

Credit of picture: <https://giriprakash.com/our-mind-restructured-with-habits>

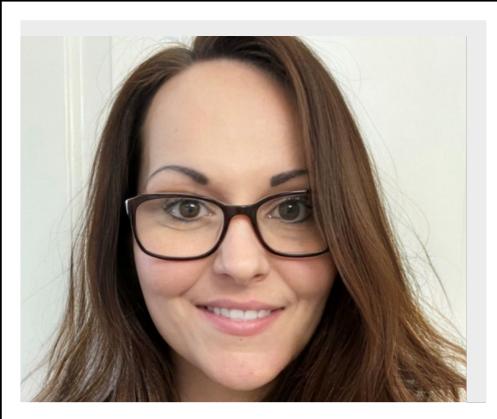
# SQL Server Split Brain

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Navigating High  
Availability Challenges  
and Preventative  
Strategies



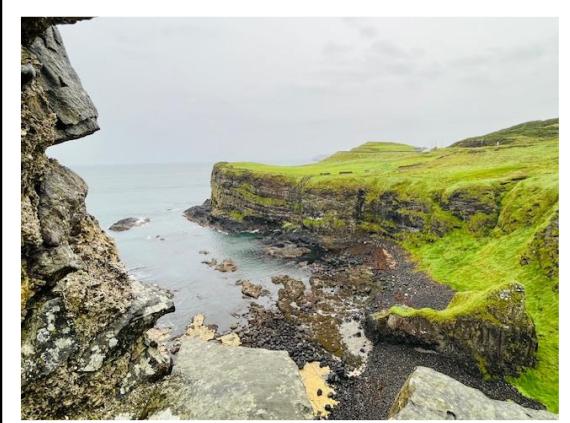
# Amy Abel



Sr DBA  
Advanced MD



Blogging Site: AAA-DBA.com  
<https://www.linkedin.com/in/amy-abel/>



# EIGHTKB

SQL SERVER INTERNALS CONFERENCE





Part 1- PRODUCTION IS DOWN!

# Three Goals Today

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- What is Split Brain
- What Causes Split Brain
- How to Prevent Split Brain

