



Designing for Concurrency

Building Scalable Data Platforms





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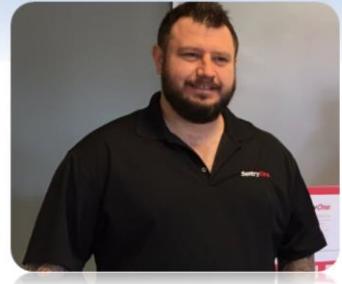
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About Me

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Microsoft Data Platform MVP



Over a decade of experience with SQL Server as a Dev, DBA and BI Dev. Most recently working as a Premier Field Engineer with Microsoft UK.

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LinkedIn : <https://uk.linkedin.com/in/johnqmartin>



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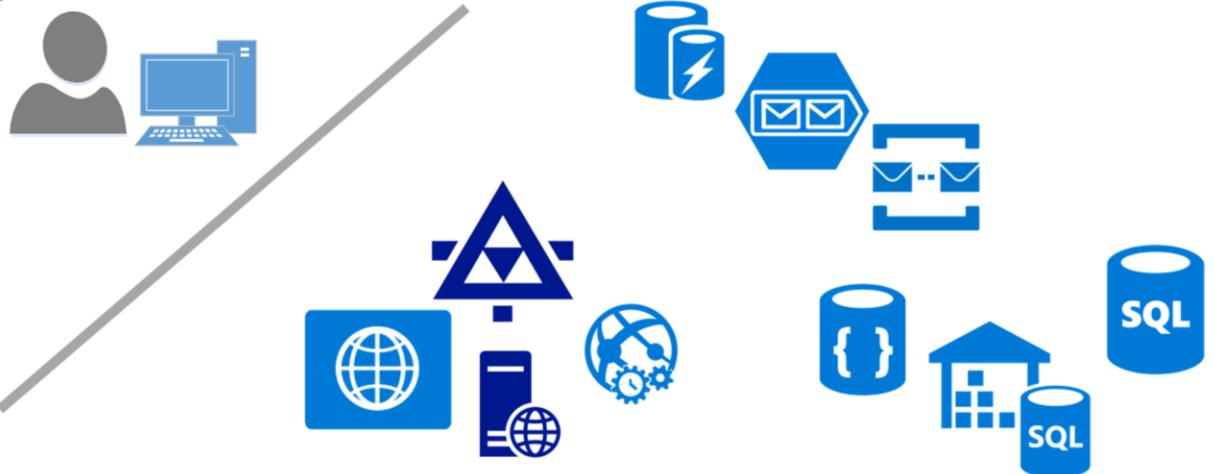
Different Workloads



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Many Options, One System



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There are many different options for building out modern applications, the current methodologies espouse Micro services, nano-services, SOA, and a decoupled design approach. This can lend itself well to building large scale solutions, however data persistence is still an area that needs to develop in order to support the scalability of the tiers above.

Another important element of the system design is to understand where the system needs to have Synchronous Vs Asynchronous communications between the components. This will help determine how flexible the system can be, where it is possible to make a call asynchronously then it can allow for greater tolerance and lower concurrency requirements.

Many Options, One System



Many Options, One System



Data Model

- Data Types
- In-Memory OLTP
- Partitioning
- Sharding

Configuration

- Isolation Levels



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Many Options, One System



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- Sharding

Configuration

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Application Infrastructure

- Queues & Workers
- Messaging
- Caching

Many Options, One System



Application Delivery Tier

- Web Services
- IoT Hubs
- App Services
- Web Sites

Application Infrastructure

- Queues & Workers
- Messaging
- Caching

Database Configuration



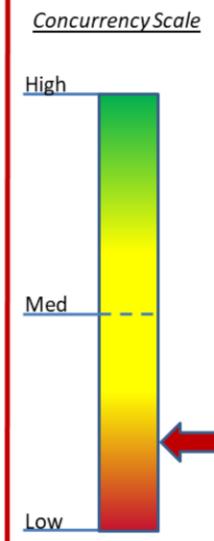
Application Delivery Tier

- Web Services
- IoT Hubs
- App Services
- Web Sites



Database Configuration : Isolation Level

Serializable



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Reference Materials

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Serializable Isolation Level

