AWS Database Migration

Agenda

- Upon completing this module, you should be able to:
  - Understand AWS DB migration Challenges
  - Understand a brief Introduction to AWS DB Migration services
  - Understand AWS DB services
  - Typical use case for AWS DB Migration
  - Understand AWS DB migration services in detail
  - Understand pre, during and post DB migration task
  - Perform lab for heterogeneous DB migration as per lab guide

DB Migration challenges

- Identifying and prioritizing DB Migration
- Large Databases (TBs ,PBs)
- Live Migration with Zero Data Loss
- Schema Migration
- Secure DB migration

AWS Database Migration Service (DMS) – Overview

- AWS Database Migration Service is a web service used to migrate data from On-premises databases, Amazon Relational Database Service (Amazon RDS) DB instance or database running on an Amazon Elastic Compute Cloud (Amazon EC2) instance.
- Use the AWS Schema Conversion Tool (AWS SCT) to translate your database schema to the new platform and then use AWS DMS to migrate the data.
- AWS DMS & AWS Snowball Edge Integration enables mass Database Migrations and Migrations of large databases.
- AWS Migration Hub helps to keep track of the progress of DB Migrations and also provides key metrics .

How is AWS DMS different ?

- AWS DMS helps to migrate databases to AWS **quickly and securely.**
- **Live Migration :** The source database remains fully operational during the migration, m**inimizing downtime** to applications that rely on the source database
- DMS can migrate data to and from most widely used **commercial and open-source databases.**
- The service supports **homogenous migrations** such as Oracle to Oracle, as well as **heterogeneous DB migrations** between different database platforms, such as Oracle to Amazon Aurora or Microsoft SQL Server to MySQL
- AWS DMS can also be used for Database Consolidation , Continuous data replication with high-availability

AWS DMS Overview

AWS
Database Migration
Service

PostgreSQL ORACLE Amazon Aurora

Amazon Redshift MySQL MariaDB Microsoft SQL Server

Start your first migration in 10 minutes or less

Keep your apps running during the migration

Replicate within, to or from Amazon EC2 or RDS

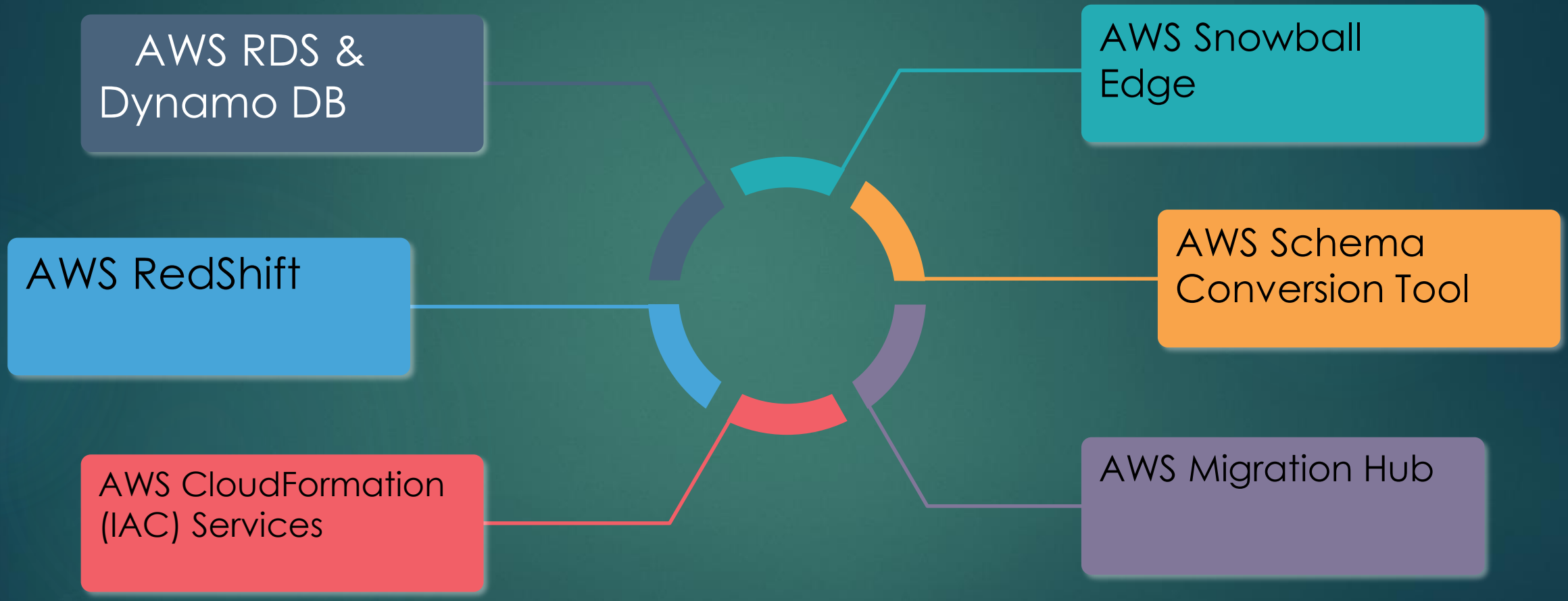
Move data to the same or different database engine

Learn more at aws.amazon.com/dms

Introduction to AWS DB services

- Main Services & Tools
  - AWS RDS
  - AWS Redshift
  - AWS Dynamo DB – A non RDS DB
  - AWS Migration Hub
  - AWS Schema Migration Services
- Support Services
  - AWS Cloud Formation services

AWS Services related to AWS DMS



AWS RDS Overview

01

Amazon Relational Database Service (RDS AWS) is a web service that makes it easier to set up, operate, and scale a relational database in the cloud.

02

It provides cost-efficient, re-sizable capacity in an industry-standard relational database and manages common database administration tasks such as database setup , patching and backups.

03

Provides better performance , High Availability , Security and Compatibility for databases.

04

AWS RDS Database Engines

- Amazon RDS is available on several database instance types - optimized for **memory, performance or I/O** - and provides with following six familiar database engines to choose from

Amazon Aurora

Provides 5x faster than RDS MySQL and 3x faster than RDS PostgreSQL

MySQL

Open Source Database Management System which uses SQL to access the data

Postgre SQL

Open Source Database Management System which uses SQL to access the data stored in its system.

Microsoft SQL Server

Relational Database Management System, which was developed by Microsoft in 2005 for the enterprise environment

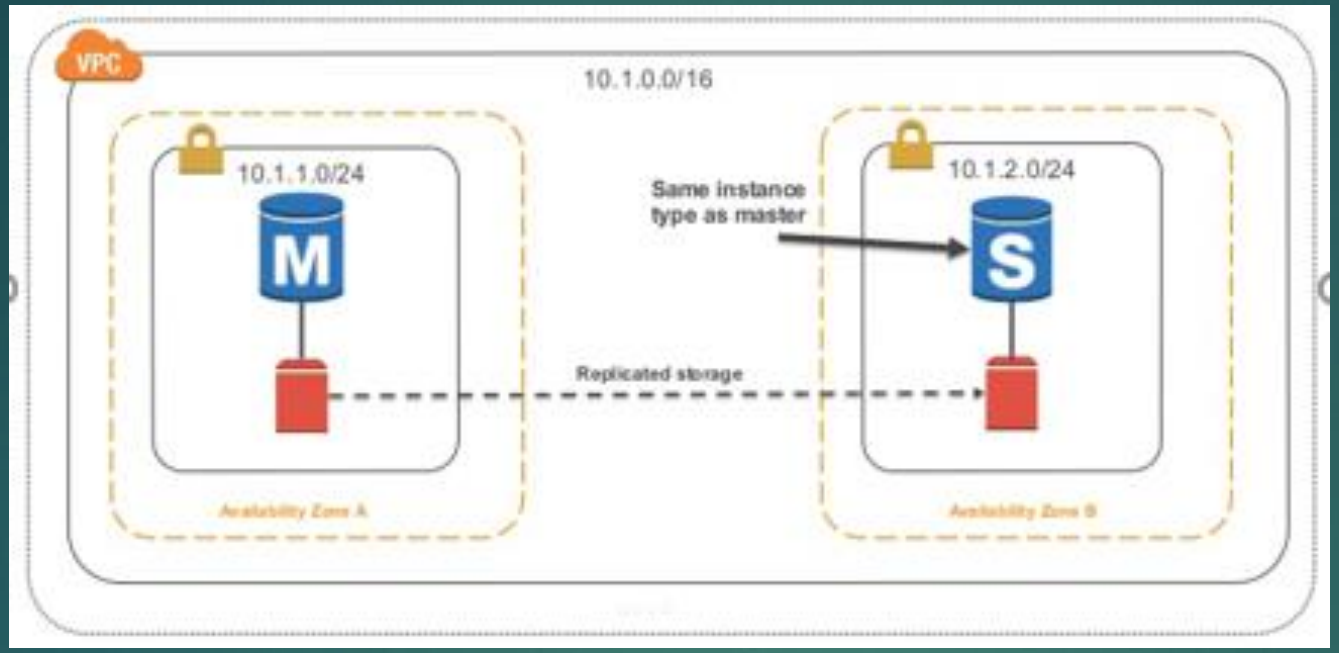
Oracle

Object-relational database management system which was developed by Oracle Inc

Maria DB

MariaDB is a community developed fork of MySQL DBMS

AWS RDS in HA



- Amazon RDS Multi-AZ deployments provide enhanced availability and durability for Database (DB) Instances.
- When you provision a Multi-AZ DB Instance, Amazon RDS automatically creates a primary DB Instance and synchronously replicates the data to a standby instance in a different Availability Zone (AZ).
- Each AZ runs on its own physically distinct, independent infrastructure.
- Amazon RDS performs an automatic failover to the standby, in case of failure.

AWS Dynamo DB Overview

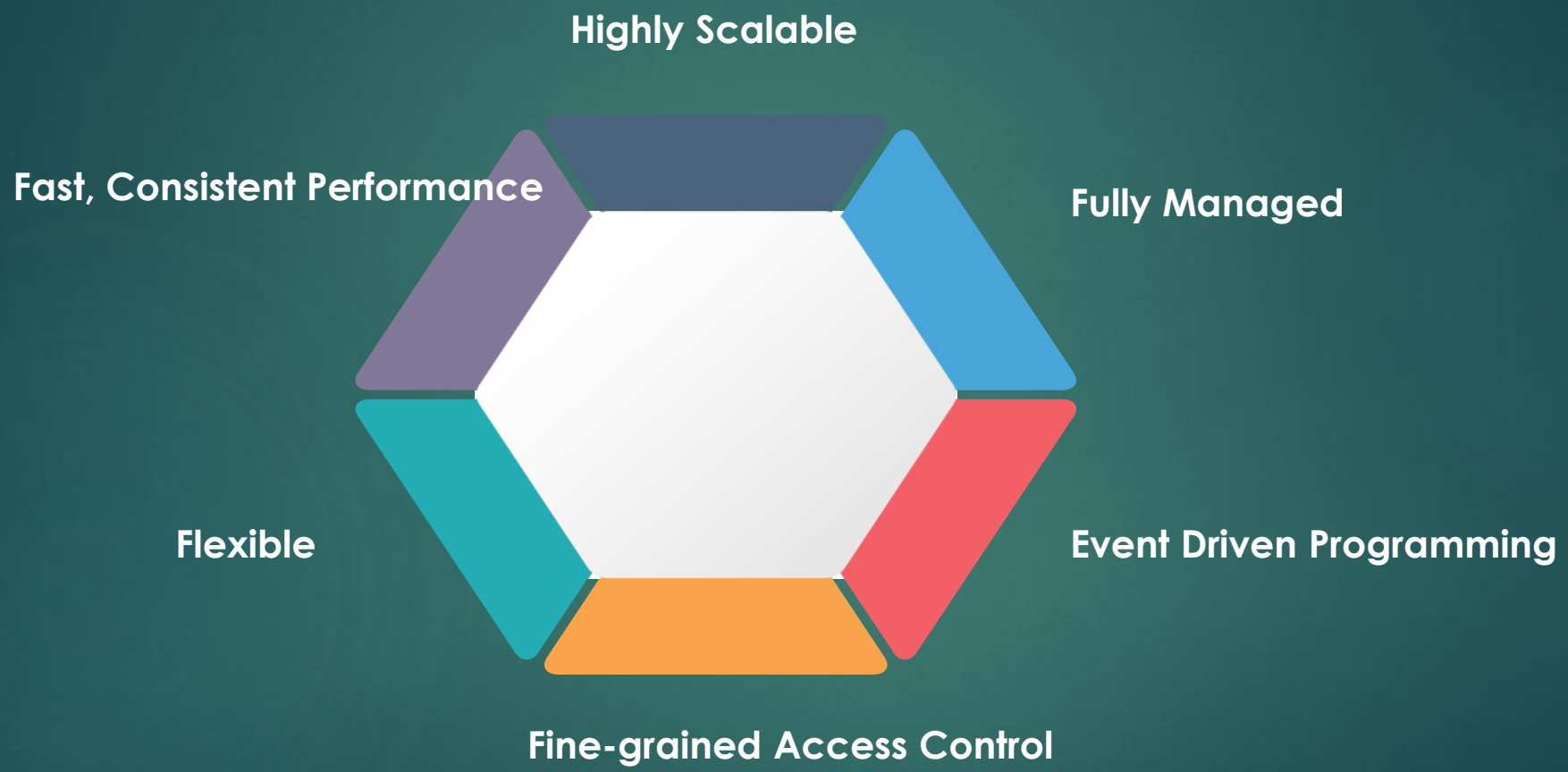
01 Dynamo DB is a NoSQL database managed service provided by AWS

