Move part of your body to Azure SQL Data Warehouse

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altius


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What's next?

- Kalen Delaney on Monday - https://bit.ly/2lORt7F
- Pinal Dave, September 27 - https://bit.ly/2lORdW6
- Precon 2020, September 4 – with Brent Ozar
- SQL Saturday 2020, September 5

Kamil Nowiński

Microsoft Data Platform **MVP**

Speaker, blogger, data enthusiast

Principal Microsoft Consultant at Altius (www.altiusdata.com)

15+ yrs experience as DEV/BI/(DBA)

Member of the Data Community PL

Project member of „SCD Merge Wizard”

Founder of blog SQLPlayer (www.SQLplayer.net)

SQL Server Certificates:

MCITP, MCP, MCTS, MCSA, MCSE Data Platform,

MCSE Data Management & Analytics

Moreover: Bicycle, Running, Digital photography

@NowinskiK, @SQLPlayer

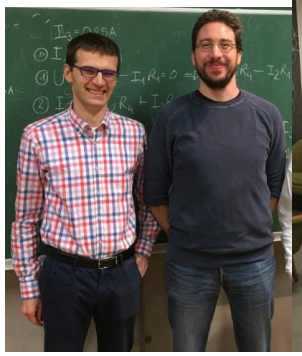
Blog & interviews

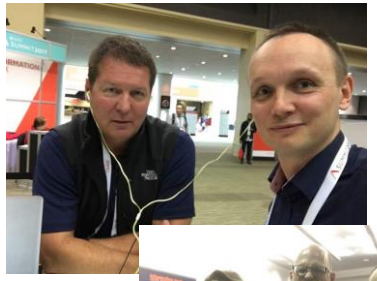
www.SQLPlayer.net

PODCAST – interviews with...

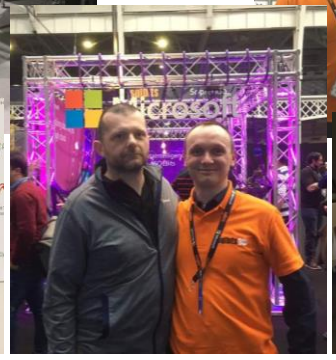

Scan me









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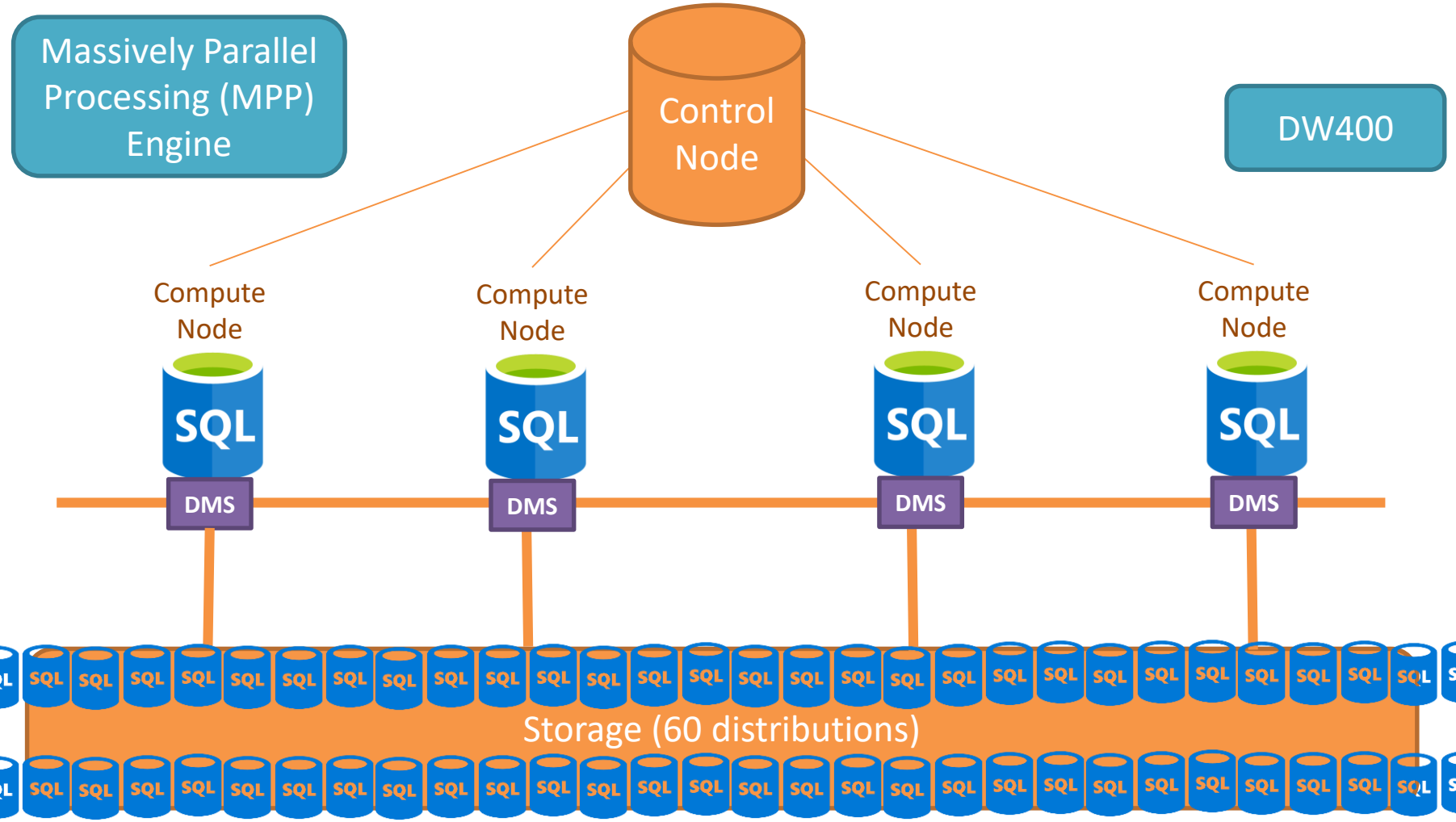
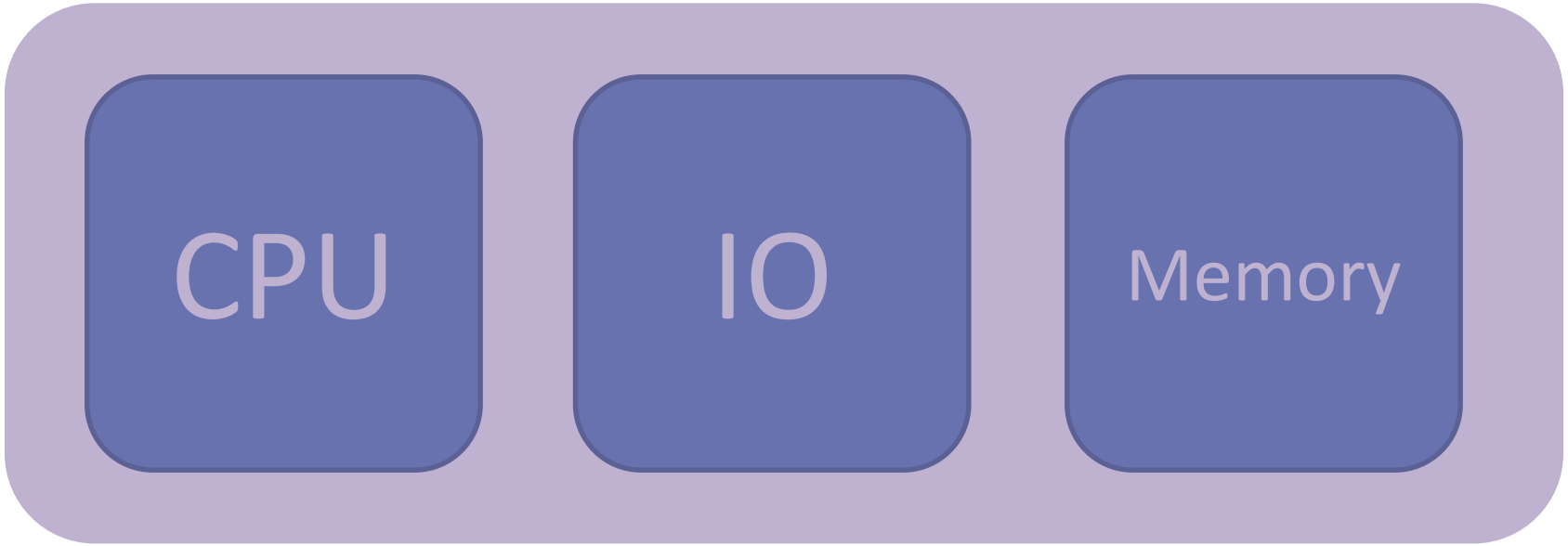
Azure SQL Data Warehouse Architecture



