SOLISYON
www.solisyon.de

Zötler Bier
natürlich, sympathisch, frisch

DATAmasterminds

POWER BI SENTINEL
Documentation · Data Lineage · Change Tracking · Backup

ROSEN
empowered by technology

SentryOne

HEDDA.IO

redgate

SHOP APOTHEKE
EUROPE

dbWatch
DATABASE CONTROL

About me

Rune Ovlien Rakeie
Cloud Architect @ EVRY in Norway

20+ years experience with database technology and SQL Server specifically, as Developer, DBA & Solution Architect.

🐦 **@runeo34**

@ rune@ovlien.net

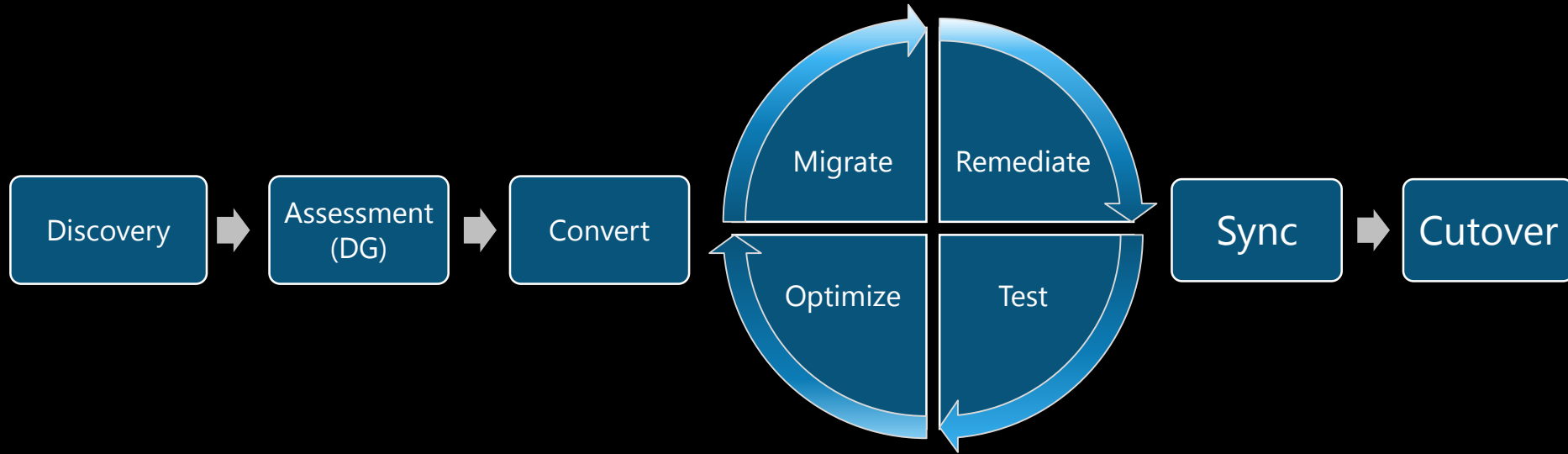*EVRY*

Plan your dive
&
Dive your plan!

EVRY

My AWSOME migration plan

1. OK...what to do first?
2. Google is my friend?

Data migration process
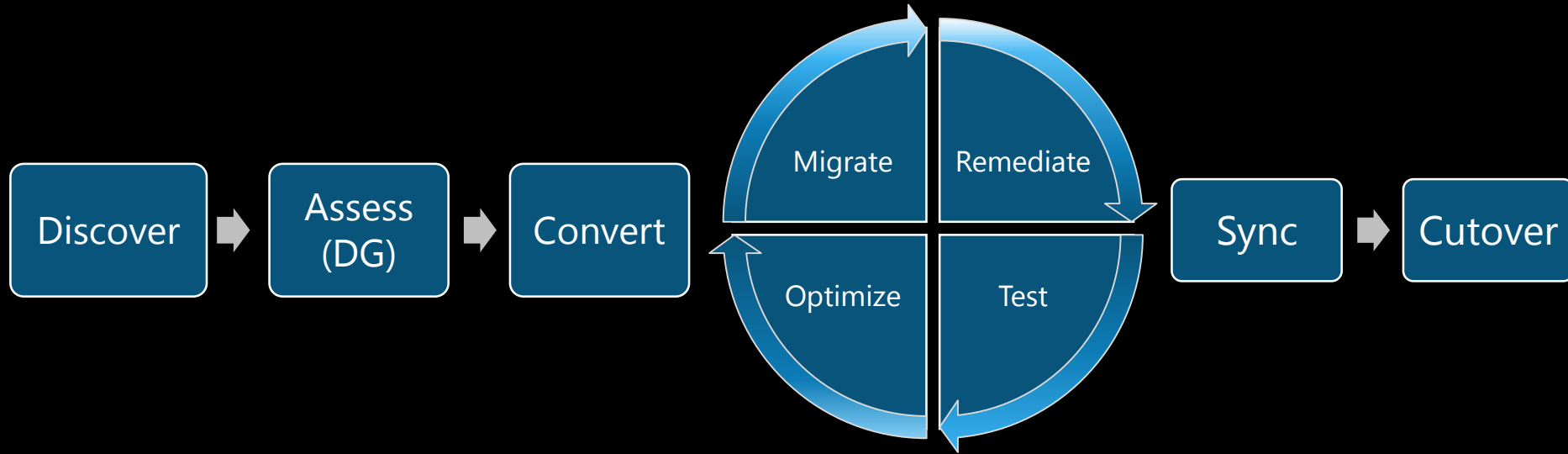
Data migration process

Discovery

WHAT
- Identify existing databases/instances
- Document version and features in use

HOW
- ~~Query up to date CMDB~~
- Discovery tool
  - MAP (Microsoft Assessment & Planning)

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Data migration process

Discover → Assess (DG) → Convert → [Migrate / Remediate / Optimize / Test cycle] → Sync → Cutover

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Data migration process

Assessment (DG)

WHAT
- Analyze data source
- Identify gaps between source & target

HOW
- AWS
  - AWS Schema Conversion Tool (AWS SCT)
  - AWS Database Migration Service (AWS DMS)
- Azure
  - Microsoft Data Migration Assistant (DMA)
  - Microsoft SQL Server Migration Assistant (SSMA)
- 3rd party
  - migVisor (all major db engines and clouds)

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AWS Schema Conversion Tool (SCT)

WHAT
- Schema conversion (to supported targets)
- Migration assessment reports
  - PDF - output
  - Excel - output
- Integrated with DMS
  - Create and monitor migration tasks
- Emulate features that can't be converted
- Analyze SQL in application code
  - C++, C#, Java & other code

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Data migration assessment report (PDF)

Executive summary

Conversion statistics w/graphics

Detailed recommendations

Data migration assessment report (cont.)

