



# *Database administration through the ages*

---

RANDOLPH WEST  
DATA PLATFORM MVP

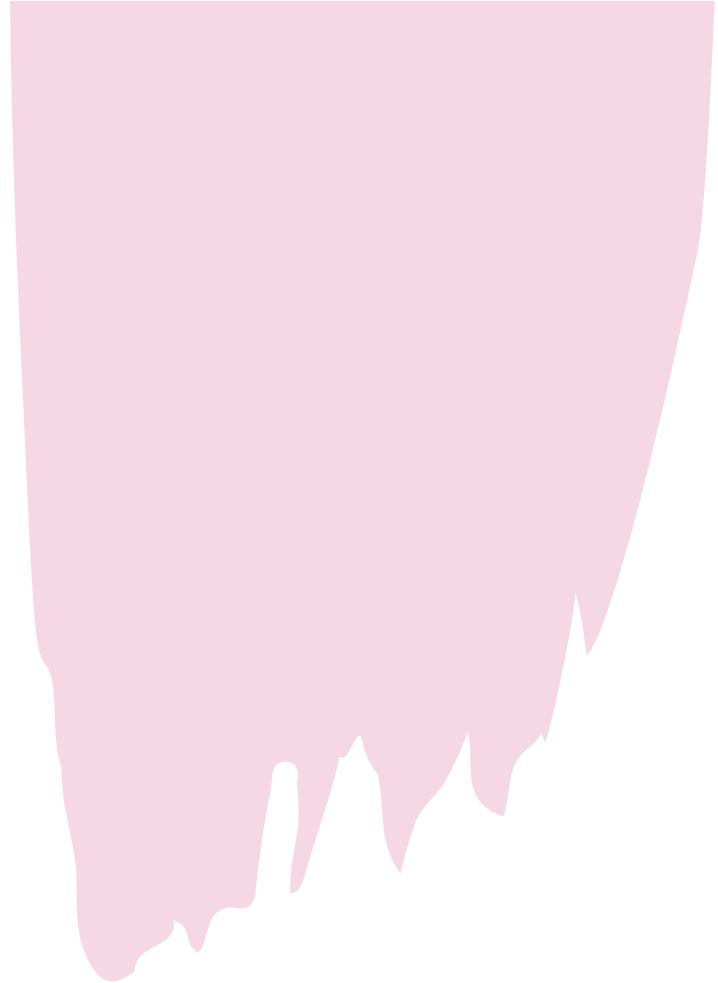




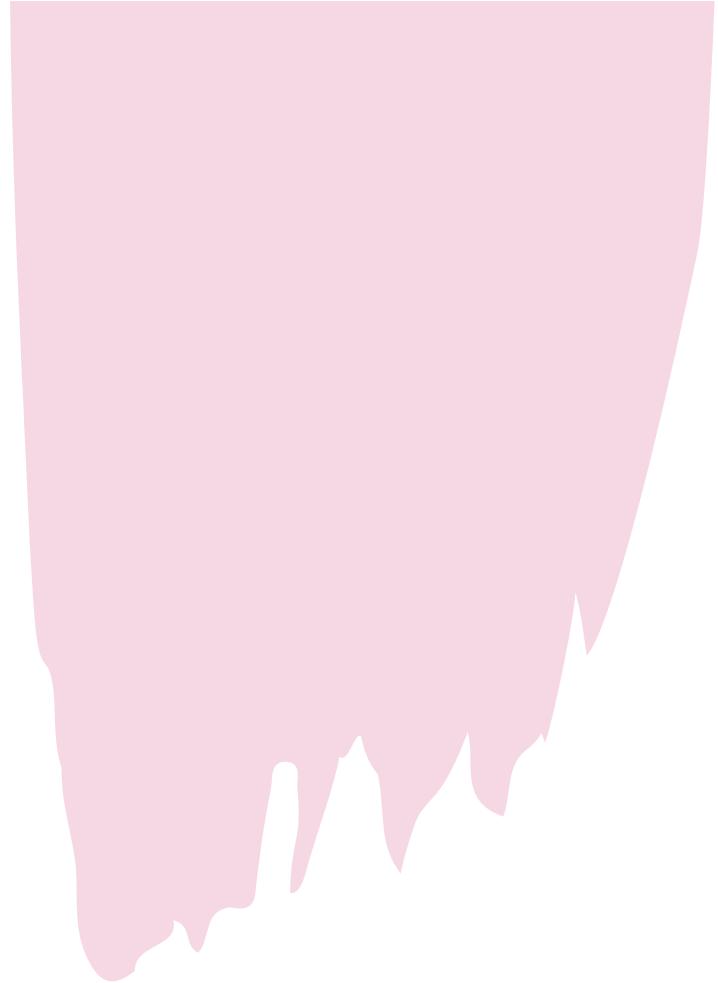
## *Who is this punk?*

- SQL Server 2017 Administration Inside Out (Microsoft Press)
- Stories from the Trenches (Melody Zacharias)
- SQL Server 2019 Administration Inside Out (Microsoft Press)
- SQL Server on Azure VMs (Packt Publishing)
- Filmmaker, actor, director, and raconteur
- r@ndolph.ca (bornsql.ca)

What does a  
database administrator  
do?



What does a  
data professional  
do?



# *What does a data professional do?*

- Installs, upgrades, migrates, and configures
- Plans resource and capacity management
- Modifies data structures (including query tuning)
- Manages data security, user security, and compliance
- Manages high availability and disaster recovery
- Queries data for reporting and analysis
- Monitors the data estate
- Deals with customers

*This list comes from Wikipedia and is not original work, because I'm a hack*

## *What does a data professional know?*

- All the stuff on the previous slide
- Database theory and design