DWUs & cDWUs

- **DWU** – Data Warehouse Units
- **cDWU** – compute Data Warehouse Units
- Normalized amount of compute
- Converts to billing units i.e. what you pay



DWUs & cDWUs

	DWU (Gen1)	cDWU (Gen2)
The optimized for	**Elasticity** performance tier	**Compute** performance tier
Support scaling compute up/down	YES	YES
Disk-based cache	NO	YES

STORAGE

Table Distribution Options: ROUND ROBIN

PROS:

- Default distribution
- Data distributed evenly across nodes
- East to start

CONS:

- Will incur more data movement at query time

Table Distribution Options: ROUND ROBIN

1	Poland
2	Germany
8	UK
...	
66	Switzerland
70	Ireland

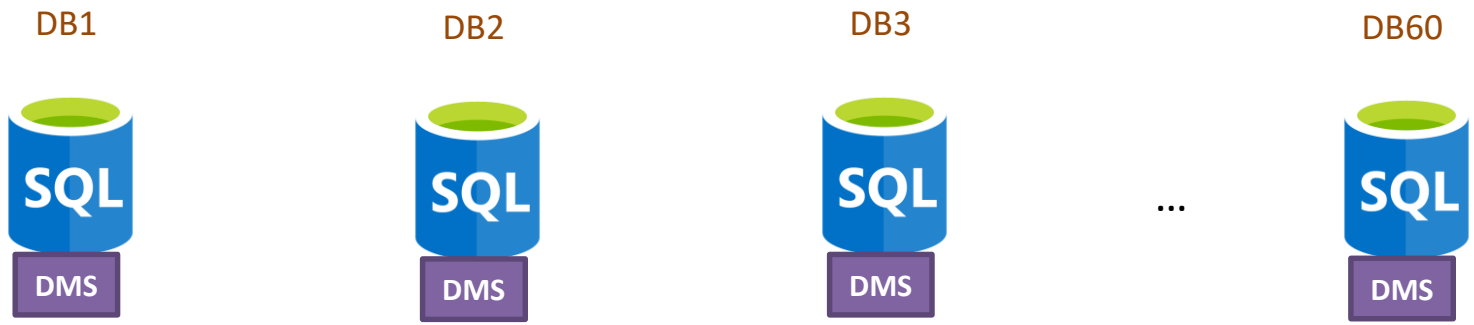


Table Distribution Options: HASH

PROS:

- Data divided across nodes based on hashing algorithm
- Same value produces the same hash value
- Single column only

CONS:

- Check for Data Skew, NULLs, -1, etc.

Table Distribution Options: HASH

1	Poland
2	Germany
8	UK
...	
66	Switzerland
70	Ireland

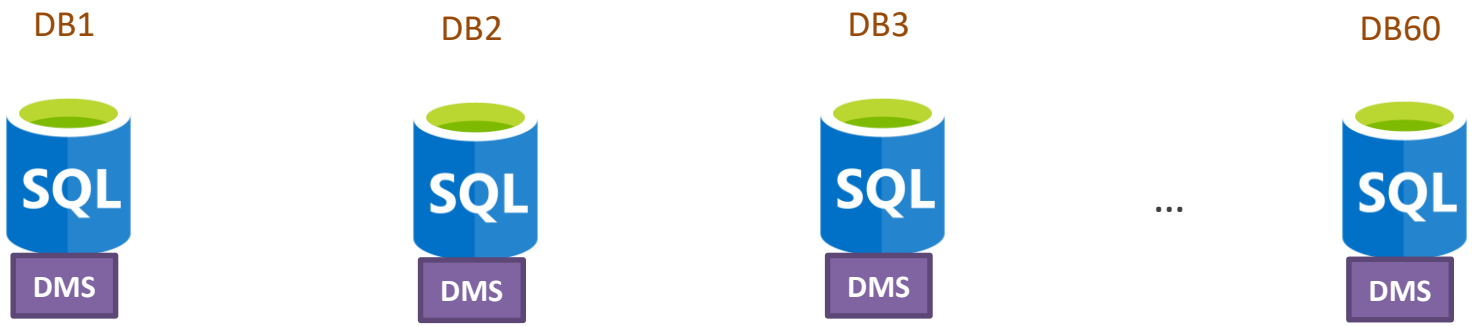


Table Distribution Options: REPLICATED

PROS:

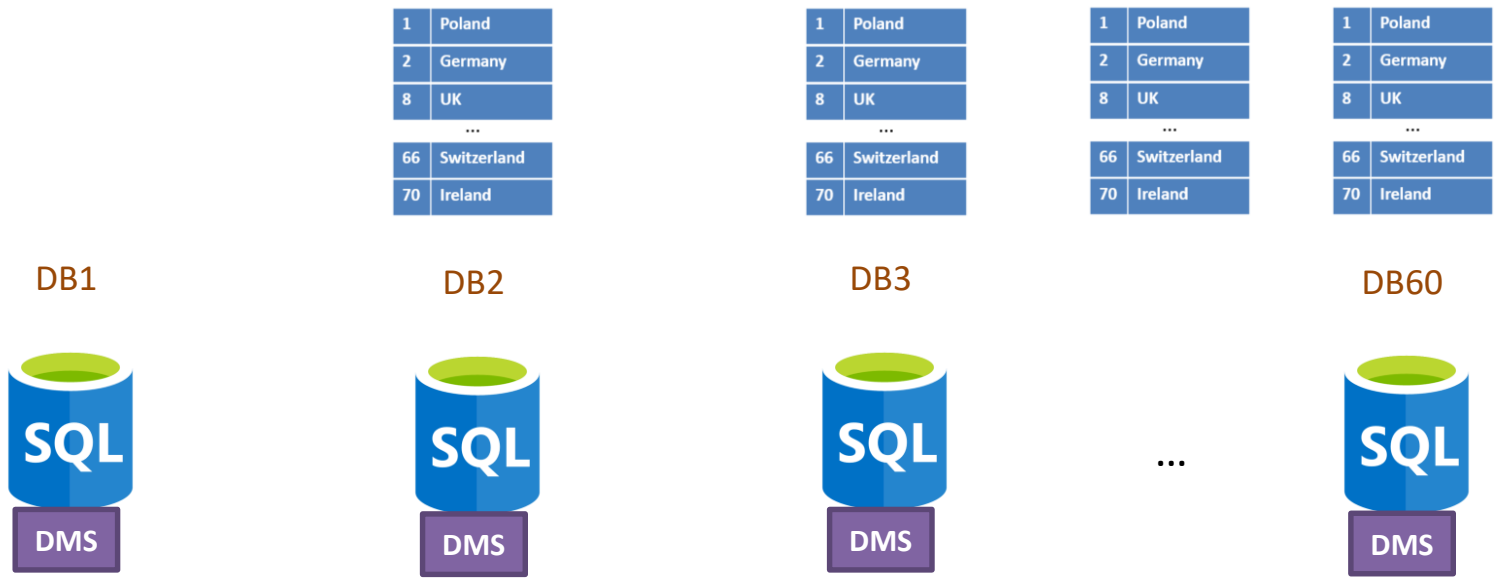
- Data repeated on every node
- Simplifies many query plans and reduces data movement
- Best with joining hash table

CONS:

- Consume more space
- Joining two replicated tables runs on one node

Table Distribution Options: REPLICATED

1	Poland
2	Germany
8	UK
...	
66	Switzerland
70	Ireland



Execution Plan – DMS Operations

DMS Operation	Description
ShuffleMoveOperation	Distribution → Hash algorithm → New distribution Changing the distribution column in preparation for join.
PartitionMoveOperation	Distribution → Control Node Aggregations - count(*) is count on nodes, sum of count
BroadcastMoveOperation	Distribution → Copy to all distributions Changes distributed table to replicated table for join.
TrimMoveOperation	Replicated table → Hash algorithm → Distribution When a replicated table needs to become distributed. Needed for outer joins.
MoveOperation	Control Node → Copy to all distributions Data moved from Control Node back to Compute Nodes resulting in a replicated table for further processing.
RoundRobinMoveOperation **HadoopRoundRobinMoveOperation**	Source → Round robin algorithm → Distribution Redistributes data to Round Robin Table.

Statistics

Statistics

- One or more columns of a table
- Indexed view
- External table

- Cost based Query Optimizer
- Candidate columns when used in:
  - JOIN
  - GROUP BY
  - WHERE
- Update statistics after incremental load
- Use multi-column statistics if needed

Important things

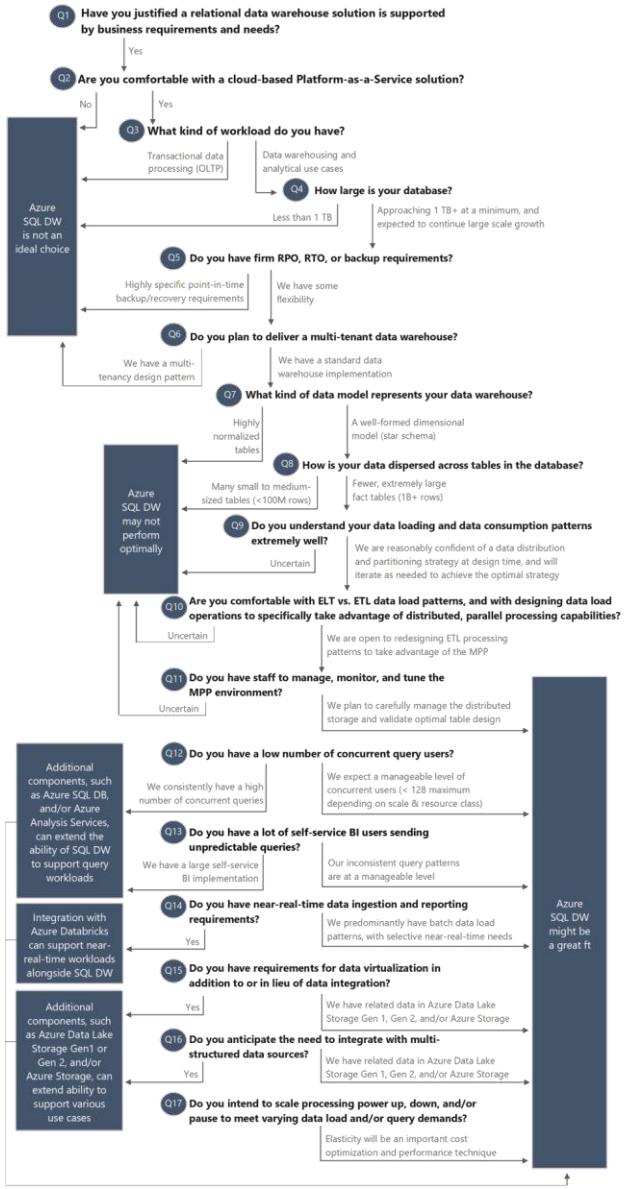
- SQL DW is based on an MPP architecture (not SMP)
  - The same engine under hood, but scale and concurrency are vary
- SIZE does really matter
- Individual table size and rowcount are important
- OLTP reporting type workloads are usually poor candidates
- Proper schema design – important in SQL Server
- Right schema desing – CRITICAL in SQL DW

