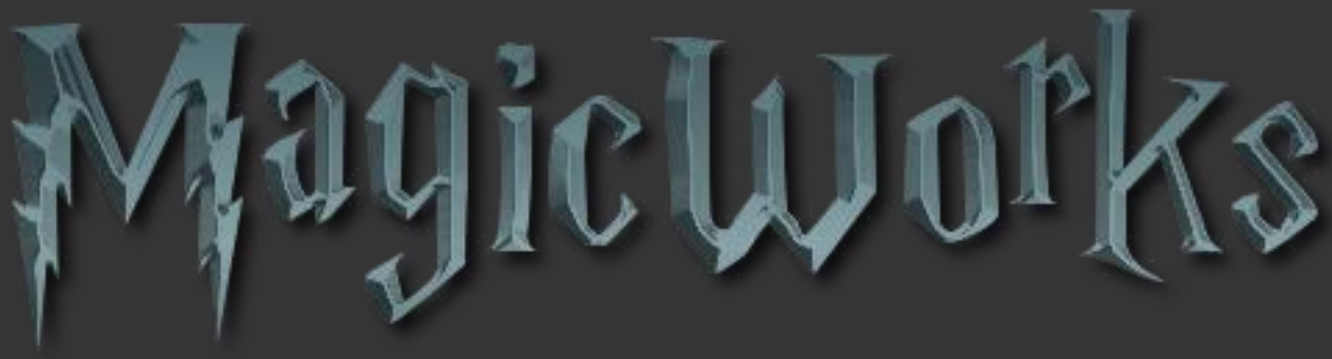
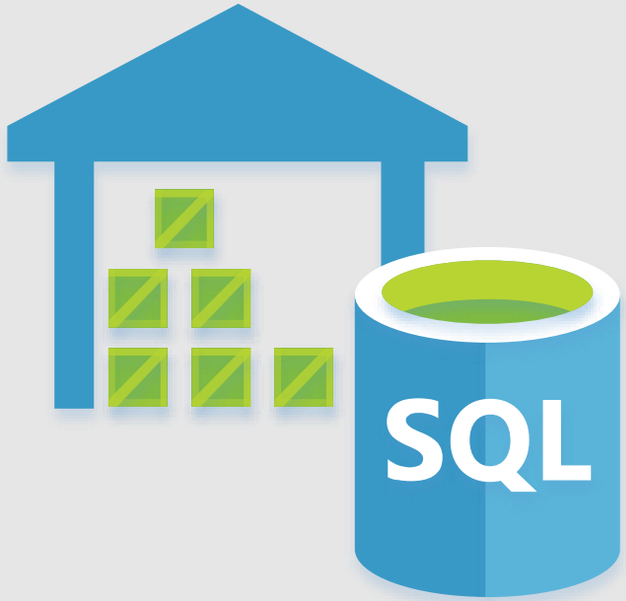
What's the Problem?



MagicWorks™ are struggling

- Analytics queries too slow
- Data volumes are growing
- Their servers are at capacity
- Queries are already tuned by SQL experts



Azure SQL Data Warehouse

Agenda

Service architecture

Elastic performance and scalability

Table storage

Business Continuity

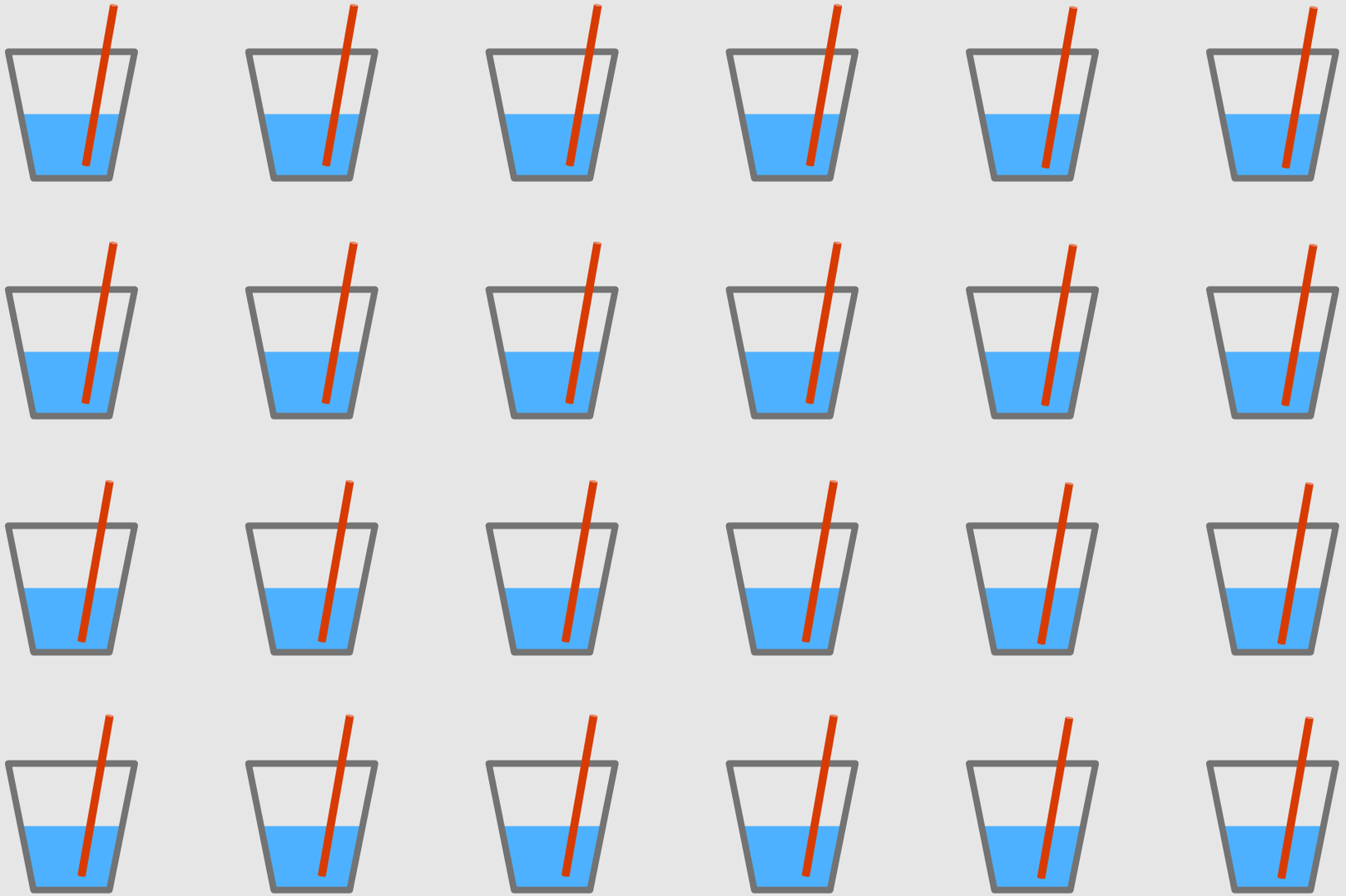
Workload Management

Service Integration

But first…

Who likes Drinking Games?

Scaling out: The ultimate team game…



Target workload: Analytics

Store large volumes of data

Consolidate disparate data into a single location

Shape, model, transform and aggregate data

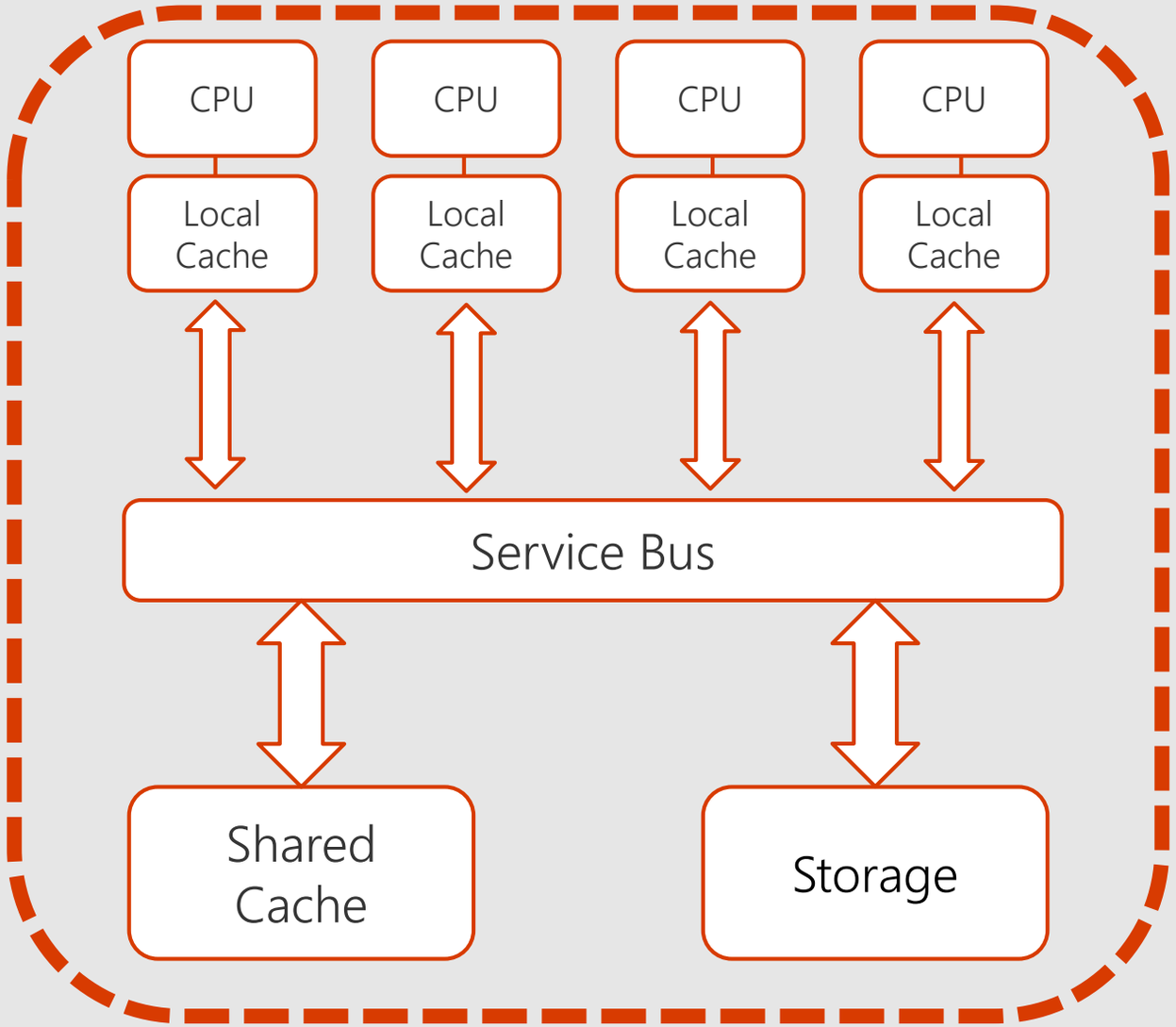
Perform query analysis across large datasets

Ad-hoc reporting across large data volumes

All using simple SQL constructs

"SQL on SQL"

SQLDW Service Architecture

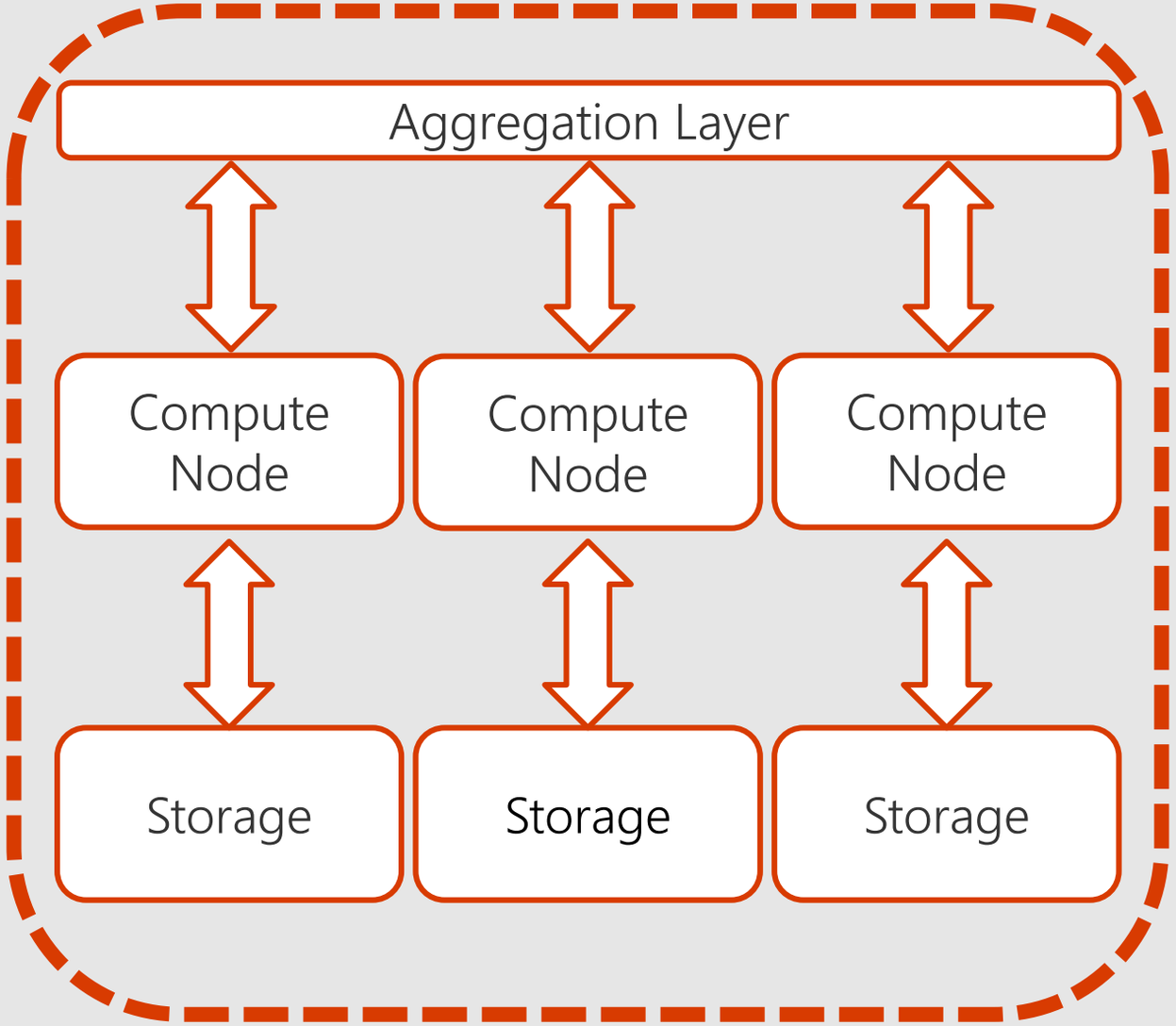


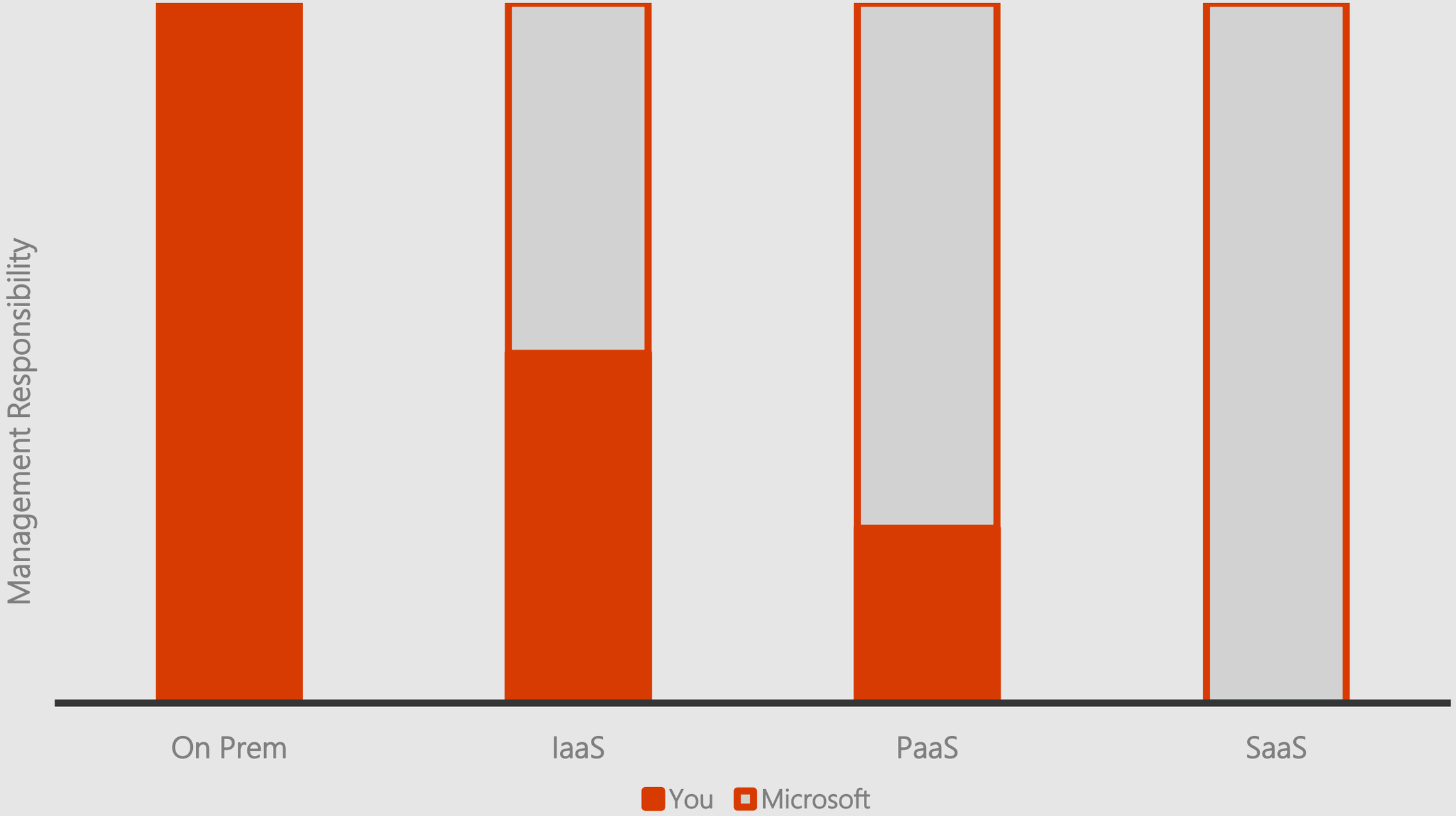
SMP

Symmetric Multi-Processing
(ie: A Standard SQL Server)

