

White Paper

Maximizing the Potential of Modern IT with Oracle x86 Servers

Oracle x86 Server Innovations Are Transforming IT for Modern Workloads and Data Security

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Contents

Introduction	3
Modern Business Success Requires Transformation	3
The Cost of Commoditization	4
The Advantage of Oracle x86 Server Technology: Value Beyond Commodity Compute	5
Optimized, Dense, and Resilient Design	6
Oracle Hardware Coengineered with Oracle Software	6
Performance Innovation Vital for Real-time Insight	7
Optimized for In-memory Analytics – Faster Insights, Greater Opportunities	7
Secure Compute Vetted in the Cloud	8
The Bigger Truth.....	9

Introduction

How well a business leverages its data, or the “fuel of the future,” as some are calling it,¹ determines its success in this modern, digitally defined economy. At first glance, it might be simple to dismiss this growing narrative about the essential value that data presents to the modern business. Digital information and the surrounding IT services have been critical to business operations for decades. So, what has changed? Why is data more valuable now than ever before?

The answer lies in the combination of data and analytics to deliver competitive differentiation. While traditional IT services may be commonplace, the effective use of corporate data with analytics and business intelligence can decide market winners and losers. New insights are delivering gains in productivity, customer satisfaction, customer acquisition, and, in some cases, the development of new products and services, all of which drive business growth and profitability.

With data now a valuable business asset, IT organizations must ensure that the infrastructure, equipment, and personnel are in place, to both:

- Efficiently extract the maximum value from the company’s data.
- Ensure that this valuable asset is secured as effectively as possible.

Accomplishing these goals forces companies to evolve, or transform, their approaches to IT, and this digital transformation is not free. New digital initiatives, such as analytics or new application development plans, not only increase the strain on IT resources, but also may siphon resources away from infrastructure management and support. In summary, IT is essential to business competitiveness, but as demands increase, IT resources can spread thinner.

With demands evolving and increasing while budget concerns persist, businesses need to invest in the right places, while staying cost-conscious in others. The strategy of leveraging the right innovations for the right workloads is a core design principle in Oracle’s x86 server development strategy. As a leader in systems innovation, Oracle is optimizing the hardware infrastructure to maximize the value derived from higher-value business workloads, such as Oracle Databases. Applying the right investment to the right workloads is essential to achieving superior results, while simultaneously controlling costs.

Modern Business Success Requires Transformation

To stay relevant in the modern digital economy, companies worldwide are currently launching or growing large-scale digital transformation programs. These programs are not optional. Executives understand that if they do not change, they will be less competitive and/or less effective—according to the combined 86% of respondents surveyed by ESG.²

As businesses invest in IT resources, protecting and maximizing the value of data are top priorities, with strengthening cybersecurity (37%) and improving data analytics (31%) among the top three most commonly identified business initiatives driving IT spending (see Figure 1).³

86% of IT executives agree, “If we do not embrace digital transformation, we will be a less competitive and/or effective organization.”

Not to be ignored, cost reduction (30%) is also among the top three. It is this need for cost control that can lead IT organizations down suboptimal paths. Too often, organizations focus on pure capital (hardware) cost reduction, while neglecting the importance of creating opportunities and optimizing operational efficiencies in key high-value workloads.

¹ Source: The Economist, [Data is giving rise to a new economy](#), May 2017.

