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Migrating your databases to AWS

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Business Development, Database, AWS

Agenda

Database freedom

AWS Schema Conversion Tool (AWS SCT)

AWS Database Migration Service (AWS DMS)

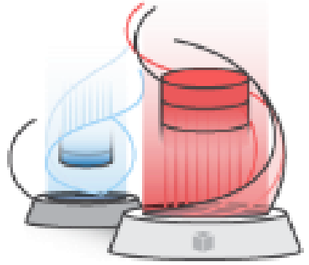
How does it work?

Managing database migration projects

Hints and tips

Database freedom

Our goal: Allow customers the freedom to choose the best data platform for their needs #DBFreedom



AWS Schema Conversion Tool (AWS SCT) converts your commercial database and data warehouse schemas to open-source engines or AWS native services, such as Amazon Aurora and Amazon Redshift

AWS Database Migration Service (AWS DMS) easily and securely migrates and/or replicates your databases *and* data warehouses to AWS

AWS Schema Conversion Tool (AWS SCT)

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AWS SCT product highlights

Assessment Report	Converts Schema and Code	Extracts and Migrates DW to Amazon Redshift
• Assessment of migration compatibility of source databases with open-source database engines—Amazon RDS for MySQL, Amazon RDS for PostgreSQL, and Amazon Aurora • Recommends best target engine • Provides detailed level of effort to complete migration	• Attempts to convert all schema and code objects to the target engine, including stored procedures and functions • Scans and converts embedded SQL statements in app code • Generates a report with recommendations	• Extracts data through local migration agents • Files are loaded to an Amazon S3 bucket and to Amazon Redshift • Netezza • Vertica • Greenplum • Teradata • Oracle • SQL Server

What's new: AWS Schema Conversion Tool (AWS SCT)

- Support for orafce extension when migrating from Oracle to PostgreSQL
- SAP ASE 15.5 as a source support
- Amazon RDS for MariaDB 10.2 & 10.3 as a target
- MySQL 8.0 and PostgreSQL 11 as targets
- Convert Oracle ETL and Teradata BTEQ to AWS Glue
- Convert stored procedures to Amazon Redshift stored procedures
- General conversion improvements across multiple sources and targets

Demo: Assessment report

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AWS Database Migration Service (AWS DMS)

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AWS DMS product highlights

Pre-migration Assessment

- Checks migration task settings prior to launch
- Alerts for potential issues, such as unsupported data types
- Prevents unnecessary, time-consuming runtime migration failures

Data Validation

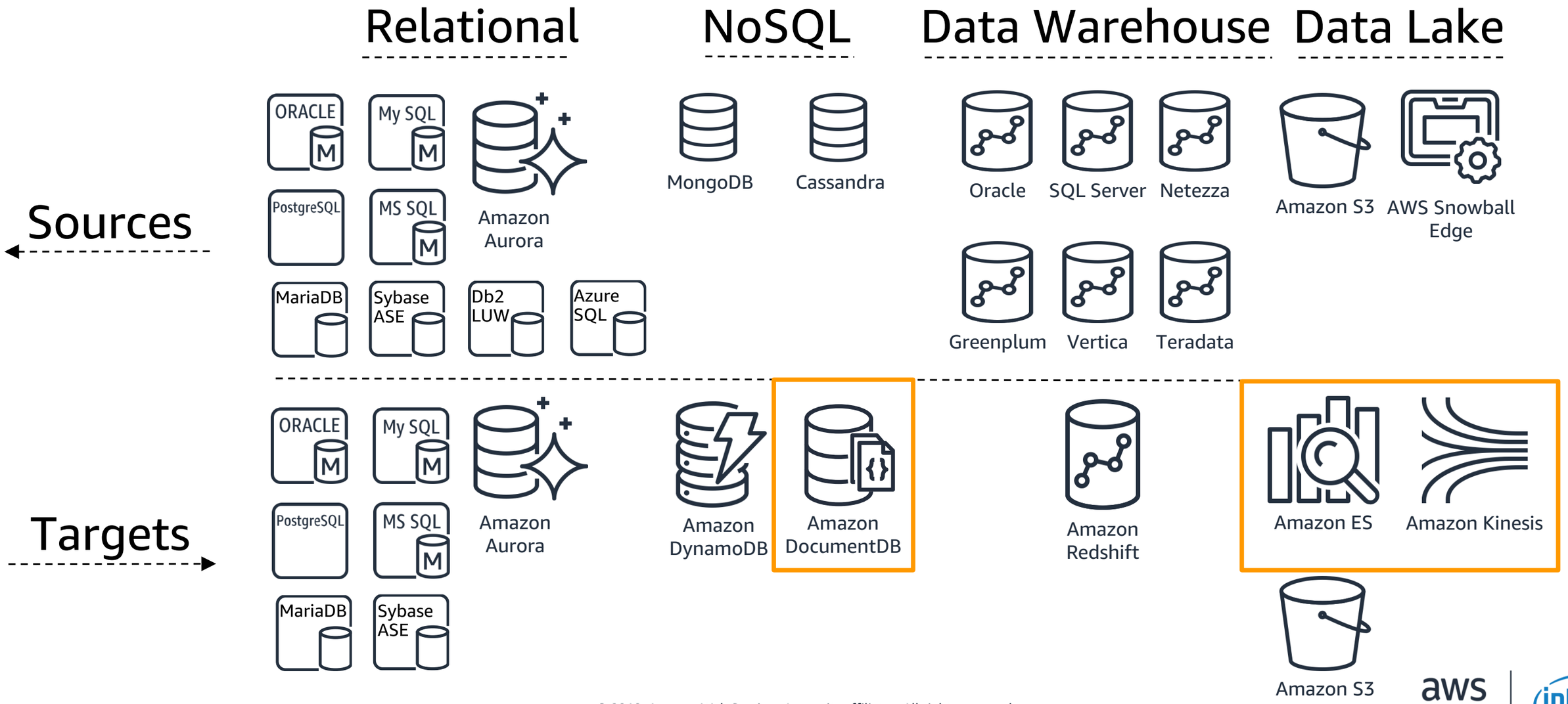
- Validates that all data selected for migration migrated properly
- Includes both stages of full load and CDC
- Applies to both homogeneous and heterogeneous migrations