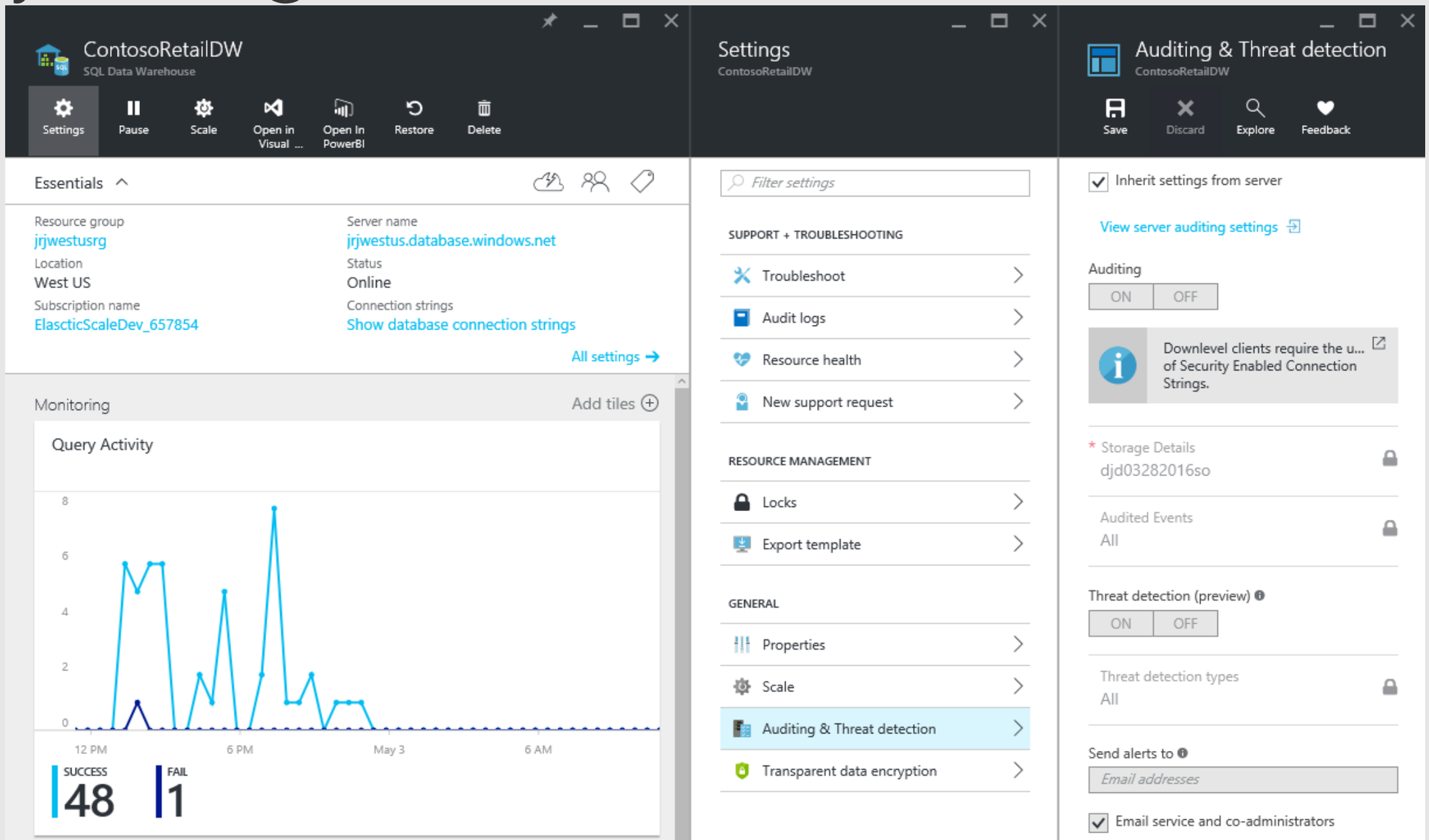
MPP

Massively Parallel Processing




Management Responsibility
On Prem
IaaS
PaaS
SaaS
You
Microsoft

Fully managed PaaS



Connectivity

Windows or Linux

ODBC

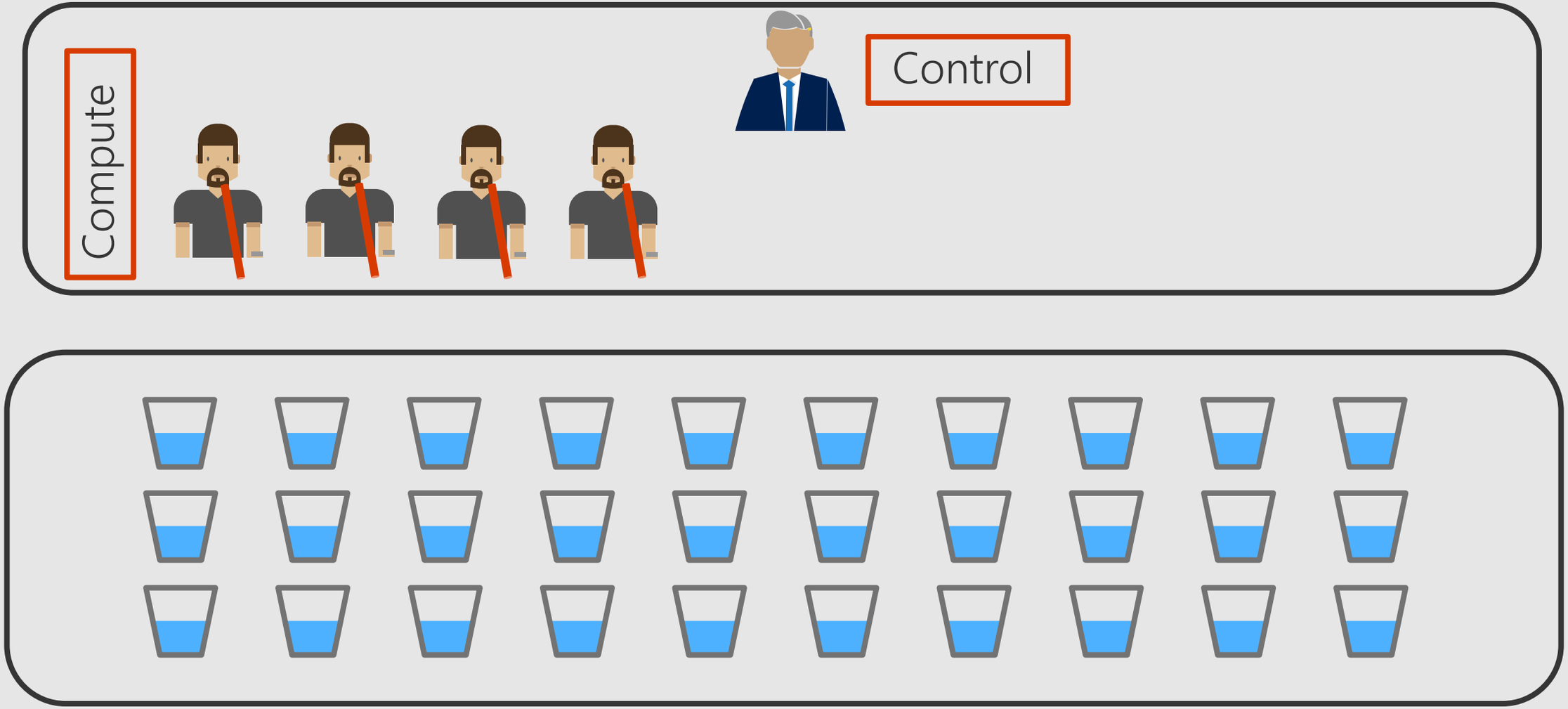
OLEDB

JDBC

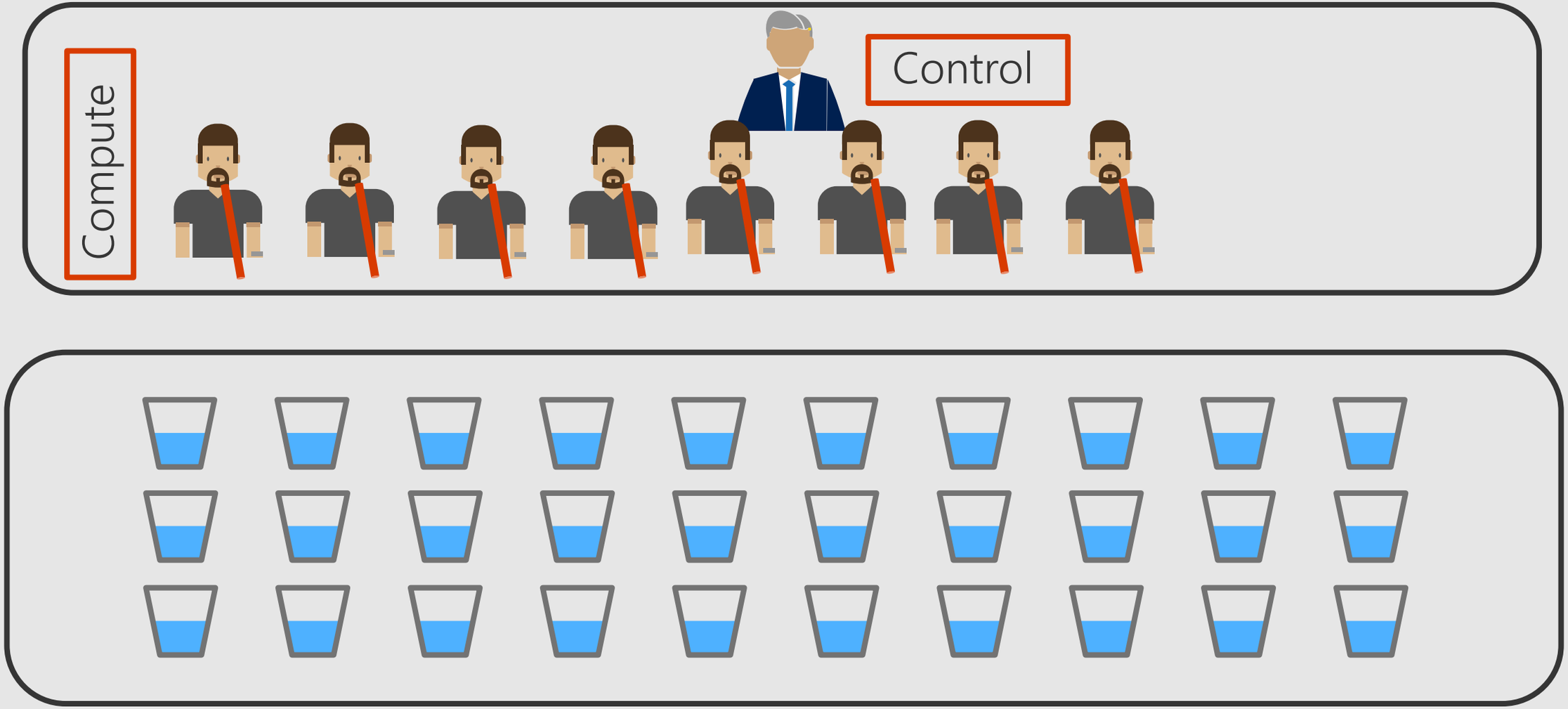
ADO.NET

PHP

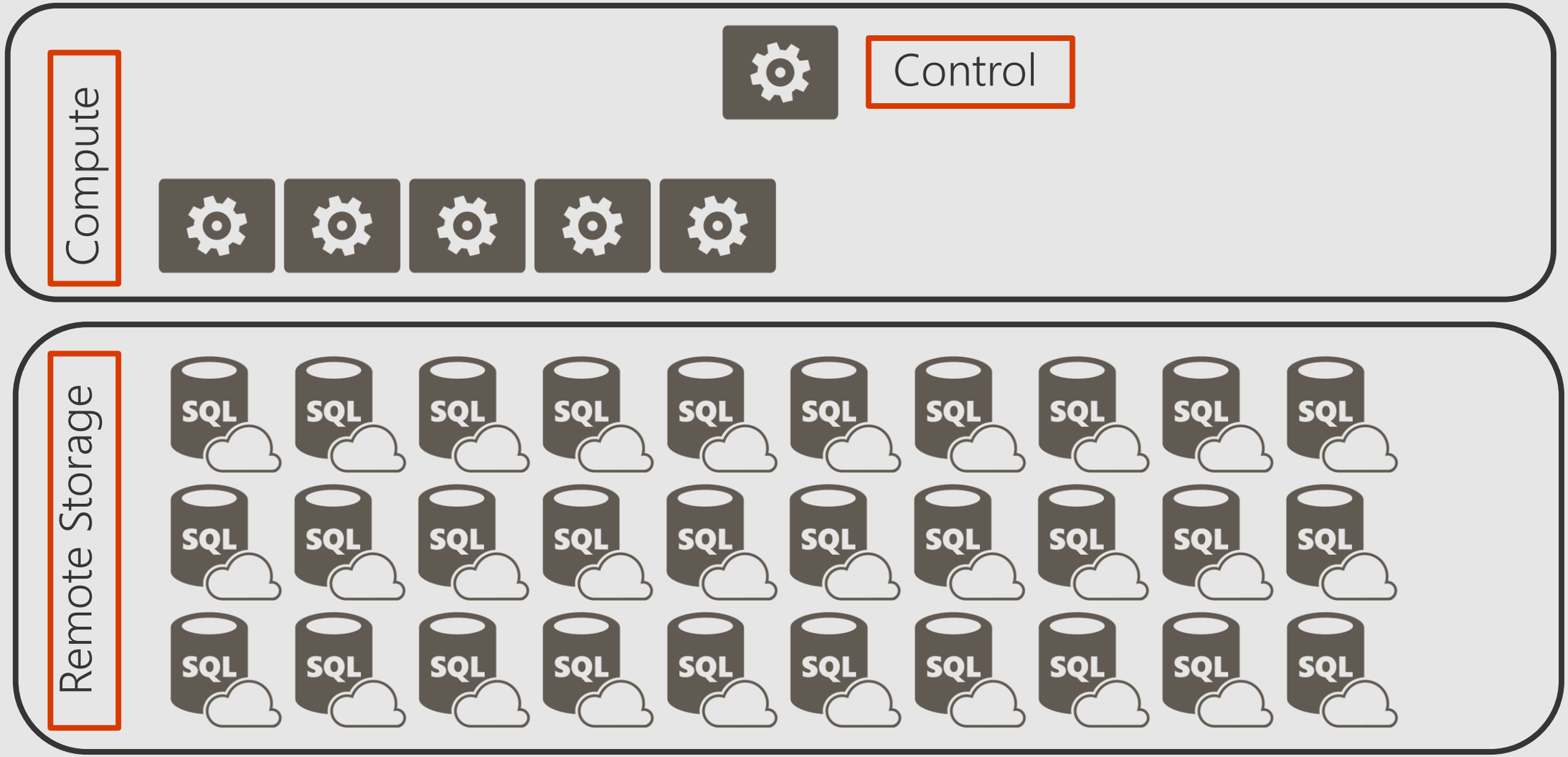
Separation of compute from storage



Separation of compute from storage



Separation of compute from storage



Instance

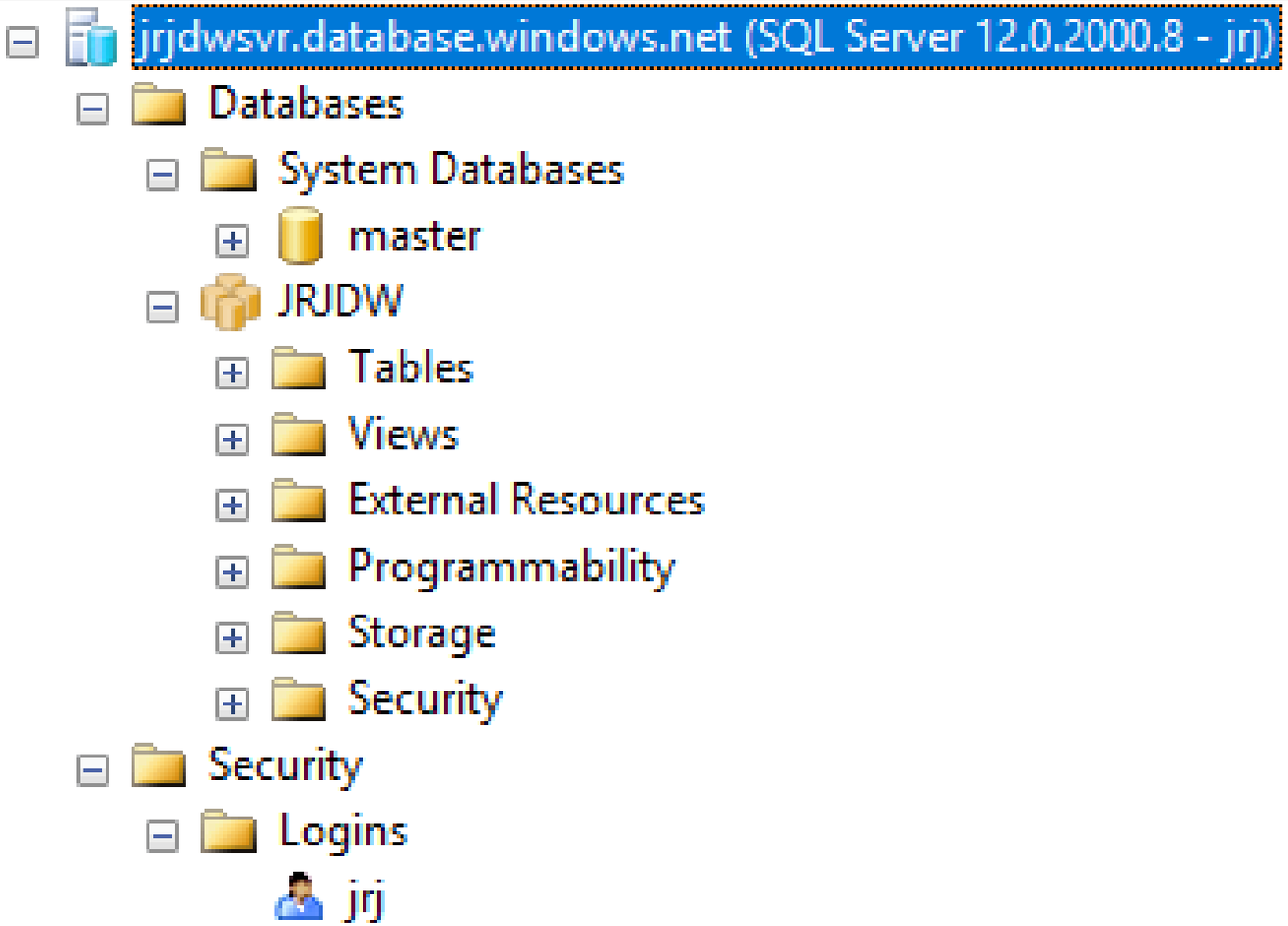
Logical server

Database

- Schemas
- Tables
- Views
- Stored Procedures
- UDFs

Security

- Logins
- Users
- Certificates



Demo: Creating & Connecting to Azure SQLDW

Nodes:

```
SELECT   [pdw_node_id]    AS node_id
,        [type]           AS node_type
,        [name]           AS node_name
FROM     sys.[dm_pdw_nodes]
;
```

Distributions:

```