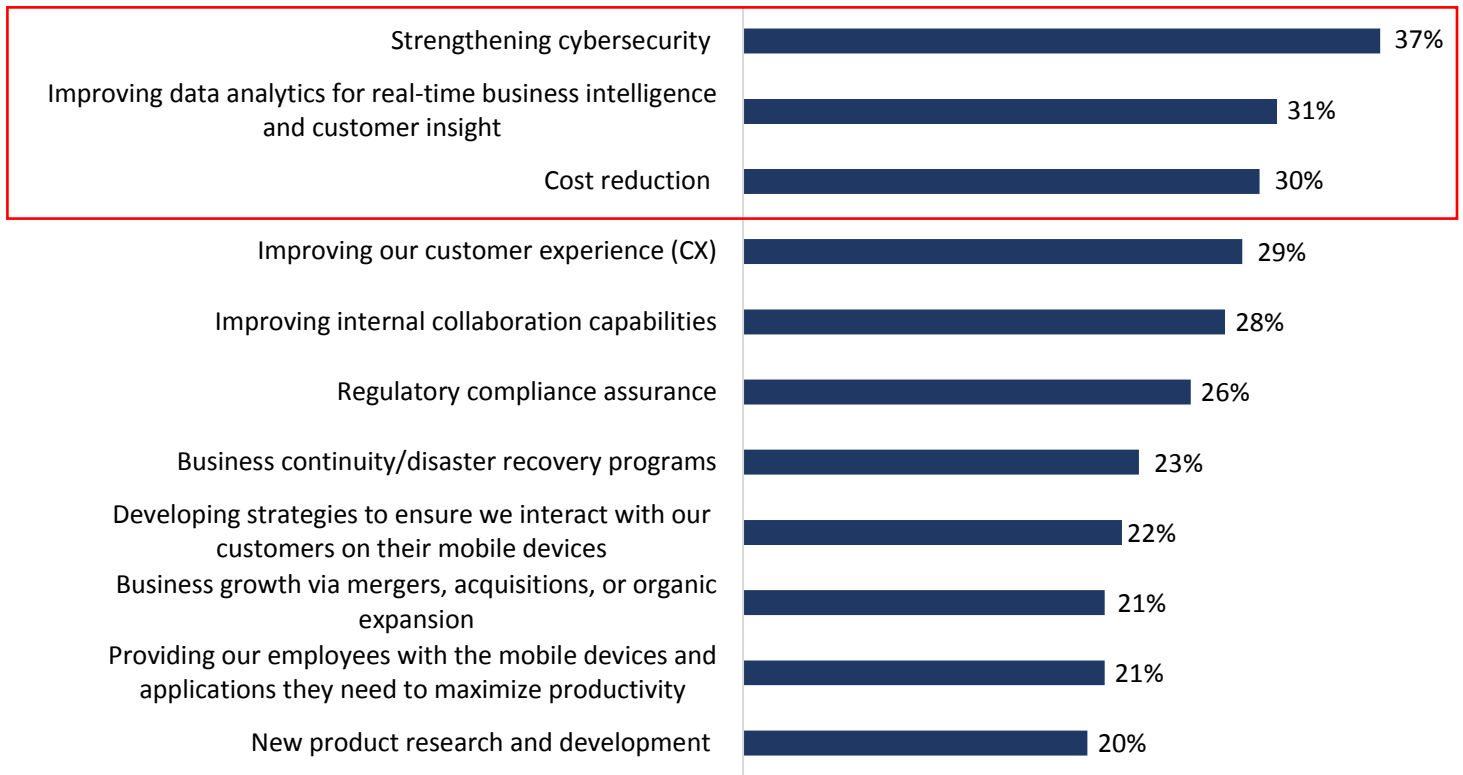
² Source: ESG Master Survey Results, [2018 IT Spending Intentions Survey](#), December 2017.

³ Source: ESG Research Report, [2019 Technology Spending Intentions Survey](#), February 2019.

There are multiple ways to control costs; firms that focus unduly on minimizing the cost of hardware can inadvertently increase costs in other areas.

Figure 1. Business Initiatives Driving the Most Technology Spending Over the Next 12 Months

Which of the following business initiatives do you believe will drive the most technology spending in your organization over the next 12 months? (Percent of respondents, N=810, five responses accepted)



Source: Enterprise Strategy Group

The Cost of Commoditization

For the more ubiquitous IT services that are not likely to offer a competitive advantage, hardware can often be standardized, with a focus on cost control, i.e., delivering the same as before for less money. For high-value workloads, however, ones that more directly impact business efficiency and opportunity, such as business intelligence and analytics, a cost-only focus often hinders efficiency and limits opportunity. Given the increased role that data plays in business success, several new truths have emerged.