Executive summary

We completed the analysis of your Microsoft SQL Server source database and estimate that 100% of the database storage objects and 45% of database code objects can be converted automatically or with minimal changes if you select Amazon Aurora (MySQL compatible) as your migration target. Database storage objects include schemas, tables, table constraints, indexes, types, tabletypes, sequences, synonyms and xml schema collections. Database code objects include triggers, views, procedures, scalar functions, inline functions, table-valued functions and database triggers. Based on the source code syntax analysis, we estimate 98% (based on # lines of code) of your code can be converted to Amazon Aurora (MySQL compatible) automatically. To complete the migration, we recommend 28 conversion action(s) ranging from simple tasks to medium-complexity actions to significant conversion actions.

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Data migration assessment report (cont.)

Figure: Conversion statistics for database storage objects

Schema (1: 1/0/0/0): 1

Table (5: 5/0/0/0): 100% — 5

Constraint (9: 9/0/0/0): 100% — 9

0 ————————————————— 10

- Objects Automatically Converted
- Objects with simple actions
- Objects with medium-complexity actions
- Objects with significant actions
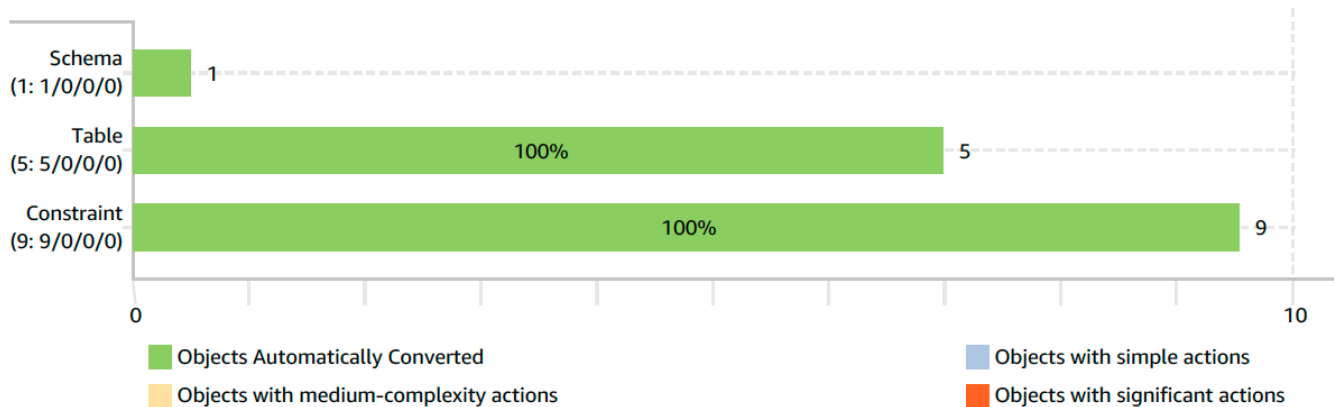
Figure: Conversion statistics for database code objects

Procedure (10: 3/1/0/6): 30% | 10% | 60% — 10

Scalar function (1: 1/0/0/0): 1

0 ————————————————— 10

- Objects Automatically Converted
- Objects with simple actions
- Objects with medium-complexity actions
- Objects with significant actions
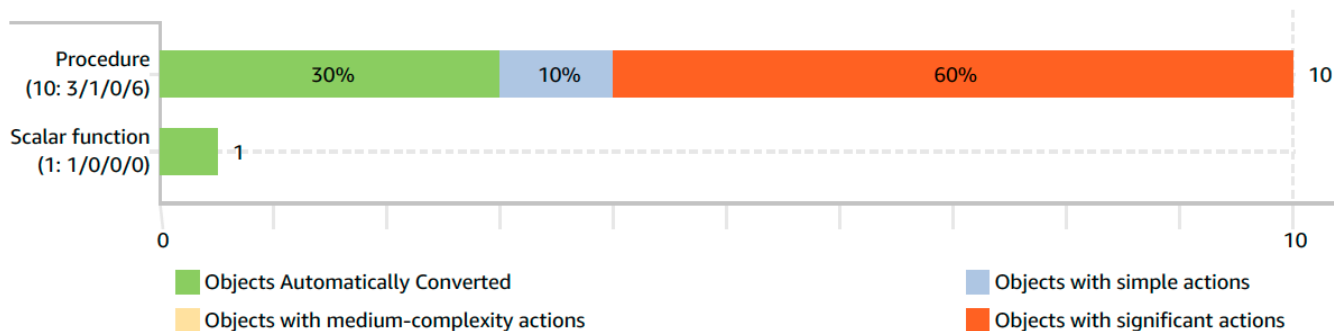
Data migration assessment report (cont.)

⚠ Issue 774: Unable to perform an automated migration of the arithmetic operations with mixed types of operands

Recommended action: Make cast operands to the expected type.

Issue code: 774 | Number of occurrences: 1 | Estimated complexity: Simple

Databases.SalesDB.Schemas.dbo.Procedures.getTopCustomerProductWeek: 639:662

⚠ Issue 810: MySQL doesn't support the SET NOCOUNT

Recommended action: If need try another way to send message back to the client application.