Data Distribution

DEMO

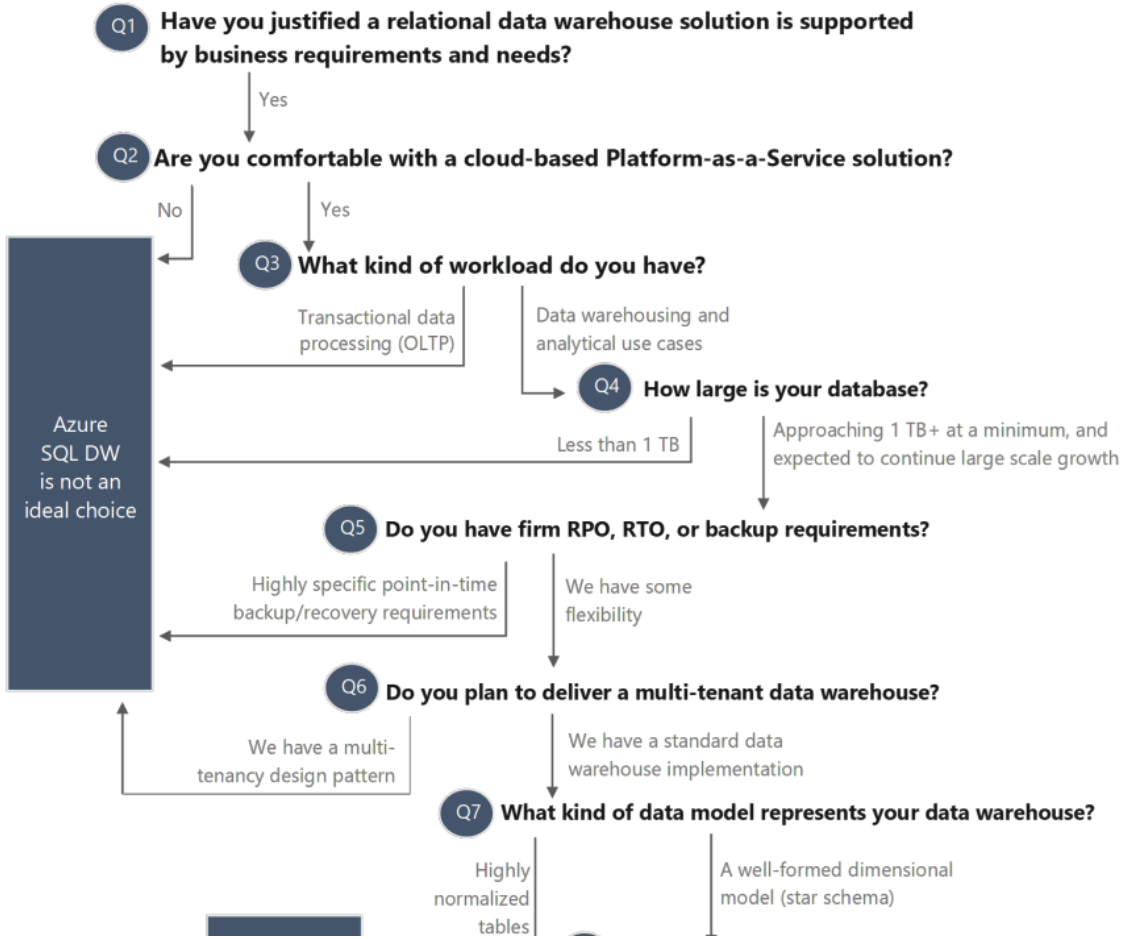
Is Azure SQL Data Warehouse a good fit?

- Verify your source in many aspects
- Do answer for many questions
- Use form from more experienced
- Questions' diagram
- Ask **Melissa Coates**

