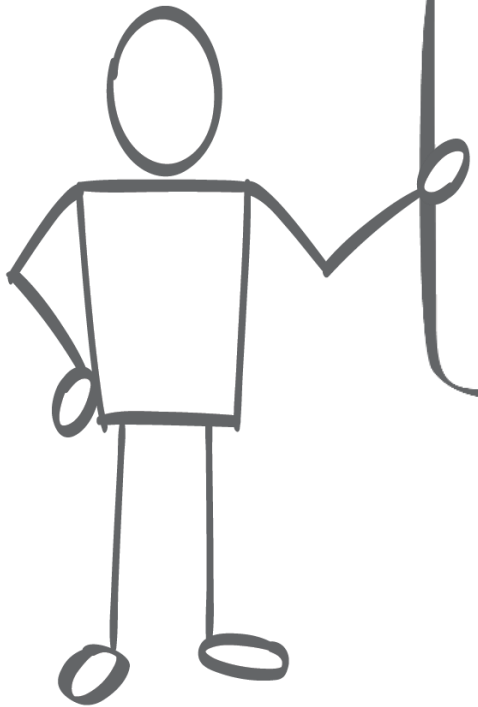
amazon web services | intel

AWSome Day

ONLINE CONFERENCE



Module 4
Databases

SQL and NoSQL Databases

	SQL	NoSQL
Data Storage	Rows and Columns	Key-Value
Schemas	Fixed	Dynamic
Querying	Using SQL	Focused on collection of documents
Scalability	Vertical	Horizontal

SQL

ISBN	Title	Author	Format
9182932465265	Cloud Computing Concepts	Wilson, Joe	Paperback
3142536475869	The Database Guru	Gomez, Maria	eBook

NoSQL

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{
      ISBN: 9182932465265,
      Title: “Cloud Computing Concepts”,
      Author: “Wilson, Joe”,
      Format: “Paperback”
}
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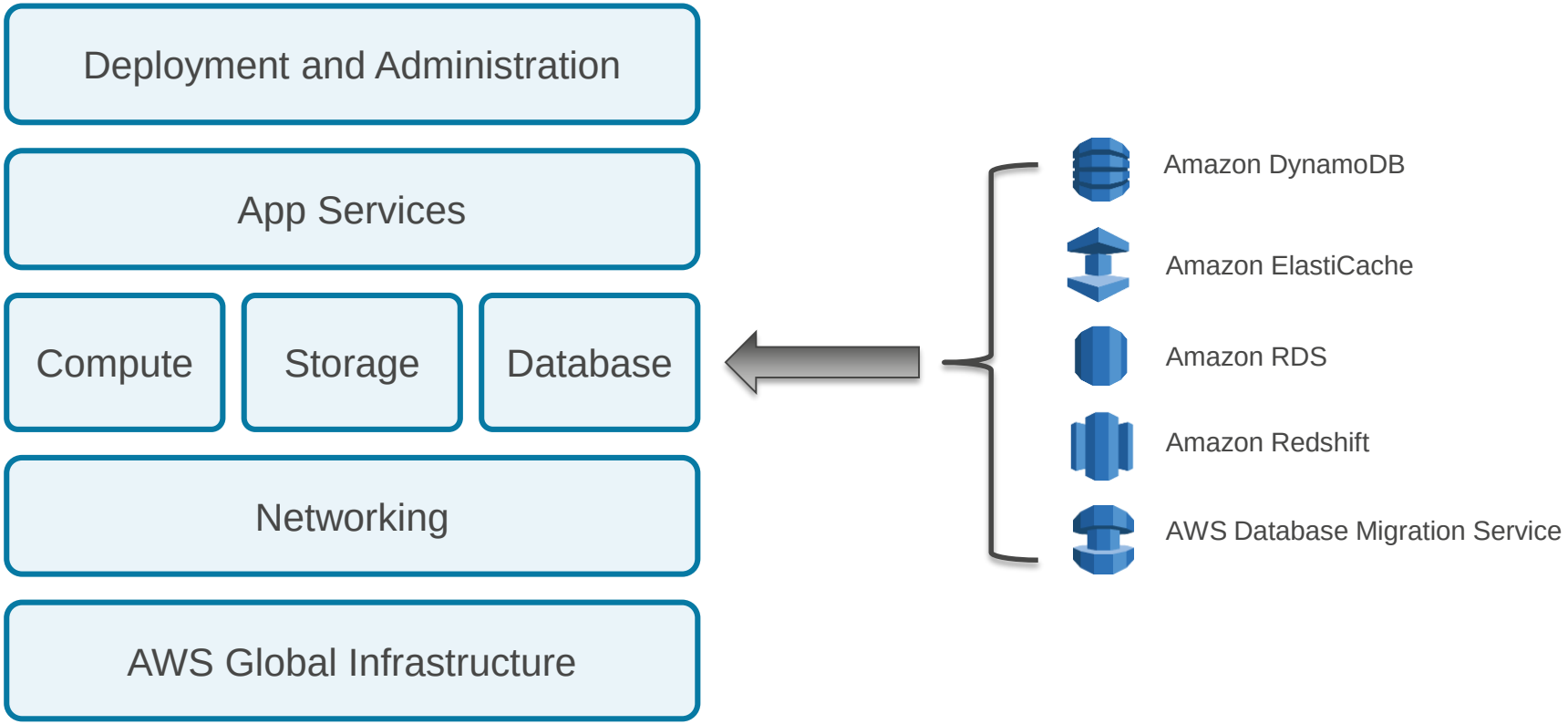
Data Storage Considerations

