

Test-Drive for SQL Server on Linux

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M I L A N O
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Agenda

- Why SQL Server on Linux
 - Opportunities & Commitments
- What is SQLPAL
 - System Architecture
- Test Drive on Linux
 - Linux OS
 - Install & Configure
 - Tools & Drivers
- Features & Scenarios
 - Migration
 - What will be enabled & roadmap



Why SQL Server on Linux?



Microsoft®
SQL Server



SQL Server 2016: Everything built-in

Industry leader in
Mission Critical OLTP

built-in

Most secure
database

built-in

Highest performing
data warehouse

built-in

End-to-end mobile
BI on any device

built-in

In-database
Advanced Analytics

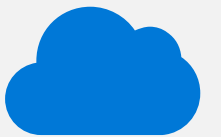
built-in

2. SQL Server 2016 SP1

We are announcing SQL Server 2016 SP1 which is a unique service pack – for the first time we introduce **consistent programming model** across SQL Server editions. With this model, programs written to exploit powerful SQL features such as in-memory OLTP, in-memory columnstore analytics, and partitioning **will work across Enterprise, Standard and Express editions.** Developers will find it easier than ever to take advantage of innovations such as in memory databases and advanced analytics – you can use these advanced features in the Standard Edition and then step up to Enterprise for Mission Critical performance, scale and availability – without having to re-write your application.



Consistent experience from on-premises to cloud



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National Institute of Standards and Technology Comprehensive Vulnerability Database update 10/2015

TPC-H 10TB non-clustered results as of 04/06/15, 5/04/15, 4/15/14 and 11/25/13, respectively. http://www.tpc.org/tpch/results/tpch_perf_results.asp?resulttype=noncluster

The world
is demanding
SQL Server on
Linux



22K+ applications for private preview
55% of Fortune 500 signed up in first week



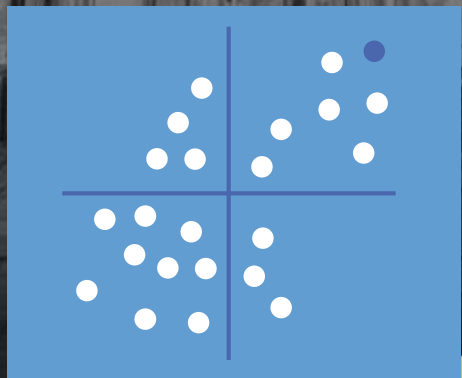
Most popular
Scott Guthrie
tweet ever
1.5K retweets

TechMeme

#1

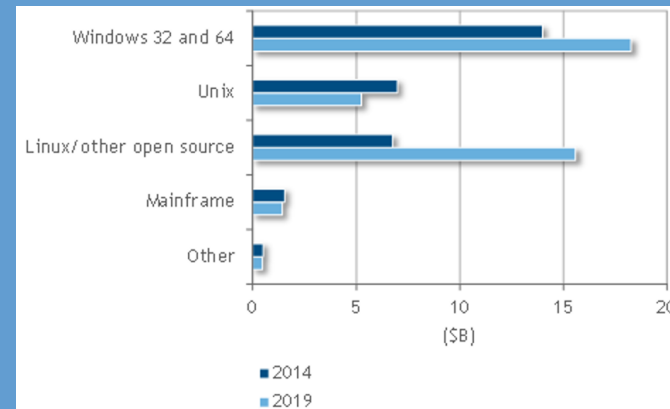
Hacker News

Microsoft is the
 only Gartner
 RDBMS Magic
 Quadrant
 vendor without
 support for
 Linux



\$15B+

Linux DB
 market by 2019



6.6%
 per year



Relational DB market
 growth through 2019

New server shipments of Linux
 expected to be **2.4x** that of
 Windows by FY 2021



SQL Server on Linux

SQL Server into Containers

Microsoft contri
joining Linux Fo
Google to the .N

Announces several new tools to help an

Posted November 16, 2016 By Microsoft News

PowerShell on Linux

Organizations with the most open source contributors

	Microsoft	16,419
	facebook	15,682
	docker	14,059
	angular	12,841
	google	12,140
	atom	9,698
	FortAwesome	9,617
	elastic	7,220
	Apache	6,999
	npm	6,815

system by
coming

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in

169



about that entire data
estate across Windows
and Linux.