- Database queries
- SQL Server internals
- Structured query language (SQL)
- Distributed computing architecture (client-server model)
- Operating systems (Windows, Linux, macOS)
- Storage technologies and networking

*This list comes from Wikipedia and is not original work, because I'm a hack*

## *What does the current landscape look like?*

- SQL Server 6.5
- SQL Server 7.0
- SQL Server 2000 (8.0)
- SQL Server 2005 (9.0)
- SQL Server 2008 (10.0)
- SQL Server 2008 R2 (10.50)
- SQL Server 2012 (11.0)
- SQL Server 2014 (12.0)
- SQL Server 2016 (13.0)
- SQL Server 2017 (14.0) + Linux
- SQL Server 2019 (15.0) + Linux
- Azure SQL Database
- Managed Instance
- Containers, Kubernetes, BDC

*This list comes from my brain*

## *What does the current landscape look like?*

- ~~SQL Server 6.5~~
- ~~SQL Server 7.0~~
- ~~SQL Server 2000 (8.0)~~
- ~~SQL Server 2005 (9.0)~~
- ~~SQL Server 2008 (10.0)~~
- ~~SQL Server 2008 R2 (10.50)~~
- SQL Server 2012 (11.0)
- SQL Server 2014 (12.0)
- SQL Server 2016 (13.0)
- SQL Server 2017 (14.0) + Linux
- SQL Server 2019 (15.0) + Linux
- Azure SQL Database
- Managed Instance
- Containers, Kubernetes, BDC

