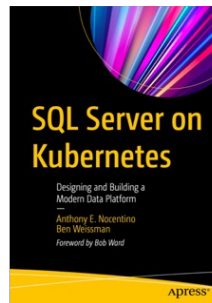
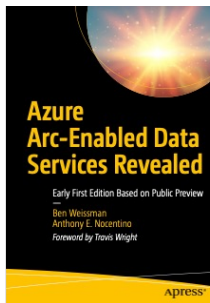


Architecting for High Performance SQL Server on Virtual Machines

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I'm glad you're here...



Agenda

- It's all about the hardware
 - But really, it's all about the software
 - Virtual Machine Configuration
 - SQL Server
 - Case Studies
- 

Assumptions

- You know what a virtual machine is
- You're not in charge of your VMware Environment
- You're most likely a DBA
- Focusing on Windows
- No demos, but lots of stories

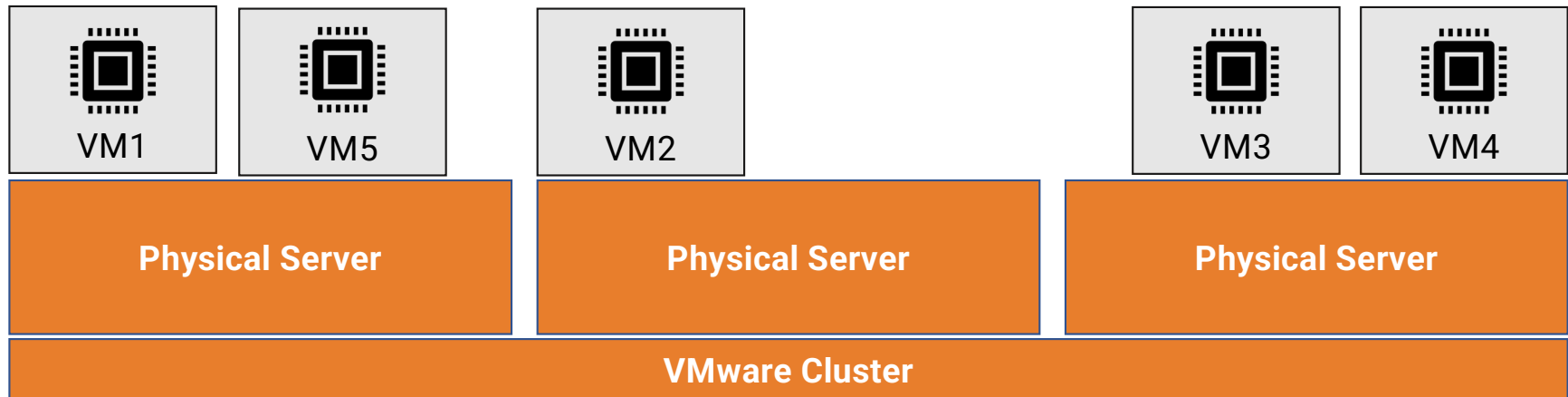


But Anthony...you love containers....why VMs?

- In my experience...
 - About 90% of production workloads are on Vmware
 - SQL Server on Linux and containers primarily Dev/Test/CI/CD



Let's talk about your VMware environment...