”

What is SQLPAL?

Overview & System Architecture



System Architecture

Full breadth of SQL Server across multiple OS
Enabled through platform abstraction layer (PAL)

Extend existing SQL OS layer ("SOS")

RDBMS

AS

IS

RS

SQL Platform Abstraction Layer
(SQLPAL)

Windows
Host Ext.

Linux Host
Extension

Windows

Linux

Everything else

System Resource &
Latency Sensitive
Code Paths

SQL Platform Abstraction Layer
(SQLPAL)

Win32-like APIs

SQL OS API

SQL OS v2

Host Extension mapping to OS system calls
(IO, Memory, CPU scheduling)

SQLPAL Architecture Zoom In

RDBMS

Hosted Windows APIs

SOS Direct APIs

Storage
Manager

Network
Manager

Resource
Manager

Process
Manager

Security
Manager

Availability
Manager

Config.
Manager

SOSv2 (Memory, Scheduling, Synchronization)

Host Extension

Test Drive on Linux

Installation, Configuration, Tools & Drivers



Few facts to start...

SQL Server 2016 64-bit only

- No GUI (*at the moment*)
- New configuration tool SQLCONF
 - Network Protocols: TCP (*at the moment*)

Super simple and fast install

- Traditional Linux package managers (APT-GET, YUM, etc.)

Same Database binary format

- Portable MDF/NDF/LDF
- Backup on Windows -> Restore on Linux
- AlwaysOn AG Linux <-> Windows
- Same DB Samples 😊



SQL Server vNext on Red Hat Enterprise Linux 7.2

Linux



Containers



Windows



- Red Hat Enterprise Linux 7.2 Workstation, Server, and Desktop
 - Available in Azure Gallery
 - XFS EXT4
- Ubuntu 16.04 LTS
 - EXT4
- SUSE Enterprise Linux (SLES) v12 SP2
- Other Linux distributions?
- Docker: Windows & Linux containers
- Windows Server / Windows 10

SQL Server Setup on Linux (Redhat)

1/2

- Download installation package from Linux repositories
`sudo yum install -y mssql-server`
- Run SQL Server setup
`cd /opt/mssql/bin && sudo ./sqlservr-setup`
- Set service for auto-startup after reboot
`sudo systemctl enable mssql-server`
- Start the service
`sudo systemctl start mssql-server`
- Open the firewall for TCP 1433
`sudo firewall-cmd --zone=public --add-port=1433/tcp --permanent`
`sudo firewall-cmd --reload`
- Linux directories
"/var/opt/mssql": SQL instance "runtime" directory (where DB are located)
"/opt/mssql": installation directory for binaries (setup files location)

SQL Server Setup on Linux (Redhat)

2/2

QUESTION: How many questions you will be asked during the setup?

- Unattended installation
 - Online vs. Offline installations (YUM + RPM)
- Client tools and ODBC drivers *not* installed!
- Linux tools for post installation
 - «PS» «HTOP» «SYSTEMCTL» «FREE», etc.
 - CAT & GREP & LESS on SQL Server ERRORLOG
- Config file & Installation directories
 - MSSQL-CONF (trace flags, SA pwd, default dirs, etc.)
 - Directory mapping: "C:\\" → «[/var/opt/mssql](#)»
- Storage & File systems & RAID?
 - XFS (default on RHEL) or EXT4 file system
 - Highly recommended MD vs. LVM
 - My blog post on Linux storage [here](#)

DEMO



Install
SQL Server 2016
on
Linux Redhat

Already available today...

