

Deep Inside Azure SQL High Availability

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EightKB

SQL Server Internals

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Why This Topic?

- Availability Groups are complex intersection of networking, clustering, and database functionality
- Troubleshooting can be complex—there are lots of moving pieces
- Having a deep understanding of what's going on can save you headaches
- Poor configuration can limit your overall throughput
- Worse it can cause you to lose data

Joey D'Antoni

Joey has over 20 years of experience with a wide variety of data platforms, in both Fortune 50 companies as well as smaller organizations

He is a frequent speaker on database administration, big data, and career management

MVP, MCSE BI and Data Platform

VMWare vExpert

He is the co-president of the Philadelphia SQL Server User's Group

He wants you to make sure you can **restore your data**



@jdanton

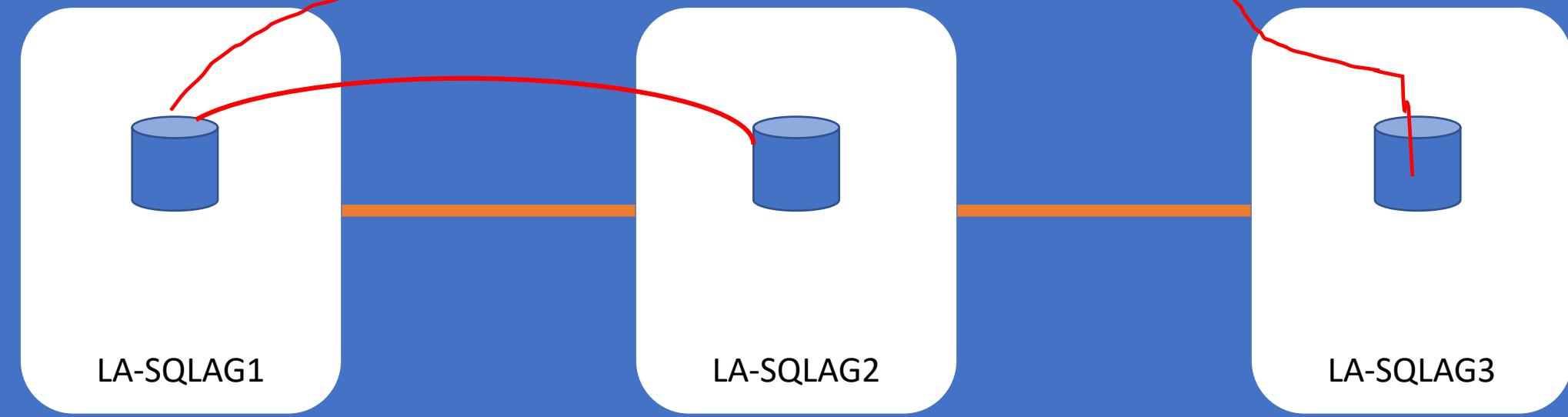


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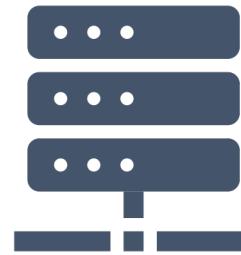
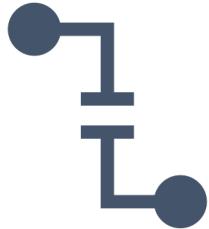




