



WHITE PAPER

## Next-Generation Cloud Delivers Enterprise Scale

Customer Experiences with Oracle, Amazon, and Microsoft's  
Cloud Infrastructure and Platform Services

December 2017

A large, abstract 3D graphic composed of various blue and white cubes and rectangular prisms, some of which are stacked or arranged in a grid-like pattern. The graphic is set against a blue background with faint white grid lines and perspective lines, suggesting a digital or architectural theme.

Dao Research is a competitive intelligence firm working with Fortune-500 companies in the Information Technology sector. Dao Research is based in San Francisco, California.

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## Executive Summary

The cloud has matured considerably over the past several years. Early adopters were largely risk-tolerant startups and small groups at enterprises running low-risk or net-new, “cloud-native” workloads. With the proof of success from these pioneer use cases, enterprises are more interested in achieving cloud benefits with their more complex, enterprise-scale workloads. This has forced an IT strategy conversation around cloud services.

The objective is deriving more value from IT and delivering business value faster. To that end, a recent study by 451 Research found that 80% of 700 organizations surveyed said that placing workloads in the cloud would boost the ability to respond to shifting business needs. The discussion is moving beyond offloading low-risk services at each layer of the cloud, and more toward cloud providers taking responsibility for the performance and support for complex, mission-critical enterprise solutions. And while leading companies are now more willing and even eager to be “all in” with cloud, they still need assurances that their mission-critical workloads can run with as good as or better support than internal IT.

With larger-solution portfolios containing multivendor technology stacks, customers also need guidance to find their least disruptive and expensive path to the cloud. It’s that perspective that is empowering customers to ask for more from their technology and cloud providers. The complexity of enterprise portfolios lies in their integration, security, predictability, and resiliency, and operational excellence is now managed with service level agreements (SLAs). The choice of a provider is no longer about the one “great” technology at a single layer of the solution stack but rather about the completeness of the offering from infrastructure to platform to applications. It’s about understanding complex business challenges and making it all work together, be supported together, and be billed together. Many independent software vendors have transformed to managed service providers delivering on this customer expectation. And, in our research, only one cloud provider had the domain and operational knowledge in business and IT to become a full-service cloud provider helping companies execute their next-generation, holistic IT strategy.

Dao Research investigated enterprise cloud deployments—including business drivers, key workloads, and experiential feedback—on three popular cloud platforms: Amazon Web Services (AWS), Microsoft Azure, and Oracle Cloud. A few of the key takeaways from our research are as follows:

- Customers are prioritizing cloud provider decisions based on a solutions-and-support perspective, rather than independent decisions across each cloud tier, such as infrastructure and application services. Research participants told us that it is compelling to choose a vendor who can provide the technology, the holistic business solution(s), the subject matter expertise, and the unified support required for complex enterprise deployments. Microsoft and Oracle were considered by our study participants as good providers for this need with comprehensive platforms of IaaS, PaaS, and SaaS combined with enterprise expertise. In contrast, they considered Amazon more of an infrastructure player with a limited value proposition at the PaaS and SaaS layers.
- As enterprise requirements become more complex and global in nature, study participants needed vendors to provide solutions that are easy to understand and purchase from both a service mapping and a pricing perspective. This applies to both initial and ongoing subscriptions as service needs change. Oracle’s cloud service structure and pricing were described by customers interviewed as more straightforward than AWS and Azure and better enabled global business, internal charge-backs, and transparency. AWS, specifically, was perceived as costly at enterprise scale due to its many hidden charges, and Amazon tends to advise clients generally to add more processing power and ongoing subscription cost.

“A full spectrum of cloud platform capability, including IaaS, PaaS, and SaaS components, is a likely characteristic of a long-term cloud platform leader.”