Operations Features

- Support for RHEL, Ubuntu, Docker
- Package based installs, Docker image
- Support for Open Shift, Docker Swarm
- Failover Clustering through Pacemaker
- Backup/Restore
- SSMS on Windows connected to Linux
- Command line tools: sqlcmd, bcp, sqlpackage
- SQL Agent
- Replication
- Log Shipping
- Transparent Data Encryption
- SCOM Management Pack
- DMVs

Programming Features

- All major language driver compatibility
- In memory OLTP and ColumnStore
- Compression
- Always Encrypted, Row Level Security, and Data Masking
- Service Broker
- Change Data Capture
- Partitioning
- Auditing
- CLR
- JSON, XML
- Third party tools

***...and
more!***

Known Issues & Unsupported features and services



- Features not supported
 - Failover Clustering (*)
 - AlwaysOn Availability Group (*coming soon*)
 - AD Authentication (*coming soon*)
 - Distributed Query
- Services not supported
 - SQL Agent, SQL Browser, FullText, Polybase
 - SSAS, SSIS, SSRS, MDS, DQS
- Limitations
 - Single SQL Server instance
 - 15-chars name limit
 - Fixed locations of TempDB data and log files, and System DBs
- Known issues
 - In-Memory OLTP databases can only be created in the /var/opt/mssql directory
 - Some time zone names in Linux don't map exactly to Windows time zone names
 - SQL Server Configuration Manager can't connect to SQL Server on Linux

Tools & Drivers on Linux

- Client tools
 - BCP, SQLCMD, SQLPACKAGE
 - Must be installed separately
 - PowerShell for SQL? SSIS?
- SQL Server Management Studio (SSMS)
 - Separate installation, frequent releases to support cloud «velocity»
- JDBC & ODBC Drivers for Linux
 - New [releases](#) to support Always On & Always Encrypted & latest SQL 2016/SQLDB features
- Windows-based SQL Server tools
 - SSMS, SSDT, Profiler work when remotely connected to SQL Server on Linux
 - 3rd party tools continue to work
 - All existing drivers and frameworks supported
- Visual Studio Code for Linux (and Mac)
 - Add-ins and [Extensions for SQL Server](#)



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SQL Server on Linux:

