SQL Server 2016 SP1
Changes The Game

Things you can do now that were Enterprise-only before

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What we’ll cover

• The game-changing alteration in SS2k16 SP1
• Editions which benefit from this change
• Features that were formerly Enterprise-only
  – Whether new in SS2k16 or new in previous releases
• Features that remain limited to some editions
• Some related changes of interest
• Ways you can check these things out for free/cheap

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The game-changing alteration

• As of SP1, most features that were Enterprise-only are now available in all editions
  – This includes cool new SS2k16 things, Ent-only on initial release
    • Which are now available in all or more editions as of SP1
  – But also some previous version features, Ent-only before
    • Many of which are now available in all or more editions

• We’ll see over a dozen of these, many very important

• However...

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What has NOT changed?

• Note first that the capacity limits & “licensed uses” for those editions have not changed as of SP1
  – For instance:
    • Express still limited to 10g DBs
    • Standard still limited to 128g RAM use, and so on
    • More on these differences in a moment

• Also, there do remain many features which ARE still limited to Enterprise only, or perhaps Ent/Standard, or Ent/Std/Web
  – Most of those are about resource usage, server config/admin, etc.

• Indeed...
A new acronym for some: CPSA

- MS refers to this change as about providing a CPSA
  - Consistent (or Common) Programmability (or Programming) Surface Area
    - Stressing the portability of code among editions: more in a moment
- But even that terminology short-changes the significance
  - Some changes are indeed about features “surfaced” to developers
    - But some make available important performance-related improvements
- And we’ll get to those changes, but first let’s level-set some other terminology and perspectives on edition differences

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EDITIONS WHICH BENEFIT FROM THIS CHANGE
Most know there are several editions of SQL Server

• Traditional perspective for some years has been:
  – Enterprise: commercial, full-featured, pretty much no restrictions
  – Standard: commercial, fewer features, some restrictions
  – Web: commercial, still fewer features, still more restrictions
  – Express: free, still fewer features, still more restrictions
    • Express with Advanced Services: adds Reporting Services and more
  – LocalDB (since SS2k12): free, Express-light (process, not service)
  – Trial/Eval edition: only available as Enterprise-level functionality
  – Developer: also Enterprise functionality, for development only
    • All other editions above can be used for production

• Previous editions: BI, Datacenter, Workgroup, others
So why the change?

• Big challenge for apps built to run against Trial or Developer, then moved in prod to editions other than Enterprise (on-prem or Azure)
  – Some functionality would now **not** work
    • If leveraging programming features restricted in those editions
  – Similar challenge for ISVs/vendors creating apps deployed to all editions

• As important, many powerful performance/config features were Enterprise-only
  – Might have been compelling/useful in other editions
    • even with the capacity limits that edition may have
  – But couldn’t even be “tasted” in prod, if not on Enterprise

• This change in SP1 solves both of those problems!

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OPENING THE FLOODGATES:
FEATURE-BY-FEATURE CHANGES *

* The info in this section was gathered by analysis of details at https://msdn.microsoft.com/en-us/library/cc645993.aspx and comparing with similar details in prior releases

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Scalability and Performance

• New in SS2k16, initially Ent-only, now in all editions
  – Stretch database

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Scalability and Performance (cont.)

- Not new in SS2k16, but formerly Ent-only, now in all editions
  - In-Memory OLTP
  - Columnstore indexes
  - Table and index partitioning
  - Data compression
  - Multiple Filestream containers

1 Of course, you must be using SS2k16 SP1 to leverage these features

2 Subject to scale limits, Ent/Std/Web/Express: Unlimited/32 GB/16 GB/352 MB

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Scalability and Performance
Feature Limits NOT Changed in SP1

• Not new in SS2k16, still Ent-only as of SP1*  
  – Resource Governor  
  – Partitioned Table Parallelism  
  – NUMA Aware and Large Page Memory and Buffer Array Allocation  
  – IO Resource Governance

* Note: I’ll NOT be listing in this talk features that are not new and had already been available in Ent/Std/Web, given focus of this talk on what now IS
Security

• New in SS2k16, initially Ent-only, now in all
  – Always encrypted
Security (cont.)

