Cassandra Interview Questions

1. What is Apache Cassandra?

   Apache Cassandra is a highly scalable, high-performance, distributed database designed to handle large amounts of data across many commodity servers, providing high availability with no single point of failure.

2. What is a token in Cassandra?

   A token in Cassandra is a value that the partitioner uses to distribute data across the nodes. Each row of data is distributed across the system using the partition key and the token value.

3. What are the differences between RDBMS and Cassandra?

   Cassandra is a NoSQL database while RDBMS is a SQL-based database system. RDBMS provides ACID properties, whereas Cassandra provides 'eventual consistency'. Cassandra is designed for handling big data workloads across multiple nodes without any single point of failure.

4. Can you explain what SSTable is in Cassandra?

   SSTable stands for Sorted Strings Table. It's a data file to which Cassandra writes memtable data after flushing.

5. What is a Column Family in Cassandra?

   Column Family in Cassandra is a structure that contains a collection of rows. Each row contains ordered columns. A column family is the equivalent of RDBMS's table.

6. Explain CAP theorem. How is it related to Cassandra?

   CAP theorem stands for Consistency, Availability, and Partition Tolerance. Cassandra offers tunable consistency, which means you can balance between consistency and availability based on your requirements. By default, it provides 'eventual consistency'.

7. What is the purpose of using Cassandra Query Language (CQL)?

   CQL is a language that Cassandra uses to interact with the database. It is similar to SQL, making it easier for developers with SQL background to adopt Cassandra.

8. What is tunable consistency in Cassandra?

   Tunable consistency is a fantastic feature of Cassandra. It allows users to select the consistency level best suited for their use case. Consistency can be chosen on a per-operation basis.

9. What are some of the key features of Cassandra?

   Some key features of Cassandra include fault tolerance, decentralized, elastic scalability, tunable consistency, and schema-free design.

10. What is a keyspace in Cassandra?

    A keyspace in Cassandra is a namespace that determines how data is replicated on nodes. It's the container for your application data, similar to a schema in a relational database.

11. What are the different types of Replication Strategies in Cassandra?

    There are two types of replication strategies in Cassandra: SimpleStrategy (used for a single data center setup) and NetworkTopologyStrategy (used for multiple data centers).

12. Explain Compaction in Cassandra.

    Compaction is a process in Cassandra that reclaims the unused disk space, deletes the obsolete data, and merges the different copies of the same row by taking the most recent update made to a column.

13. What is the Bloom filter in Cassandra?

    A Bloom filter is a space-efficient probabilistic data structure that is used to test whether an element is a member of a set. Cassandra uses Bloom filters to save IO when performing a key lookup: each SSTable has a Bloom filter associated with it that checks if any data for the requested row exists in the SSTable before doing disk I/O.

14. What is Snitch in Cassandra?

    A snitch in Cassandra determines which data centres and racks nodes belong to. They inform Cassandra about the network topology so that requests are routed efficiently and allows Cassandra to distribute replicas by grouping machines into data centres and racks.

15. What are Cassandra-Stress tools and its usage?

    Cassandra-Stress is a tool that allows you to stress test your Cassandra cluster. It provides a variety of options to simulate different workloads and read and write rates, thus enabling you to understand how your cluster would behave under different scenarios.

16. What is Gossip protocol in Cassandra?

    Gossip is a peer-to-peer communication protocol in which nodes periodically exchange state information about themselves and about other nodes they know about. This ensures that every node in the cluster knows about every other node.

17. What is a Commit Log in Cassandra?

    The commit log is a crash-recovery mechanism in Cassandra. Every write operation is written to the commit log before it is processed.

18. What is Read Repair in Cassandra?

    Read Repair is a process where Cassandra performs consistency checks on a read to make sure the returned data is consistent across replicas.

19. How is data stored in Cassandra?

    Data in Cassandra is stored as bytes on disk. Each row of data is stored separately and can have different numbers of columns. Columns are sorted by name.

20. Explain the role of the Coordinator node in Cassandra.

    The Coordinator is the node that a client connects to and communicates with. The Coordinator node is responsible for routing the client's request to the appropriate replicas.

21. What is the Hinted Handoff in Cassandra?

    Hinted Handoff is a process of handling write requests when a replica node is down or not responding. The coordinator node writes a hint indicating that a write needs to be replayed to the unavailable node.

22. What is Apache Cassandra's write pattern?

    Cassandra's write pattern is referred to as "write anywhere" pattern as it allows writes to happen on any node in a cluster.