SQLCONF

SSMS & DMVs

Backup & Restore

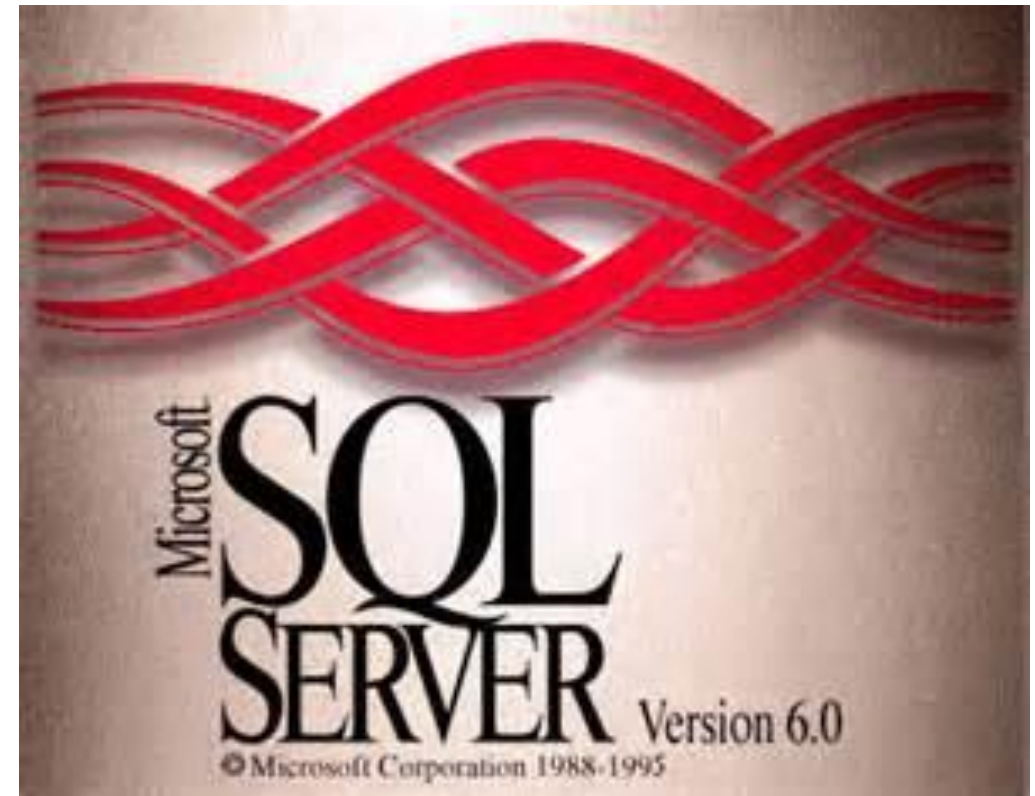
BCP & Bulk-Import

SQLPACKAGE & BACPAC

Migrating to SQL Server on Linux

Remember: same database binary format!

- Backup/Restore & Attach/Detach
 - Compression & encryption supported
- BCP
 - The oldest but still most performant
- Data Migration Assistant ([DMA](#))
 - Replacement for *SQL Server Migration Assistant (SSMA)*
- Database Experimentation Assistant ([DEA](#))
 - *A/B Testing & Trace Replay*
- SSIS
 - You only need the proper ODBC driver
- BACPAC
 - Export from SSMS and SQLPACKAGE usage
- AlwaysOn?
 - Coming soon....



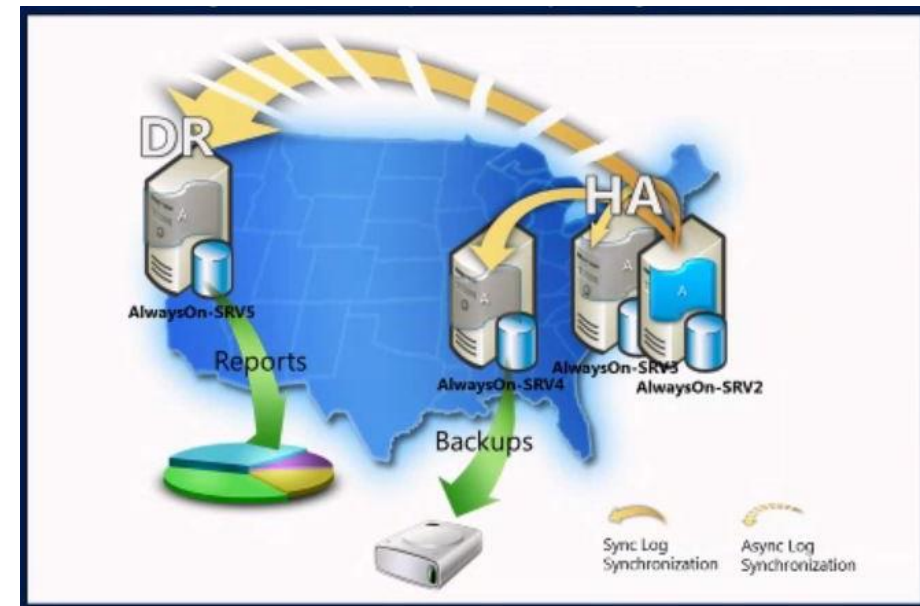
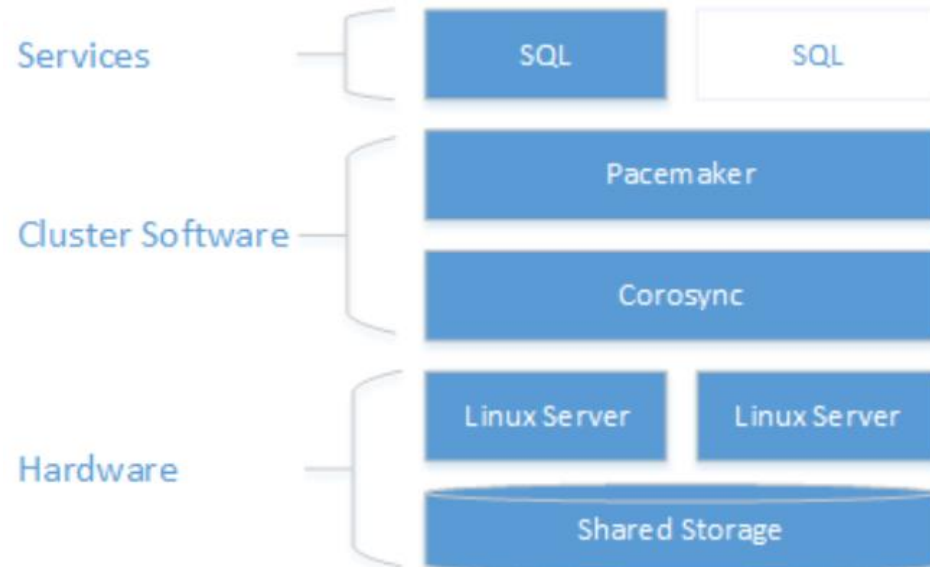
Features & Scenarios