AWS Snowball Integration

Use AWS Snowball & AWS DMS to migrate data to AWS

- Migrate large databases (more than 5 TB)
- Migrate many databases at once
- Migrate over slow networks
- Push vs. pull

AWS DMS: Endpoint support expansion



What's new: AWS Database Migration Service (AWS DMS)

- Elasticsearch as a target
- Db2 LUW Version 11.1 as a source, with all fix packs supported
- Change table/column names during migration
- Amazon S3: Parquet, encryption, and tagging support
- UTF-8 4-byte character set support
- Improved full load performance for partitioned and sub-partitioned tables
- Improved large objects (LOB) performance
- Table load order during full load

How does it work?

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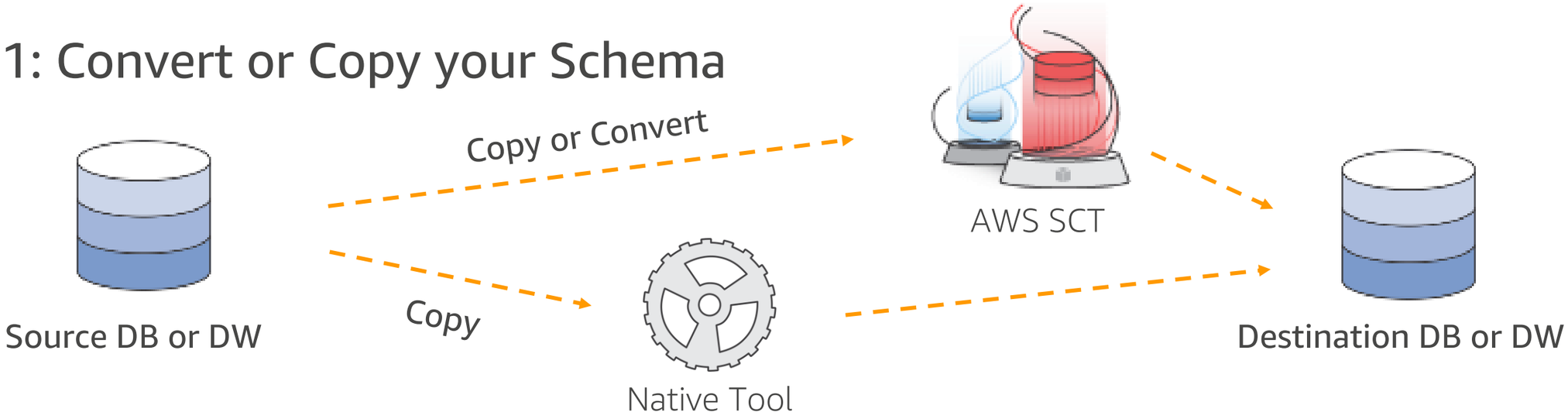
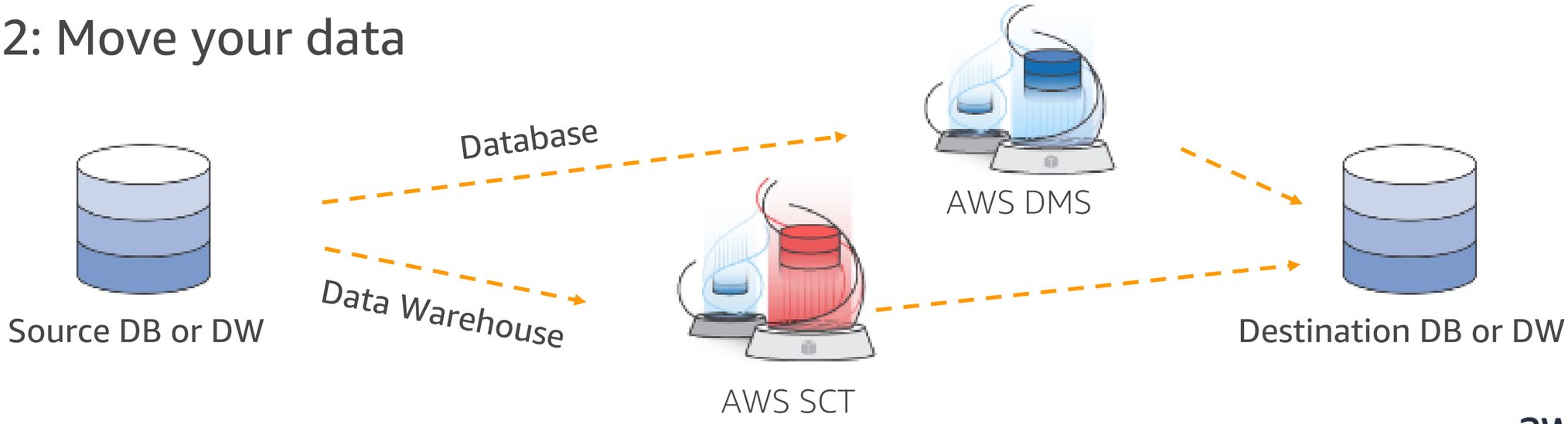
Database migration process