02 High-Performance databases which utilize a variety of data models, including document, graph, key-value, and columnar

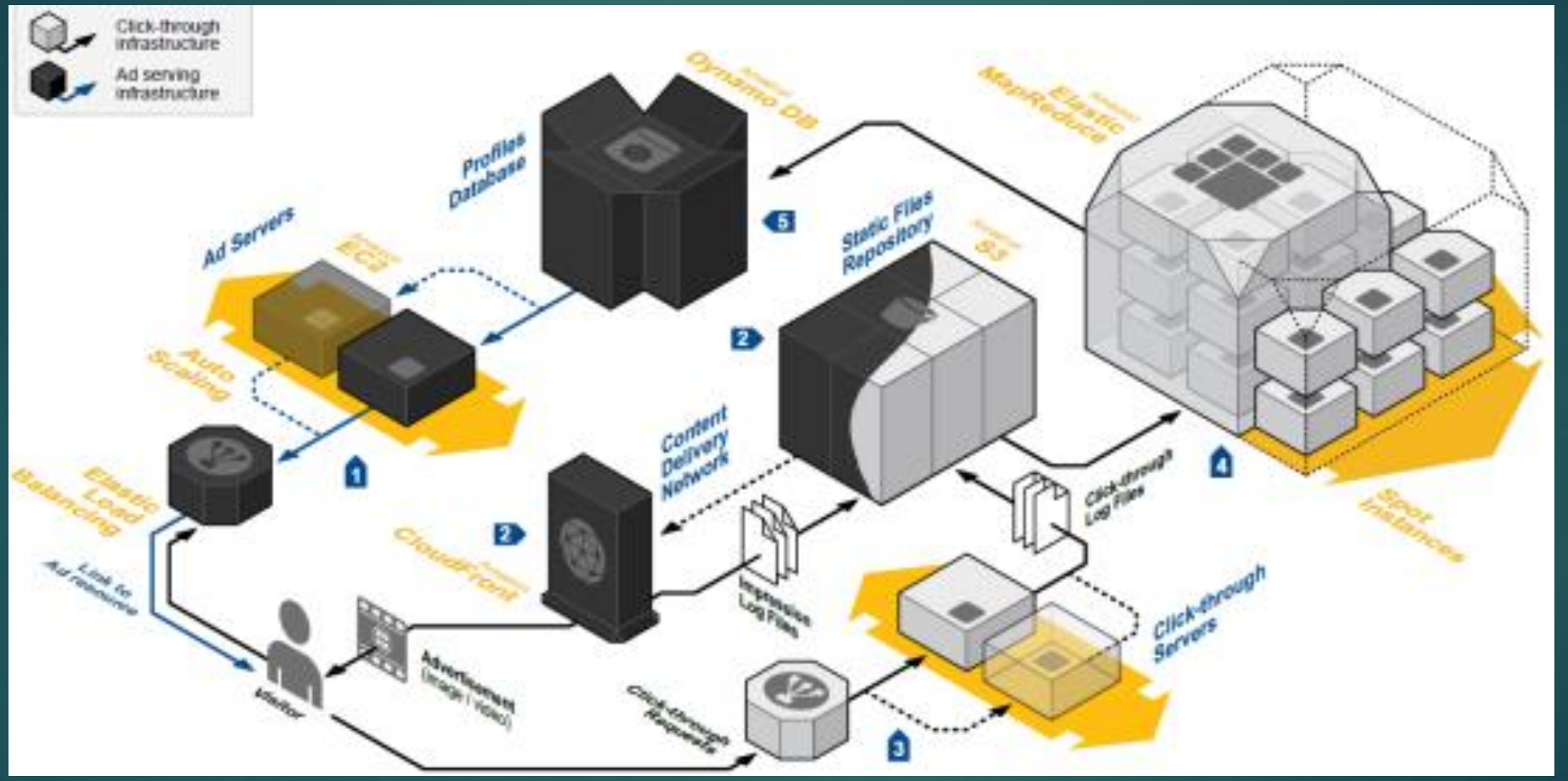
03 Recognized for ease of development, highly scalable performance, high availability, and resilience

04 Database service for all applications that need consistent, single-digit millisecond latency at any scale . Eg: Mobile, Web, gaming, ad tech, IoT, and many other applications