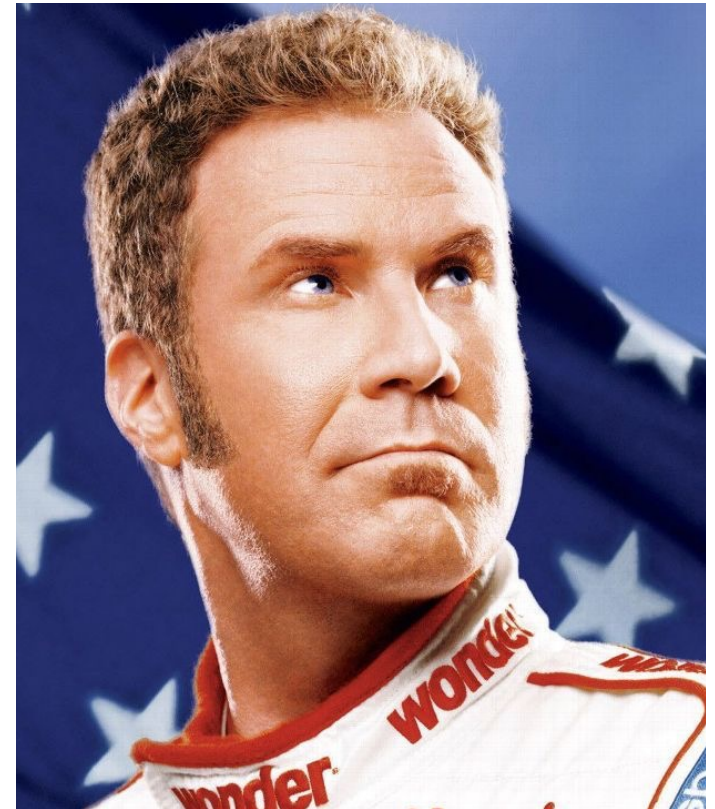
It's all about the hardware

- Have a dedicated cluster for SQL Server
- If you can't...
 - Dedicate a host(s)
 - But if there's a failure make sure there's enough capacity in your cluster
 - Use affinity/anti-affinity rules to separate the workloads...

Bonus Tip: If you're running AGs or FCIs you can use affinity/anti-affinity to keep those VMs off the same hosts

So, you wanna go fast?

- High Performance Power Plan(s)
 - BIOS / UEFI
 - ESX
 - Operating System
 - Windows and Linux
- How fast?
 - In some scenarios 30%

