Redshift Interview Questions

1. Explain the architecture of Amazon Redshift.
   Answer: Redshift is based on the massively parallel processing architecture. The core infrastructure of Redshift is called a cluster, which comprises a leader node and one or more compute nodes.
   The leader node manages communications with client programs and all the communication with compute nodes. It is responsible for parsing, rewriting and compiling the queries and distributing them to compute nodes.
   The compute nodes execute the compiled code and send intermediate results back to the leader node for final aggregation. Each compute node has its own dedicated CPU, memory and attached disk storage, which are determined by the node type. The actual data that you store on the Redshift cluster is stored on Compute nodes.
   A compute node is further divided into slices, which are assigned a portion of the compute nodes' memory and CPU.

2. Explain the different node types available for Amazon Redshift.
   Answer: Redshift offers the following three different node types:
   Dense Compute (DC): These are suitable for workloads that require more compute than storage.
   Dense Storage (DS): These types of nodes provide more storage than compute.
   RA3: These are for Redshift advanced analytics, which decouple storage from compute.

3. What is the importance of system catalogue tables/views in Redshift? What are some important system catalogue tables/views used in Redshift?
   Answer: There are two types of system tables, which are as follows: STL and STV tables.
   STL tables are generated from logs that have been persisted to disk to provide a history of the system. STV tables are virtual tables that contain snapshots of the current system data. They are based on transient in-memory data and are not persisted to disk-based logs or regular tables.
   System views that contain any reference to a transient STV table are called SVV views. Views containing only references to STL tables are called SVL views.
   Some important system tables and views are as follows:
   STV_INFLIGHT: View currently running queries
   STL_QUERY: View historical queries that ran on the database
   STL_LOAD_ERRORS: View COPY command errors

4. What is the RA3 node type and how does it differ from the usual DC/DS node types?
   Answer: **RA3** is a new type of node offered by AWS, which provides separate storage, and they are flexible to grow your compute capacity without increasing your storage costs. They scale your storage without over-provisioning your compute capacity.

5. How do you force COPY and UNLOAD traffic to flow through the Amazon VPC and not route it through the internet?

Answer: Amazon Redshift enhanced VPC routing**:** Amazon Redshift forces all the COPY and UNLOAD traffic between your cluster and your data repositories through your Amazon VPC if you use Enhanced VPC routing. If enhanced VPC routing is not enabled, then Amazon Redshift routes the traffic through the internet, including the traffic to other services within the AWS network.

6. How does elastic resize differ from classic resize?

   Answer: Both Elastic resize and classic resize are used to scale the Redshift cluster up or down. With classic resize, a new cluster is created with the required nodes, and data is copied from the existing cluster to the new one. Once it is completely copied, the existing cluster is terminated, and the new cluster is renamed to the existing one. Throughout the course of classic resize, the cluster is available in the read-only mode.

   In elastic resize, new nodes are added/removed from the existing cluster within minutes. Data is distributed in the background. The cluster is available for read and write during data distribution.

7. Suppose you created a single-node Redshift Cluster. When you are trying to connect this cluster from an SQL workbench, an error is thrown that states 'Connection Refused'. What could be the possible cause of this and how would you diagnose this error?
   Answer: The possible causes for this may be the following:
   1. The cluster is not in the 'available' state.
   2. The cluster was created in a private subnet, and no NAT gateway is attached to this private subnet. You try to connect from outside the private subnet.
   3. The security groups associated with the clusters do not allow connections from your source IP.
   4. You use an incorrect JDBC/ODBC URL or port number for connecting to the cluster.

8. How does an interleaved sort key differ from a compound sort key?
   Answer: A compound sort key is more efficient when query predicates use a prefix, which is a subset of the sort key columns in order.
   An interleaved sort key gives equal weight to each column in the sort key, and so, query predicates can use any subset of the columns that make up the sort key in any order.

9. Suppose you are managing a Redshift cluster for a telecom company. Today, you received multiple complaints from the users about the queries running slowly. How would you diagnose the issue?
   Answer:
   1. Check whether any changes were made to the table structure recently or the data volume has unexpectedly increased in the underlying tables. It can be one of the potential causes for the queries running slower.
   2. Check whether or not the underlying tables have been vacuumed and analysed. Stale statistics for a table can cause the optimiser to generate bad query plans, which lead to performance degradation.

3. Generate an EXPLAIN plan for the query. Read it and assess whether or not data is being broadcasted over the network. If yes, then review the sort keys and distribution keys for the underlying tables.
4. In the EXPLAIN plan, check whether the data is being written to the disk frequently or not. If it is, then increase the WLM memory for the queue in which these queries are running. If less memory is available, then disk writes happen, which lead to performance degradation.