SELECT   [distribution_id]    AS dist_id
,        [pdw_node_id]        AS node_id
,        [name]               AS dist_name
,        [position]           AS dist_position
FROM     sys.[pdw_distributions]
;
```

Lab 001 – Connecting to SQLDW
10 mins

Elastic performance & scalability

Scale up architecture

One bucket (motherboard)

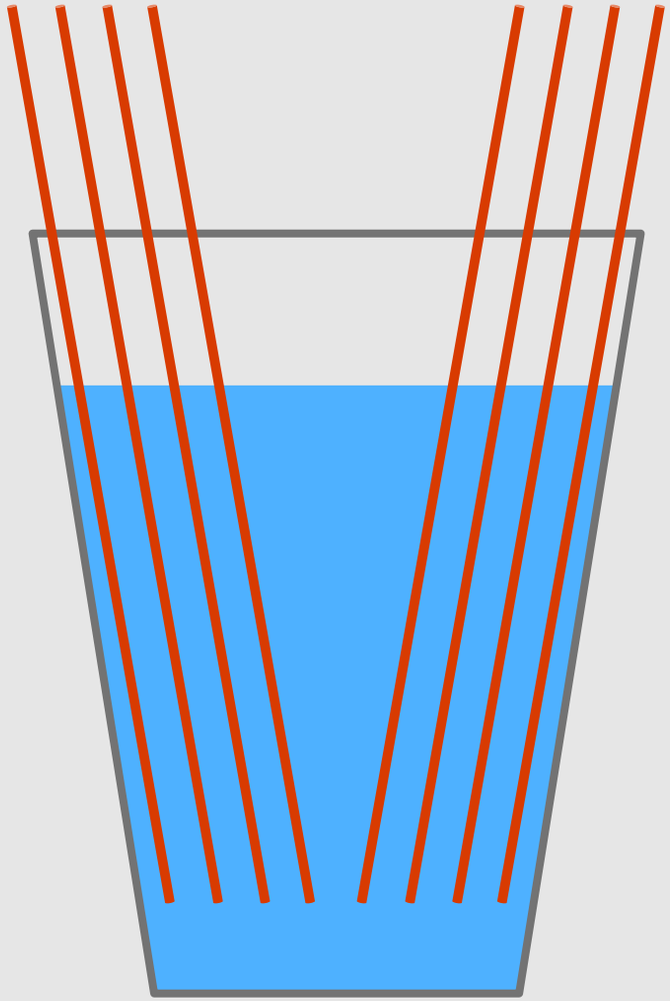
Contains all the water (resources)

Drinking through straws (logical procs)

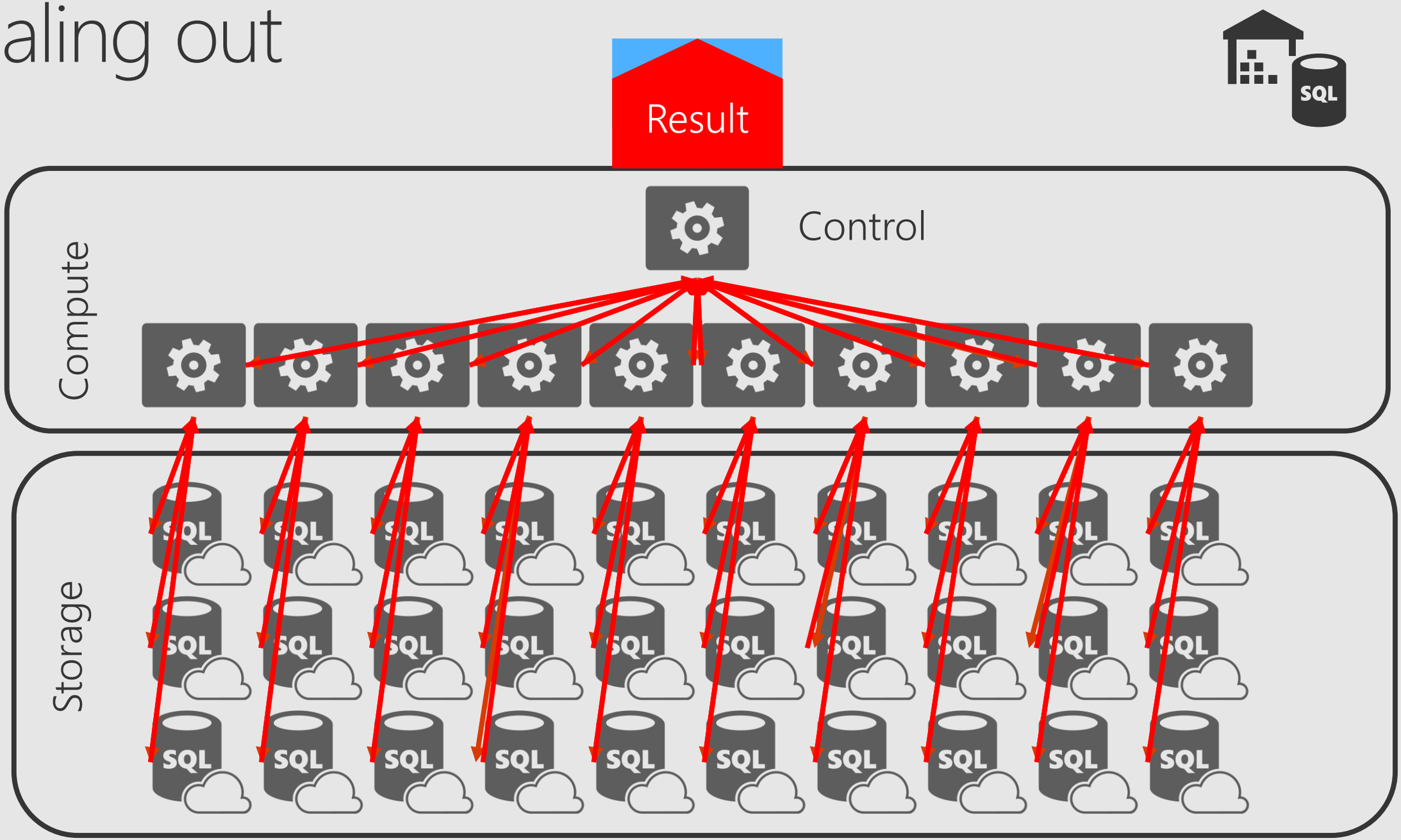
Want more resources?

- Buy a bigger bucket

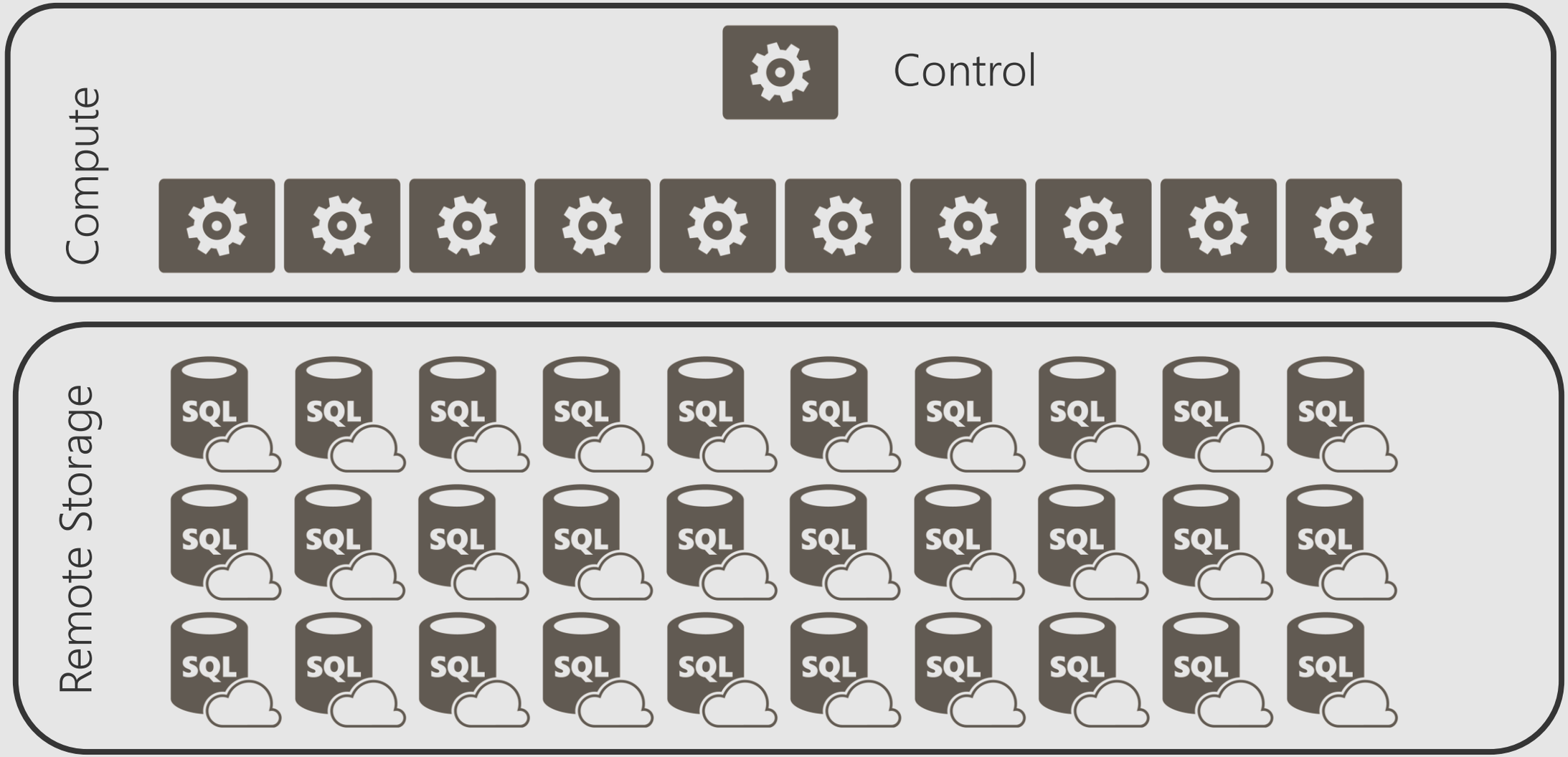
Sometimes you only get one straw…



Scaling out



Independently scale compute



Data Warehouse Units

Normalized amount of compute

Converts to billing units i.e. what you pay

Relates directly to number of compute nodes

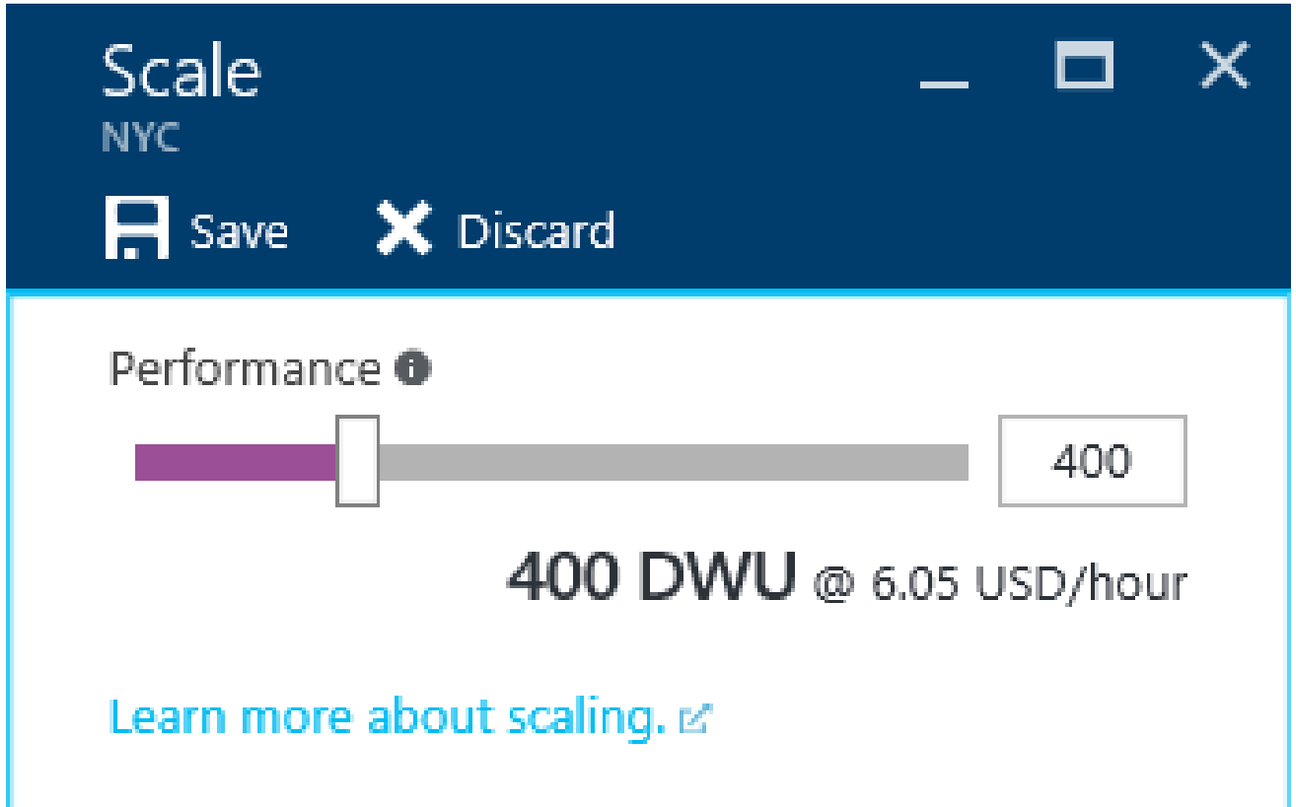
DWU
100
200
300
400
500
600
1000
1200
1500
2000
3000
6000