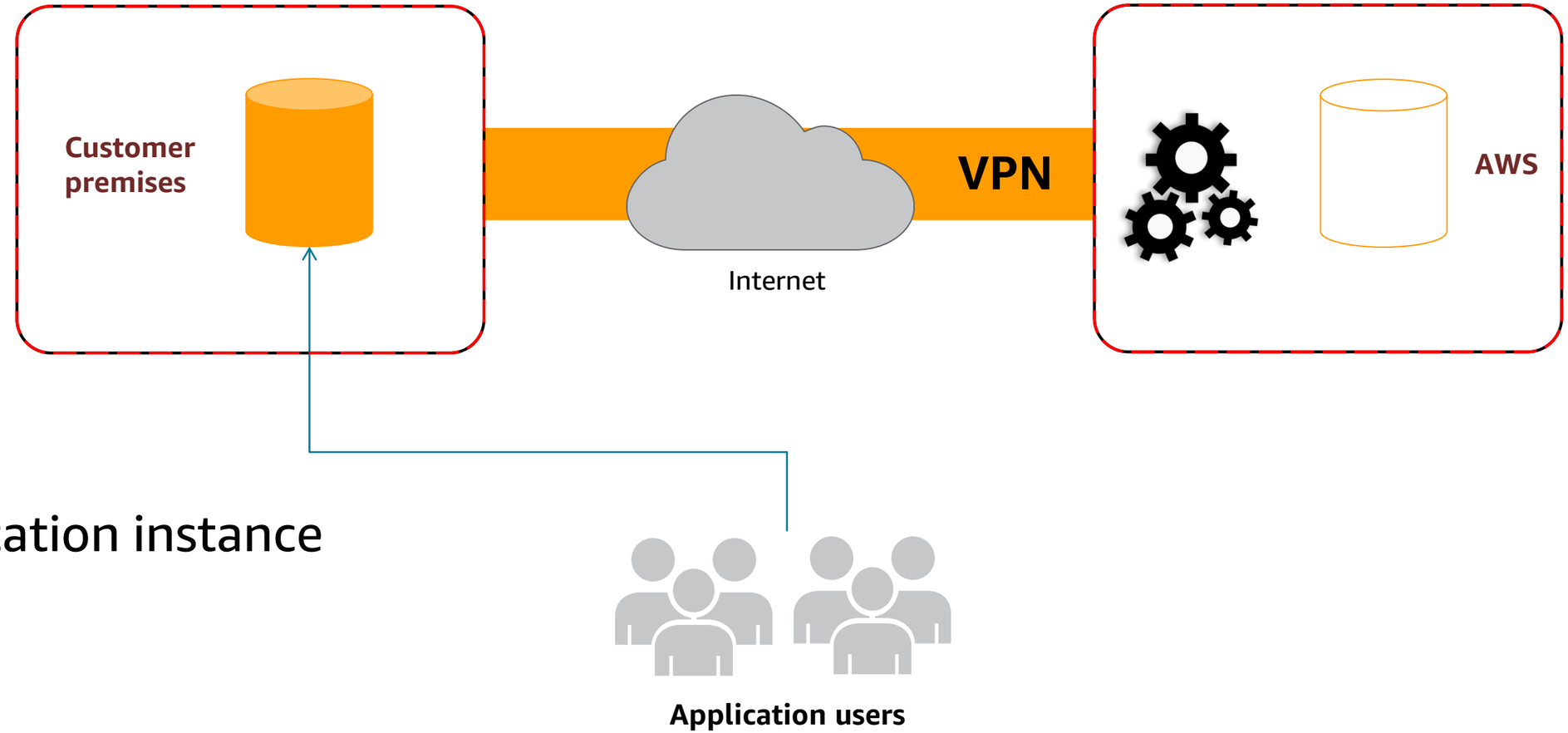
Step 1: Convert or Copy your Schema



Step 2: Move your data

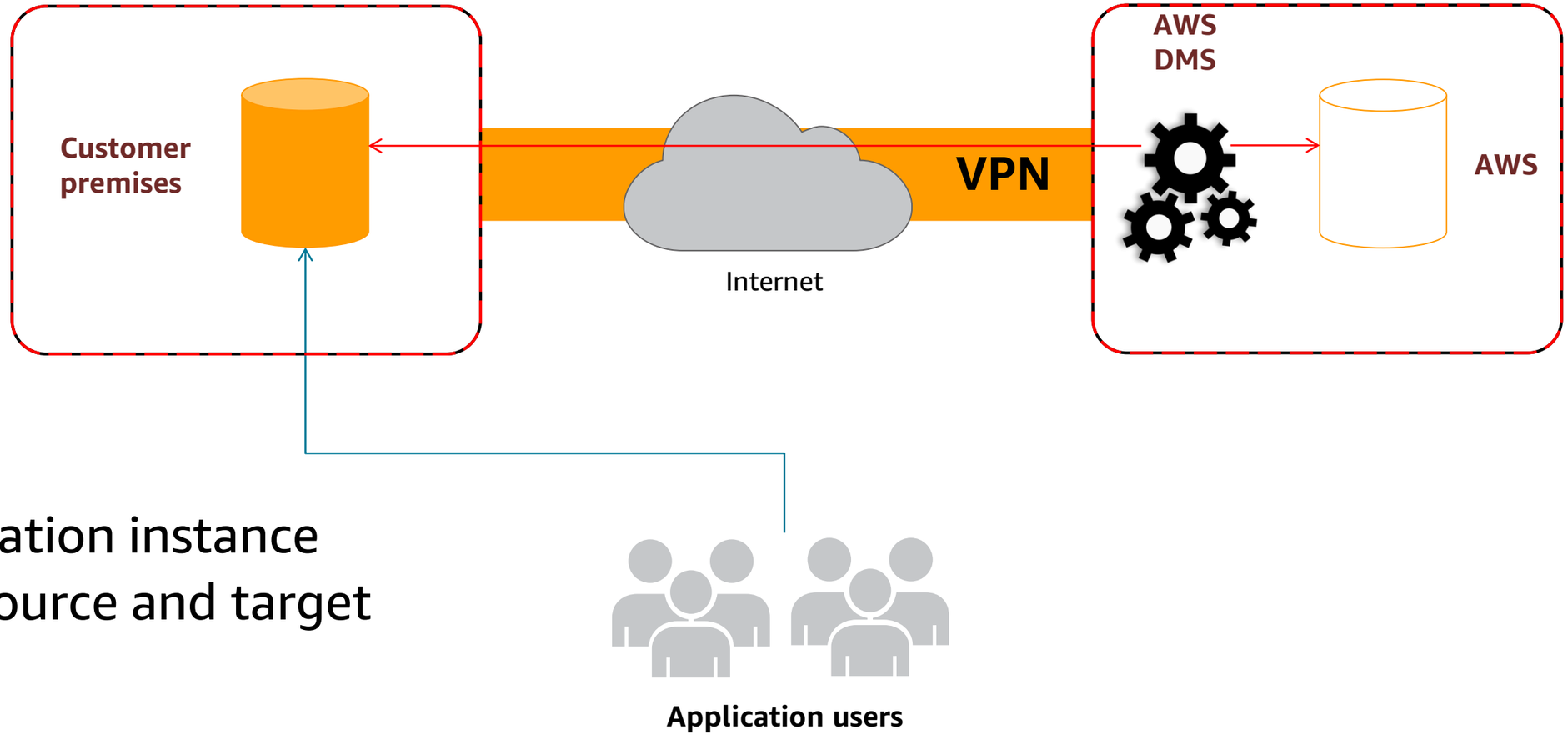