Active
Directory

Windows Server Failover Cluster

Availability Groups are Complicated



**While deploying can be easy there
are challenges:**

Kerberos is always lurking

The Network is reliable

Bandwidth is infinite

Topology doesn't change

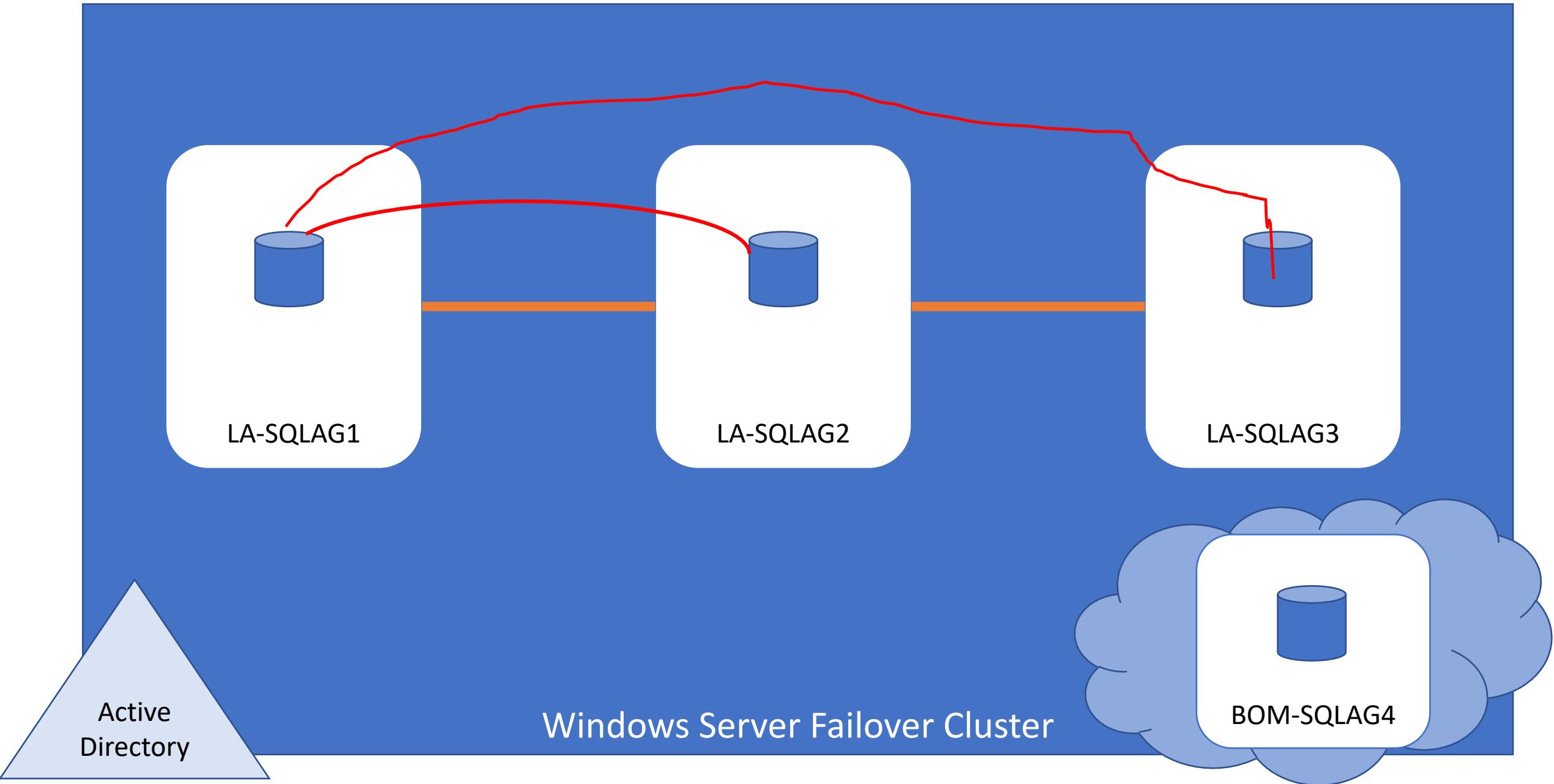
Transport costs are zero

The network is homologous*

Distributed systems are hard, yo

*These are the fallacies of distributed computing

What I wanted to build...