*“It’s just SQL Server” – Buck Woody*



## *FUNDAMENTALS*

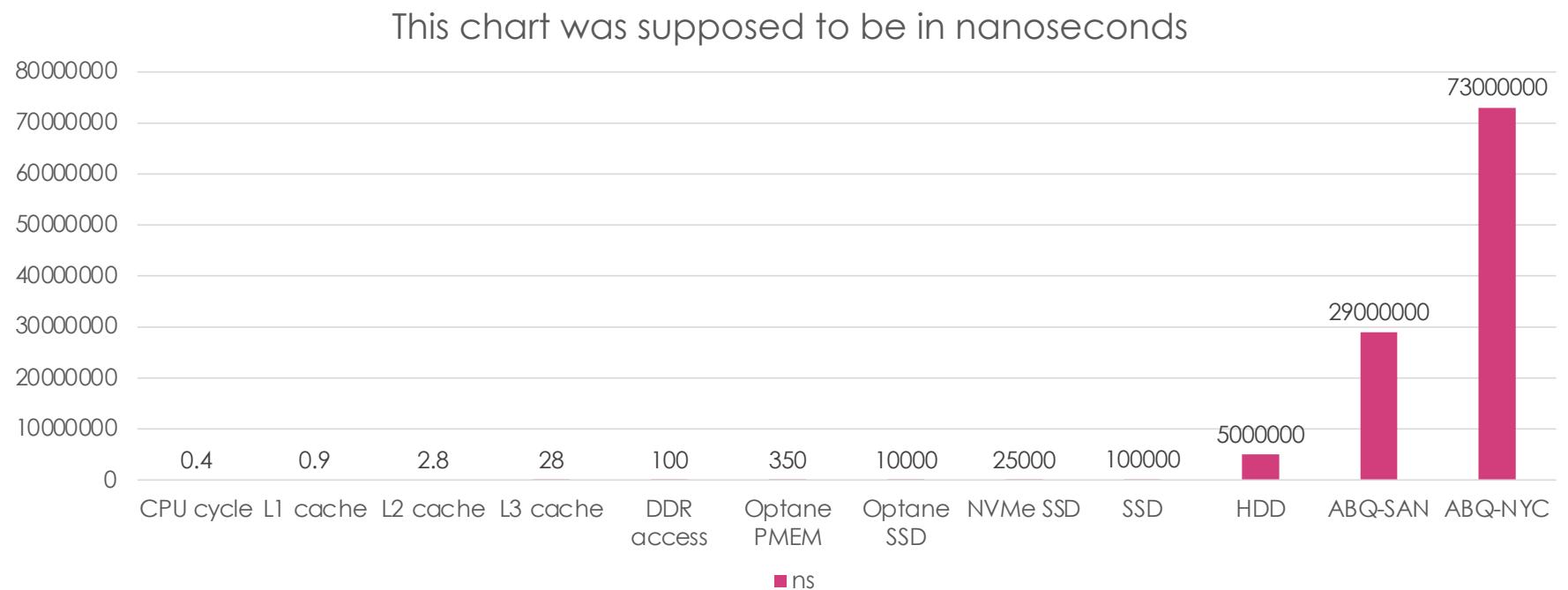
*There are 1,000,000,000 nanoseconds in 1 second*