*Technology Industry  
Analyst*

- Oracle’s Cloud Infrastructure services are unique and proving valuable for companies choosing to move enterprise infrastructure to the cloud and requiring consistently high performance, governance, and control using familiar tools and leveraging existing skillsets. Customers in our study cited key advantages for Oracle relative to Azure and AWS including performance on its cloud infrastructure and a service pricing and governance approach that far better supports charge-backs critical for global operations. When evaluated along with platform services (IaaS + PaaS), this is a significant differentiator for Oracle vis-à-vis the current generation of AWS and Azure IaaS offerings.
- As more massive-volume, production database-driven workloads are slated for cloud, customer organizations and managed service providers catering to them are looking to more robust cloud solutions. Most of the historical database workloads running on IaaS were development focused or modest in production scale. It is not surprising that equity analyst firm Cowen Research stated that 64% of IaaS-supported database workloads are at risk of being replaced with SaaS-/PaaS infrastructure. We found Oracle well positioned for this shift with its Oracle Database Cloud services and Exadata Cloud Service offerings. Study participants cited capabilities such as Oracle RAC, Oracle Data Guard, pluggable databases, and Exadata as critical enablers in the move to cloud. Our research found no real equivalent capability or commercial service offering from Azure or AWS.
- Cloud-native application development is evolving rapidly to a microservices and container-driven model that provides scalability, performance, and security. Our research finds that while this model is supported by AWS, Azure, and Oracle, Oracle provides a richer set of integrated DevOps services for the development lifecycle and operational management of not only cloud-native applications but also traditional enterprise applications. Study participants cited the breadth of services for web, mobile, low code, API, analytics, and container orchestration as critical to application development. They also found value in having the tooling and capability from a single vendor as compared to the “do-it-yourself” approach inherent in AWS via the use of numerous third-party tools. Study participants noted the do-it-yourself approach can work in development and testing, but it presents challenges moving to production environments. Enterprise production deployments require comprehensive management and diagnostic tooling, something that interviewees acknowledged as a strength for Oracle.
- Customers in our study indicated the importance of hybrid cloud and the ability for customers to migrate to the cloud at their own pace. In a study completed in early 2017 conducted by market research agency Kantar TNS, 63% of respondents cited usage of at least one hybrid cloud solution. Study participants identified Oracle as having a superior approach to hybrid cloud as compared to Azure and AWS based on the fact that the same standards, technology, tooling, and skillsets are leveragable across on-premises and cloud deployments. Also, Oracle provides a strong proposition for migration of enterprise application workloads due to the tools they offer to automate migration of Oracle applications to cloud, the level of service integration across IaaS, PaaS, and SaaS offerings, and the business and solutions level approach they employ.

“Exadata for us is huge. When we ran benchmarking for our application, we realized that Exadata was running our applications five times faster than the standard Oracle DB server. Even if you deploy Oracle VMs on Azure or AWS, you can’t match the same level of performance. It’s just not possible.”

*Director of Cloud Services for Financial Services Application Provider*

“To build something brand new in the cloud where it also interfaces with all your legacy applications and can support that in a hybrid way, that’s really tough. Oracle has enabled us from a hybrid model to do things that nobody else would.”

*Director of Cloud Services for Global Food and Fuel Ingredient Company*



## Introduction

Initial cloud adoption focused on low cost to get started, do-it-yourself, predominantly dev/test scenarios. While this was sufficient for startups and decentralized divisions of larger enterprises, it was a challenging model for larger enterprise IT due to the lack of control over resources, unpredictable performance, and the inability for cloud providers to take responsibility for workload management.

Migrating and operating enterprise workloads has a host of challenges. At a technical level, there must be a reasonable level of on-premises and cloud platform compatibility for tech stacks, toolsets, and DevOps processes. And operationally, management, security, and governance need to be reconciled and ideally unified across an increasingly diverse enterprise IT estate, including cloud native, on-premises, and hybrid deployments. In short, while good economics and agility are a strong motivation for cloud adoption, enterprise use cases are operationally complex with challenges that must be explicitly addressed.

Based on our research, key enterprise requirements include the following:

- Predictable pricing that fits within constraints of budgeting processes.
- On-premises license and cloud subscription credit conversion.
- SLA commitments for availability, disaster recovery (DR), and performance.
- Non-variable performance, particularly for data centric workloads.
- Multiload/multivendor cloud.
- Governance, tagging, and charge-back capabilities.
- Security and compliance.
- Compatibility with management toolsets and existing workloads.
- Lower long-term cost of ownership as compared to on-premises and competing cloud alternatives.
- Leverage of existing investments in on-premises applications and technology.



## Research Approach and Findings

This study concentrates on complex enterprise workload cloud adoption—those use cases with multivendor solutions, portfolio complexity, and interdependence, as well as complex operational support. It also includes companies who have centered their applications development or development operations in the cloud. Within that context, Dao Research identified a set of common and complex enterprise workloads to focus our primary and secondary research. We then sourced study participants who had experience with one or more popular cloud providers, including Amazon, Microsoft, and Oracle. Our profiling prioritized those who had experience with several of the cloud platforms from an IaaS, PaaS, or in some cases SaaS perspective. The following scenarios were included in our research:

- Cloud infrastructure for enterprise operations.
- Packaged or custom applications with large production databases.
- Cloud-native application development.
- Migration of enterprise applications and workloads (“lift and shift”).

