

# Oracle Exadata Statement of Direction

MAY 2017



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## Introduction

The Oracle Exadata Database Machine is engineered to be the highest performing, most cost effective and most available platform for running Oracle Database. Exadata is a modern architecture featuring scale-out industry-standard database servers, scale-out intelligent storage servers, state-of-the-art PCI flash storage servers and an extremely high speed InfiniBand internal fabric that connects all servers and storage.

Exadata takes advantage of Oracle's decades of database experience and builds on Oracle's leadership position as the #1 database for Online Transaction Processing (OLTP), Data Warehousing (DW), Database Consolidation, and In-Memory Analytics. Current Exadata offerings are the outcome of twelve-plus years of dedicated development, and thousands of engineer years of effort.

With thousands of Exadata deployments globally, that include the top banks, telecoms and retailers, one common question for customers invested and interested in Exadata is where the Exadata technology is headed in the near future. The following is intended to outline the general product direction for Oracle Exadata, so that customers can feel reassured that they will continue to get significant returns on their Exadata investment for the foreseeable future.

## Exadata's Scale-out Flexible Architecture

The Exadata architecture moves beyond the legacy idea that customers should assemble database systems from silos of compute and generic storage connected with legacy networks. Exadata architecture was designed from the ground up, to seamlessly integrate modern scale-out principles at both the compute and storage layers, along with unified connectivity based on optimized network protocols, tightly integrated flash and in-memory technologies, as well as application-aware intelligence within storage. As business workload grows, database CPUs, storage, and networking can be added in a balanced fashion without scalability bottlenecks. This scale-out architecture accommodates any size workload and allows seamless expansion from small to extremely large configurations while avoiding performance bottlenecks and single points of failure.

Key to the success of the Exadata architecture is software that makes many scale-out servers look like a single system to an application. Applications do not need to be changed to run on Exadata or to take advantage of additional database or storage servers after they are added.

## Exadata's Hardware Update Strategy

The Exadata Hardware Update Strategy is very logical and easy to understand. Oracle has successfully followed the same strategy for many generations and intends to continue to follow the same strategy going forward.

Exadata leverages state-of-the-art components to build the fastest, most highly available and cost-effective Oracle Database platform in the market. Each generation of Exadata adopts leading-edge processors, memory, flash, disk, and networking technologies. Because Exadata is built using industry standard servers for both compute and storage, it easily takes advantage of the rapid evolution of high volume hardware. Exadata offers superior database

performance today, and future versions will continue to track state-of-the-art processors, storage, memory, flash, and networking technologies, delivering the best performance and price-performance.

The following diagram outlines how successive Exadata generations have evolved, along with corresponding enhancements in leading-edge hardware components.

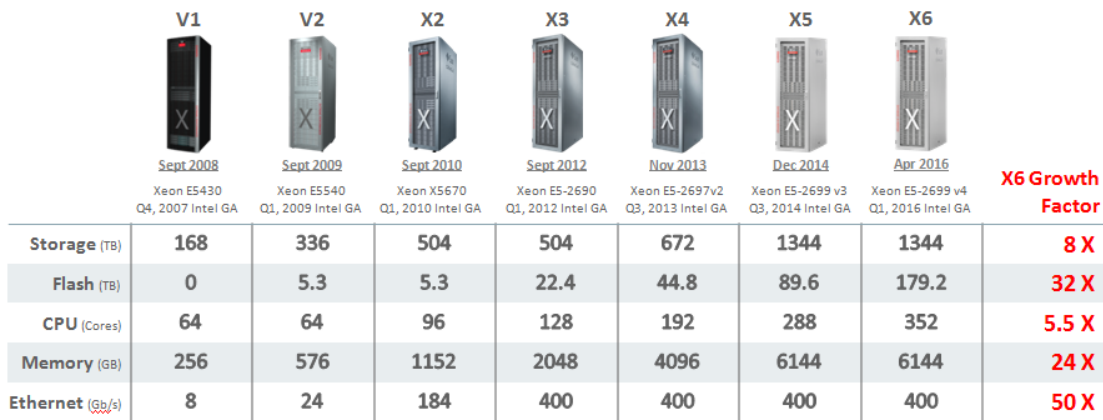


Figure 1: Exadata Hardware Generational Advances  
(assumes typical full rack configuration of 8 database servers and 14 storage servers)