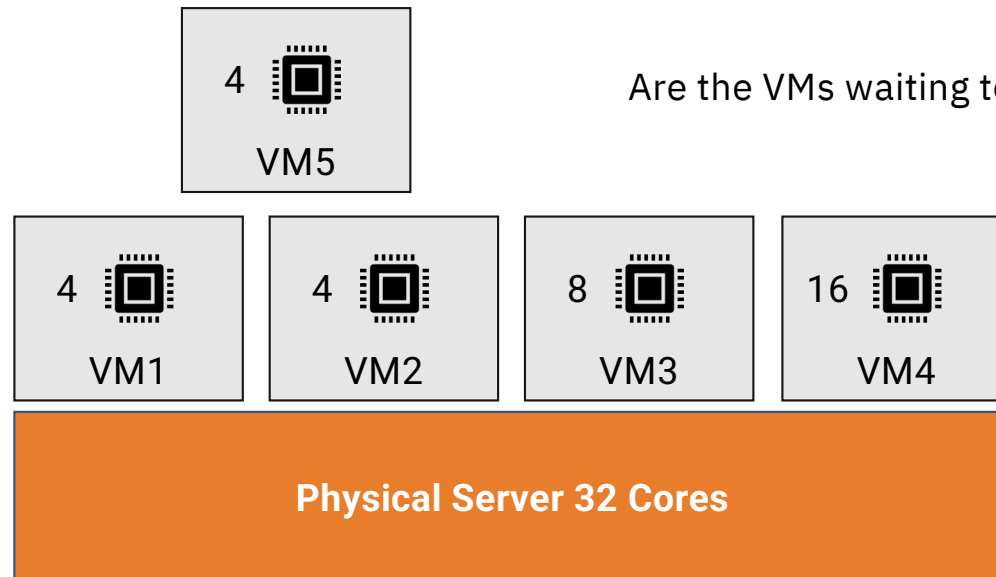


Let's talk about your VM configuration - CPU

Now I have 36 allocated vCPUs

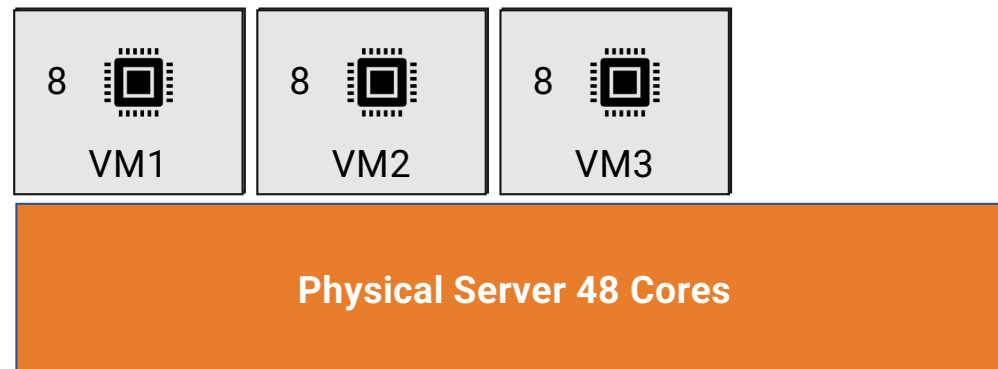
Is this bad?

Are the VMs waiting to get access to the pCPUs?



<https://kb.vmware.com/s/article/2001003>


Story Time - pCPU Over Subscription



vCPU Allocation and Configuration Guidance

- Deploy and measure
- Tier 1 systems – vCPU allocation \leq pCPU
- Don't have too many vCPUs in a VM...bigger isn't better
- Cores per socket
 - SQL Server Standard can only see the first 4 sockets
- Disable CPU Hot Plug – this is free latency

<https://blogs.vmware.com/performance/2019/12/cpu-hot-add-performance-vsphere67.html>



Let's talk about your VM configuration - Memory

What about LPIM?

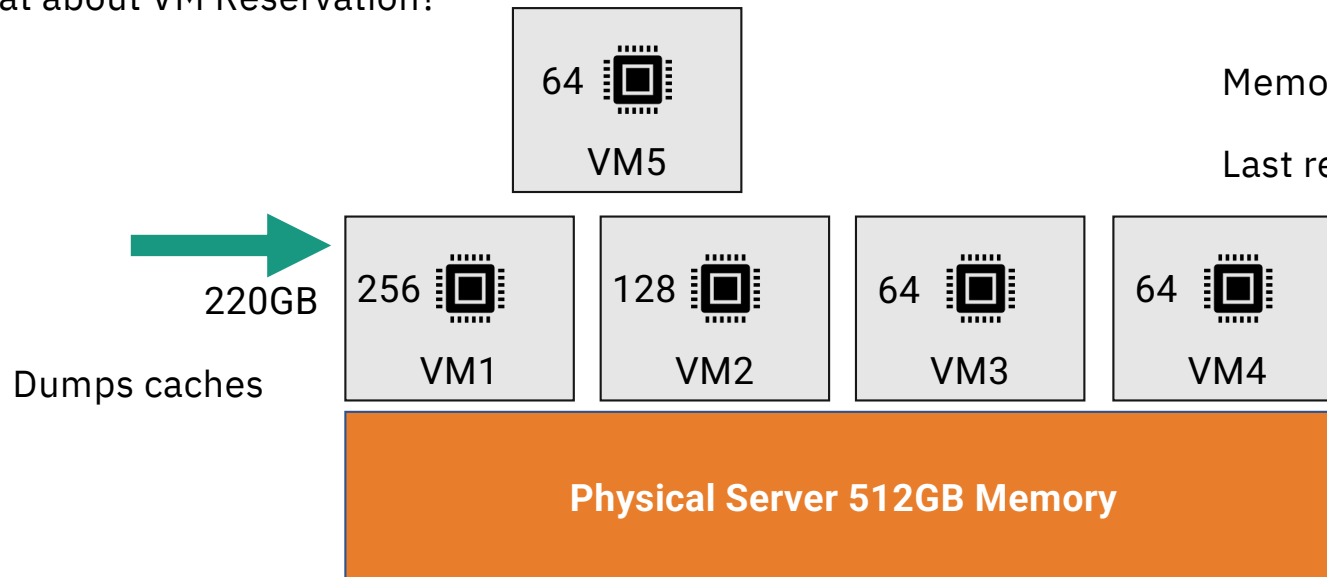
What about VM Reservation?

