Superdome X: Performance, Scalability, Reliability, and Flexibility for Modernizing SAP Environments

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EXECUTIVE SUMMARY

SAP applications are critical for business. The day-to-day operations of many companies are executed by SAP applications, and these applications also inform heavily on business strategy. SAP is committed to innovating its environment and invests hundreds of millions of R&D spending annually.

It is now SAP's strategy to make the company's in-memory database, HANA, the foundation of the entire environment (for combined analytical and transactional processing under S/4HANA), which is quickly becoming a critical competitive capability. These environments run on Linux and will demand very specific hardware capabilities that are only now becoming available in the marketplace.

SAP's strategic road map leaves thousands of customers at a crossroads. Enterprise customers running traditional, mission-critical SAP applications on very solid databases, such as Oracle and DB2, and on high-RAS, high-performing, scale-up Unix platforms now face a very different future. Their current environment typically includes a host of complex, customized, highly interoperable SAP implementations running on a proprietary Unix system that has been managed, maintained, and optimized for many years. It probably helped grow the company to what it is today. But looking forward, they see an open source-driven ecosystem that has a distinct preference for standard x86 architecture, one designed to manage previously unimaginable amounts of data and numbers of transactions.

The very practical question these SAP customers are asking themselves is, "How do we bridge our proprietary past and our open source future without causing any disruption in our day-to-day operations? What platform will allow us to make this transition smoothly with the lowest risk?"

Over the next several years, SAP customers face a potential fourfold transition in updating their SAP environment. The changes are at multiple levels: infrastructure, operating system (OS), database, and application. This means that a new infrastructure investment for running SAP must be able to support changes at the OS, database, and application levels, as defined in SAP road maps, during the next 5–10 years.

IDC took an in-depth look at Hewlett Packard Enterprise's (HPE's) Integrity Superdome X, and we believe that this platform may be the answer for the following SAP customer segments: those migrating from a Unix platform, those migrating from a smaller standard x86 system, and those contemplating a large, greenfield SAP implementation on x86.

ABOUT THIS WHITE PAPER

This white paper addresses the needs of SAP customers in the current business environment of increasing data volumes, transaction speeds, and RAS requirements, especially for those that currently run SAP on Unix and need to migrate to Linux with some urgency. The paper also discusses the merits of HPE's Superdome X for such a migration. As a high-performance, high-RAS, scale-up platform on x86, the Superdome X may be uniquely suitable for SAP customers that wish to migrate to a scale-up system on standard x86 architecture.

SITUATION OVERVIEW

The majority of enterprises today rely on a vast and complex SAP application landscape to execute day-to-day business operations. These applications act as the core of the business and rely on IT infrastructure to enable them.

Whether customers run SAP with Oracle, DB2, SQL, or HANA, it is important to understand that SAP has reached an inflection point. SAP has indicated that SAP HANA and S/4HANA (the next generation of SAP ERP written to take full advantage of the HANA in-memory database) represent the strategic direction of the company. This is where SAP is investing most of its R&D resources in order to deliver innovation and functionality to its customers.

To remain competitive, enterprises must keep pace with SAP advances to ensure access to the latest functionality and the comprehensive support offerings that SAP delivers. This means adopting and migrating to HANA over time for analytics (Business Warehouse [BW]) and transactional/operational (S/4HANA) workloads as this will allow users to optimize processes, speed access to analytics, reduce costs, and promote innovation.

The full transition to HANA will come gradually. IDC data shows that while there has been a significant uptick in HANA installations in the past few years, many SAP customers continue to maintain legacy environments running multiple SAP applications on traditional database management systems (DBMSs). One important factor is the risk of migrating business-critical environments.

SAP has stated that it will support existing environments for at least another 10 years. However, for SAP customers operating on aging Unix infrastructure, the need to migrate is significantly more urgent. They will have to decide on a new platform now, whether or not they are preparing to move to HANA, for the simple reason that their Unix infrastructure is becoming too expensive to operate, too complex to maintain, and increasingly unfit to keep pace with today's transaction volumes and database size requirements.