Based on meeting our profiling requirements, 12 companies participated in in-depth interviews. Topics included the drivers for and their journey to the cloud, experiential feedback on vendor cloud platforms, the business value realized and expected from their cloud strategy, and their future plans related to cloud deployments. The study participants included Forbes Global 2000 companies, independent software providers, and large systems integration firms. Participants are listed in [Table 1](#).

**Table 1. Companies Included in Primary Research**

| Company  | Title                            |
|--|----------------------------------|
| Global Systems Integrator                        | Director, Client Services        |
| Global Food and Fuel Ingredient Company          | Director of Cloud Services       |
| Healthcare Company                               | IT Director                      |
| Financial Services Application Provider          | Director of Cloud Services       |
| Retailer   | AWS/Azure Database Administrator |
| Managed Service Provider for Oracle Applications | Chief Executive Officer          |
| Global Education Provider                        | President                        |
| Finance and Automotive Industry                  | Cloud Architect                  |
| IT Services Company                              | Digital Practice Director        |
| Cloud Migration Company                          | Chief Executive Officer          |
| IoT Solution Provider                            | Vice President                   |
| IT Conglomerate                                  | Group Chief Technology Officer   |

## Scenario 1: Cloud Infrastructure for Enterprise Operations

The first workload scenario evaluated was Cloud Infrastructure (IaaS). This workload includes foundational services for the compute, storage, and networking layers with an emphasis on enterprise requirements. AWS and Azure both offer a wide range of services for compute, storage, and networking based on very granular service options with detailed and varied regional pricing plans. While the array of services and data center options can be viewed as a robust service portfolio, many study participants cited service and pricing complexities for both vendors that required third-party guidance and hindered global operations. Specifically, billing and charge-back operations were noted as extremely challenging.

Oracle, although being a newer provider in this space, was found to have designed their cloud infrastructure (IaaS) offerings based on an innovative, next-generation architecture. Based on customer feedback, the resulting experience is to significantly exceed performance as compared to on-premises infrastructure. Oracle's offering was also considered simpler than AWS and Azure and far easier to execute on billing and charge-backs, particularly in a global business scenario. Oracle's IaaS platform also was considered better suited for Disaster Recovery (DR) and high availability (HA) as compared to AWS and Azure.

Lastly, study participants cited the integration of services and service components among IaaS, PaaS, and SaaS offerings from Oracle as an advantage, and they experienced performance improvements when lifting and shifting on-premises workloads to Oracle Cloud.

Table 2. Comparison of Cloud Infrastructure

| Cloud Platform | Strengths   | Challenges  |
|----------------|---|---|
| <b>AWS</b>     | Recognized as pioneer and market share leader in IaaS with solid services and good datacenter coverage and well suited to "open" workloads in which variable performance is acceptable.   | Cited by study participants as a relatively complex array of services that in some cases requires an expert third party to acquire. Noted for variability in performance. Study participants cited many hidden charges and, as a result, pricing becomes an issue at enterprise-grade deployment where AWS is perceived to be expensive, challenging to track and control service pricing and difficult to do charge-backs and support global operations. |
| <b>Azure</b>   | Recognized as suited for Microsoft workloads, good data center coverage and good integration of/support of hybrid in terms of access/identity management and Office365. Considered to be well geared for IT professionals vs. developers.   | Cited as lacking in HA/DR capability with some customers having to architect their own backup to Azure, lacking/limited bare metal offering, and not as mature or flexible as compared to AWS. Also, a challenge to do billing and charge-backs based on complexity of services and pricing.  |
| <b>Oracle</b>  | Recognized for next-generation cloud infrastructure architecture that provides predictable performance and pricing, straightforward services and pricing that enable global business, and robust HA and DR capabilities. Research participants cited performance improvements exceeding 50% for Oracle workloads. | Cited as relatively new in the IaaS solution market and needing to expand datacenter coverage. Perception of suitability for mostly Oracle workloads, even though it supports Docker, Kubernetes, Linux, Windows, and hundreds of open-source software and frameworks.  |

To underscore the detailed experiential feedback in [Table 2](#), a global IT consultancy recently executed a number of performance tests on Oracle’s next-generation IaaS compared to running the same workloads on-premises and on AWS IaaS. The results were evaluated in terms of performance comparison for handling transactional data loads and also a cost evaluation to achieve “like” performance. The test results demonstrate a significant performance difference of Oracle Cloud versus AWS with more than three times the transactional volume processed with Oracle Cloud with the same-sized configurations. The second element involved increasing the size of the AWS infrastructure configuration and evaluating the cost of that increase relative to the performance. The result of this exercise demonstrated an even wider difference with Oracle producing more than five times the transactions per dollar as compared to AWS.