- No one size fits all.
- Analyze your data requirements by considering:
  - Data formats
  - Data size
  - Query frequency
  - Data access speed
  - Data retention period

AWS Managed Database Services



Amazon Relational Database Service (RDS)

Amazon RDS

- Cost-efficient and **resizable capacity**
- Manages time-consuming **database administration** tasks
- Access to the full capabilities of **Amazon Aurora**, **MySQL**, **MariaDB**, **Microsoft SQL Server**, **Oracle**, and **PostgreSQL** databases

Amazon RDS Use Case

> We were able to go from concept to delivered product in about six months with just a handful of engineers.
>
> **Greg Scallan**
> Chief Architect, Flipboard

- Flipboard is an online magazine with millions of users and billions of “flips” per month.
- Flipboard is one of the world’s first social media magazines.
- Flipboard uses Amazon RDS and its Multi-AZ capabilities to store **mission critical user data**.

Amazon RDS

- Simple and fast to deploy
- Manages common database administrative tasks
- Compatible with your applications
- Fast, predictable performance
- Simple and fast to scale
- Secure
- Cost-effective

DB Instances

- DB Instances are the basic building blocks of Amazon RDS.
- They are an isolated database environment in the cloud.
- They can contain multiple user-created databases.

How Amazon RDS Backups Work

- Automatic Backups:
  - Restore your database to a point in time.
  - Are enabled by default.
  - Let you choose a retention period up to 35 days.

- Manual Snapshots:
  - Let you build a new database instance from a snapshot.
  - Are initiated by the user.
  - Persist until the user deletes them.
  - Are stored in Amazon S3.