As can be seen from above, Exadata Database Machine generations closely follow processor update cycles. This model maintains an innovation cadence that ensures adoption of the latest microprocessor technologies, with new advancements approximately every year. In addition to adopting new processors, every new generation of Exadata adopts state-of-the-art memory, flash, disks and networking. For example, the latest Exadata release, Exadata X6, doubled the flash capacity compared to the previous version. New Exadata hardware generations follow new processor releases, allowing time for integration of all components and hardening and stabilization needed for mission critical applications. Exadata hardware updates bundle together as many new components as possible, eliminating cumbersome piecemeal changes. The goal is to be timely enough to maintain leading performance and price-performance, while being conservative enough to ensure the highest quality.

## Exadata's Software Update Strategy

Oracle will continue to develop unique new Exadata software capabilities to optimize compute, storage, and networking, enabling even higher levels of performance, availability and scalability for the Oracle Database. Exadata software is released in periodic intervals, with the latest software release incorporating customer feedback and additional enhancements since the previous releases. Exadata software is compatible with previous Exadata hardware platforms. Similarly, a major Database software release is followed by the release of a major Exadata software version that is fully compatible with that release of the Database software.

Exadata software is developed directly by Oracle's core Database development team. Many of the new capabilities require algorithmic enhancements at several layers of the software stack, including core RDBMS, OS, VM and storage. All such necessary software enhancements are provided by various Oracle product development teams working together in a tightly integrated manner. Oracle is thus uniquely positioned in the industry to be able to

innovate across all layers of the hierarchy for all types of database workloads, realizing immense value to customers.

The unique innovations that Oracle has created in Exadata software over the last several years have not only enabled unparalleled levels of performance, availability, scalability, and capacity for the Oracle Database when it is run on Exadata, they also differentiate Exadata from generic integrated infrastructure platforms available from other vendors. Many of these infrastructure platforms are also based on recent processors, network, flash, disk, and other hardware. They do trail Exadata in adoption of hardware advances such as 8TB disk drives, 3D V-NAND NVMe PCI Flash, Memory-level performance with Shared Flash, Unified InfiniBand Networking, etc. They also lack the deep database integration and unique optimizations that are present between Exadata software and the Oracle Database, such as smart scan, storage indexes, hybrid columnar compression, database-aware flash, in-memory fault tolerance, etc. These innovative software features create a performance, capacity, price-performance, and availability gap between Oracle Database on Exadata vs. Oracle Database on generic integrated platforms that is extremely large today, and is growing at a very rapid pace, as shown in the diagram below.

Oracle will continue to develop unique software capabilities for the Exadata platform that will further increase the gap between Exadata and generic integrated platforms. Some of the new software capabilities will be tied to specific hardware advances, but the majority of these capabilities are pure software optimizations that will benefit both new Exadata systems and previous Exadata generations. Therefore, Exadata customers benefit from a constant stream of software improvements that increase the performance and ROI of their existing and new Exadata platforms.