One study participant shared their journey in working with all three cloud platform providers. The company is a U.S.-based global food and fuel ingredient company with rapid growth from \$400M to nearly \$5B in just the last seven years. Rather than scale out their IT with a people- and resource-intensive approach, they decided to leverage cloud to manage their large datacenter environment. They have a diverse set of applications and systems, as well as a substantive portfolio of Oracle Database and applications, including E-Business Suite and Hyperion. After early attempts to move these workloads to AWS or Azure, they made the decision to move their Oracle workloads to Oracle Cloud Infrastructure. They are also moving several non-Oracle Windows-based applications—including Informatica, Vertex, and a software package for laboratory management—to Oracle Cloud.

“Tests with our payroll applications demonstrated previously long running processes, which used to run for hours, now ran in minutes on Oracle’s cloud.”

*Director of Cloud Services for Food and Fuel Ingredient Company*

The challenges in their experience with AWS and Azure come down to three main factors. First, the performance differences among the platforms and their experience and testing showed their applications and services running much faster on Oracle Cloud compared to AWS and Azure. According to the director of cloud services, “Linux

“Oracle is the only cloud I have today that allows me to replicate the Oracle workloads in a show-back, charge-back model that is underneath a single subscription.”

*Director of Cloud Services for Food and Fuel Ingredient Company*

running on Microsoft Azure was somewhat painful, to say the least, since we are primarily a Linux shop on the Oracle side. It was pretty much straightforward migration of our workload over to Oracle’s cloud and we got a very good performance boost. Our clones were taking eight hours from on-prem to Azure. That started going down to four hours, and now we’re just under two hours with Oracle Cloud.” Furthermore, he followed by saying that “tests with our payroll applications demonstrated previously long-running processes, which used to run for hours, now ran in minutes on Oracle’s cloud.”

The second major consideration was the requirement to support their global business by effectively charging back IT services to various business units and divisions around the globe. They found this capability lacking in both AWS and Azure, due partly to the complexity in regional pricing and partly to a lack of effective tools for accounting and reporting on utilization. Per the director, “International business requires that I do things in a particular tax format that includes legal entity for bill-back. If Brazil wanted me to stand up more Oracle boxes, I could not do so in AWS or in Azure simply because their show-back, bill-back models are so poor that I couldn’t tell which business unit was using which devices and how much they were using. In addition, the actual price lists are different across regions. The services could not be divided easily outside of creating the

separate subscriptions, which create network issues. In order to get the right architecture in a single subscription, Oracle is the only cloud I have today that allows me to replicate the Oracle workloads in a show-back, charge-back model that is underneath a single subscription.”

The final major consideration for the company was the ability to support hybrid cloud, which is very important for leveraging existing investments and maintaining data sovereignty or regional compliance requirements. The director of cloud services shared, “To build something brand new to where it interfaces with all of your legacy applications and is able to support that in a hybrid way, that’s really tough. So yes, I think that there are some things that Oracle has done that enables us to use a hybrid model to do things that nobody else would.”

Though they are primarily focused on IaaS for their datacenter migration, this global food and fuel ingredient company is factoring in their cloud decisions in a longer-term strategy. Interestingly, they do view this strategy as a multivendor cloud approach using the cloud provider deemed best suited for specific workloads. In that regard, they acknowledged Oracle as a primary partner to support their journey as they look beyond IaaS to PaaS and ultimately to SaaS. The director went on to say, “From a SaaS perspective and a PaaS perspective, we can use the PaaS to grow and shrink and do things new, and we can use the SaaS as a try before you buy. Although we may start hybrid today, the intent is in ten years to be as close to PaaS and SaaS as we can be. And that’s our Nirvana.”