23. What is Lightweight Transaction in Cassandra?

    Lightweight transactions in Cassandra use the Paxos consensus protocol to ensure linearizability i.e., a guarantee of consistency in a distributed system.

24. What is a Composite Key in Cassandra?

    A composite key in Cassandra is a key that consists of multiple data elements (or columns), grouped together to create a single key.

25. Can you explain how Cassandra handles data modifications?

    Cassandra writes data modifications to a commit log on disk first. Then, the changes are logged in the memtable. When the memtable is full, it is flushed to disk in an SSTable data file.

26. What are the different types of tombstones in Cassandra?

    There are three types of tombstones in Cassandra: row tombstones, range tombstones, and cell tombstones. They're used to mark deleted data.

27. What is a Super Column in Cassandra?

    A super column in Cassandra is a special column, therefore, it is a key-value pair where the key is a string, and the value is a map of other key-value pairs.

28. Explain the role of Memtable in Cassandra.

    A Memtable is an in-memory write-back cache of data rows that Cassandra looks up during reads and updates with write operations. When a Memtable gets full, it gets flushed to disk as an SSTable.

29. What is meant by 'consistent hashing' in Cassandra?

    Consistent hashing is a special kind of hashing technique that changes a minimal amount when the number of servers change. In Cassandra, consistent hashing is used to distribute data across different nodes.

30. What is Time to Live (TTL) in Cassandra?

    TTL is a feature that allows data to expire after a specified period of time. It is set on a per column basis and its value is the number of seconds since the column was created.

31. What are seeds in Cassandra?

    Seeds are special nodes used when a node joins a cluster. They are contacted for information about the cluster, and they serve as a communication point during startup.

32. What is the role of the Partitioner in Cassandra?

    The Partitioner is responsible for distributing the data across the nodes in the cluster. It does this by determining which node a particular row of data goes to based on the partition key.

33. What is the difference between deleting and expiring in Cassandra?

    Deleting in Cassandra means marking a cell as deleted, which Cassandra achieves by using tombstones. Expiring, on the other hand, is related to the TTL (Time To Live) property of a cell. When a cell is created with a TTL value, the cell will automatically be marked as deleted after the TTL has elapsed.

34. What are Repair and Anti-Entropy in Cassandra?

    Repair in Cassandra refers to the process of synchronizing data across replicas. Anti-entropy is the process of ensuring that the data in a distributed system, like Cassandra, remains consistent across all nodes.

35. What is a Materialized View in Cassandra?

    Materialized views are used to handle the denormalization of data in Cassandra. It's essentially a view of a base table's data that has a different primary key, and potentially, different columns as well.

36. What is the role of CQLSH in Cassandra?

    CQLSH is a Python-based command-line tool, and it provides a prompt where you can interact with Cassandra using CQL (Cassandra Query Language).

37. Explain the difference between a node, a cluster, and a data center in Cassandra.

    A node is a single machine running Cassandra. A cluster is a collection of nodes, and it can span across multiple data centers. A data center is a collection of related nodes and is usually tied to a physical location.

38. What is a counter column in Cassandra?

    A counter column is used to store a distributed counter value, i.e., a long integer value that can be increased (but not decreased) arbitrarily.

39. Explain what "write heavy" and "read heavy" means in the context of Cassandra.

    "Write heavy" and "read heavy" refer to the types of operations that are more prevalent. If you are mostly storing data, then your usage is write-heavy. If you're mostly fetching data, then your usage is read-heavy. Cassandra is often a good choice for write-heavy systems due to its log-structured storage engine.

40. What are dynamic columns in Cassandra?

    Dynamic columns in Cassandra refer to the ability to have a variable number of columns in a row, unlike in traditional relational databases where the number of columns is fixed at table creation time.

41. What is a Batch in Cassandra?

    A Batch in Cassandra allows you to execute multiple DML statements (like Insert, Update, Delete) as a single atomic operation.

42. What is Rack Awareness in Cassandra?

    Rack Awareness is about understanding the physical layout of the nodes in the cluster in terms of racks and data centres. It allows Cassandra to intelligently place replicas to ensure data safety.

43. What is a Secondary Index in Cassandra?

    Secondary Indexes in Cassandra are used to support queries on non-primary key columns. They are local to each node, and can be created on any non-primary key column.

44. What is the role of the Cassandra.yaml file?

    The cassandra.yaml is the main configuration file of Cassandra which holds settings like cluster name, seed nodes, data file directories, etc.

45. What are Collection data types in Cassandra?

    Collection data types in Cassandra allow you to store multiple values in a single column. Cassandra supports three types of collections: Lists, Sets, and Maps.

