Virtualize FCI and AGs

What to know before you decide

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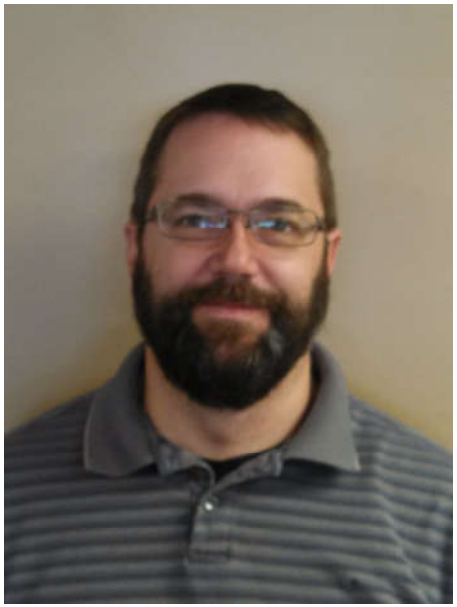
About Me



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- SQL Server Principal Architect, practice lead
- Experience in VMware, Microsoft, SQL Server, storage infrastructure, performance tuning.
- Been working with SQL sever since 6.5 in 1996.
- Speaks at many events including Pass Summit, VMworld, SQL Saturdays, local user groups and virtual chapter meeting

About HoB

- Founded in 1998
- Focus on Business Critical Apps - Oracle, Microsoft, VMware, and Cloud
- House of Brick Services:
  - Oracle and MS license review, optimization, & audit defense
  - Application re-platforming and data migration
  - Virtualization of business critical applications
  - HA, DR, and private cloud architectures

Agenda

- Uber short description of virtualization
- Why failover cluster instances
- VMware settings to know
- Storage options – quorum and data drives
- AlwaysOn
- DR considerations

Introduction

- Will cover VMware mostly, but some Hyper-V
- Will not be discussing how to build WSFC, FCI, or AGs, but will focus instead on the impacts of running the same cluster on virtual machines
- The presentation is designed to be 45 minutes long, to allow for questions
- Ask questions