• New in SS2k16, initially Ent/Std-only, now in all
  – Row-level security
  – Dynamic data masking

• Not new in SS2k16, formerly Ent-only, now in all
  – Fine grained (database-level) auditing
Security Feature Limits NOT Changed

• **Not** new in SS2k16, still Ent-only
  – Transparent database encryption
  – Extensible key management

• **Not** new in SS2k16, still Ent/Std-only
  – Encryption for backups

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HaDr Features

• **Not** new in SS2k16, formerly Ent-only, now in all
  – Database snapshots
HaDr Feature Limits NOT Changed

- New in SS2k16, only in Std
  - Always On *Basic* Availability Groups
    - Replaces deprecated Database Mirroring
    - Ent has Always On availability groups (not “basic”)

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HaDr Feature Limits NOT Changed (cont.)

• **Not** new in SS2k16, **still** Ent/Std-only
  – Backup compression
  – Encrypted backup
  – Hybrid backup to Windows Azure (BACKUP “TO URL”)
  – Always On failover cluster instances (still only 2 nodes in Std)

• **Not** new in SS2k16, **still** Ent/Std/Web-only
  – Log shipping

• **Not** new in SS2k16, **still only available completely in Ent**
  – Database mirroring
    • still full safety only in Std
    • still witness-only in Web/Express/LocalDB
HaDr Feature Limits NOT Changed (cont.)

- Not new in SS2k16, still Ent-only
  - Always On availability groups
  - Online page and file restore, indexing, and schema change
  - Fast recovery
  - Mirrored backups
  - Hot add memory and CPU
Replication Feature Limits NOT Changed

- New in SS2k16, still Ent/Std-only
  - Transactional replication to Azure
- Not new in SS2k16, still Ent/Std-only
  - Heterogeneous subscribers
  - Transactional replication updateable subscription *
- Not new in SS2k16, still Ent-only
  - Oracle publishing
  - Peer to peer transactional replication

* Transactional replication otherwise in all editions; subscriber-only in Web/Express/LocalDB
Programmability

• New in SS2k16, initially Ent-only, now in all
  – Polybase compute node
    • Polybase head node is still Ent-only
Programmability Feature Limits NOT Changed

• New in SS2k16, already in all editions
  – Basic R integration (though in Express, only with Adv Svcs)
  – JSON
  – Query Store
  – Temporal tables

• New in SS2k16, still Ent-only
  – Advanced R integration
  – R Server (Standalone)
Data Warehouse

• **Not** new in SS2k16, but formerly Ent-only, now in Std
  – Change data capture (CDC)
    • Different from already-existing change tracking (CT)
    • CT tracks only THAT a change was made, not the change itself
    • CDC tracks both, and keeps them historically

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Feature areas unchanged *

- Analysis (Analytics/BI)
- Integration
- Manageability
- Management tools
- Development tools

- So that’s it! Let’s review/summarize...

* “Unchanged” meaning no change to support across editions. Many features were and remain limited to Ent-only, or Ent/Std, etc.

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Summary: Features Newly Available in All

- Always encrypted
- Columnstore indexes
- Data compression
- Database snapshots
- Dynamic data masking
- Fine grained (db-level) auditing
- In-Memory OLTP

- Multiple Filestream containers
- Persistent main memory
  - Mentioned in MS table of new features, no doc found at all
- Polybase compute node
- Row-level security
- Stretch database
- Table and index partitioning

Note: Basic R integration, JSON, Query Store, Temporal tables though new in 2k16 were already available in Std/Web/Express
Summary: Features still limited to Ent

- Advanced R integration
- Always On availability groups
- Extensible key management
- Fast recovery
- Hot add memory and CPU
- IO Resource Governance
- Mirrored backups
- NUMA Aware and Large Page Memory and Buffer Array Allocation
- Online page and file restore, indexing, and schema change
- Oracle publishing
- Partitioned Table Parallelism
- Peer to peer transactional replication
- Polybase head node
- R Server (Standalone)
- Resource Governor
- Transparent database encryption