Now I have 512GB Memory

Is this bad?

Memory ballooning will kick in

Last resort – swapping to disk



Virtual Machine Memory Considerations

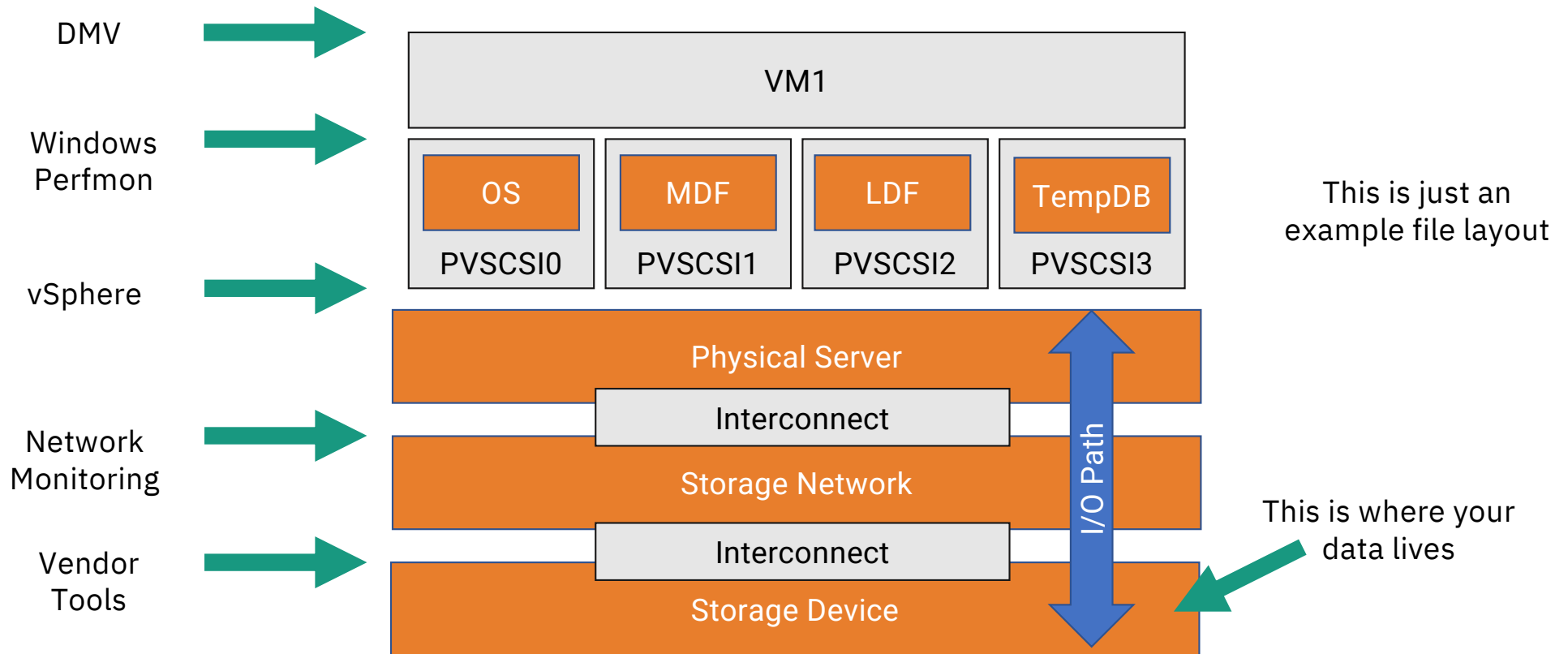
Avoid over-allocation the physical capacity of the host

