Hewlett Packard Enterprise

NonStop TBC 2023 TBC23-TB51 Accelerate your digital transformation with SQLMX

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Sep 12th, 2023

Forward-looking statements

This is a rolling (up to three year) Roadmap and is subject to change without notice

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Agenda

- The unique value of NonStop SQL/MX
- A mainstream database user experience (common standards)
- The digital transformation
- Secure database management
- Reduce your costs with NonStop SQL Cloud Edition
- Futures

HPE NonStop SQL/MX

Highest availability in the industry
98% linear scale
Cluster hyper automation

Ideal transaction platform for micro-services

Utmost data integrity
Secure database management
Business continuity

Ideal for the most critical data

Extensive data integration
Oracle skillset compatible
HPE support and services

Ideal for IT management & LOBs

Open APIs
DBaaS easy consumption
Focus on business logic

Ideal for developers

The SQL/MX Unique value

What differentiates SQL/MX from other databases?

Data integrity at scale

NonStop SQL/MX was designed to scale like NoSQL but without giving up strong data integrity

Data integrity and governance
Universal standard API

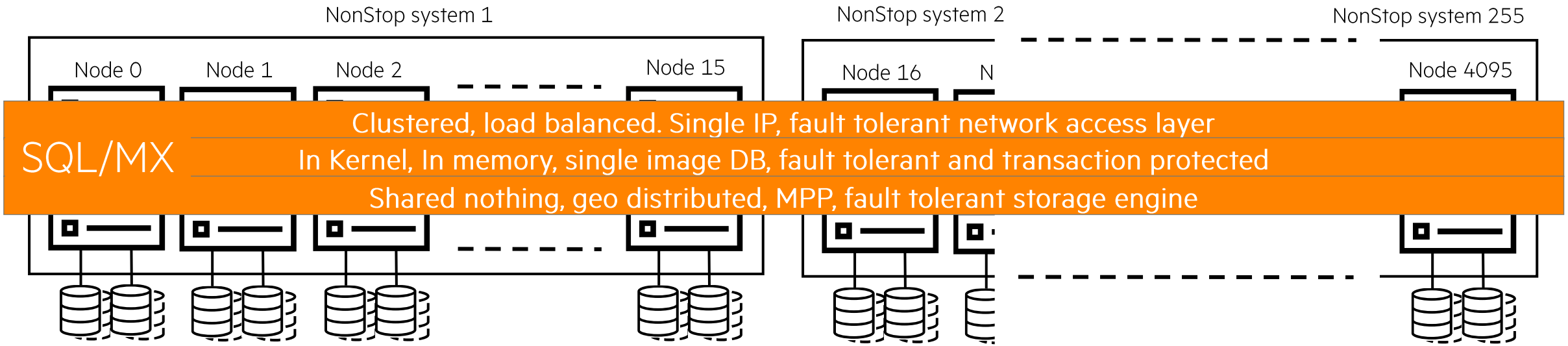
SQL/MX can scale up to 4000 CPUs yet centrally managed as a single database instance

Higher scale and availability
At lower cost

SQL/MX is the only database with fault-tolerant data integrity

Fault tolerant, distributed, transactional, all built-in

An RDBMS that was explicitly designed for a cluster of servers

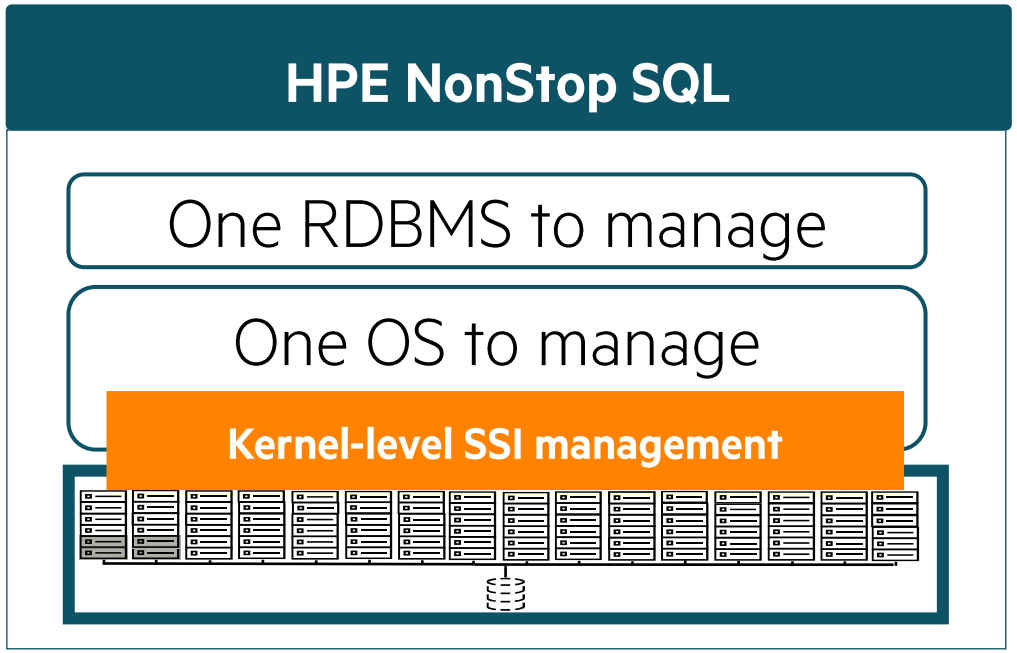


- Auto-provisioned & auto-managed clustering of storage, kernel, transaction engine and database
- The database is highly available without using replication
- Workloads and data are load-balanced and distributed across the nodes of a local or geographical cluster
- All nodes are put to work and participate in massively parallel execution of queries (MPP)
- No system failover, instead processes from a failing node are redistributed across remaining nodes
- Data access is fault tolerant (no visible application impact on any storage failure) with storage process mirrors