IT managers with SAP applications running on proprietary processor architectures (such as SPARC, Power, or Itanium) and operating environments such as Solaris, AIX, or HP-UX are therefore considering migrating to industry-standard x86 and open-standard Linux or Windows. Any platform they consider will have to deliver on three critical dimensions to ensure that their enterprise's complex and highly mission-critical SAP implementations continue to run smoothly:

- **Performance and scalability.** For a company to remain competitive, IT needs the means to process vast amounts of transactional data and, at the same time, respond to demands from the business for real-time analytical insights.

- **The ability to run multiple instances in a single frame.** Customers that operate complex SAP environments want to be able to run multiple SAP applications in a single frame (e.g., HANA BW for analytics and SAP Business Suite on the same machine as companies slowly migrate to HANA; mixed OLTP and OLAP workloads for fast insights; or a mix of development, QA, and production for rapid app development and release).
- **High availability (HA) and reliability.** Today's Unix customers will migrate their mission-critical SAP environment only to an industry-standard x86 platform that is as bulletproof as their legacy system to ensure business continuity.

In the sections that follow, this paper takes an in-depth look at the HPE Superdome X, which addresses these and other pressing customer needs through a massive scale-up x86 platform combining high performance and capacity with Unix-like RAS features and a partitioning technology that allows for exceptional platform flexibility. This solution works well both for phased migration and for combining multiple environments within a single frame.

SAP Business Advantages and Superdome X

A database server that runs a company's mission-critical SAP landscape must provide exceptional performance, reliability, scalability, and flexibility. HPE's Superdome X is currently the largest scale-up server that has been certified to run SAP Business Suite on HANA (SOH) with very high levels of reliability and availability. At the same time, thanks to its hard partitioning technology, the system is flexible enough to run mixed workloads simultaneously, including BW and Business Suite on traditional databases and/or HANA, whether for development, testing, or production.

Performance and Capacity for Faster Business Performance

Data volumes are soaring and transaction speeds are accelerating. Companies that cannot respond adequately are losing their competitive edge to those that can keep up. Business teams that have the means to capture and analyze fast-moving data from their SAP applications in real time can make critical business decisions in minutes instead of days or weeks, meeting ever-increasing stakeholder expectations.

The Superdome X is a high-speed platform for SAP applications that can meet these performance requirements because of its 24TB memory footprint and ability to scale to 288 cores with exceptional I/O. This extensive pool of memory allows customers to run application servers, DBMSs, and central instances in one partition instead of separating them. This leads to fewer handoffs and faster throughput. The large memory footprint supports multiple and complex DBMS calls simultaneously, reducing the latency associated with storage I/O. One SAP customer on a Superdome X reported that its large (8,000-user) retail SAP implementation on DB2 ran exceptionally well yet took up only three-quarters of the server. This allowed the company to deploy another virtualized instance of SAP on HANA in the remaining quarter using Superdome X hard partition support, which allows different environments to coexist securely within the same system.

Superdome X's performance also improves business transaction speeds. SAP HANA requires a strict CPU cores-to-memory ratio. With the Haswell microarchitecture, the Superdome X with all of its 288 cores enables an impressive 12TB in-memory computing. The platform shows strong I/O performance, thanks to its unique crossbar fabric, which HPE designed to minimize latency across the system's cells to spinning media and SSDs. This ability especially benefits customers on traditional SAP and relational databases because it shortens the duration of every transaction and results in faster business performance.

HPE recently completed an SAP benchmark on Superdome X and achieved 459,580 SAPS (SAP Application Performance Standard) with 84,000 SAP benchmark users on the two-tier SAP Sales and Distribution (SD) standard application benchmark. This was a leadership result for 16 processors at the time of benchmarking. For HANA, Superdome X performance is less dependent on I/O throughput because an in-memory database such as HANA primarily relies on memory speed to read and write data faster. In-memory processing typically requires large amounts of memory, which is why the Superdome X is an ideal system for HANA and S/4HANA. Its 24TB memory capacity on the Haswell Xeon processor is larger than most other vendors' systems, and customers can expand the memory footprint in a scale-up fashion. This means that when HANA is running on the Superdome X, business transaction speeds accelerate dramatically.