Consider setting memory reservations to prevent ballooning

Monitor and alert on ballooning



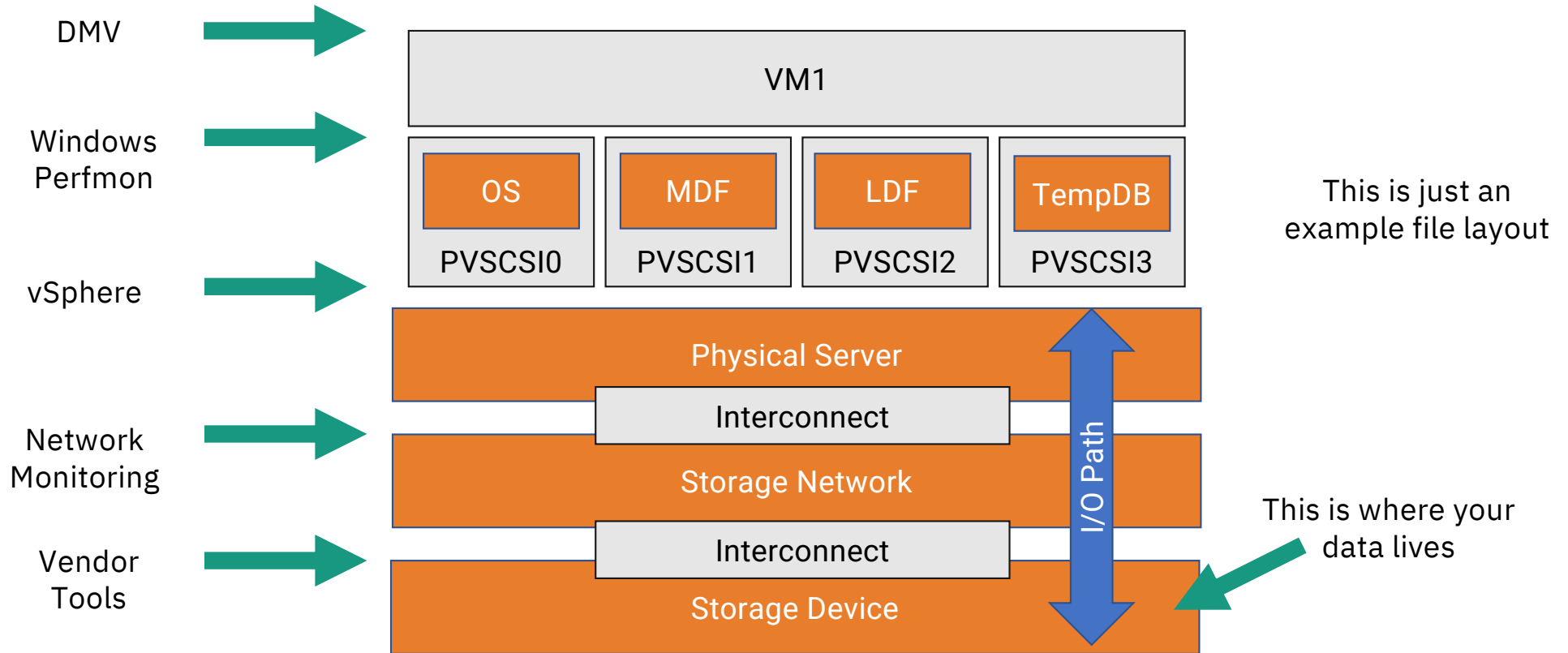
Let's talk about your VM configuration - Disks



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

Story Time - I/O Troubleshooting

Let's talk about your VM configuration - Disks



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

Virtual Disk Considerations

- Virtual disk type (VMFS, RDM, vVols)
- Measure the workload for queuing and latency
 - You may have to re-balance the virtual disks on the PVSCSI
 - You may have to balance out the workload at the file level in SQL

<https://www.codyhosterman.com/2014/07/pure-storage-flasharray-and-re-examining-vmware-virtual-disk-types/>