HPE NonStop SQL addresses complexity like no other

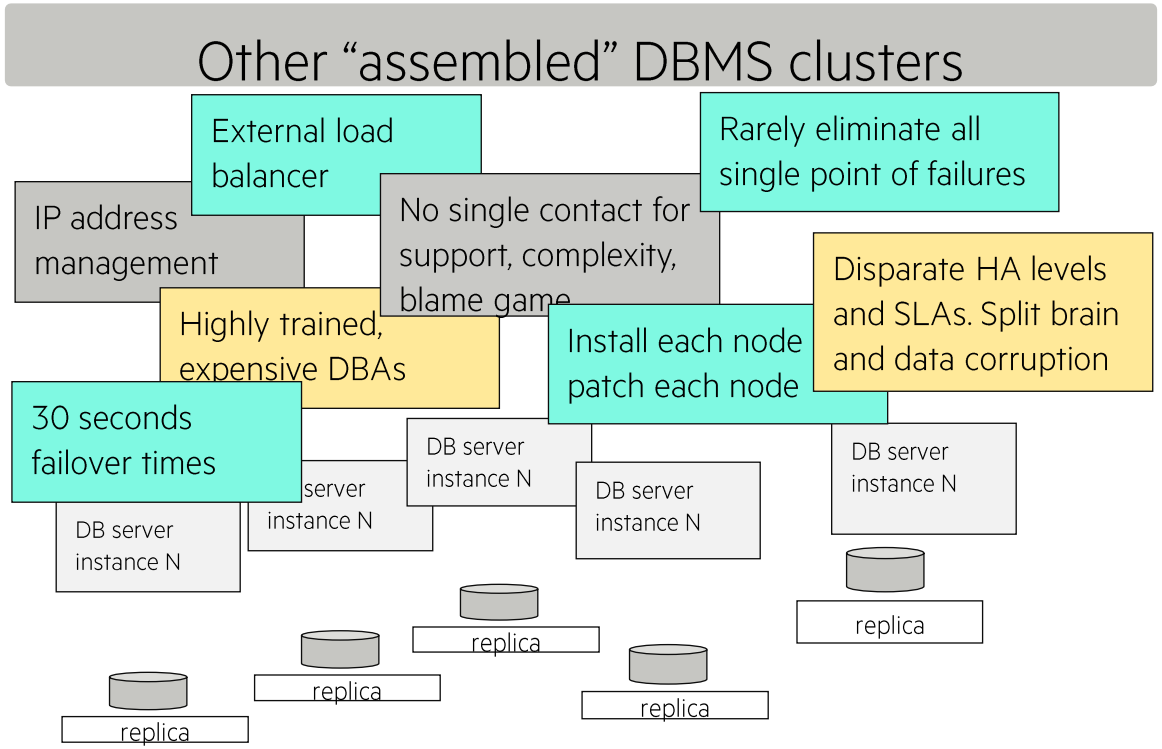
So that you can get the scale and availability of clusters without the complexity and risks

Simple



Kernel-level SSI management is the most desirable solution to manage clusters (*)

Complicated



Unpredictable TCO and high probability for failures due to complexity

(*) Gregory F. Pfister "In search of clusters" (1998).

The SQL/MX Unique value

What differentiates SQL/MX from other databases?

Unique value

- Data Integrity at scale
- Fault tolerant, distributed, transactional, all built-in
- HPE NonStop SQL addresses complexity like no other

A mainstream database user experience

Is SQL/MX easy to adopt?

SQL/MX 3.8 (L21.11), 3.8.1 (L22.09), 3.8.2 (L23.08)

Compatibility

- Native blobs and clobs
  - DDL/DML
  - JDBC type 4 driver
  - OSS ODBC/MX driver **3.8.1**
  - PL/MX
  - Utilities
- PL/MX **3.8.1** **3.8.2**
  - System packages, DBMS_LOB, UTL_RAW, DBMS_OUTPUT, DBMS_CRYPTO
  - Global types, arrays, sub-programs
  - Cursors attributes
  - Enhanced before triggers
  - functions
  - Exception handling

Compatibility
Security

- Built-in functions
  - Length()
  - Instr()
  - Next_day()
  - Dual
  - to_number()
- [Var]binary
  - update
- DDL auditing
- OSS ODBC driver C++ neutral **3.8.2**
- Native SSL support for Linux ODBC driver **3.8.2**

Manageability
Productivity
Performance

- WMS **3.8.1** **3.8.2**
  - Unique query switch
  - Increased query limit to 64k or 3500 queries per second
  - SQL/MX metadata management
  - Extended API
  - Performance
- Row count
- DBS **3.8.1** **3.8.2**
  - Add volumes to DBS pool
  - Cascade option for user, db sharing and schema ownership change

PL/MX: DBA's preferred and most used language!

Features

- Natural extension of the SQL language
- Secured sandbox and full security governance for DBAs
- Portable to other databases (Compatible with Oracle PL/SQL)

Benefits

- Immediate onboarding for Oracle users to manage SQL/MX
- Data transformation such as ETL
- Automate data maintenance
- Reduce porting effort for migration from Oracle to SQL/MX
- Can reduce network traffic and allow faster execution
- Create customized SQL functions

PL/MX versus SPJs

- Full DB storage and governance of program source
- Optimized performance with execution in master when applicable
- Library of specialized ready to use APIs (packages)

Tip!

http://www.sqlines.com/online
Free tool to translate T-SQL to PL/SQL very easily!