## Scenario 2: Large Production Database

Databases have been a key component in application workloads in early cloud adoption, with companies often leveraging IaaS to deploy databases primarily for development and testing workloads. The market is seeing an evolution of cloud database adoption, but many organizations still maintain their largest and most mission-critical databases on-premises.

However, the maturity of the cloud provider market, and particularly PaaS offerings, is leading to increased adoption of large- and massive-scale databases in the cloud. In fact, a recent report by Cowen Research stated that 64% of IaaS-supported database workloads are at risk of being replaced with SaaS/PaaS solutions. As IT organizations revisit their broader strategy and look more holistically across their enterprise, they would be well suited to seek a platform that can handle the breadth of requirements to support small development and testing environments, as well as scale up to massive loads quickly and on-demand. They also need to evaluate performance and the difference between peak performance and price performance versus consistent performance. Compliance, governance, and security are also extremely important requirements in trusting the most critical enterprise data in the cloud.

Given Oracle’s rich history as a database company and their recent but aggressive move to cloud, it is not surprising that study participants found the Oracle Database Cloud services more compelling relative to both AWS and Azure. The reasons cited included the breadth of performance options, the ability to easily scale up or down, granular security, and enterprise capabilities such as pluggable databases.

Further, participants noted the availability and reliability enabled by Oracle RAC and Oracle Data Guard in Oracle Cloud are unrivaled as compared to running Oracle Database on AWS and Azure. At the highest end of performance requirements, our secondary and primary research found that Oracle’s Exadata Cloud Service has no direct equivalent in AWS or Azure. This high comfort level to scale to enormous data loads was important to our study participants.

Table 3. Comparison of Large Production Database

| Cloud Platform | Strengths  | Challenges  |
|----------------|--|---|
| <b>AWS</b>     | Recognized for flexibility in running a wide range of third-party and open-source database options with performance adequate for some workloads where variable performance is acceptable. Rich security features but incumbent on customer to understand and execute. Scalable to high throughput but requires allocating more CPUs. Considered developer-friendly and easy to set up. | Data security is largely the responsibility of the customer. No support of hybrid cloud, as customers cannot deploy AWS in their own datacenters, thus limiting customer deployment strategy. Amazon as a culture disregards on-premises software, touting data migration as part of hybrid cloud, but mostly only one way from on-premises to cloud. Expensive and lacking key enterprise-scale features such as Oracle RAC and Oracle Data Guard to run Oracle Database in the cloud. Lacking extreme performance service equal to Exadata Cloud Service. |

| Cloud Platform | Strengths   | Challenges  |
|----------------|---|---|
| <b>Azure</b>   | Recognized for Microsoft shops migrating database workloads (SQL) to the cloud. Ability to leverage existing Microsoft skillsets. Ability to leverage access control from on-premises to the cloud via Active Directory.  | Cited for limited scalability and performance based on max size and throughput limitations. On-premises SQL Server and Azure SQL not 100% compatible, thus limiting ease of migration. Limited hybrid cloud support (e.g., limited/no support for Azure SQL on Azure Stack), and no unified management capability across cloud and on-premises. Lacking extreme performance database cloud service. |
| <b>Oracle</b>  | Recognized for broad service offering from schema service for developers to Exadata extreme performance service. Support for sustained high performance, HA, and data integrity and protection. Same technologies support hybrid cloud and on-premises and cloud. Can leverage existing skillsets and resources. Pluggable databases and other capabilities enable effective multitenant scenarios. Comprehensive management capabilities and autonomous operations to lower operational costs. | Database cost was a historical concern for some customers, even though Database Cloud Service includes more features than other cloud provider's offerings. Oracle "bring your own license to PaaS" allows customers to transfer on-premises licenses to Oracle Cloud.  |

Another study participant was a financial services application provider with a traditional on-premises offering but in transition from a hosted application to a SaaS application on Oracle Cloud Infrastructure. They have a growing customer base for their complex backend transaction and reconciliation services. Their customers include extremely large financial institutions with the most demanding data integrity and security requirements. Their increase in compliance and security needs has led these customers to move to cloud and externalize applications because it is too costly for their IT to maintain.

The application provider's key drivers were simple, centered on the highest availability and reliability. While many of their customers were using AWS and Azure in their environments for noncritical workloads, many of them were leveraging Oracle Databases on-premises using Oracle RAC and Oracle Data Guard to guarantee availability. For the application provider, after some evaluation and having some experience with other platforms, they chose Oracle Database Cloud services due to their customer's mission-critical requirements but also to support their plans to grow their business. According to the director of cloud services, "Amazon is using RDS, and we could not take such a risk to invest in a new technology as we wanted to go very quickly to cloud. When we saw that AWS and Azure could not certify the usage of RAC and Data Guard on their cloud, then we said okay, it's an obvious choice to go with Oracle Cloud."