Keep your apps running during the migration



Start a replication instance

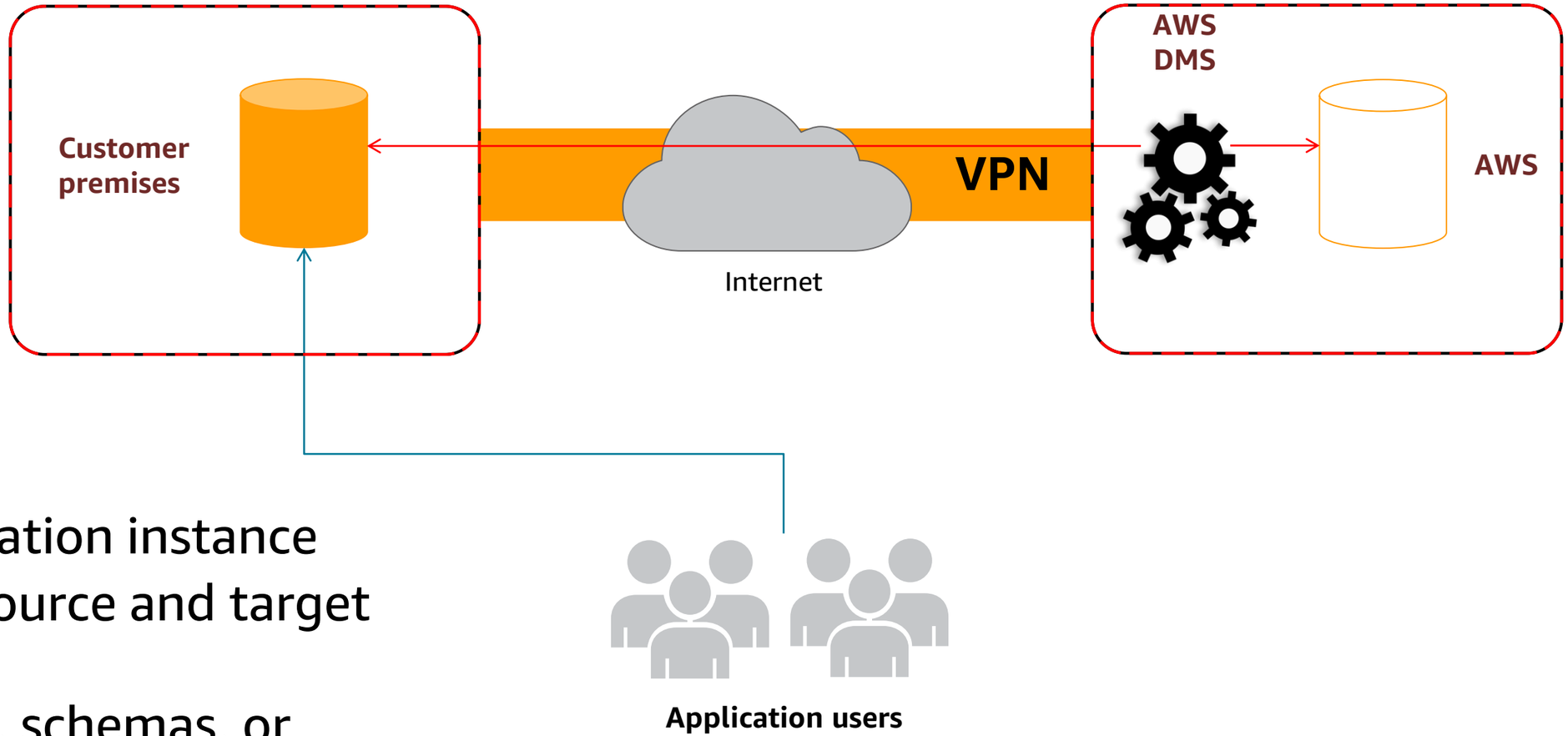
Keep your apps running during the migration