SQL/MX 3.8 and 3.8.1: PL/MX, packed with new features

New PL/MX features in SQL/MX 3.8 & 3.8.1

- Collections
- Cursor declarations in package specifications with parameters.
- Cursor attributes.
- REF Cursors.
- Default UDR arguments.
- NOCOPY parameter attribute.
- Global types.
- Subprogram name overloading.
- Subtypes.
- Nested subprograms.
- BLOB, CLOB, and RAW Datatypes
- BULK COLLECT
- FOR ALL
- New System Packages (DBMS_LOB, UTL_RAW, DBMS_OUTPUT)
- Master Executor Execution

A system package example: DBMS_LOB

- APPEND – Appends one LOB to the end of another LOB.
- CLOSE – Closes a previously opened LOB.
- COMPARE – Compares two LOBs.
- CONVERTTOBLOB – Converts CLOB character data to a BLOB.
- CONVERTTOCLOB – Converts BLOB data to a CLOB.
- COPY – Copies LOB data to another LOB.
- CREATETEMPORARY - Creates a temporary LOB.
- ERASE - Erases LOB data.
- FREETEMPORARY - Frees a temporary LOB.
- GETCHUNKSIZE - Returns the amount of space used to store the LOB.
- GETLENGTH - Returns the length of a LOB.
- GET_STORAGE_LIMIT – Returns the storage limit of a LOB.
- INSTR - Returns the position of an occurrence of a pattern in a LOB.
- ISOPEN – Returns true if the LOB has been opened.
- ISTEMPORARY – Returns true if the LOB is temporary.
- LOADFROMFILE – Reads data from a file into a LOB.
- OPEN – Opens a LOB.
- READ – Returns data from a LOB.
- SUBSTR - Returns LOB data starting at a specified offset.
- TRIM – Truncates a LOB value to a specified length.
- WRITE – Inserts data into a LOB.

SQL/MX 3.8.2: PL/MX introducing DBMS_CRYPTO

Function	Description
HASH	Applies one of the supported cryptographic hash algorithms (MD5, MD4, SHA-1, or SHA-2) to data.
MAC	Applies Message Authentication Code algorithms (MD5, SHA-1, or SHA-2) to data to provide keyed message protection.
RANDOMBYTES	Returns a RAW value containing a cryptographically secure pseudo-random sequence of bytes, and can be used to generate random material for encryption keys
RANDOMINTEGER	Returns a random BINARY_INTEGER
RANDOMNUMBER	Returns a random 128-bit integer of the NUMBER datatype
ENCRYPT	Encrypts RAW data using a stream or block cipher with a user supplied key and optional IV (initialization vector)
DECRYPT	Decrypts RAW data using a stream or block cipher with a user supplied key and optional IV

- MD4, MD5 and SHA-1 are supported for backward compatibility but for security reasons we recommended to use SHA-2
- PL/MX supports MP tables and that includes support for using this API with MP tables. See PL/MX guide for restrictions.

SQL/MX 3.8 and 3.8.1 – Native Blobs and Clobs

A universal datatype often used for application encryption in addition to large media files

Native LOB features

- Support for BLOB, CLOB, NCLOB datatypes
- Automatic LOB table management on DDL/DML including partitioning
- Uniform and built-in support from SQL utilities and security
- Migration from JDBC non-native blobs to JDBC native blobs
- Support for C, C++ and Python via OSS ODBC driver **3.8.1**

Native LOBs benefits

- Unstructured and semi-structured data (media, encryption, xml, JSON,…)
- Scales linearly along with base tables such as other data types
- DDL and DML compatibility with Oracle and other implementations
- Addresses limitations of the previous JDBC only implementation

Example

```
CREATE TABLE MYTABLE
(
  COL1      INT NOT NULL,
            ...
  COLX      BLOB (10 GB),
            ...
);
```

Requires Schema version 3800

jdbc type 4 driver, the most ubiquitous database access

Browsers have enabled the SaaS era. Will the JDBC type 4 driver become the DBaaS enabler?

Same driver runs everywhere

Open database connectivity

URL style syntax
Universally adopted

jdbc:t4sqlmx://host[:port]/[properties...

Larger Java ecosystem	How to switch to a new DB	NonStop benefits
Higher abstraction : Hibernate DevOps automation: Liquibase Tools: DB Visualizer, Jmeter,... More advanced APIs: XA, Blob API, authentication, ...	**All your application needs to know is:** • URL as above • Class: com.tandem.t4jdbc.SQLMXDriver • Add t4sqlmx.jar file in the CLASSPATH	Client-side caching, native SSL Server-side caching (MFC) Server-side connectivity is fault tolerant Server-side auto load balancing Server-side multi-tenant resources pool

A mainstream database user experience

Is SQL/MX easy to adopt?

Common standards

- Standard languages, SQL, PL/MX
- Common datatypes and functions
- Standard connectivity and protocols ODBC, JDBC

The digital transformation

How do you transform to a data driven Enterprise?

SQL/MX versus SQL/MP

Available only in SQL/MX	tables
DbaaS, multi-tenancy, database compatibility	MX table only
Unicode, 32k rows, 2k key size, 128 digits precision	MX table only
Triggers, Referential integrity	MX table only
Identity columns, Sequence generators, [VAR]binary, blobs and clobs	MX table only
Hash partitioning, automatic partitioning (POS) for hash partitions	MX table only
ANSI GRANT/revoke, privilege groups, separation of duties	MX table only
Primary key update, multi commit delete, fastcopy, ….	MX table only
Python, PL/MX, Workload management and NSDA, remote mxci	MP or MX table
Scalable ODBC connectivity (MXCS), Off platform JDBC connectivity (JDBC type 4 driver)	MP or MX table
Stored procedures, Publish/subscribe, C++ embedded SQL	MP or MX table
ANSI SQL-99 and partial 2003 compliance	MP or MX table

SQL/MX can adapt to all scenarios to produce analytics

Leveraging SQL standards

Data is extracted using standard SQL and loaded in batch mode into analytics tools

Excel, Tableau, Power BI

Leveraging replication

Data is replicated off platform to another database that is optimized for analytics purposes