Issue code: 810 | Number of occurrences: 5 | Estimated complexity: Simple

Databases.SalesDB.Schemas.dbo.Procedures.sp_alterdiagram: 192:201
Databases.SalesDB.Schemas.dbo.Procedures.sp_creatediagram: 197:206
Databases.SalesDB.Schemas.dbo.Procedures.sp_dropdiagram: 141:150
Databases.SalesDB.Schemas.dbo.Procedures.sp_helpdiagramdefinition: 155:164
Databases.SalesDB.Schemas.dbo.Procedures.sp_renamediagram: 177:186

⊖ Issue 811: Unable to convert functions

Recommended action: Create a user-defined function.

Issue code: 811 | Number of occurrences: 7 | Estimated complexity: Significant

Databases.SalesDB.Schemas.dbo.Procedures.sp_alterdiagram: 511:533
Databases.SalesDB.Schemas.dbo.Procedures.sp_creatediagram: 469:491
Databases.SalesDB.Schemas.dbo.Procedures.sp_dropdiagram: 403:425

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	Amazon Aurora (MySQL)	Amazon Aurora (PostgreSQL)	MariaDB 10.2 and 10.3	Microsoft SQL Server	MySQL	PostgreSQL	Oracle	Amazon DynamoDB
Microsoft SQL Server (version 2008 and later)	✓	✓	✓	✓	✓	✓	✗	✗
MySQL (version 5.5 and later)	✓	✓	✗	✗	✓	✓	✗	✗
Oracle (version 10.2 and later)	✓	✓	✓	✗	✓	✓	✓	✗
PostgreSQL (version 9.1 and later)	✓	✓	✗	✗	✓	✓	✗	✗
IBM Db2 LUW (versions 9.1, 9.5, 9.7, 10.5, and 11.1)	✓	✓	✓	✗	✓	✓	✓	✗
Apache Cassandra (versions 2.0 and 3.0)	✗	✗	✗	✗	✗	✗	✗	✓
Sybase (16.0 and 15.7)	✓	✓	✗	✗	✓	✓	✗	✗

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AWS SCT support «matrix» (DWH)

	Amazon Redshift
Greenplum Database (version 4.3 and later)	
Microsoft SQL Server (version 2008 and later)	
Netezza (version 7.0.3 and later)	
Oracle (version 10 and later)	
Teradata (version 13 and later)	
Vertica (version 7.2.2 and later)	

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Microsoft Data Migration Assistant (DMA)
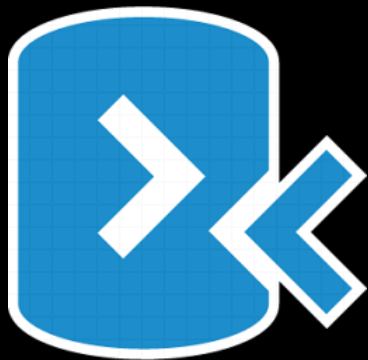
WHAT
- Assess SQL Server for migration to Azure (or upgrade)
  - Migration blocking issues
  - Partially supported or unsupported issues
- Discover compatibility issues
  - Breaking or behaviour changes and deprecated features
- Feature recommendations (new stuff in target)
  - Performance, security or storage related
- Migrate on-prem SQL Server to modern SQL Server
  - Database schema, data & users, server roles, logins
- DMA CLI

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Consolidate assessment report

WHAT
- Scaled assessment of multiple instances

HOW
- Define an inventory of instances and databases
  - CSV or SQL Server table
- Run the scaled assessment using a Powershell module

```
1   dmaDataCollector -getServerListFrom SqlServer `
2                    -serverName "demo.database.windows.net" `
3                    -databaseName EstateInventory `
4                    -InventoryAuthenticationMethod SQLAuth `
5                    -AssessmentName "Assorted SQL Servers" `
6                    -TargetPlatform AzureSqlDatabase `
7                    -AuthenticationMethod SQLAuth `
8                    -OutputLocation "C:\DMAConsolidated\"
9
```

- The dmaDataCollector generates a JSON file

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Consolidate assessment report (cont.)

- Consume the assessment JSON

```
1  dmaProcessor -processTo SQLServer `
2               -serverName "demosql" `
3               -CreateDMAReporting 1 `
4               -CreateDataWarehouse 1 `
5               -databaseName DMAReporting `
6               -warehouseName DMAWarehouse `
7               -jsonDirectory "C:\DMAConsolidated\"
8
9
```

- Run the script to load the datawarehouse
- Open the Power BI report template

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Microsoft
Data Migration Assessment

Readiness is
65.55%

Readiness Bucket

75-99% REA...
2

50-75% ...
5

10...
3

NOT READY
4
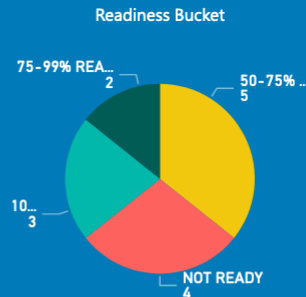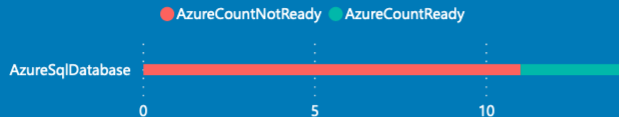
MigrationBlocker
BehaviorChange
Information

● AzureCountNotReady ● AzureCountReady

AzureSqlDatabase

0   5   10

Filters

No filters set.

Data Migration Assessment | Remediation Plans

Filter data

Remediation Plan

InstanceName	DatabaseName	ChangeCategory	ObjectType	ImpactedObjectName	Title
MSSQL01	DWH_EDW	BehaviorChange	Login	ACME\mary-poppins	[71627] Database users mapped with Windows authentication (integrated security) not supported in Azure SQL Database Managed Insta
MSSQL01	DWH_EDW	BehaviorChange	Login	ACME\peter-pan	[71627] Database users mapped with Windows authentication (integrated security) not supported in Azure SQL Database Managed Insta
MSSQL01	DWH_EDW	MigrationBlocker	User	acmjas	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	User	op5sjekk	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	User	SSRS_ReportExecution	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	User	acmjas	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	User	op5sjekk	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	User	SSRS_ReportExecution	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	View	dbo.KlarnaMonthly	[71501] Unresolved references found
MSSQL01	DWH_EDW	MigrationBlocker	View	dbo.KlarnaMonthly	[71501] Unresolved references found
MSSQL01	DWH_EDW	NA	NA	NA	NA
MSSQL01	DWH_Management	BehaviorChange	Login	ACME\mary-poppins	[71627] Database users mapped with Windows authentication (integrated security) not supported in Azure SQL Database Managed Insta
MSSQL01	DWH_Management	BehaviorChange	Login	ACME\peter-pan	[71627] Database users mapped with Windows authentication (integrated security) not supported in Azure SQL Database Managed Insta
MSSQL01	DWH_Management	BehaviorChange	Login	ACME\Sql.MSSQL01.DBO.Dwh	[71627] Database users mapped with Windows authentication (integrated security) not supported in Azure SQL Database Managed Insta
MSSQL01	DWH_Management	BehaviorChange	User	ACME\ACM RAPPORTERING	[71627] Windows users can be converted to external users in Azure SQL Database