Hard Partitioning for Business Agility, Consolidation, Lower Opex, and Low-Risk Migration

Superdome's nPars play an important role in the platform's ability to accommodate rapidly evolving workload demands in today's time- and budget-constrained business environments. HPE nPars hard partitioning technology, unlike software-based virtual partitioning, securely isolates partitions electrically. Each HPE nPar has its own CPUs, memory, and I/O that can be removed and added to another HPE nPar via management software. There is no physical manipulation involved. The electrical isolation ensures that if one nPar were to experience a hardware failure, other nPars will continue to function normally. nPars allow customers to configure each Superdome X system as a single server or as many smaller, independent servers. The business benefits from this capability are substantial:

- **Running analytical and transactional workloads in the same frame.** Analytical (OLAP) workloads look up and cross-reference many records at a time. This I/O-bound characteristic requires a memory, I/O, and CPU configuration that differs markedly from the configuration needed for transactional (OLTP) workloads. The latter typically process a single record at a time in rapid succession. With Superdome X's nPars, the SAP infrastructure manager can isolate these workloads and execute them simultaneously. Because of the electrical isolation between the nPars, the system runs separate OS instances that do not share I/O and the applications do not interfere with each other. System replication between the two data sources ensures synchronization. The Superdome's ability to run analytical (OLAP) and transactional (OLTP) workloads at the same time obviates the need for building separate hardware instances for each workload and speeds the process of standing up and configuring infrastructure for waiting workloads, thus enhancing business agility.

- **Consolidation.** An effective way to reduce cost in the datacenter is to consolidate workloads in a single server. The large capacity of Superdome X combined with its hardware partitions allows customers to consolidate SAP applications (ERP, CRM, SRM, PLM, etc.) and different IT landscapes (QA, development, production) that formerly resided on many smaller servers without the fear of interference from neighboring partitions. This reduces server sprawl as well as IT staff labor, the associated datacenter footprint, and related power and cooling costs. It also simplifies management. The Superdome X's ability to vary memory, I/O, and CPU cores by partition enables IT to be as flexible as necessary and provision a wide variety of workload profiles in a single frame.

- **Resilience and security.** Keeping an application up to date increases security, and patching it without requiring planned downtime improves business resilience. The Superdome X with its nPars eliminates the need to take an application down to install and configure software revisions, upgrades, and patches. By replicating an SAP application within a separate nPar, IT can keep the application up in one partition as it brings down and upgrades the application in another partition. This results in less downtime and fewer interruptions, fewer "off-hours" duty calls, greater business resilience, and improved security.

- **Resource management.** Workloads have become increasingly variable as data from end users, Internet-of-Things devices, and social and business networks fluctuates with market trends, supply chain events, or popular sentiment. Anticipated peaks require well-executed resource management. *Unexpected* peaks additionally require a flexible infrastructure. HPE nPars make it feasible for IT managers to quickly change the Superdome X's workloads and increase or decrease resources as needed. Whether Oracle, DB2, SQL Server, or HANA, the Superdome X has the flexibility, within the whole frame, to respond to needs without a customer having to move to another server or upgrade its hardware.

- **Reduced software licensing costs.** Software licensing costs can be among the largest opex factors in the datacenter, and consolidating workloads on a large server can increase those costs unless that server can be partitioned. For example, customers that are migrating a DBMS (e.g., Oracle migrating from Unix on a proprietary processor architecture to a large x86 server) could face higher DBMS licensing costs if the x86 server includes more processors. But HPE nPars enable customers to limit the license to an nPar with a lower core count (instead of the entire server). This reduces the licensing cost and the overall infrastructure cost per user.

- **Datacenter in a box.** Consolidation of many smaller servers onto a single large server that can be partitioned is extremely effective and cost efficient. Some customers turn the Superdome X into a "datacenter in a box," with smaller HANA and legacy SAP partitions as well as partitions with Exchange and other third-party applications.

Using Hard Partitioning for a Low-Risk Migration to HANA and S/4HANA

Migrating to HANA is anything but a quick and easy proposition. In many companies, the SAP applications that run on top of a traditional database are as essential to the business as capital, labor, and access to resources. The risk of disrupting the SAP environment during a migration instills fear in IT and lines of business alike. An environment in which the old and the new can run in parallel greatly relieves that concern. By using nPars to manage different environments in parallel, SAP customers can make decisions to cut over from a traditional database to HANA and then to S/4HANA in a careful, gradual fashion, with much less impact on the operational environment and thus significantly less risk. This makes the HPE Superdome X a suitable platform for SAP customers that are planning to first migrate to a scale-up x86 environment and then to HANA and S/4HANA. Sample scenarios might include:

- **Sample scenario 1:** A company might decide to stay on Oracle, DB2, or SQL Server for now, or IT might decide that it wants to gain experience with HANA by running BW on HANA in a separate partition, without touching the company's business-critical transactional system. Next, the company might decide to run SAP Business Suite on a non-HANA database in a different partition while running SAP Business Suite on HANA in a third partition, side by side until it is ready to cut over to HANA entirely.