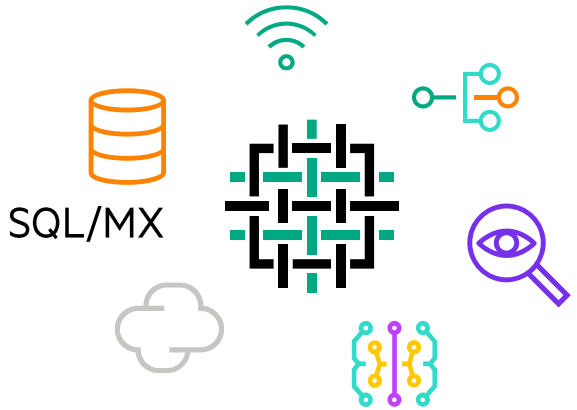
Solutions such as HPE Shadowbase can produce **real-time**, identical databases copies to mainstream DB platforms (SQL server, Oracle,…)

Leveraging in-memory data transformation

Data is transformed **in-memory** for various destinations and replication is optional

Multiple and disparate data sources can be correlated simultaneously

Solutions such as HPE NonStop Striim allows creating **real-time** data pipelines leveraging more than 150 adaptors



Striim: a next generation platform

On- premises

Other Clouds

Messaging

Cloud

CDC

Oracle
MongoDB
SQL Server
PostgreSQL
MySQL

Logs

Sensors

Real-time, continuous data movement

striim

Server

Template Driven Migrations

Built-in Delivery validation & Alerts

Real Time Data Visualization & Intelligence

With in-line de-normalization and transformations

Cloud data warehouses

Cloud messaging

Cloud services

Cloud databases

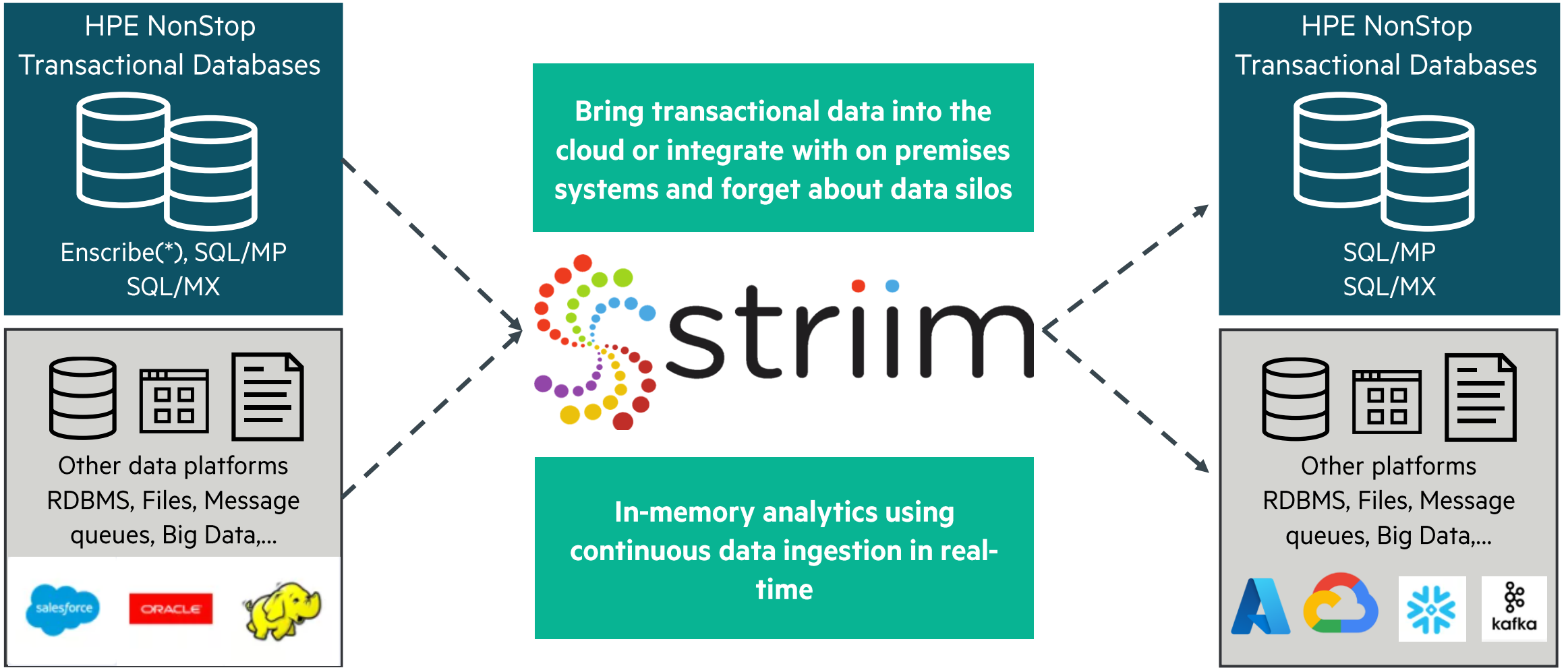
Cloud storage

Offloading reporting

Real-time analytics and apps

Advanced Analytics/ML

A complete data integration solution for NonStop



(*) Initial load not native

HPE NonStop to Cloud

striim

HPE NonStop
SQL/MX, SQL/MP
Enscribe

- Cloud Databases
- Cloud Data Warehouses
- Cloud Messaging
- Cloud Storage
- Cloud Services

Azure	aws	Google Cloud
SQL DB Azure DB Cosmos DB Synapse	RDS Aurora Redshift	Cloud SQL Cloud Spanner BigQuery
snowflake		
Event Hubs Data Lake Storage HDInsight	Kinesis S3 EMR	Cloud Pub/Sub Cloud Storage Cloud Data Proc

The digital transformation

How do you transform to a data driven Enterprise?

Digital transformation

- From SQL/MP to SQL/MX
- Data Integration with solutions such as Striim

Secure database management

How do you secure your data?