Start a replication instance

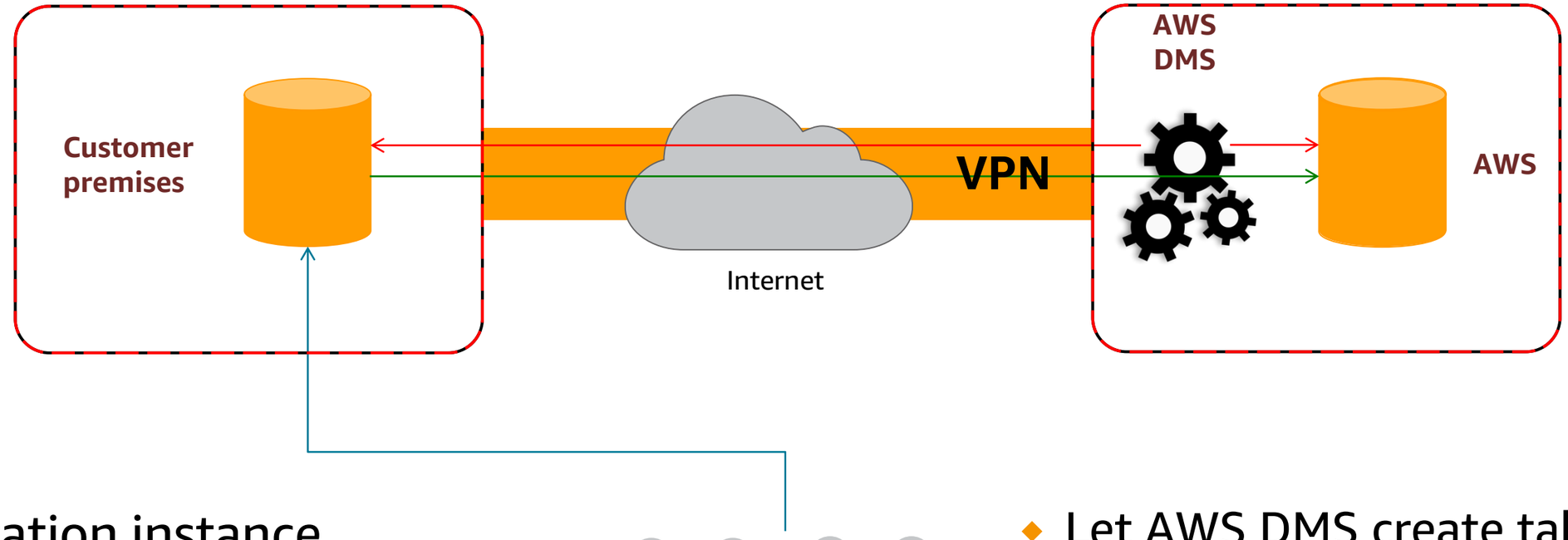
Connect to source and target databases

Keep your apps running during the migration



- Start a replication instance
- Connect to source and target databases
- Select tables, schemas, or databases