Link : <https://sqlperformance.com/2014/04/t-sql-queries/the-serializable-isolation-level>

Type : Documentation

Source : TechNet

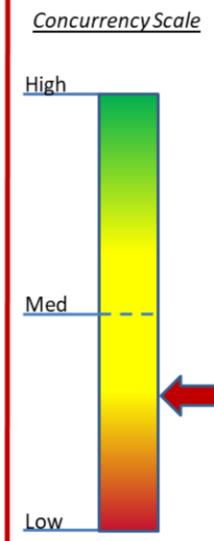
Author : Microsoft

Title : SET TRANSACTION ISOLATION LEVEL (Transact-SQL)

Link : <https://technet.microsoft.com/en-us/library/ms173763.aspx>

Database Configuration : Isolation Level

Repeatable Read



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Reference Materials

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Repeatable Read Isolation Level

Link : <https://sqlperformance.com/2014/04/t-sql-queries/the-repeatable-read-isolation-level>

Type : Documentation

Source : TechNet

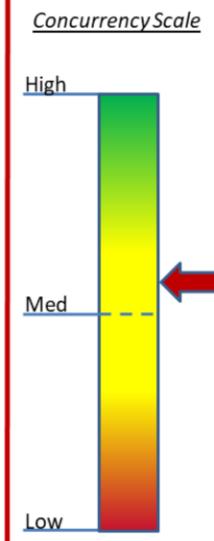
Author : Microsoft

Title : SET TRANSACTION ISOLATION LEVEL (Transact-SQL)

Link : <https://technet.microsoft.com/en-us/library/ms173763.aspx>

Database Configuration : Isolation Level

Read Committed



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Reference Materials

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Read Committed Isolation Level

Link : <https://sqlperformance.com/2014/04/t-sql-queries/the-read-committed-isolation-level>

Type : Documentation

Source : TechNet

Author : Microsoft

Title : SET TRANSACTION ISOLATION LEVEL (Transact-SQL)

Link : <https://technet.microsoft.com/en-us/library/ms173763.aspx>

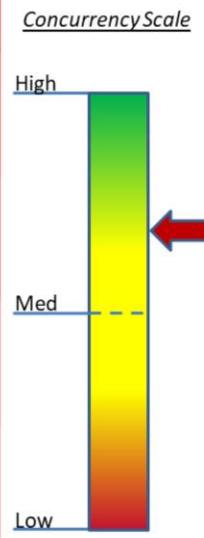
Database Configuration : Isolation Level

Read Uncommitted



Aka.

NOLOCK



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Reference Materials

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Read Uncommitted Isolation Level

Link : <https://sqlperformance.com/2015/04/t-sql-queries/the-read-uncommitted-isolation-level>

Type : Documentation

Source : TechNet

Author : Microsoft

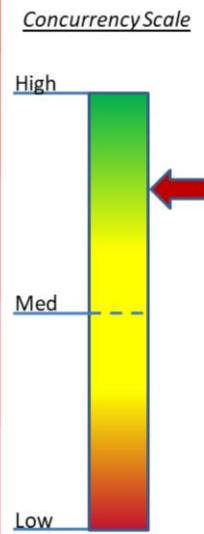
Title : SET TRANSACTION ISOLATION LEVEL (Transact-SQL)

Link : <https://technet.microsoft.com/en-us/library/ms173763.aspx>

Database Configuration : Isolation Level

Snapshot & Read

Committed Snapshot



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Reference Materials

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Snapshot Isolation Level

Link : <https://sqlperformance.com/2014/06/sql-performance/the-snapshot-isolation-level>