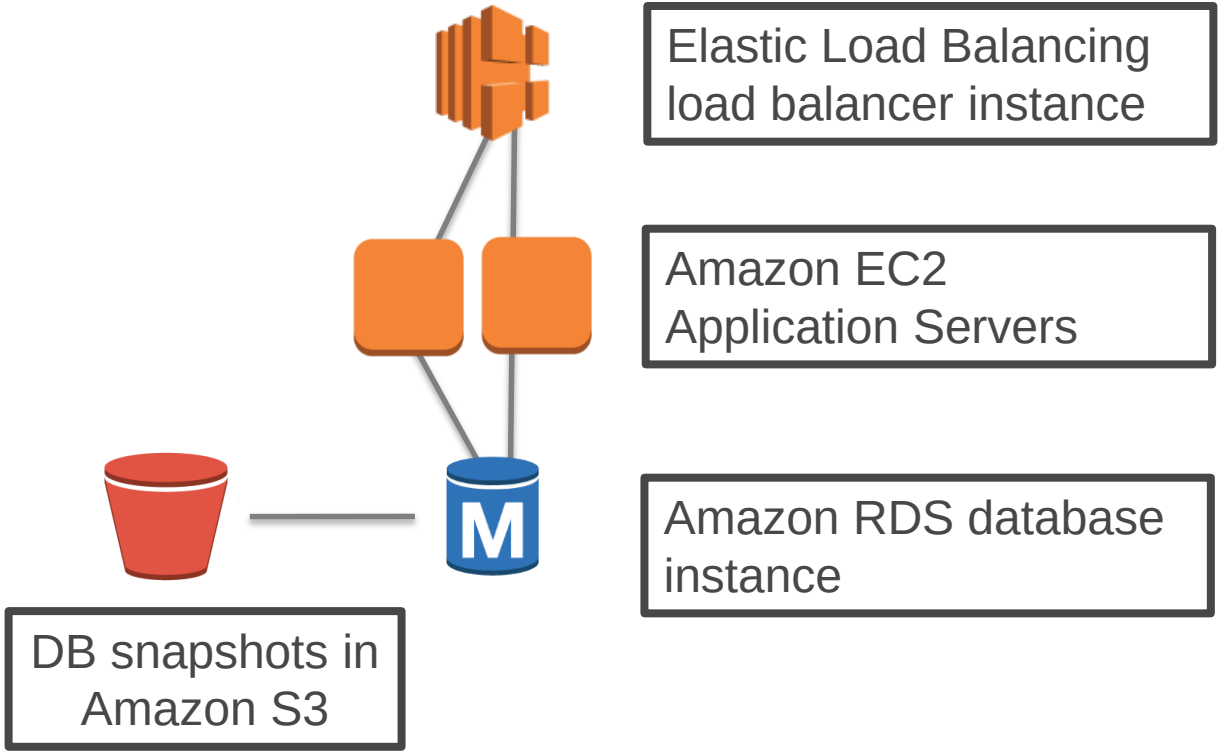
Cross-Region Snapshots

- Are a copy of a database snapshot stored in a different AWS Region.
- Provide a backup for disaster recovery.
- Can be used as a base for migration to a different region.

Amazon RDS Security

- Run your DB instance in an **Amazon VPC**.
- Use **IAM policies** to grant access to Amazon RDS resources.
- Use security groups.
- Use Secure Socket Layer (**SSL**) connections with DB instances (Amazon Aurora, Oracle, MySQL, MariaDB, PostgreSQL, Microsoft SQL Server).
- Use Amazon RDS **encryption** to secure your RDS instances and snapshots at rest.
- Use network encryption and transparent data encryption (**TDE**) with Oracle DB and Microsoft SQL Server instances.
- Use the security features of your DB engine to control access to your DB instance.

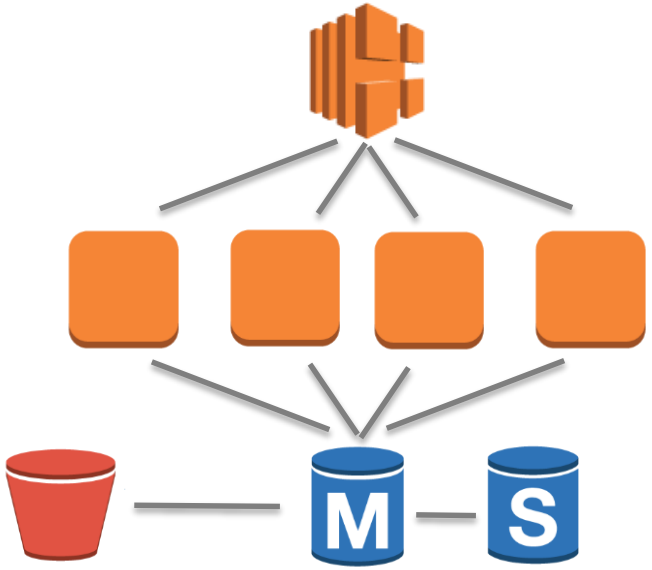
A Simple Application Architecture



Multi-AZ RDS Deployment

- With Multi-AZ operation, your database is synchronously replicated to another AZ in the same AWS Region.
- Failover automatically occurs to the standby in case of master database failure.
- Planned maintenance is applied first to standby databases.