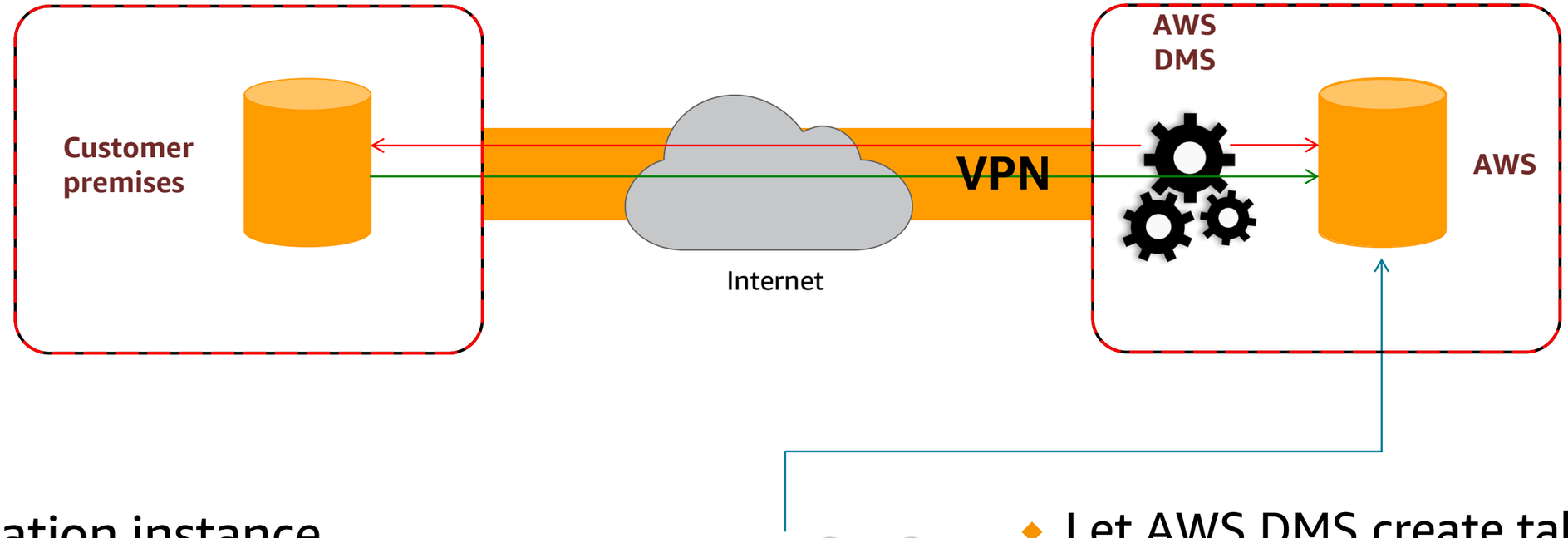
Keep your apps running during the migration



- Start a replication instance
- Connect to source and target databases
- Select tables, schemas, or databases

- Let AWS DMS create tables and load data and keep them in sync
- Switch applications over to the target at your convenience

Keep your apps running during the migration



Start a replication instance

Connect to source and target databases

Select tables, schemas, or databases

- Let AWS DMS create tables and load data and keep them in sync
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Managing a database migration project

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Application assessment

Business driver and intended ROI?

Migration sponsor (business owner, C-level)?

ISV application? Does the ISV support the target?

Maintenance window for the migration?

Design documentation?

Original developers/DBAs still available?

Database assessment

How many database objects (tables, triggers, SPs, users, etc.)?

How much data?

Complexity of the SPs and triggers?

Proprietary DB features?

Nonstandard or custom data types?

Character set conversions?

Time zone or UTC?

User authentication method?

Licensing mechanism (cores, users, ULA, etc.)?

Application technical assessment

- Database access:
  - SQL statements throughout the code?
  - Calls to a data abstraction layer?
  - API calls?
- ANSI SQL used where possible?
- SQL complexity—e.g., analytics with many joins or simple CRUD?
- Number of lines of SQL code?
- Application access—e.g., LDAP, DB users, etc.

Building a migration team

Application architect/developer: Application expert who can identify what components are important, complex, redundant, etc.

Source DBA: Knows the database design, schema, features used, and what must be migrated to the target

Target DBA: An expert in the target database to help map features from the source DB with the Source DBA

AWS solutions architect: Determines the correct target architecture in AWS and is familiar with AWS DMS and AWS SCT

Application/database developers: Customer and/or partner resources to migrate the stored procedures, triggers, and application code

Hiring and developing talent

New skills are needed for the target DB and often AWS if migrating from on premises

Develop **training plans** for existing employees

Hire in required skills if necessary

Retrain, **redeploy**, or make people **redundant** if their skills are no longer relevant

Pilot/POC

Choose a **reasonably complex** module/component to migrate to **validate your assumptions** from the **assessment**

You should:

- Obtain more accurate migration assessments
- Determine what can be **automated**
- Learn how the migration tools behave (limitations, bugs, improvements needed)
- Learn what **skills are missing** from your team

Database migration: Multiphase process

Phase	Description	Automation	Effort (%)
1	Assessment	AWS SCT	2
2	Database schema conversion	AWS SCT	14
3	Application conversion/remediation	AWS SCT	25
4	Scripts conversion	AWS SCT	7
5	Integration with third-party applications		3
6	Data migration	AWS DMS	4
7	Functional testing of the entire system		29
8	Performance tuning	AWS SCT	2
9	Integration and deployment		7
10	Training and knowledge		2
11	Documentation and version control		2
12	Post-production support		3

Hints and tips

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Old world to AWS Migration Playbooks

- Topic-by-topic overview of how to migrate databases and data warehouses to AWS services
- Covers all proprietary features and the different database objects
- Migration best practices
- Oracle to Aurora PostgreSQL – **available**
- SQL Server to Aurora MySQL – **available**
- SQL Server to Aurora PostgreSQL – **available**
- Oracle to Aurora MySQL, Cassandra to Amazon DynamoDB, data warehouses to Amazon Redshift, and Db2 LUW to Amazon Aurora PostgreSQL – Q1

