Understanding Storage Types Suitable for SQL Server Workloads

Glenn Berry

PRINCIPAL CONSULTANT

@GlennAlanBerry www.sqlskills.com/blogs/glenn

Module Summary

Different types of storage that are commonly used for SQL Server

Strengths and weaknesses of each type of storage

Considerations for getting best performance from each type of storage

SQL Server Storage Types

Many different types of storage are commonly used by SQL Server

Internal SAS/SATA drives

PCIe Flash-based AIC storage cards

Direct-Attached Storage (DAS)

Storage Area Network (SAN)

SMB 3.0 file shares

Scale-Out File Servers (SOFS)

Storage Spaces Direct (S2D)

Internal SAS/SATA Drives

Can be more than adequate for many workloads, especially when flash-based

Can be very well suited for AlwaysOn AG node storage

Make sure to use the best hardware RAID controller available and that cache is enabled

Direct-Attached Storage (DAS)

External storage enclosure with 14-24 SAS/SATA drives

Try to dedicate at least one RAID controller to each storage enclosure

Easy to configure and manage and suited to AlwaysOn AG node storage

Can provide excellent sequential read/write performance, only limited by PCIe slot bandwidth

DAS Considerations for Good Performance

Use best RAID controller(s) possible

Make sure RAID controller is in an appropriate slot

Make sure hardware cache is enabled

Try to dedicate hardware cache to writes

SQL Server buffer pool is a better read cache

Storage Area Network (SAN)

Shared external storage enclosure with multiple components

High initial capital cost, requires training and expertise to set up and manage

SANs are usually optimized for IOPS so don't do as well for latency or sequential throughput

Shared SAN performance tends to be inconsistent

SANs are not magic...

SAN Considerations for Good Performance

Make sure to give specific performance requirements to SAN Administrator

Consider complete data path between host and SAN

Consider moving tempdb to host if warranted by workload

PCIe Flash-based AIC Storage Cards

Flash-based storage on a PCIe expansion card, capable of extremely high performance

Newer products using Non Volatile Memory Express (NVMe) protocol have even better performance

Lower latency, higher sequential bandwidth, and more IOPS than SAS/SATA devices

Server Message Block (SMB) 3.0 File Shares

Fully supported with SQL Server 2012 and Windows Server 2012 or newer

Requires network adapters that support Remote Direct Memory Access (RDMA)

Provides an alternative to a SAN for shared storage, using Scale-Out File Servers (SOFS)

Windows Server 2016 has many improvements, including Storage Spaces Direct (S2D)

