Applications form the central nervous system in modern enterprises; they are the foundation on which businesses maintain their existing revenue streams while examining ways to create new revenue streams. Firms must constantly evolve their application strategy to be successful at expanding their competitive differentiation in the digital economy. Their applications portfolio must be constantly infused with new-generation applications that run in the cloud, are delivered as microservices, leverage open source technologies, and are increasingly (infrastructure) platform independent.

All applications are driven by data, however, and their ability to scale and adapt to changing business requirements is dependent on the database management system (DBMS) that drives the applications. For applications to be scalable and highly available, they need an underlying DBMS that can process transactions quickly and reliably and, for large analytic tasks, that can ingest huge and diverse data sets with low latency and leverage in-memory technologies for both transactional processing and real-time analytics. That DBMS must also support the next generation of applications that will require the ability to embed analytic queries in transaction processing, moving from online transaction processing (OLTP) to analytic transaction processing (ATP). Furthermore, these applications and their databases need to meet security and compliance requirements such as PCI DSS, GDPR, and HIPAA.

A versatile operating system environment (OSE) such as Linux is an ideal platform for consolidating current- and new-generation applications and their respective data management stacks.

The availability of Microsoft SQL Server on Linux enhances the value proposition of both platforms:

- For existing applications, SQL Server on Linux offers reduced total cost of ownership (TCO). Firms with investments in SQL Server can now chart a path for platform consolidation while preserving interoperability.
- For new application development, SQL Server on Linux provides more opportunities. Developers can now choose to go with SQL Server for the database layer without giving up on Linux as their deployment platform.
SITUATION OVERVIEW

Application Modernization Is an Essential Business Function

A modern application portfolio is essential for firms to efficiently compete in the digital economy. Application strategies must be constantly adjusted and tweaked so that the portfolio collectively enables the firm to meet its business objectives. Application development and support teams, working in conjunction with their IT operations peers, employ a variety of techniques to maintain the currency of their applications:

- Repackaging is the process of moving custom-developed applications to run natively in the new environment (e.g., a public cloud). The most common form of repackaging involves modifying the application so that the entire application or pieces of it can run inside portable, lightweight containers.
- Replatforming involves tweaking or updating the source code so that the entire application or pieces of it can run natively in the new environment (e.g., public, private, or hybrid cloud).
- Refactoring is the process of restructuring existing code – changing the factoring – without changing its external behavior. Refactoring improves nonfunctional attributes of the software (e.g., the operating system environment or data management layer).

These techniques are often used to meet key objectives involving redesign or change to the underlying components so the application becomes more highly scalable and distributed and thus highly available. These objectives and hence the techniques are not mutually exclusive. Example use cases include:

- Deploying data management systems (e.g., relational databases) that can ingest a huge amount of diverse data sets with low latency, leverage in-memory technologies for both transactional processing and real-time analytics, and generate near-real-time predictions based on transactions using machine learning as they are processed
- Achieving platform consolidation so that all or part of the application uses a common infrastructure layer such as the OSE with or on a modern virtualization stack
- Deploying secure computing and data layer processes (e.g., developer sandbox environments) so that the applications and their data management systems can meet security and compliance requirements such as PCI DSS, GDPR, and HIPAA
- Leveraging microservices that enable the development of applications as a set of independently deployable small and modular services in which each service or function runs a unique process or command and communicates through well-defined, lightweight mechanisms such as APIs

The Role of OSEs in Application Modernization

A versatile OSE is an ideal platform for consolidating current- and new-generation applications and their respective data management stacks. Such operating systems are designed to host or be hosted on a modern virtualization stack and offer the flexibility of choosing either on-premises or cloud deployments.

Over the past decade, Linux has become a preferred OSE at most enterprises given their propensity for open OSEs. As a modern OSE, Linux – specifically commercial Linux – enables IT organizations to offer:

- Deployment flexibility and seamless experience on bare metal or in virtualized environments, in the public cloud, on-premises, and in hybrid cloud configurations
- Development agility with tools and frameworks used in modern application development and natively supported on the OSE
▪ Currency, by benefiting from a faster release cadence of features and functions thanks to a vibrant open source community
▪ Enterprise service-level agreements, with enterprise-grade single-vendor support
▪ Choice, thanks to a robust ecosystem of vendors that provide a diverse array of software solutions

It is noteworthy that most infrastructure-focused independent software vendors (ISVs) have made Linux their preferred deployment platform.