Identify Azure SQL Database SKU

- Collect performance counters & other system data from source system

```
.\SkuRecommendationDataCollectionScript.ps1 `
  -ComputerName MyComputer `
  -OutputFilePath D:\my-computer-counters.csv `
  -CollectionTimeInSeconds 2400 `
  -DbConnectionString
   "Server=localhost;Initial Catalog=master;Integrated Security=SSPI;"
```

- Recommended runtime is minimum 40 minutes, preferably 2 hours
- Outputs a file for further processing
- Run DMA CLI to analyze data collection
  - Return a recommendation for an Azure SQL DB and Managed Instance target
  - Can generate output in TSV, JSON and HTML format

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Identify Azure SQL Database SKU (cont.)

- DMA CLI analyze performance counter data

```
.\DmaCmd.exe /Action=SkuRecommendation `
/SkuRecommendationInputDataFilePath="D:\my-computer-counters.csv" `
/SkuRecommendationTsvOutputResultsFilePath="D:\My-SKU-DMA.tsv" `
/SkuRecommendationCurrencyCode=EUR `
/SkuRecommendationOfferName=MS-AZR-0003P `
/SkuRecommendationRegionName=WestEurope `
/SkuRecommendationDatabasesToRecommend="SalesDB" `
/SkuRecommendationSubscriptionId=<Your Subscription Id> `
/AzureAuthenticationInteractiveAuthentication=true `
/AzureAuthenticationClientId=<Your AzureAuthenticationClientId> `
/AzureAuthenticationTenantId=<Your AzureAuthenticationTenantId>
```

- Return recommendation for a Azure SQL DB and Managed Instance target
- Can generate output in TSV, JSON and HTML format

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Identify Azure SQL Database SKU (cont.)

- TSV output

DatabaseName	MetricType	MetricValue	PricePerMonth	RegionName	IsTierRecommended
SalesDB	DTU_STANDARD_TIER	S4	253.01	West Europe	FALSE
SalesDB	DTU_PREMIUM_TIER	P2	784.27	West Europe	TRUE
SalesDB	VCORE_GENERAL_PURPOSE	GP_GEN4_2	336.3	West Europe	FALSE
SalesDB	VCORE_GENERAL_PURPOSE_GEN5	GP_GEN5_4	671.85	West Europe	FALSE
SalesDB	VCORE_BUSINESS_CRITICAL	BC_GEN4_4	1783.19	West Europe	FALSE
SalesDB	VCORE_BUSINESS_CRITICAL_GEN5	BC_GEN5_8	3564.75	West Europe	FALSE

ExclusionReasons	AppliedRules
This database is hosted on an SSD. It is more suited to the Premium/ Business Critical tiers.	DbDriveType
This database is hosted on an SSD. It is more suited to the Premium/ Business Critical tiers.	DbDriveType
This database is hosted on an SSD. It is more suited to the Premium/ Business Critical tiers.	DbDriveType
There is a less expensive SKU that can host the database.	Price
There is a less expensive SKU that can host the database.	Price

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Identify Azure SQL Database SKU (cont.)

Azure SQL Database SKU Recommendations

We have analyzed 1 database. For each database, we have identified the minimum recommended Azure SQL DB SKU based off of the performance counters collected from your instances. For more detailed information about the predictions, please refer to one of the text-based output formats.

The sliders below can be used to adjust the compute level and the maximum data size for each database. After configuring the databases and entering the subscription information, click "Generate Provisioning Script" to generate a powershell script that can be used to provision the databases.

Subscription information

| Subscription Id: | | Resource Group: | | Server Admin Username: | |

| Region: | West Europe▾ | Server Name: | | Server Admin Password: | |

Configure Databases

Provision	Database Name	Pricing Tier	Compute Level		Max Data Size		Est. Cost Per Month
☑	SalesDB	Premium▾	P2 (250 DTU)	€784.27	Max Data Size: 10 Gb	€0.00	€784.27
						Total Estimated Monthly Cost	€784.27

☐ I already have a SQL Server License (up to 55% savings).

Reset All to Recommended   **Generate Provisioning Script**

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DMA support «matrix»

Source

SQL Server 2005
SQL Server 2008
SQL Server 2008 R2
SQL Server 2012
SQL Server 2014
SQL Server 2016
SQL Server 2017 on Windows
AWS RDS SQL Server

Target

SQL Server 2012
SQL Server 2014
SQL Server 2016
SQL Server 2017 on Windows and Linux
Azure SQL Database
Azure SQL Database Managed Instance

