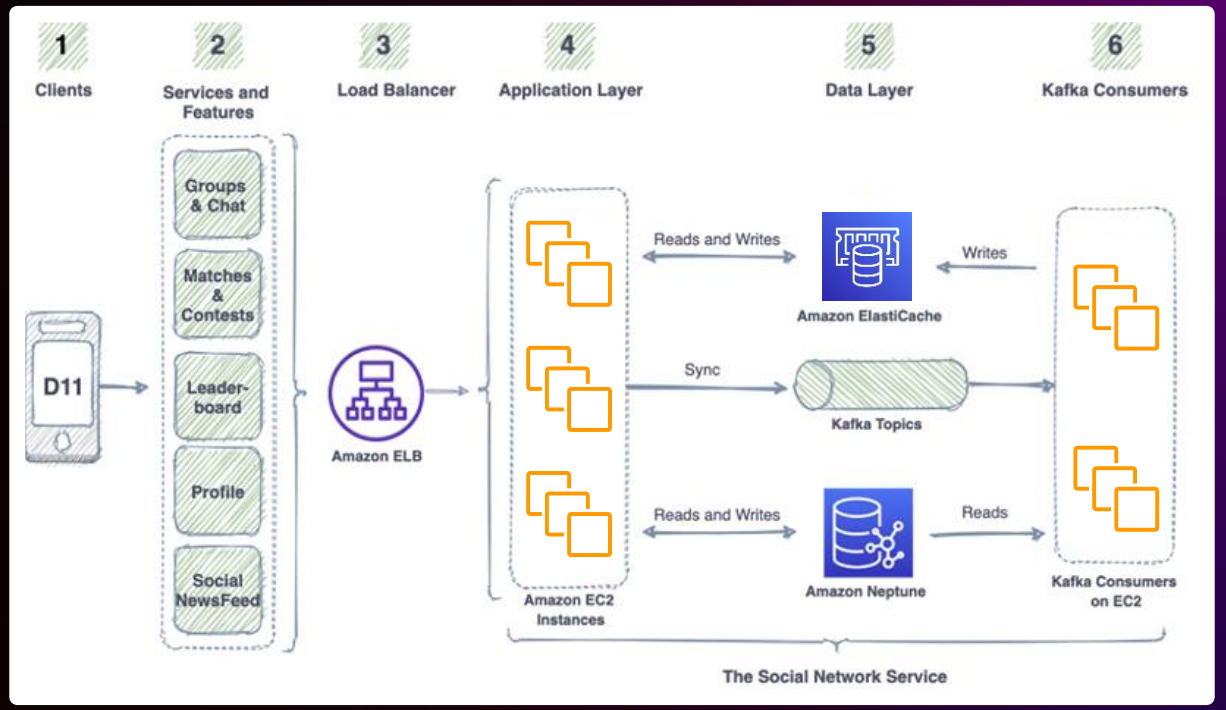
Challenges

As the Social Network Service gained popularity, it needed to scale from thousands to millions of followers per user and withstand spiky behavior around popular match times.

Solution

Amazon Neptune provides persistent graph storage with proven high availability, scalability, and performance supporting social graph traversals such as friends in common and clusters of friends.

Amazon ElastiCache for Redis enables extremely high-throughput API calls such as counts and sorted lists of followers.

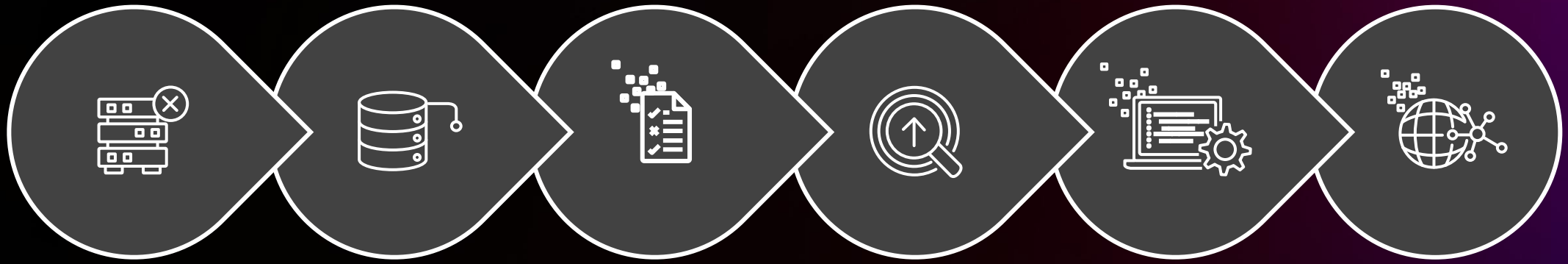


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Amazon Timestream

SERVERLESS, FULLY MANAGED TIME-SERIES DATABASE

Collect, store, and process data sequenced by time at any scale



Serverless auto scaling for ingesting, storing, and querying

Data lifecycle management

No predefined schema

Access data across storage tiers with adaptive query engine

Built-in time-series analytics in SQL

Integrates with ML, analytics, data collectors

Amazon Timestream is ideal for

Real-time performance tracking • Forecasting • Trend analysis • Event tracking

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Amazon QLDB

FULLY MANAGED LEDGER DATABASE SERVICE

Immutable



Append-only, immutable journal **tracks history of all changes**

Verifiable



All changes are **cryptographically chained** and **verifiable**

Serverless



Scalable and highly available, no need to provision storage and I/O in advance

Easy to use



PartiQL offers familiar SQL operators; ION data model is rich and expressive

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Amazon QLDB is ideal for

Audit databases • State change modeling • Systems of record • Blockchain alternatives