A Resilient, Durable Application Architecture



Elastic Load Balancing load balancer instance

Application, in Amazon EC2 instances

Amazon RDS database instances:
Master and Multi-AZ standby

DB snapshots in Amazon S3

Amazon RDS Best Practices

- **Monitor** your memory, CPU, and storage usage.
- Use **Multi-AZ** deployments to automatically provision and maintain a synchronous standby in a different Availability Zone.
- Enable automatic backups.
- Set the **backup window** to occur during the daily low in WriteIOPS.
- To increase the I/O capacity of a DB instance:
  - Migrate to a DB instance class with high I/O capacity.
  - Convert from standard storage to provisioned IOPS storage and use a DB instance class optimized for **provisioned IOPS**.
  - Provision additional throughput capacity (if using provisioned IOPS storage).
- If your client application is caching the DNS data of your DB instances, set a TTL of less than 30 seconds.
- **Test** failover for your DB instance.

Amazon DynamoDB

Amazon DynamoDB

- Store any amount of data with **no limits**
- Fast, predictable performance using **SSDs**
- Easily provision and change the **request capacity** needed for each table
- **Fully managed**, **NoSQL** database service

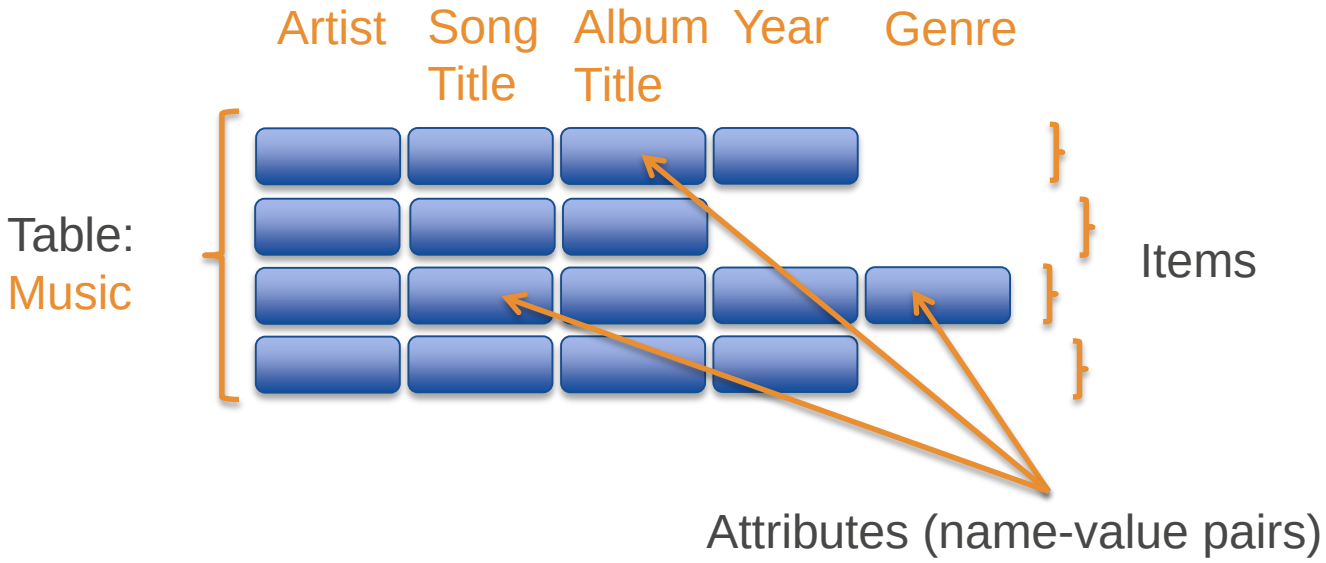
DynamoDB Use Case

> We spend more on snacks than we do on Amazon DynamoDB.
>
> **Valentino Volonghi**
> CTO, Adroll

AdRoll, an online advertising platform, serves 50 billion impressions a day worldwide with its global retargeting platforms.