	Oracle Feature	PostgreSQL Feature	Compatibility
Link	Index Organized Tables (IOTs)	PostgreSQL "Cluster" Tables	Yes*
Link	Common Data Types	Common Data Types	Yes
Link	Table Constraints	Table Constraints	Yes
Link	Table Partitioning including: RANGE, LIST, HASH, COMPOSITE, Automatic LIST	Table Partitioning including: RANGE, LIST	Yes*
Link	Exchange & Split Partitions	N/A	None
Link	Temporary Tables	Temporary Tables	Yes*
Link	Unused Columns	ALTER TABLE DROP COLUMN	Yes
Link	Virtual Columns	Views and/or Function as a Column	Yes*
Link	User Defined Types (UDTs)	User Defined Types (UDTs)	Yes
Link	Read Only Tables & Table Partitions	Read Only Roles and/or Triggers	Yes*
Link	Index Typ		
Link	B-Tree Inc		
Link	Composit		
Link	BITMAP Ir		
Link	Function-		
Link	Global an Indexes		
Link	Identity C		
Link	MVCC (Table & F		
Link	Character		
Link	Transactio		
Link	Recovery Manager (RMAN)	AWS Aurora Snapshots	Yes
Link	Flashback Database	AWS Aurora Snapshots	Yes
Link	12c Multi-tenant architecture: PDBs and CDB	Databases	Yes*
Link	Tablespaces & DataFiles	Tablespaces	Yes*
Link	Data Pump	pg_dump & pg_restore	Yes
Link	Resource Manager	Separate AWS Aurora Clusters	Yes
Link	Database Users	Database Roles	Yes
Link	Database Roles	Database Roles	Yes
Link	SGA & PGA Memory	Memory Buffers	Yes
Link	V$ Views & Data Dictionary	System Catalog Tables, Statistics Collector, AWS Aurora Performance Insights	Yes*
Link	Log Miner	Logging Options	Yes
Link	Instance & Database Parameters (SPFILE)	AWS Aurora Parameter Groups	Yes
Link	Session Parameters	Session Parameters	Yes
Link	Alert.log (error log)	Error Log via AWS Console	Yes
Link	Automatic and Manual Statistics Collection	Automatic and Manual Statistics Collection	Yes
Link	Viewing Execution Plans	Viewing Execution Plans	Yes

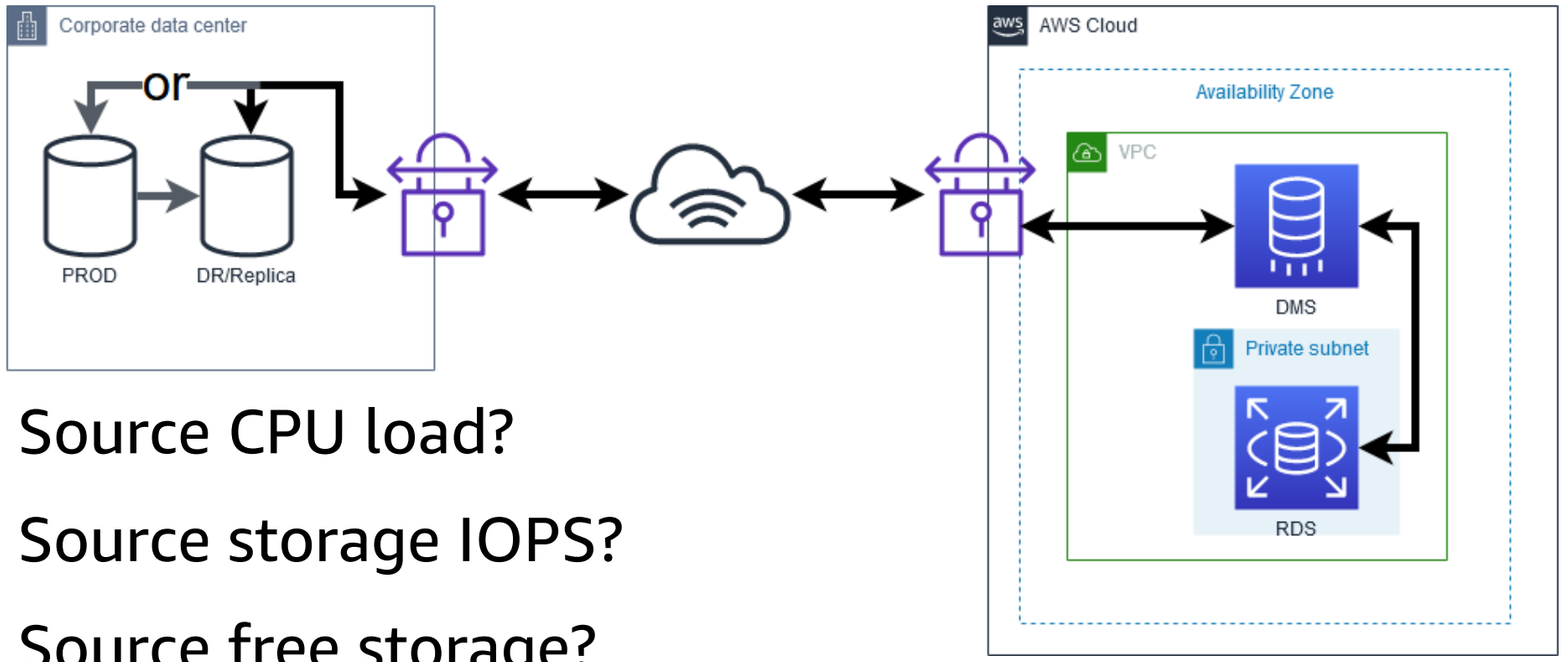
Schema + Data + Best Practices

AWS SCT **AWS DMS** **Playbook**

Hints and tips: General guidance

- Database migrations must be managed as proper IT projects
    - Application code, integration points, functional and performance testing, resourcing, support, etc.
- Things will go wrong!
    - Data types, query performance, networking bandwidth, networking devices (firewall and optimizers), bugs in source databases
- Test all scenarios—e.g., don’t assume that because it worked in dev/test, you can just execute in production; always plan tests in production too
- Use native migration method—e.g., Data Pump, .BAK, Mysqldump, Data Guard
- Ask AWS for help through the Forum, Support, and your account team

Optimize at all points!