Secure database management

RBAC

A more productive way to secure privileges

MFA

Multi-Factor Authentication against password brute force attack

Auditing

Detect, analyze, address and avoid security breaches

SIEM

Enterprise security integration to streamline and simplify security

USE RBAC for DBA activities

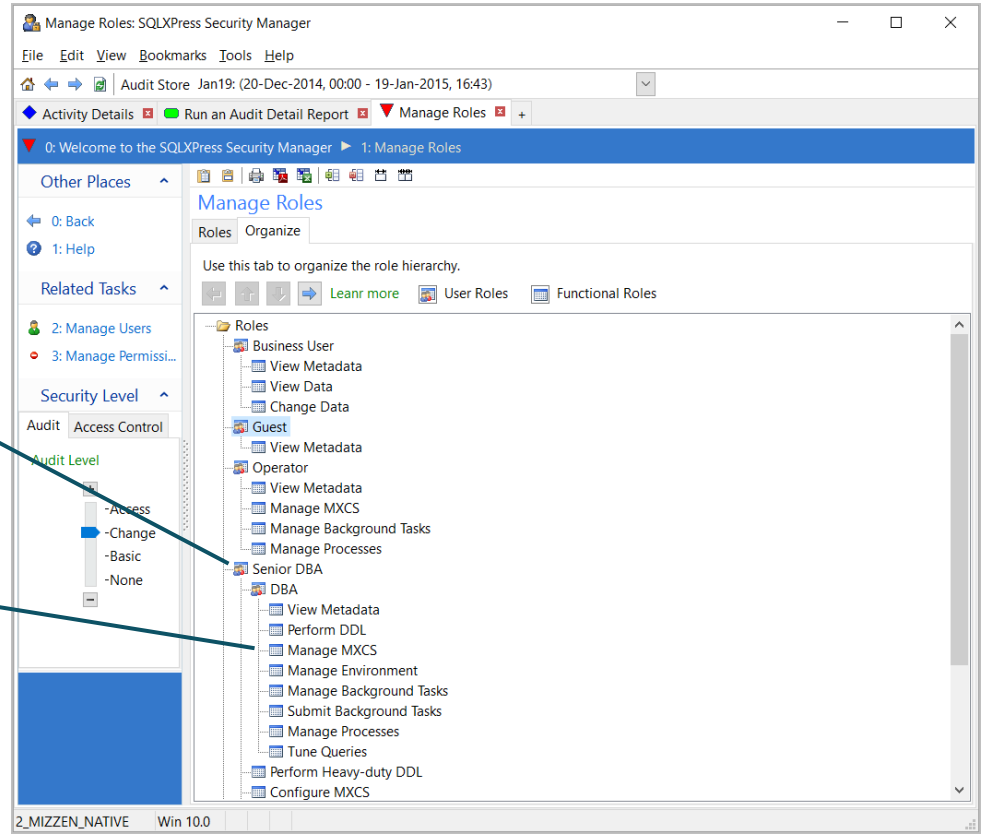
Access Control

- SQLXPress includes an extensive role-based access control implementation
- Includes roles hierarchy
- Includes concepts of user roles and function roles

SQLXPress 3.7 & later

User role
"Senior DBA"

Function role
"Manage MXCS"



Benefit examples

Fine grained roles and functions to prevent elevation of privilege
Easier security management than raw ACLs

Multi-factor authentication

Access Control

- SQLXPress is the most comprehensive GUI based administration solution for SQL/MX (as well as SQL/MP)
- No configuration required for SQLXPress:
  - SQLXPress detects if XUA is setup for MFA
  - If enabled SQLXPress will use MFA
- MFA setup in XUA
  - Requires RSA SecurID or Radius Authentication server
  - In a UAGROUP element define the types of authentication required by a given user (other criteria available)
  - NonStop user IDs are mapped to external user IDs (i.e. RSA SecurID ID)

SQLXPress 3.7 & later

Benefit examples

Prevents brute force password attack

Prevents elevation of privilege

Quick Tip

Access to mxci in OSS can also be protected using MFA. This can be enforced at the user level when using SSH with the attribute REQUIRED-AUTHENTICATIONS

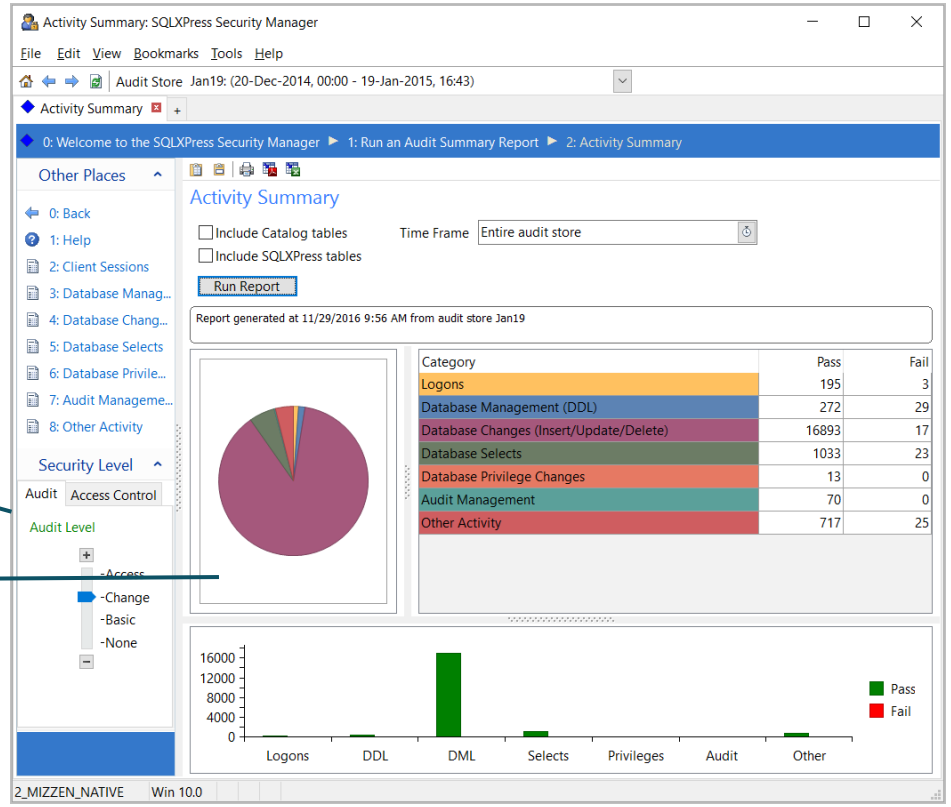
Enable auditing of DBA activities

Prevent data tampering

- Audit activity of SQLXPress users
- Audits logons, SQL statements, scripts
- Includes audit levels
- Include audit reports