*"When we saw that AWS and Azure could not certify the usage of RAC and Data Guard on their cloud, then we said okay, it's an obvious choice to go with Oracle Cloud."*

*Director of Cloud Services for Financial Services Application Provider*

Another major factor in their decision was the ability to leverage Oracle Database capability to support their multitenant strategy. They found the Oracle Pluggable Database (PDB) architecture enabled this strategy with granular configuration, security, and ease of cloning. The director said, "First, I can dedicate resources to achieve a specific IO speed for a PDB. For security, PDBs allow for a complete segregation of data while sharing a DB server. And cloning quickly facilitates the deployment and upgrade of our application. You can clone a PDB very quickly, apply a script, run some tests, and then you switch to the new pluggable database and you get rid of the previous one."

The final element of their experience relates to their ability to scale their business and guarantee performance as they grow. They found Oracle Exadata Cloud Service as key to their plans. "Exadata is huge for us. When we ran

some benchmarking for our application, we realized that Exadata was running our applications five times faster than the standard Oracle DB server. Even if you deploy Oracle VMs on Azure or AWS, you can't touch the same level performance. It's just not possible."

Another study participant was a large healthcare company who selected Azure to move to the cloud for their database services. Their choice was driven primarily by their experience with Microsoft SQL Server on-premises and a desire to realize cost savings from not having to procure infrastructure for times when they experienced peak loads. In short, they wanted to be able to respond to cyclical changes in capacity requirements by scaling up or down easily. They anticipated value in Microsoft's hybrid cloud and the ability to leverage existing skillsets from on-premises to cloud.

Their experience with Azure and Azure SQL was successful in terms of the scaling objectives, but they encountered issues along the way. According to the IT Director, the on-premises SQL Server and Azure SQL have some differences, and "the learning curve was steep with respect to automation and leveraging PowerShell based on templates. This took a lot more effort than anticipated." They also found that Azure's rapidly changing practices and processes forced them to maintain their own high-availability capability to augment Azure. He went on to say, "You need to have your own HA available to make sure that your application does not get impacted by their schedule."

Finally, they echoed some of the same issues as cited in the IaaS scenario regarding billing and charge-backs. He shared, "Every country will have different currencies and a different tax model. And Azure did not have a way for one global organization to split the bill into different region currency and charge a tax for that price. And they didn't provide any tool that would do that, so that was also another disappointment."

*"[With Azure], you need to have your own HA available to make sure that your application does not get impacted by their schedule."*

*IT Director for Large Healthcare Company*

### Scenario 3: Cloud-Native Application Development

In addition to migrating existing workloads to the cloud, many customers we interviewed also wanted to develop applications in the cloud to be run in the cloud. Some of the key distinguishing elements of this scenario are the following:

- A cloud-first approach to application development.
- Support for development methodologies: Agile, DevOps, and CI/CD.
- Environments: web, mobile, API, low/no code, and containers.
- Microservices architecture.

From a holistic development perspective, cloud development has a collection of necessary elements including service components, deployment options, and supported frameworks. The development pipeline has accelerated, and DevOps has had an increasing role in streamlining efficiency and solution performance in the complex world of multicloud, multivendor, and open source.

In the first wave of cloud, this scenario is one of AWS "sweet spots," which was based on net-new development using a variety of open source technologies running on AWS infrastructure. However, these were the simpler cases, where development has fewer versions and dependencies to manage. As the next phase of cloud adoption occurs and major enterprises move and migrate their IT estates to the cloud, another set of requirements are brought to the foreground and the cloud evaluation opens up to a much broader spectrum of enterprise platform capabilities. This is where the value proposition of AWS, which derives roughly 80% of their revenue from infrastructure services, begins to fade when moving up the enterprise stack.