- **Sample scenario 2:** Another company might decide to take half a server and hard partition it for 6TB Suite on HANA and then take two more partitions, virtualize the partitions with VMware or Red Hat Enterprise Virtualization (RHEV) to set up non-HANA databases, application servers, and the central services that manage the entire SAP instance, and put various SAP or non-SAP workloads on the same frame.

Once migrated to HANA, not every SAP customer will need a full footprint of 12TB memory for each HANA instance. For example, a company with multiple divisions that cannot mix their workloads can break up the Superdome X into four distinct nPars. This allows the company to deploy multiple SAP HANA environments in the same frame, one for each division. Yet, from an IT perspective, it's just a single large system that needs to be managed. One division may migrate to S/4HANA within its partition, while the other divisions continue to use their partitions for SAP on HANA, for Enterprise Central Component (ECC), or, if enough resources exist, for BW.

Additional Flexibility: Virtualization and Multitenant Containers on the Superdome X

As described previously, virtualization on the Superdome X is primarily achieved with nPars, but customers can virtualize traditional SAP applications with VMware and RHEV and HANA with VMware (since VMware is SAP certified). HPE does not offer a certified appliance that runs VMware. Customers that want to run HANA in VMs will need a Tailored Datacenter Integration (TDI) solution, meaning IT brings the various infrastructure components together instead of obtaining an appliance to do so. Until recently, SAP allowed only one VM for production on the server, but SAP has loosened that restriction and is now allowing customers to run multiple VMs.

SAP has also taken steps to allow multiple HANA instances to run under the same OS in production (until now, SAP allowed this only in nonproduction environments), giving customers an additional layer of flexibility. Furthermore, with HANA's Support Package Stack 09 (SPS 09), SAP has come out with multitenant containers, which are gaining traction. Multitenancy allows customers on larger systems such as the Superdome X to mix different types of workloads (e.g., running a Suite on HANA with ECC and CRM as a workload in their own container and BW as a separate workload in another container). In a way, this too can be viewed as internal virtualization.

Scalability to Respond to Business Volume Increases

Because SAP applications must cope with rapidly increasing data streams, growing transaction volumes, and increasingly complex and time-constrained analytical demands from the business, infrastructure scalability is an important requirement. The Superdome X is suitable for both scale-out (within the frame as well as by adding frames) and scale-up. The platform has been certified for 3TB of memory in the scale-out configuration and up to 12TB of memory for Business Suite on HANA for a single database node.

Scale-Out for BW on HANA on the Superdome X

In an OLAP environment such as BW, SAP HANA works best with a scale-out infrastructure. SAP has certified that the Superdome X meets the memory-to-CPU ratio required for scale-out. The Superdome X with Haswell can apply 384GB of memory per socket and is certified for 3TB per node. For scaling out on BW, the Superdome X is divided into two nPars, each with eight sockets. SAP's requirement for BW on HANA allows for no more than 2TB from those eight sockets. This is sufficient for most customers (remember that HANA has a powerful compression technology that drastically reduces database sizes). Customers that need more nodes can add more frames. For example, a customer that needs 16TB can achieve this with four frames. Currently, the Superdome X can scale out to a maximum of 96TB with a master node and slave nodes.

Scale-Up for Business Suite on HANA on the Superdome X

Business Suite on HANA, or Suite on HANA, which is an OLTP environment, performs much better in a scale-up solution, running in one big memory footprint. HPE states that with 16 sockets and 12TB – which the company says is currently the largest configuration in the industry – Superdome X can handle 99% of customer requirements today. With permission from SAP, the system could even be grown to 24TB.