Type : Blog Post

Source : SQL Performance.com

Author : Paul White

Title : The Read Committed Snapshot Isolation Level

Link : <https://sqlperformance.com/2014/05/t-sql-queries/read-committed-snapshot-isolation>

Type : Documentation

Source : TechNet

Author : Microsoft

Title : SET TRANSACTION ISOLATION LEVEL (Transact-SQL)

Link : <https://technet.microsoft.com/en-us/library/ms173763.aspx>

Data Model & Concurrency

- **Workload profile** : Large scale data ingestion from a number of clients, writing data into few very large tables that contain the data. Workload is split 80/20 on Write Vs Read activity.
- **Symptoms** : Latch contention on the leading edge of a table with an Integer based leading key in the clustered index.

Data Type for Clustered Index leading column – GUID

Partitioning

- Hash
- Partitioned Views
- Table Partitioning



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Reference Material

Type : Download

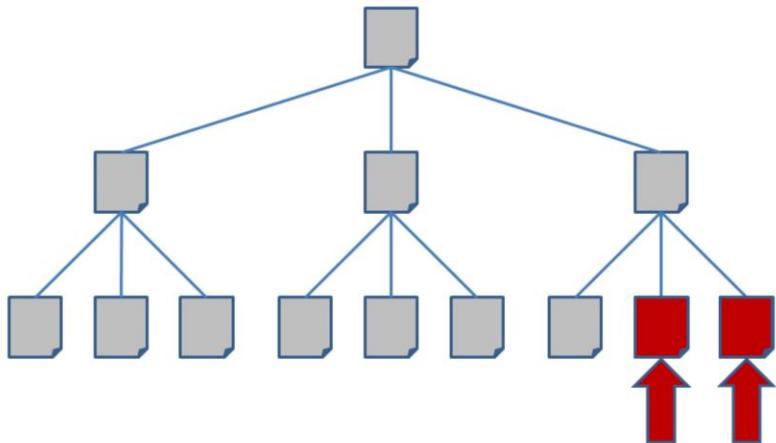
Title : Diagnosing and Resolving Latch Contention in SQL Server

Author : Microsoft

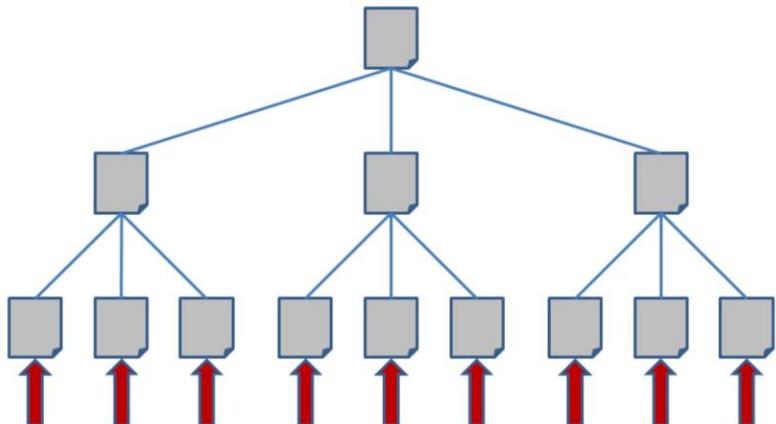
Source : Microsoft

Link : <https://www.microsoft.com/en-us/download/details.aspx?id=26665>

GUID Vs INTEGER



GUID Vs INTEGER



The Reality

Experience other issues first

- Transaction Log Throughput
- Storage Throughput limitations
- CPU Limitations

Edge Case

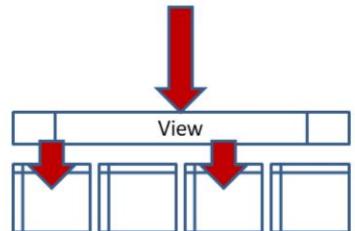
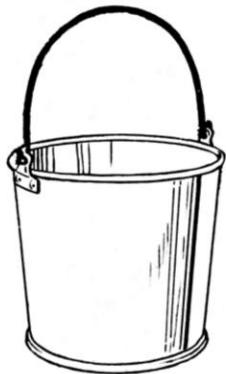
- Not the first option to handle input saturation
- Other architecture patterns available



