Working with NoSQL Databases

Course Description

This course introduces participants to the world of NoSQL databases, exploring their concepts, types, architectures, and practical applications. It emphasizes hands-on learning with popular NoSQL systems, enabling learners to design, query, and manage non-relational data effectively.

Duration

4 Days (32 Hours)

Pre-requisites

- Basic understanding of databases and SQL
- Familiarity with programming concepts (Python/JavaScript preferred)
- Knowledge of data structures (JSON, key-value pairs)

Learning Objectives

By the end of this training, participants will be able to:

- Understand the fundamentals and need for NoSQL databases
- Differentiate between types of NoSQL systems (Document, Key-Value, Column, Graph)
- Design schemas for NoSQL databases
- Perform CRUD operations and queries in NoSQL systems
- Apply NoSQL databases to real-world scenarios such as big data, analytics, and web applications

Content Coverage

Module 1: Introduction to NoSQL

- Evolution of databases: SQL vs NoSQL
- Characteristics of NoSQL databases

- CAP theorem and BASE properties
- Use cases and industry adoption
- Advantages and limitations

Module 2: Types of NoSQL Databases

- Key-Value Stores (e.g., Redis, DynamoDB)
- Document Stores (e.g., MongoDB, CouchDB)
- Column-Oriented Stores (e.g., Cassandra, HBase)
- Graph Databases (e.g., Neo4j)
- Comparative analysis of types
- Choosing the right NoSQL database

Module 3: Data Modeling in NoSQL

- Schema-less design principles
- JSON and BSON structures
- Denormalization strategies
- Indexing and query optimization
- Handling relationships in NoSQL
- Best practices for scalability

Module 4: Working with Document Databases (MongoDB Focus)

- Installation and setup
- CRUD operations (Create, Read, Update, Delete)
- Query operators and aggregation framework
- Indexing and performance tuning
- Replication and sharding concepts

- Hands-on exercises with MongoDB

Module 5: Key-Value and Column Stores

- Redis basics: data types and operations
- Use cases for caching and session management
- Cassandra architecture: partitioning and replication
- Querying with CQL (Cassandra Query Language)
- Performance considerations
- Practical exercises with Redis and Cassandra

Module 6: Graph Databases

- Introduction to graph theory in databases
- Nodes, relationships, and properties
- Cypher query language (Neo4j)
- Use cases: social networks, recommendation engines
- Visualization of graph data
- Hands-on exercises with Neo4j

Module 7: Advanced Topics and Real-World Applications

- NoSQL in Big Data ecosystems (Hadoop, Spark)
- Cloud-based NoSQL solutions (AWS DynamoDB, Azure Cosmos DB)
- Security and access control in NoSQL
- Backup and disaster recovery strategies
- Case studies from industry
- Future trends in NoSQL databases

Module 8: Capstone Project

- Designing a real-world application using NoSQL
- Selecting the appropriate NoSQL type
- Implementing CRUD and queries
- Performance tuning and scaling