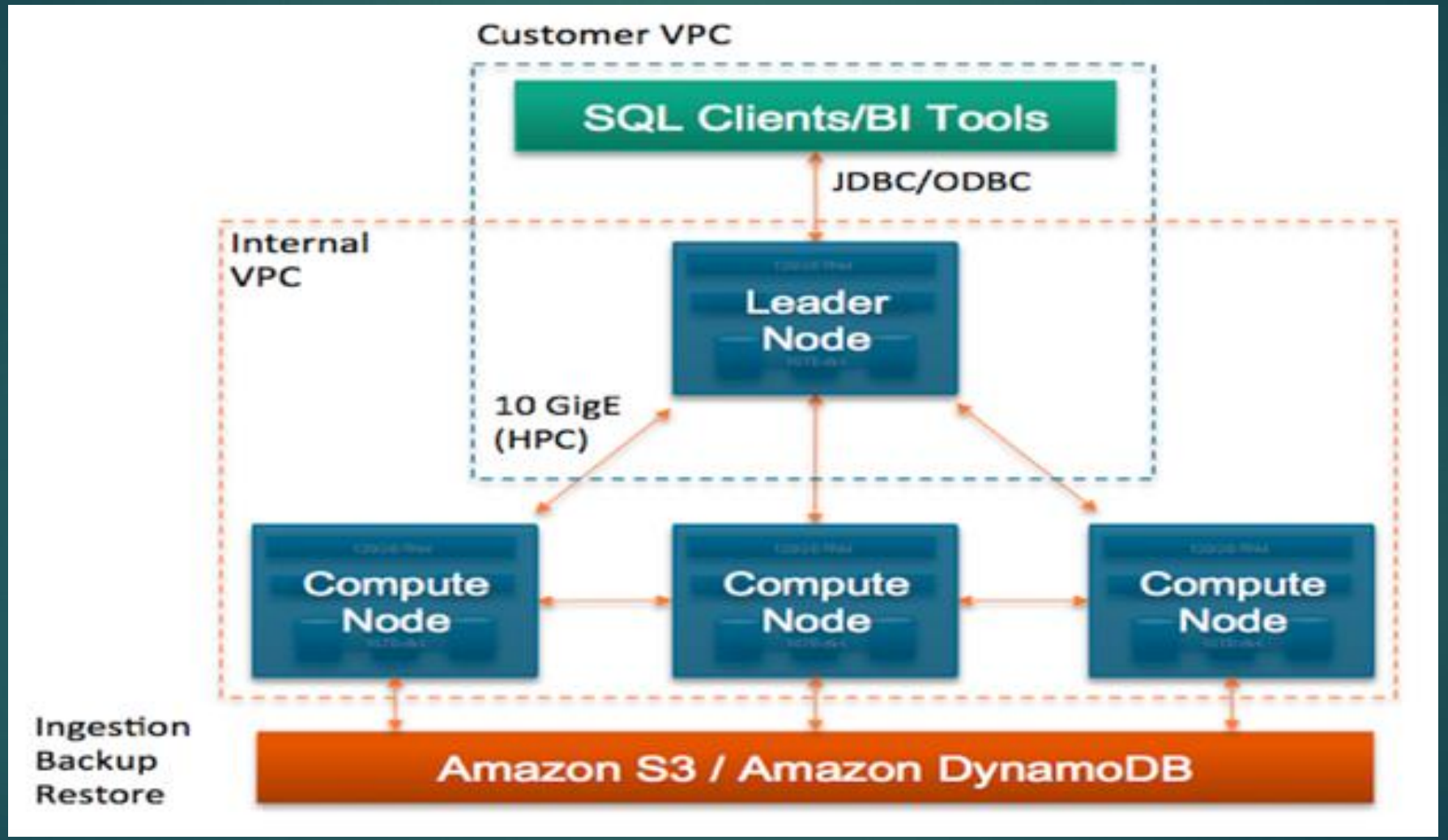
AWS DynamoDB Benefits



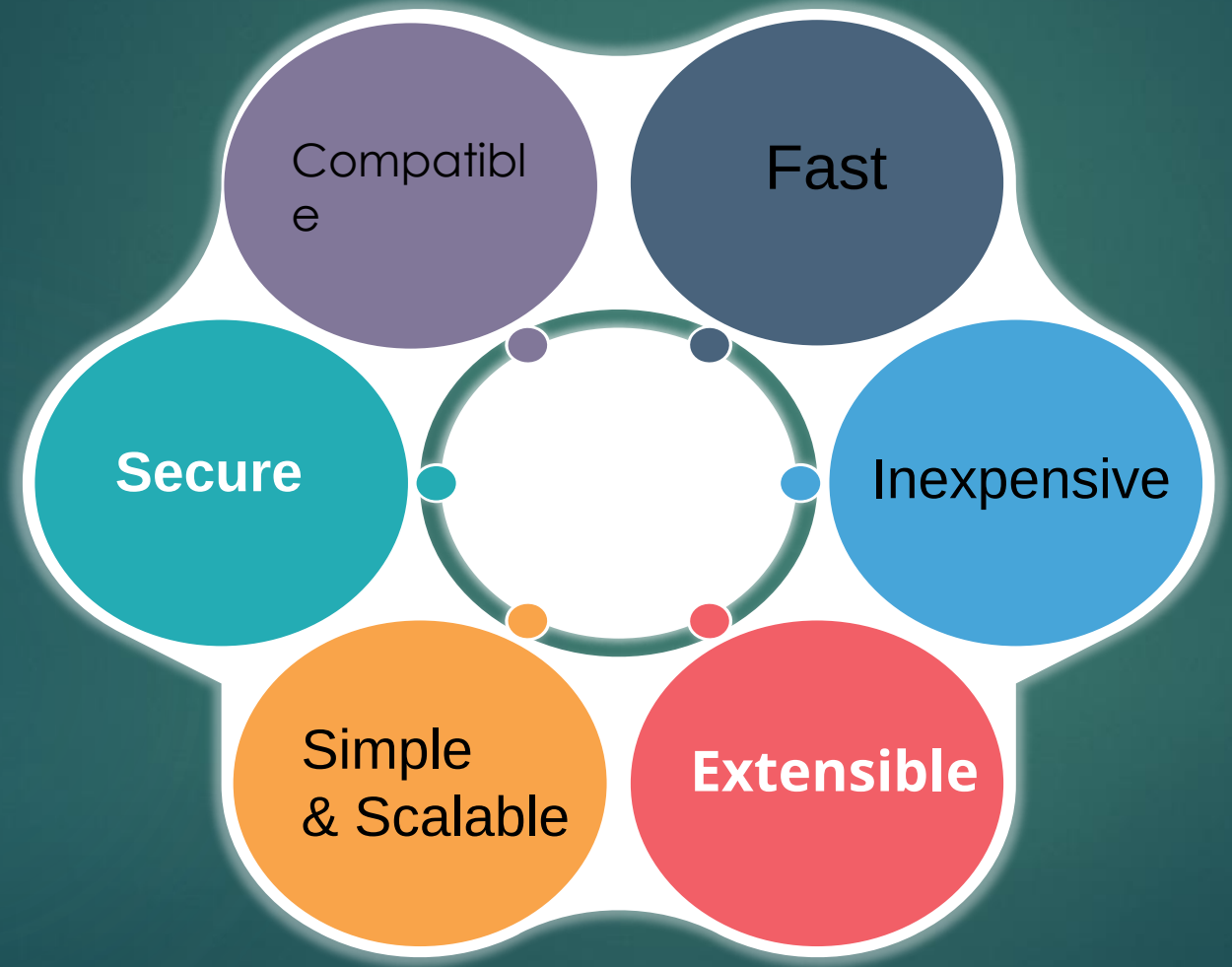
Use Case - Ad Tech



AWS Redshift Architecture



AWS Redshift Benefits



AWS CloudFormation - IaaC

01 AWS CloudFormation helps customers to describe and provision all the infrastructure resources in Cloud

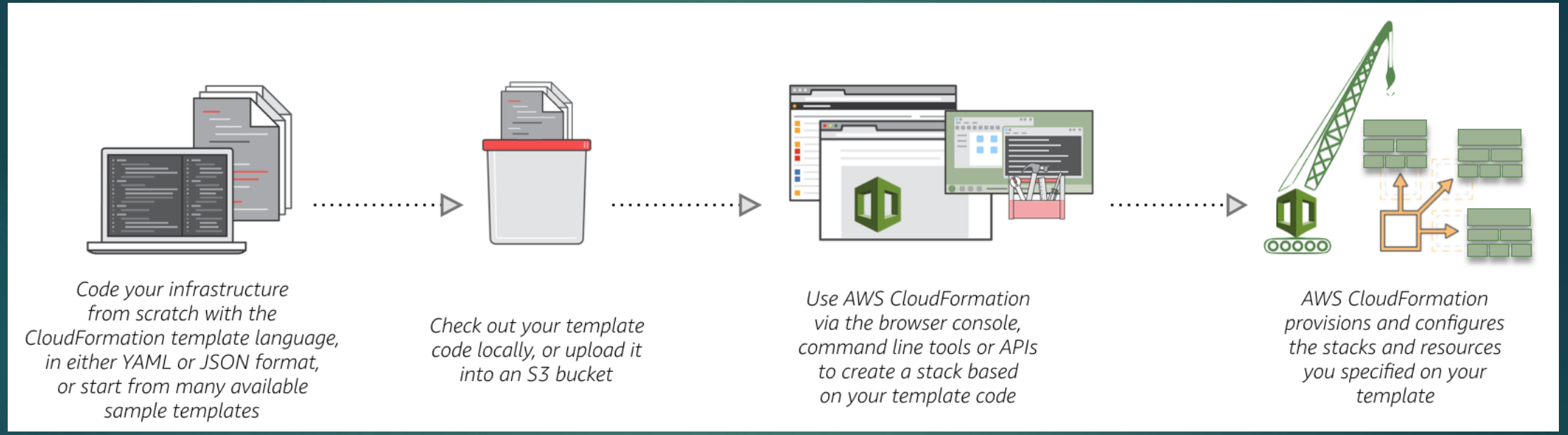
02 Comprehensive templating language that enables you to create managed 'stacks' of AWS resources

03 AWS provides large number of ready cloud formation stack template which can be used directly or customized for creating cloud infrastructure

04 AWS CloudFormation is available at no additional charge, and you pay only for the AWS resources needed to run your applications.

05

How CloudFormation Works



Code your infrastructure from scratch with the CloudFormation template language, in either YAML or JSON format, or start from many available sample templates

Check out your template code locally, or upload it into an S3 bucket

Use AWS CloudFormation via the browser console, command line tools or APIs to create a stack based on your template code

AWS CloudFormation provisions and configures the stacks and resources you specified on your template

AWS Snowball Edge

01 It is a 100TB data transfer device with on-board storage and compute capabilities.

02 Used to move large amounts of data into and out of AWS and to support local workloads in remote or offline locations.

03 Connects to your existing applications and infrastructure using standard storage interfaces, streamlining the data transfer process and minimizing setup and integration.

04 Used to cluster together to form a local storage tier and process your data on-premises, helping ensure your applications continue to run even when they are not able to access the cloud.

AWS Snowball Process

CREATE A JOB

*Create a new data transfer job in the **AWS Management Console.** AWS will ship you one or more Snowball appliances based on the amount of data.*

CONNECT THE SNOWBALL

*Connect the appliance to your network and set the **IP address**. Download the Snowball client and job **manifest** from the Console, run the client to connect and identify data to transfer.*

COPY TO THE SNOWBALL

The client will encrypt and copydata to the appliance at high speed. Once complete, the E ink shipping label will automatically update.

AWS WILL MOVE YOUR DATA TO S3

Track the job status via Amazon SNS, text messaging, or directly in the Console.

Job Created — Shipped — With Customer — Transit to AWS — At AWS — Job Completed

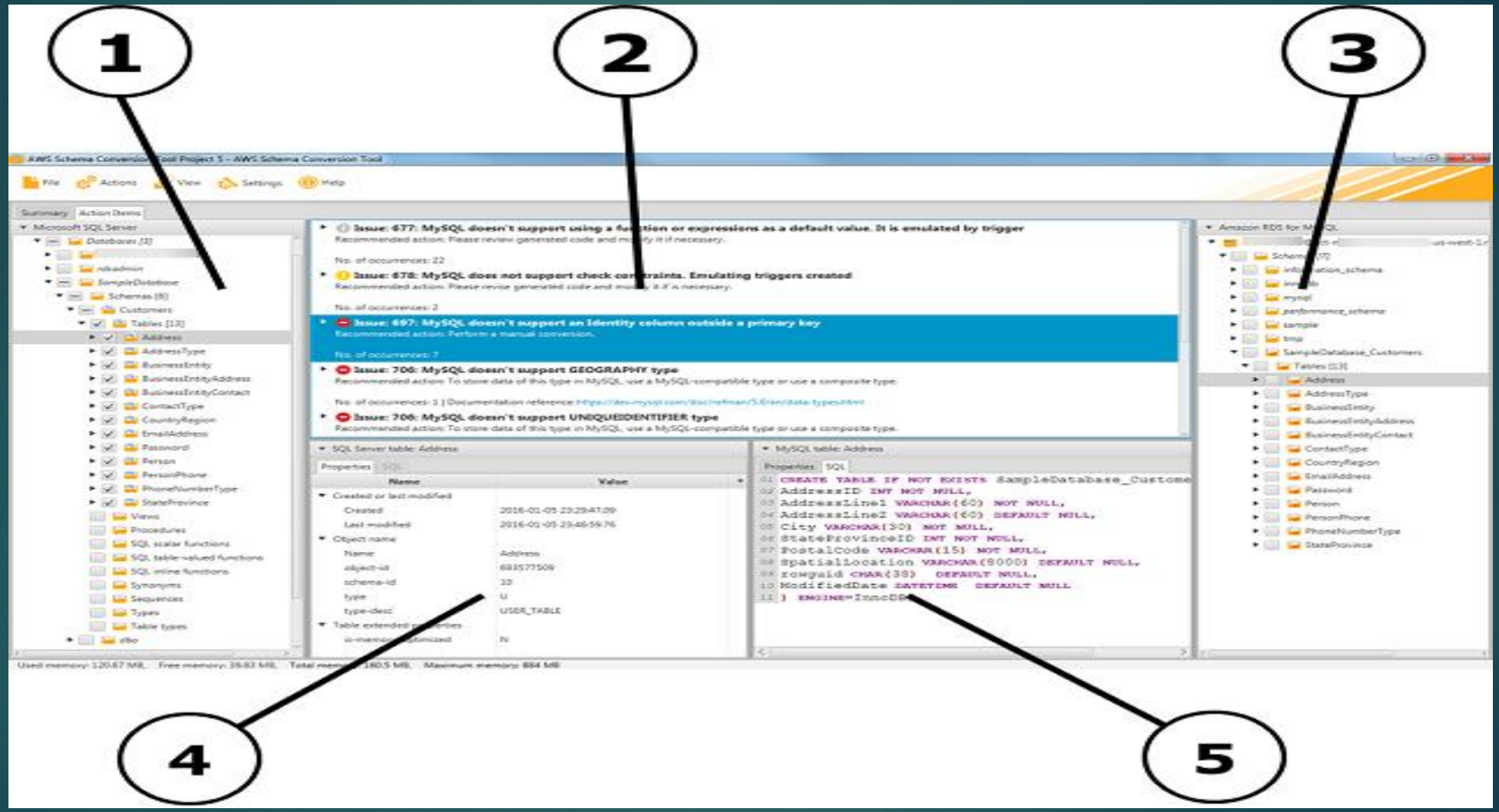
Overview of AWS Schema Conversion Tool (SCT)

1. Used for Heterogenous Database Migrations
2. **Automatically converts** the source DB schema and a majority of the source DB code objects, including views, stored procedures, and functions, to a format compatible with the target database.
3. Marks objects which cannot be converted so that they could be manullay migrated
4. It can also scan application source code for embedded SQL statements and convert them as part of DB Schema conversion project.
5. Source database can be on-premises, or in Amazon RDS or EC2 and the target database can be in either Amazon RDS or EC2