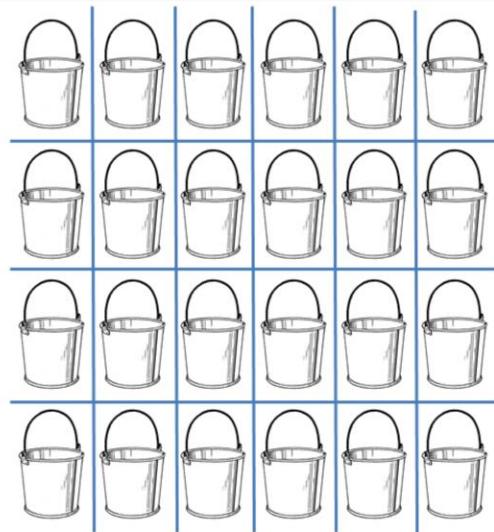
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Table Partitioning



Hash Partitioning



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Reference Materials

Type : Blog Post

Source : SQLSkills

Author : Joe Sack

Title : SEQUENCE Object versus Modulus Hash Partitioning

Link : <https://www.sqlskills.com/blogs/joe/sequence-object-versus-modulus-hash-partitioning/>

Type : Blog Post

Source : SQLSkills

Author : Joe Sack

Title : Hash Partitioning with SQL Server 2012's SEQUENCE object and CYCLE argument

Link : <https://www.sqlskills.com/blogs/joe/hash-partitioning-with-sql-server-2012s-sequence-object-and-cycle-argument/>

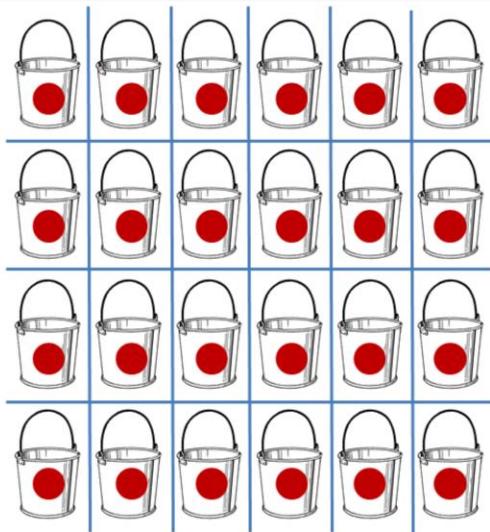
Hash Partitioning

What is my workload?

- Do I need to retrieve or just insert?

Hashing outcome

- Round Robin
- Data Distribution



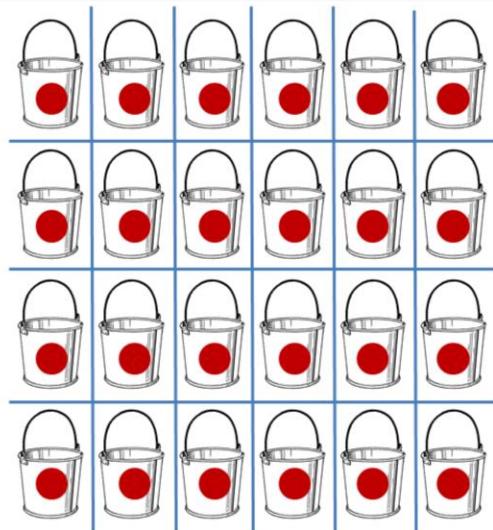
Hash Partitioning

What is my workload?