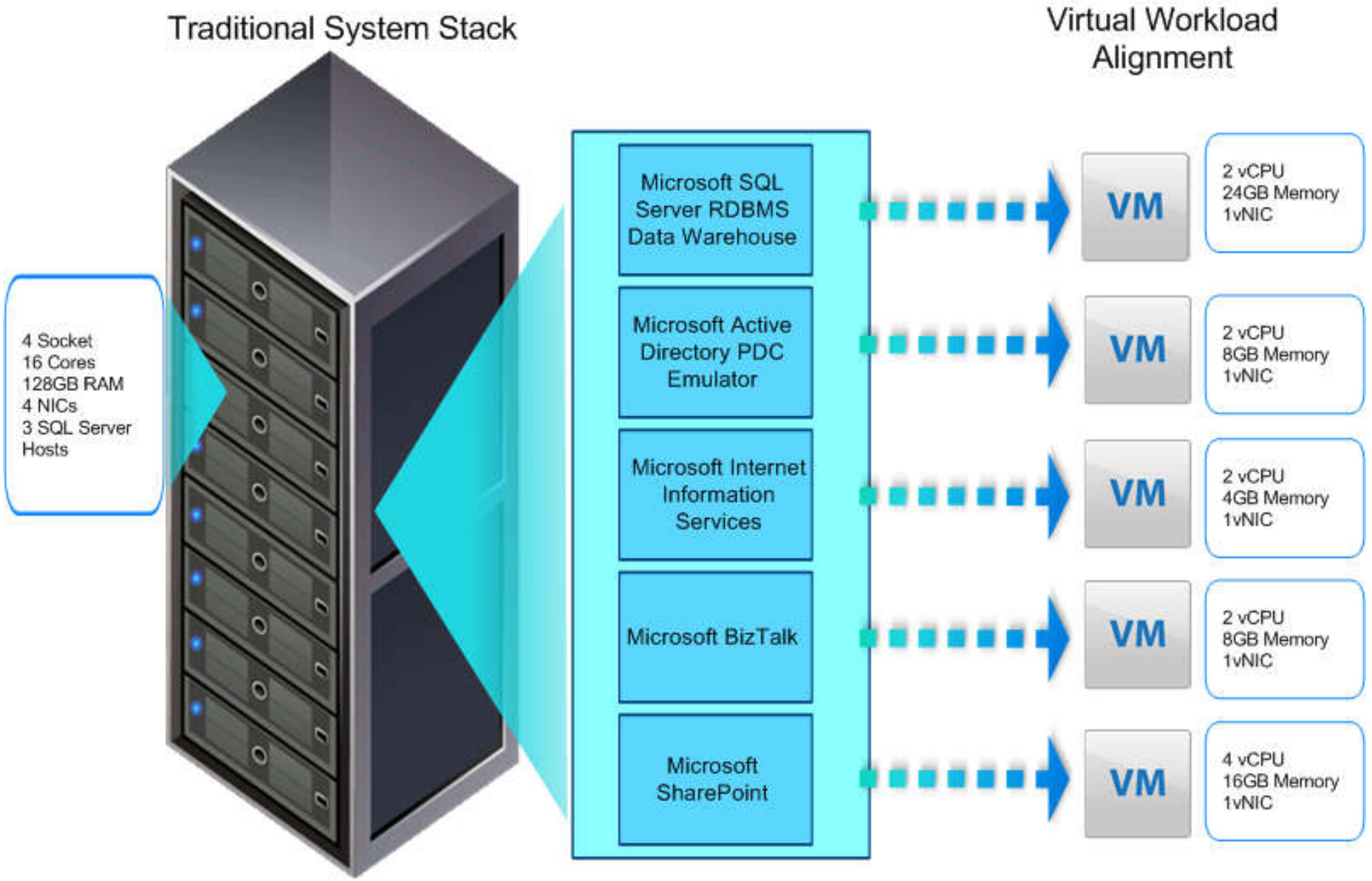
Terminology

- Always On vs AlwaysOn
- Cluster, can mean Hyper-V, VMware, or SQL Server
- WSFC – Windows Failover Cluster Services
  - FCI and AGs both rely on WSFC
- FCI – Failover Cluster Instance
- AGs – Availability Groups
  - Basic Availability Groups – Standard Edition feature in SQL Server 2016
- SQL – Structured Query Language
- SQL Server – Microsoft's Database Platform, what we are hear to learn about

Why Virtualize Everything?

- IT can now move at the speed of business!
- Increased flexibility and agility
- Cost optimization
- High Availability / Disaster Recovery Optimization
- Product Release Cycle Optimization
- Standardization
- Firmware
- Dynamic Capacity and Scalability
- Isolation and Security (Atomic Model)

Atomic Workloads



Failover Cluster Instances vs. VMware HA

Four FCI evaluation criteria:

- Less than four minute MTTR?

  then

- Rolling maintenance utilized
- Cluster-aware middle tier?
- Does technical expertise exist to support FCI & AGs?

Criteria answers = "Yes"

- AGs with VMware HA
- FCI SQL Server with VMware HA

Otherwise

- Other options exist

Review of High Availability

- HA isn't HA
- Multiple areas to consider

	VMware HA	Hyper-V HA	SQL FCI	AGs	VMware FT*
Hardware failure	4 min	4 min	30 seconds - 3 minutes	30 seconds	None
Rolling patching	No	No	Yes	Yes	No
OS corruption	No	No	Yes	Yes	No
Storage redundancy	No	No	No	Yes	Yes
Complexity	Simple 4 clicks	Medium	Very	Very	Simple 3 clicks
Limits	None	None	None	None	4 cores

*VMware FT is only included for vSphere 6.0 and above.

Virtual Failover Cluster Instances

- Adding another layer of complexity to an already complex configuration
  - Another group involved in troubleshooting issues, possible more finger pointing
- Can be a mix of physical and virtual machines

- SQL server FCI is easier on top of Hyper-V clustering than on top VMware, mostly due to storage presentation
- Storage is typically the most difficult design point for virtual WSFC
- Maximum of 5 nodes for VMware, for Hyper-V OS limits

Quorum Options

- Is there a difference for how the quorum works?
  - NO
- Quorum disk
- File share witness
  - Doesn't require a shared disk for the quorum
- Node majority
  - Also doesn't require a shared disk for the quorum
- Those not requiring a shared disk are easier to setup
- WSFC is harder to setup than FCI