Conversely, this is where the value proposition of Azure and Oracle Cloud greatly increases as they provide a more proven and robust set of platform capabilities for data, integration, process management, and application services. Oracle in particular provides value in the cloud-native development and SaaS extension scenarios with a broader set of platform services required in a typical enterprise deployment. Its integrated cloud service for DevOps is compatible with many on-premises tools that developers are already familiar with. Oracle is also

aggressive in support of emerging standards relative to container development and management such as Kubernetes. Somewhat ironically, AWS is now acknowledged as a more proprietary system, making it challenging to move workloads to other vendor cloud platforms. Part of the reason is the AWS EC2-specific approach and the “build-it-yourself” style development in AWS.

**Table 4. Comparison of Cloud-Native Application Development**

| Cloud Platform | Strengths  | Challenges   |
|----------------|--|--|
| <b>AWS</b>     | Recognized more for infrastructure as compared to platform services, but study participants acknowledged the breadth of the AWS partner ecosystem to allow customer flexibility in choice of tooling.  | Extensive use of third-party tools for DevOps creates challenges related to interoperability and management. Considered a “build-it-yourself” environment catering to developers in traditional “sandbox” scenarios but proposition found weaker at true enterprise scale. Ironically, participants cited vendor lock-in to EC2 and AWS lacking support for multivendor cloud. |
| <b>Azure</b>   | Recognized as mature PaaS offering with good partner ecosystem but mostly suited for Microsoft “shops” doing development in .NET, even though other languages and frameworks are also supported.   | Limited strength outside of Microsoft sphere, even though Microsoft claims polyglot support in their Azure environment (e.g., its CI/CD has limited native support for Java SE and EE).  |
| <b>Oracle</b>  | Recognized for mature platform of integrated services for Apple, integration, API, mobile, and low-code tools to include open-source frameworks. Offers full breadth of DevOps tooling. Supports 12 factor apps, polyglot programming, containers, and multivendor cloud scenarios. Supports hybrid cloud (dev/test in cloud and optionally deploy in one’s own datacenter). | Cited as more recent solution provider for cloud services but is recognized for pace of innovation with respect to cloud offerings and compelling roadmap.   |

An IT director for a large healthcare company shared his development experience using AWS and Azure. He mentioned that cloud platform choice is driven largely by the applications and existing skillsets: “Existing legacy systems and apps drive the PaaS/laaS selection. For example, for apps in .Net, Azure would make sense, while for other languages it might not. Likewise, for NoSQL databases, AWS is the way to go. We like AWS for having a smaller footprint and bigger datacenters and higher availability of services.” More generally speaking, he finds Azure more suited to IT professionals versus AWS, which is more suited to developers. He shared, “Azure has a lot more support and the interface is much more IT-professional friendly versus AWS, but in terms of AWS they are more flexible on working with you to accommodate your app. But then again you have to pay for it, and as long as you don’t care about the cost, AWS is more flexible.”

He acknowledged, however, that AWS involved a lot more third-party tools for development, stating, “With AWS we used a number of third-party tools—Eclipse for coding, Octopus for deployment, and Chocolatey for management—which in some cases created delays and required additional resources.”

Another study participant is a cloud architect in the finance and automotive industry. He has extensive experience helping companies move significant portions of their IT infrastructure to a combination of AWS and Azure. The motivation for companies to do this is to move IT from being considered a cost center to being considered a more

“But 95% of people that go into AWS build on AWS’s EC2 environment, which means you cannot export the build afterwards. So, if you want to get out of AWS, it now becomes cost-intrusive, because you have to go out and rebuild all your workloads.”

*Cloud Architect for Financial and Automotive Industry*

significant part of the company value chain. His specialized skill is helping companies overlay a “layer seven, consumable security ecosystem” to ensure applications running in the cloud maintain security and compliance.

From his vantage point, AWS is good for workloads based largely on open source, but at the same time “AWS doesn’t guarantee compliance and has security flaws including shared responsibility for developers to maintain compliance within their own systems/apps.” He also noted an issue around portability of workloads to other cloud platforms or on-premises environments once they are in AWS. He stated, “If you export a workload that is in VMware and you import it as an AMI and then build your new workload on top of that AMI, okay, then you can export that AMI back to VMware or Azure, later. But 95% of people that go into AWS build on AWS’s EC2

environment, which means you cannot export the build afterwards. So, if you want to get out of AWS, it now becomes cost-intrusive, because you have to go out and rebuild all your workloads.”

“The Oracle Application Container Cloud Service allows us to develop code in Docker images in Java, PHP or NodeJS and easily deploy it into the application container service in Docker. We are also planning to further leverage Kubernetes for container orchestration as we move to production. The primary factors in Oracle’s architecture and cloud services are both the scalability and security it provides in enterprise deployments.”