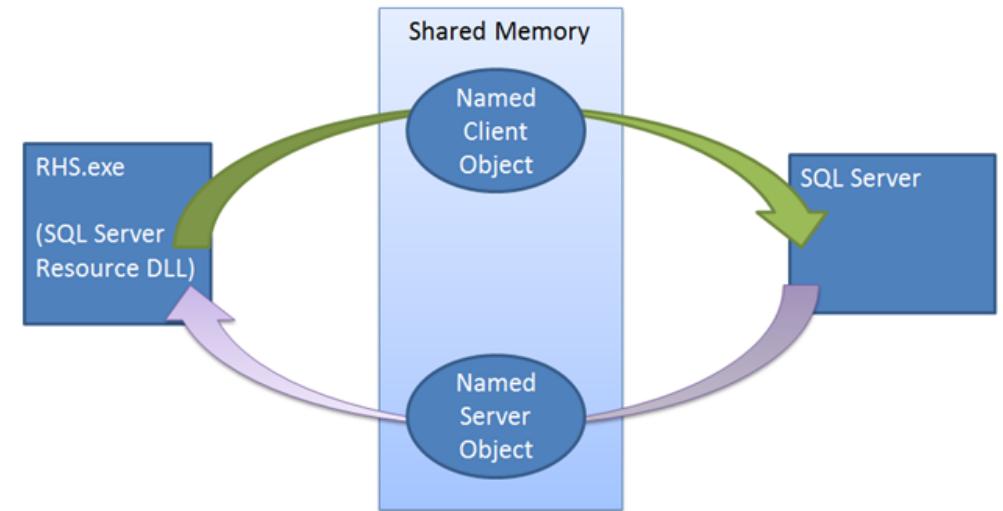




Failover Clustering and Availability Groups

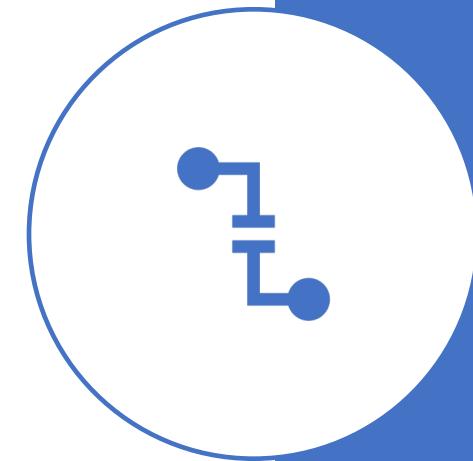
Leases and Why They Matter

- SQL Server and Failover Clustering have a complex relationship with Ags
- SQL Server plays an active role in the cluster lead mechanism
- RHS.exe
- Lease mechanism enforces synchronization between SQL server and WSFC



Lease Timeouts

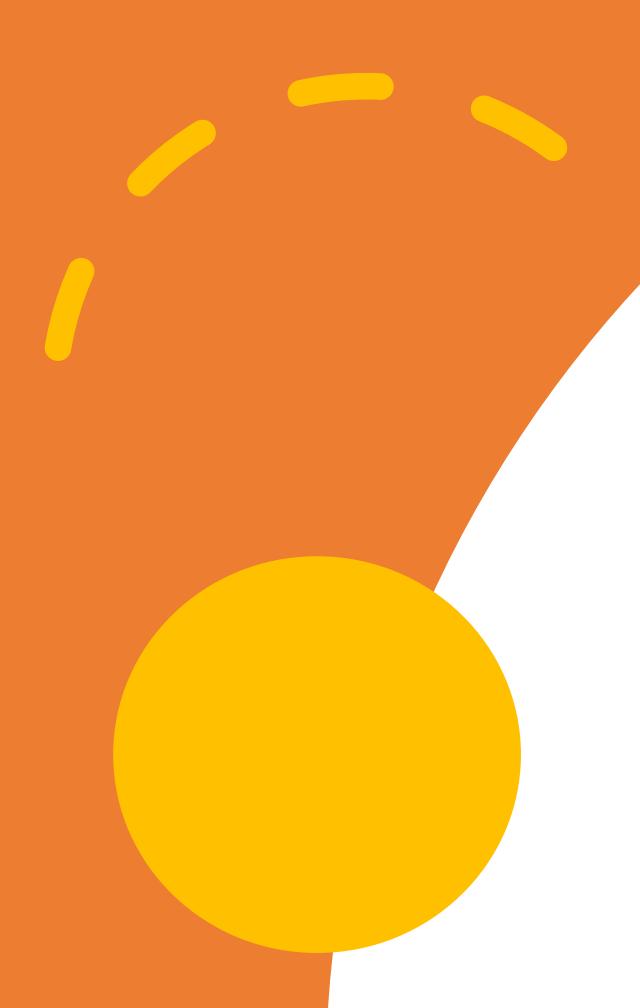
- Main function of this mechanism is to take the SQL Server resource offline if the cluster can't communicate with instance, while failing over
- One of the main availability group problems I've encountered
- Can create failure conditions when SQL does not respond causing unneeded failover
 - High CPU
 - Out of memory conditions
 - Network saturation



Troubleshooting Path for AGs

- Look in SQL Server error log on each node first
- AlwaysOn Health xEvent is basically useless
- Cluster log is needed for deeper problems