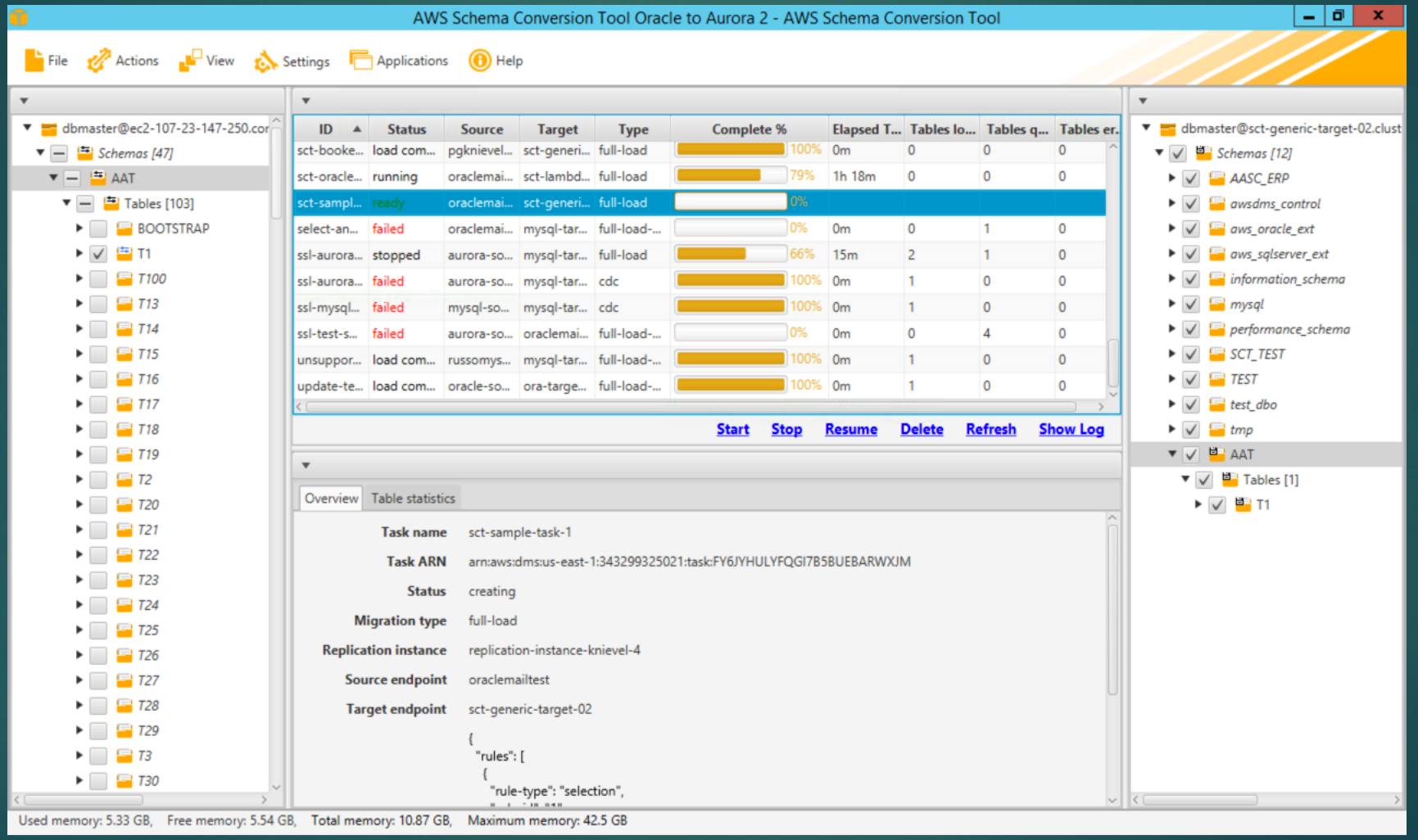
DB Conversions supported by SCT

Source Database	Target Database on Amazon RDS
Oracle Database	Amazon Aurora, MySQL, PostgreSQL, MariaDB
Oracle Data Warehouse	Amazon Redshift
Microsoft SQL Server	Amazon Aurora, Amazon Redshift, MySQL, PostgreSQL, MariaDB
Teradata	Amazon Redshift
IBM Netezza	Amazon Redshift
Greenplum	Amazon Redshift
HPE Vertica	Amazon Redshift
MySQL and MariaDB	PostgreSQL
PostgreSQL	Amazon Aurora, MySQL, MariaDB
Amazon Aurora	PostgreSQL
IBM DB2 LUW	Amazon Aurora, MySQL, PostgreSQL

AWS SCT Project Window



AWS Schema Conversion Tool (Oracle to Aurora2)



Sample SCT Service Report

Database Objects with Conversion Actions for Amazon RDS for PostgreSQL

Of the total 8 database storage object(s) and 3 database code object(s) in the source database, we were able to identify 8 (100%) database storage object(s) and 2 (67%) database code object(s) that can be converted to Amazon RDS for PostgreSQL automatically or with minimal changes.

1 (33%) database code object(s) require 1 medium and 4 significant user action(s) to complete the conversion.

Figure: Conversion statistics for database storage objects

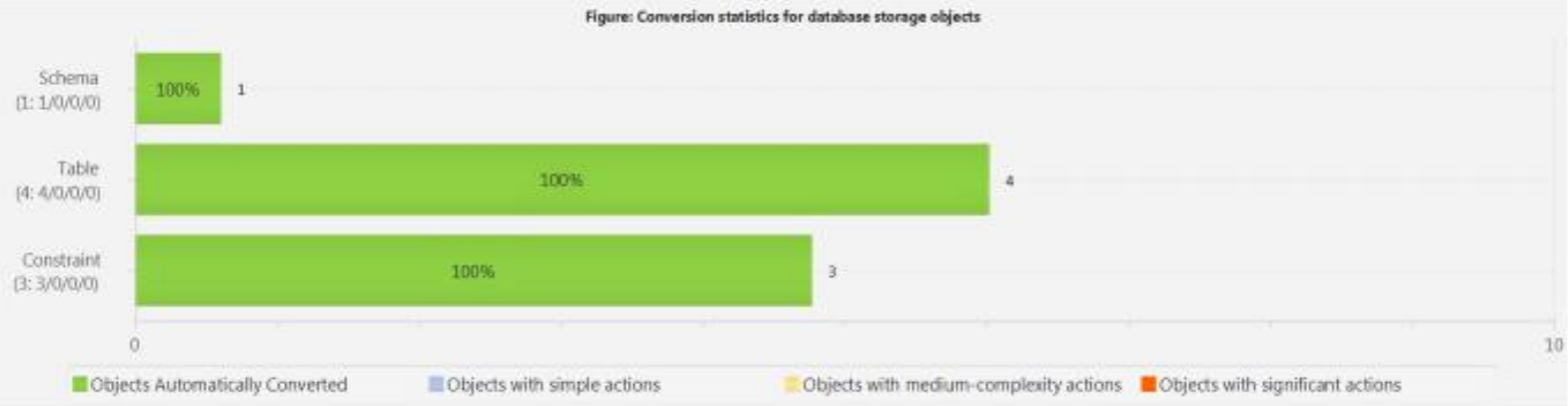
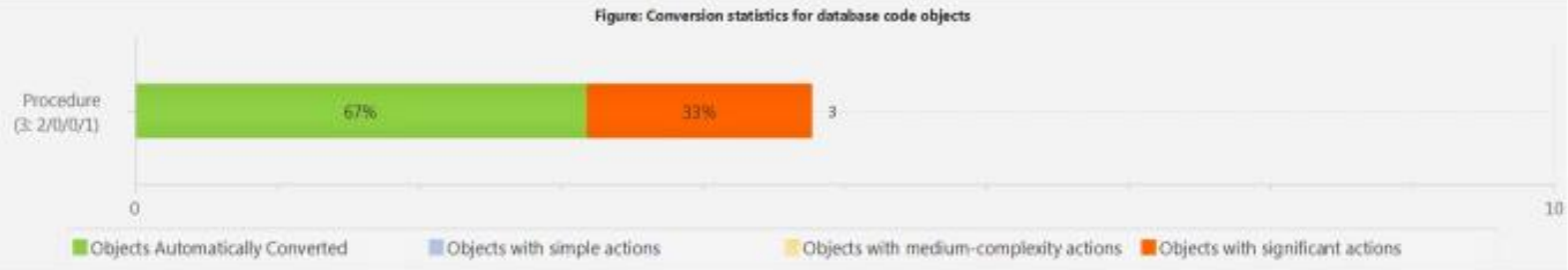
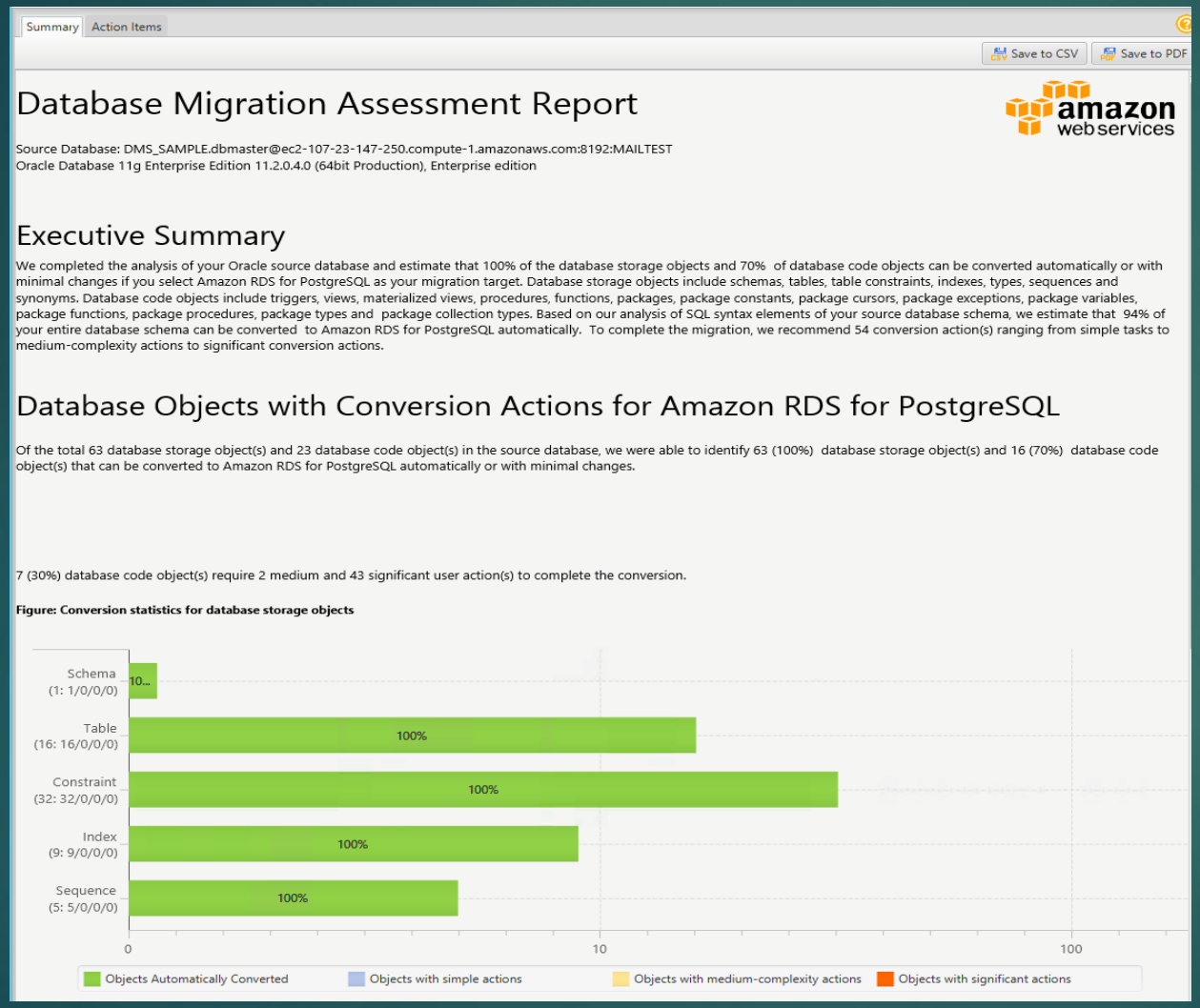