What is available today, main features ported, roadmap



High-Availability

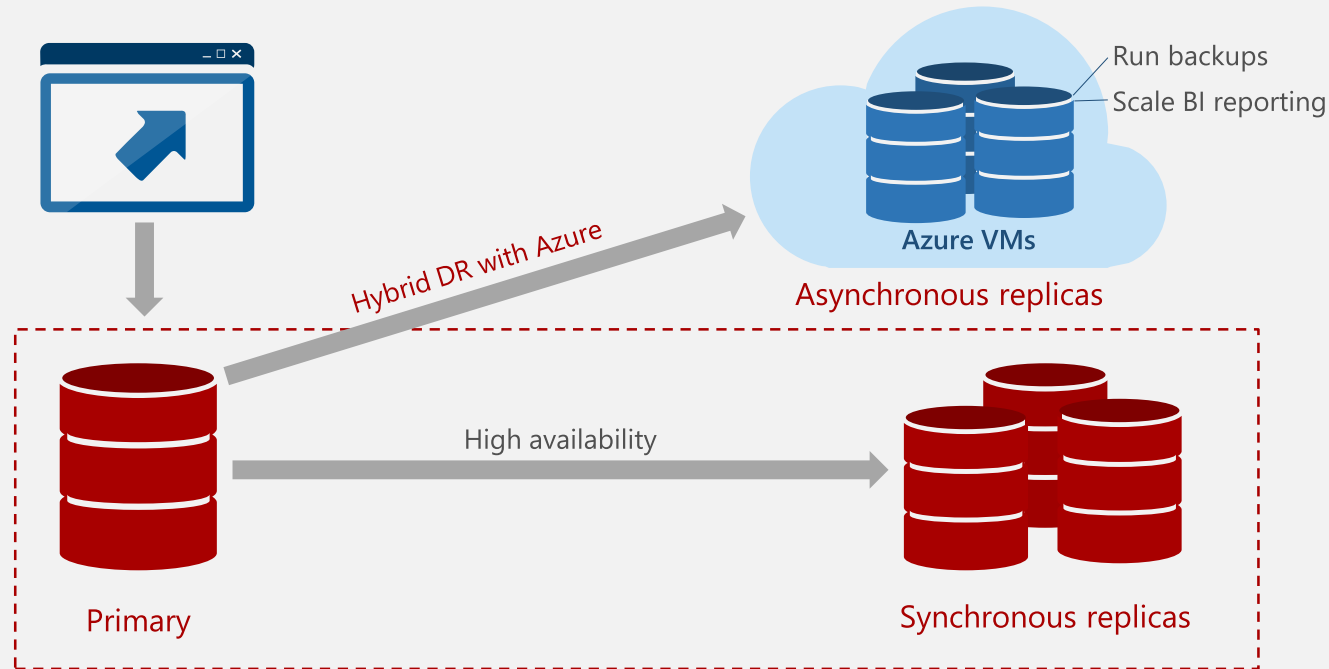
- Native SQL Server 2016 AlwaysOn Availability Group (AG)
 - Always On availability groups with automatic fail-over, listener, synchronous replication, read only secondaries
- Linux Pacemaker (& Corosync), RedHat [HA Add-In](#)
 - Fail-over clustering using Pacemaker and other clustering platforms through integration scripts and guides. «High Availability Add-On» on from RedHat