Set audit level

Get instant report



SQLXPress 3.7 & later

Benefit examples

Non-repudiation

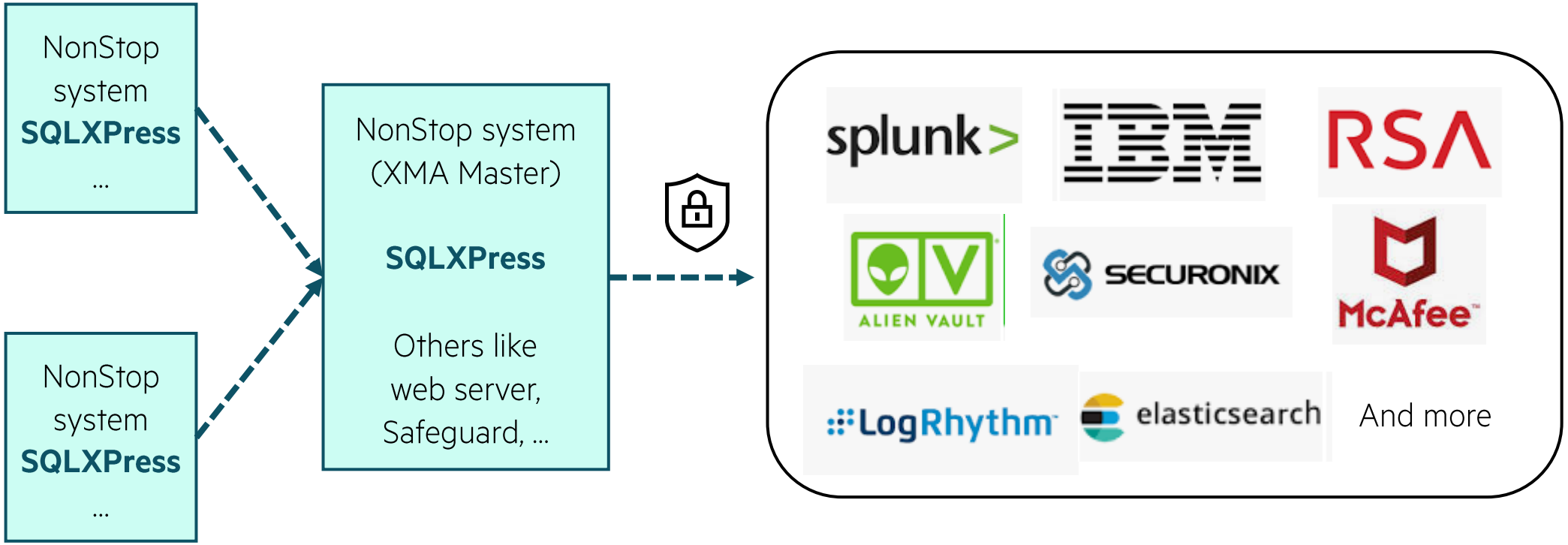
Detect security breach attempts

Quick Tip

With SQL/MX 3.8 we introduce a new DDL auditing feature native to SQL/MX that can be leveraged by 3rd party tools

Security Information and event management (SIEM)

- SQLXPress security events are forwarded to a NonStop XMA (XYGATE Merged Audit) Master node
- For reasons that include security compliance, such acquired data needs to be sent off platform in a repository (aka SIEM) such as Splunk, ElasticSearch or others….
- XMA is part of the OS and provides filters for both incoming data into the XMA database and what is sent to a SIEM



NonStop SQL out of the box security features

	NonStop SQL/MP	NonStop SQL/MX	NonStop SQL Cloud Edition
SQL memory protection	✓	✓	✓
Guardian RWEP	✓	N/A	N/A
Posix read, write, execute	N/A	✓	✓
ANSI Grant/Revoke	-	✓	✓
Privilege groups	- (can use RBAC Optional [1])	✓	✓
Security admin	- (or use Optional [1])	✓	✓
SSL (odbc/jdbc)	- (or use Optional [1])	✓	✓
PL/MX SQL governance	-	✓	✓
DBS reduced attack surface	-	✓	✓
Role Based Access Control	Optional [1]	Optional [1]	✓
DBA MFA authentication	Optional [2]	Optional [2]	✓
DBA auditing	Optional [1]	Optional [1]	✓
Enterprise security integration	Optional [3]	Optional [3]	✓

[1] SQLXPress ; [2] SQLXPress (via XUA); [3] SQLXPress (via XMA)

Secure database management

How do you secure your data?

Secure DB	• Secure DB management • More security with NonStop SQL Cloud Edition

Reduce your costs

How do you reduce your costs?

HPE NonStop SQL Cloud Edition

HPE NonStop SQL Cloud Edition

- HPE NonStop SQL/MX
- HPE NonStop SQLXPress
- HPE NonStop Database Analyzer

NonStop SQL Cloud Edition is available at the same price as SQL/MX but with the essential manageability tools included

The complete HPE NonStop SQL/MX Software product with all features such as high-availability, scale and multi-tenancy already included that let you focus on the application