Figure: Conversion statistics for database code objects



Sample SCT Service Report



AWS Migration Hub - Overview

01

02

03

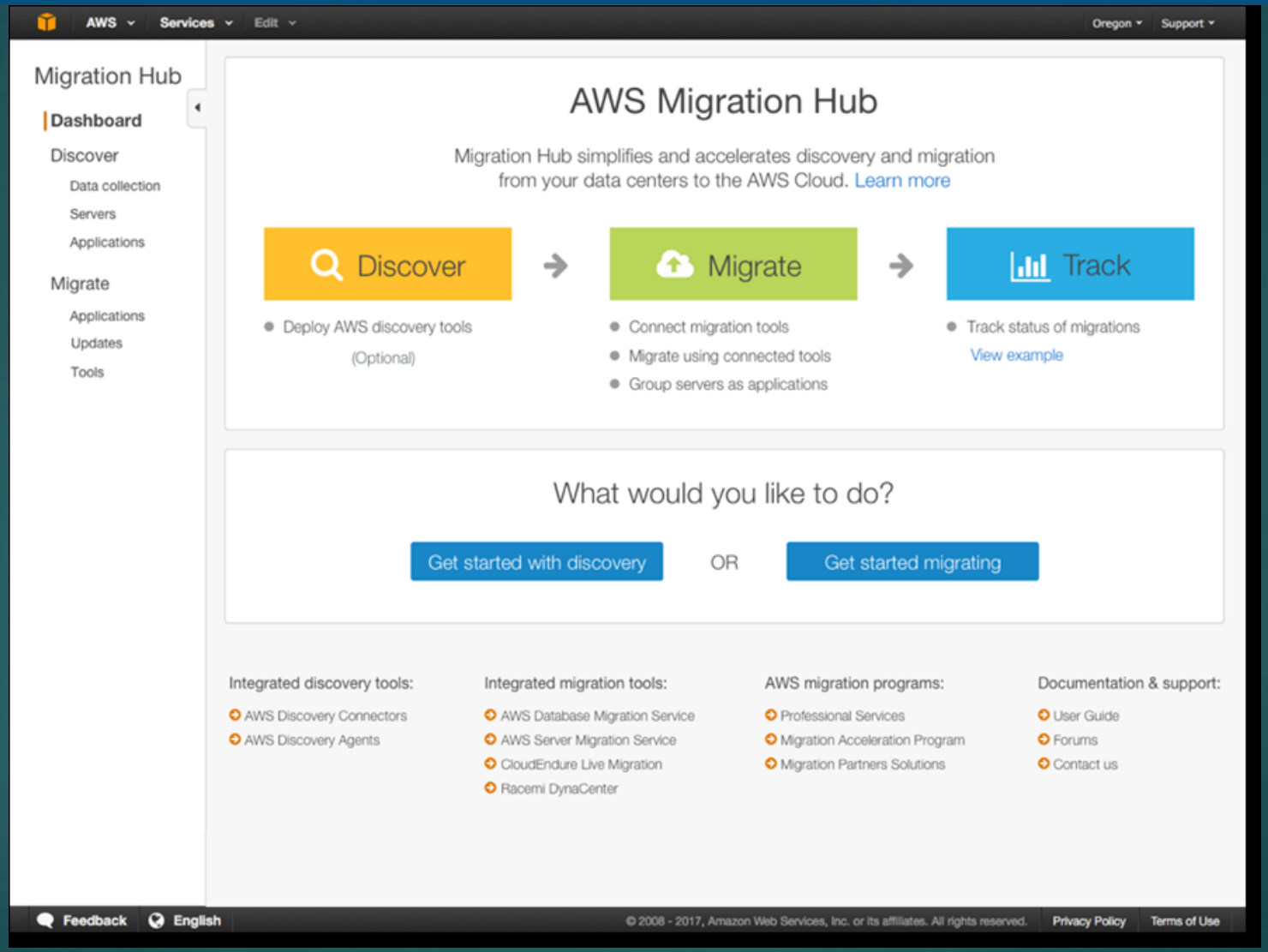
Migration Hub makes it easier for users to navigate the

04

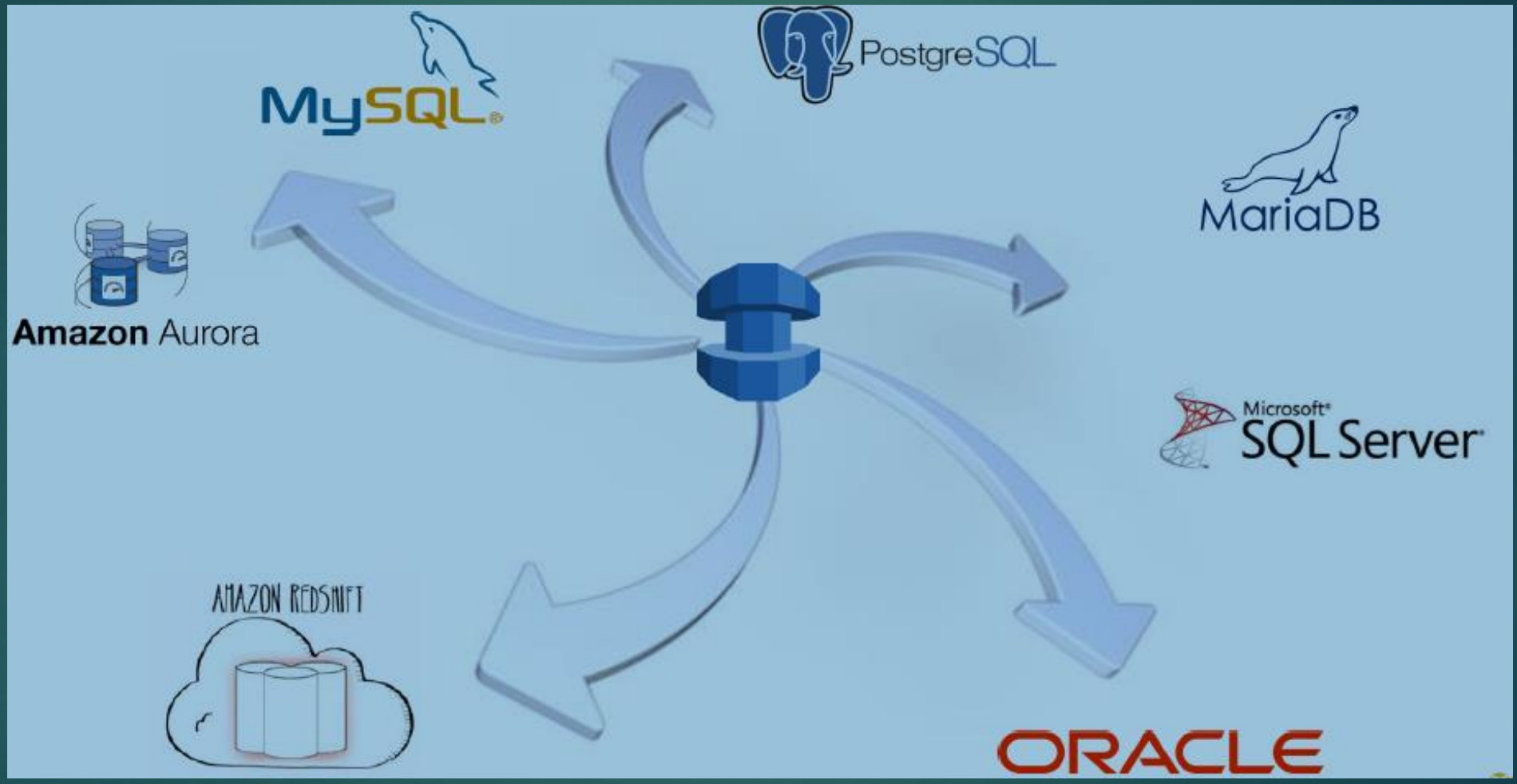
Quickly get progress updates across all of your migrations

05

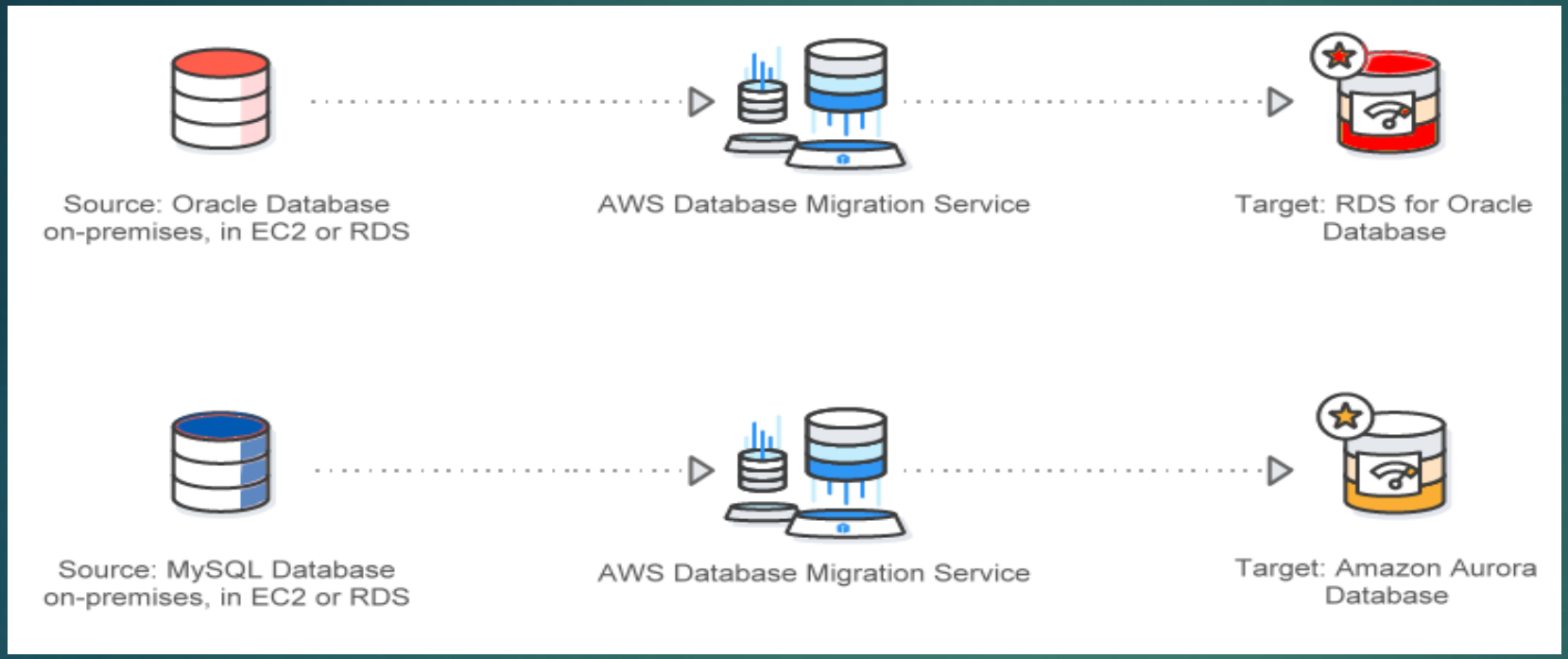
AWS Migration Hub (Main Screen)



DB Migration Use Cases – From Source to Target



DB Migration Use Cases – Homogeneous

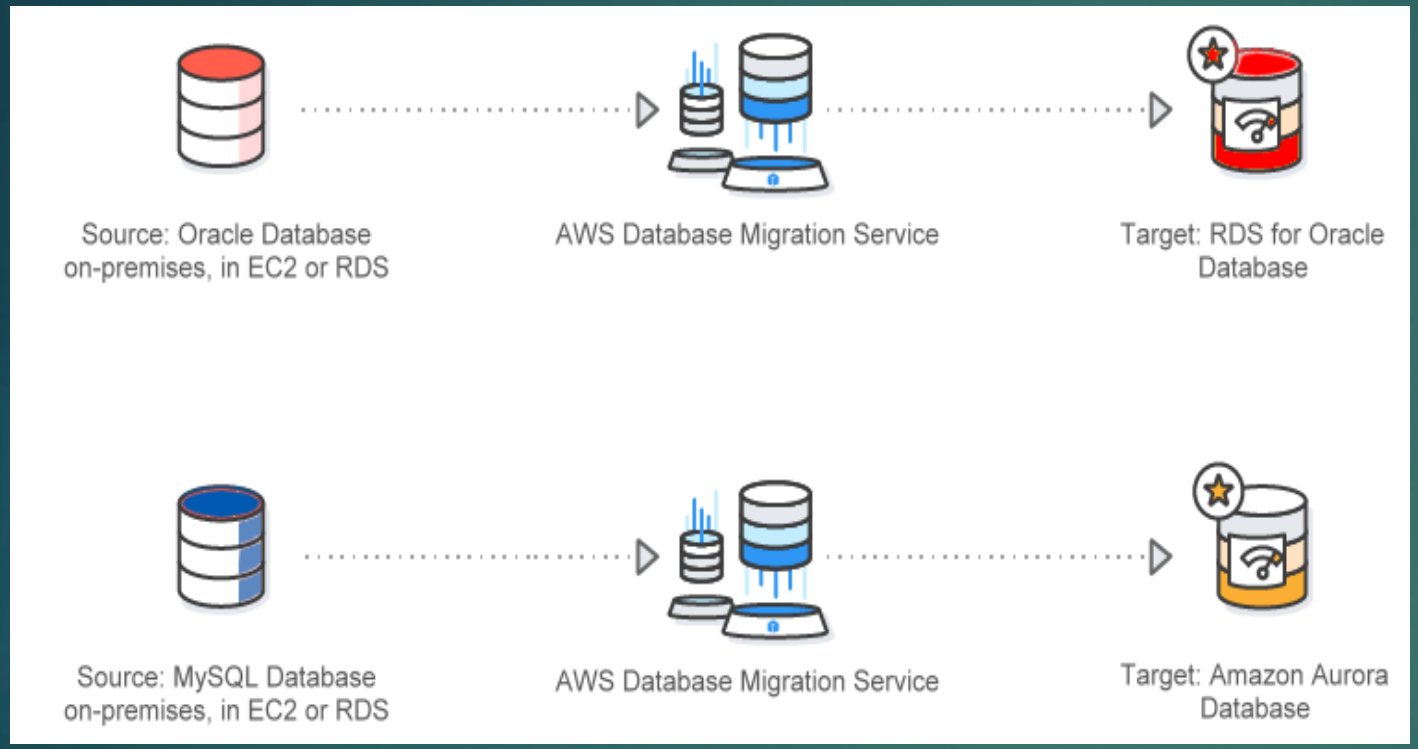


DB engine on both side are same

Amazon Aurora is a new developed DB engine which is fully managed, **MySQL-compatible,** relational database engine