## *How fast are we talking, here?*

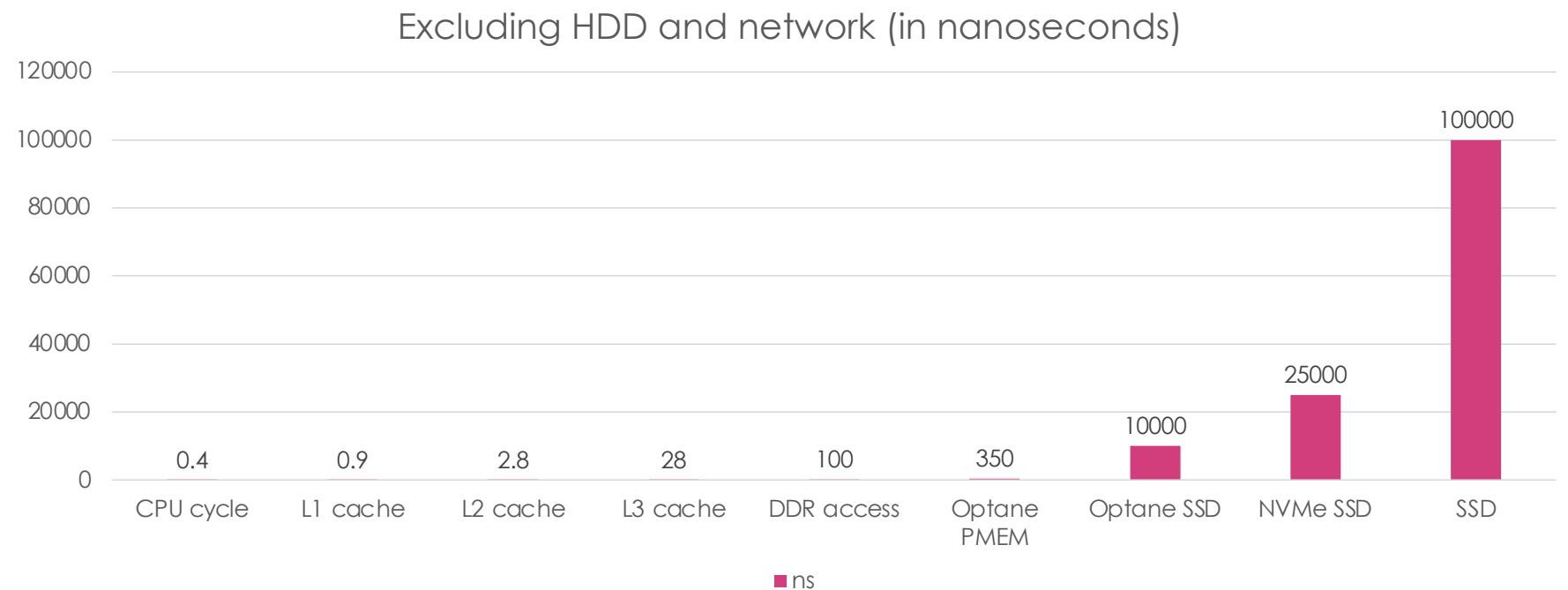
- CPU cycle
- L1 cache access
- L2 cache access
- L3 cache access
- DDR RAM access
- Optane SSD access
- NVMe SSD access
- Regular SSD access
- Hard drive access
- LAN ping time
- ABQ to San Diego ping
- ABQ to New York ping

# *How fast are we talking, here?*



<https://wondernetwork.com/pings/Albuquerque>  
<https://www.prowesscorp.com/computer-latency-at-a-human-scale>

# *How fast are we talking, here?*



<https://wondernetwork.com/pings/Albuquerque>  
<https://www.prowesscorp.com/computer-latency-at-a-human-scale>