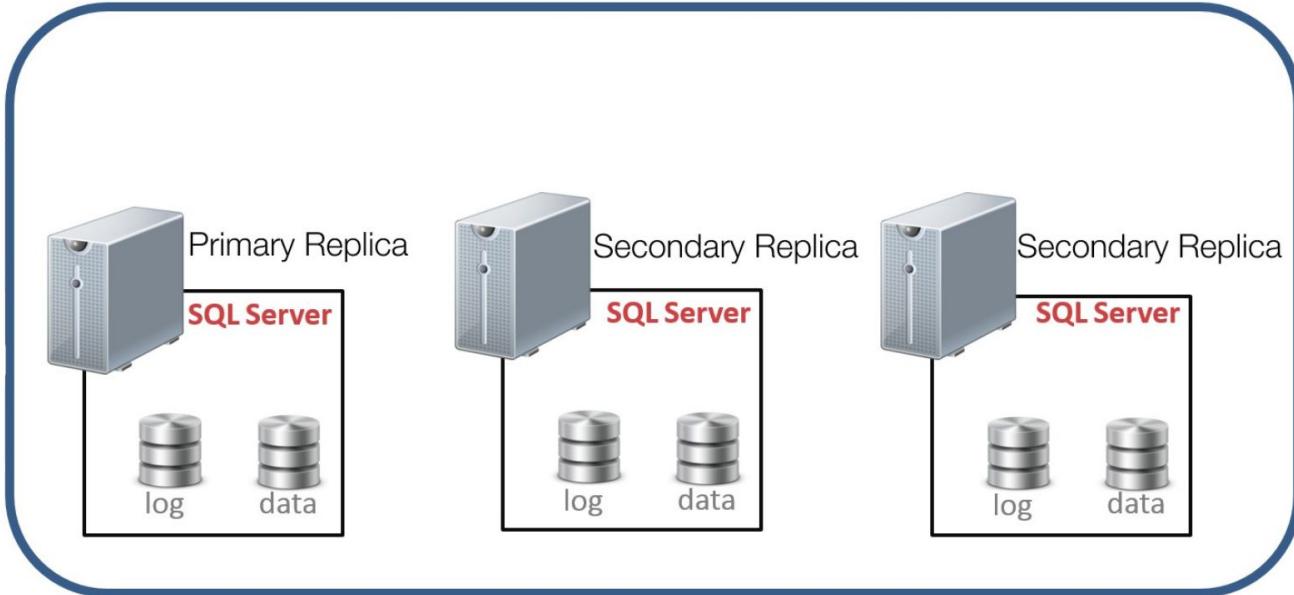


# Concepts & Terminology

# Node



# Cluster



Windows Server Failover Cluster

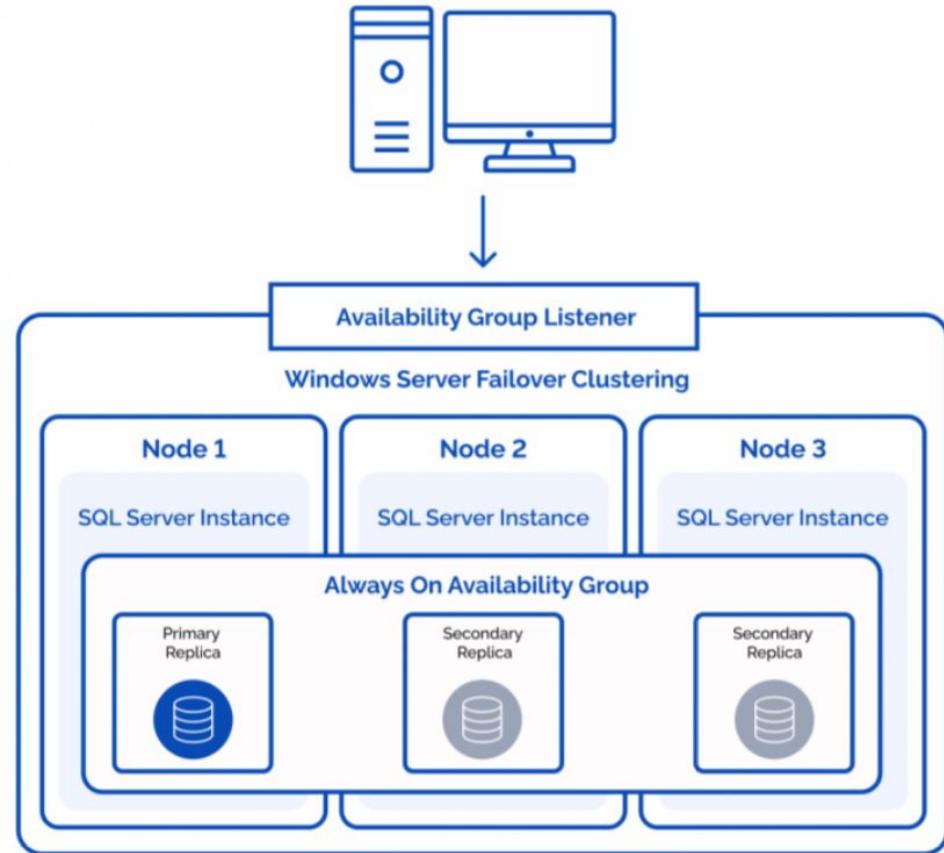
# Quorum



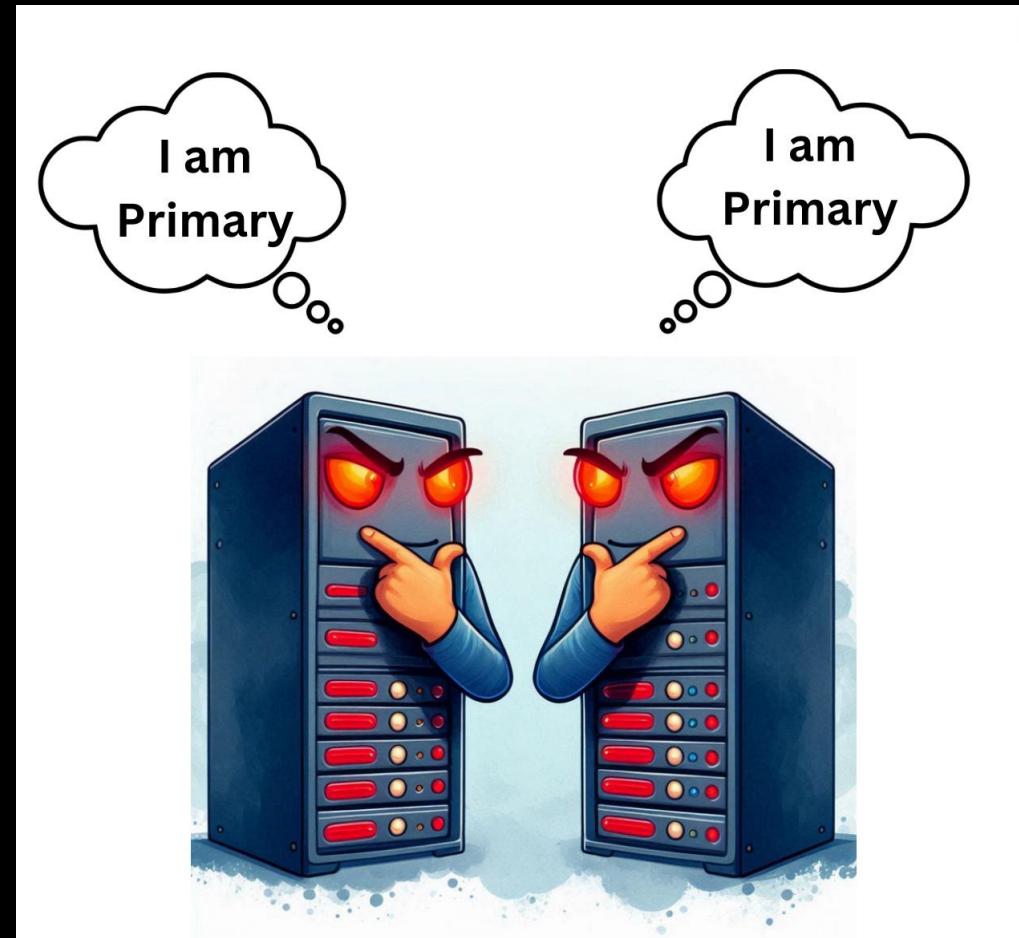


# Basic Setup

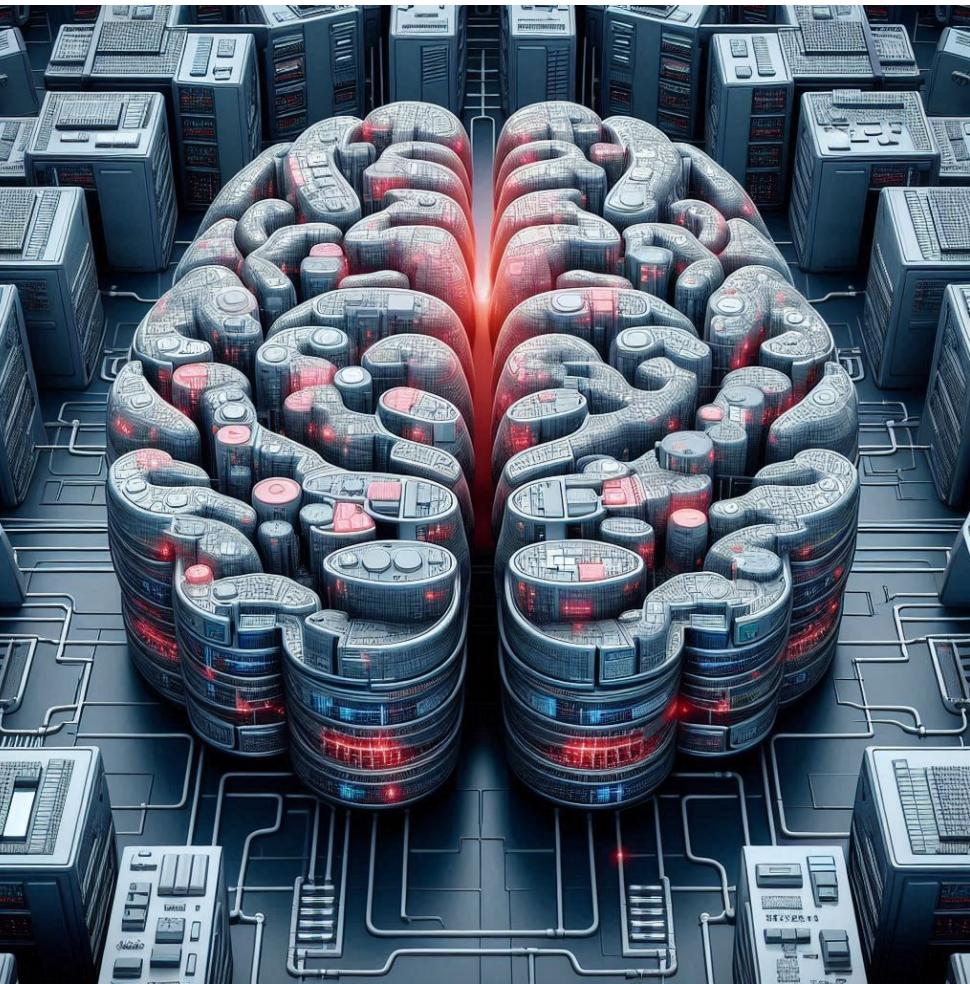
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# What Is Split Brain?