Sources : https://aws.amazon.com/dms/

DB Migration Use Cases – Heterogeneous



Homogenous DB migration is a two Step Process

Step1: Schema and code transformation with AWS Schema conversion(SCT) tools

Step2: DB migration via AWS DB Migration services

Sources : https://aws.amazon.com/dms/

DB Migration Use Cases – DB Consolidation

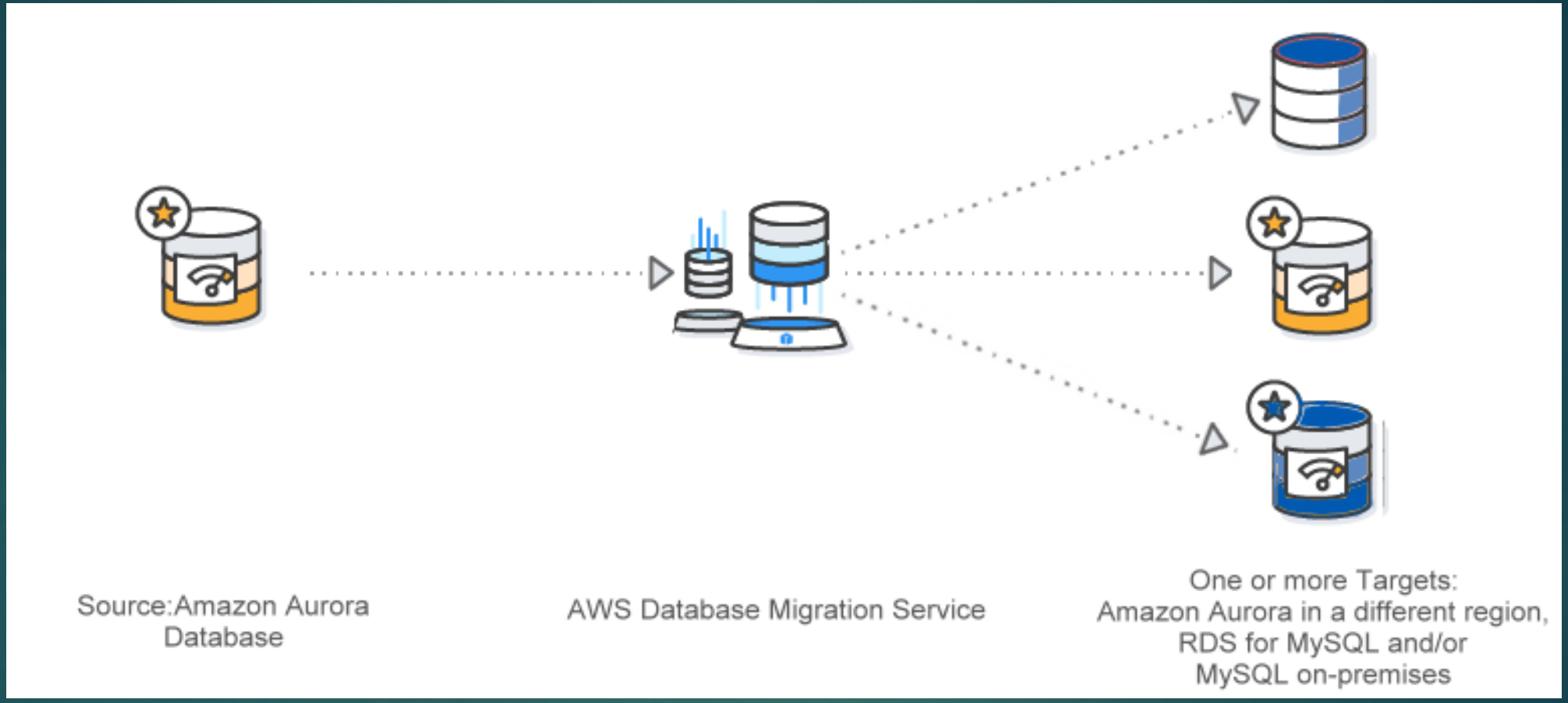
Source: Multiple MySQL Databases on-premises, in EC2 or RDS