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Data migration process
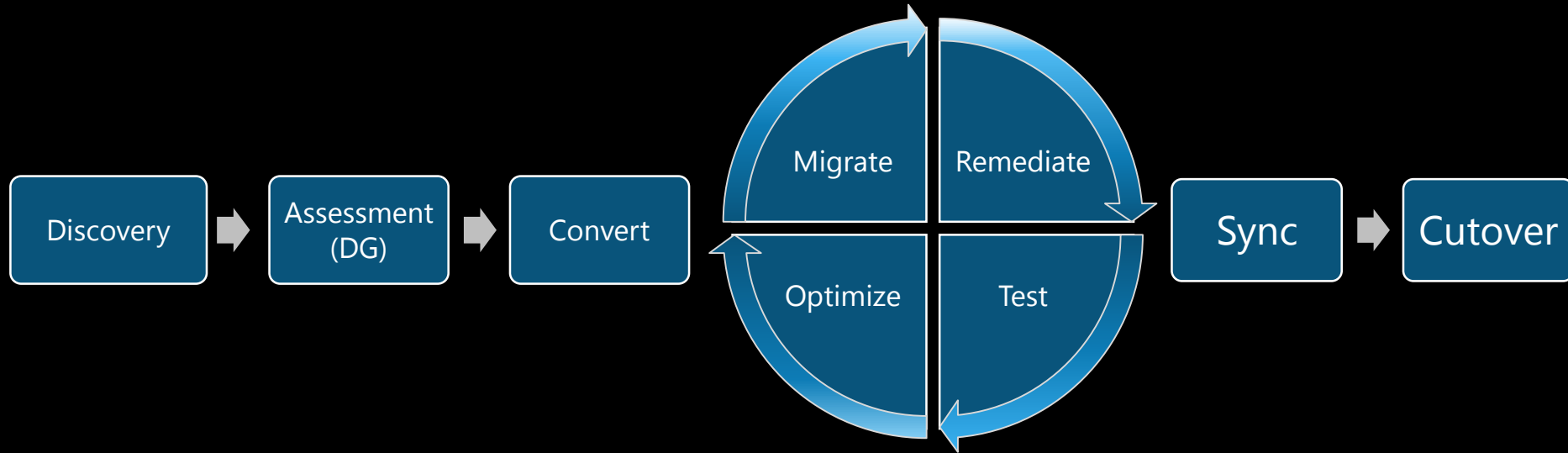
Data migration process

Convert

WHAT
- Schema conversion
  - Usually only for heterogenous migrations

HOW
- Manually or using tools
  - AWS Schema Conversion Tool
  - Microsoft Database Migration Assistant (DMA)
  - Microsoft SQL Server Migration Assistant (SSMA)
  - migVisor (all major db engines and clouds)

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Demo environment - AWS

Demo environment - Azure

Google Cloud
«On-premises network»

SQL Server 2008R2

SQL Server 2005

IPSec IKEv2 VPN tunnel

North Europe

Database Migration Service

Windows Jump client
w/ DMA

Azure SQL Database
Serverless

EVRY
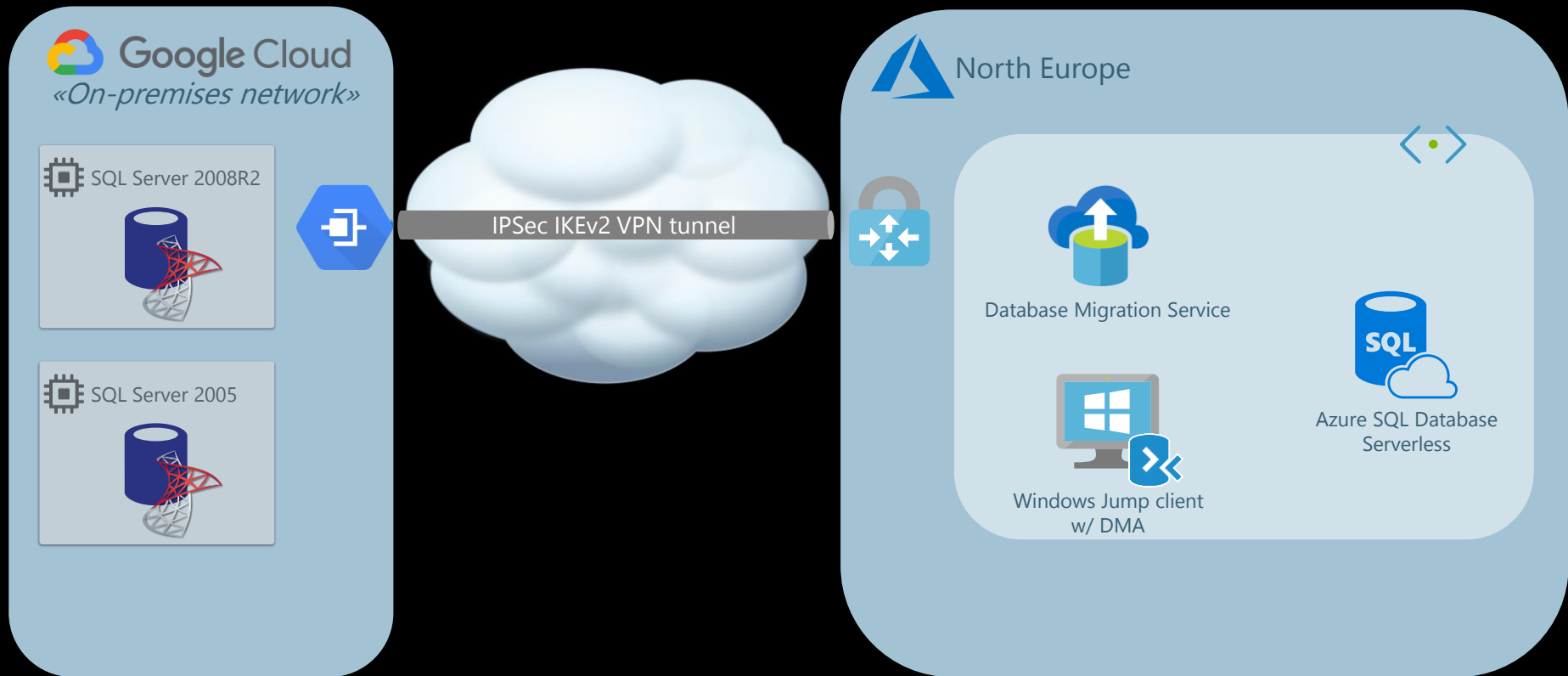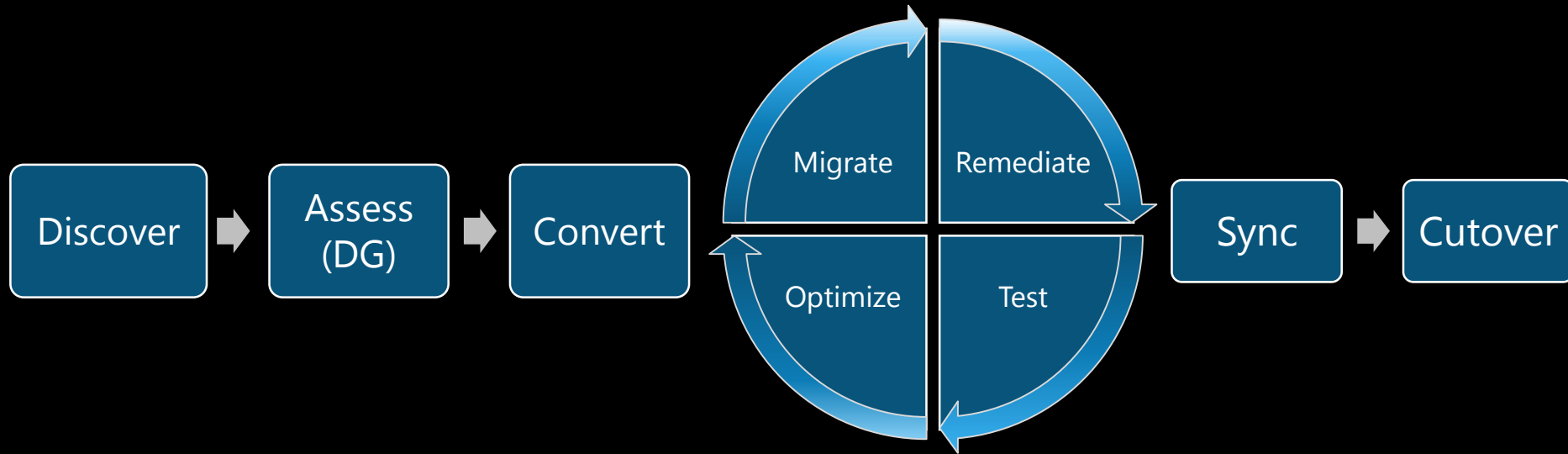
Data migration process