Source CPU load?

Source storage IOPS?

Source free storage?

Source redo volume?

Primary or DR/replica?

Source database patched?

Firewall ports open?

Network throughput adequate?

Network shaping/optimization?

Routing optimized?

AWS DMS instance right-sized?

AWS DMS tasks optimized?

Amazon RDS instance right-sized?

Performance Insights on?

Enhanced Metrics on?

IAM and SG permissions?

Hints and tips: Post–data migration

- Data validation
- Indexes, stored procedures, triggers, sequences
- Failback plan
- Cutover plan: Big bang, CDC + testing, parallel run through load balancer
- Operations: Backups, HA/DR, performance monitoring and alerts
- Continuous replication: Consider AWS DMS with Multi-Availability Zone option

Hints and tips: Real customer issues

- Network optimizer reduced AWS DMS throughput
- Network firewall dropped long-running DB connections
- Network bandwidth doesn’t allow for peak or batch operation throughput
- Data type mapping from Oracle to PostgreSQL causes performance problems
- Sequences need to be updated at the end of CDC
- Source database not patched and didn’t support CDC of partitioned tables on DR
- Customer used AWS DMS without using AWS SCT!
- AWS accounts with incorrect IAM permissions
- Incorrect security group and other access-related issues
- Didn’t read the documentation!
- T2 instance ran out of CPU credits and migration fell behind

Choose the right instances

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Instance types

Families	Description	Example Use Cases
t2, m3, m4, m5	**General Purpose** Balanced Performance	Websites, web applications, Dev, code repos, microservices, business apps
c3, c4, c5, cc2	**Compute Optimized** High CPU Performance	Front-end fleets, web servers, batch processing, distributed analytics, science and engineering apps, ad serving, MMO gaming, video encoding
g2, p2	**GPU Optimized** High-end GPU	Amazon AppStream 2.0, video encoding, machine learning, high perf databases, science
r3, r4, r5, x1, cr1	**Memory Optimized** Large RAM footprint	In-memory databases, data mining
d2, i2, i3, hi1, hs1	**Storage Optimized** High I/O, High density	NAS, data warehousing, NoSQL

Amazon EC2 z1d: High-frequency for specialized workloads

NEW!

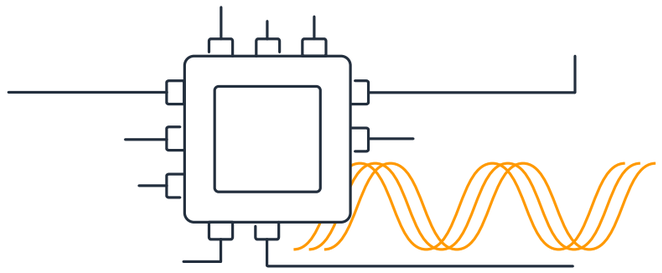
High-frequency instances with custom Intel Xeon Scalable processors running at sustained 4 GHz all-core turbo

8:1 GiB to vCPU ratio

Up to 25 Gbps network bandwidth and up to 1.8 TB of local NVMe storage

z1d.large	6 sizes	z1d.12xlarge
16 GiB	● ● ●	384 GiB
2 vCPU		48 vCPU

Electronic design automation



Relational databases

Gaming

NEW! *z1d.metal Bare Metal instances coming soon*

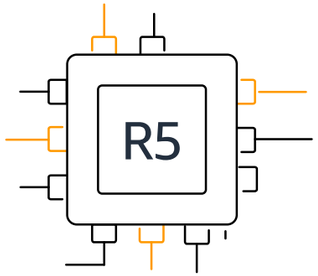
Amazon EC2 R5: Memory-optimized instances

3.1 GHz Intel Xeon Platinum processors (Skylake)

Memory-optimized instances with 8:1 GiB to vCPU

Up to 25 Gbps NW bandwidth

R5d instances include up to 3.6 TB of local NVMe SSD

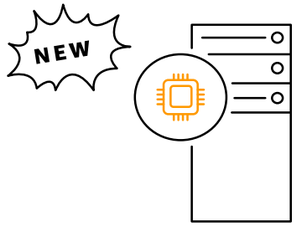


r5.large	6 sizes	r5.24xlarge
16 GiB	● ● ●	768 GiB
2 vCPU		96 vCPU

In-memory caches

High-performance databases

Big data analytics



R5.metal Bare Metal instances coming soon on Intel Xeon Scalable processors

Summary

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Learn from AWS experts. Advance your skills and knowledge. Build your future in the AWS Cloud.

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Classroom Training

Classes taught by accredited AWS instructors

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Exams to validate expertise with an industry-recognized credential

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- Help you take full advantage of all the business benefits that AWS has to offer
- Provide services and solutions to support any AWS use case across your full customer life cycle

APN Partners with deep expertise in AWS services:

AWS Managed Service Provider (MSP) Partners

APN Partners with cloud infrastructure and application migration expertise

AWS Competency Partners

APN Partners with verified, vetted, and validated specialized offerings

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APN Partners with a track record of delivering specific AWS services to customers

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