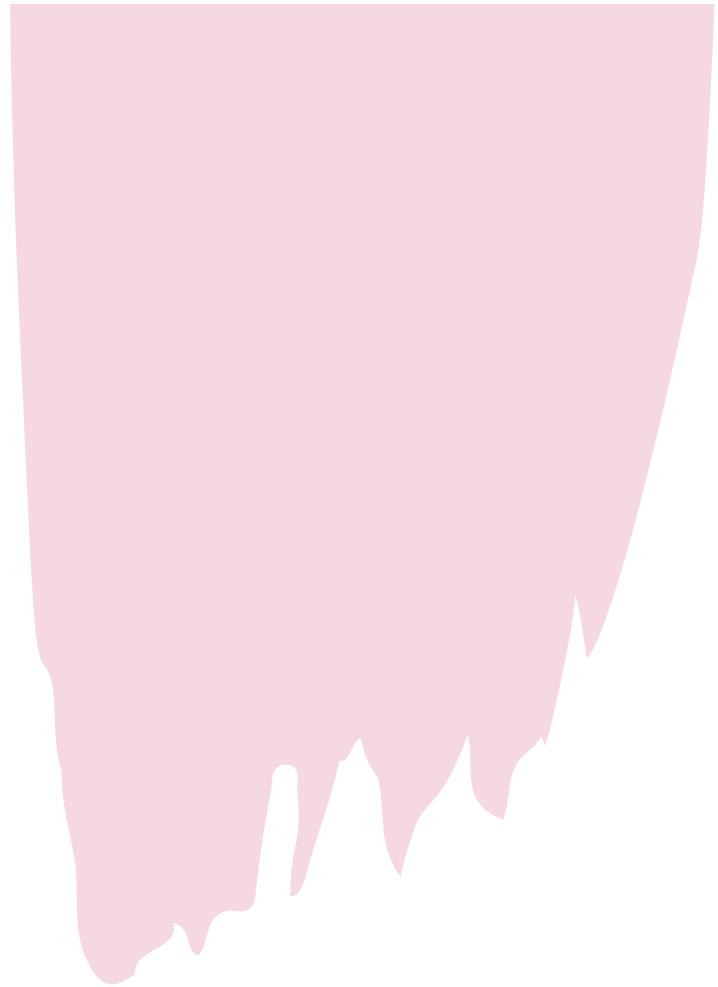
# *How fast are we talking, here?*

System event	Actual latency	Human scale
CPU cycle	0.4 nanoseconds	1 second
L1 cache access	0.9 nanoseconds	2 seconds
DDR RAM access	~100 nanoseconds	4 minutes
NVMe access	~25 microseconds	17 hours
SSD access	~100 microseconds	3 days
LAN ping	~1 millisecond	1 month
Wi-Fi network ping	~2 milliseconds	2 months
Albuquerque to San Diego ping	~29 milliseconds	29 months

<https://wondernetwork.com/pings/Albuquerque>  
<https://www.prowesscorp.com/computer-latency-at-a-human-scale>

# *Fundamentals*

CPU

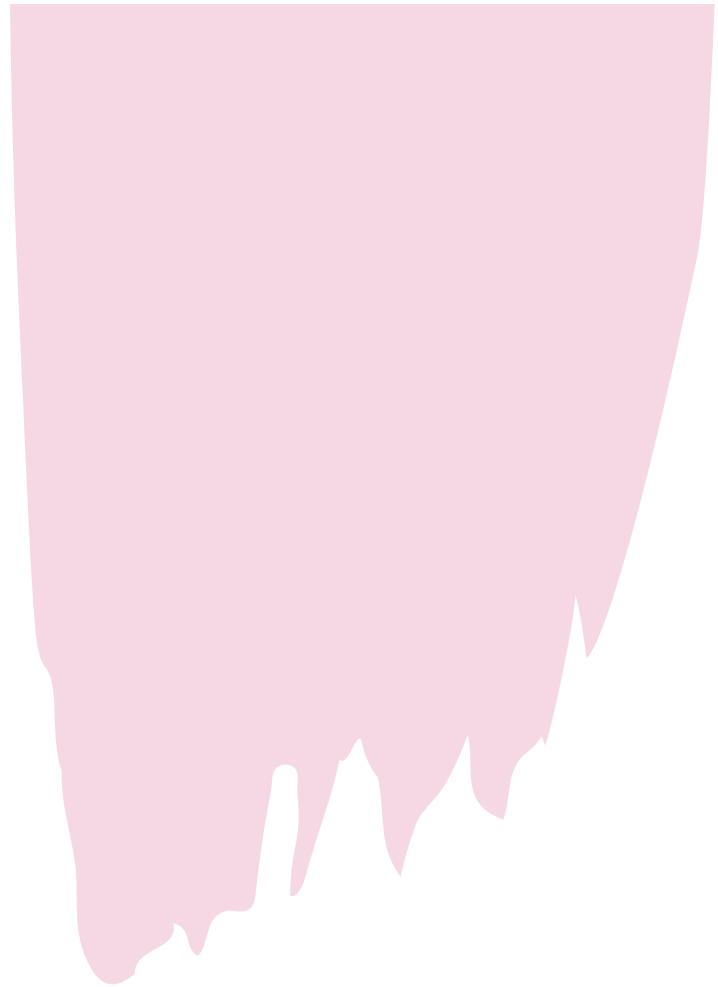


## *Central processing unit*

- Cores
  - Physically distinct processing units on the same die
  - Single-threaded performance matters more for OLTP
  - New MAXDOP options in SQL Server Setup
- Simultaneous Multithreading (SMT)
  - Adds approximately 15% additional headroom
  - Is not equivalent to additional cores (cf. virtualization)
- AMD has caught up to Intel with Ryzen
- Disable power saving settings