Dramatically simplify HA & DR

+35% operational efficiencies with hybrid cloud

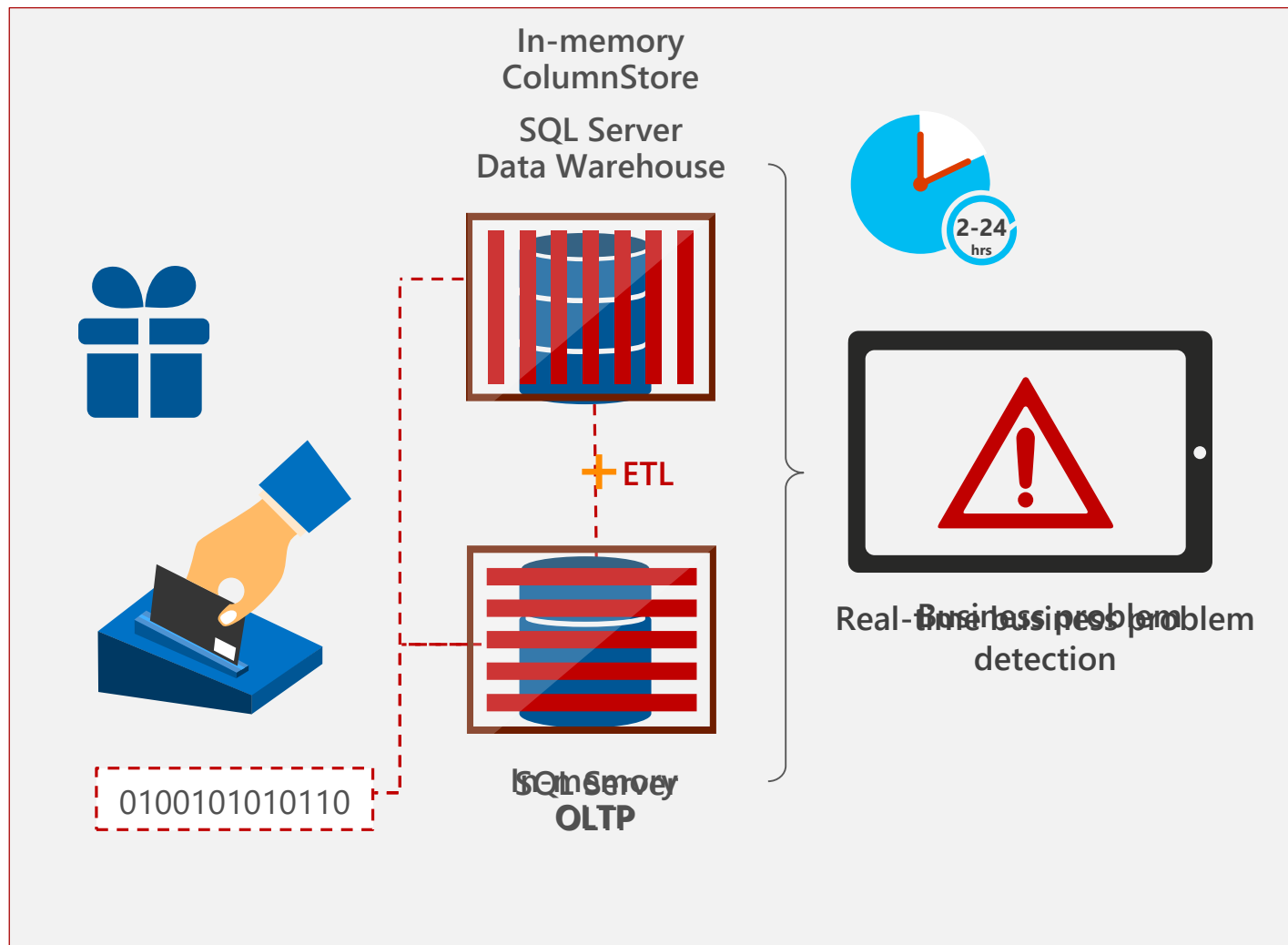
Enhanced AlwaysOn^{NEW*}



- ➡ **Easy Setup** of on-premises and hybrid cloud HA & DR
- ➡ **Load balancing** of readable secondaries
- ➡ **Fast failover** on-premises or to cloud