**Platform Consolidation and Choice for Data Management**

Platform consolidation and data management architecture go hand in hand. A modern OSE enables the repackaging, replatforming, and refactoring of the data management and analytics layers in line with other application components. Running databases in containers, for example, enables integration with development methodologies such as DevOps and continuous integration/continuous delivery (CI/CD), thereby giving developers more control over the provisioning and orchestration of infrastructure resources. Furthermore, the use of a microservice delivery model results in a smaller and nimbler database footprint and allows for a higher density of database instances compared with running the same environment in a virtual machine.

**MICROSOFT SQL SERVER ON RED HAT ENTERPRISE LINUX EXPERIENCE**

Since 1993, Red Hat has steadfastly executed on its mission to accelerate enterprise adoption of commercially supported open source platforms. Its portfolio of products, offerings, and solutions enables customers to preserve many of their existing investments without making serious financial investments to self-maintain open source platforms. A key reason for the industry success of open source software is vendors such as Red Hat. And key reasons for the success of Red Hat are its commitment to and support of the open source community – both financially and by code contributions. Red Hat is one of the largest employers of developers supporting all the open source initiatives worldwide. Red Hat has successfully commercialized operating systems (Linux), cloud platforms (OpenShift and OpenStack), virtualization (KVM), storage (Gluster and Ceph), orchestration and automation (CloudForms and Ansible), and middleware (JBoss).

**Red Hat Enterprise Linux**

Red Hat's product stack begins with the company's flagship operating system product, Red Hat Enterprise Linux (RHEL). IDC research has found that Red Hat Enterprise Linux customers often use RHEL for enterprisewide business-critical deployments because of:

▪ Enterprise-grade features such as stability, reliability, security, and performance for current-generation workloads
▪ A solid yet flexible foundation for a new generation of workloads and solutions with the ability to deploy them in the core, at the edge, and in the cloud (Consistency is a key value proposition for RHEL – consistency across deployment choices.)
▪ Access to one of the industry's most extensive communities of partners, customers, and experts on infrastructure software
The Choice of Microsoft SQL Server for RHEL

A commercial Linux distribution such as RHEL, which is also Microsoft's reference Linux platform for SQL Server, enables IT to better support database consolidation, application modernization, and modern application development and packaging techniques such as support for DevOps, microservices, and containerized deployments. This is because RHEL offers:

- A consistent experience, whether running on bare metal or in virtualized environments or deployed in the public cloud, on-premises, or in hybrid cloud configurations
- Native support for tools and frameworks that are required for modern application development
- The best of both worlds – a faster release cadence of features and functions thanks to a vibrant open source community and enterprise-grade single-vendor support
- A robust ecosystem of vendors that provide a diverse array of software solutions

Most enterprises use relational DBMSs (RDBMSs) to manage their databases of record as well as their key ongoing analytic data management workloads. A great many of those enterprises are committed to the use of Microsoft's RDBMS, Microsoft SQL Server, for transaction processing as well as analytics and business intelligence. Microsoft SQL Server can manage data in a memory-optimized row or column format and employs the columnwise vector processing capability that combines processor cache exploitation with single instruction, multiple data (SIMD) processing. It can be deployed as a single instance or in a cluster.

That the latest version of Microsoft SQL Server can also support ATP establishes its long-term strategic position for such enterprises. But as these enterprises plan their future cloud migrations, one obstacle has stood in the way: Microsoft SQL Server ran only on Windows, but for many of these enterprises, Linux is the key strategic OSE for cloud migration and deployment. Fortunately, this constraint no longer exists.

RHEL Is Microsoft's Reference Linux Platform for SQL Server

When it comes to platform consolidation, existing Microsoft and Red Hat customers get more choice without making any compromises:

- **Enterprise-grade functionality**: Microsoft has been developing and adding innovative and enterprise-grade features to SQL Server, its flagship database product, for over 20 years. These capabilities are now available on RHEL, which gives SQL Server feature/function parity on Linux and Windows, allowing common deployments across each platform.

- **Workload-optimized performance**: SQL Server on RHEL provides faster performance for tough workloads relative to other open source or commercial relational databases supported on Linux. Red Hat claims that SQL Server performs as well on RHEL as it does on any other server platform.

- **Consistency**: Firms benefit from a streamlined and consistent SQL Server database experience across RHEL instances running on-premises or in the Microsoft Cloud, on bare metal servers, and as virtual machines and the database instances themselves running inside containers in the cloud (Azure).