AWS Database Migration Service

Target: Amazon Aurora Database

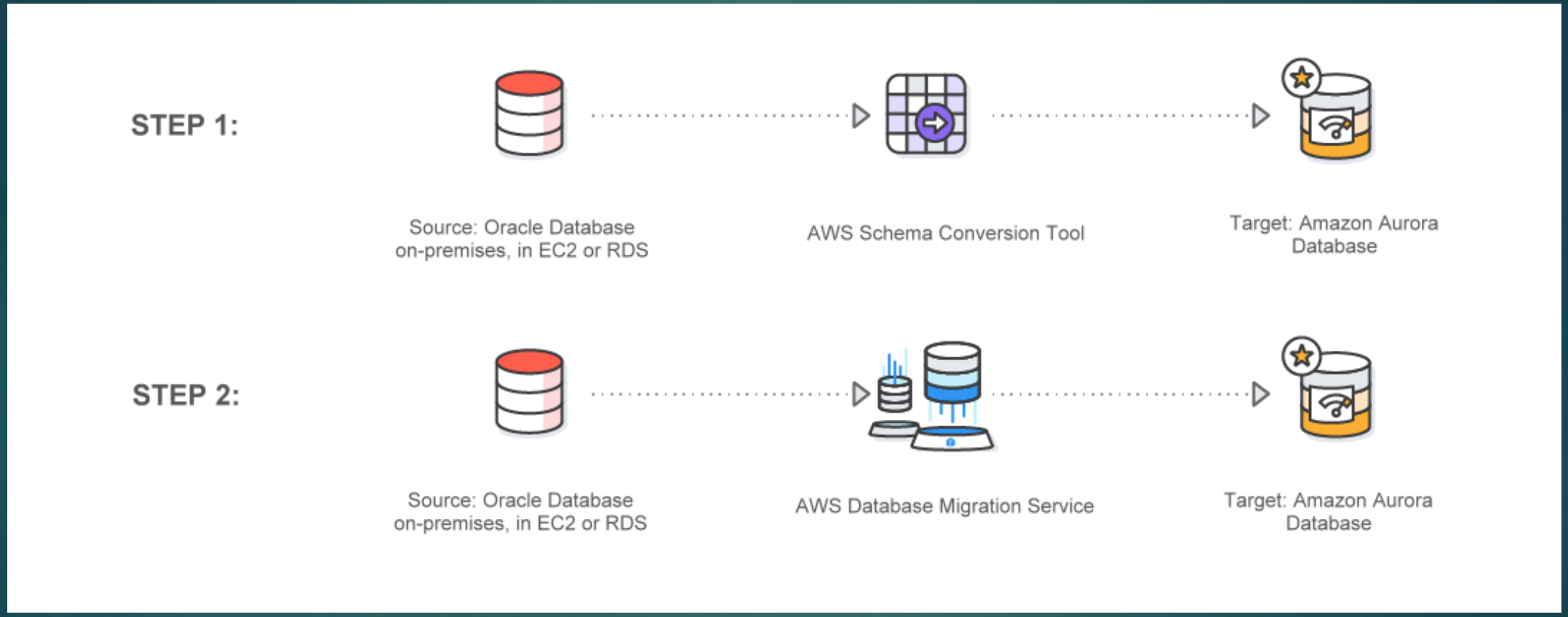
https://aws.amazon.com/dms/

DB Migration Use Cases – Continuous Data Replication

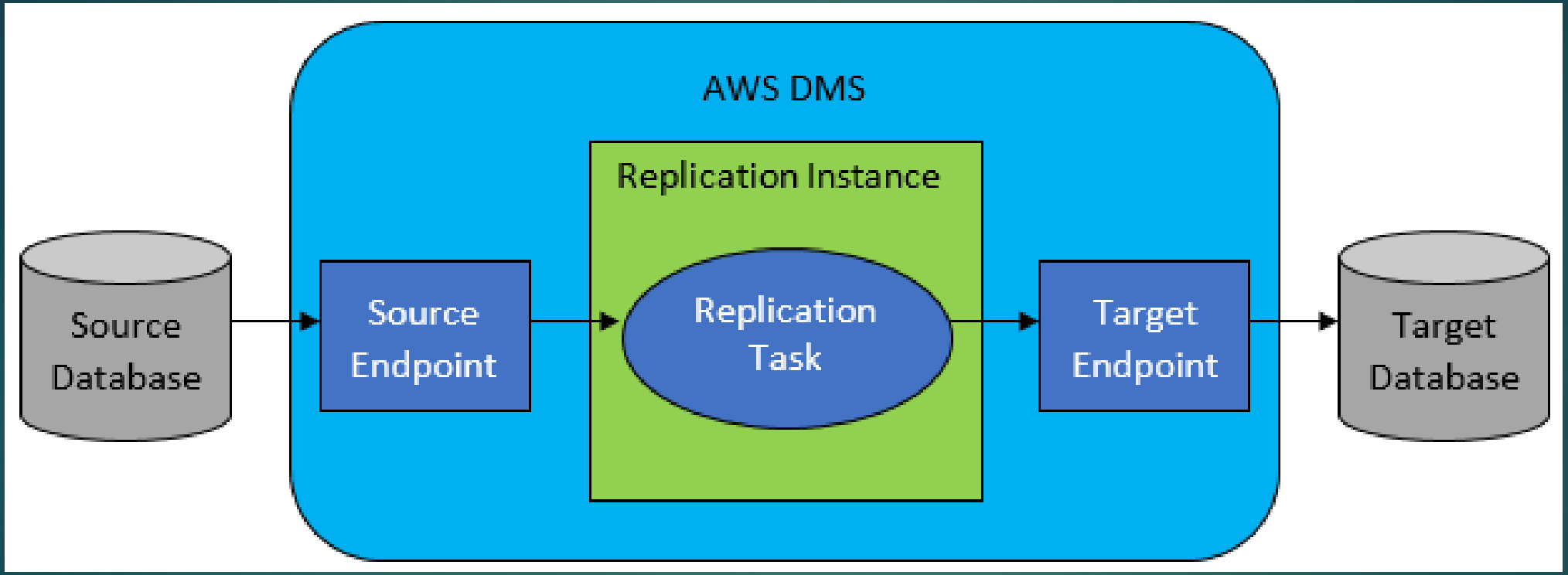


Sources : https://aws.amazon.com/dms/

DMS & SCT Working together



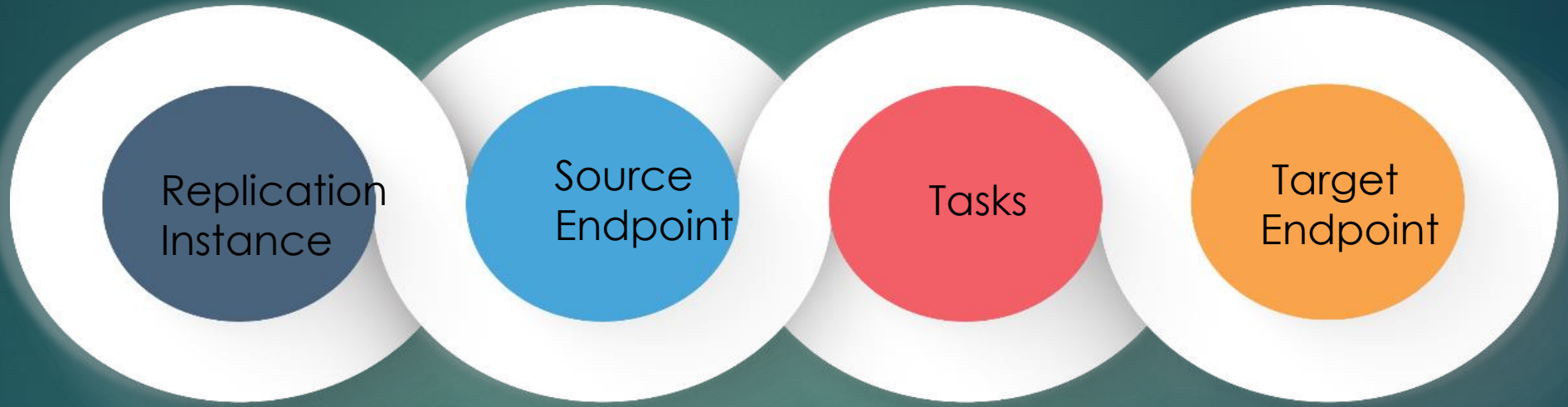
How DMS Works



How AWS DMS Works

- Identify your source and target data stores. These data stores can reside on any of the data engines.
- For both the source and target, configure endpoints within AWS DMS that specify the connection information to the databases. The endpoints use the appropriate ODBC drivers to communicate with your source and target.
- Provision a replication instance, which is a server that AWS DMS automatically configures with replication software.
- Create a replication task, which specifies the actual data tables to migrate and data transformation rules to apply. AWS DMS manages running the replication task and provides you status on the migration process.

AWS DMS Components



AWS DMS Components

- **Replication instance:** Replication instance (EC2) provides the compute resources you need for the migration. As with other AWS services, you have the freedom to choose which size fits your needs best.It also provides High Availability and fail-over capabilities.

.

- **Endpoints:** Either called ‘source’ or ‘target’ endpoints, which specify the entry points to the database you are migrating from/to.

- **Tasks:** Specify the endpoints you want to use for the migration, task settings which can be tuned for each type of migration, and table mappings which allow you to perform some additional modifications at schema, table or column level during the migration.

DMS Components – Replication Instance

- **EC2 instance class**
  - **Smaller EC2 instance** classes are sufficient for testing the service or for small migrations.
  - If migration involves a large number of tables and to run multiple concurrent replication tasks, consider using one of the **larger instances**.

- **Storage**
  - Depending on the EC2 instance class storage comes with either 50 GB or 100 GB of data storage.
  - Storage is used for log files and any cached changes collected during the load
  - If there are multiple tasks running on the replication server, you might need to increase the amount of storage

DMS Pricing

- Pay only for the compute resources and additional log storage used during migration process .
  - On-Demand Instances let you pay for database migration by the hour.
  - Currently supports the T2, C4 and R4 instance classes (R4 in limited regions)

- Data Transfer
  - All data transfer into DMS Service and between DMS and databases in Amazon RDS and Amazon EC2 Instances in the same Availability Zone is free.
  - Standard AWS data transfer rates apply when there are any migrations from source database to a target database in a different Availability Zone, Region, or outside of AWS

For more details regarding pricing , refer the link
https://aws.amazon.com/dms/pricing/

DB Migration to AWS – 3 Stages

- AWS DB Migration process can be divided into 3 stages
  - Stage 1
    - Pre migration
  - Stage 2
    - Migration
  - Stage 3
    - Post Migration
- In each stages users have to perform certain tasks which are detailed in subsequent slides

DB Migration to AWS – Stage 1

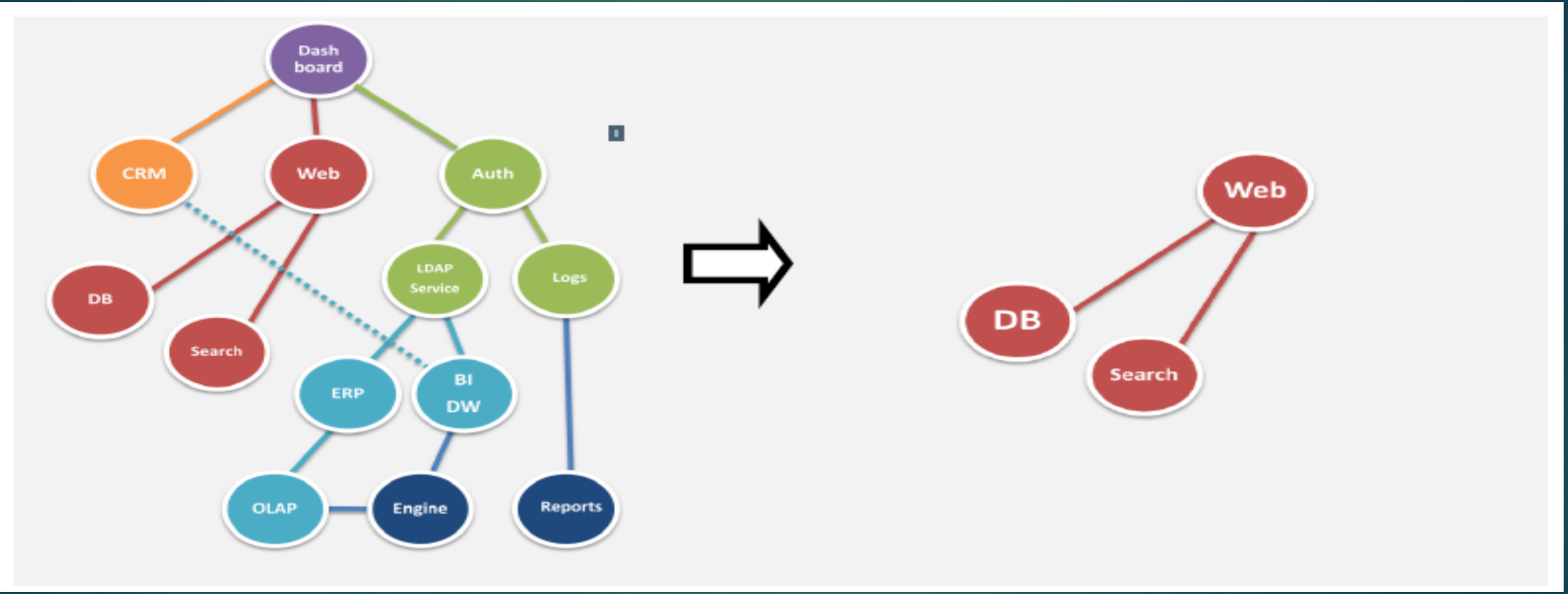
- Learn all about all DB migration related Services
- Identify and priorities DB'S which need to be migrated
  - First migrate those DB'S which have least dependencies
- In case of heterogeneous migration , use SCT tool to get an advance report on DB Migration
- This report can help in an early understanding of DB transformation complexity
- Use **AWS CloudFormation** to define you target AWS cloud **instruction stack**
- Create your entire **target stack using CloudFormation**
- Apply **AWS well architecture framework** on AWS target cloud Architecture

Identifying and Prioritizing DB's for Migration

- Consider those DB'S which have least dependencies on other resource
- Ensure that along with the DB's relevant applications are also migrated other wise you may face latency issues
- Prioritize those DB whose role is as cloud backup or a read only DB

Identifying and Prioritizing DB's for Migration

- For identifying a right DB migration services, create a DB dependency graph as shown below



DB Migration to AWS – Stage 2

- Run SCT in case of heterogeneous DB migration
- Configure DMS for DB Migration
- Initiate your DB Migration task
- Use **AWS Migration Hub** to monitor all DB migration

Running SCT tool for Heterogeneous DB Migrations

- Step 1 - Install SCT tools
  - For details Please use this link

- Step 2 – Connect to your source DB
- Step 3 – Connect to your Target DB
- Step 5 – View the schema feedback report to understand the complexity of DB migration
- Step 4 – Convert your schema from Source to Target
- Step 5 – Apply your schema on target DB

DB Migration to AWS – Stage 3

- Validate That **all data** has been migrated
- Perform all post migration activities
- Integrate your data with other AWS cloud services
- Apply again well **AWS architecture framework** to further optimize your DB in Cloud

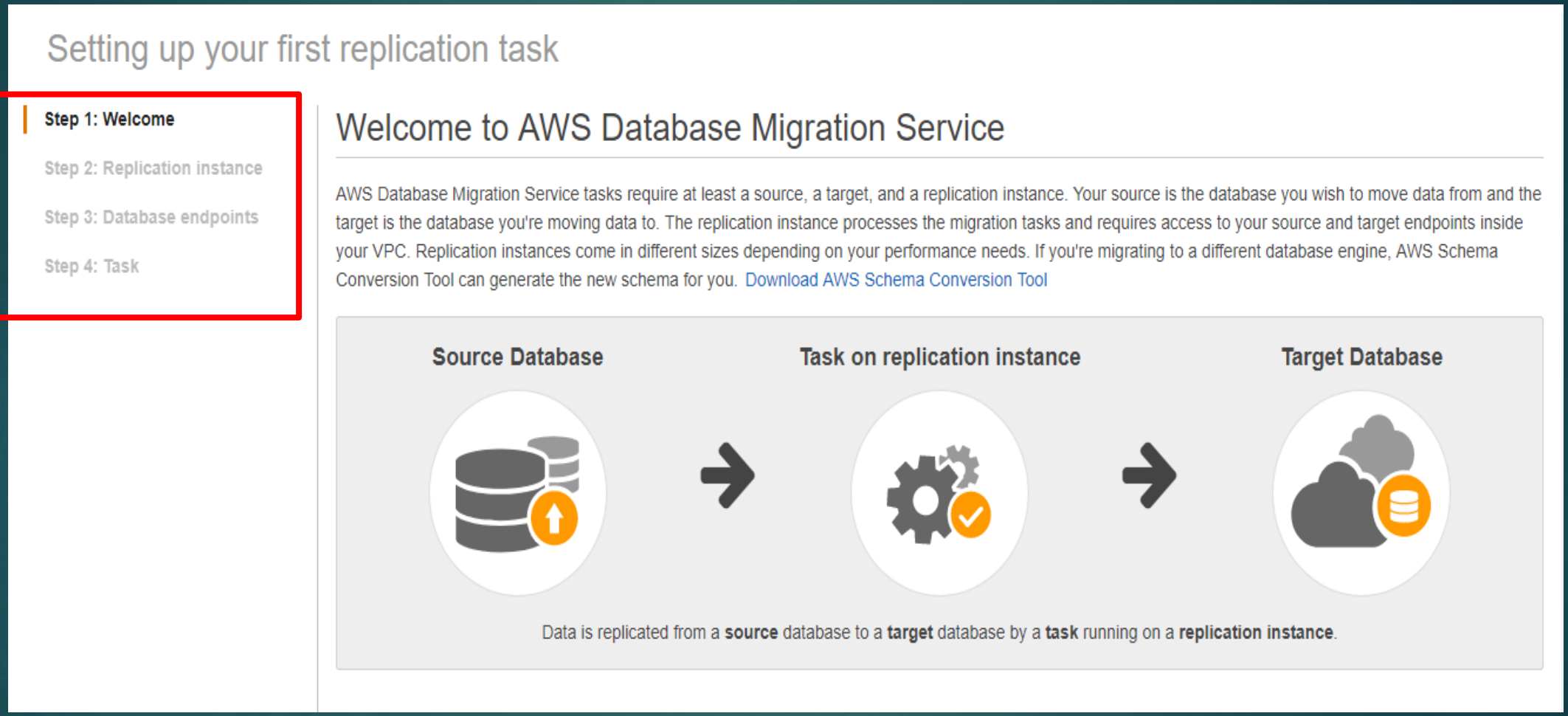
DMS Configuration

- At a high level, when using AWS DMS, we should do the following for configuration:
  - Create a replication server.
  - Create source and target endpoints that have connection information about your data stores
  - Create one or more tasks to migrate data between the source and target DB'S