Virtual Storage Presentation

- Virtual Machine Disk (VMDK/VMFS), Fixed VHDX
  - Preferred for Tier-1
  - Maximum ESXi-level and Hyper-V storage tooling
  - VMDK does not work with FCI, unless CIB
- RDM-P
  - Maximizes SAN-level tooling transparency
  - Even less ESXi-level storage tooling
  - No snapshots or vMotion
- Direct-mounted (In-guest iSCSI or SMB)
  - No ESXi-level storage tooling, no Hyper-V storage tooling
  - vMotion works, Live Migration works

Storage

	Microsoft Clustering on VMware	vSphere support	VMware HA support	vMotion DRS support	Storage vMotion support	WSFC Node Limits	Storage Protocols support						Shared Disk	
							FC	In-Guest OS iSCSI	Native iSCSI	In-Guest OS SMB	FCoE	NFS	RDM	VMFS
Shared Disk	WSFC with Shared Disk	Yes	Yes[1]	Yes[5]	No	5	Yes	Yes	Yes	Yes[4]	Yes	No	Yes[2]	Yes[3]
	Exchange Single Copy Cluster	Yes	Yes[1]	Yes[5]	No	5	Yes	Yes	Yes	Yes[4]	Yes	No	Yes[2]	Yes[3]
	SQL Clustering	Yes	Yes[1]	Yes[5]	No	5	Yes	Yes	Yes	Yes[4]	Yes[8,9]	No	Yes[2]	Yes[3]
Non shared Disk	Network Load Balance	Yes	Yes[1]	Yes	Yes	Same as OS/app	Yes	Yes	Yes	N/A	N/A	No	N/A	N/A
	Exchange CCR	Yes	Yes[1]	Yes	Yes	Same as OS/app	Yes	Yes	Yes	N/A	N/A	No	N/A	N/A
	Exchange DAG	Yes	Yes[1]	Yes	Yes	Same as OS/app	Yes	Yes	Yes	N/A	N/A	No	N/A	N/A
	SQL AlwaysOn Availability Group	Yes	Yes[1]	Yes	Yes	Same as OS/app	Yes	Yes	Yes	N/A	Yes[7]	Yes[6]	N/A	N/A

http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1037959

In-Guest Notes

- No NFS
- SMB only works with SQL 2012, but not for FCI without a work around
- SQL 2014+ will work with SMB with FCI
  - Works with SMB 2.1
  - Ensure the storage system can support SMB 3.02
- You can use cluster shared volumes with SQL 2014
- iSCSI works well and has for many years

Moving a virtual machine

- vMotion and Live Migration both work to move FCI nodes
  - Must be on vSphere 6.x or higher to work on VMware
- On high performance SQL Server minimize the movements
- Both technologies have a governor feature to allow the migration to complete
- Ensure dedicated and fast networking on migration networks
  - vMotion network
  - Live Migration network
- Migration networks should be dedicated