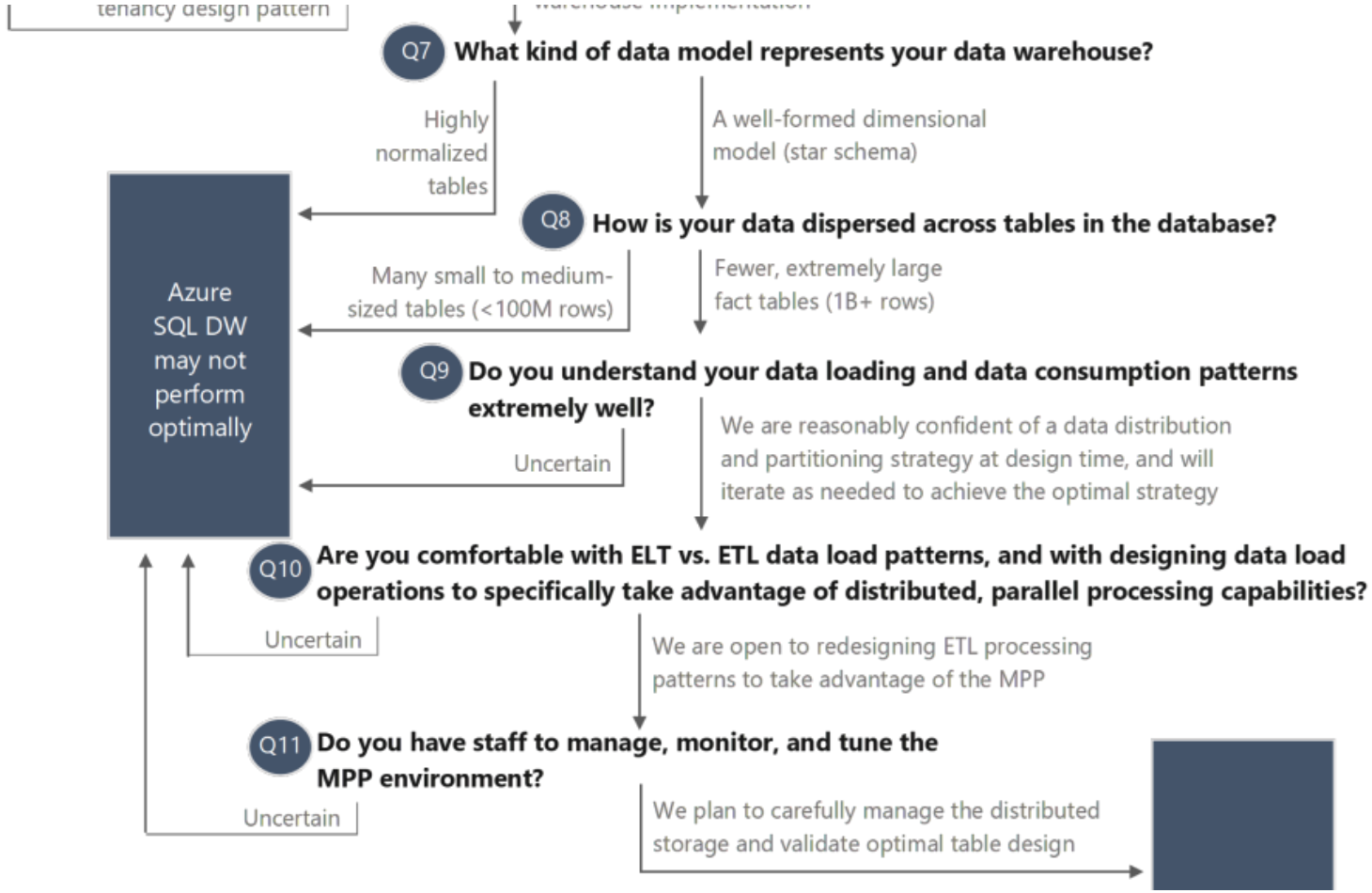


https://www.blue-granite.com/blog/is-azure-sql-data-warehouse-a-good-fit-updated

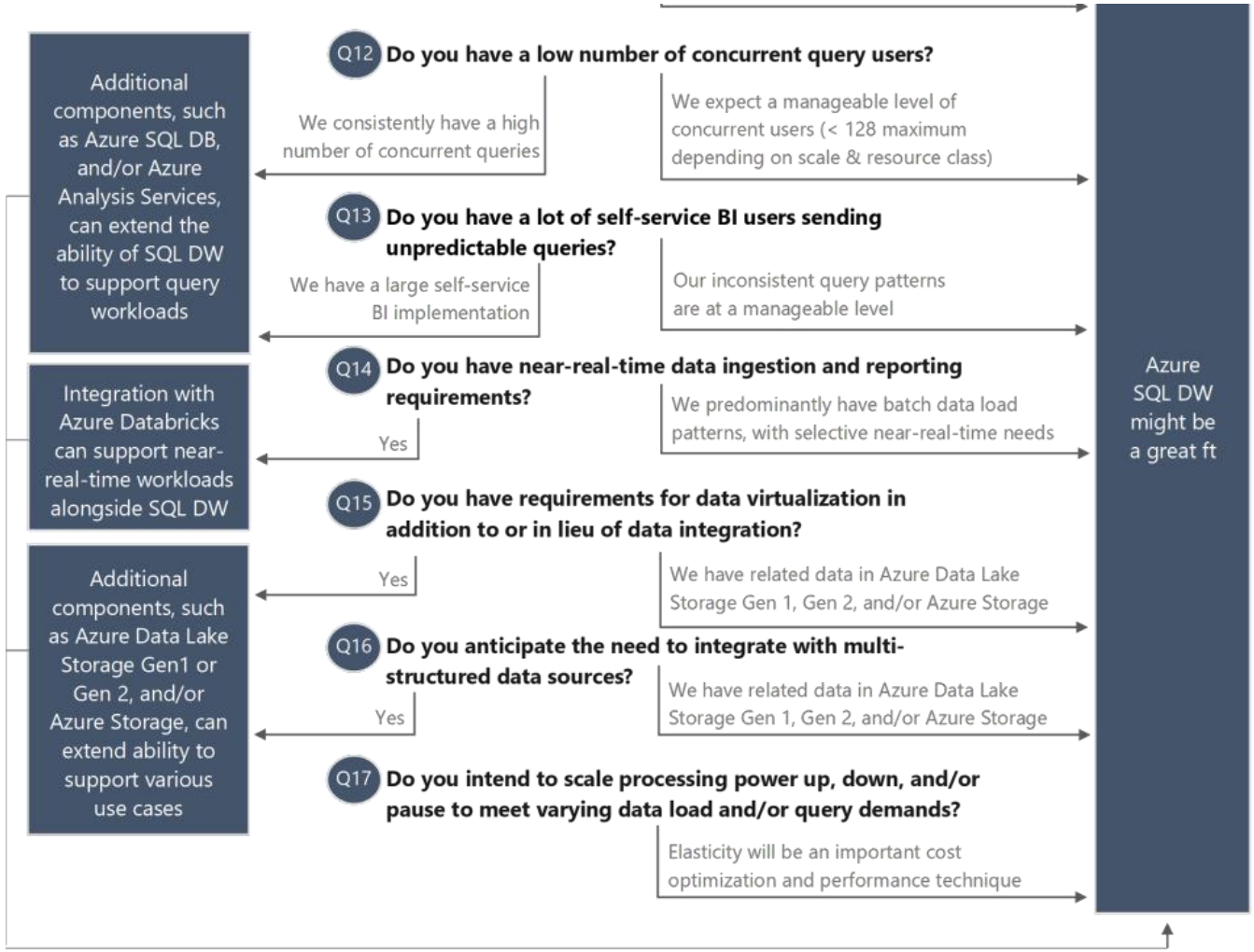
Is Azure SQL Data Warehouse a good fit? technology choice for your implementation?



Is Azure SQL Data Warehouse the best technology choice for your implementation?



Is Azure SQL Data Warehouse the best technology choice for your implementation?



Data Preparation

- Filter essential objects to migrate
- Create performant local storage to receive exported data
- Establish standard or dedicated connectivity to cloud
- Choose region nearest to you with Azure SQL DW
- PolyBase: One folder per table in storage container

Data Migration Recommendations

- Use Migration Tool
- Understand current T-SQL surface area and workarounds
- Avoid Singelton DML operations (INSERT, UPDATE, DELETE)
  - Batch DML if possible
  - If unavoidable, wrap in transaction (BEGIN TRAN ... COMMIT)
- Use heap table OR temp table for staging data
- Avoid large fully logged operations
  - Considers CTAS as this is minimal logged operation
  - Process by partition to leverage parallelism and partition switching
- Design retry logic to address service disruption

Data Migration Recommendations

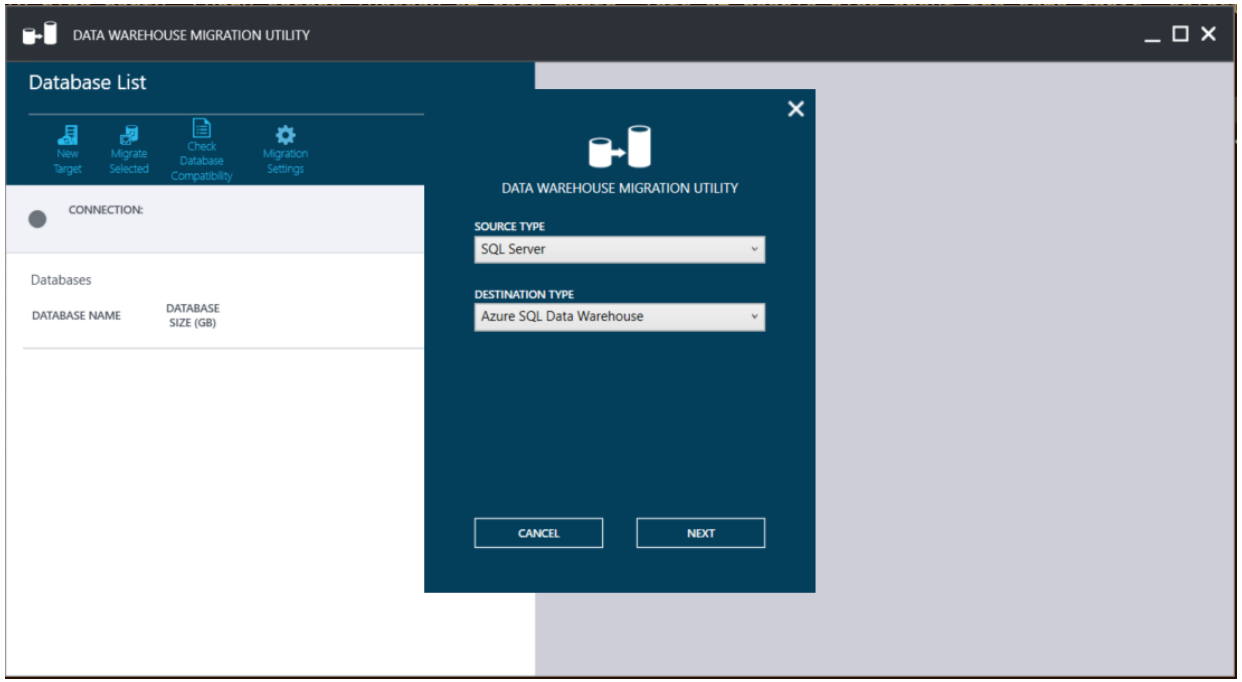
- Data Format Conversion
  - Data Format, Field delimiters, Escaping, Field order, encoding
- Compression
  - Use Gzip, ORC, parquet
- Export
  - BCP for fast export
  - Multiple files per large table, one folder per table
- Copy
  - AZCopy
  - Data Movement Library