Migrate

WHAT
- Migration of the data
  - Iterative step

HOW
- Database Migration Service (AWS/Azure)
- Microsoft DMA / SSMA
- Attunity Replicate
- migVisor

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Database Migration Service (DMS)

WHAT
- Make it easier to migrate databases
  - Into the cloud, between on-premises or a mix
- Do one-time migrations or replicate on-going
- Is a cloud service -> all the benefits of the cloud
- AWS Only
  - Fault-tolerant
  - Can migrate DDL
  - Free if migrating to AWS managed database
- Azure Only
  - 2 modes; Offline & Online
  - 2 pricing tiers
    - Standard – only offline, but free
    - Premium – online and offline and free first 6 months

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AWS DMS support «matrix»

Source

Oracle 10.2->, 11g- 12.2
Microsoft SQL Server 2005-2016
MySQL versions 5.5, 5.6, and 5.7
MariaDB
PostgreSQL version 9.4 ->
MongoDB versions 2.6.x and 3.x ->
SAP ASE 12.5, 15, 15.5, 15.7, 16 ->
Db2 LUW 9.7, 10.1, 10.5,
Azure SQL Database
Amazon RDS & Amazon S3

Target

Oracle 10.2->, 11g- 12.2
Microsoft SQL Server 2005-2016
MySQL versions 5.5, 5.6, and 5.7
MariaDB
PostgreSQL version 9.4 ->
SAP ASE 12.5, 15, 15.5, 15.7, 16 ->
Amazon RDS instance databases
Amazon Redshift
Amazon DynamoDB
Amazon S3
Amazon Elasticsearch Service
Amazon Kinesis Data Streams
Amazon DocumentDB

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Microsoft DMS support matrix (offline)

	Azure SQL DB	Azure SQL DB MI	Azure SQL VM	Azure Cosmos DB	Azure DB for MySQL	Azure DB for PostgreSQL
Microsoft SQL Server	🟩	🟩	🟩	🟥	🟥	🟥
AWS RDS SQL Server	🟥	🟥	🟥	🟥	🟥	🟥
Oracle	🟥	🟥	🟥	🟥	🟥	🟥
MongoDB	🟥	🟥	🟥	🟩	🟥	🟥
MySQL	🟥	🟥	🟥	🟥	🟥	🟥
AWS RDS MySQL	🟥	🟥	🟥	🟥	🟥	🟥
PostgreSQL	🟥	🟥	🟥	🟥	🟥	🟥
AWS RDS PostgreSQL	🟥	🟥	🟥	🟥	🟥	🟥

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Microsoft DMS support matrix (online)

	Azure SQL DB	Azure SQL DB MI	Azure SQL VM	Azure Cosmos DB	Azure DB for MySQL	Azure DB for PostgreSQL
Microsoft SQL Server	🟩	🟩	🟥	🟥	🟥	🟥
AWS RDS SQL Server	🟩	🟩	🟥	🟥	🟥	🟥
Oracle	🟥	🟩	🟥	🟥	🟥	🟩
MongoDB	🟥	🟥	🟥	🟩	🟥	🟥
MySQL	🟥	🟥	🟥	🟥	🟩	🟥
AWS RDS MySQL	🟥	🟥	🟥	🟥	🟩	🟥
PostgreSQL	🟥	🟥	🟥	🟥	🟥	🟩
AWS RDS PostgreSQL	🟥	🟥	🟥	🟥	🟥	🟩

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DMS DEMO

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Data migration process

WHAT
- Making necessary application code changes

Remediate

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Data migration process

Discover → Assess (DG) → Convert → [Migrate · Remediate · Optimize · Test] → Sync → Cutover