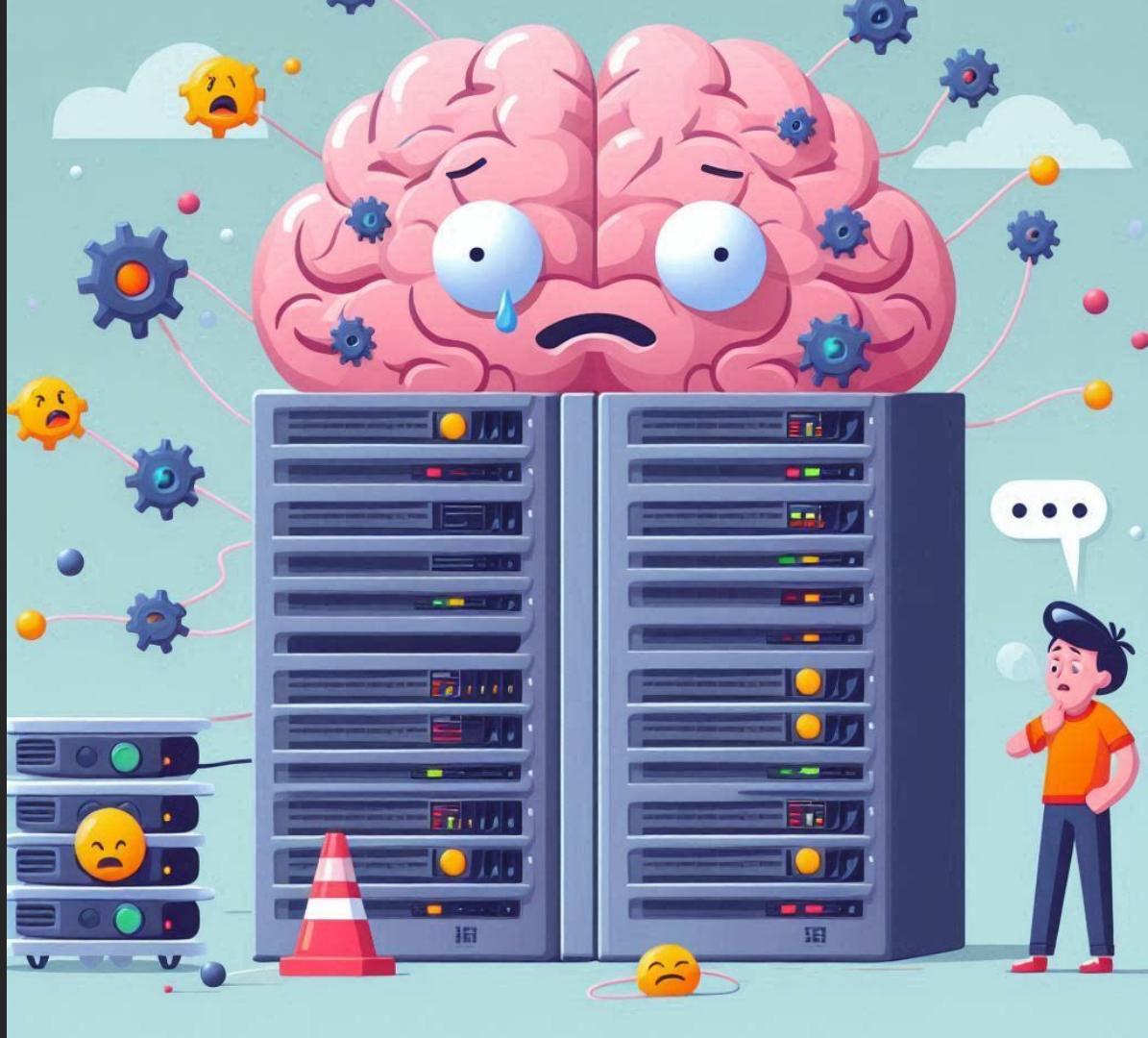
# What Causes Split Brain?