Again: Not tracking here Analysis (Analytics, BI), Integration, Manageability, Mgt/Dev tools features, as none of the limits changed
Summary: Features still/newly limited to Ent/Std

- Always On failover cluster instances (still only 2 nodes in Std)
- Availability Groups (Basic in Std, Full in Ent)
- Backup compression
- Change data capture (CDC)
- Encrypted backup
- Encryption for backups
- Heterogeneous subscribers
- Hybrid backup to Windows Azure (BACKUP “TO URL”)
- Log shipping (also in Web)
- Transactional replication to Azure
- Transactional replication updateable subscription

Again: Not tracking here Analysis (Analytics, BI), Integration, Manageability, Mgt/Dev tools features, as none of the limits changed
Some other new SS2k16 SP1 features

• These don’t vary per edition, so beyond scope, but:
  – “CREATE OR ALTER” support added to SQL DDL
  – New query optimizer OPTION argument: “Use Hint”
  – Persistent log buffer / Storage Class Memory (Win2k16)
  – Database cloning adds support for cloning CLR, Filestream/Filetable, Hekaton and Query Store objects
  – And much more
    • https://blogs.msdn.microsoft.com/sqlreleaseservices/sql-server-2016-service-pack-1-sp1-released/
WAYS YOU CAN CHECK OUT THESE THINGS FOR FREE (OR CHEAP)

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How to check things out

• Even if SS2k16 is “not yet available where you work”
  – There are several ways you can check out these new capabilities today
• Some may be old news, some may be surprising changes
  – Links to these are provided at end of talk
  – ...

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You most likely knew about...

- Free 180-day SQL Server 2016 trial/eval
  - Again, only as Enterprise-level functionality/capacities
- Developer edition – used to be cheap, now **free**
  - This was changed originally in SS2k14
  - Again, only as Enterprise-level functionality/capacities
- Express and LocalDB editions
  - Again, free; with more capacity limits than Std, Web
But did you know also about...

• Free 30-day trial of Azure SQL Database
  – Available in Basic, Standard, Premium, Premium RS editions
  – Features and capacities vary by edition and “performance level” chosen
• Free 2-hour virtual labs (cloud, as Enterprise)
• Free pre-packaged Docker containers (as Express)
  – For Windows or Linux
• Finally, did you know SQL Server can now run on Linux?
• Links for these and more offered in a moment
SOME RELATED CHANGES OF INTEREST *

* Link to these are provided at end of talk

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A new sample database

• Of course, there are ample docs, and those virtual labs, and other available books/training on these new features

• But if you’re wanting to explore things on your own, consider new sample database: **WideWorldImporters**
  – And also **WideWorldImportersDW**, for analytics/BI

• Not just an alternative to AdventureWorks (or Northwind)
  – But WWI comes pre-configured to show use of these features newly available features to users of all editions...
WWI Support for new features *

- Real-time operational analytics of sales data is enabled through the use of nonclustered columnstore indexes
- Archive tables can be stretched to Azure for long-term retention, reducing storage cost and improving manageability
- Query Store is used to keep track of query performance
- Temporal tables are used to conveniently keep track of the history of reference data, as well as some of the main entities
- ...


From: http://bit.ly/2oj7sGs
• JSON is used to enable AJAX calls to some of the key tables, and also to extend the relational schema to record such things as application settings and user preferences
• Advanced security features like Always Encrypted, Row-Level Security and Dynamic Data Masking are used to secure data
• In-Memory OLTP is used to optimize the performance of table-valued parameters (TVPs) and to optimize ingestion of sensor data
• Clustered columnstore indexes are used to reduce the storage footprint of large tables with insert-only workload
• Partitioning is used to improve the manageability of large tables
New JDBC Driver

• Be aware also that if you will be leveraging SS2k16 features from Java
  – You’ll want to use the latest MS SQL Server JDBC driver, version 6.0 or above
  – Is now open source, on github
    • Not to be confused with jtds.sourceforge.net