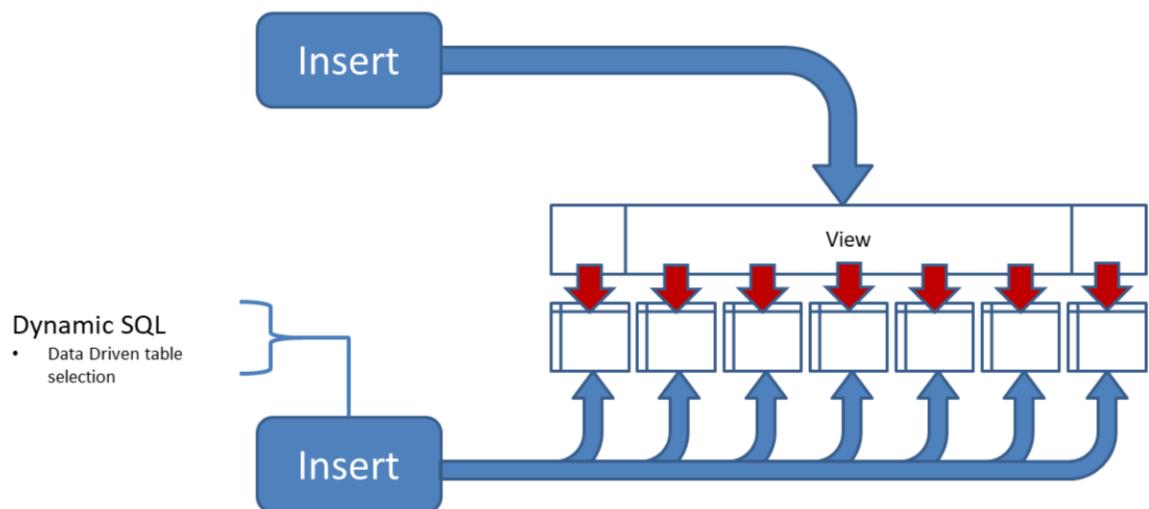
- Do I need to retrieve or just insert?

Hashing outcome

- Round Robin
- Data Distribution



Partitioned Views



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Reference Materials

Type : Blog Post

Source : SQLSkills

Author : Kimberly Tripp

Title : SQLskills SQL101: Partitioning

Link : <https://www.sqlskills.com/blogs/kimberly/sqlskills-sql101-partitioning/>

Type : Blog Post

Source : SQL Server Pro

Author : Kimberly Tripp

Title : Partitioned Tables v. Partitioned Views—Why are they even still around?

Link : <http://sqlmag.com/blog/partitioned-tables-v-partitioned-views-why-are-they-even-still-around>

The Reality

Adds Complexity to query tuning

- Reading needs to be aware of partitioning scheme
- Need to understand data distributions
- Statistics & Index management overheads