# Split Brain Causes

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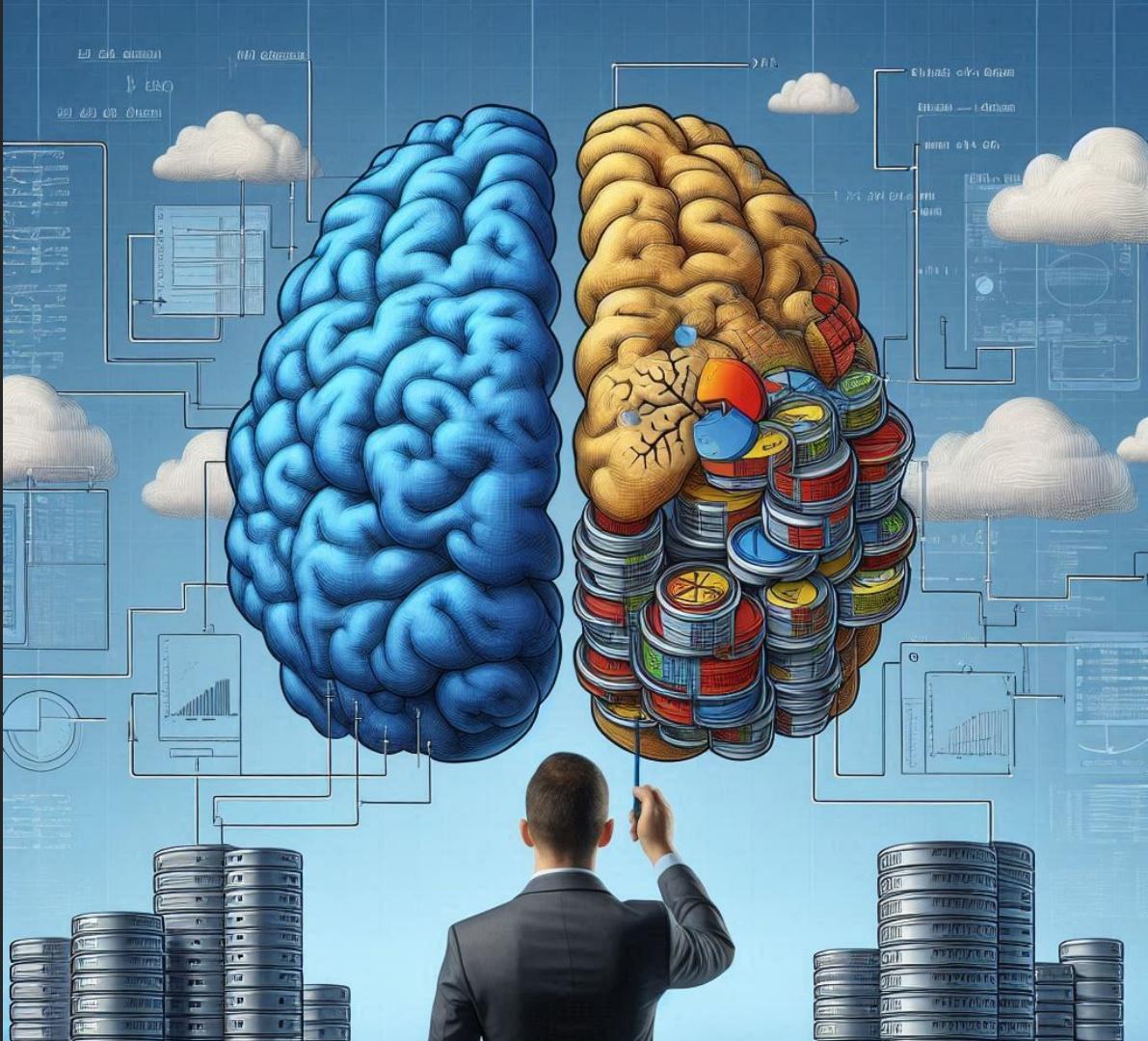
- Network Failures
- Misconfigurations
- Hardware Failures
- Software Bugs
- Power Outages



# Other Split Brain Causes

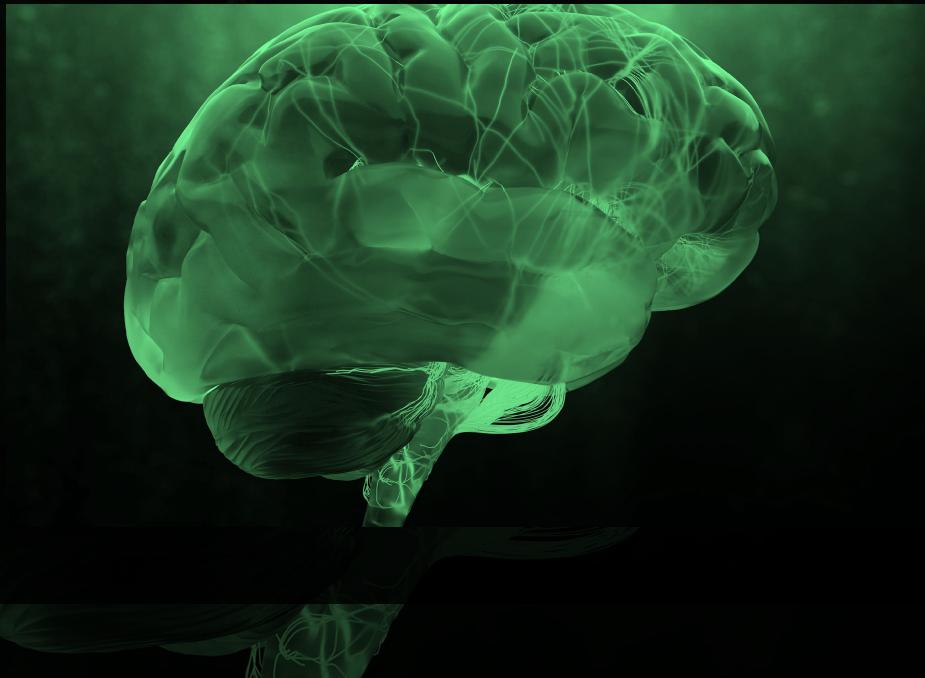
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- Quorum Failures
- Complex Failover Logic
- Manual Intervention
- Resource Contentions



# Side Effects of Split Brain

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# Consequences

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- Data Corruption
- Difficulty In Recovery
- Manual Intervention
- Lost Transactions