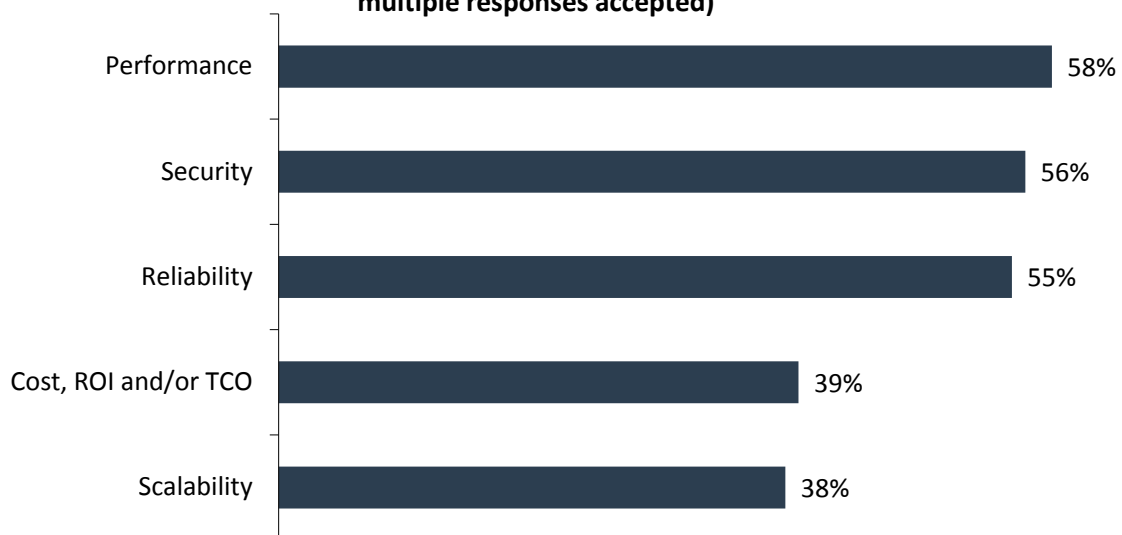
- The increased importance of data to business success has given rise to a greater diversity of workloads.
- Different workloads vary in their ability to drive business opportunity, and therefore, some are more valuable than others.
- General-purpose, or commodity, hardware can deliver cost advantages, but can hinder the efficiency of more valuable workloads, limiting opportunities or increasing costs in other areas.

- Selecting technologies optimized for the more valuable workloads, such as databases, increases efficiency and delivers tangible businesses benefits.
- High-value database workloads benefit from innovations in performance, security, and reliability.

In other words, general-purpose hardware has its uses, but for more valuable business workloads, investing in the right innovation can improve business results. Businesses already understand these dynamics, as the three infrastructure attributes most commonly identified by ESG research respondents as important for database workloads are performance (58%), security (56%), and reliability (55%).⁴ It is to these database workloads, with these infrastructure attributes, that Oracle x86 servers offer an advantage.

Figure 2. Top Five Attributes for Database Infrastructure

Which of the following attributes are most important to your organization when considering underlying systems and infrastructure for databases? (Percent of respondents, N=354, multiple responses accepted)



Source: Enterprise Strategy Group

The Advantage of Oracle x86 Server Technology: Value Beyond Commodity Compute

The term general-purpose implies a hardware design isolated from the workload and for the most part, the bulk of x86 system development has been aligned with this approach. Oracle's approach is anything but general-purpose. Oracle does leverage Intel's Xeon line of processors, but the similarities stop there. According to Oracle, its strategic focus is to design a server system that runs Oracle software better than any alternative x86 system while simultaneously providing capabilities demanded by both enterprise users and cloud providers. Additionally, Oracle's x86 platforms are the exact same hardware systems leveraged by Oracle Cloud and Oracle's Engineered Systems, including Exadata Database Machine, which according to Oracle is the highest performing, most available architecture for Oracle Database.⁵ ESG has validated the capabilities of Oracle x86 technology firsthand as part of an analysis of Oracle's [Zero Data Loss Recovery Appliance \(ZDLRA\)](https://www.oracle.com/technetwork/database/exadata/exadata-x7-8-ds-3938980.pdf), an Oracle Engineered System, which ESG recognized as a gamechanger for Oracle Database Environments. This common infrastructure allows organizations to easily run workloads both on-premises and in the cloud, differentiating Oracle from other x86 vendors.