Data Migration Tips

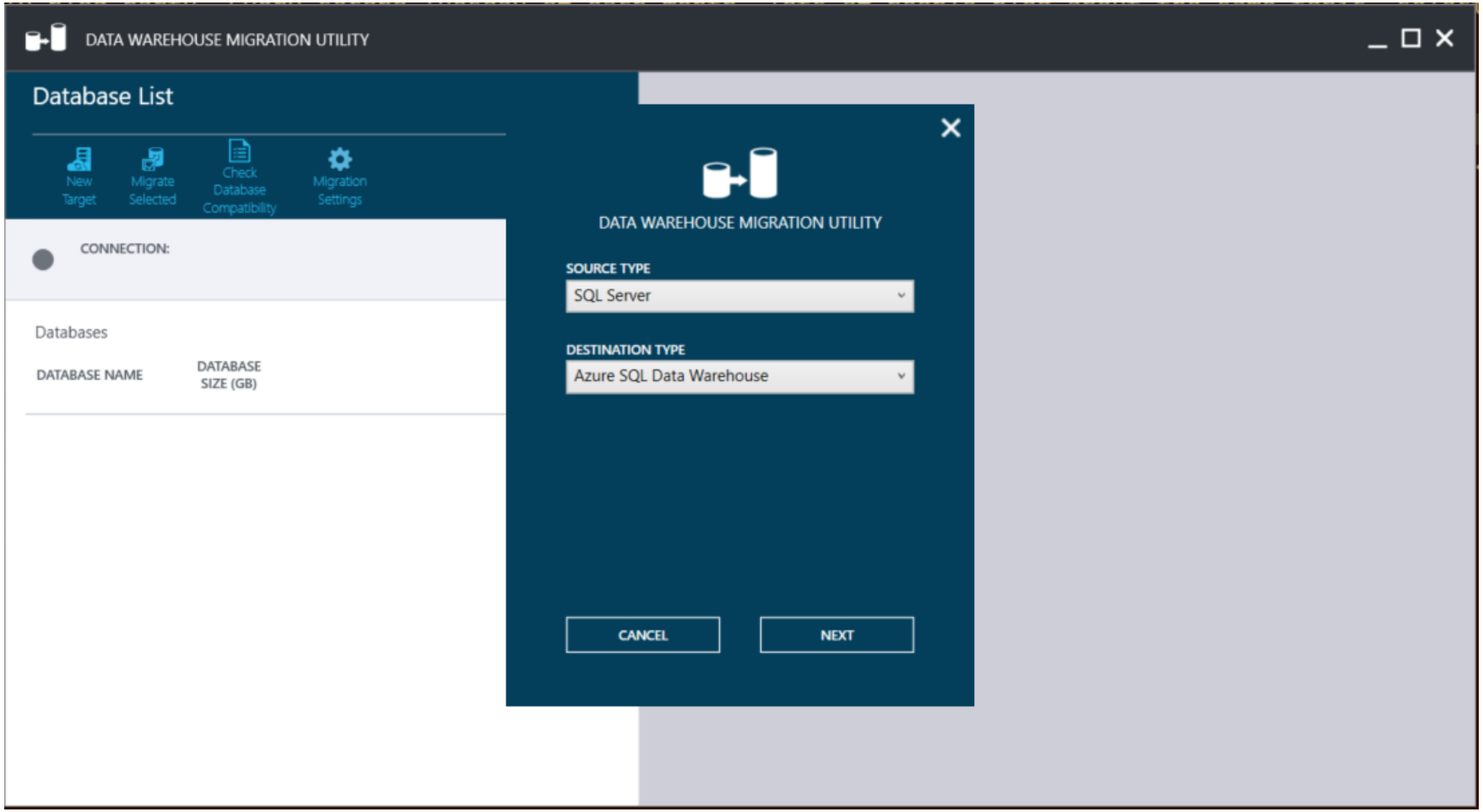
- Incorrect format means migration needs to be entirely repeated
- Exploit bcp options, hints, parralellism
- Multiple compressed files, split files
- Parallel import, reliable transfer
- Don't use multiple files in the same gzipped file
- Efficient Copy
  - Parallel, Async, Resumable
  - Limit concurrent copies if low bandwith
- Very large Data transfer
  - Express Route, Import/Export Service

Data Migration (WWI)