Scale-up not only means being able to turn on more processors but also means being able to do so without gradual performance loss. If a system's scalability is not linear, the system will become less effective and less efficient with each additional set of activated processors. The transaction and analytical speeds that a business needs from the platform will inevitably suffer. HPE has demonstrated that the Superdome X scales near linearly: With each doubling of its processor capacity, its performance doubles as well, even when scaled to the largest configurations. This gives IT the means to quickly scale up SAP applications without performance loss.

With SAP Business Suite on HANA, which is a scale-up configuration, Superdome X offers one large memory footprint because of the CPU-to-memory ratio. With a large memory footprint, a better response time is achieved because the data doesn't cascade across additional servers.

Scale-Up for S/4HANA on the Superdome X

With its S/4HANA release, SAP envisions delivering a means of supporting both BW and OLTP at once, on the same server. This would, in SAP's view, provide users with real-time analytics around logistics, supplies, sales, and so forth. Without separate activities for transaction data extraction, transformation, and loading into a separate platform, business managers can apply analytics to make immediate, real-time decisions. This architecture will eliminate the need for system replication as S/4HANA works with a single data source across both OLTP workloads – for order entry, shipping, logistics, finance, and so forth – and OLAP workloads.

The Superdome X's ability to provide a single, large in-memory data pool is important in this context. IDC expects that OLAP and OLTP will become increasingly mixed, which will require that systems support both OLTP's many parallel short transactions (inserting/updating/deleting specific small sets of records) and BW's vast data scanning, huge joins, and massive aggregations. Superdome's scale can handle HANA's likely demands for both types of memory footprint, positioning businesses to quickly take advantage of these S/4HANA benefits as they appear.

Linux as a Prerequisite for HANA and for Open Source-Driven Innovation

HANA does not run on Unix. For SAP customers on Unix, a move to Linux before any other migration is therefore necessary and, increasingly, inevitable. Further, a move to Linux has the added benefit of allowing enterprises to simplify and standardize on broadly available open source technologies in a large, versatile software ecosystem. Linux frees businesses from vendor lock-in and reduces the number and type of IT specialists required on staff. This ultimately reduces the cost of IT infrastructure per SAP user, an important business goal for many SAP customers.

Unix experts in the datacenter have found Linux to be similar to Unix, easing the learning curve of the migration process. Linux has also evolved to approximate the RAS features of a Unix platform, especially if the underlying hardware is built with enterprise-level HA requirements in mind, as is the Superdome. Furthermore, IDC believes that Linux has become the preferred operating system for the open source environments that are enabling next-generation application development. Combined, Linux and open source adoption exerts a powerful, innovative impact on businesses and is becoming an increasingly potent competitive force.

Superdome X represents an industry-standard x86 platform that runs on Linux (and Windows) with the scalability and RAS features of a Unix platform. Most SAP customers looking to migrate from large Unix platforms have not previously found comparably scalable x86 servers with Linux. The Superdome X, however, is such a platform. Its above-mentioned hard partitioning allows these customers to begin a low-risk, phased journey to Linux. The Superdome X is currently certified to run SAP HANA with SUSE and Red Hat.

High Availability and Reliability

High availability is the mantra of today's business environment. Tolerance for crashed apps, downed Web sites, or lost or corrupted customer data in today's digital environments is approaching nil. Nonavailability can lead to instant, sometimes dramatic, revenue loss, damage to reputation, customer anger, internal disciplinary measures, external penalties for noncompliance, and negative media coverage. Quite a few IT managers and directors have experienced major unplanned breakdowns in the datacenter, and today, HA — together with security — is top of mind, especially with regard to something as mission critical as a company's SAP implementation.

HPE states that the Superdome X achieves 99.999% single-system availability. IDC measures availability levels of server platforms with a categorization of 1-4, whereby AL1 (Availability Level 1) represents a system with no built-in availability and AL4 (Availability Level 4) means that, no matter what, business processing continues without interruption. In this categorization, the Superdome X is an AL3 platform, which applies to servers shipped with robust clustering software such as, in this case, HPE Serviceguard.

HPE has enabled Serviceguard to work in concert with HANA HA/DR for failover between nodes. Serviceguard also protects the traditional SAP implementations, specifically Serviceguard for Linux, Metrocluster, and Continentalcluster. For customers with very demanding SLAs, SAP system replication may require a hot standby with memory always up to date and ready in the failover server. All Serviceguard then needs to do is flip the virtual IPs over and the standby is up and running in production. If the standby is a dual-use server that needs to first shut down its current workload (e.g., QA) and then load 12TB of memory so that it can take over production, downtime will be longer (about an hour for 12TB, according to HPE estimates).