Service objective

```
SELECT   db.[name]                        AS [db_name]
,        ds.[edition]                     AS [db_edition]
,        ds.[service_objective] AS [db_slo]
FROM     sys.[database_service_objectives]   AS ds
JOIN     sys.[databases]                     AS db
ON       ds.[database_id] = db.[database_id]
WHERE    ds.[edition]     = 'DataWarehouse'
;
```

Changing Service Level Objectives (SLO)

```
ALTER DATABASE ContosoDW
MODIFY
(service_objective = 'DW1000'
)
;
```



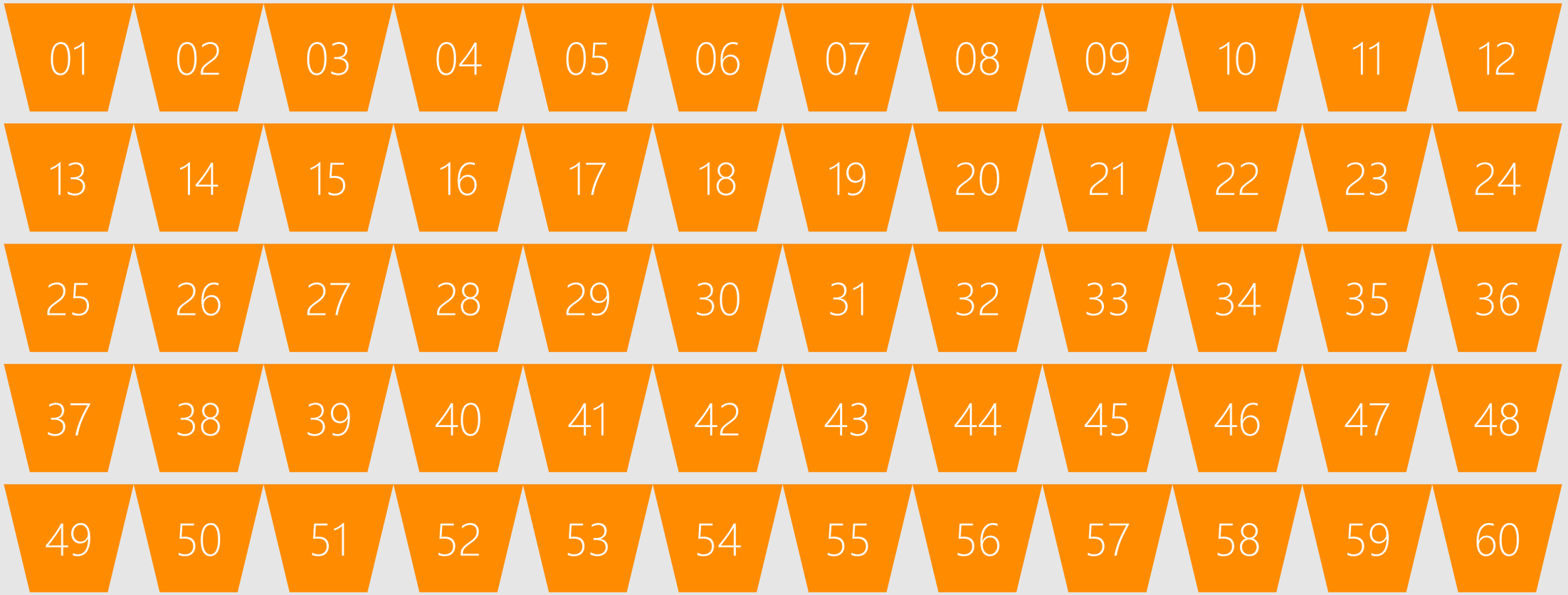
Changing Service Level Objectives (SLO)

```
Set-AzureRmSqlDatabase
        -DatabaseName “Database"
        -ServerName “Server"
        -RequestedServiceObjectiveName "DW1000"
```