DEMO



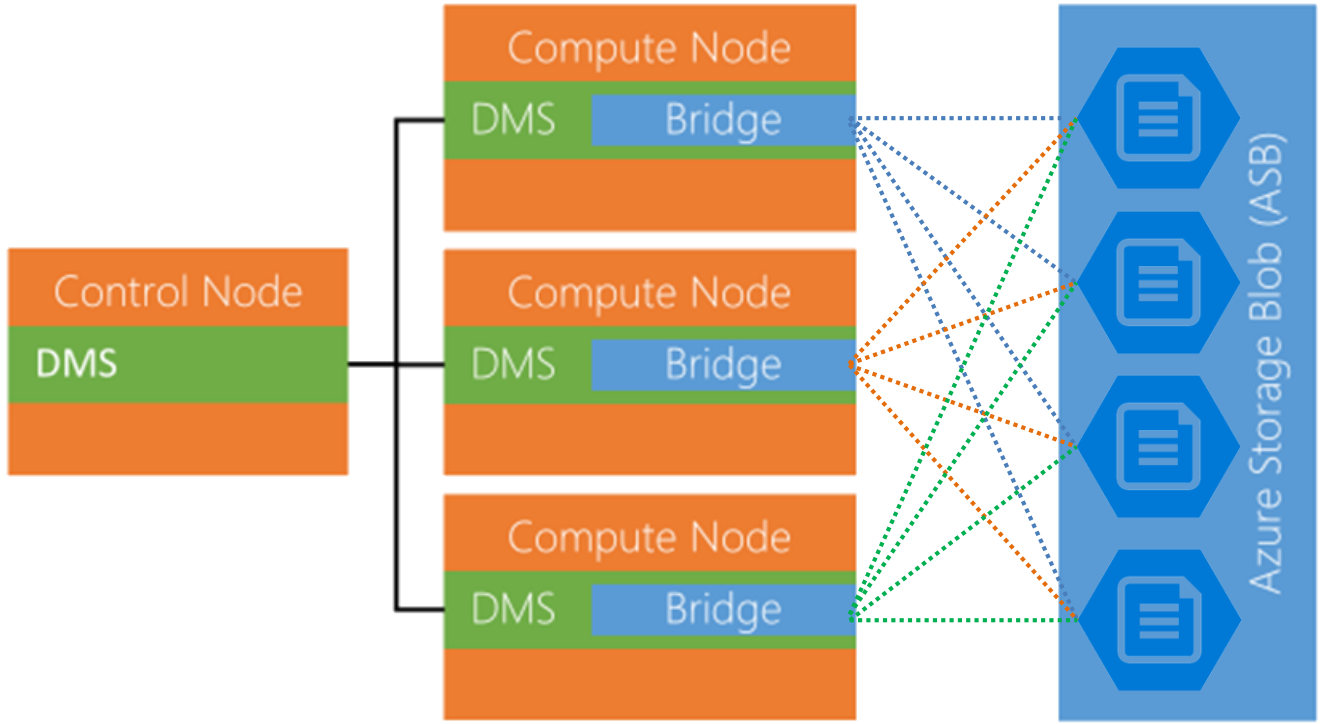
Data Warehouse Migration Utility (Preview)



Data Loading Recommendations

- PolyBase and SSIS (with 2017 Azure feature pack) the fastest method
  - Upload to BLOB via AZCOPY or PowerShell library
  - Historical load – use CTAS
  - Incremental – use INSERT...SELECT
  - UTF-8, UTF-16 also supports
- Use the highest resource class (without sacrificing concurrency)
- Increase DWU before load, decrease once done
- ADLS supported
- Doesn't support:
  - Extended ASCII
  - Custom multi-date format
  - ~~No reject files & reason for rejected rows~~

Parallel Loading with PolyBase



Data Loading Options

	PolyBase	SSIS *	ADF	BCP	SqlBulk Copy
Rate	Fastest → Slowest				
Rate increase as DWU increases	Yes	Yes	Yes	No	No
Rate increases as you add concurrent load	No	No	No	Yes	Yes

* With SSMS Azure Feature Pack June 2017 (or newer)

PolyBase characteristics

- Single PolyBase load provides best performance for non-compressed files
- Load performance scales as you increase service level objective (SLO)
  - Number of files should be greater than of equal to the total number of readers of your service level objective (SLO)
- Automatically parallelizes data load process;
  - no need to manually break the input data into multiple files and issue concurrent loads
  - Each reader slice 512 MB block from data files
- Max throughput depends on number of readers available on the DWU level
- Multiple readers will not work against a compressed text file (gzip)
  - Only a single reader is used per compressed file since uncompressing the file in the buffer is single threaded
  - Alternatively, generate multiple compressed files