- **Agility**: SQL Server is fully compatible with containerized deployments – that is, SQL Server itself can be containerized and support other applications running in containers. When applications are replatformed onto Linux, developers can choose to deploy the entire stack to run in containers, which are natively and fully supported on RHEL.
Security: Both RHEL and SQL Server offer robust security capabilities. For example, RHEL has been certified by the U.S. military as a secure platform. Similarly, SQL Server has had the fewest security vulnerabilities of any database platform over the past seven years (source: NIST National Vulnerability Database). The combination results in a formidable stack: the SQL Server on RHEL stack with built-in end-to-end security. It includes technologies such as Transparent Data Encryption (TDE), encrypted client connections, Row-Level Security (RLS), Dynamic Data Masking (DDM), and Always Encrypted (AE). For user and data access, SQL Server also provides audit capabilities and integration with Active Directory directly or via Red Hat IDM.

Service and support: Given that RHEL is Microsoft's reference Linux platform for SQL Server, existing Microsoft and Red Hat customers ought to know that all development and testing of "SQL Server on Linux" first happened on RHEL. Both vendors are committed to collocated support for SQL Server on RHEL customers. Moreover, these customers benefit from product support from Red Hat and Microsoft product security teams.

Humantech Uses SQL Server on Linux to Reduce Costs and Boost Efficiency

Humantech – one of the world’s largest providers of ergonomics consulting and software services – decided to standardize its IT environment on a single operating system to promote its continued growth and success. However, Humantech wanted to keep its preferred Windows database, Microsoft SQL Server, because of the solution’s reliable performance and familiar technology. To satisfy both needs, the company adopted SQL Server 2017 on Linux. In the process, Humantech saved on IT maintenance and has an updated database that offers fast operation and strong security.

Source: Microsoft

Key Use Case: Platform Modernization and Consolidation

SQL Server on RHEL is a great choice for existing Red Hat customers that want to consolidate their data management stack on a common enterprisewide platform without giving up flexibility or feature/function parity.

Non-Red Hat customers will also find SQL Server on RHEL attractive as they consider a path to migrate away from legacy platforms. Both groups will benefit from a reduced TCO by moving to a consolidated, simplified, and modern data management stack on a single commercial Linux OSE.

By focusing on the following key business benefits of SQL Server on RHEL, both groups will be able to convince business stakeholders that may resist any movement toward standardization or optimization that fails to align with their vision for "what is best or already working for them":

- Availability, performance, and security capabilities in line with business requirements
- Quick issue resolution backed by engineering and support teams from both vendors collaborating via an integrated ticketing system
- An extensive knowledge base that provides guidelines on migrating database instances without impacting business operations
OUTLOOK

Linux continues to show growth in the enterprise — both for on-premises and off-premises and in cloud and traditional IT deployments. Linux, specifically commercial Linux, will continue to gain strategic importance among firms as they embark on a multipronged business transformation strategy to remain competitive in the digital economy:

- Existing application modernization initiatives that require replatforming, refactoring, or repackaging to run natively on Linux
- New application development efforts to increase customer engagement and retention, such as applications that incorporate data collected via "Internet of Things" devices or sensors

IDC research shows that for the foreseeable future, Linux will remain a preferred platform for modern application and data management delivery, regardless of the application type and the way the application is delivered (i.e., bare metal, virtualized, or containerized) and the way the application is deployed (public cloud, private cloud, or traditional IT).

Successful vendors will be those that support a modern digital business stack and have a reputation for supporting commercial and open source platforms, all the way from the operating system to the application layer. Such vendors not only understand the nuances of application and database development and delivery but also can provide a one-stop shop for IT administrators and developers alike.

Microsoft and Red Hat partnering to support SQL Server and RHEL will surely open the floodgates for more application modernization and platform consolidation. IT buyers that are hesitant to touch their legacy production systems for fear of impacting business operations will now find a guided path toward a more modern, standardized, and well-managed application, data management, and operating environment stack that serves as the basis for innovation.
CHALLENGES/OPPORTUNITIES FOR RED HAT

IDC considers the availability of Microsoft SQL Server – a leading relational database platform – on Linux to be a noteworthy development that provides more choice to IT buyers:

- Red Hat has built a formidable portfolio of open source products and platforms. This portfolio is further strengthened by a robust ecosystem of ISVs and solution partners that build open source and commercial software with diverse data management stacks. Furthermore, Red Hat has extensive experience in supporting other OSEs such as Microsoft Windows Server. Red Hat also provides robust support and services for its own products as well as joint support and services for its partners’ products.

- For Microsoft, its investments in building its cloud-based Azure data services have paid off. Microsoft has gained solid traction in the enterprise as a tier 1 public cloud service provider. With platforms such as SQL Server, Microsoft also provides customers with a robust data platform that not only caters to enterprisewide relational and structured data management requirements but also supports unstructured, nonrelational, and big data and analytics requirements. The latter is gaining importance as firms aggressively chart out a plan for competing in the digital economy. A consolidated platform play is therefore a logical choice for such firms.