FCI Impact to VMware

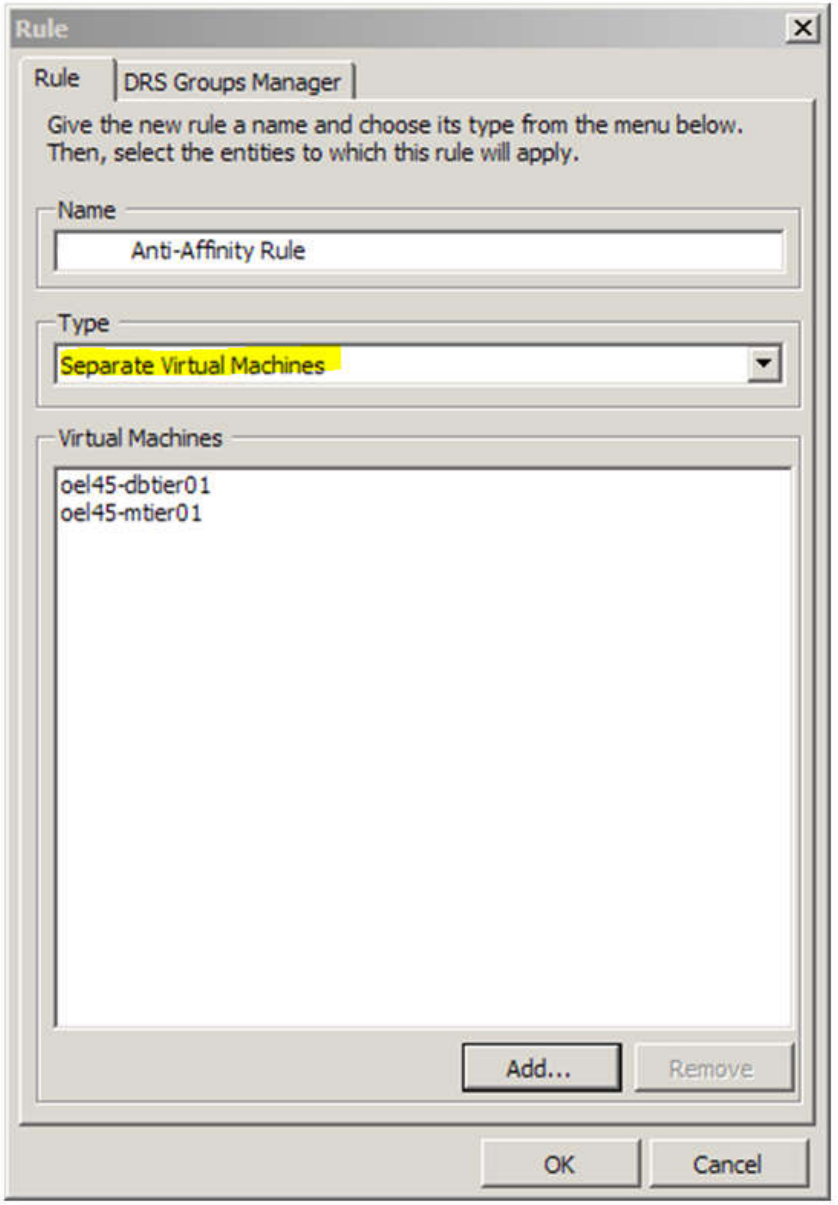
- The VMware admins have a large tool box for managing the environment, some of these features are removed when you create SQL clusters
- Cannot vMotion SQL cluster nodes until vSphere 6, all hot add features or drive growths cannot occur
- RDM-P prevents storage vMotion, can no longer balance storage usage on the fly
- RDMs are not compatible with snapshots, changes virtual backup rules, ability to rollback patches
- Cannot use vFlashCache, vSAN, or other caching tools to improve IO read performance and multiple new items in vSphere 6
- Adds more administrative work to VMware admins

VMware Settings

- Remove FCI nodes from DRS
- Create anti-affinity rules for SQL server cluster nodes
- Create all disks using EagerZeroThick
- All RDMs should be on a separate SCSI controller, LSI Logic not the VMware Paravirtual Controller
- Use perennially reserved RDMs, VMware KB1016106
- Add the additional SCSI controller before adding networking
- VMware HA should be enabled
- All the same best practices for virtual SQL servers exist

DRS Rules

- Remove cluster nodes from DRS, or create anti-affinity rules for SQL server cluster nodes



FCI Impacts to Hyper-V

- Remove nodes from Performance Resource Optimization (PRO)
  - Part of System Center VMM
- Setup Anti-Affinity rules
- Use fixed VHDX disks
- Multiple controllers, spread out the load
- Can use in guest fibre channel