• And that’s it
  – Let’s wrap up with links to may resources mentioned
Links for new SS2k16 features mentioned

• Security
  – Always encrypted
    • https://msdn.microsoft.com/library/mt163865.aspx
    • MS Video: https://www.youtube.com/watch?v=EPlq70NzQ4k
  – Row-level security
    • https://msdn.microsoft.com/library/dn765131.aspx
    • MS Video: https://www.youtube.com/watch?v=Sa-kdNdWKgU
  – Data masking
    • https://msdn.microsoft.com/library/mt130841.aspx
    • MS video: https://www.youtube.com/watch?v=7ch8tbstkyM
  – Fine-grained auditing
Links for new SS2k16 features mentioned (cont.)

- Stretch database
  - MS Video: https://www.youtube.com/watch?v=rBbkdOMx3Js
- Query store
  - MS Video: https://www.youtube.com/watch?v=HxBRjZXi3L0
- Temporal tables
  - MS video: https://www.youtube.com/watch?v=FXvDOjNQEs
- JSON
  - MS video: https://www.youtube.com/watch?v=P5yqP72K_4s
- Change Data Capture
Links for new SS2k16 features mentioned (cont.)

• SQL Server R (Server and Services)
  – https://docs.microsoft.com/en-us/sql/advanced-analytics/r-services/
  – **MS video**: https://www.youtube.com/watch?v=P5yqP72K_4s

• Polybase
  – **MS Video**: https://www.youtube.com/watch?v=lBxSB0UY4wA

• Always On Basic Availability Groups
  – https://docs.microsoft.com/en-us/sql/database-engine/availability-groups/windows/basic-availability-groups-always-on-availability-groups
  – **MS Video**: https://www.youtube.com/watch?v=vG8H7hTNfdY

• Transactional replication to Azure
Links for new SS2k16 features mentioned (cont.)

• Guide to licensing SS2k16 SP1 across editions

• Of course there are links for all the features NOT new in 2016
  – Also checkout these helpful MS videos
    • in-memory OLTP as of 2016: https://www.youtube.com/watch?v=l5l5eophmK4
    • columnstore: https://www.youtube.com/watch?v=EB0MzVdc-ZI
    • Realtime operational analytics: https://www.youtube.com/watch?v=VgV5fbh_O-0

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Links for ways to check these out

- **SS2k016 2-hour virtual labs**

- **SQL Server Docker containers**
  - https://hub.docker.com/r/microsoft/mssql-server-windows/
  - https://hub.docker.com/r/microsoft/mssql-server-linux/

- **SQL Server on Linux**
  - http://sqlserveronlinux.com

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Links for other new things I’ve pointed out

- **WideWorldImporters sample DB**
  - https://github.com/Microsoft/sql-server-samples
  - See also sample DB about In-memory OLTP feature
    - https://github.com/Microsoft/sql-server-samples/releases/tag/in-memory-oltp-demo-v1.0

- **MS-provided SQL Server 2016 JDBC driver**
  - https://docs.microsoft.com/en-us/sql/connect/jdbc/microsoft-jdbc-driver-for-sql-server

- **Open source edition of JDBC driver**
  - https://github.com/Microsoft/mssql-jdbc
Summary

• Key point: can do in any edition most things previously limited to Enterprise
  – So apps built in Trial/Developer Edition should work in Std, etc. or if deployed to Azure SQL DB
  – Important performance/config features previously “enterprise-only” can be leveraged in Std, etc (within any remaining capacity limits)
  – Includes features both new in SS2k16 and new but limited in previous ones
• There are many free/cheap, easy ways to get SS2k16 running to check these things out (local, cloud, docker, Linux, etc)
• ...

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Summary (cont.)

• Questions on preso? charlie@carehart.org
  – Or via Twitter, FB, LinkedIn, Slack: all as carehart
    • But please don’t contact me with questions about USING these or other features
    • Happy to consider feedback/corrections on the content

• But I certainly DO hope you’re encouraged to check out SQL Server 2016 SP1 and these newly available features!
  – And enjoy the rest of the SSWUG presentations