Real-time operational analytics

In-memory **built-in**



➔ Up to **30x** faster transactions with in-memory OLTP

➔ Queries from **minutes to seconds**

Real-time
operational analytics

NEW*



Most secure database

Layers of protection



Monitor activity

- Advanced Threat Analytics ^{NEW*}
- SQL Server auditing



Control access

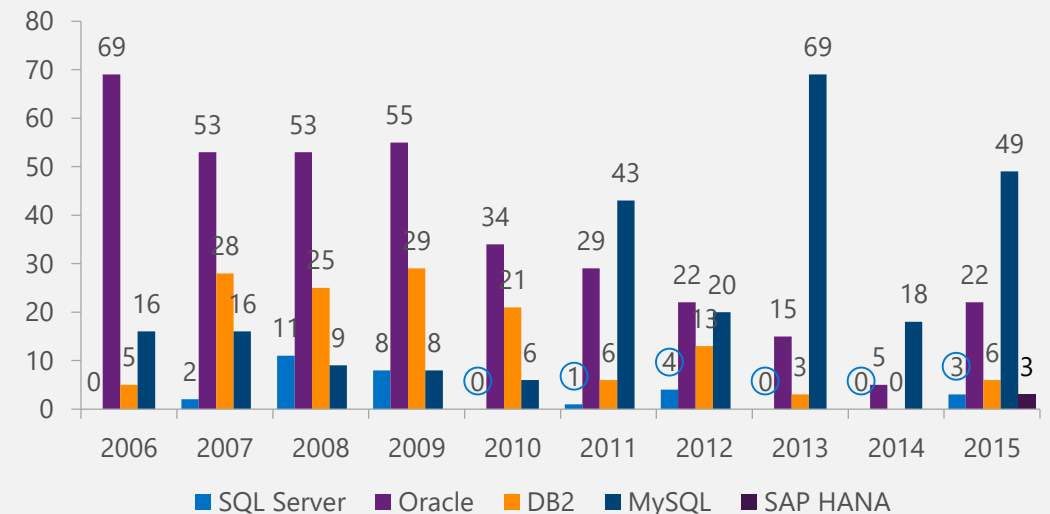
- Windows Authentication
- Row-level security ^{NEW*}
- Dynamic data masking ^{NEW*}



