High-level Architecture

This lesson gives a brief overview of Dynamo’s architecture.

We'll cover the following

- Introduction: Dynamo’s architecture
  - Data distribution
  - Data replication and consistency
  - Handling temporary failures
  - Inter-node communication and failure detection
  - High availability
  - Conflict resolution and handling permanent failures

At a high level, Dynamo is a **Distributed Hash Table (DHT)** that is replicated across the cluster for high availability and fault tolerance.

Introduction: Dynamo’s architecture#

Dynamo’s architecture can be summarized as follows (we will discuss all of these concepts in detail in the following lessons):

Data distribution#

Dynamo uses **Consistent Hashing** to distribute its data among nodes. Consistent hashing also makes it easy to add or remove nodes from a

Dynamo cluster.

Data replication and consistency#

Data is replicated optimistically, i.e., Dynamo provides **eventual consistency**.

Handling temporary failures#

To handle temporary failures, Dynamo replicates data to a **sloppy quorum** of other nodes in the system instead of a strict majority quorum.

Inter-node communication and failure detection#

Dynamo's nodes use **gossip protocol** to keep track of the cluster state.

High availability#

Dynamo makes the system "always writeable" (*or highly available*) by using **hinted handoff**.

Conflict resolution and handling permanent failures#

Since there are no write-time guarantees that nodes agree on values, Dynamo resolves potential conflicts using other mechanisms:

- Use **vector clocks** to keep track of value history and reconcile divergent histories at read time.
- In the background, dynamo uses an anti-entropy mechanism like **Merkle trees** to handle permanent failures.

Let’s discuss each of these concepts one by one.

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Dynamo: Introduction

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Data Partitioning

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