⁴ Source: ESG Survey, [Enterprise Database Trends](#), February 2017.

⁵ <https://www.oracle.com/technetwork/database/exadata/exadata-x7-8-ds-3938980.pdf>

Oracle's most recent x86 server portfolio includes the X8-2, a 1U, 2 processor x86 platform; the X8-2L, a 2U, 2 processor x86 platform; and the X8-8, a 5U platform with 4 or 8 processor options. The Oracle X8-8 serves as an example of Oracle innovation, as the system can house either a single eight-socket server or two four-socket servers for improved density.

Optimized, Dense, and Resilient Design

As a leader in x86 innovation and building upon its experience in cloud infrastructure, Oracle offers the hardware density to deliver the compute capacity of over 2,000 cores and 64 TB of memory in a single rack. In addition to expected enterprise-level resiliency features such as hot swappable, redundant disks, cooling fans, and power supplies, Oracle's design minimizes the use of unnecessary components, such as cables. For example, the power supplies and the fans connect directly on the motherboard.

Oracle Hardware Coengineered with Oracle Software

For seven generations, Oracle x86 servers have been designed with direct engagement from the Oracle software team, something Oracle claims is specific to its systems alone. In contrast, other server vendors, such as HPE and Dell, who do not develop enterprise databases, limit their ability to optimize their hardware with those applications. This coengineering process offers Oracle's hardware design team insights into the inner workings of Oracle software, optimizing the "Oracle on Oracle" solution at the lowest level. As a result, Oracle claims to offer improved uptime by 30% when running Oracle software, with several innovations, including:

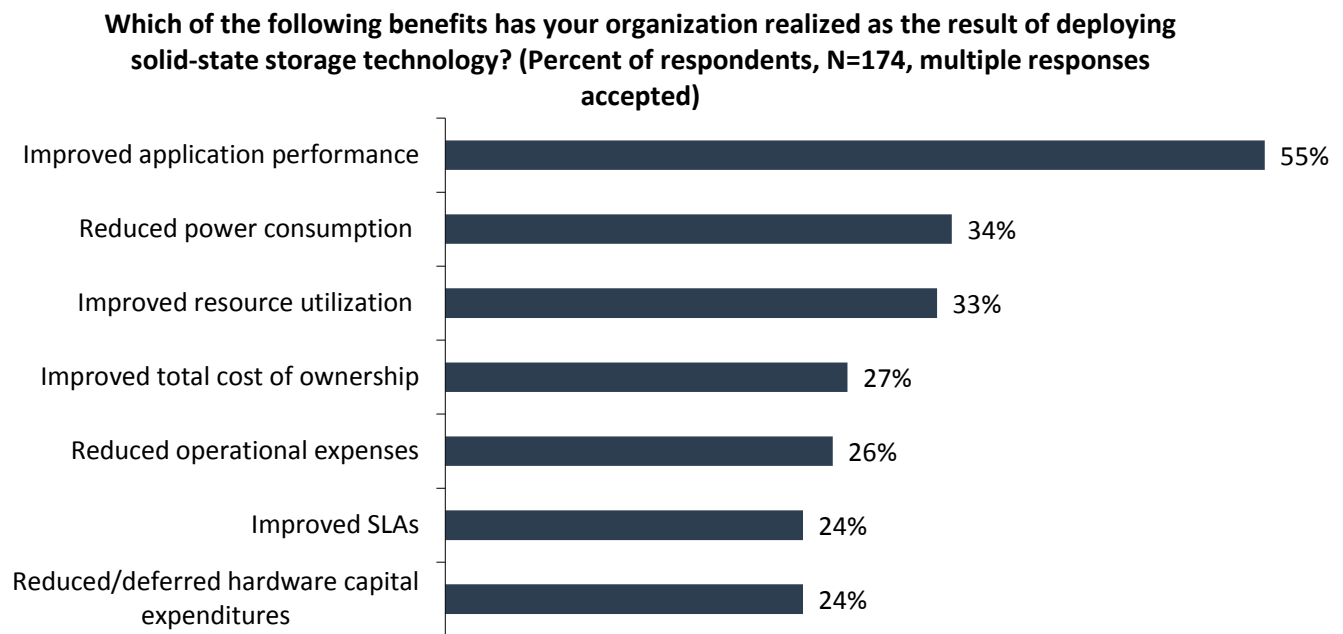
- **Operating system included:** Server hardware is just a piece of a larger solution. With each Oracle x86 Server, Oracle includes Oracle Virtual Machine and the choice of either the Oracle Linux or Solaris operating system. The combined solution purchase and delivery expedites deployment and reduces the cost of the resulting solution. This approach separates Oracle from the industry as most x86 vendors sell only hardware, leaving it to their customers to provide their own virtualization and OS software, which adds unnecessary cost and complexity.
- **Consolidated cross systems management:** With general-purpose hardware, design and management are separated between the hardware, operating system, hypervisor, and software. With Oracle, the OS, the hypervisor, and the server are managed together, along with Oracle Database and application software, reducing the management burden and cost of management, which are essential when managing infrastructure at cloud-scale.
- **Consolidated diagnosis and error handling:** Oracle's server design features bidirectional communication for the exchange of health information between the server hardware with Oracle Integrated Lights Out Manager (ILOM) and the Oracle Linux or Oracle Solaris operating systems. The complexity of isolating issues burdens IT resources when they occur within solutions where each component, such as the server and the OS, features isolated fault management. How to know which component is truly to blame? Now, imagine this complexity in a cloud-scale infrastructure, where issue isolation becomes exponentially more difficult and costlier, increasing downtime and risking critical workloads. Both Oracle Linux and Oracle Solaris provide an automated error diagnosis and fault isolation based on raw error events generated by the hardware, with examples including off-lining a faulty CPU thread or retiring a memory page on a DIMM.
- **Linux designed for Oracle x86:** Oracle Linux is used in all Oracle x86 platforms: servers, Engineered Systems, and Oracle Cloud. The Oracle distribution of Linux supports Oracle Ksplice technology, a valuable technology for improving cybersecurity. Ksplice allows IT admins to apply security patches to the operating system kernel without incurring downtime. Staying up to date with security patches is basic security hygiene and essential in today's digital environment. Oracle allows for patch updates without downtime, a feature that is vital for supporting massive cloud-