Better suited to solving other problems

- Decompose larger tables into manageable portions



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In-Memory OLTP

Partial Use

- Shock Absorber Pattern

Total Use

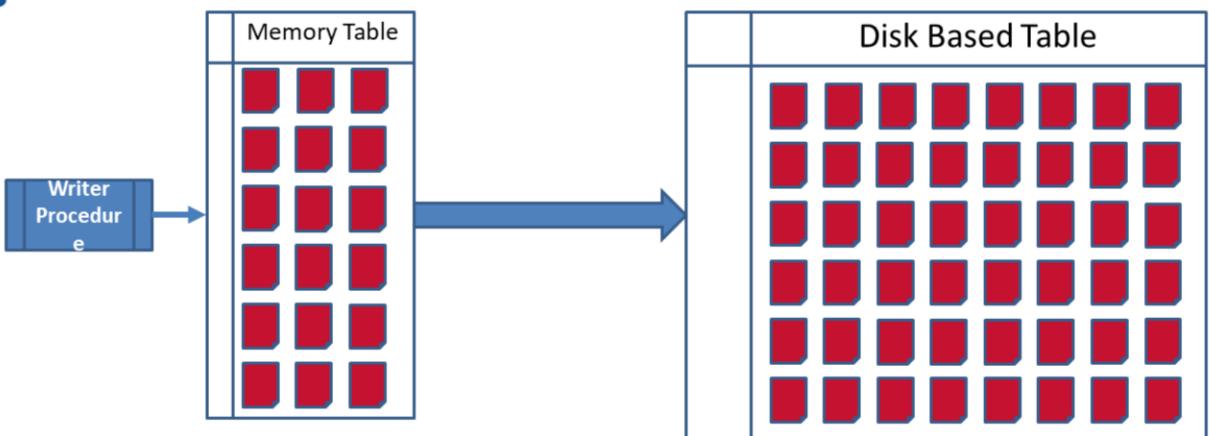
- Move whole tables to exist in memory



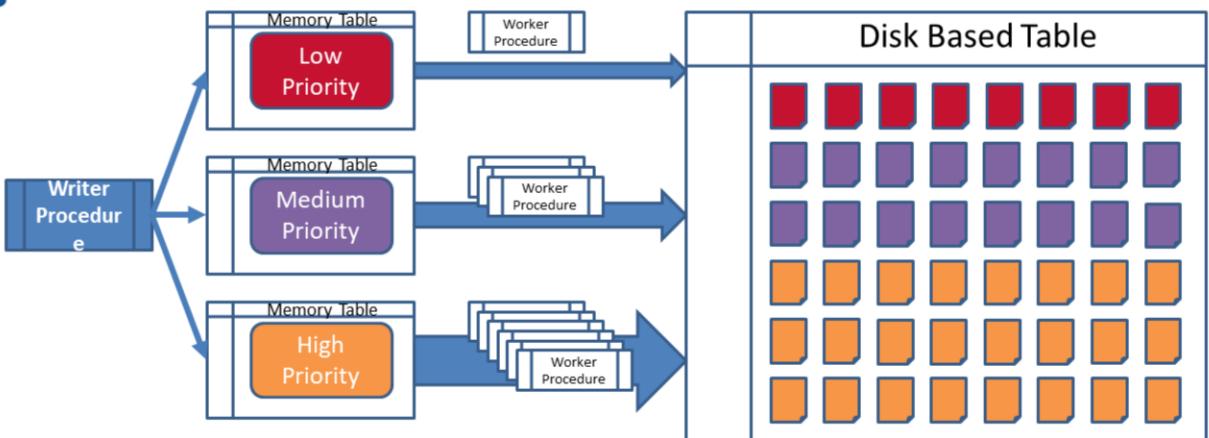
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In-Memory OLTP – Shock Absorber



In-Memory OLTP – Shock Absorber



In-Memory OLTP

Use In-Memory OLTP for workload

- Memory Considerations

Versions/Editions of SQL Server

- 2014 – Probably not
- 2016 – Possibly, still workload dependent
- Azure SQL Database – Are you made of money??



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The Reality

Adds a lot of complexity

- Needs external processes to coordinate worker processes for data transfer

Still have limitations on data model

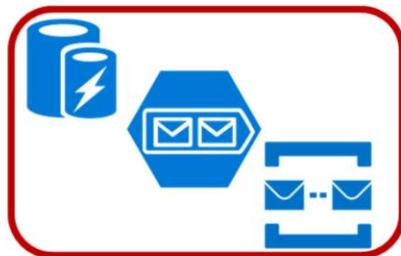
- There are still types and functions that do not yet work with In-Memory OLTP