- Adroll Uses AWS to grow by more than **15,000%** in a year
- Needed **high-performance**, **flexible** platform to swiftly sync data for worldwide audience
- Processes **50 TB** of data a day
- Serves **50 billion** impressions a day
- Stores **1.5 PB** of data
- **Worldwide** deployment minimizes latency

DynamoDB Data Model



Primary Keys

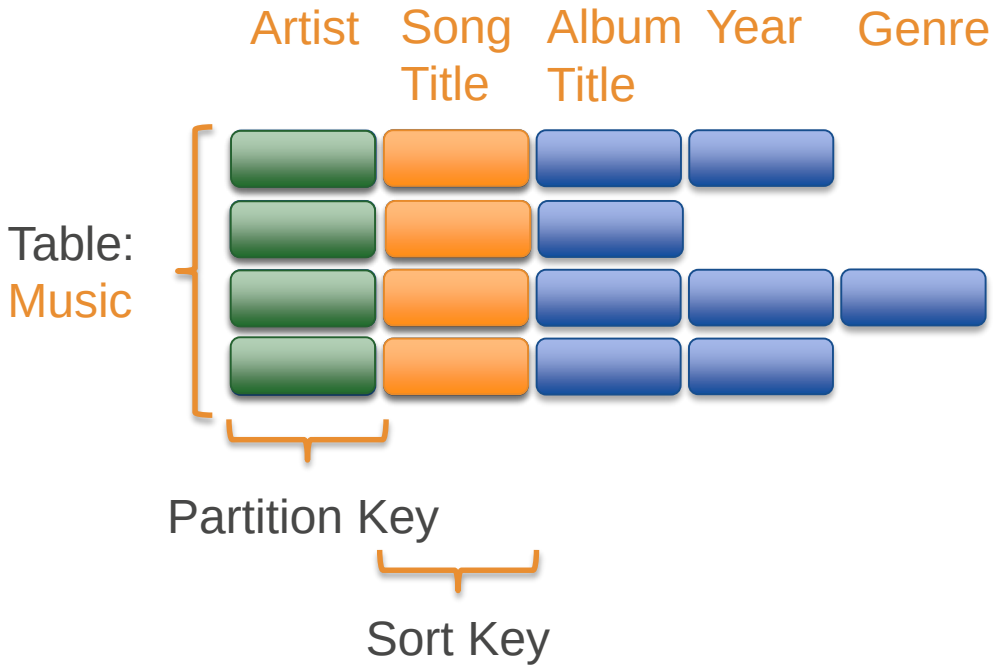


Table: Music
Partition Key: Artist
Sort Key: Song Title

(DynamoDB maintains a sorted index for both keys)