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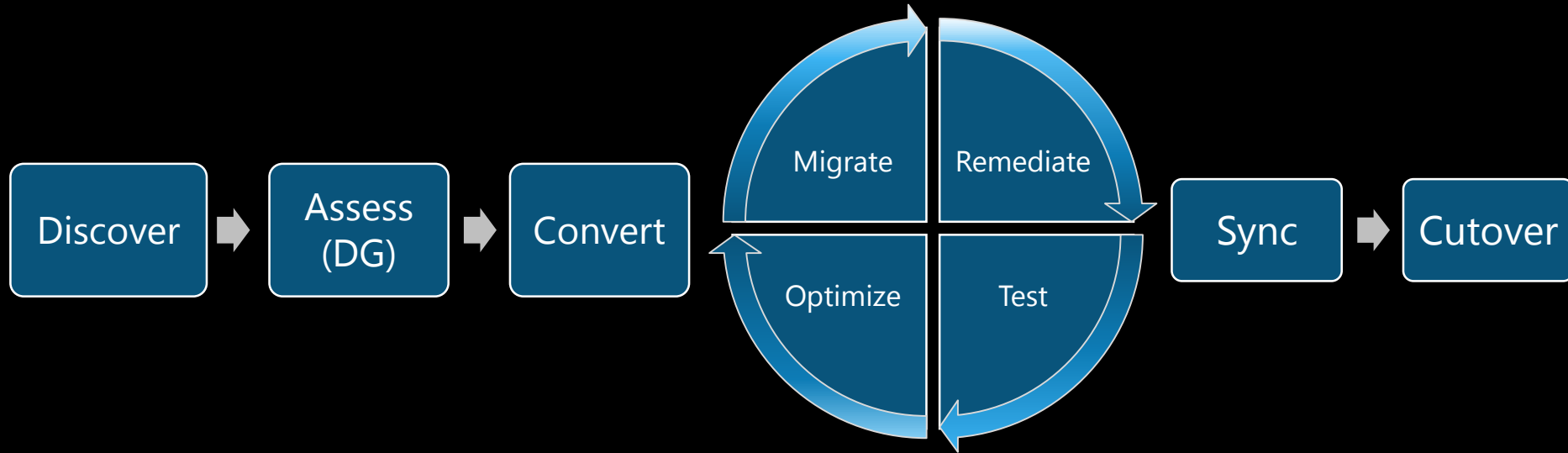
Data migration process

WHAT
- Making sure all the of data we wanted to migrate actually was migrated
- Making sure the application works as intended

HOW
- Data validation tests
- Functional tests
- Performance test
- Workload performance comparison

Test

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Data migration process

Workload performance comparison
WHAT
- Capture workload events from source system
- Replay workload on target system
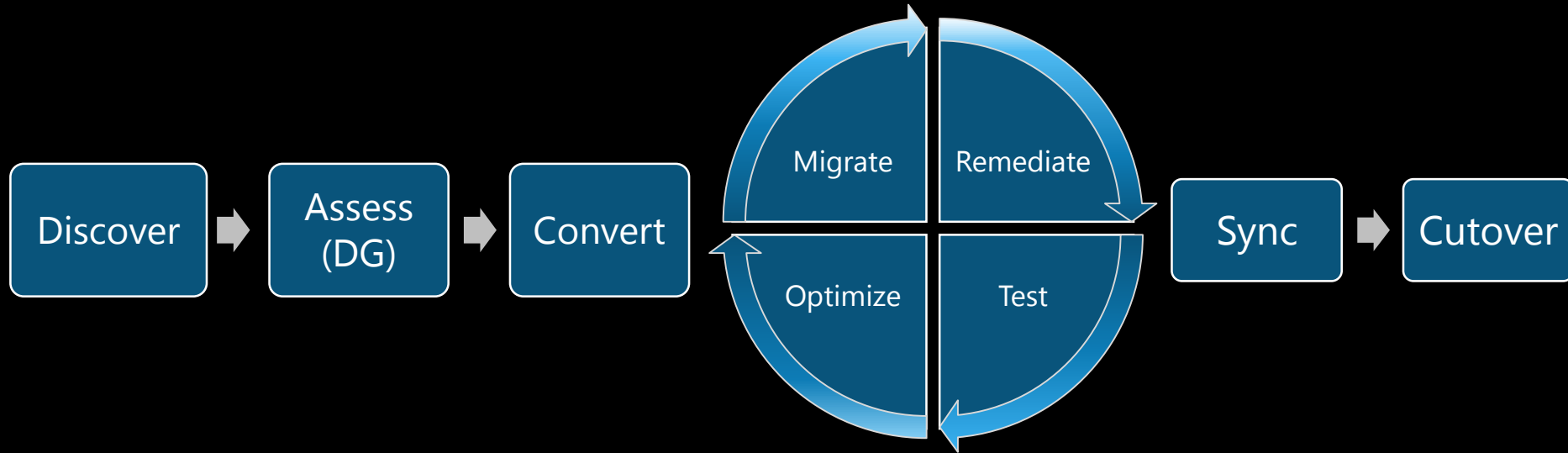- Compare performance metrics

HOW
- Microsoft Data Experimentation Assistant
- Workload tools (open source)
  - Gianluca Sartori (SpaghettiDBA)
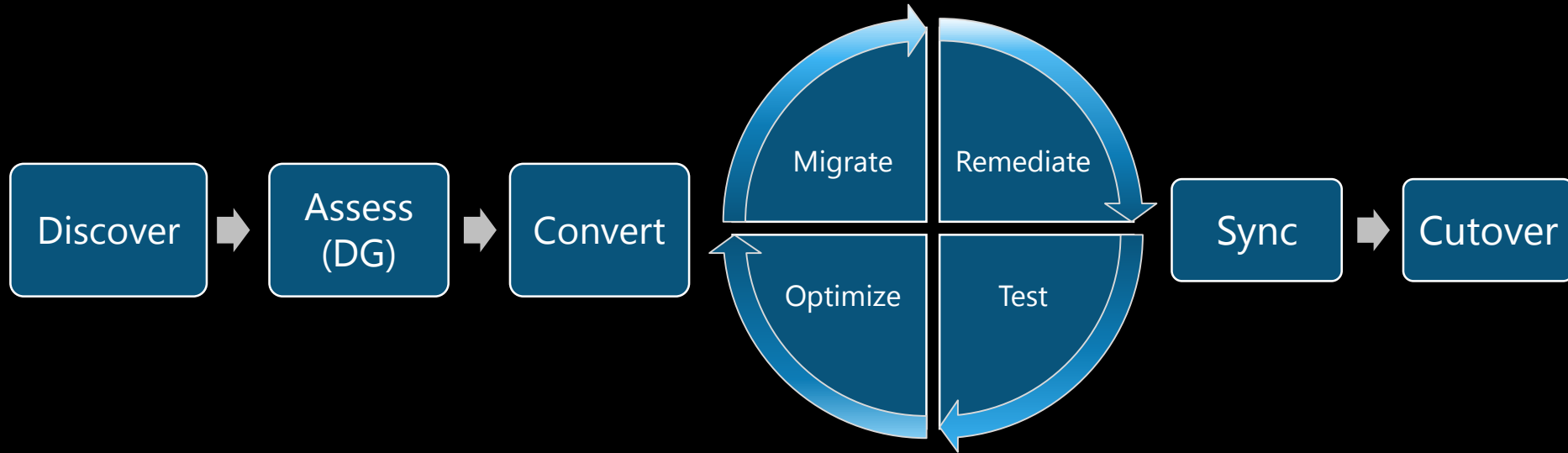
Test

