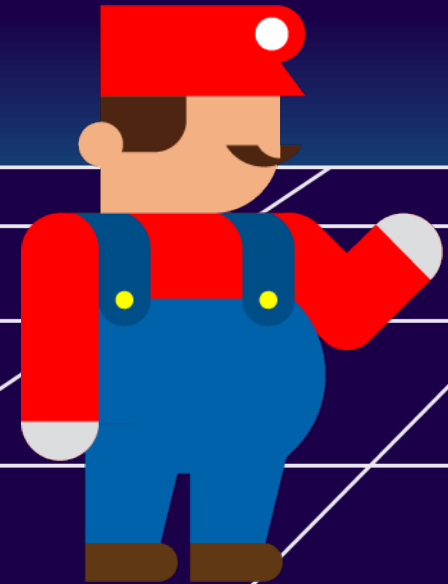


LET'S TALK STORAGE

ANTHONY E. NOCENTINO
(HE/HIM)
@NOCENTINO

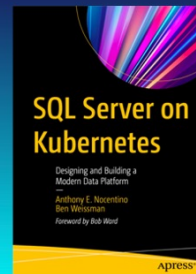
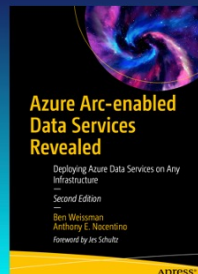


sqlbits



ANTHONY E. NOCENTINO

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PLURALSIGHT



PURE
STORAGE

EIGHTKB

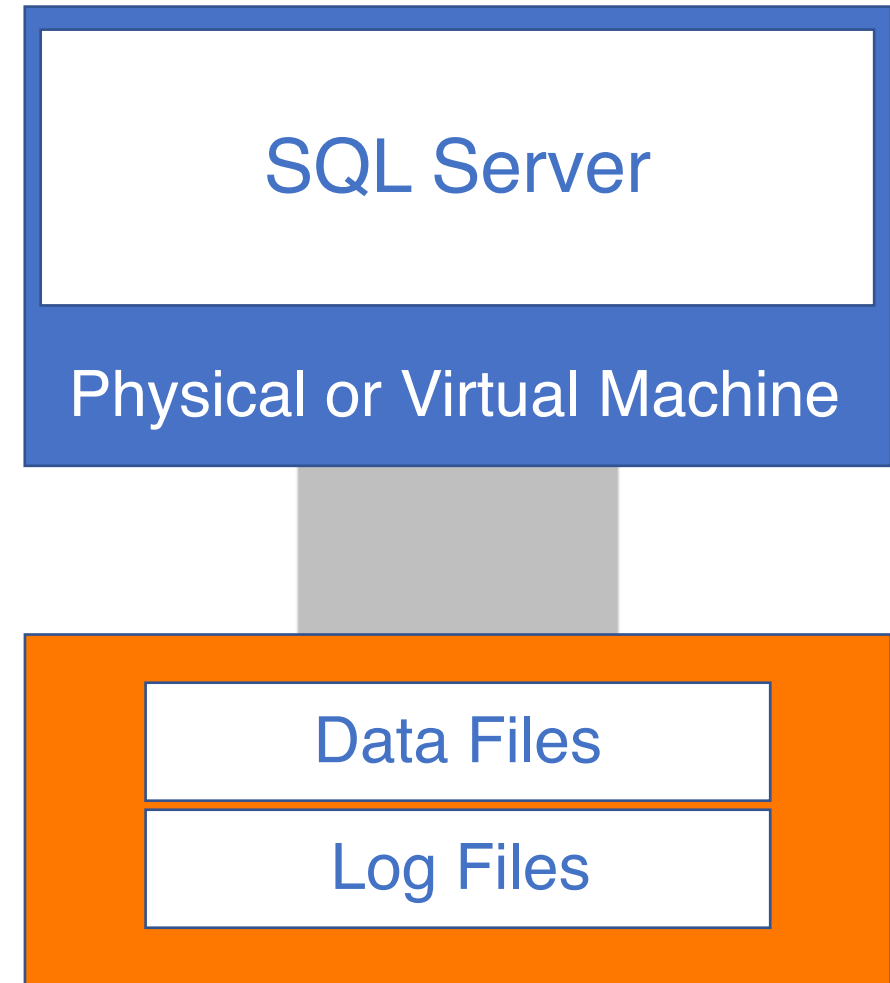


Agenda

- Storage is Where Data Lives
- Protocols and Interconnects
- Key Performance Metrics and Why Database Care
- Database Files, Transaction Log Files, and File Systems
- A Closer Look at Latency
- Hypervisors
- Story Time

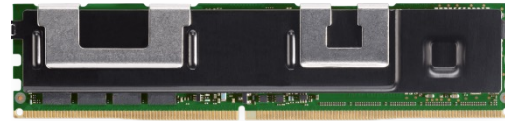
Storage is where data lives...

- SQL Server stores data...
- On disks
 - In files
 - Local
 - SCSI
 - PCIe
- **Remote**
 - Fibre Channel
 - iSCSI
 - NVMe-oF



Protocols, Interconnects and Storage Devices

- SCSI
- SATA
- Fibre Channel
- iSCSI
- NVMe
- NVMe-oF



Key Performance Metrics

Latency

How Long a Request
Takes

Transaction Log I/Os

Saturation Leads to
Queuing

Throughput

Amount of data moved

Function of the storage
interconnect

Type of storage used

IOPs

Number of Requests

Size Depends on the
Application

Why Database Systems Care About These...

Latency

Does your system sell things?

Is your system time sensitive?

OLTP

Throughput

Does users need reports?

Backups?