Together with Microsoft, Red Hat can capitalize on its unique position in the enterprise for consolidating SQL workloads.

However, Red Hat will face some headwinds as it seeks to expand the SQL Server on RHEL install base:

- **Perception:** This is not the first time that platforms have been ported from one OSE to another. Many of the firms that made the switch early on had to contend with unfortunate side effects that included lack of feature parity between the old and new stacks, mixed experience from the various application and data management components, and lack of single-vendor/joint-vendor support. Fortunately, Red Hat is no stranger to replatforming and can utilize its reputation to its advantage.

- **Stickiness of SQL Server on Windows:** Given the fact that SQL Server has been run exclusively on Windows since its inception, the IT buyer base it is pursuing will have plenty of reservations in replatforming the database portion of it, not so much because of the RDBMS itself but because the applications it serves may be Windows native and difficult to migrate. These reservations will include migration of SQL Server from Windows to Linux and supporting Linux, an environment with which many current Windows administrators have little to no experience.

Red Hat must focus on the business benefits of SQL Server on Linux as a strategy for warding off potential resistance to Linux that might be present. For example:

- Database administrators don’t necessarily have the time to adapt to a new platform. Operations productivity is also hindered by a lack of cross-platform tooling. Moving the database layer to an OSE they know (i.e., Linux) will make it easier for them to utilize SQL Server for their structured data needs.

- Developers can continue to use the tools with which they are familiar. SQL on RHEL supports existing SQL development tools such as SQL Server Operations Studio, MSSQL_CLI, and Visual Studio Code.
• The database tier can blend into the existing workflows, thus eliminating any need to devote additional resources or a greater portion of the budget to new hardware, software, and processes (e.g., DevOps) to meet these needs. For example, for managing SQL Server, Azure SQL Database, and Azure SQL Data Warehouse, SQL Operations Studio runs on Linux, MacOS, and Windows.

• By taking a solutions approach, Red Hat can focus on an ROI story. With SQL running on Linux, other Red Hat solutions can be brought to bear, increasing value for these customers. For example, JBoss middleware together with SQL Server is a great opportunity for Red Hat to go after other open source and commercial competitive stacks.

ESSENTIAL GUIDANCE FOR IT BUYERS

IT investments have a cumulative effect on firms. Over the course of many years, firms have made heavy investments in IT infrastructure, applications, processes, and policies. Much of their business runs on these technologies, and keeping them functioning "as is" is crucial for their IT organizations. At the same time, these IT organizations are under increasing pressure to become more efficient and increasingly agile so their firms can compete in the digital economy. These new requirements often trigger IT organizations to migrate to new platforms, adopt new technologies, and embrace newer workflows and processes. In light of aging infrastructures, the increased demand of both applications and workloads, and processes and policies that fail to map to modern "best practices," something needs to give should the IT organization wish to not fall further and further behind.

While it would be ideal for every IT organization to "start fresh," the reality is that IT organizations are generally unable to scrap existing investments and assets because of their resistance to write off sunk costs combined with a general tendency to limit change and a reluctance to compel their stakeholders to change the processes that directly impact the business. Embracing change and planning for the future while minimizing disruption to current operations are challenging to say the least.

A consolidation strategy with the right OSE (Linux) helps firms mitigate or address these challenges. The process works something like this:

1. **Acknowledge**: Acquire greater insight into how the problems (i.e., dwindling efficiencies and increased costs) may grow worse should one choose to ignore them and/or not take any action.

2. **Assess**: Acquire greater insight into how embracing change is easier and safer than it seems. For example, it is worth learning how it is possible to preserve existing investments as one standardizes and modernizes existing platforms. Recognize the benefits associated with IT optimization.

3. **Plan and execute**: Select a trusted partner that can help "keep the lights on" while enabling the migration to a modern and industry-standard OSE and data management stack. Create a plan for how to meet the needs of today while building out an IT infrastructure for the demands of tomorrow. Finally, execute.

CONCLUSION

Selecting the right platforms for enterprisewide consolidation is crucial for maximizing the chances of a successful outcome. Tried and trusted platforms such as RHEL and Microsoft SQL Server are great platforms on their own. Collectively, SQL Server on RHEL amplifies the value proposition because it brings together experienced product development expertise, investments in cloud platforms and services, and the support and services reputation of the respective vendors. The net beneficiary is the customer.
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