scale infrastructure environments, where managing rolling downtimes consumes too many resources. In addition, Oracle Linux cooperates with Oracle x86 systems to provide a comprehensive fault management architecture.

Performance Innovation Vital for Real-time Insight

With business intelligence and analytics workloads, as insights age, their value to the business diminishes. Low-latency, high-performance infrastructure, such as flash, is critical for business intelligence workloads. With the rise of NVMe, a protocol designed to accelerate the benefits of flash storage media, the already transformational benefits of flash (see Figure 3) are poised to extend even further. IT decision makers are already bullish about NVMe—79% of IT managers surveyed by ESG who were familiar with NVMe technology said they expect it to eventually replace traditional SAS- or SATA-connected solid-state flash storage.⁶

Figure 3. Benefits of Flash Storage



Source: Enterprise Strategy Group

Oracle offers several innovations designed to maximize the potential of NVMe-based flash storage technology, beyond basic support for the protocol. For example, Oracle's server design leverages multiple temperature sensors monitored by Oracle ILOM to ensure each drive maintains optimum operating temperature. This design prevents high-performance SSDs from throttling down I/O when the temperature increases, as Oracle ILOM controls the server fan speed to ensure sufficient cooling. The net result provides higher and more consistent workload performance. According to Oracle, its NVMe flash technology accelerates Oracle Database performance up to an additional 30%.

Optimized for In-memory Analytics – Faster Insights, Greater Opportunities

The Oracle Server X8-8 offers a large memory footprint and bandwidth optimized for the memory-intensive applications, such as financial trading applications, batch processing workloads, or other workloads that require a high level of simulation or computation. To further accelerate in-memory access speeds, Oracle's design features six memory channels

⁶ Source: ESG Master Survey Results, [2017 General Storage Trends](#), November 2017.

per processor, increased from four in the previous generation. Oracle claims that the additional channels, along with enhancements to bus speed, increase the total system memory bandwidth to 1,024 GB/sec.