PowerShell

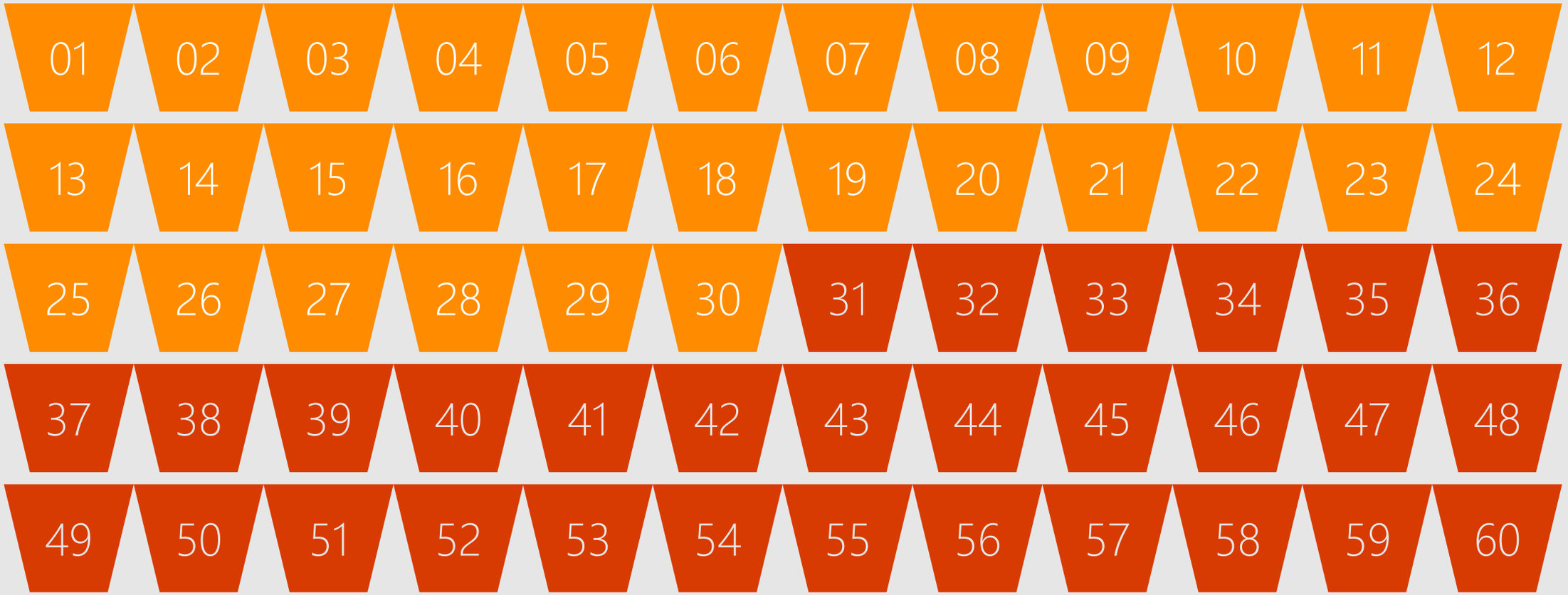
Mapping Compute in SQLDW

DW100



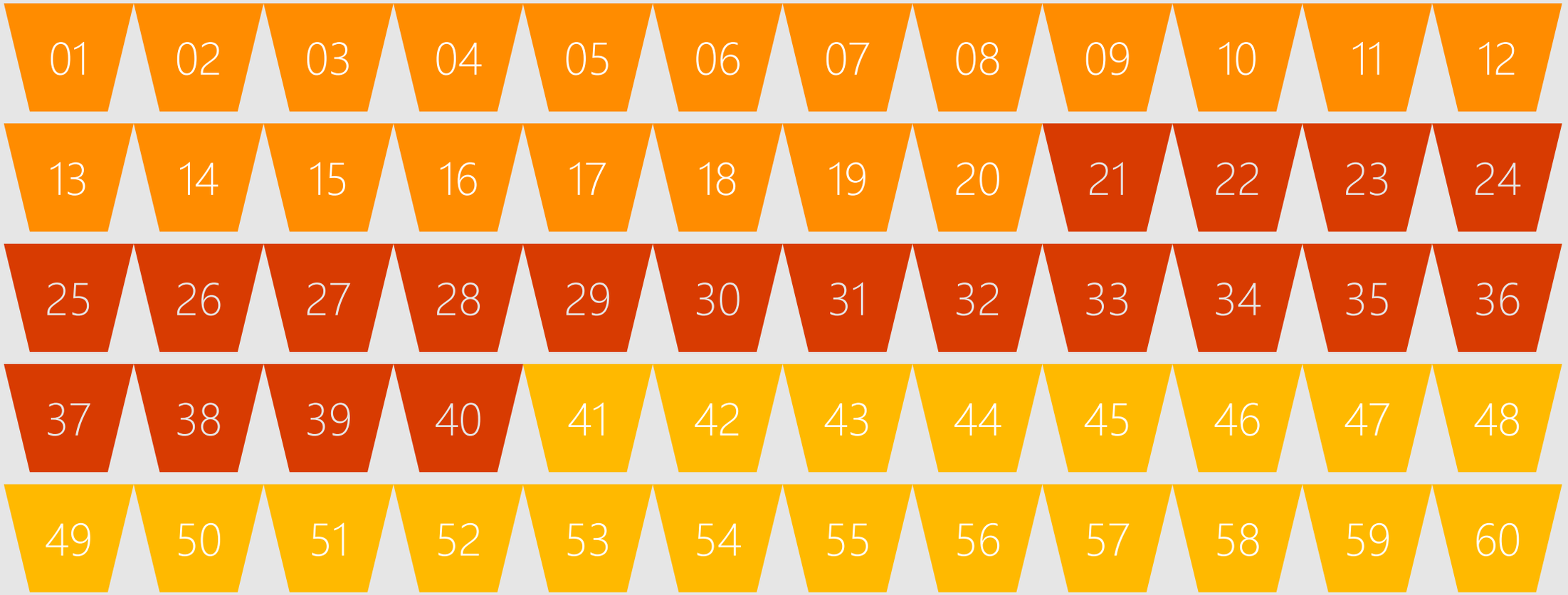
Mapping Compute in SQLDW

DW200



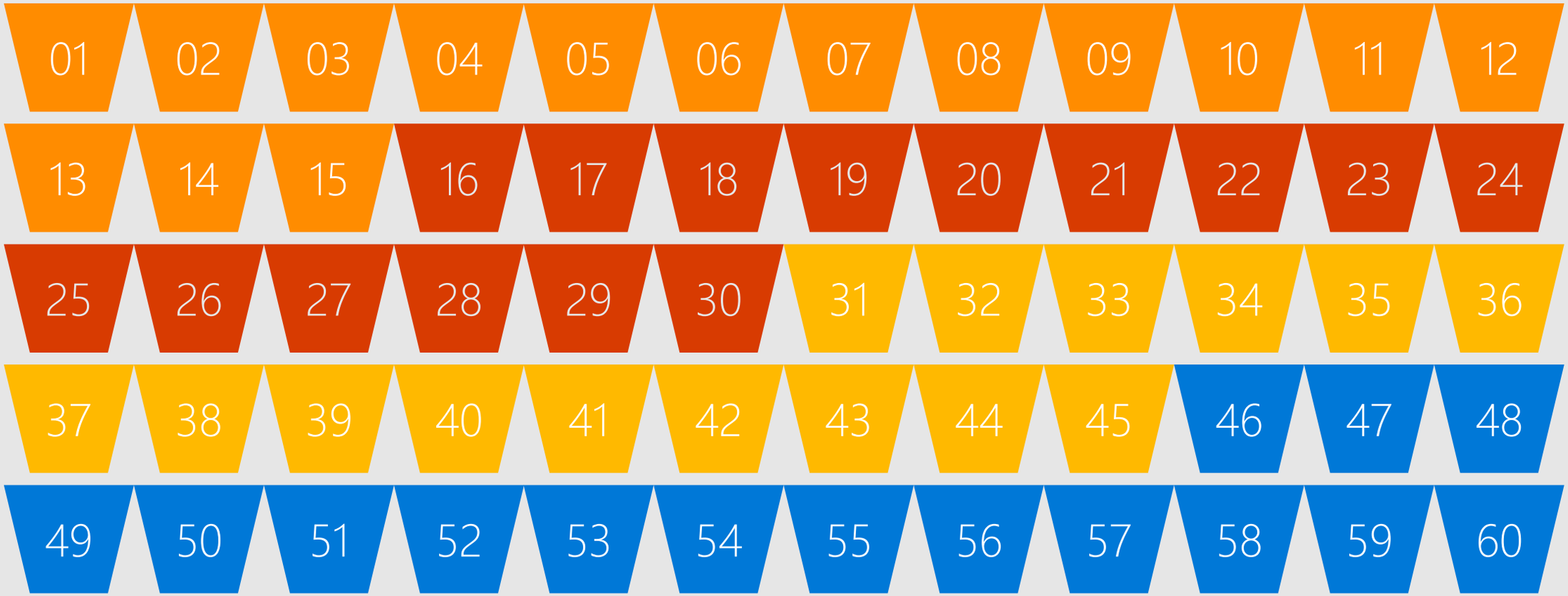
Mapping Compute in SQLDW

DW300



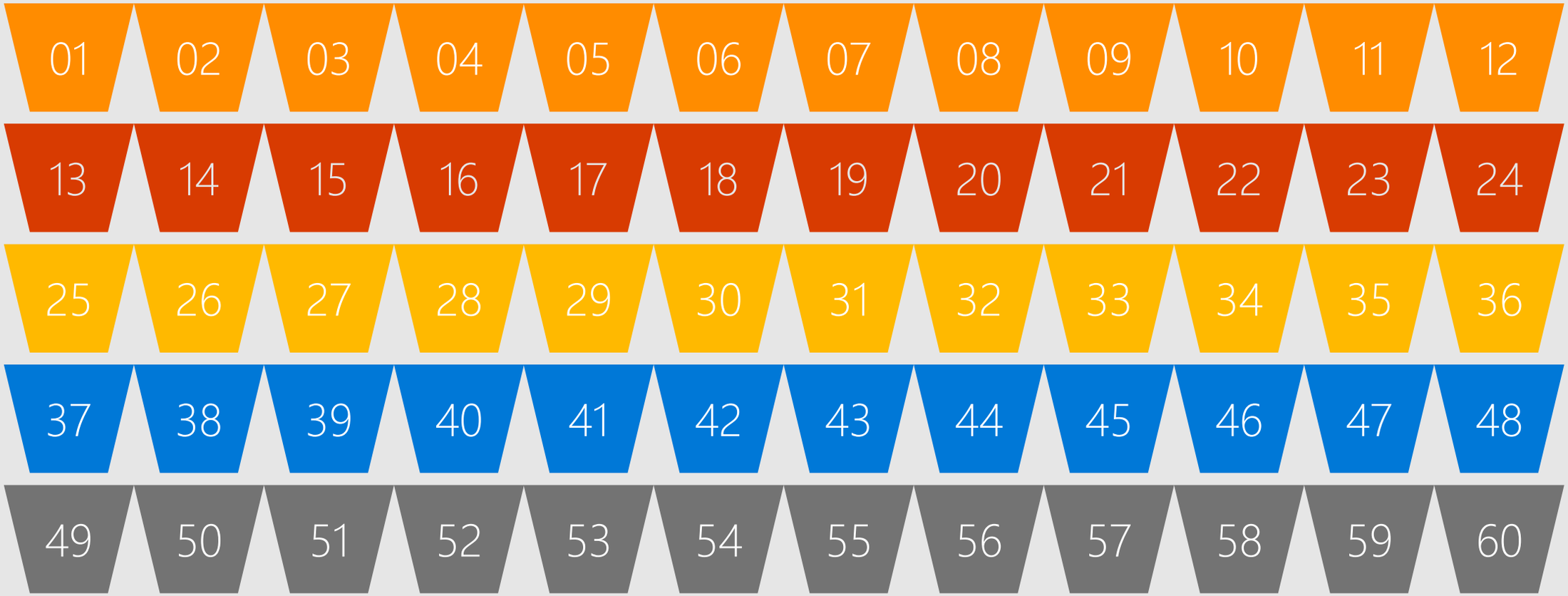
Mapping Compute in SQLDW

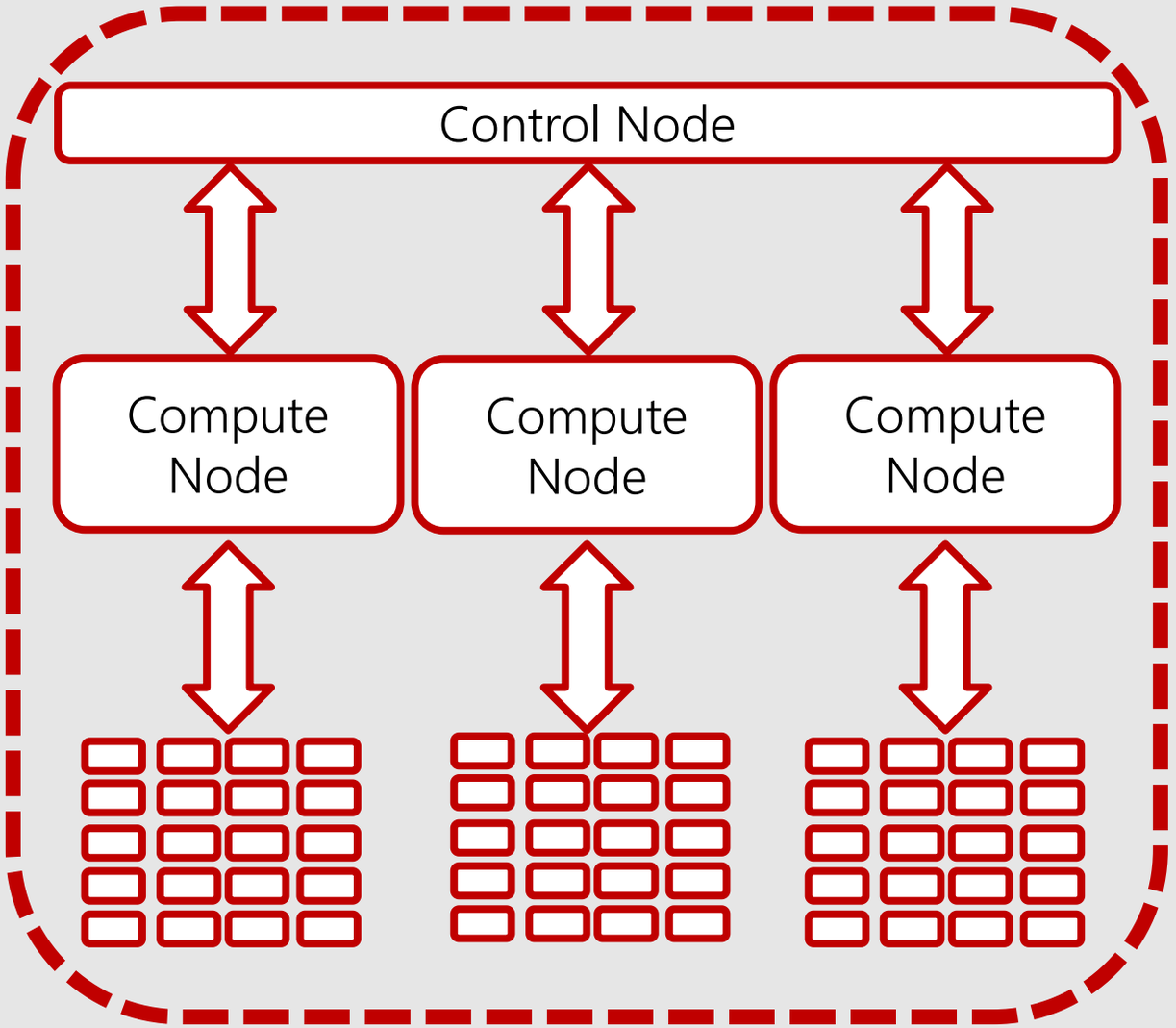
DW400



Mapping Compute in SQLDW

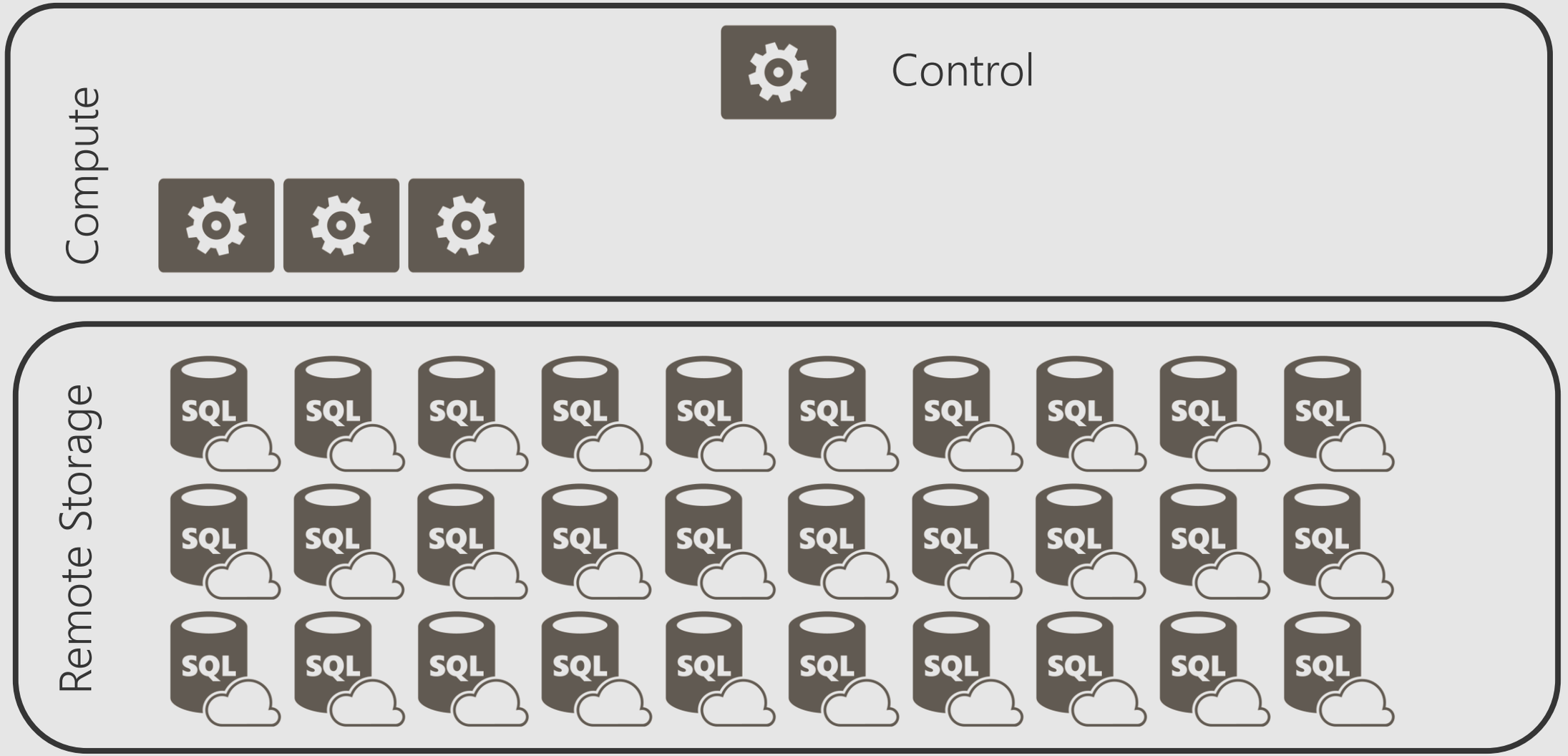
DW500





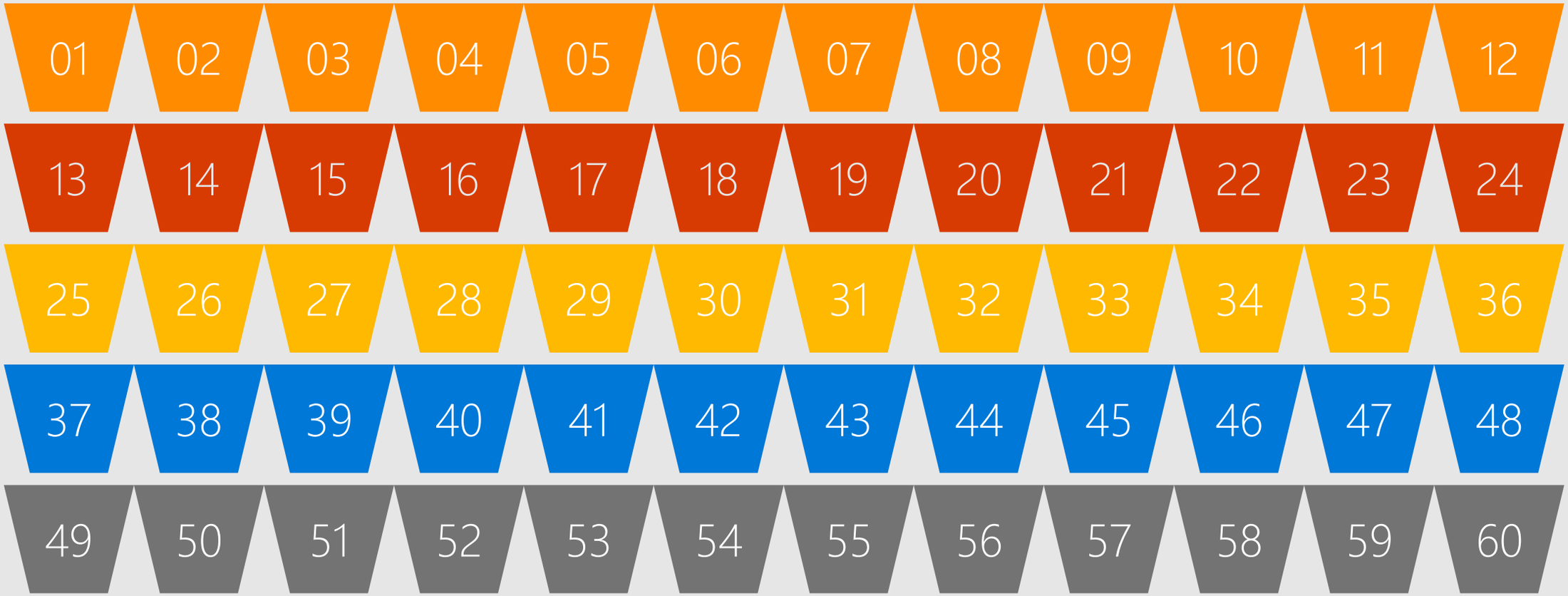
300 DWUs
As An MPP diagram

Pause and resume workload



Pausing compute in SQLDW

DW500



Pausing compute in SQLDW

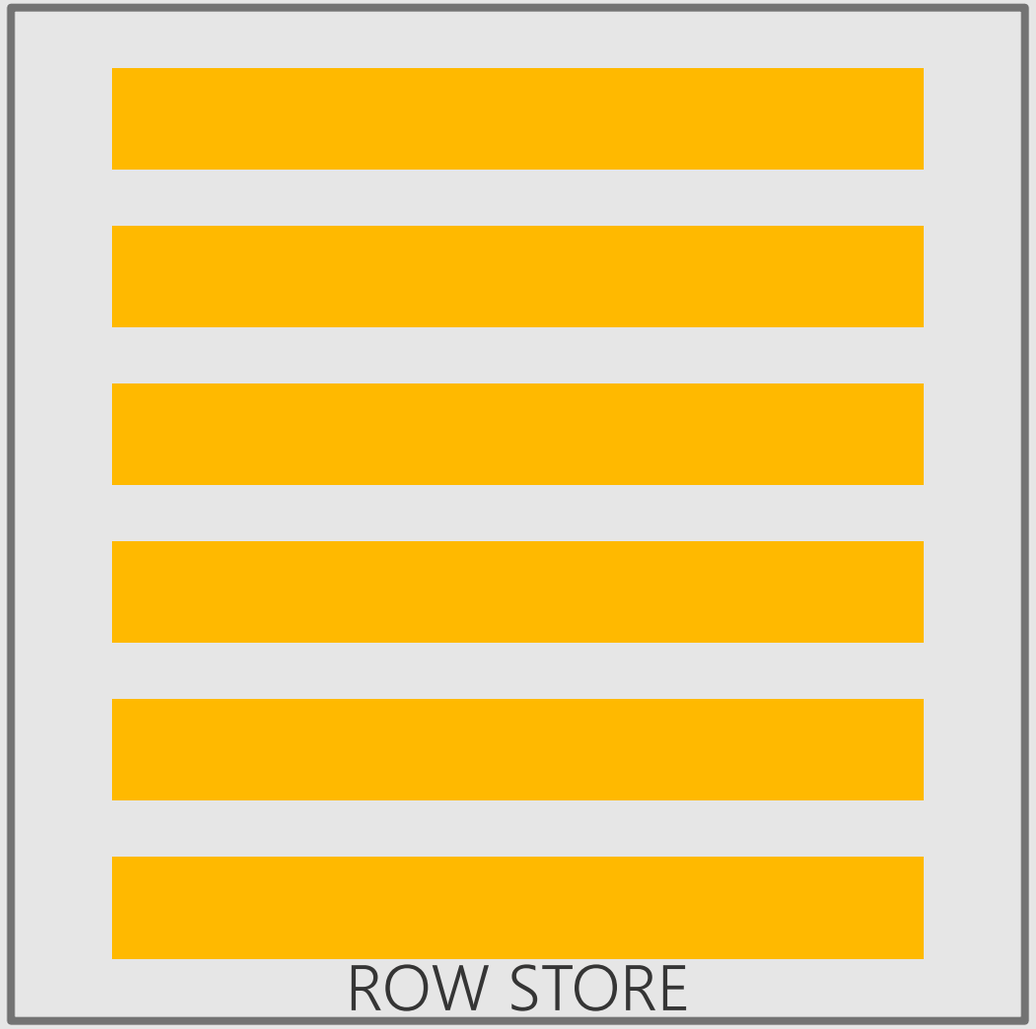
```
Suspend-AzureRmSqlDatabase
    –ResourceGroupName "ResourceGroup"
    –ServerName "Server"
    –DatabaseName "Database"
```

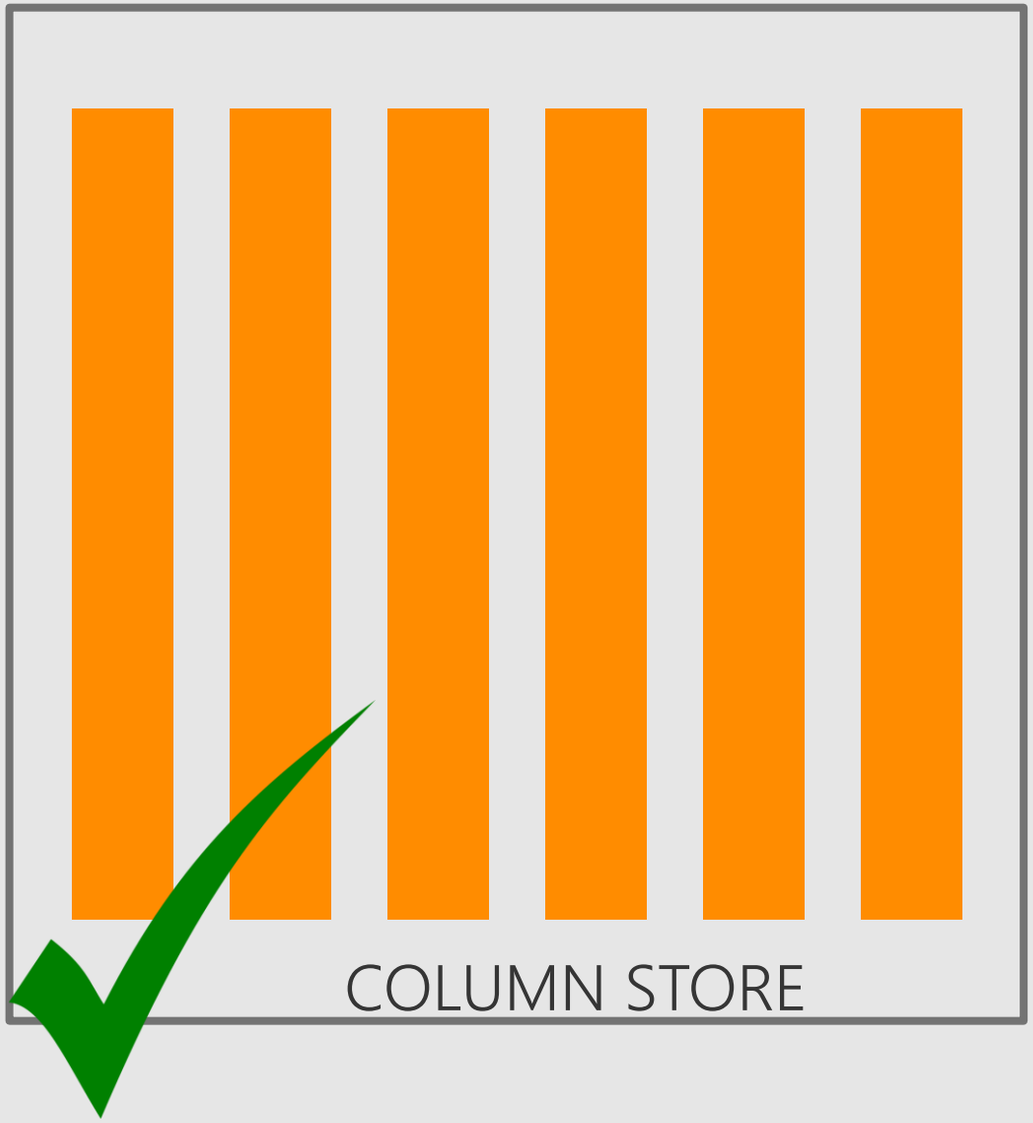
```
Resume-AzureRmSqlDatabase
    –ResourceGroupName "ResourceGroup"
    –ServerName "Server"
    –DatabaseName "Database"
```