Identifier	Source
Messages with [RES] and [HADRAG]	Hadrres.dll (AG resource DLL)
Messages with [RHS]	RHS.exe (Resource Hosting Subsystem)
Messages with [RCM]	Resource Control Monitor (Cluster Service)
RcmAPI/ClusAPI	An API call—usually SQL Server



Cluster Lease Mechanism

Demo

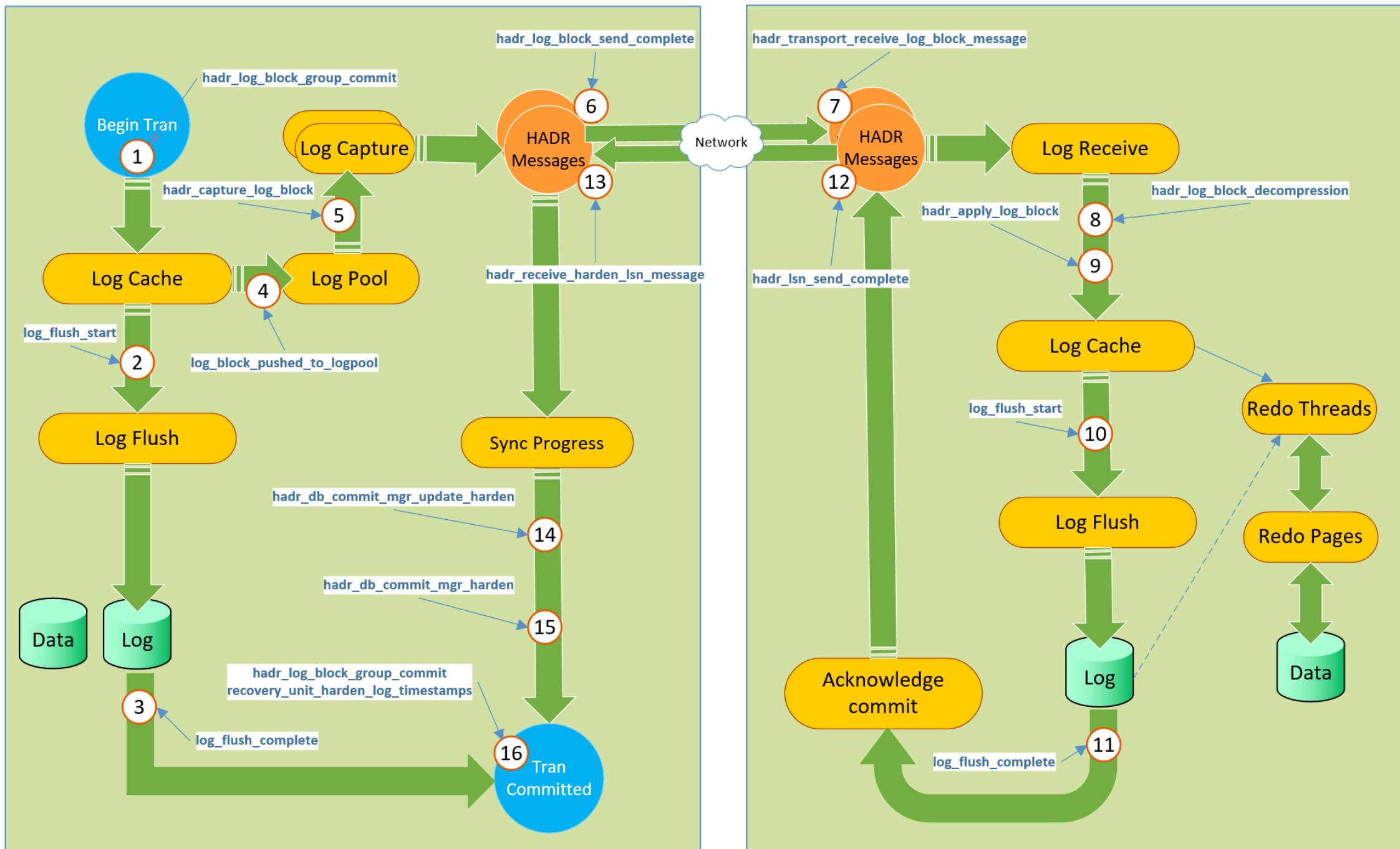
Transaction Log Transport

Understand Log Transport

- The data protection model for availability groups is to read transactions from the transaction log to the secondary log(s)
- In synchronous mode, this can cause increased latency on the primary replica
- Influences of this latency include:
 - Network bandwidth
 - I/O Subsystem performance
 - Limitations of code
 - Sunspots