Local Secondary Index

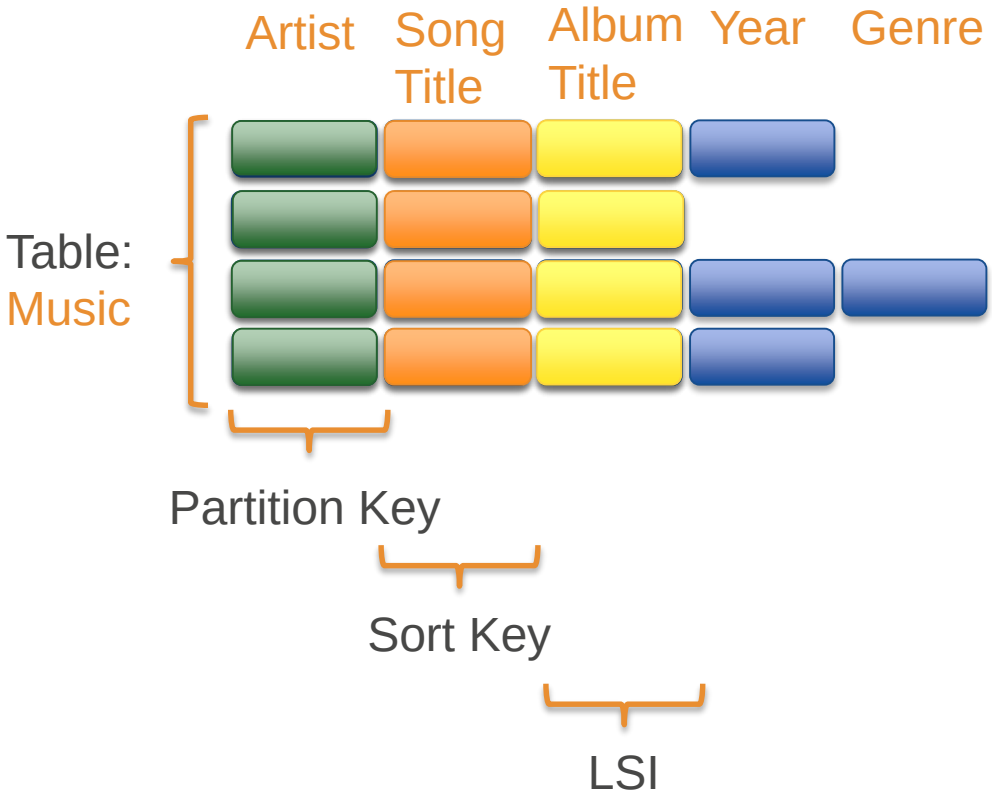
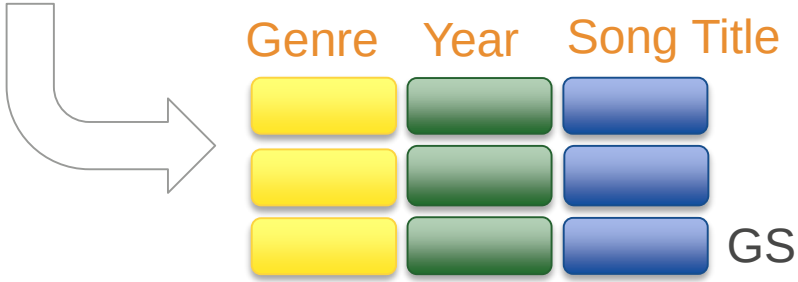


Table: Music
Partition Key: Artist
Sort Key: Song Title
LSI: Album Title

Global Secondary Index

Table: Music
Partition Key: Artist
Sort Key: Song Title

Choose which attributes to project (if any)