# *Fundamentals*

MEMORY

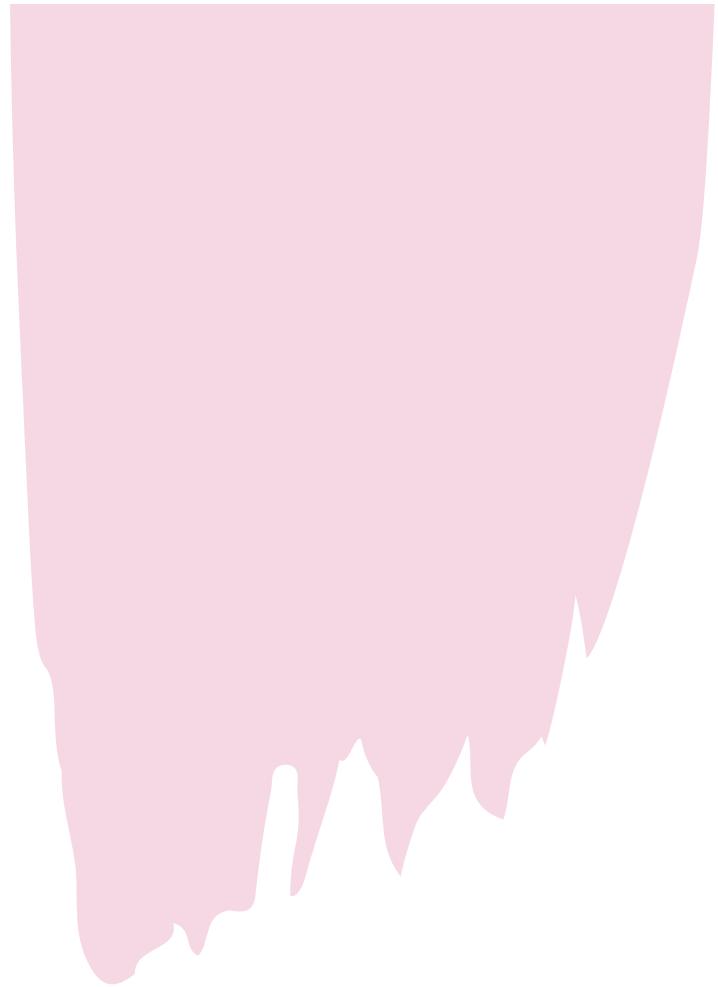


# *Random Access Memory (RAM)*

- Max Server Memory setting
  - Default will use all available memory (2.1 PB)
  - Does not apply to columnstore or in-memory objects
  - Watch out for Linux OOM killer
  - New Max Server Memory options in SQL Server Setup
- Use ECC RAM
  - Accounts for cosmic rays flipping bits
- Lock pages in memory (LPIM)
  - Avoid with virtual machines on shared hosts