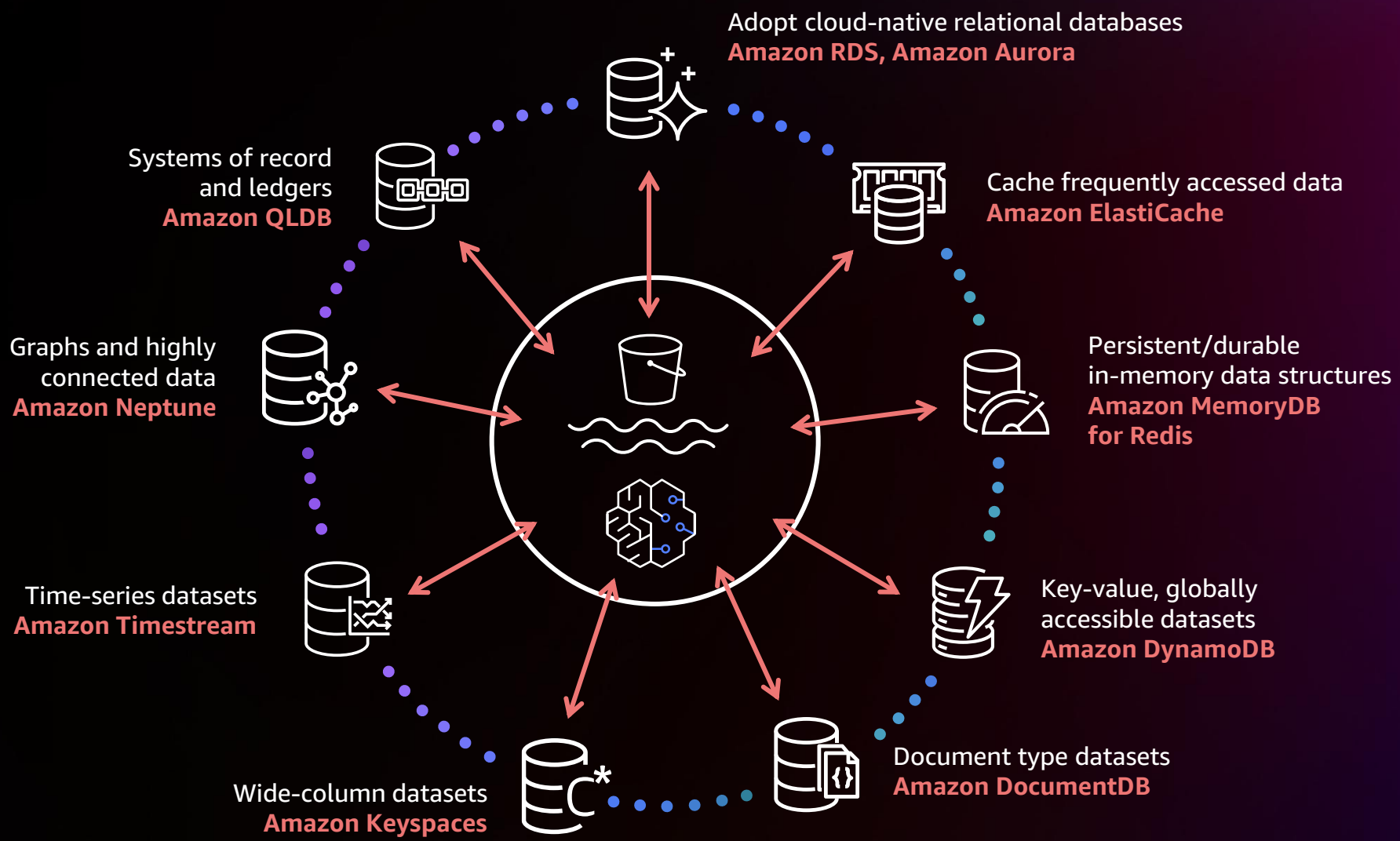
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Next steps: Unify and innovate

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Unify using data lakes, and innovate using ML



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To sum it all up

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Purpose-built modernization is a journey

BOTH ORGANIZATIONALLY AND TECHNOLOGICALLY

1. **Move relational workloads to managed DB services**
   Amazon Aurora, Amazon RDS
   Improve: agility, ease of management, and cost efficiency

2. **Implement caching and offload in-memory workloads**
   Amazon ElastiCache, Amazon MemoryDB for Redis
   Improve: scalability and performance

3. **Move non-relational query patterns to NoSQL**
   Amazon DynamoDB, Amazon DocumentDB, Amazon Keyspaces
   Improve: agility, innovation, scalability, performance, ease of management, and cost efficiency

4. **Move specialized datasets and query patterns to specialized databases**
   Amazon Neptune, Amazon Timestream, Amazon QLDB
   Improve: agility, innovation, scalability, performance, ease of management, and cost efficiency

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Thank you!

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