46. What is Paxos in Cassandra?

    Paxos is a consensus protocol used in Cassandra for lightweight transactions. It's used to ensure that concurrent transactions don't conflict with each other.

47. What is a wide row in Cassandra?

    A wide row in Cassandra is a row that has many columns. Cassandra is particularly well-suited for wide rows due to its log-structured storage engine.

48. Explain the difference between 'QUORUM' and 'LOCAL_QUORUM' consistency levels.

    QUORUM requires a quorum of replicas in all datacenters, while LOCAL_QUORUM requires a quorum only in the local datacenter.

49. What are the limitations of using Secondary Indexes in Cassandra?

    Secondary indexes in Cassandra can lead to increased storage costs and slower write speeds. They are also not well-suited for high cardinality columns, and performing range queries on a secondary index can be inefficient.

50. What is a Thrift in Cassandra?

    Thrift is the name of the RPC (remote procedure call) framework that was used by Cassandra for client communications in earlier versions. It has been largely replaced by the native protocol in more recent versions of Cassandra.

51. Explain the differences between 'ONE', 'TWO', 'THREE', and 'ALL' consistency levels in Cassandra.

    These consistency levels refer to the number of replicas that must respond before a read or a write operation is considered successful. ONE requires a response from one replica, TWO requires two replicas, and so on. ALL requires all replicas to respond.

52. What are prepared statements in Cassandra and why would you use them?

    Prepared statements are pre-compiled CQL queries that you can reuse with different values for faster executions and to prevent SQL injection attacks.

53. What is 'tombstone garbage collection grace seconds'?

    This is a setting in the cassandra.yaml file that specifies how long to wait before garbage collecting tombstones (deletion markers). Its default value is 10 days.

54. What is a Super Column Family in Cassandra?

    A Super Column Family in Cassandra is a special column family that contains super columns. Each super column contains one or more columns. Super column families are deprecated in recent versions of Cassandra.

55. How does Cassandra handle concurrent writes?

    Cassandra uses a timestamp value attached to each write operation to reconcile concurrent writes. The writer with the latest timestamp wins.

56. What is the purpose of the System Keyspace in Cassandra?

    The System Keyspace in Cassandra is used to store internal data such as schema metadata and bootstrap tokens.

57. What are some use cases where you would not want to use Cassandra?

    Some cases where Cassandra might not be the best choice include: when your data set is small and fits comfortably on a single server, when you need ACID transactions with rollback capabilities, or when you need to perform complex queries or joins.

58. What is a Column Family Store in Cassandra?

    A Column Family Store in Cassandra is a type of data structure where data is stored in column families, similar to tables in a relational database. A column family store is designed to handle very large amounts of data spread out across many commodity servers.

59. How can you secure your Cassandra deployment?

    You can secure your Cassandra deployment by using features such as internal or external authentication and role-based access control, client-to-node encryption, or node-to-node encryption.

60. What is the Hinted Handoff in Cassandra?

    Hinted Handoff is a feature in Cassandra where if a write operation cannot be performed on a node because it is down, a hint is stored at a live node. Once the failed node recovers, the hint is used to replay the write operation. This ensures high write availability and eventual consistency.

61. How does Cassandra handle conflicts during replication?

    Cassandra handles conflicts using a "last-write-wins" approach based on timestamps. The write with the latest timestamp will win.

62. What is the purpose of Cassandra's Read Repair mechanism?

    Read Repair is a process in Cassandra that checks and resolves inconsistencies between replicas during a read request. It's part of Cassandra's anti-entropy operations.

63. How does the Gossip protocol work in Cassandra?

Gossip is a peer-to-peer communication protocol used by Cassandra nodes to exchange location and state information about themselves and about other nodes they have gossiped about.

64. What's the difference between Levelled Compaction and Size Tiered Compaction?

    Levelled Compaction is good for write-intensive tasks. It reduces disk space usage by continually compacting SSTables into a series of levels. Size Tiered Compaction, on the other hand, is more suited for read-heavy tasks as it compacts SSTables of approximately the same size.

65. What is a Bloom Filter and how does it work in Cassandra?

    A Bloom Filter is a data structure used to test whether an element is a member of a set. It's used in Cassandra to check if any data exists for a particular row on the SSTable, without needing to read the disk.

66. How does Cassandra ensure Durability?

    Cassandra ensures Durability by immediately writing all writes to a commit log on disk before acknowledging the write to the client. The data is also eventually written to SSTables on disk.

67. What is the purpose of the Commit Log in Cassandra?

    The Commit Log is a crash-recovery mechanism in Cassandra. Every write operation is written to the Commit Log before it is acknowledged.