# *Fundamentals*

STORAGE

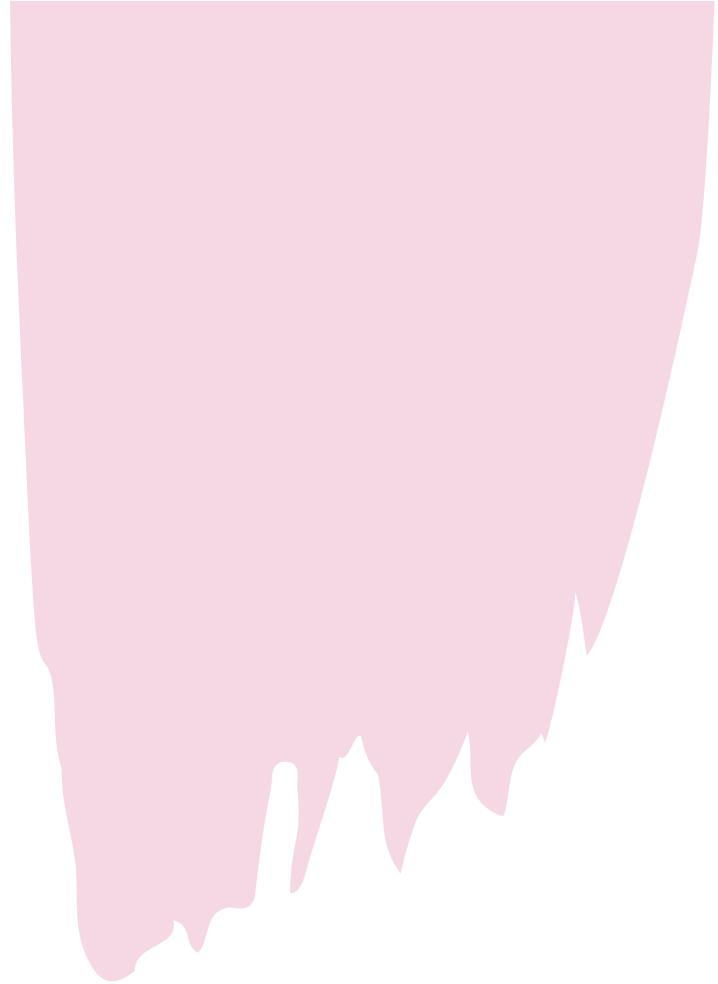


## *Persisted storage*

- Faster is better
  - Solid-state eliminates seek times
  - Test IOPS with large block size (SQL Server uses 64KB extents)
  - Drive queue depth is as important as IOPS
- Malware detection is the enemy
- Be wary of hyper-converged infrastructure (HCI)
  - CPU / storage trade-off
- Persistent memory (PMEM)
  - Hybrid buffer pool can bypass storage layer

# *Fundamentals*

NETWORK

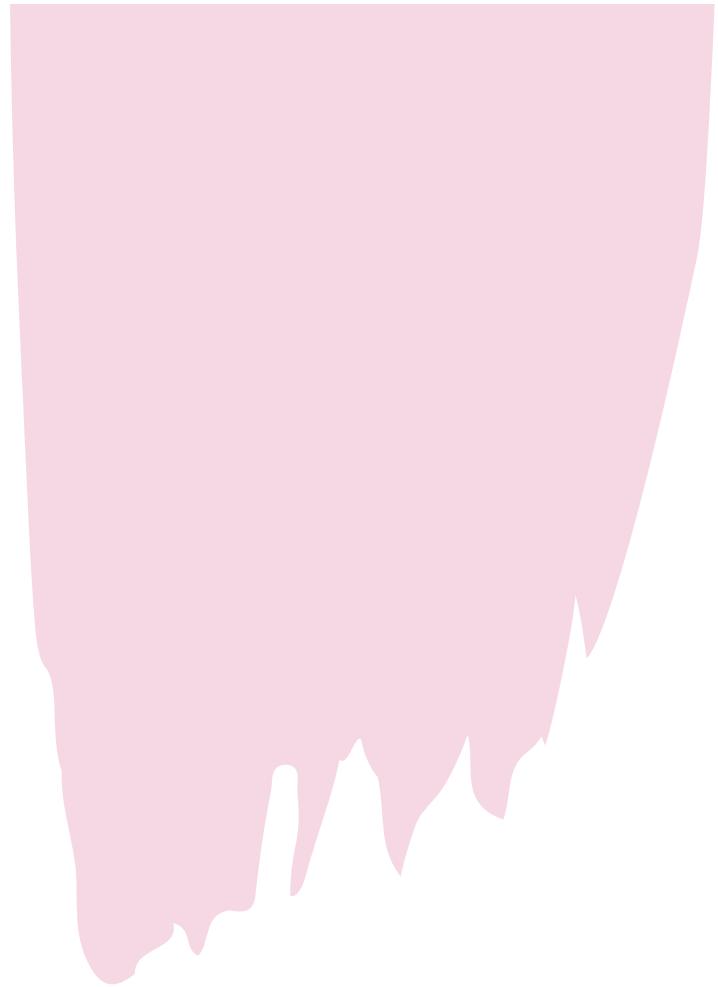


## *The network is slow*

- Latency is the enemy
  - You always want < 10ms
- “It was DNS” – everyone, basically
  - CNAME entries can help
  - TTL (time to live) will affect failovers
- Avoid row-by-agonizing row (RBAR)
  - Set-based operations, NOCOUNT ON, and don't use Profiler
- Everything in the cloud is defined by the network