PowerShell

Table Storage

Table Storage: Row store & Column store



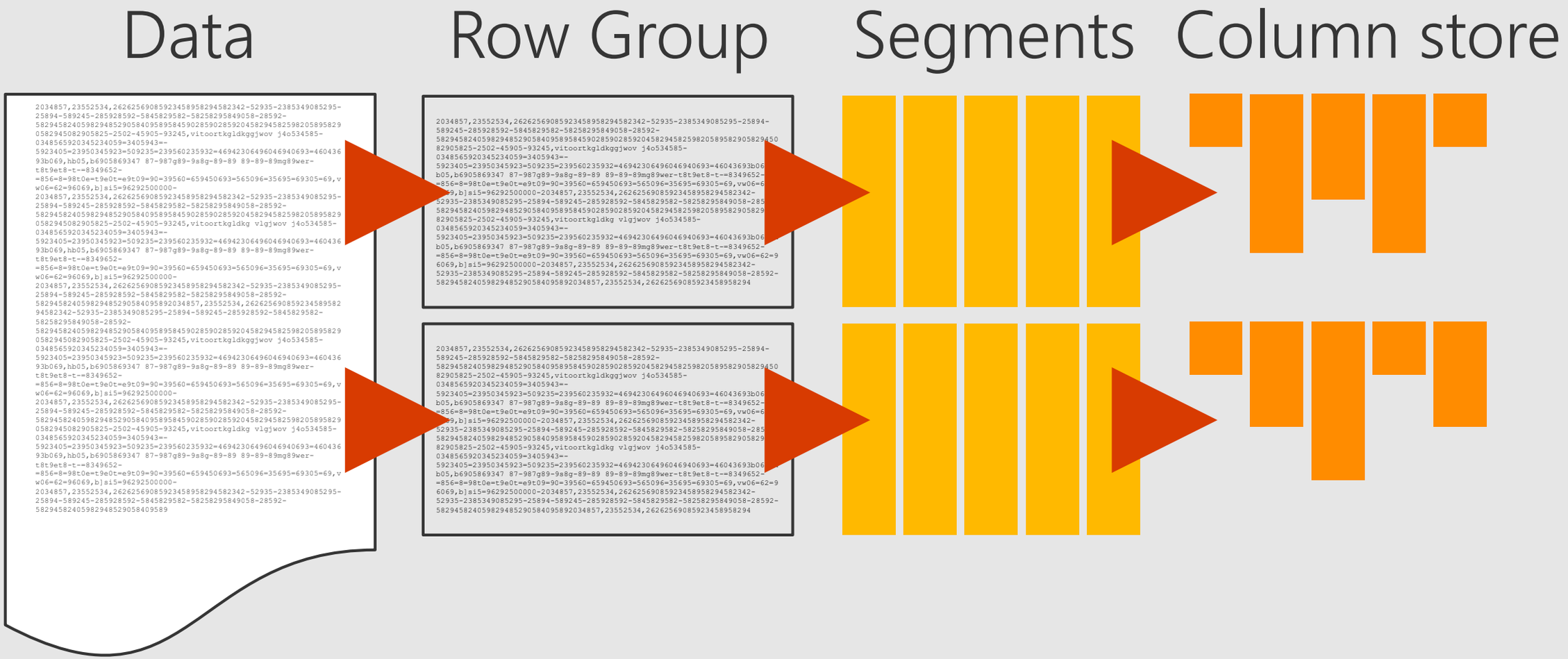


Scaling out: Impact of distributions on tables

ROW STORE

COLUMN STORE

Column store



Why does ColumnStore help?

Name	Species
Hedwig	Owl
Mrs. Norris	Cat
Crookshanks	Cat
Pigwidgeon	Owl
Nagini	Snake
Errol	Owl
Scabbers	Rat
Fawkes	Phoenix
Hermes	Owl
Fluffy	Dog

Name	Species
Mrs. Norris	Cat
Crookshanks	Cat
Fluffy	Dog
Hedwig	Owl
Pigwidgeon	Owl
Errol	Owl
Hermes	Owl
Fawkes	Phoenix
Scabbers	Rat
Nagini	Snake

Name	Species
Mrs. Norris: 1	Cat: 2
Crookshanks: 1	Dog: 1
Fluffy: 1	Owl: 4
Hedwig: 1	Phoenix: 1
Pigwidgeon: 1	Rat: 1
Errol: 1	Snake: 1
Hermes: 1	
Fawkes: 1	
Scabbers: 1	
Nagini: 1	

Run Length Encoding

Indexes

Primary Indexing

Heap = Base Row Store

Clustered Index (CI) = Base Row Store maintained as a B-Tree

Clustered Columnstore Index (CCI) = Base Column Store

Secondary Indexing

Non Clustered Index (NCI) = Secondary B-Tree Index

NCI can be on Heap

NCI can be on Clustered Columnstore Index (NCI on CCI)

Business Continuity and Disaster Recovery

Storage Snapshots

System RPO

8 hours

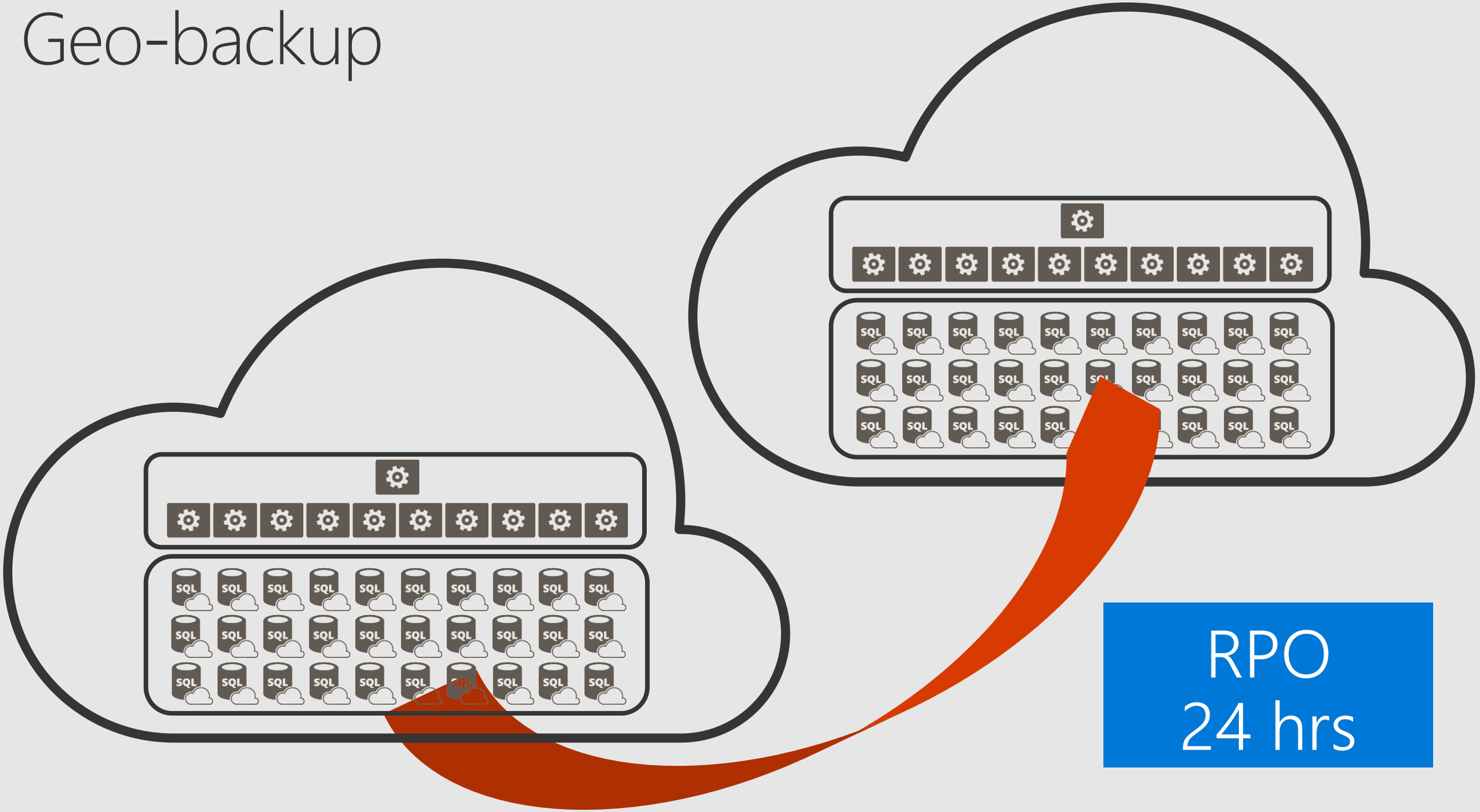
Snapshot frequency

Every few hours (generally 4)

Snapshot retention

7 days

Geo-backup



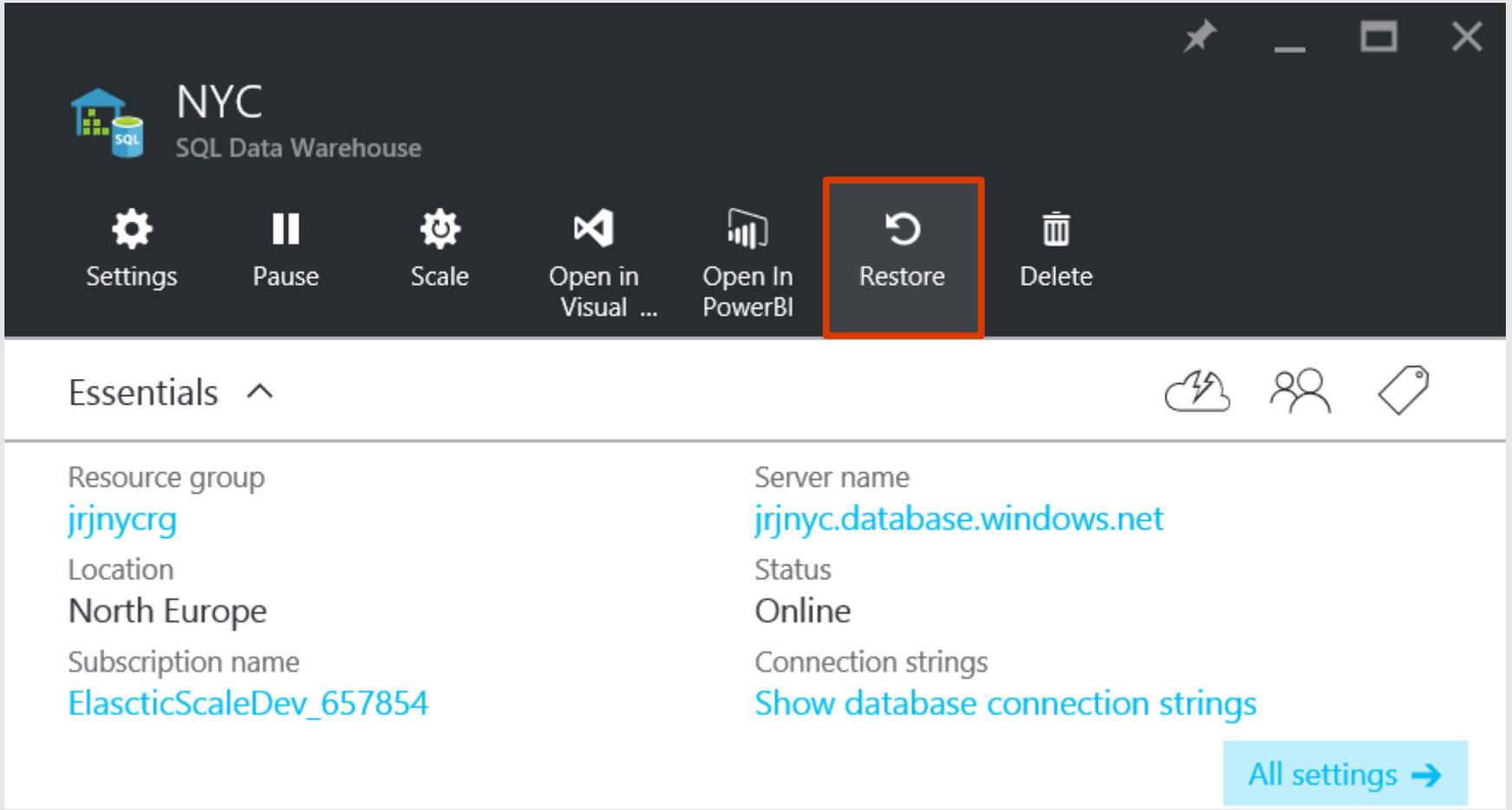
Restore

Same server overwrite (fastest)

In-region

Geo restore

Restoring in the Portal



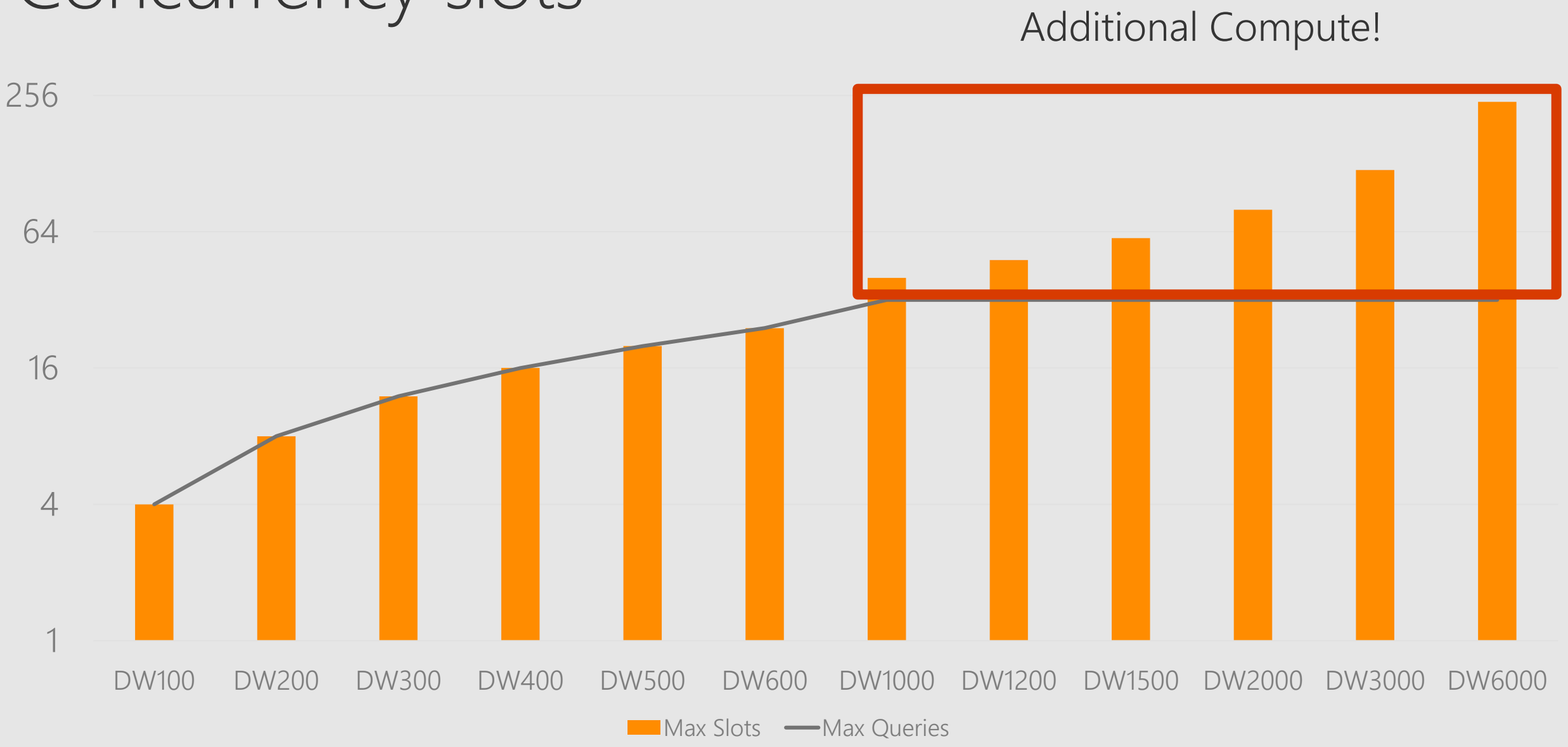
Snapshots

```
SELECT  [run_id]                        AS bkup_run_id
,       [session_id]                    AS session_id
,       [request_id]                    AS request_id
,       [name]                          AS bkup_name
,       [submit_time]                   AS bkup_submit_time
,       [start_time]                    AS bkup_start_time
,       [end_time]                      AS bkup_end_time
,       [total_elapsed_time]            AS bkup_duration_ms
,       [total_elapsed_time]/1000.0 AS bkup_duration_sec
FROM    sys.pdw_loader_backup_runs
;
```

Workload Management

Concurrent queries

Concurrency slots



Resource classes

Dynamic

- Increases resource consumption as you scale
- No increase in concurrency as you scale