10. Suppose you are working at XYZ Company that uses Redshift for advanced analytics. It loads its data daily from 9 pm to 6 am for analytics to be run on the next day. It has two different user groups / teams that run queries on the Redshift cluster. One is the Advanced Data Science team that runs complex analytics queries on the data and the other one includes Business Users who run a few small queries throughout the day. How would you ensure maximum efficiency and low contention on the Redshift cluster?
   Answer: You can set up Workload Management on Redshift. Create different queues for ETL, ADS and Business Users.

   Manual WLM: Assign most resources (suppose 90%) to the ETL queue from 9 pm to 6 am, and switch the WLM settings at 6 am. Assign approximately 60% resources to the ADS queue and 30% to the business users' queue with short query acceleration and concurrency scaling on.

   Automatic WLM: Redshift will take care of resource distribution automatically.

11. Your development team wants to test their new enhancement code on the production Redshift cluster. What would be your recommendation? Would you give them access to the production environment?
   Answer: You can create a snapshot of the production Redshift cluster and create a new development cluster from this snapshot. The development team can work on this cluster without affecting the production cluster.

12. What is the best way to download data from a Redshift cluster to an S3 bucket in another AWS account?
   Answer: You can use **IAM role chaining**. Create an IAM role in your account and another one in the target AWS Account (the one that has access to the S3 bucket in that account). Give the IAM role in your account the permission to assume the role in another AWS account. You can use the UNLOAD command with role chaining to assume the target account's role and dump the data into the target account's S3 bucket.

13. Suppose you are working at ABC Financial Company, and it has a strict requirement of keeping the history of user activity on their Redshift cluster for the recent one month. As a Redshift administrator, what solution would you recommend/implement? Or what are the different ways of tracking user activity on the Redshift cluster?
   Answer: Amazon Redshift provides the following three logging options:
   Audit logs: Stored in Amazon Simple Storage Service (Amazon S3) buckets
   STL tables: Stored on every node in the cluster
   AWS CloudTrail: Stored in Amazon S3 buckets

Audit logs and STL tables record database-level activities, such as which users who logged in and when. These tables also record the SQL activities and the time at which these users performed them. Redshift system tables do not store data for more than 3–5 days. It is recommended to create a custom script to incrementally copy the data from some important system tables to permanent user-defined tables to preserve the history of system tables.
CloudTrail tracks the activities performed at the service/API level.

14. Suppose you manage a Redshift cluster for ABC Company. On Monday, one of the users informs you that they have accidentally deleted one fact table from the production database. This table is extremely critical for the overall operations. How would you approach this problem?
Answer: Ask the user the approximate time when they deleted the table. Check the latest available snapshot for that cluster before that timeframe.
You can restore the table from that snapshot.
If you do not have any snapshot for that cluster, then it is not possible to restore the table.

15. How do you optimise costs for your Redshift cluster?
Answer: Costs for your Redshift cluster can be optimised in several ways, which are as follows:
    a. Node reservations
    b. Rightsizing
    c. Proper column encoding/compression
    d. Pausing Redshift cluster it is when not in use and resuming when required
    e. Ensuring that vacuum is running and reclaiming the disk space

16. How do you decide the memory and concurrency values for different WLM queues?
Answer: First, you identify different workload types for your cluster. For example, if you are loading data into your Redshift cluster or performing any ETL operations, then it would qualify as one queue. If you have analytical users or BI tools connecting to your database, then it would qualify as another queue.
Then, you use the Redshift admin utility to determine the number of queries that are running in one queue and analyse whether there is any waiting time in a queue. Based on this information, you can tune the WLM parameters.
The alternate option is to use automated WLM in which Redshift will automatically determine the memory and concurrency for each queue.

17. How do you secure your Redshift database from external security threats?
Answer: First, Redshift clusters can be encrypted using AWS KMS (Key Management Service), which will encrypt the data at rest within the compute nodes.
For in-transit encryption, you can enable SSL connections. There is a parameter in the Redshift parameter group that can be set to true, which allows only SSL-secured connections to the cluster.
For UNLOAD and COPY commands, it is recommended to not use IAM keys as credentials. Instead, create an IAM role and attach it to the cluster. Use that IAM role for UNLOAD and COPY commands.

You can also enable enhanced VPC routing to secure the UNLOAD and COPY command traffic such that the traffic flows only within the AWS VPC and not over the public internet.