Synchronous-commit mode



Log Transport

Demo





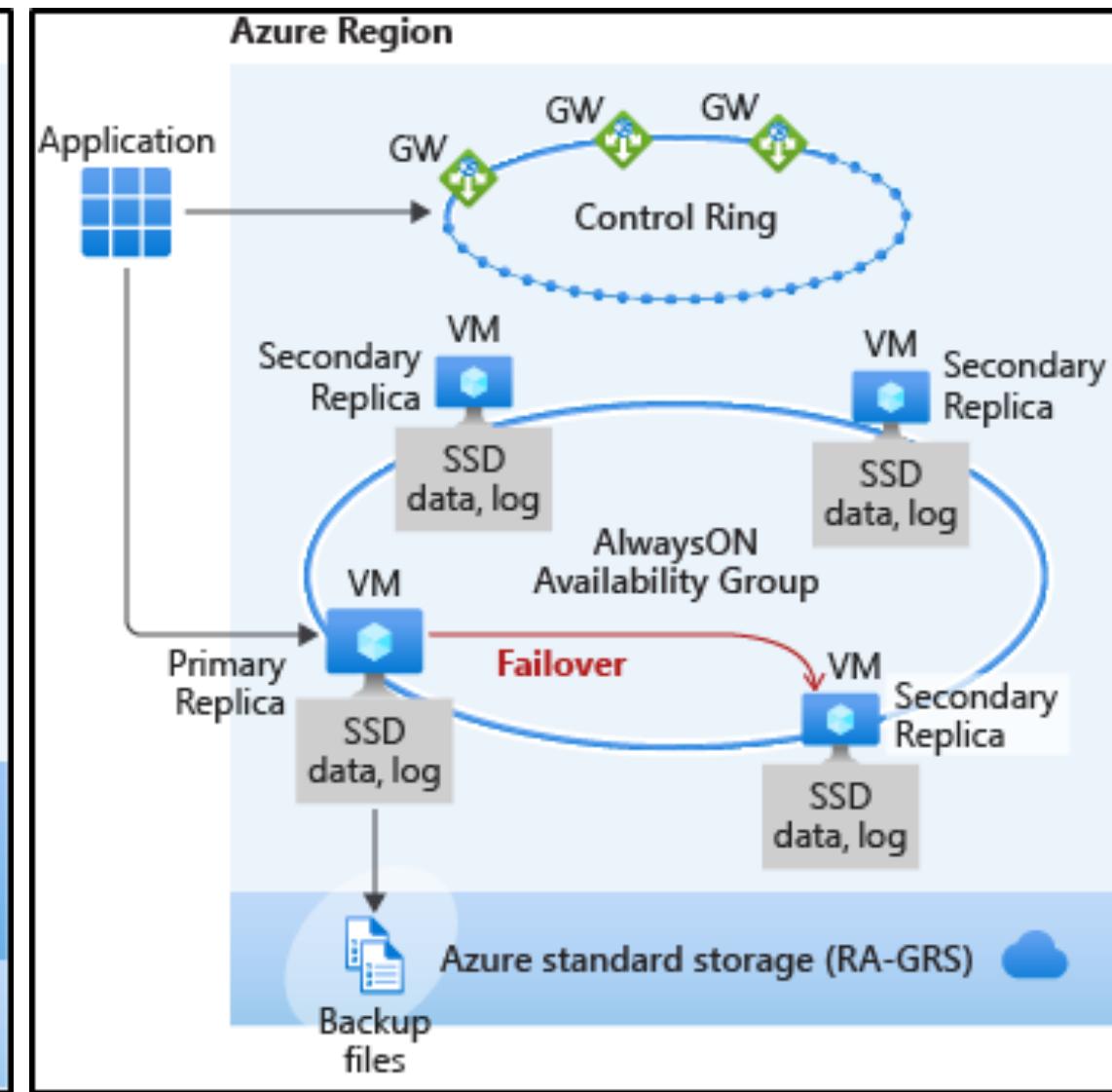
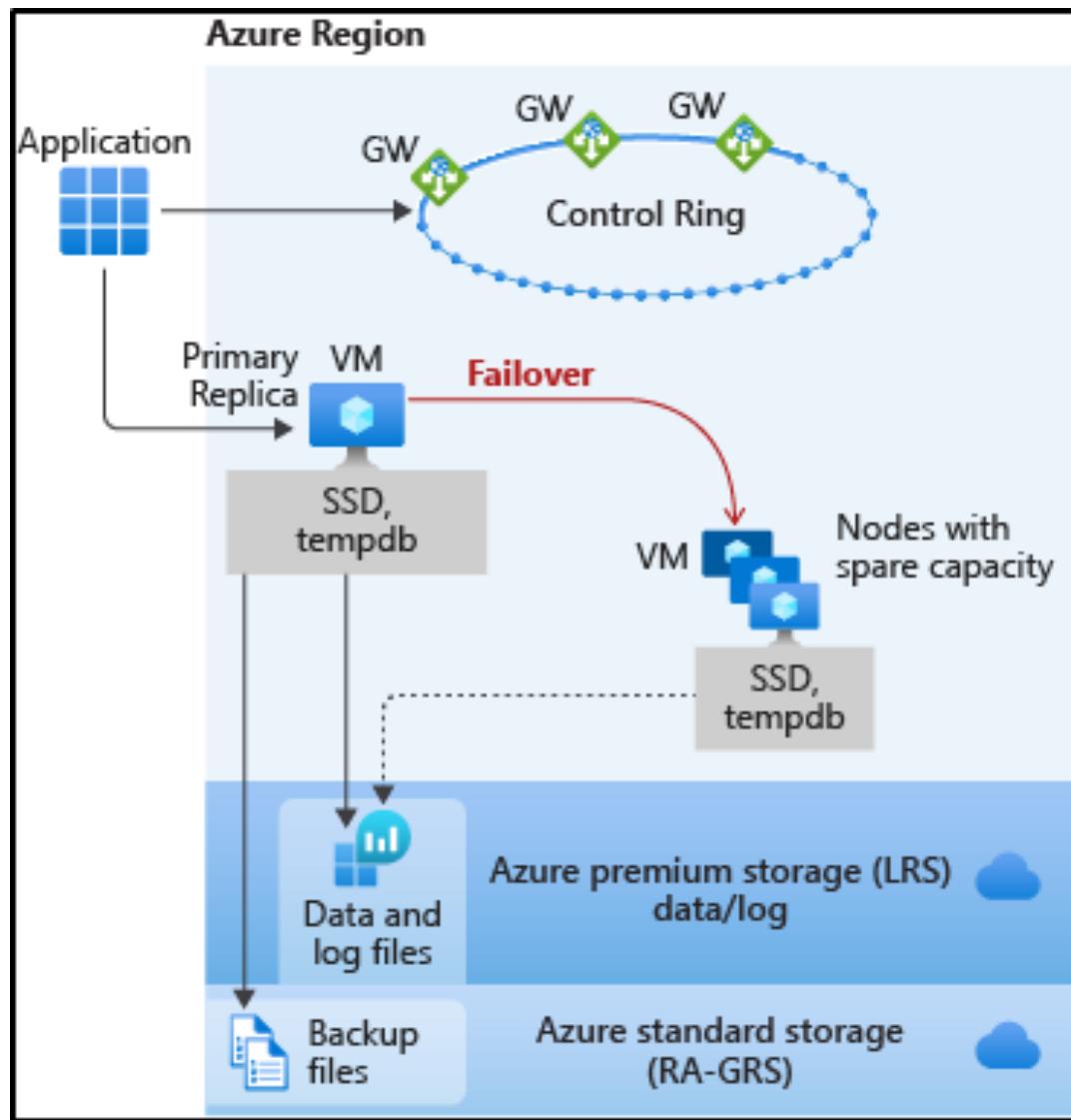
Azure





HA and DR in Azure PaaS

Azure Magic™



Azure HA/DR Architecture

Summary



Distributed Systems are hard



Clustering abstracts a lot of the complexity of what happens



Availability Groups are really complex



Azure simplifies this by having completely homogenous infrastructure and owning the entire network

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