Static

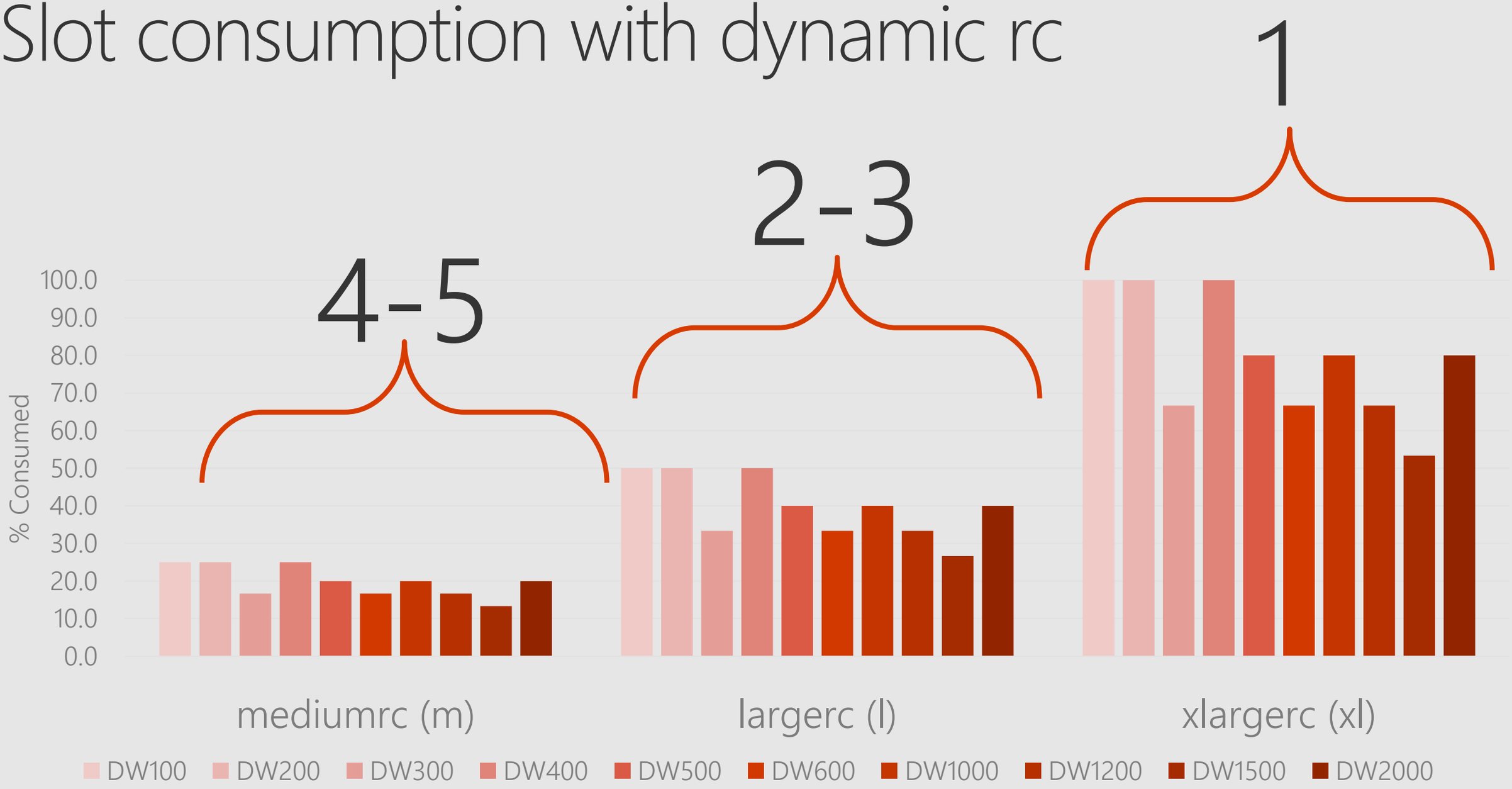
- Maintain resource consumption as you scale
- Increase concurrent queries as you scale

Consume Slots	Increase memory Isolate resources

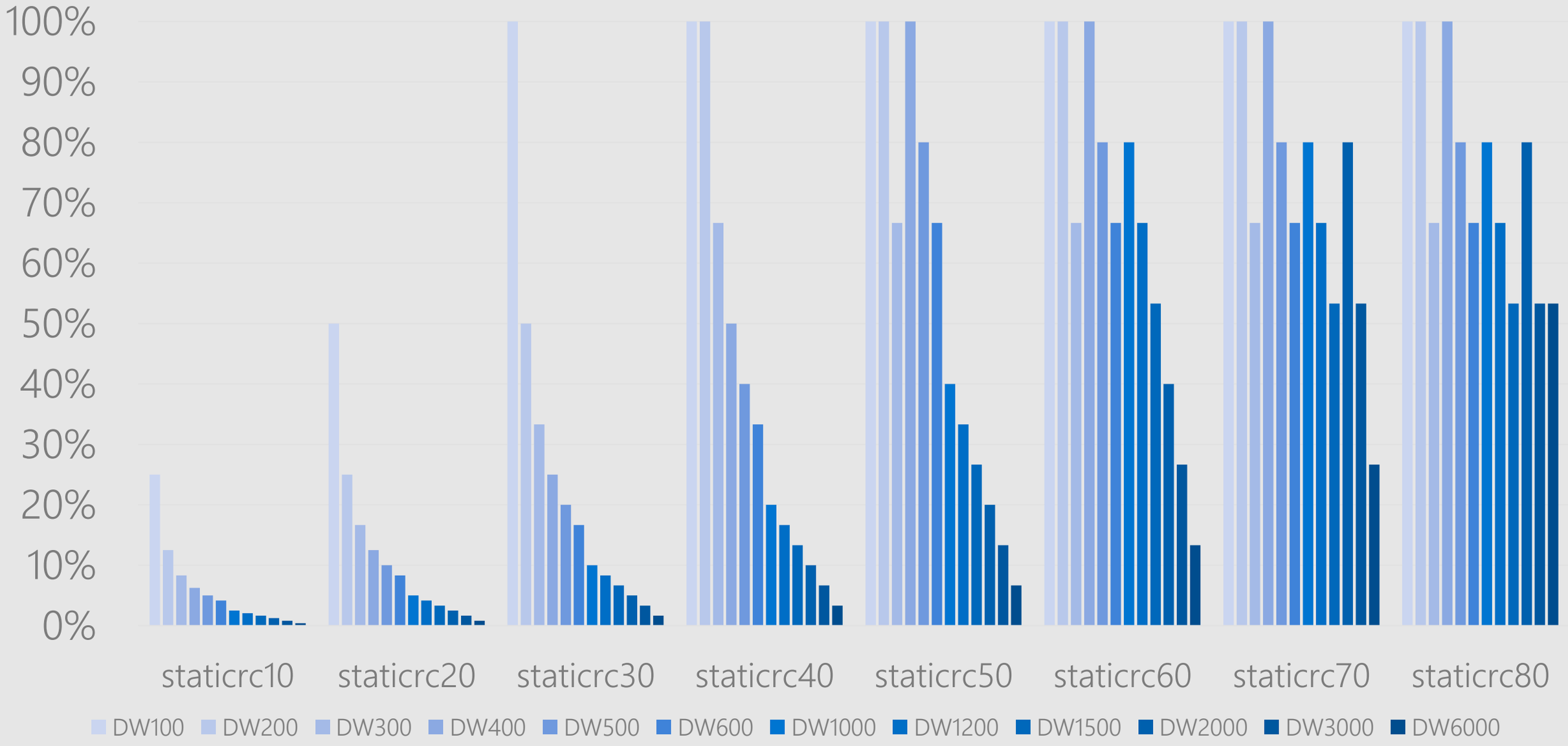
Resource classes

```
-- Pre-req
CREATE USER data_loader FOR LOGIN data_loader
;
-- Add user to static rc
EXEC sp_addrolemember 'staticrc40','data_loader'
;
-- Remove user from static rc
EXEC sp_droprolemember 'staticrc40','data_loader'
;
```