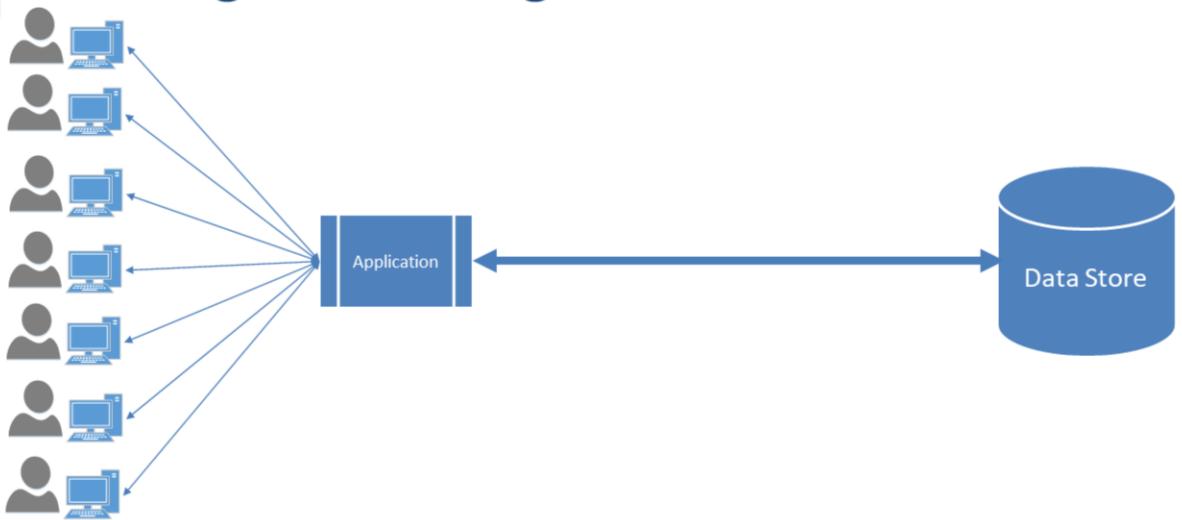
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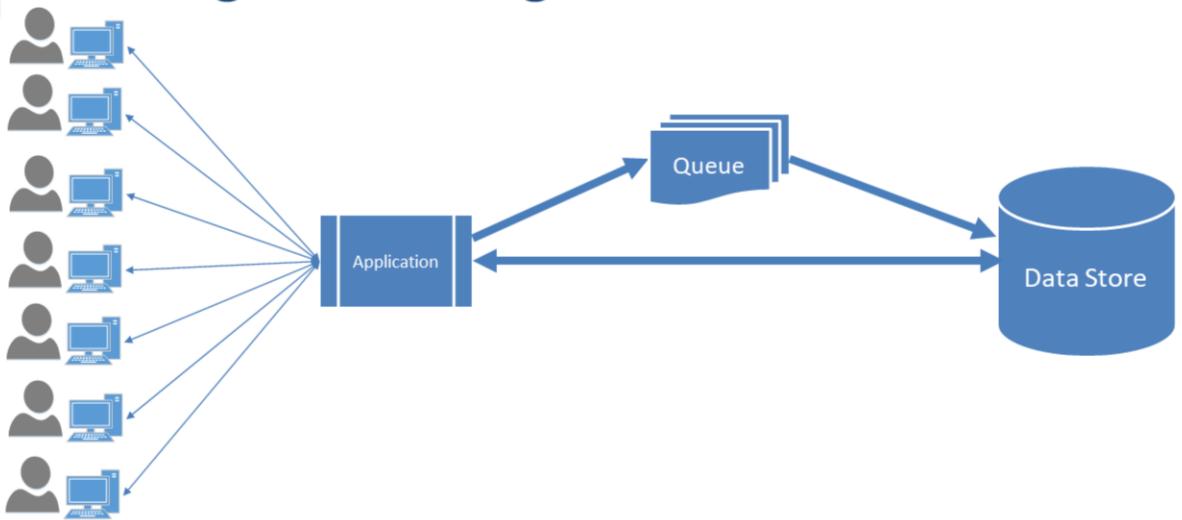
Queuing and Caching