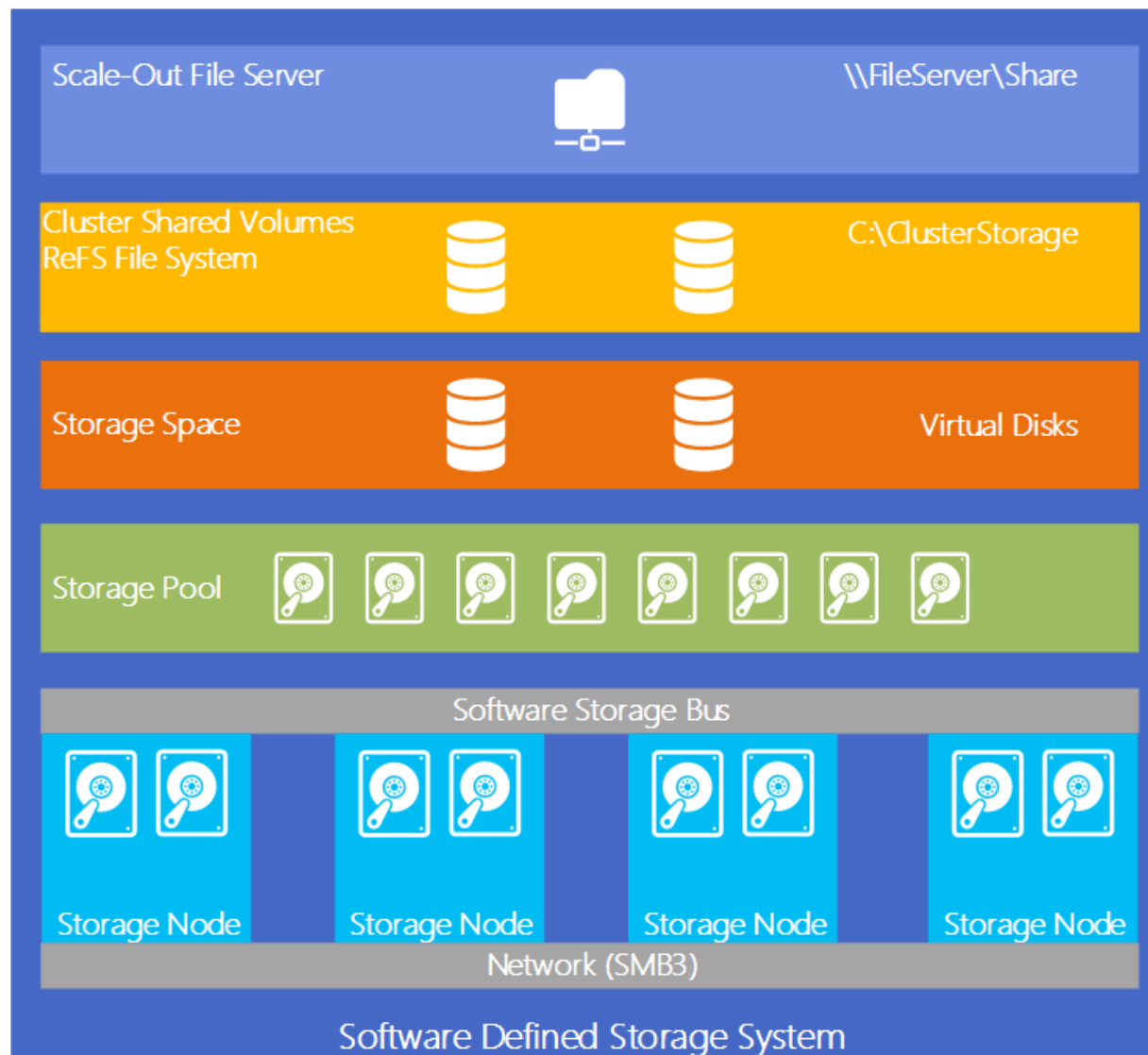# Storage Spaces Direct in Windows Server 2016

Software-defined storage that is highly available and scalable for Hyper-V and SQL Server

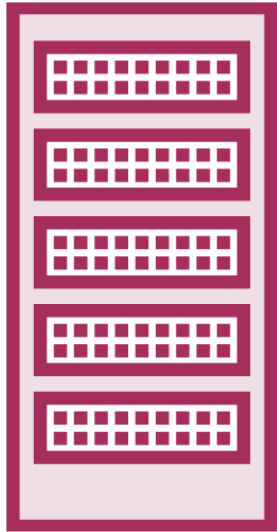Uses commodity file servers with lower cost SAS/SATA drives (magnetic or flash)

Can use hybrid storage configurations (NVMe, SATA SSD, SATA HDD)

Uses Ethernet/RDMA network as storage fabric

Storage Spaces Direct Architecture

S2D Hardware File Server Requirements

Homogenous server configuration, 4-16 file servers in a storage cluster

Two-socket, Intel E5-2600 v3 or newer

10GbE or better, RDMA capable NIC

Minimum two caching devices, four capacity devices in each storage node

RAID controllers not supported

What We Covered

Different types of storage that are commonly used for SQL Server

Strengths and weaknesses of each type of storage

Some considerations for getting best performance from each type of storage