GSI: MusicGSI
Partition Key: Genre
Sort Key: Year

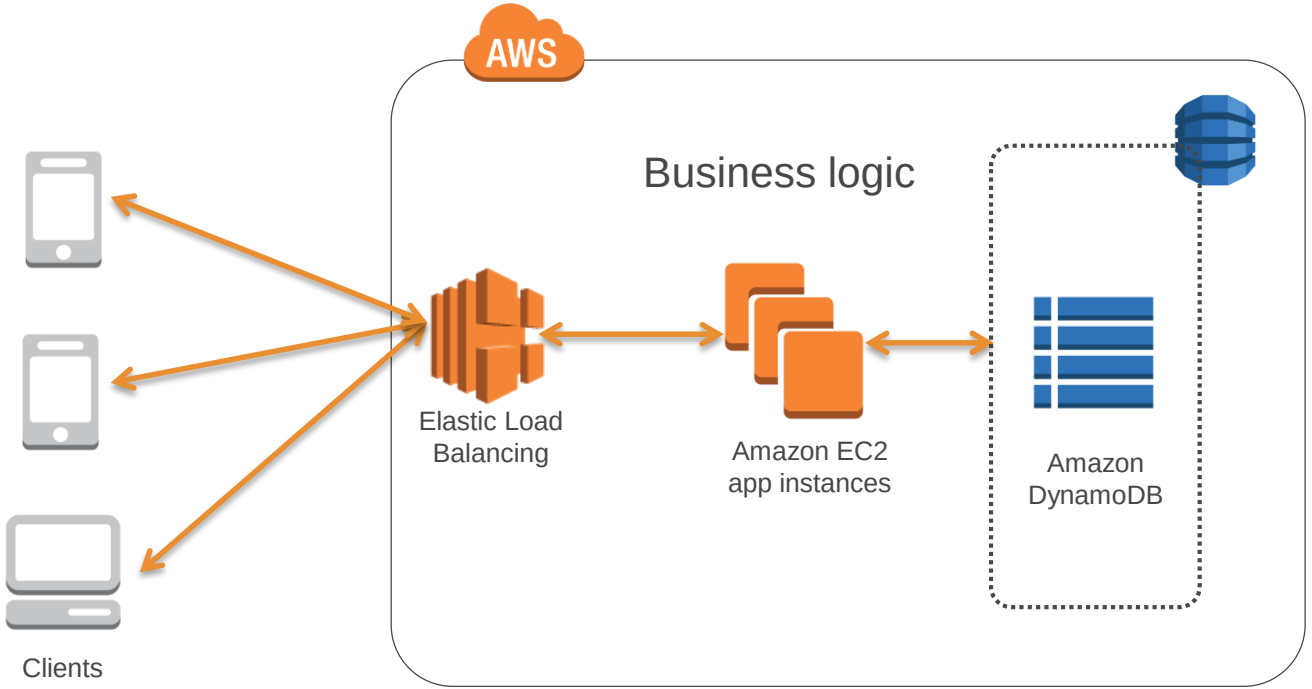
Provisioned Throughput

- You specify how much provisioned throughput capacity you need for reads and writes.
- Amazon DynamoDB allocates the necessary machine resources to meet your needs.
- Read capacity unit:
  - One strongly consistent read per second for items as large as 4 KB.
  - Two eventually consistent reads per second for items as large as 4 KB.
- Write capacity unit:
  - One write per second for items as large as 1 KB.

Supported Operations

- Query:
  - Query a table using the partition key and an optional sort key filter.
  - If the table has a secondary index, query using its key.
  - It is the most efficient way to retrieve items from a table or secondary index.
- Scan:
  - You can scan a table or secondary index.
  - Scan reads every item – slower than querying.
- You can use conditional expressions in both Query and Scan operations.

Simple Application Architecture



Amazon RDS and Amazon DynamoDB

Factors	Relational (Amazon RDS)	NoSQL (Amazon DynamoDB)
Application Type	• Existing database apps • Business process–centric apps	• New web-scale applications • Large number of small writes and reads
Application Characteristics	• **Relational** data models, transactions • **Complex** queries, joins, and updates	• Simple data models, transactions • Range queries, simple updates
Scaling	Application or **DBA–architected** (clustering, partitions, sharding)	**Seamless, on-demand scaling** based on application requirements
QoS	• Performance–depends on data model, indexing, query, and storage optimization • Reliability and availability • Durability	• Performance–**Automatically optimized** by the system • Reliability and availability • Durability

Database Considerations

If You Need	Consider Using
A relational database service with minimal administration	**Amazon RDS** • Choice of Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, or PostgreSQL database engines • Scale compute and storage • Multi-AZ availability 
A fast, highly scalable NoSQL database service	**Amazon DynamoDB** • Extremely fast performance • Seamless scalability and reliability • Low cost 
A database you can manage on your own	Your choice of **AMIs** on Amazon EC2 and Amazon EBS that provide scale compute and storage, complete control over instances, and more. 

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