# *Fundamentals*

VIRTUAL CONSUMERS

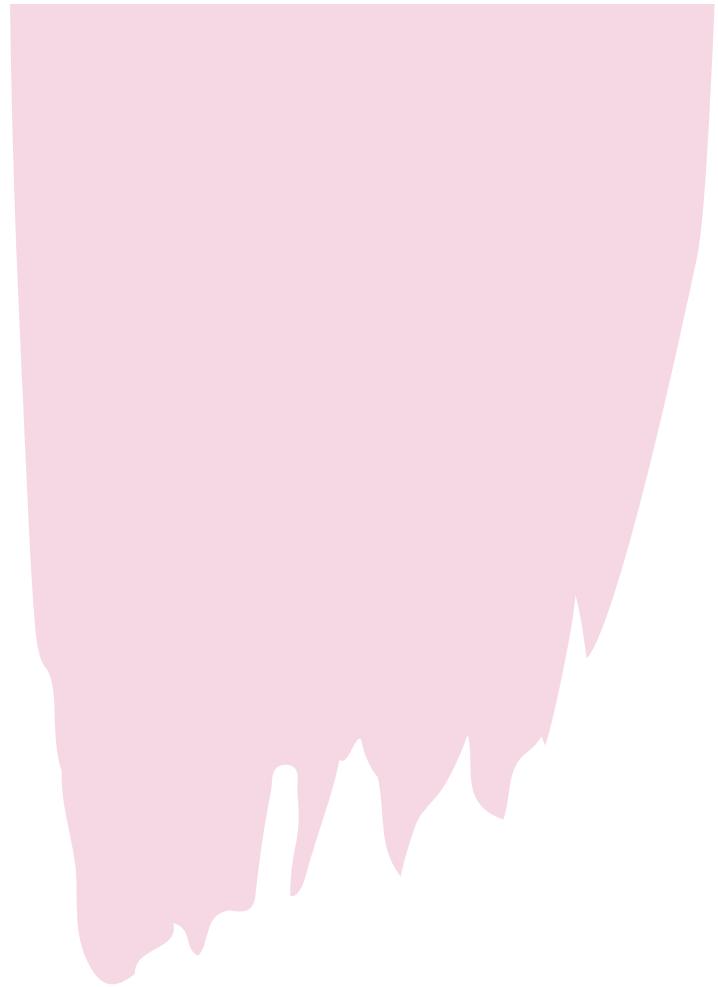


## *Virtual consumers (VMs and containers)*

- Abstraction onion
  - Hardware layer (VM) vs operating system (container)
- VMware and Docker are market leaders
  - Hyper-V isn't going away though
- Kubernetes (K8s) is how you manage containers
  - OpenShift is still K8s
  - So is AKS
  - Having Linux knowledge will really help
- Windows containers exist

# *Fundamentals*

MANAGEMENT





## *How do you manage your data estate?*

- Tools
  - SQL Server Management Studio (SSMS)
  - Azure Data Studio (ADS)\*
  - Command line (sqlcmd, mssql-cli, bcp)\*
- PowerShell\*
  - SqlServer module (SQLPS is obsolete)
  - dbatools module ([dbatools.io](https://dbatools.io))
- SQL Server Management Objects (SMO)\*

\* cross-platform support (Windows, Linux, macOS)



*Have a nice day!*

**Randolph West**

r@ndolph.ca

@\_randolph\_west (Twitter)

@bornsql (GitHub)