Support and Consulting Services

The complexities of transitioning hardware and software platforms as discussed in this paper are not to be underestimated. The variables in these shifts can be overwhelming, especially for SAP customers that are contemplating a quadruple migration from any DBMS on Unix to the same DBMS on Linux to HANA to S/4HANA. This paper has already discussed the flexibility that the Superdome X provides in terms of staging such a transition. However, the importance of obtaining comprehensive vendor support — in this case from HPE — should be mentioned.

HPE provides extensive support and hands-on help to customers in various stages of their SAP evolution, including to:

- Customers that are currently running on Unix and that have made the move to Linux for their application servers but are now deciding to port their database
- Customers that are moving an SAP environment from a traditional database to HANA and whose portfolio of applications running on the original database has grown very large and consists of many different tables that interoperate, making database migration very complex and requiring extensive testing

HPE Migration Consulting Services provide support and expertise to help customers migrate from a Unix platform to Linux without interrupting their business. They also help customers assess, prepare for, and manage the migration of an existing SAP ERP database to SAP Business Suite on HANA.

HPE's support groups can help with performance analysis and troubleshooting during a HANA migration. For some customers, this type of in-depth support is critical, and they should take full advantage of it. Others may already be working with SAP, which also provides help with these types of moves.

HPE also runs what it calls Centers of Expertise (CoEs), which support customers that want a "white glove" approach. Having implemented and maintained the customers' environment, the CoEs know it through and through, and they can respond immediately and knowledgeably to any customer-specific issue.

HPE's Deployment Accelerator Service is part of the CoE, and HPE considers this service one of its biggest differentiators. The service helps customers get their HANA appliances up and running in a very rapid fashion. HPE proudly points out that it received the 2014 SAP award for Rapid-Deployment Partner of the Year.

CHALLENGES/OPPORTUNITIES

For vendors of SAP-certified hardware, the main objective should be to help customers make the right platform choice and then deliver the optimal systems to implement the right SAP environment. What customers are asking for is that vendors help them:

- Understand their particular use case and business drivers.
- Determine whether they should migrate part of their environment and then execute a carefully phased approach to migrate other components or execute major migrations over a number of years.
- Determine whether they would benefit from an SAP appliance that can provide fast time to value because of a greatly shortened implementation time.
- Decide whether there is an opportunity to simplify their landscape because, over the years, they may have built up a proliferation of multiple development, QA, and production environments that would benefit from a combination of migration and optimization.
- Determine whether this is a good time for application rationalization, modernization, and consolidation, potentially allowing a customer that is considering a new architecture to simplify its environment and at the same time reduce costs.
- Determine whether the customer would be better served to run the SAP Business Suite on SAP's HANA Enterprise Cloud managed service or to run S/4 HANA in the public cloud, both strategic initiatives for SAP. In particular, smaller companies may benefit from a move to the cloud because it removes management requirements. Larger customers may choose to do development in a hybrid environment of HANA Enterprise Cloud with an on-premises SAP environment.

Given HPE's long history in consulting and providing support around SAP, the company is well equipped to help customers address these challenges.

CONCLUSION

IDC believes that SAP customers that find themselves at a crossroads because of their aging Unix infrastructure now have an opportunity to carefully and gradually switch their SAP environment over to Linux on a scalable, high-performance, high-RAS platform on standard x86 architecture, an option they did not have before. The HPE Superdome X is worthy of consideration for this complex migration because of its extreme performance, scalability, and RAS features and because of HPE's extensive and multitiered support.

The Superdome X is an ideal candidate because of its hard partitioning technology, which allows for a multistep migration, with various stages of the process occurring simultaneously, something that would have been impossible in a virtualized environment. This means that new environments, such as HANA and S/4HANA, can be exhaustively tested while traditional SAP applications on other databases continue to run the business, all in the same Superdome X frame, until the time is right to safely cut the cord to the past. IDC believes that with the Superdome X, HPE has provided a clear path forward for SAP customers on Unix that are ready to modernize their SAP environment.

About IDC

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