WSFC Settings

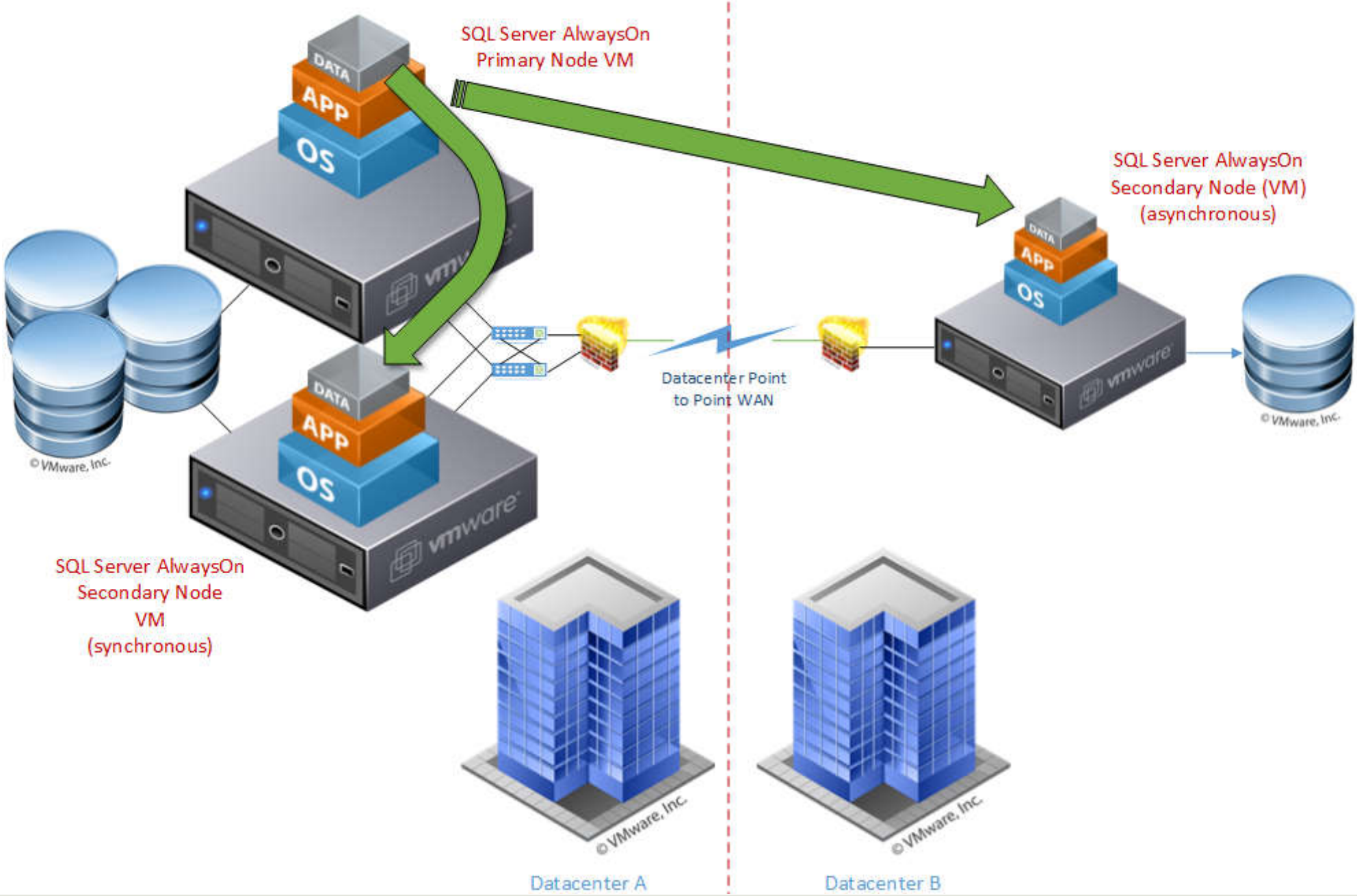
- Microsoft recommends increasing the timeout for SQL Server FCI on a Hyper-V cluster
- VMware does not have a statement either way, but most people recommend following the MS configuration for a virtual FCI
- For more details read this post http://blogs.msdn.com/b/clustering/archive/2012/11/21/10370765.aspx

Parameter	Fast Failover (Default)	Relaxed	Maximum
SameSubnetDelay	1 second	1 second	2 seconds
SameSubnetThreshold	5 heartbeats	10 heartbeats	120 heartbeats
CrossSubnetDelay	1 second	1 seconds	4 seconds
CrossSubnetThreshold	5 heartbeats	20 heartbeats	120 heartbeats

AlwaysOn Availability Groups

- AlwaysOn + VMware = Complementary technologies
- Blurs line between HA and DR
- Best of MS-FCI and Mirroring
- Watch your licensing
- Can use VMFS and VMDKs
- All rules for AlwaysOn physical still apply, nothing changes
- Still need the anti-affinity rules so two nodes do not run together

HA/DR with AlwaysOn



DR Consideration

- Virtualization provides additional DR options
- The VM is just a collection of files
  - Multiple technologies to replicate live/near live virtual machines
- Can make DR the infrastructure team's problem now (you still have to be involved to trust)
- Now you can have your database server replicated using the same method as middle-tier, and application servers
- AlwaysOn, can just live at the DR site and be async

DR Recovery

- Depending upon what the method of recovery may be:
  - Crash consistent
    - Same way as failover clustering works today
  - Backup consistent
    - Same way as a reboot will work
- Storage replication
  - Need to ensure logs and data are in sync if using snapshots

Conclusions

- You *can* virtualize your SQL server clusters
- You *should* review your business rules to see if you can simplify your environment, no clustering
- Storage decisions is the largest decision
- Architect for atomicity, agility, performance, and scalability
- Follow these guidelines, and your FCI or AG virtualization initiative will succeed!

Questions

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