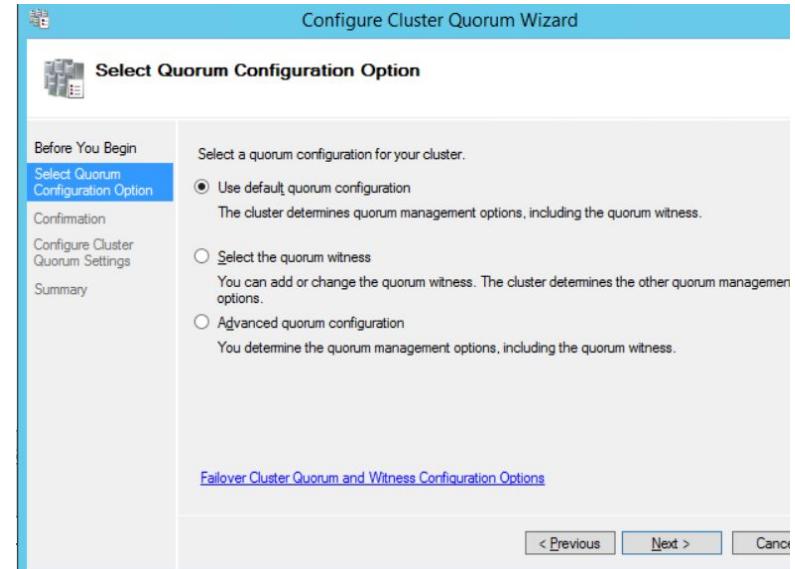
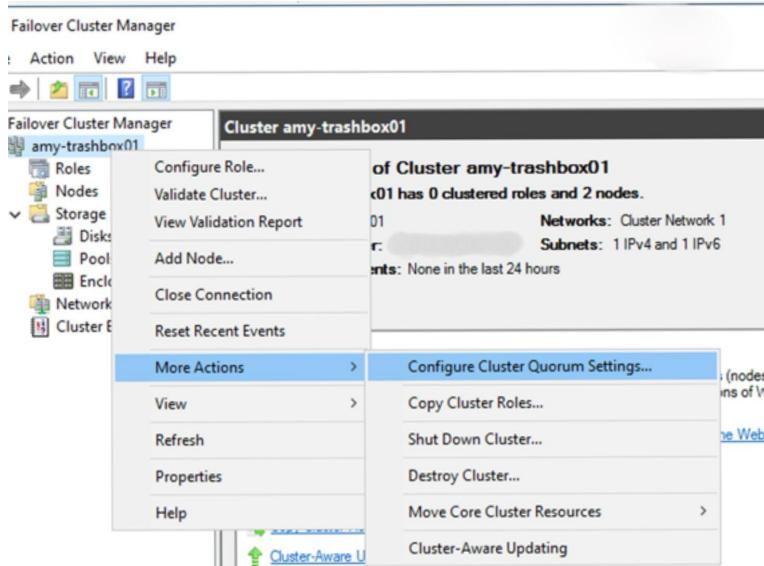




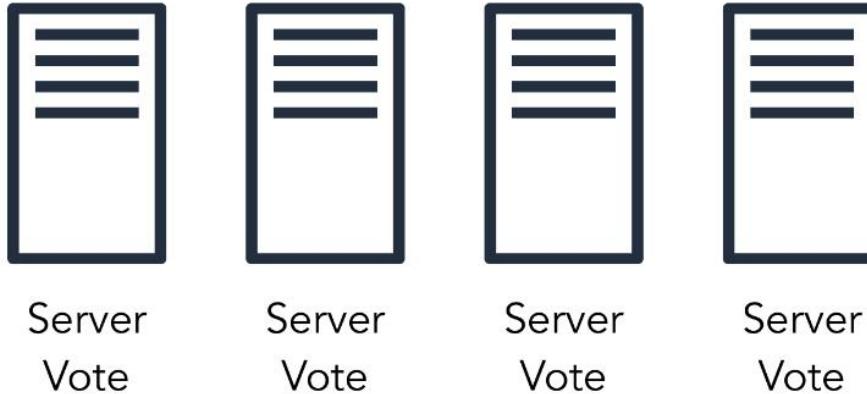
**PREVENTION  
IS BETTER THAN  
CURE!**

## **Split-Brain Prevention**

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# Quorum Configuration



## Example of a Node Majority Vote

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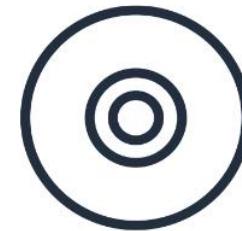
Server  
Vote



Server  
Vote



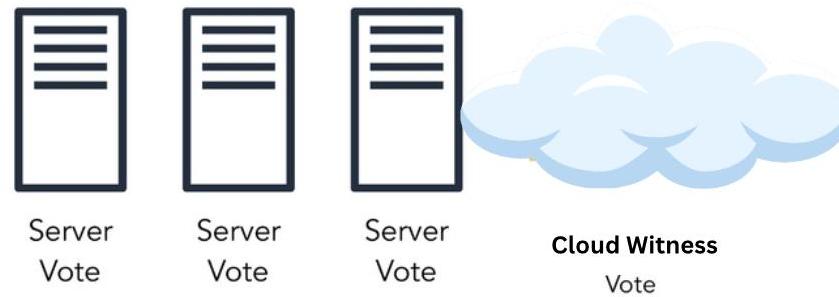
Server  
Vote



Disk  
Vote

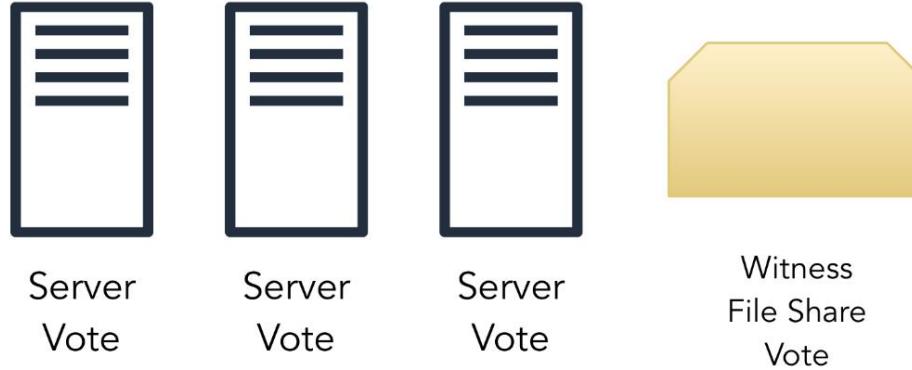
## Example of a Node and Disk Majority Vote

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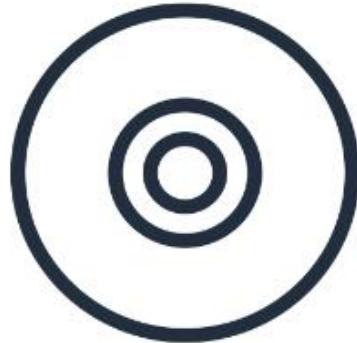
## Example of a Node and Cloud Share

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## Example of Node and a File Share Witness Majority