## Exadata Advantages Increase Every Year

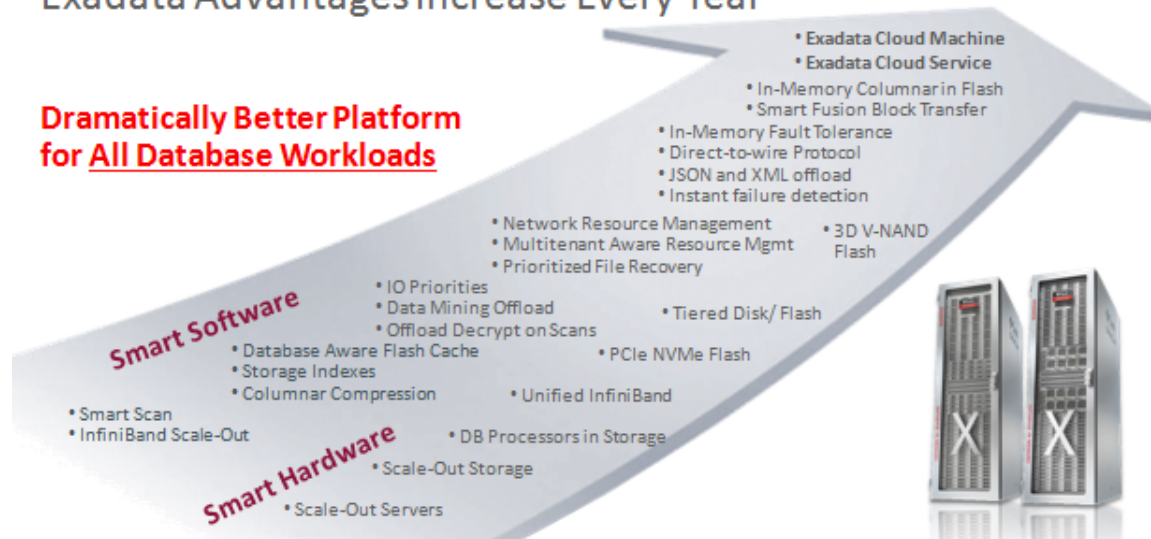


Figure 2: Benefit Gap: Exadata vs. Generic Platforms

## Investment Protection and Compatibility Guidelines

Exadata's hardware and software update methodology is consistent with the following compatibility guidelines that have been established over several generations of Exadata systems.

- » Exadata protects customer investment by allowing newer generation (e.g. X6) servers to be deployed seamlessly into customers' existing Exadata Database Machines (e.g. X3 or X4 or X5). Similarly, new Exadata software releases are compatible with previous generation Exadata Database Machines. All currently supported Exadata platforms can be combined in a single configuration and can run the latest Exadata software.
- » Oracle will continue to support future versions of the Oracle Database on current Exadata Database Machines that are still under Premier Support.
- » Oracle will continue to support both virtualized and bare metal database deployments on Exadata Database Machines.
- » To enable consolidated database environments on an Exadata Database Machine, multiple Oracle database versions can be deployed within a single Exadata Database Machine. Future Exadata Software releases will be compatible with supported database releases. Compatibility will be maintained across at least two major database releases (e.g. Oracle Database 11g and Oracle Database 12c) in one Exadata Database Machine.
- » Oracle supports co-existence and connection of the current and all supported generation Exadata systems. For example, X3, X4, and X5 Database Machine hardware can be connected to X6 Database Machine hardware to form a single configuration.
- » Oracle allows incremental growth of hardware as the customer's workload grows and/or changes. For example, customers can add X6-2 hardware (database servers and/or storage servers) to convert a half rack X5-2 Database Machine to a full rack Database Machine.

The following example highlights how it is possible to do highly flexible upgrades and expansions across generations of Exadata Database Machine, with no impact to existing production applications.

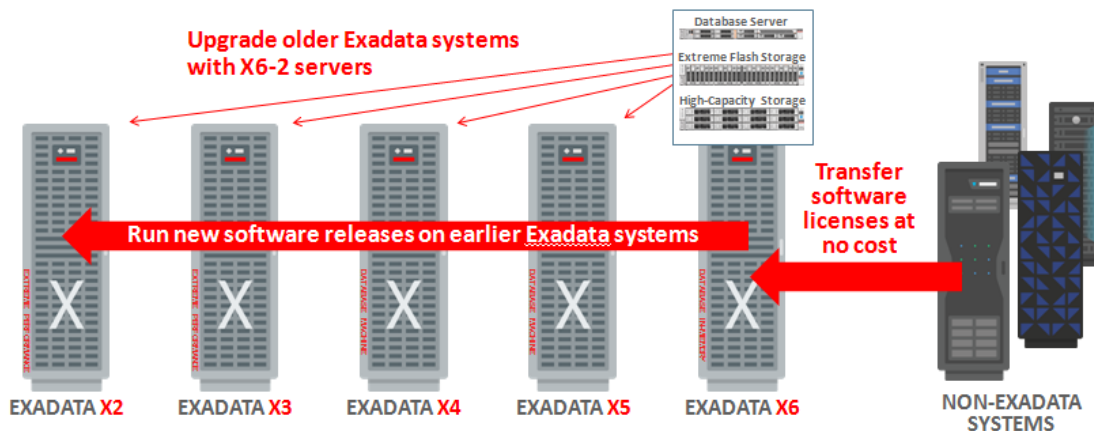


Figure 3: Seamless Upgrades and Expansions across multiple Exadata Hardware Generations