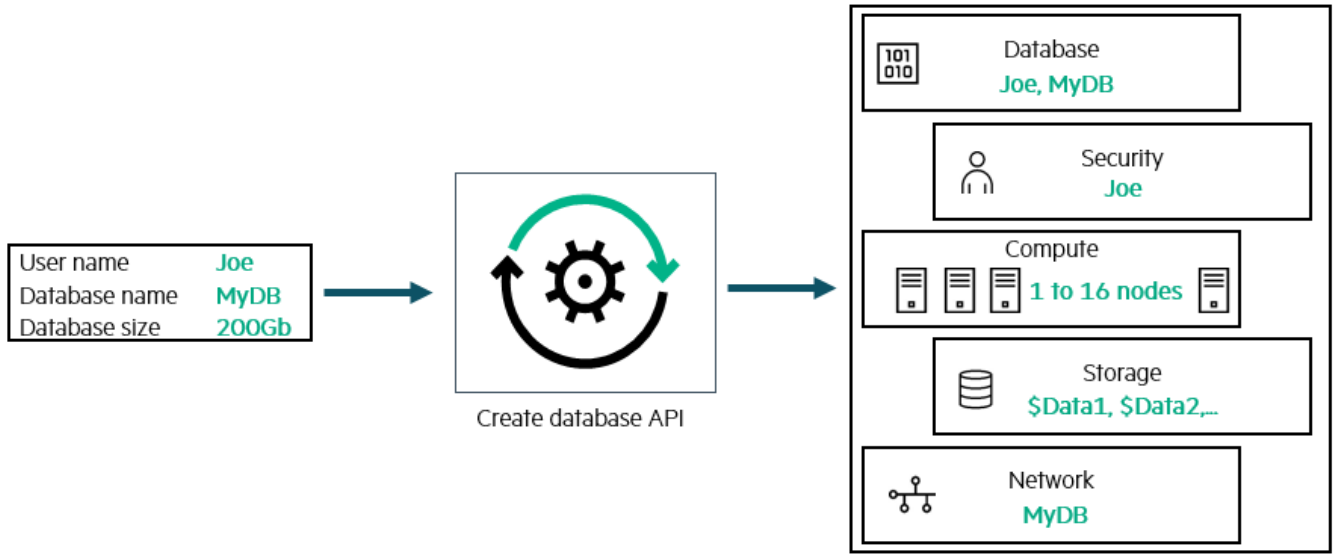
HPE NonStop SQLXPress, a management solution that makes each DBA task easy while maintaining the highest level of security

HPE NonStop Database Analyzer (NSDA), an advanced real-time monitoring of your database workload that does not require any DBA skills and shows business metrics to drive insights and optimize your workloads

SQL/MX Database Services - one click api

Your PASS to increased agility, reduced cost and business continuity for all

No training costs, exposing a simple, vendor agnostic API which in the backgrounds takes care of everything for you



It takes less DBAs to operate SQL/MX

Self service Portal

Apps

DevOps

SQL/MX

Fault-tolerance built-in
Turnkey scale out
Simplified architecture
Dynamic scale up
Multi-tenancy

Bare x86

VMware

SQLXPress: simplify, accelerate and keep everything secured!

Included with NonStop SQL Cloud Edition

Simplify

One tool instead of 10 for basic DBA functions

Tasks	Tools required
Database objects creation/update/deletes ; Query whiteboard; MXCS management; View/update data in a table; Import csv data into a table; Export data into a csv table; Show Graphical Query plans (Embedded SQL); Capture runtime statistics (Embedded SQL); Partition management; Lock analysis, scripting; process and transaction information; task manager	MXDM, mxci, rmxci, DB Visualizer, OSS import, VQP, FUP, pstate, tmfcom, netbatch

Accelerate

Only in SQLXPress

Tasks
Visual Query tuner (w/ metadata acquisition); Partition analysis and management; Create queries graphically; Histograms management ; Compare tables and DDL ; Disk space management; Database report

Secure

Zero trust ready

Tasks
MFA authentication, full RBAC capabilities, auditing, signed code, native encryption, security admin, SIEM integration

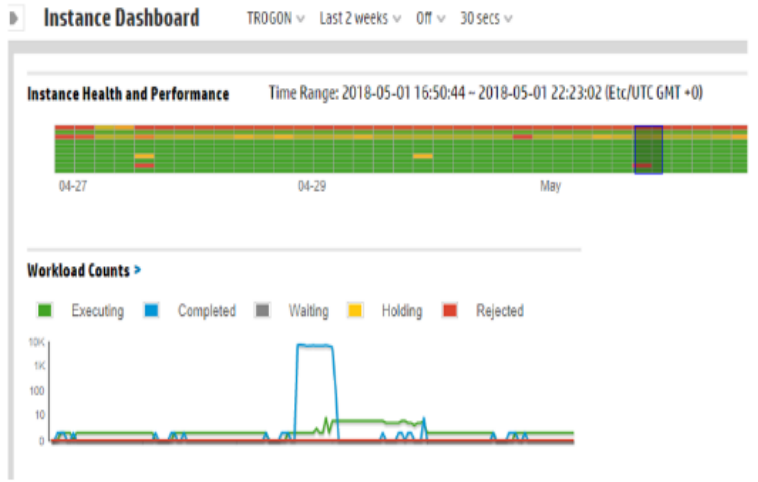
NonStop Database Analyzer (NSDA)

Included with NonStop SQL Cloud Edition

ML enabled

Features

- Real-time monitoring of your database workloads
- Full activity capture offload for historical reporting and capacity planning
- Database agnostic and browser-based cloud experience
- State of the art graphical interface user experience:
  - Drill down, time windowing/zooming, Top N dashboards, heatmaps
- Resource usage aggregation per user or database for IT LOB accounting
- Autonomous database management leveraging machine learning, alerts and automated query cancelations.



Benefits

- Empower your DBAs and application owners with a continuous view on performance and SLAs that are relevant to them, in real-time and without requiring performance gurus or NonStop OS skills.
- Drastically reduce time spent identifying root cause from weeks to seconds
- Reduce cost by optimizing workloads, predict and prevent, automating problem management

Latest additions

- **NSDA 1.3**: Machine learning and alerts
- **NSDA 1.4**: Auto-cancel, multi-window, time-range mgmt., heatmap enhancements, NSJ 11 support and container installation

Reduce your costs

How do you reduce your costs?