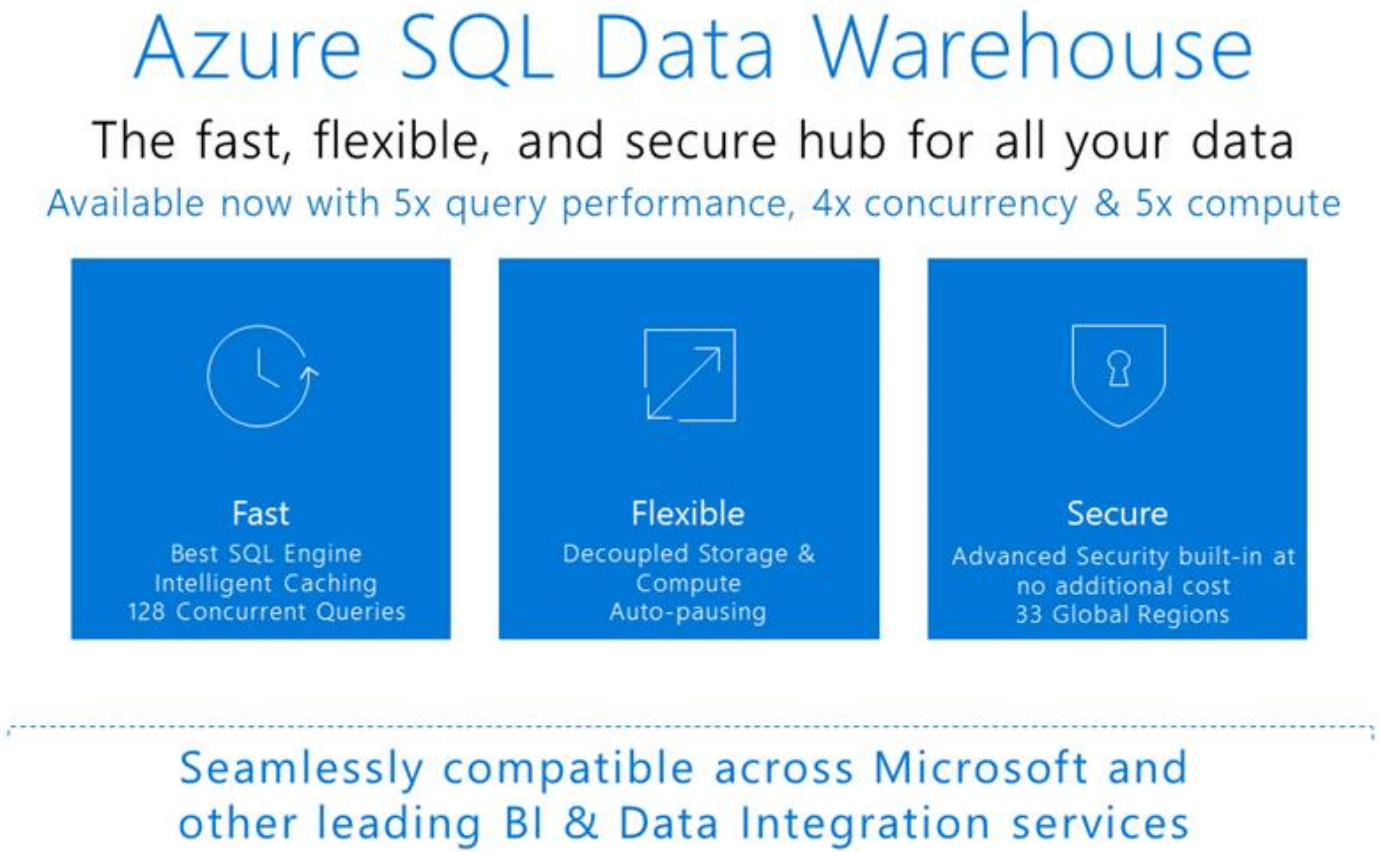
Parallel Loading with PolyBase

DEMO

SQL Azure Data Warehouse

GEN 2

Fast, flexible, and secure cloud data warehouse

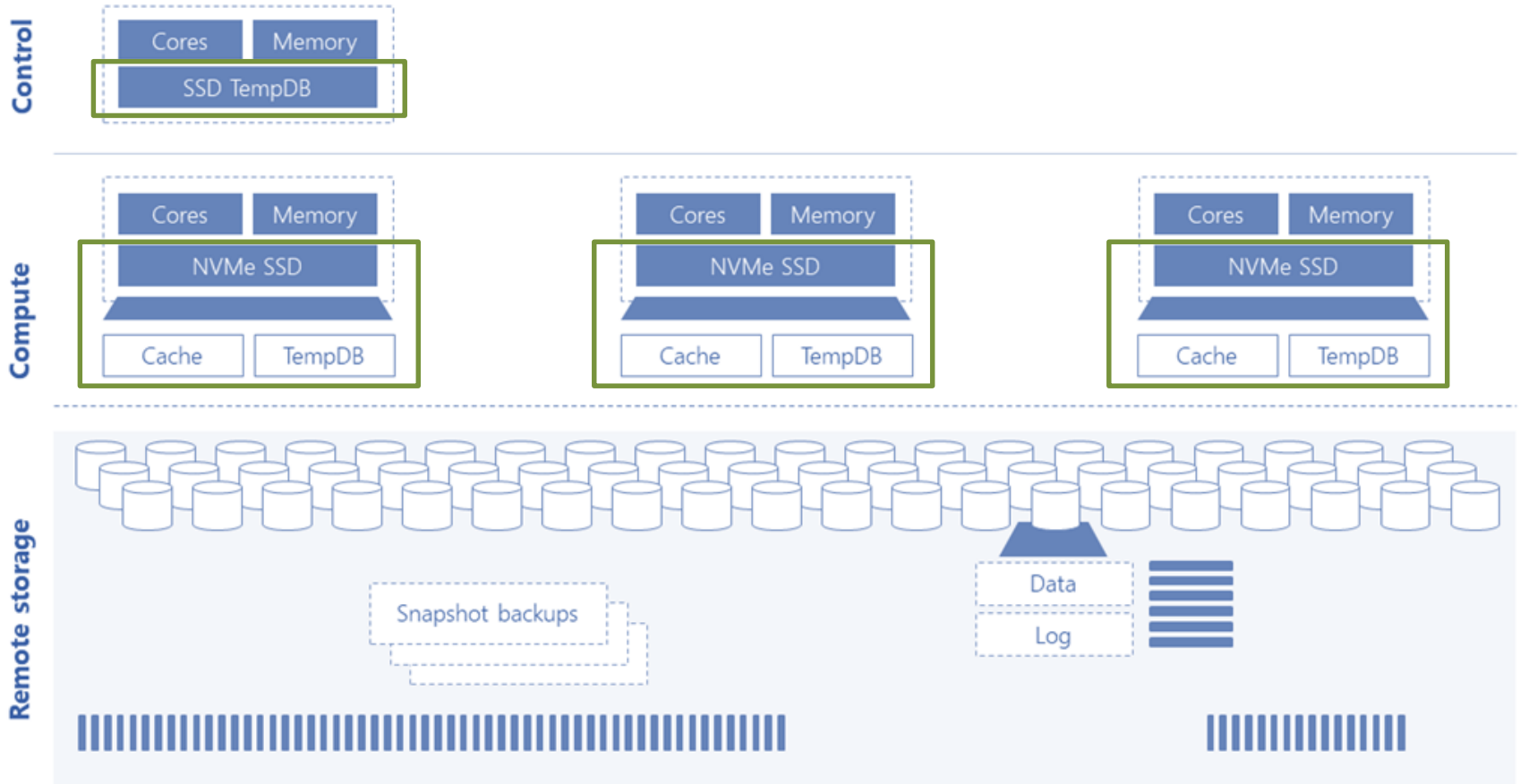


Compute Optimized Gen2 Tier

- **Generally available** since 30/04/2018
- Expanded to **33** Azure regions
- Hardware innovations behind the scenes
- NVM Express (**NVMe**) solid-state drive (SSD)
- Generally offers up to **2GB/sec** of local I/O bandwidth
- **Adaptive caching** of recently used data on NVMe

Compute Optimized Gen2 Tier

SQL DW Gen2 redefines performance with intelligent caching



Unparalleled query performance (since March 2019)

- Query Optimizer enhancements
- Instant Data Movement
- Advanced analytic functions
  - GROUP BY ROLLUP,
  - GROUPING(),
  - GROUPING_ID()
- Intelligent workload management

Without Query Optimizer enhancements

```
SELECT Country, Region, SUM(Sales) AS TotalSales
FROM Sales
GROUP BY Country, Region
UNION ALL
SELECT Country, Region, SUM(Sales) AS TotalSales
FROM Sales
GROUP BY Country, Region
UNION ALL
SELECT Country, Region, SUM(Sales) AS TotalSales
FROM Sales
GROUP BY Country, Region
```

New features available (since March 2019)

- Intelligent workload management
- Workload classification
- Workload importance
- Classifying requests with importance


```
CREATE WORKLOAD CLASSIFIER ExecReportsClassifier
  WITH (WORKLOAD_GROUP = 'mediumrc'
    ,MEMBERNAME   = 'ExecutiveReports'
    ,IMPORTANCE   = above_normal);

CREATE WORKLOAD CLASSIFIER AdhocClassifier
  WITH (WORKLOAD_GROUP = 'smallrc'
    ,MEMBERNAME   = 'AdhocUsers'
    ,IMPORTANCE   = below_normal);
```

Data Discovery & Classification

- Auto-discovery and recommendations
- Classification/Labeling
- Reporting
- Monitoring/Auditing

Resources

- Azure SQL Data Warehouse
- YouTube – sessions, webinars
- Seven Key Principles of Cloud Security and Privacy (white paper)
- And finally:
- SQLPlayer.net blog

Questions?

Thank you!

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@NowinskiK @SQLPlayer

SQLPlayer.net

https://github.com/NowinskiK/CommunityEvents

Kamil Nowinski
Microsoft Data Platform MVP
MCSE Data Platform & MCSE Data Management and Analytics