With the X8-8, Oracle also offers support for its Database In-Memory option. This technology represents database tables simultaneously using both the traditional row format as well as a new in-memory column format. This ability to represent the same data in both formats allows for the simultaneous support of both high-performance, low-latency OLTP access, and high-performance analytics workloads without requiring costly, complex, and time-consuming extract, transform, and load (ETL) processes. These translation processes not only hinder the extraction of business value from data, but also add significant and unnecessary levels of cost.

While reducing the cost and time required for generating insights, this technology will have the potentially greatest business impact from the new opportunities it creates. By reducing the time required for queries, the business is free to investigate other ad-hoc and opportunistic business-driven queries, potentially identifying untapped revenue streams or productivity gains.

Secure Compute Vetted in the Cloud

Data security is a pervasive and ever-present business priority. Strengthening cybersecurity (37%) is the business initiative most commonly identified by ESG research respondents as driving the most IT spending for 2019. And improving security/risk management (40%) is the most commonly identified business consideration used when justifying IT investments to executive management, ahead of other important business objectives, such as improving customer experience, increasing productivity, and reducing operational expenditures.⁷

Digital security is crucial to the modern business. As such, Oracle views cybersecurity as a core design tenet in its x86 server architecture. While any infrastructure vendor will tout the need for security, Oracle's development organization includes a focused Global Product Security group. This group's charter is to set, audit, and enforce security policies across all Oracle products, software and hardware. In addition to keeping pace with the latest threat profiles, conducting security audits, and ensuring compliance, this group publishes regular security alerts to all Oracle users. Given the heightened demand for digital security, these activities are essential to the delivery of robust and secure data infrastructure solutions.

The potentially most valuable aspect of this security team, however, might be its breadth, across all Oracle's products—software and hardware. This holistic approach offers Oracle a security perspective that differs from general-purpose hardware manufacturers. As a provider of the hardware, the OS, and the application, Oracle cannot assume that another vendor will address a potential threat.

As an example of the resulting security innovations, Oracle ILOM encrypts communications and data, and offers a secure firmware image signing technology. As part of this technology, Oracle ILOM is validated on every boot by hardware-protected code that cannot be modified or compromised by malicious attacks. Once validated, Oracle ILOM then validates Oracle ILOM's file system and other server components such as the BIOS image. The net result is a secure compute infrastructure that rechecks itself every time it boots.

As the foundation of Oracle Cloud, Oracle's x86 servers withstand a high volume and wide variety of malicious attacks. This experience of vetting its infrastructure in the cloud delivers a server portfolio hardened in a performance-intense environment while simultaneously scrutinized heavily for security. Also, as part of a cloud offering, these systems must also be cost-optimized, in addition to easy to manage at scale.

⁷ Source: ESG Research Report, [2019 Technology Spending Intentions Survey](#), February 2019.

The Bigger Truth

Data is valuable, but all data is not created equal. Certain workloads, such as those from Oracle Databases and enterprise applications, house high-value data sets that fuel business intelligence and real-time analytics. These workloads are among the most valuable for any enterprise. The rise of the digital economy presents new challenges and new opportunities for IT. Demands increase, opportunities increase, but treating every workload equally is a losing and ultimately unsustainable battle.

Businesses need to invest in the right high-value workloads, applying improvements in performance, security, and resiliency, where necessary. Digital transformation is not about simply scaling what has been done before—it is about using technology smarter, with a more tailored approach. It should enable organizations to accelerate the most valuable workloads, secure the most valuable data, and improve the speed at which they are able to generate insights and introduce new opportunities, while freeing IT personnel to focus on what matters most. Oracle x86 server technology, proven in Oracle's Engineered Systems and the Oracle Cloud, offers advantages not found in its commodity counterparts, delivering the right innovations for the right workloads and exemplifying the role of compute in the modern digital age, designed for analytics, for resiliency, for performance, and for security.

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