68. How can you model time-series data in Cassandra?

    Time-series data can be modelled in Cassandra using a wide-row model, with the time or event identifier as the column name, and the event details as the column value.

69. Explain Lightweight Transactions in Cassandra.

    Lightweight Transactions in Cassandra use the Paxos consensus protocol to ensure linearizable consistency, i.e., to ensure that there are no conflicts in case of concurrent writes.

70. How does Cassandra handle data compression?

Cassandra can compress SSTable data files using different algorithms like Snappy or LZ4. Compression can be configured per table and it helps save space and reduce the amount of IO.

71. Why does Cassandra not support joins?

    Cassandra doesn't support joins due to its distributed nature. Performing joins across large amounts of data distributed across many nodes would be inefficient and slow.

72. What is Eventual Consistency in Cassandra?

    Eventual Consistency in Cassandra means that updates to a replicated piece of data will eventually reach all replicas. It's a compromise to provide high availability and partition tolerance.

73. What is the concept of 'Tunable Consistency' in Cassandra?

    Tunable Consistency in Cassandra allows the user to decide how many replicas need to agree on a read or write operation before it is considered successful. This provides a balance between consistency, availability, and performance.

74. How does data distribution work in multi-datacenter deployments of Cassandra?

    In multi-datacenter deployments, Cassandra uses NetworkTopologyStrategy to place replicas in the same datacenter to reduce latency, and across different racks to ensure redundancy.

75. Why is Cassandra suitable for IoT use cases?

    Cassandra's distributed architecture, ability to handle large volumes of data, and support for time-series data modelling make it well-suited for IoT use cases.

76. Explain how compaction works in Cassandra.

    Compaction in Cassandra is the process of merging SSTables on disk, discarding old or deleted data, to maintain efficient data storage.

77. What are the different types of keys in Cassandra and how are they used?

There are three types of keys in Cassandra: Partition Key, Composite Key, and Clustering Key. The partition key is used to distribute data across nodes. The composite key consists of the partition key and the clustering key. The clustering key determines the order of data inside a partition.

78. What are SSTables in Cassandra?

    SSTables (Sorted String Tables) are immutable data files to which Cassandra writes memtables periodically or when they fill up.

79. How does Cassandra handle failures?

    Cassandra uses various techniques to handle failures, including Hinted Handoff, Read Repair, and Active Anti-Entropy.

80. What is Cassandra's Snitch and what does it do?

    A Snitch determines which data centers and racks nodes belong to. It informs Cassandra about the network topology so that requests can be routed efficiently.

81. What happens when you run out of disk space in Cassandra?

    If a node runs out of disk space, it gets automatically marked as down and cannot receive write requests until sufficient space is made available.

82. What is Apache Cassandra's strategy for handling data evictions?

    Cassandra doesn't support data eviction out of the box. If you want to expire data, you can set a TTL (Time To Live) while writing the data, after which the data is automatically deleted.

83. What happens when a Cassandra node goes down during a write operation?

    If a node goes down during a write operation, the write can still succeed if the consistency level allows for it. The failed write is stored as a hint on a live node and replayed when the downed node comes back up.

84. How can you minimize read latencies in Cassandra?

    Read latencies can be minimized by using appropriate data models, correct compaction strategies, tuning Bloom filters, and by using caches like the row cache and key cache.

85. What is the impact of Consistency Level on Cassandra's performance?

    A higher consistency level can result in higher latencies as more replicas need to respond. However, it guarantees higher consistency.

86. What is the purpose of Apache Cassandra's Coordinator node?

    The Coordinator node in Cassandra is the node that acts as a proxy between the client application and the nodes that own the data being requested.

87. How can you mitigate the impact of "wide rows" in Cassandra?

    Wide rows can be mitigated by using appropriate compaction strategies and by careful query design. Fetching too many columns from a wide row in a single query can lead to large amounts of data being read from disk and increased latencies.

88. What is vnode and what is its purpose in Cassandra?

    A vnode, or virtual node, is a subdivision of a node in the Cassandra ring. Instead of a node being responsible for a single range of data, it can be responsible for multiple ranges. This makes rebalancing easier and more efficient when nodes are added or removed.

89. How does Cassandra handle large blobs of data?

    Large blobs of data can be stored as a single cell in Cassandra. However, it's not recommended as it can result in large amounts of memory usage and increased latencies. For large blobs, it's better to use an external blob store or to chunk the data into smaller pieces.

90. Explain how Tombstones work in Cassandra.

    Tombstones are markers that are written when data is deleted. They are used to mark data as deleted on disk and to propagate the deletion