Protect data

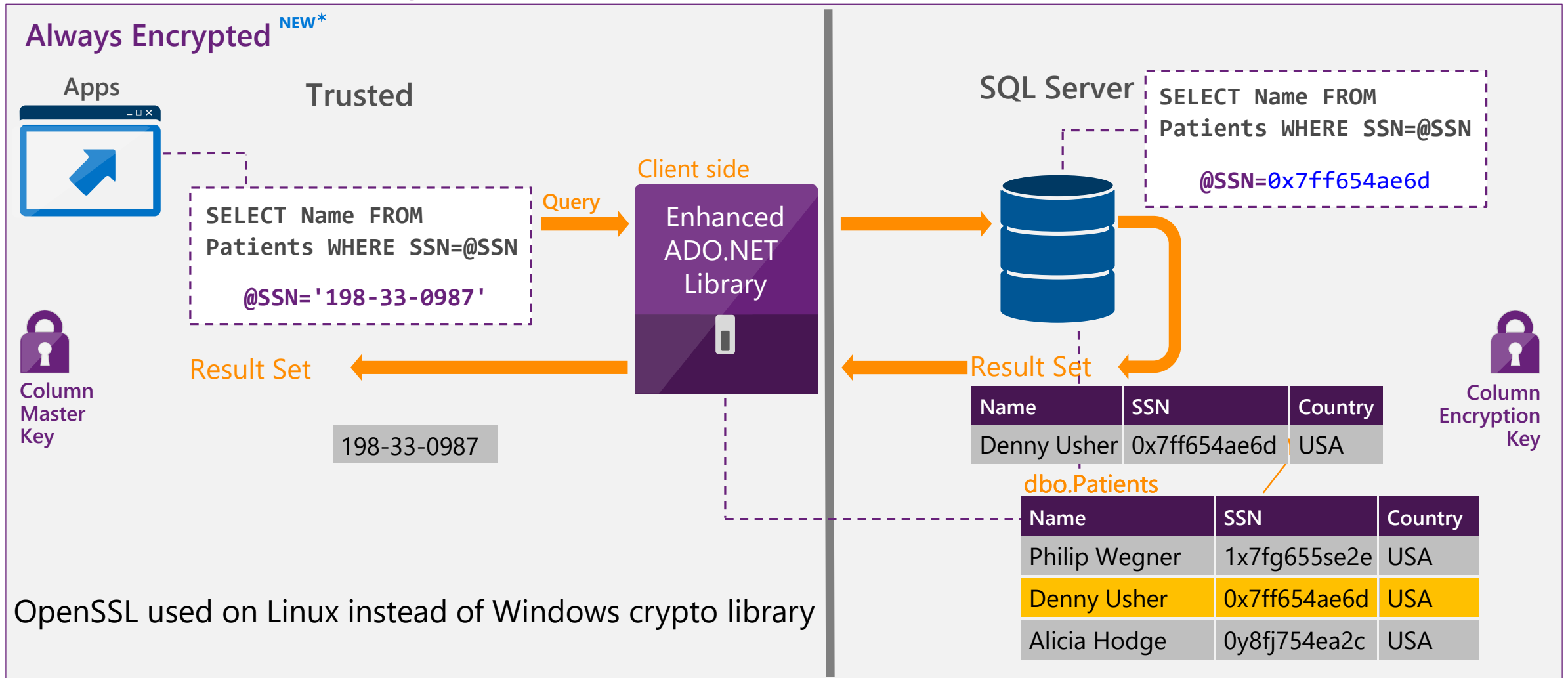
- Always Encrypted ^{NEW*}
- Transparent data encryption

Least vulnerable 6 years
in a row & **most utilized**



* National Institute of Standards and Technology Comprehensive Vulnerability Database update 10/2015

Protect your data at rest and in motion without impacting database performance



DEMO



SQL Server on Linux:

In-Memory OLTP (Hekaton)
DMVs & Diagnostics
Some Linux flavors....

Q&A



Resources

- **Get started with SQL Server on Linux**
- Scott Guthrie original blog post "[*Announcing SQL Server on Linux*](#)"
- Joseph Sirosh [*announcement*](#) at RedHat summit
- Mark Russinovich's recent appearance in the [*DockerCon keynote*](#)
- Videos on @Channel9 #DataExposed
 - [*Travis Wright «Introducing SQL Server on Linux»*](#)
 - [*SQL Server on Linux Sneak Peak*](#)
 - [*More with SQL Server on Linux*](#)
- My Blog "[*Rumors about Azure, SQL Server & Data in the Cloud....*](#)"
- Follow me on Twitter ([*@igorpag*](#))
- OLTP demo on [*GitHub*](#)

Connectivity libraries and frameworks for Microsoft SQL Server

Language	Platform	Additional resources	Download
C#	Windows, Linux, macOS	Microsoft ADO.NET for SQL Server	Download
Java	Windows, Linux, macOS	Microsoft JDBC Driver for SQL Server	Download
PHP	Windows, Linux	PHP SQL Driver for SQL Server	Operating System: * Windows * Linux
Node.js	Windows, Linux, macOS	Node.js Driver for SQL Server	Install
Python	Windows, Linux, macOS	Python SQL Driver	Install choices: * pymssql * pyodbc
Ruby	Windows, Linux, macOS	Ruby Driver for SQL Server	Install
C++	Windows, Linux	Microsoft ODBC Driver for SQL Server	Download

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