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Data migration process

Discover → Assess (DG) → Convert →

Migrate | Remediate
Optimize | Test

→ Sync → Cutover

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Data migration process

Optimize

WHAT
• Activities to fix performance issues

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Data migration process

Discover → Assess (DG) → Convert → [Migrate / Remediate / Optimize / Test cycle] → Sync → Cutover

EVRY

Data migration process

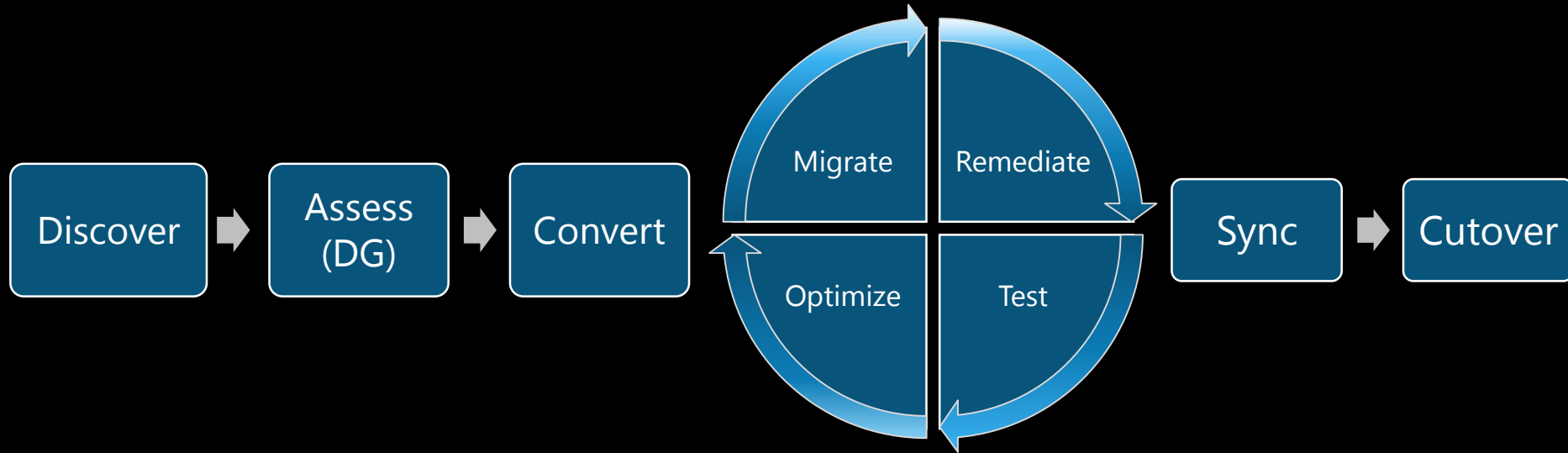WHAT
- Continuous data replication until ready for cutover

HOW
- Azure Database Migration Services
- AWS Database Migration Service
- Attunity Replicate
- migVisor

Sync

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Data migration process

Discover → Assess (DG) → Convert → [Migrate | Remediate | Optimize | Test] → Sync → Cutover

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Data migration process

WHAT
- Rollback strategy and plans are in place
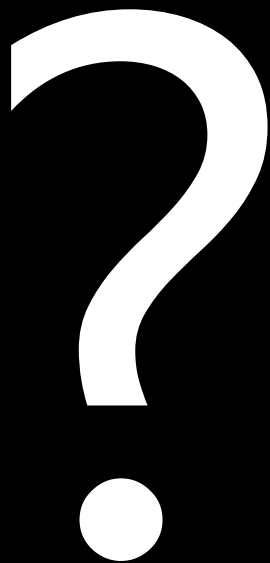- Post migration tasks detailed out

HOW
- Using DMS – press the button

Cutover

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DMS Sync/Cutover DEMO

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Resources

Microsoft data migration portal
https://datamigration.microsoft.com/

AWS Database Migration – What Do You Need to Know Before You Start?
https://aws.amazon.com/blogs/database/database-migration-what-do-you-need-to-know-before-you-start/

AWS Database Migration Playbooks
https://aws.amazon.com/dms/resources/

SalesDB sample database
https://www.sqlskills.com/sql-server-resources/sql-server-demos/

Data Workload Assessment Model and Tool
https://github.com/Microsoft/DataMigrationTeam/tree/master/Data%20Workload%20Assessment%20Model%20and%20Tool

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Tools

Microsoft Assessment and Planning toolkit (MAP)
https://www.microsoft.com/en-us/download/details.aspx?id=7826

Microsoft Database Migration Assistant (DMA)
https://docs.microsoft.com/en-us/sql/dma/dma-overview

Microsoft SQL Server Migration Assistant (SSMA)
https://docs.microsoft.com/en-us/sql/ssma/sql-server-migration-assistant

AWS Schema Conversion Tool
https://aws.amazon.com/dms/schema-conversion-tool/

migVisor (3rd party database migration tool)
https://www.migvisor.com/product/

Microsoft Data Experimentation Assistant
https://docs.microsoft.com/en-us/sql/dea/database-experimentation-assistant-overview

Workload Tools (SpaghettiDBA)
https://github.com/spaghettidba/WorkloadTools

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