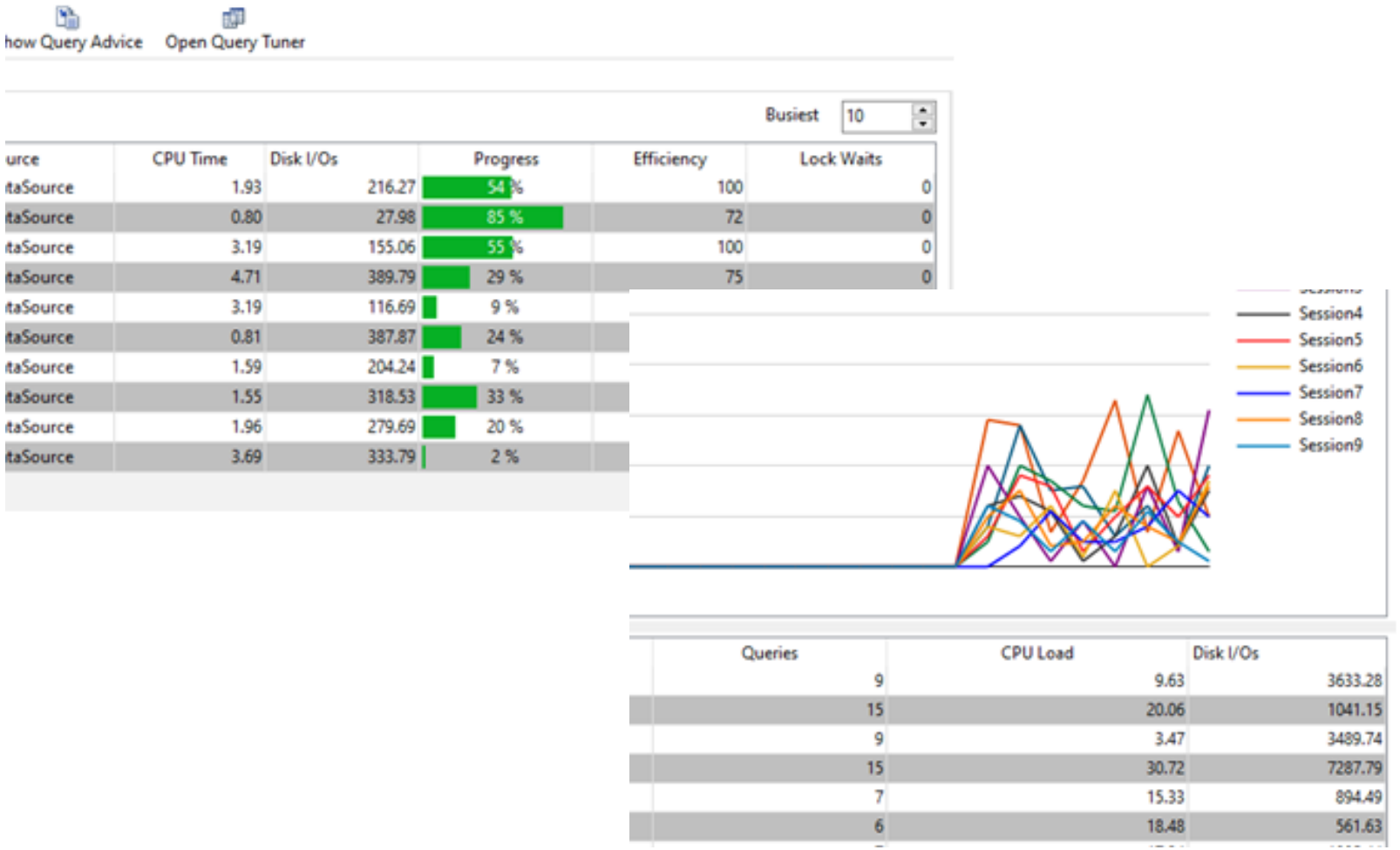
Reduced costs	• NonStop SQL Cloud Edition SQL/MX + SQLXPress + NSDA • Automation and productivity tools

Futures (subject to change)

- Adding **Transparent Data Encryption** (TDE) to SQL/MX
  - TDE is well known in the industry as a compromise between complexity/constraints of user level encryption yet providing a strong and easily deployed encryption for data at rest
- **Administrative privileges**
  - Extends the model of ANSI SQL privileges beyond data access to administrative functions
  - Better separation of duties, granular security and removing requirements for highly privileged user
- **DBaaS**
  - Admin privileges, platform management integration, SSL support, enhanced resource management functions
- **SQLXPress**
  - SQL/MX 3.8: Full DML support for native LOBs, runtime stats, row count, built-in functions & expressions
  - WMS API support: RTS/WMS performance monitoring
  - Extended PL/MX package support
  - SQL/MX DBS: SQLXPress as a DBS client, SQLXPress as DBS administration
- **Shadowbase**
  - Native blob/clob support, DDL Command replication, SBMAP data transformation, filtering and cleansing,…
- Others:
  - Lob and Binary support for Linux and Windows ODBC drivers
  - Performance improvements

SQLXPress Dynamic SQL Workloads (near future)

- Dynamic SQL workloads are typically queries coming from ODBC and JDBC, compiled on the fly
- Can be of OLTP or analytics type
- Potential for bad queries requires easy and quick identification
- Top 10 queries
- Aggregate CPU and I/O per query or per session



The SQL/MX total value

Innovate safely

Unique value	• Data Integrity at scale • Fault tolerant, distributed, transactional, all built-in • HPE NonStop SQL addresses complexity like no other
Common standards	• Standard languages, SQL, PL/MX • Common datatypes and functions • Standard connectivity and protocols ODBC, JDBC
Digital transformation	• From SQL/MP to SQL/MX • Data Integration with solutions such as Striim
Secure DB	• Secure DB management • More security with NonStop SQL Cloud Edition
Reduced costs	• NonStop SQL Cloud Edition SQL/MX + SQLXPress + NSDA • Automation and productivity tools

NonStop Partnership– It's a Beautiful Thing!

Thank you for attending this talk TBC23-TB51 Accelerate your digital transformation with SQLMX

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