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Disk  
Vote

## **Example of No Majority – Disk Only**

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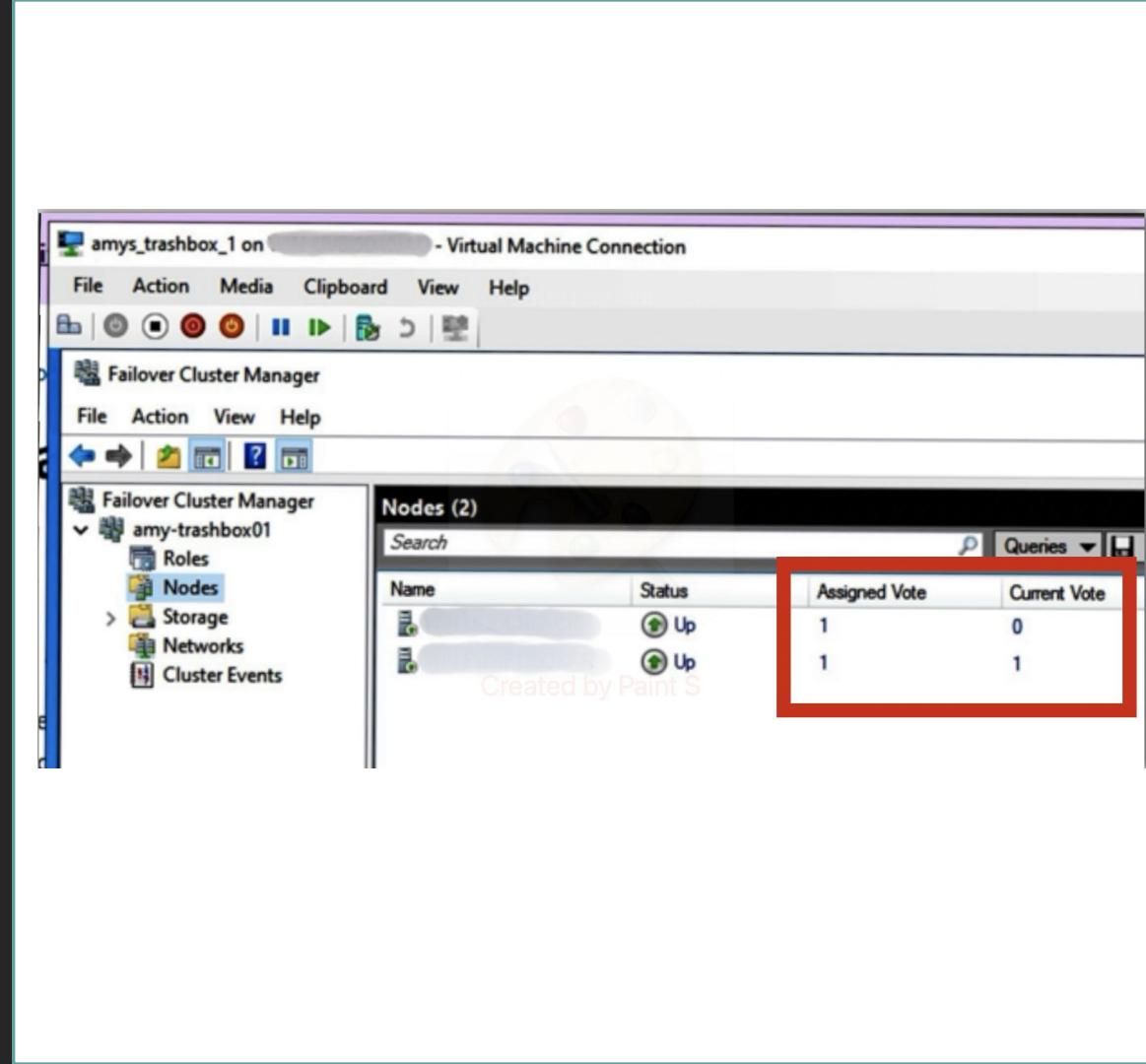
# Dynamic Quorum

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# Node Voting

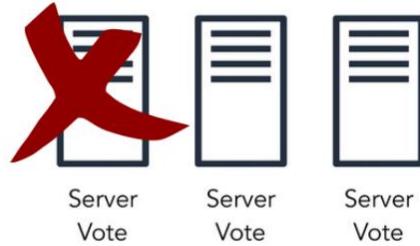
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- Configure Node Voting
- Node Participation In Quorum Calculation
- Consider Disk Or File Share



# WITHOUT DYNAMIC ON

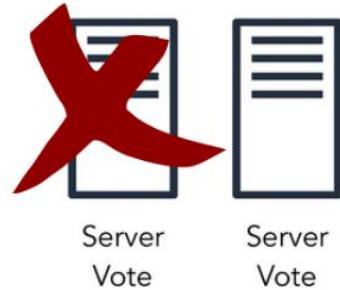
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2 votes

# WITHOUT DYNAMIC ON

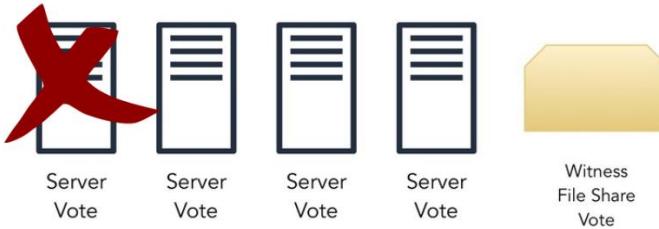
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CLUSTER IS DOWN

# WITH DYNAMIC ON

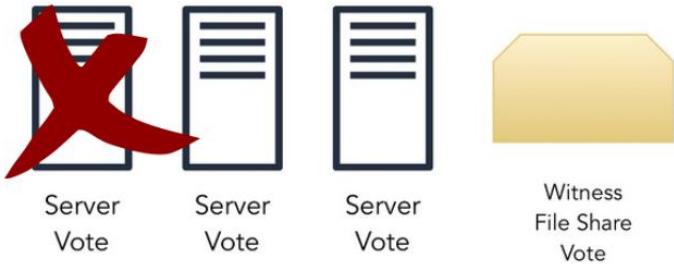
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3 votes

# WITH DYNAMIC ON

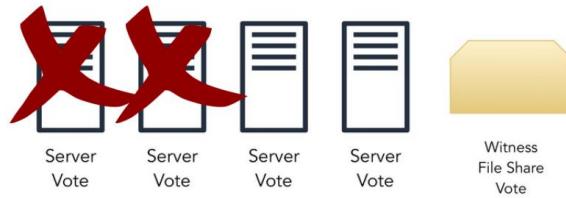
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3 votes