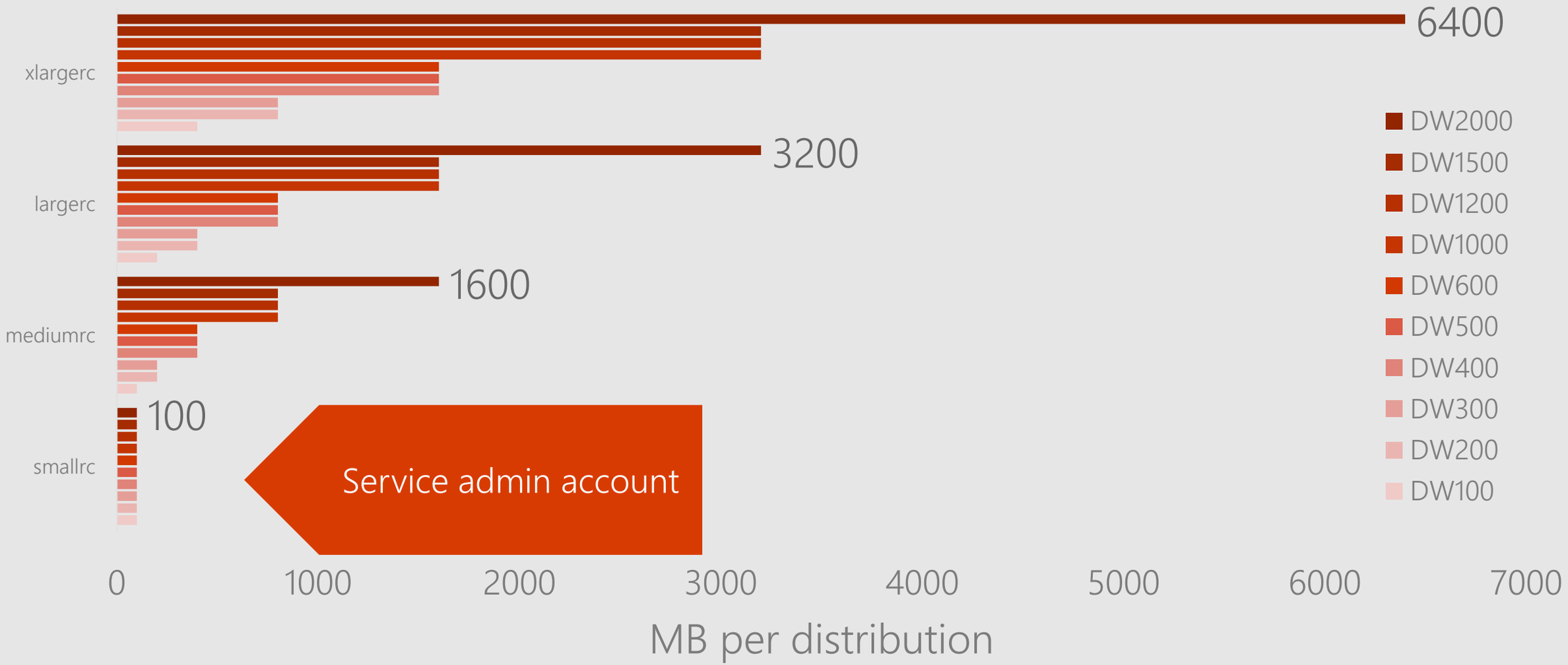
Slot consumption with dynamic rc



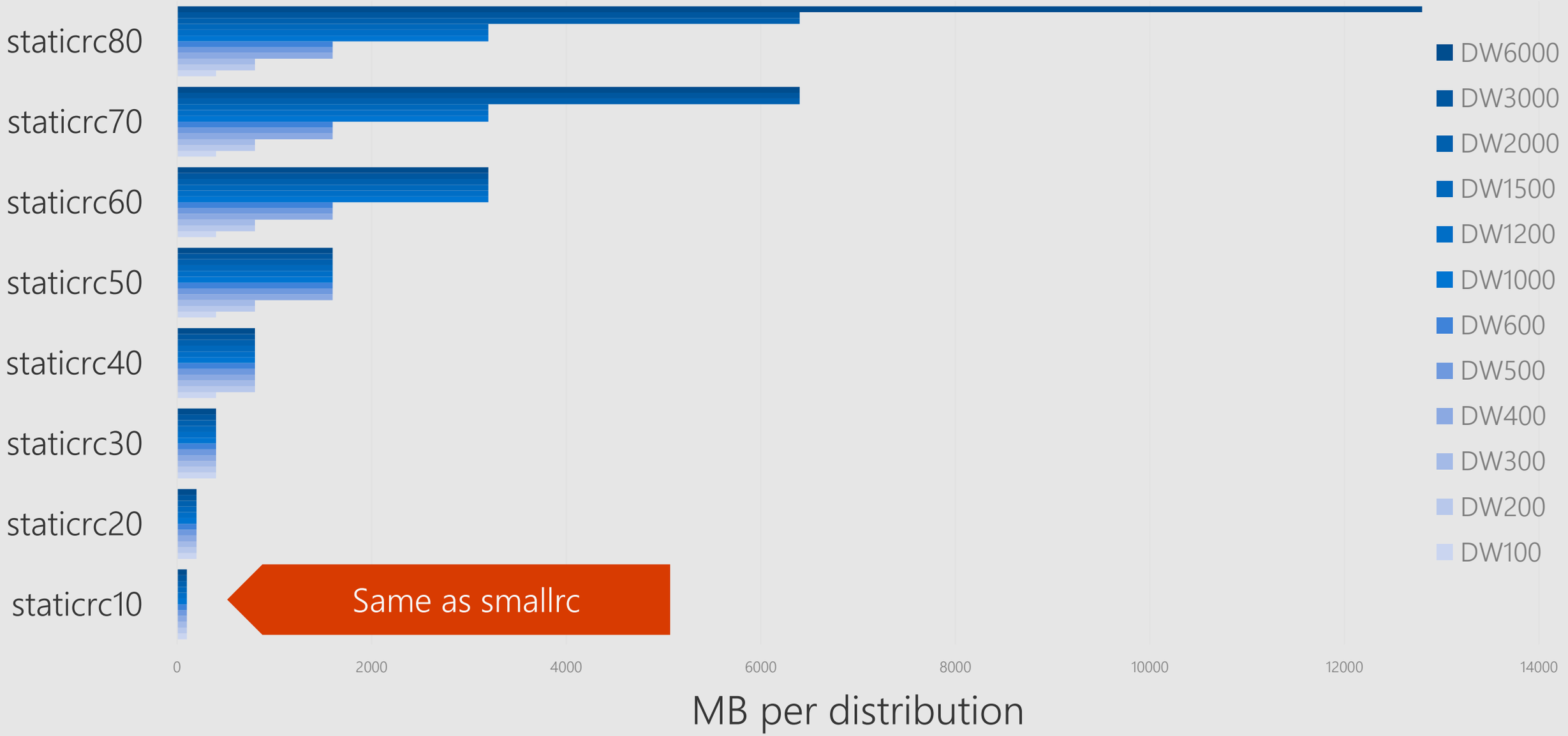
Slot consumption with static rc



Memory Allocation for dynamic rc



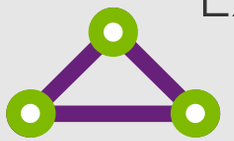
Memory allocation for staticrc



Integration with other services

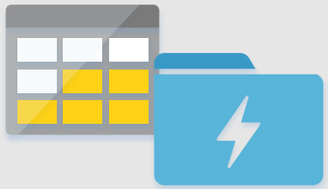
Common Integration points

Data Factory



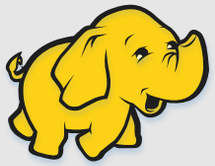
ExpressRoute

Azure Active Directory



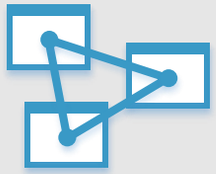
Blob / ADLS

SQLDB



HDInsight

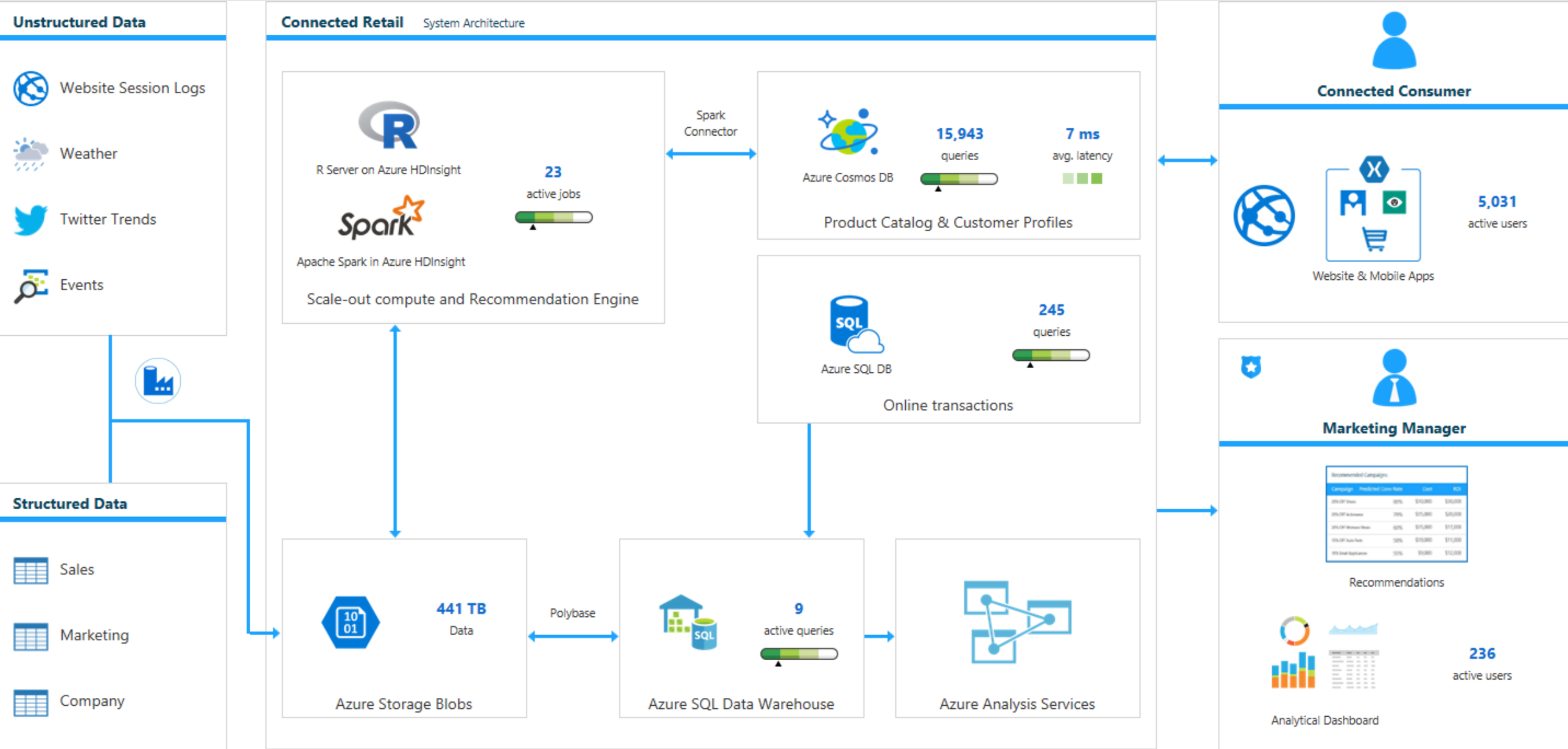
ADLA



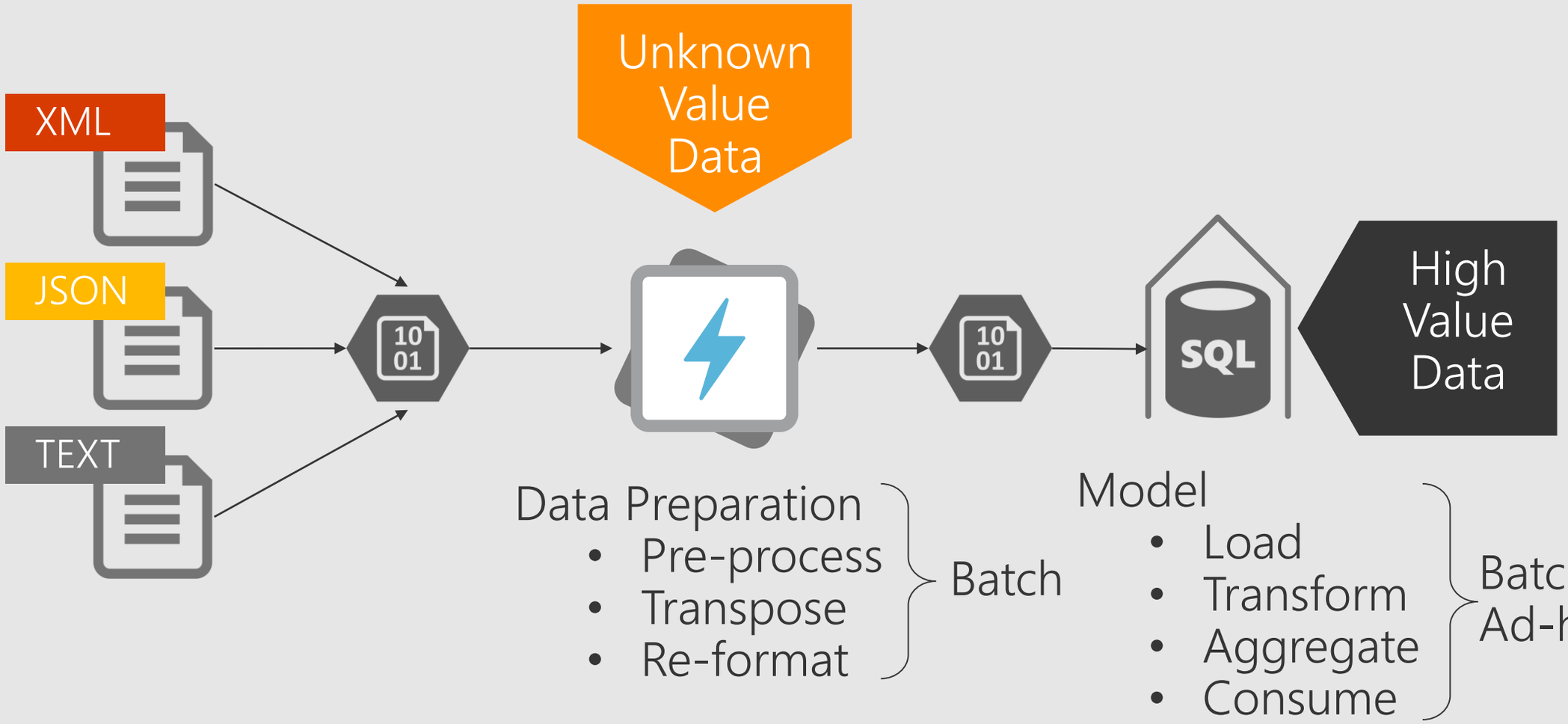
Analysis Services

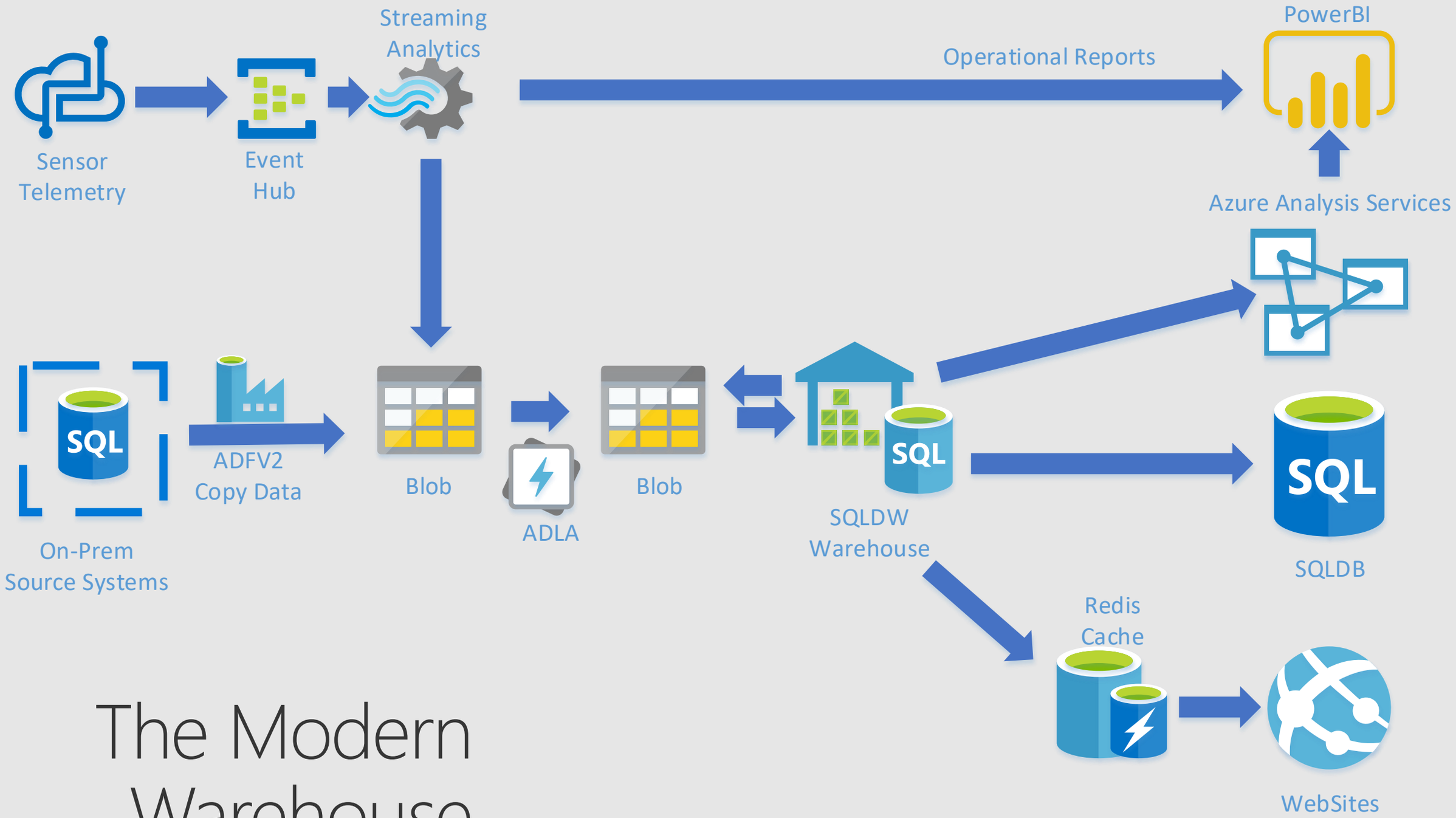
PowerBI

Cloud Data Warehouse



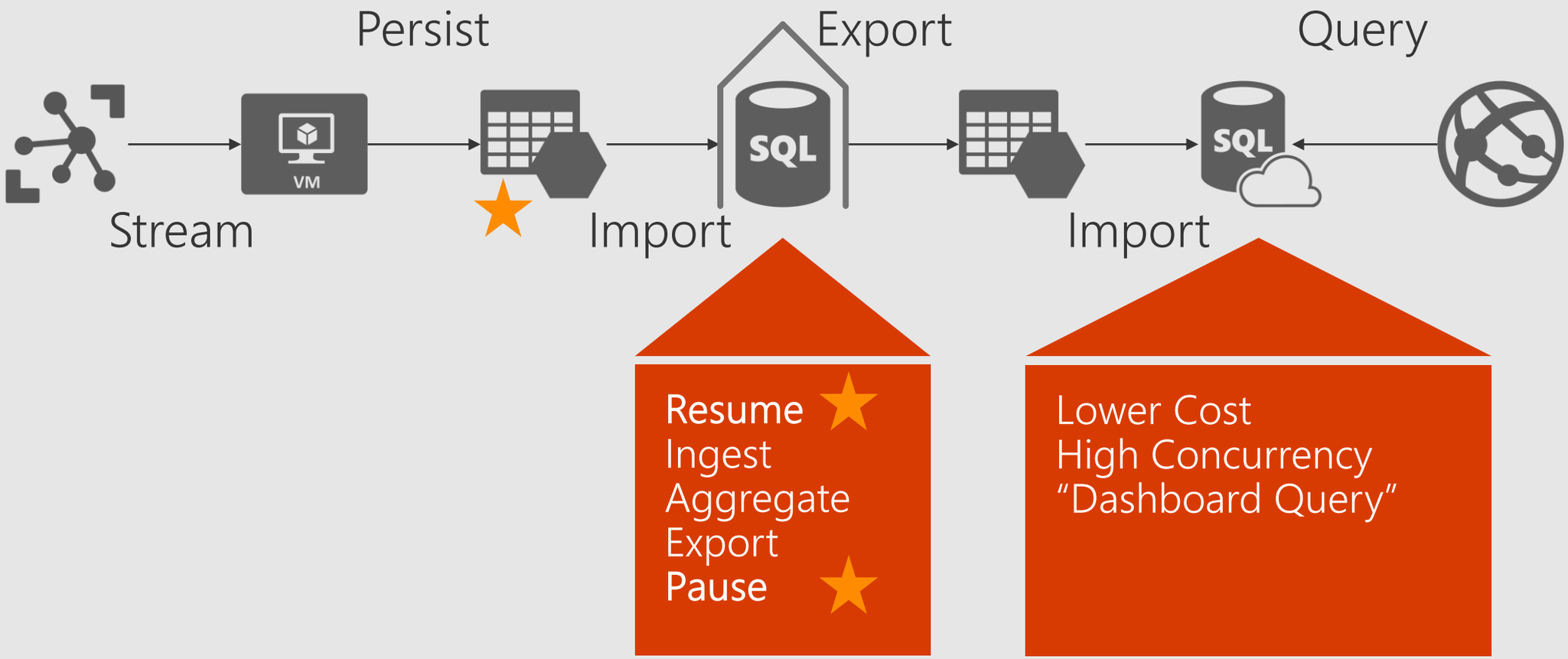
ADL & SQLDW


Unknown
Value
Data
XML
JSON
TEXT
10
01
10
01
SQL
High
Value
Data
Data Preparation
• Pre-process
• Transpose
• Re-format
Batch
Model
• Load
• Transform
• Aggregate
• Consume
Batch
Ad-hoc

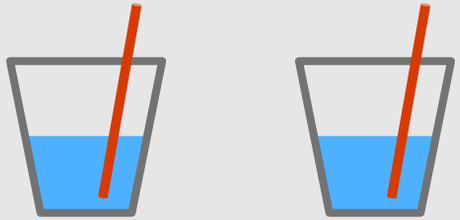


The Modern Warehouse

Cloud Economics



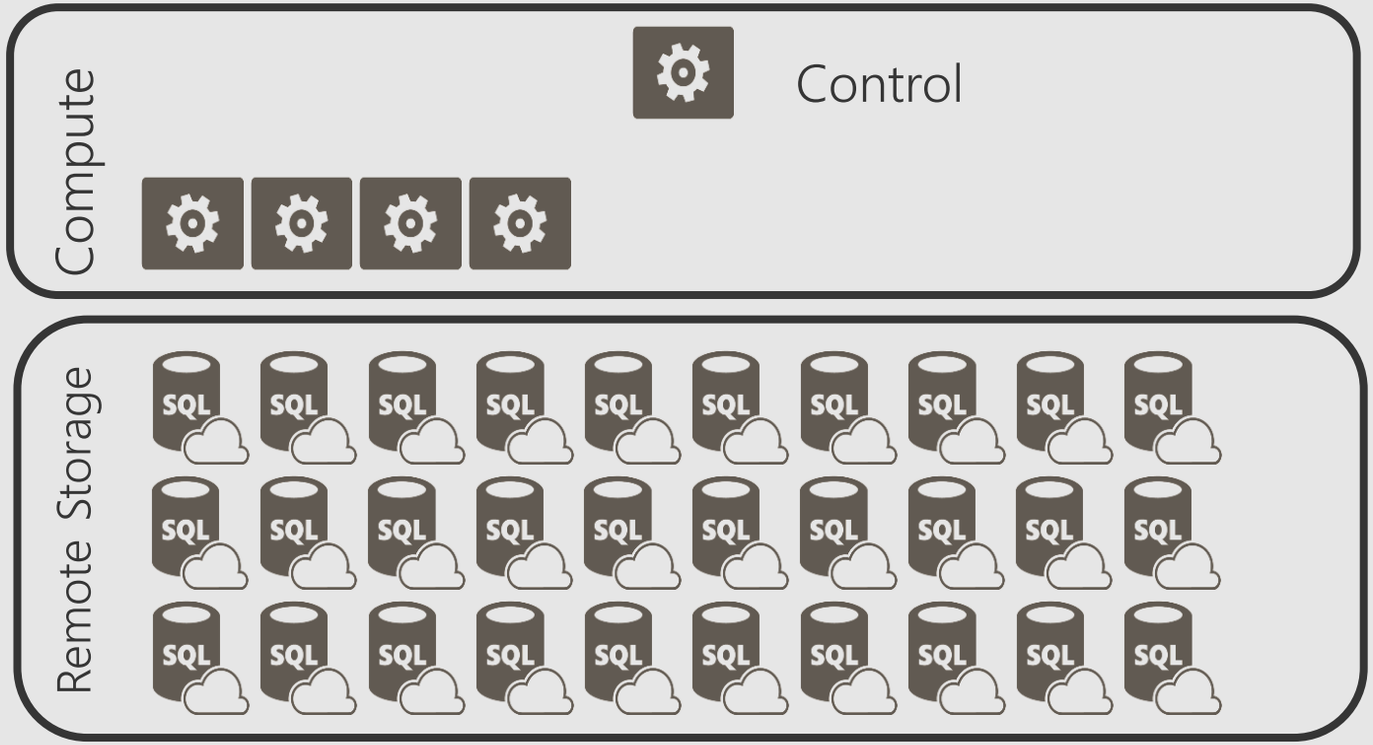
Summary



What did we learn?

Scale-out distributed query engine

Fully managed
Completely elastic
Platform as a Service (PaaS)



De-coupled storage from compute

MagicWorks

Will SQLDW Help?

- Distributed Scale-Out queries will speed up their analytics
- PetaByte scale storage can handle their growth
- Can elastically scale to handle unforeseen circumstances