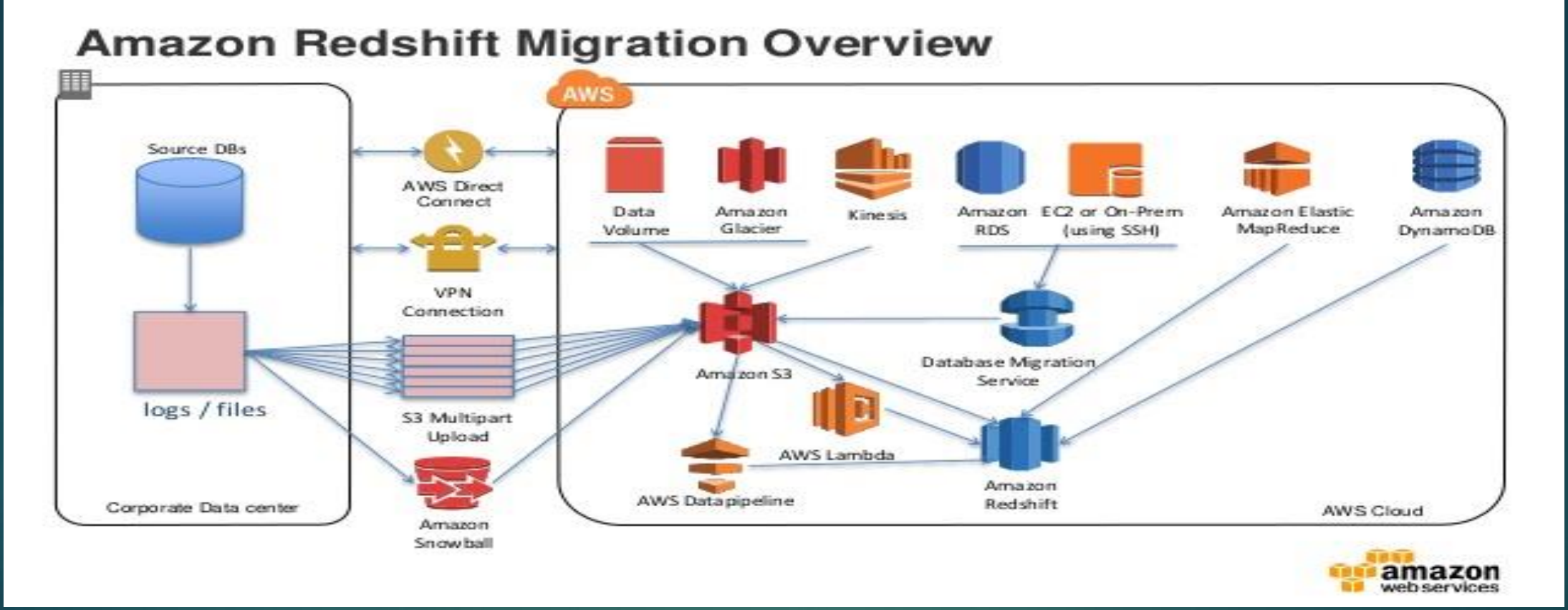
Step wise Configuring DMS Service

- Step 1
  - Go to DMS home Page
- Step 2
  - Create DMS replication instance
- Step 3
  - create aws source and target points
- Step 4
  - Create and run your AWS Task
- Step 5
  - Monitor your DB migration process
- Step 6
  - Validate that you DB migration process has been successful

DMS Configuration Steps

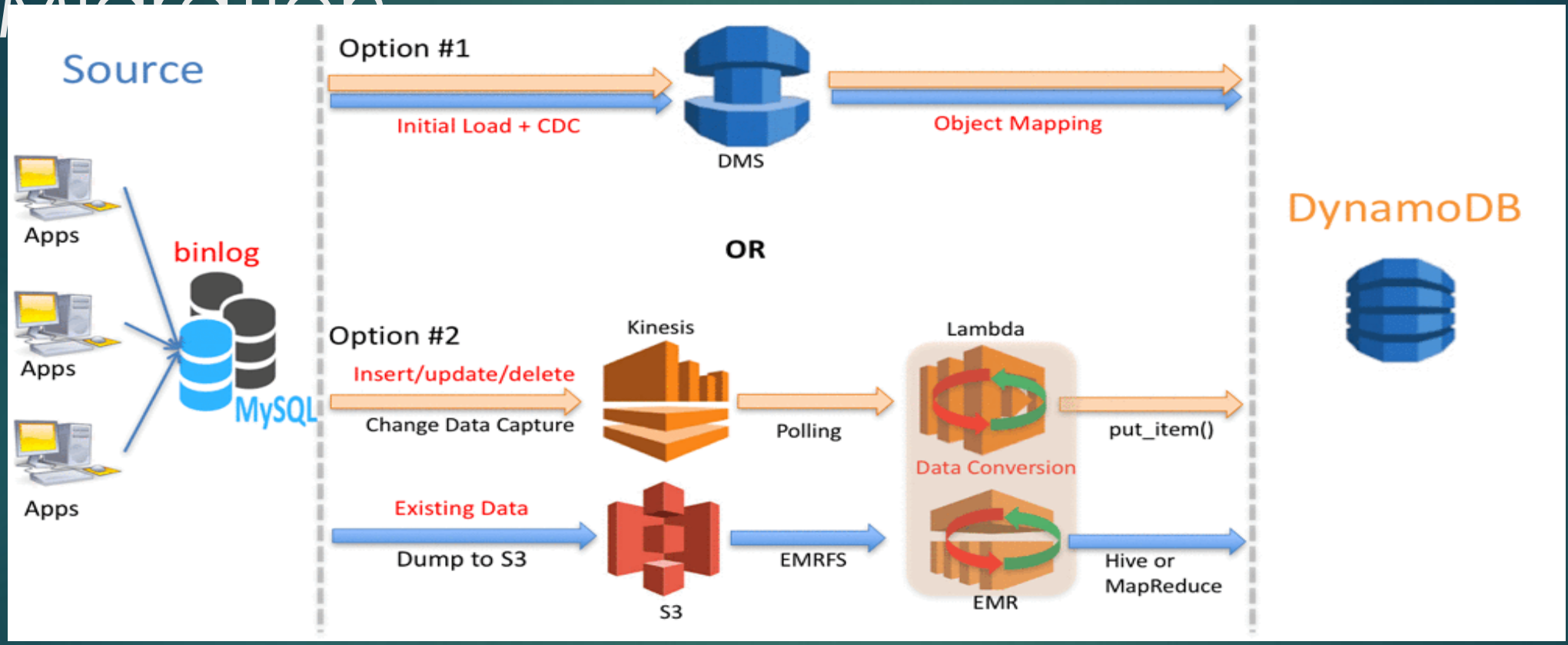


AWS Redshift Migration Architecture



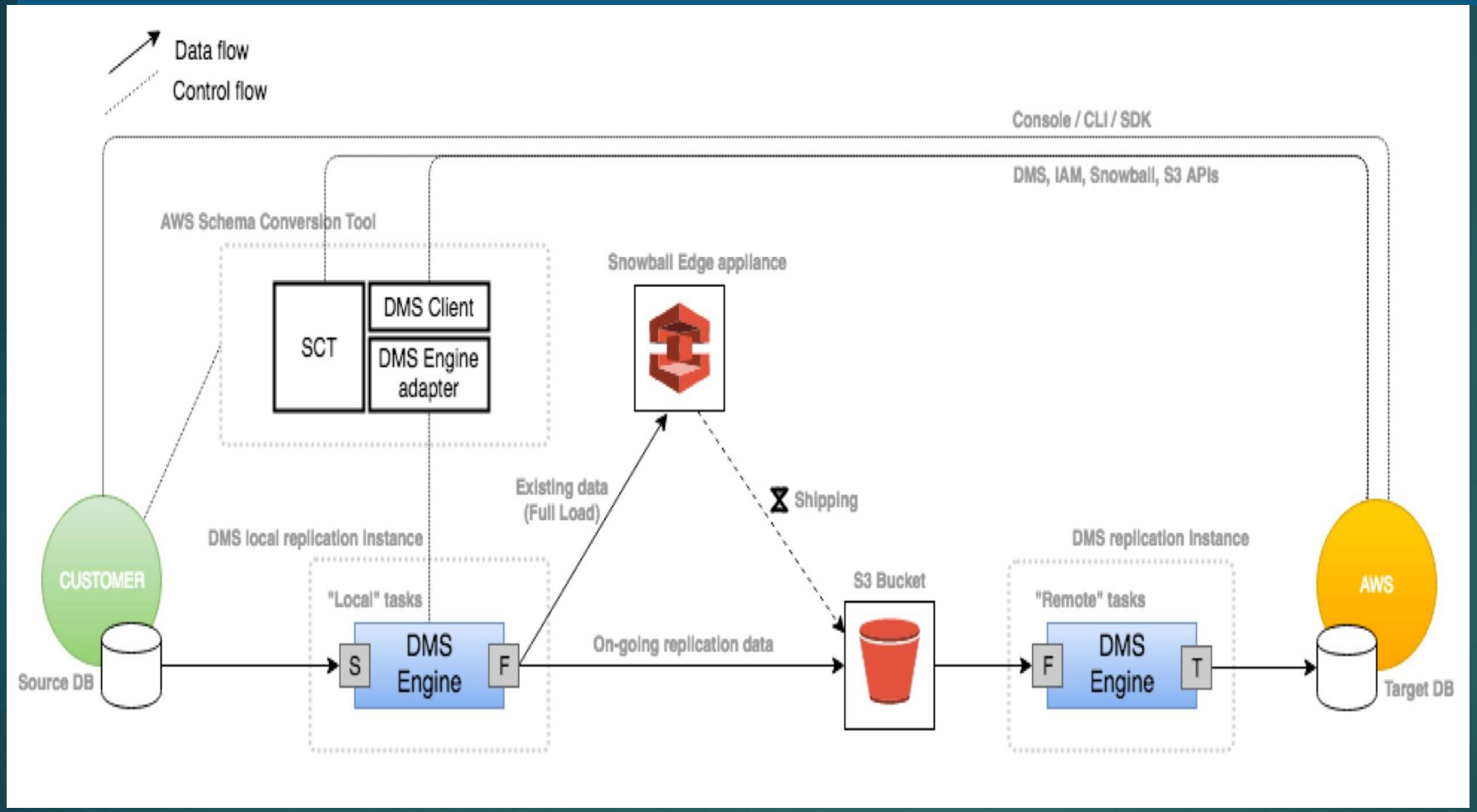
Source: https://www.slideshare.net/AmazonWebServices/migrate-your-data-warehouse-to-amazon-redshift

From RDS to AWS Dynamo DB Migration



https://aws.amazon.com/blogs/big-data/near-zero-downtime-migration-from-mysql-to-dynamodb/

Use Case Mass DB Transfer To AWS Using Snowball edge



AWS snowball is both a service and a secure device

AWS Snowball can be used to transfer very large DB's in the range of 100 TB via shipping logistic, with in two week

This can avoid issue like bandwidth limitation etc..

https://aws.amazon.com/blogs/database/new-aws-dms-and-aws-snowball-integration-enables-mass-database-migrations-and-migrations-of-large-databases/

THANK YOU