# WITH DYNAMIC ON

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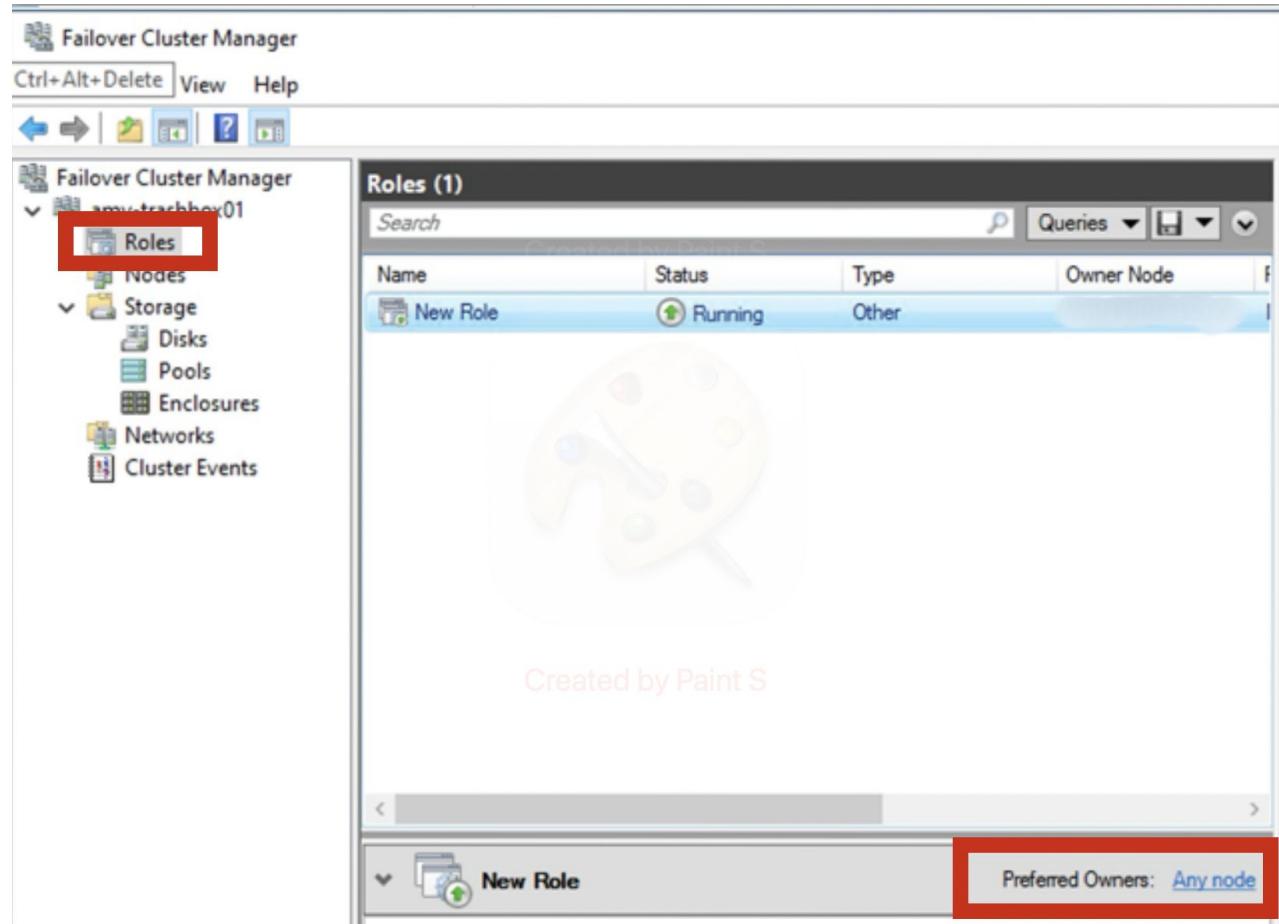


3 votes

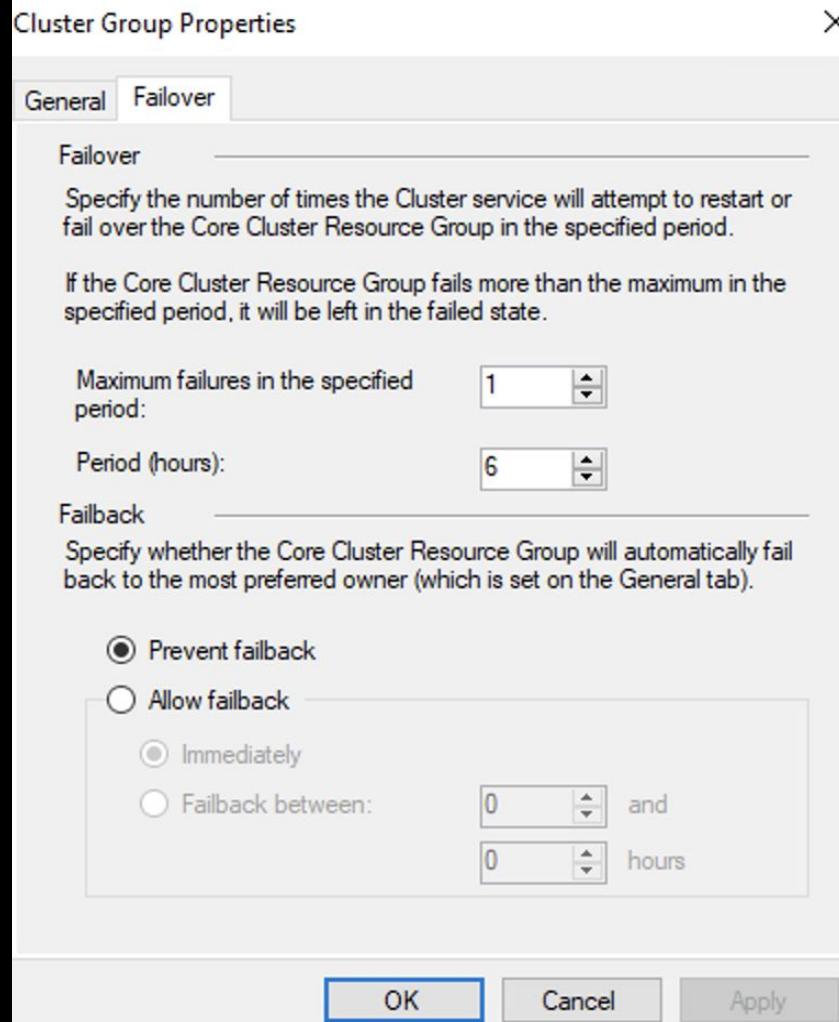
**Always  
Make Sure  
To Have  
An Odd  
Number Of  
Votes**