Windows OS Best Practices for SQL Server

- Instant File Initialization
- Lock pages in memory
- Format volumes with 64KB NTFS AUs
- Set exceptions for Anti-virus
 - MDF, NDF, LDF, and BAK/TRN
- Standardize your drive topology
 - D:\DATA, L:\LOGS, S:\SYSTEM, T:\TEMPDB
 - Mount Points if that's your jam
- Configure the OS swap – 8GB fixed

<https://www.nocentino.com/posts/2021-12-10-sqlserver-io-size/>

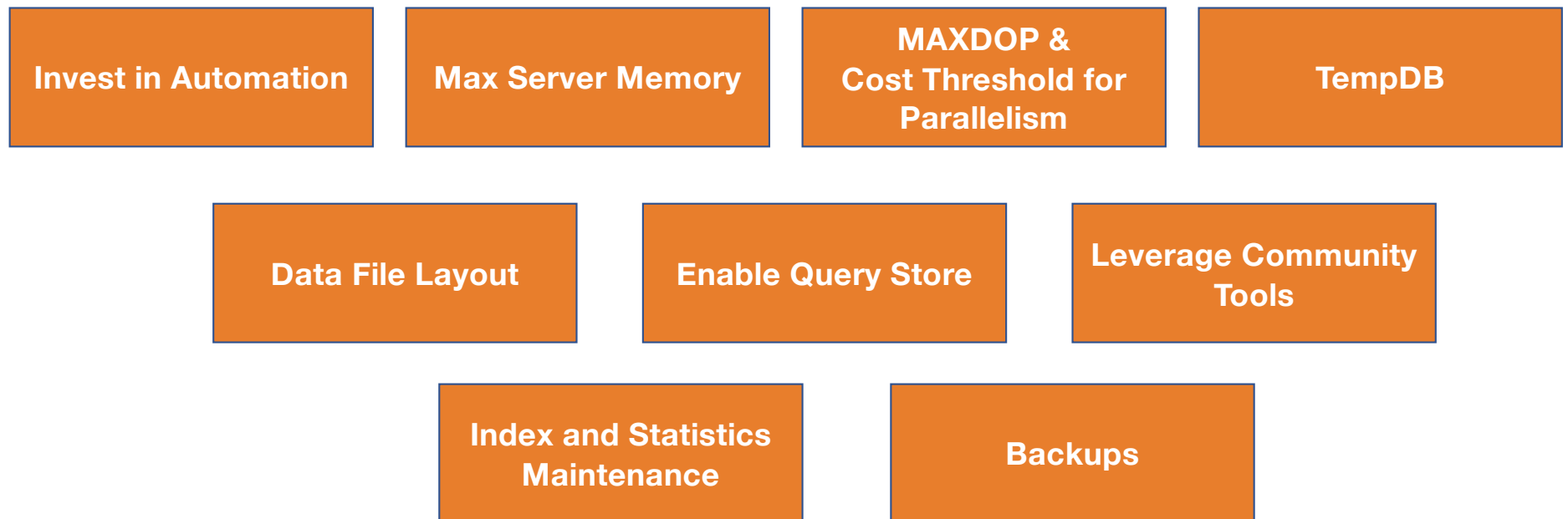


Build a VM Template

- Configure the VM config
- Base OS best practices
- At provisioning time scale the VM
 - vCPUs
 - Memory
 - Drive sizes



But what about SQL Server's config?



Agenda

- It's all about the hardware
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Resources

- <https://dbatools.io/>
- <https://ola.hallengren.com/>
- https://github.com/amachanic/sp_whoisactive
- <https://github.com/BrentOzarULTD/SQL-Server-First-Responder-Kit>
- <https://www.nocentino.com/posts/2021-09-27-sqlserver-vms-best-practices/>
- <https://core.vmware.com/resource/architecting-microsoft-sql-server-vmware-vsphere>

Need more data?

- **Contact me!**

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- **Blog:** www.nocentino.com

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<https://sqlb.it/?9294>