- » Exadata is based on x86-based database servers and storage servers. The Exadata SL6 model is based on SPARC-based database servers. The underlying operating system is Oracle Linux. Oracle has no current plans to remove the currently offered options.
- » As customer workloads change, Oracle will continue to evolve Exadata architecture in the most non-disruptive manner to accommodate changing workload patterns. For example, with the advent of workloads such as In-Memory Data Analytics and all-flash OLTP, Oracle has introduced the concept of Elastic Configurations, enabling an Exadata Database Machine to be configured with a mix of database and storage servers, to meet specific needs of those workloads. Exadata's scale-out InfiniBand architecture and use of standard servers for both

compute and storage is highly instrumental to this flexibility, allowing Exadata to evolve much more rapidly and effectively than traditional server + SAN + storage array architecture.

## Investment Protection with Exadata and Oracle Cloud

The investment protection that Oracle has ensured through multiple Exadata generations on-premises, has continued with Oracle Database Exadata Cloud Service, and with Oracle Database Exadata Cloud Machine. In these environments, workload isolation is provided through the mandatory use of virtualization.

With Exadata Cloud Service, customers can now run Oracle databases in the cloud on Exadata, with the same extreme performance and availability experienced by thousands of organizations deploying Exadata on-premises. Exadata Cloud Service combines the world's #1 database – Oracle, and the most powerful database platform – Exadata, with all the simplicity and operational flexibility of the public cloud.

Oracle databases deployed in the cloud as part of this service include all Oracle Database options and features – such as Oracle Multitenant, In-Memory Database, Real Application Clusters (RAC), Active Data Guard, Partitioning, Advanced Compression, Advanced Security, etc. It also includes all Oracle Enterprise Manager packs.

The underlying design principle of Exadata Cloud Service is that Oracle databases deployed in this Cloud Service are 100% compatible with those deployed on-premises. This means that customers' applications and data models do not have to change, ensuring a smooth transition to the cloud, and an efficient hybrid cloud strategy. They also do not have to invest in multiple cloud platforms for multiple workloads since Exadata provides a unified platform for all workloads – analytics, data warehousing, OLTP, consolidation, in-memory and mixed-workloads.


Exadata Cloud Machine takes this investment protection one step further by enabling a cloud-based Oracle Database subscription service available on Oracle Exadata, with all Database options and features, but deployed in the customer data center behind their firewall. Customers enjoy the benefits of agile cloud-based provisioning, while the associated Exadata infrastructure is maintained by Oracle.

## Exadata: Investment Protection Across Any Deployment

100% Compatible, No Application Changes, Consistent Cloud Experience



Figure 4: Exadata: Compatibility across any Deployment Model



There are four distinct customer profiles that immediately benefit from Exadata Cloud Machine:

- » Customers who are subject to data regulatory, data sovereignty and data residency laws or policies that require their data to be stored within a corporate entity or a political territory, and not in a public cloud data center.
- » Customers whose applications require the throughput or latency of a local LAN rather than a WAN.
- » Customers whose databases are tightly-coupled with existing applications and infrastructure and are not ready to move these applications to the public cloud.
- » Customers that want the agility, simplicity, elasticity, and subscription based payment benefits of a database cloud, but are not ready to move their database to a public cloud.

Exadata Cloud Machine offers customers an easy way to experience the benefits of cloud on-premises. By ensuring a consistent experience between on-premises and cloud deployments, it provides a critical first step for any customer as they embark on their cloud journey.

## Conclusion

Exadata is Oracle's highly strategic database platform and Oracle will continue investing heavily in the technology – both for on-premises and cloud deployments. It is a fundamental cornerstone of Oracle's database strategy that addresses the ever increasing need to process large volumes of data in the most optimal manner, seeking to leverage the newest trends in proven hardware and software technology. Exadata will continue to assure full investment protection for existing Oracle Database customers while also evolving and innovating, with hardware and software engineered together, delivering a complete solution for enterprise data management.





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**Integrated Cloud Applications & Platform Services**

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