# Preferred Owner Settings



# Automatic Failover Settings



# Monitoring



# Testing



# Documentation and Training



WideWorldImporters - 11/22/2017 12:32:41 PM - Vulnerability Assessment - Microsoft SQL Server Management Studio

File Edit View Project Debug Tools Window Help

New Query Generic Debugger

Object Explorer

Connect

(SQL Server 13.0.1728.2 - db-scan-user)

Databases

- System Databases
- Database Snapshots
- database1
- database2
- WideWorldImporters

Security

- Server Objects
- Replication
- PolyBase
- Always On High Availability
- Management
- Integration Services Catalogs
- SQL Server Agent (Agent XPs disabled)
- XEvent Profiler

Vulnerability Assessment Results

sql2016: WideWorldImporters

at 11/22/2017 12:32:41 PM

Total security checks: 54 ✓ Total failing checks: 6 ✗

Risk Summary:

- High Risk: 2 (Red)
- Medium Risk: 3 (Orange)
- Low Risk: 1 (Blue)

Learn more: SQL Security Center | Best Practices for SQL Security

Failed (6) Passed (48)

ID	Security Check	Category	Risk	Additional Information
VA1020	Server principal GUEST should not be a member of any role	Authentication and Authorization	High	
VA1245	The dbo information should be consistent between the target DB and mas	Surface Area Reduction	High	
VA1285	Sensitive data columns should be identified	Data Protection	Medium	No baseline set
VA1044	Remote Admin Connections should be disabled	Surface Area Reduction	Medium	
VA1219	Transparent data encryption should be enabled	Data Protection	Medium	
VA1282	Orphan roles should be removed	Authentication and Authorization	Low	



# Regular Maintenance

# Key Considerations

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# Design Considerations

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# Factors

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- Cost
- SLA Agreements
- Recovery Objectives
- Version Of SQL Server
- Multi-region Clusters
- Owners
- One File Witness At A Time





## Part 2- Investigation

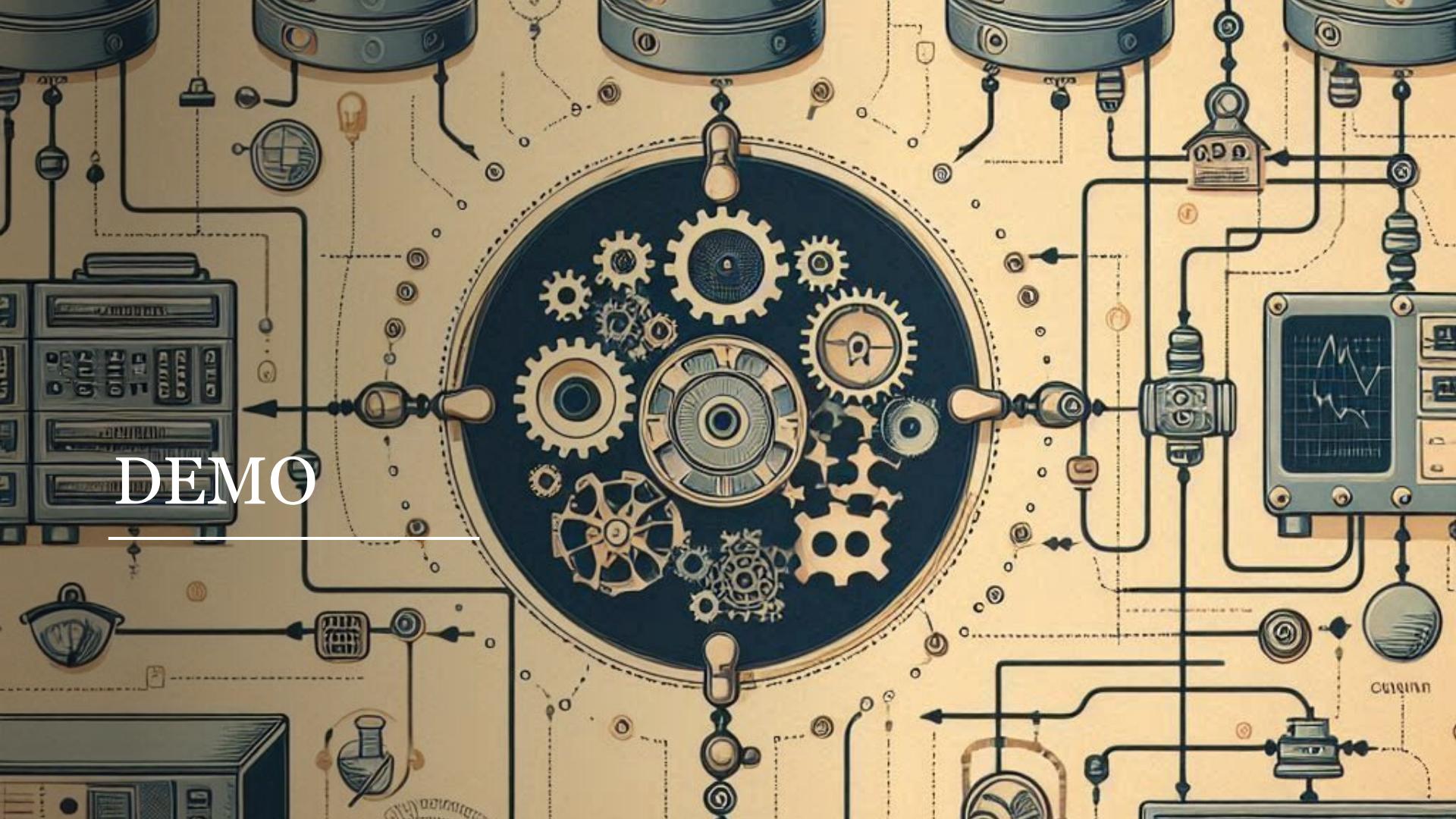
# Final Thoughts

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- Use A Tie Breaker
- Review Configurations
- Set Up Monitoring
- Investigate Cost
- Review Budget
- Create Documentation
- Test All Scenarios



DEMO



Q&A



# EIGHTKB

SQL SERVER INTERNALS CONFERENCE

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<https://www.linkedin.com/in/amy-abel/>

Thank You |