Queuing and Caching



Queuing and Caching



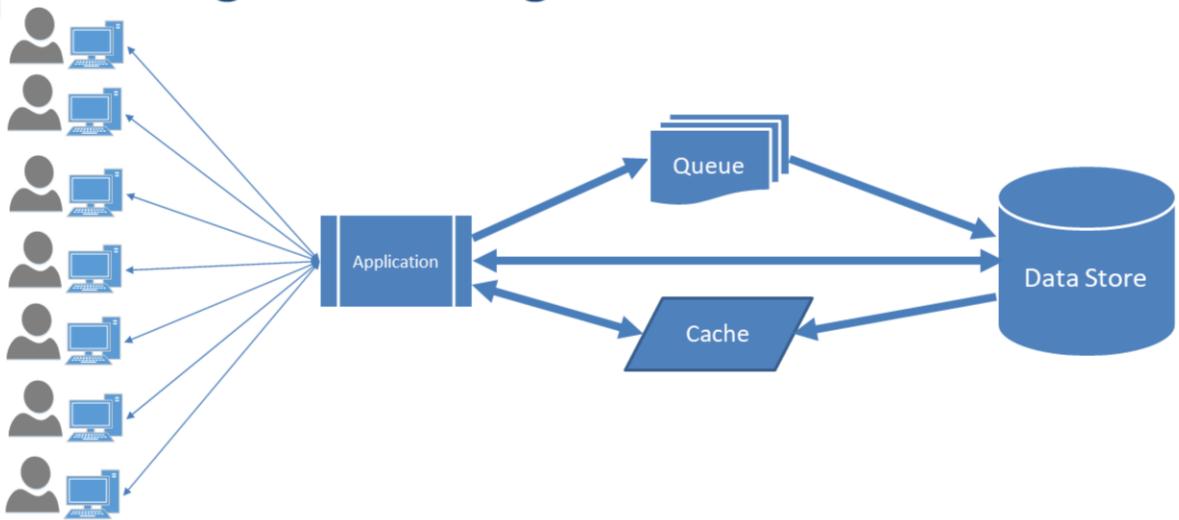
Queuing and Caching



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Queuing and Caching



Queuing and Caching

Queuing

- Azure Service Bus
- Azure Storage Queues
- BizTalk Services
- Event Hubs
- IoT Hubs
- Azure Cosmos DB



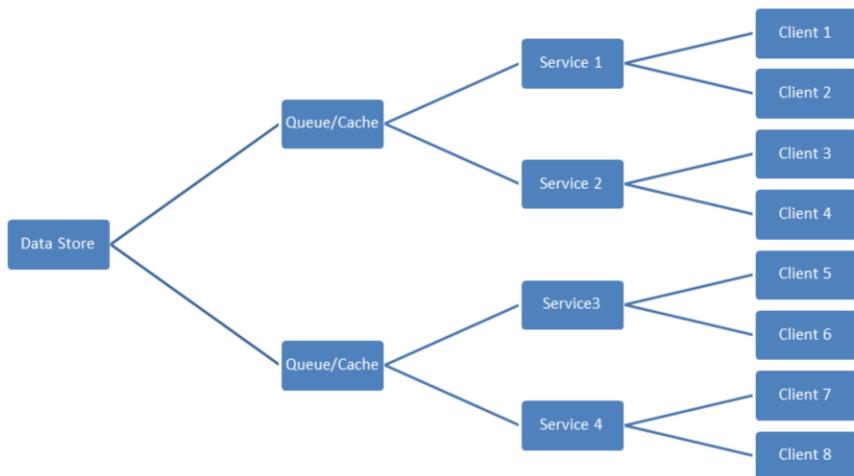
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Application Tier



Service Oriented Architecture/Micro-services



Summary

Data Platform is Changing

- No longer just the database
- Complimentary technologies

Think scale-out not scale-up

- Modular, loosely coupled architectures
- Cloud enabled, dynamically scaling solutions



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