OLAP

IOPs

Larger Requests Take Longer

Often governed in Cloud and On Premises

Data Files, Transaction Log Files and Filesystems

- **Database files**

- Read and write, varying IO sizes and latencies
- Multiple files, potentially across multiple volumes

- **Transaction log files**

- Low latency, only one (sometimes)
- 2TB max

- **TempDB**

- Read and write, varying IO sizes and latencies
- Multiple files, local storage or remote?

But What about
64KB NTFS AUs?

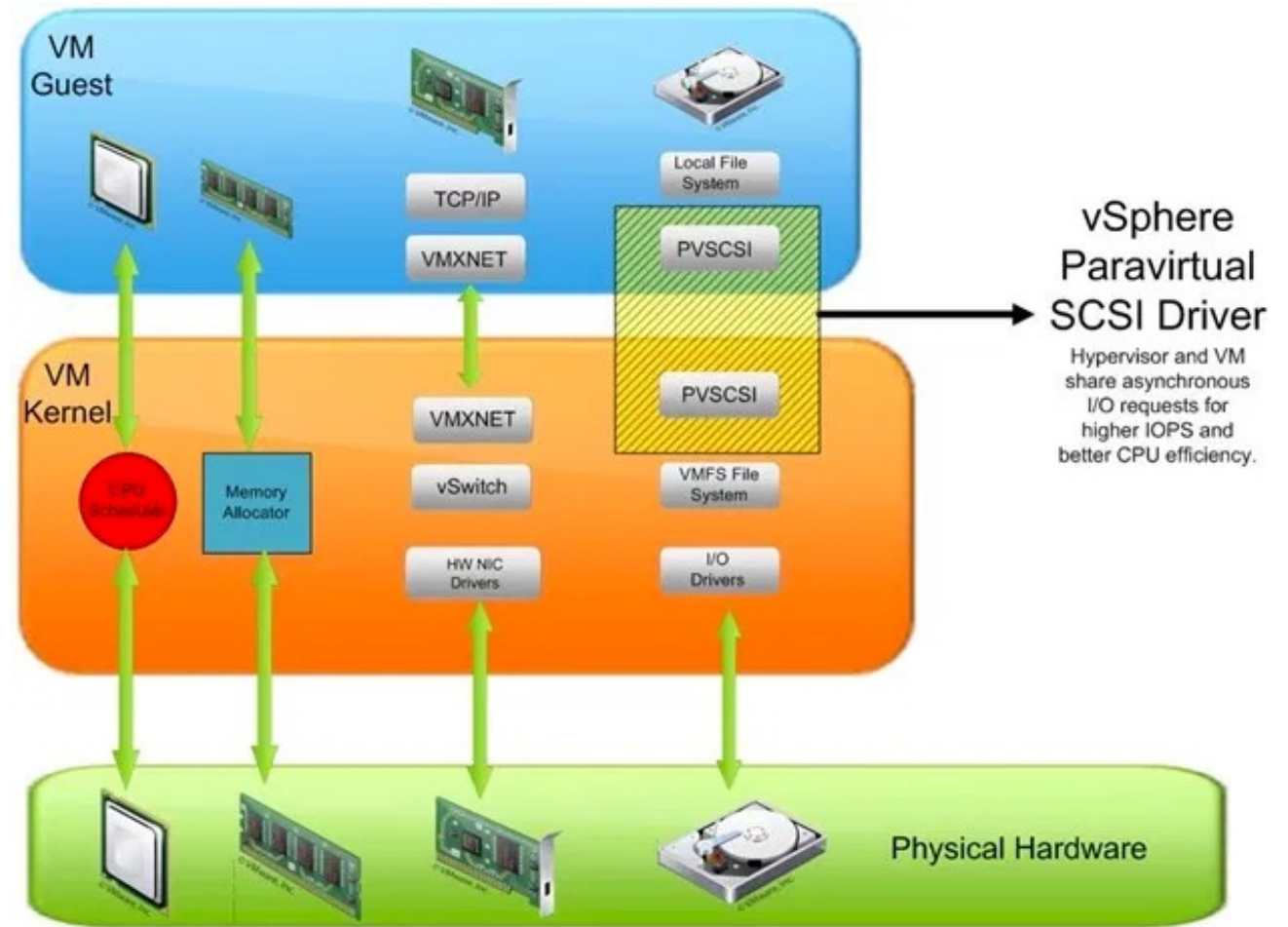
Let's Look Closer...at Latency

- Monitor Latency
- **`sys.dm_io_virtual_file_stats`**
- Average per file since instance startup
- Have a monitoring tool...

<https://www.nocentino.com/posts/2021-10-06-sql-server-file-latency/>

Hypervisors

- VMware
- Hyper-V
- Red Hat
- Others



Design by: Scott Sauer

<https://www.nocentino.com/posts/2021-09-27-sqlserver-vms-best-practices/>

Story Time...

**Line of Business
Application**

37 Second Page Load Times

App Vendor

Web Servers

Web Server Config

DBAs

SQL Servers

**High File and Disk
Latency**

VM Admins

Hypervisor

High Disk Latency

Network Team

**Storage
Interconnect**

**No Meaningful
Metrics**

Storage Team

Storage

**Super Low
Latencies**

Review

- Storage is Where Data Lives
- Protocols and Interconnects
- Key Performance Metrics and Why Database Care
- Database Files, Transaction Log Files, and File Systems
- A Closer Look at Latency
- Hypervisors
- Story Time

Need more data?

- **Contact me!**
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 - **GitHub:**
<https://github.com/nocentino/Presentations>
 - **Blog:** www.nocentino.com
- **Pluralsight** - Hit me up to get free access
 - Linux
 - Kubernetes
 - Azure



<https://sqlb.it/?7322>