*Director of Client Services for  
Global SI*

In contrast to Oracle Cloud, which he had only evaluated, he shared, “They do need to make their licensing more consumable but Oracle supports integration to Chef and Jenkins and Docker and Python scripting and everything else. I mean, this is all open-source stuff. You can upload to any cloud. And from a security measure, Oracle is pretty tight on their whole stack.”

Yet another study participant was a director of client services for a large global systems integrator building cloud-native applications for one of their many customers in the health insurance market. Health insurance organizations, particularly those in the public sector, are extremely risk-averse when it comes to data in the cloud. At the same time, not keeping pace with technology trends results in potentially alienating their customer base and losing subscribers. The company decided to use the cloud to rapidly prototype and create proof of concepts to better engage their subscriber base. At the same time,

should the user engagement improve as they expected, they wanted to be able to quickly build out an enterprise-level production capability that would scale across their organization.

The SI leveraged experience with Oracle Cloud services and was able to quickly develop a set of services to capture health and fitness data from a set of test subscribers who tracked it with wearable devices. In very short order, the SI offered a solution using Oracle Application Container Cloud Service, Oracle Mobile Cloud Service, Oracle IoT Cloud Service, and Oracle Database Cloud Service.

“Normally it would take six to eight months to develop this type of application, but using Oracle PaaS and IaaS services we were able to stand up this new service in just three weeks.”

*Director of Client Services  
for Global SI*

Speed was very important to both the SI and the end customer. According to the SI’s director, “Normally it would take six to eight months to develop this type of application, but using Oracle PaaS and IaaS services we were able to stand up this new service in just three weeks.”

They developed a set of services in Node.js that pulled user data from popular fitness provider systems and also a dashboard to track subscriber utilization and engagement. Oracle Analytics Cloud and BI Cloud Service were employed to analyze and manipulate user data to report back to management and stakeholders.

Further, they developed a chatbot service to automate cumbersome processes such as resetting user passwords. They manage and deploy their capabilities in a microservices deployment using Docker

containers, which have proven extremely effective in terms of performance and resiliency of the application services. In the words of SI director, “Microservices and containers is a service architecture we promote to all of our clients. The Oracle Application Container Cloud Service allows us to develop code in Docker images in Java, PHP, or Node.js and easily deploy it into the application container service in Docker. We are also planning to further leverage Kubernetes for container orchestration as we move to production. The primary factors in Oracle’s architecture and cloud services are both the scalability and security it provides in enterprise deployments.”

## Scenario 4: Migration of Enterprise Applications to Cloud

Perhaps the toughest challenge for cloud adoption is migrating an enterprise solution. Often called “lift and shift”, these solutions are technologically and operationally complex. Enterprise applications are complex due to multivendor technology stacks, integration, and security. And operationally, stack dependencies must be understood and managed for patching, availability, and resiliency. Both factors influence SLA commitments.

When taking an application stack to the cloud, it is logical to choose a cloud provider who has expertise in managing that stack. It further makes sense to leverage the provider who has domain expertise in the applications themselves. Oracle and Azure are more uniquely suited to meet this need because they both provide combined services for SaaS applications and the platform and infrastructure.

There are two key differences that set Oracle apart. First, Oracle can manage both the line-of-business applications and the Windows stack for its products on Oracle Cloud. And second, Oracle also manages its entire stack on-premises with its own hardware, identically to the cloud. Oracle also provides tooling to automate the migration of its apps to Oracle Cloud. Leveraging Oracle applications running in Oracle Cloud yields substantial benefits for its customers and provides a unified support model from line-of-business in SaaS and technology support across PaaS/IaaS.

Table 5. Comparison of Migration of Enterprise Applications

| Cloud Platform | Strengths  | Challenges   |
|----------------|--|--|
| <b>AWS</b>     | Recognized for migration of third-party applications running on its commodity cloud infrastructure. Mature platform with broad regional coverage. Suited for companies not concerned or interested in hybrid cloud.  | Focused more at the infrastructure layer as it relates to application migration. Customers cite considerable issues with pure “lift and shift” and many applications require re-architecting to move to cloud. While AWS’s partner ecosystem is acknowledged as an advantage, they inherently rely on partners to provide technology and subject matter expertise at the business/application layer. Lacking direct customer support for, or deep experience with, applications. Also, customers are concerned about vendor lock-in due to lack of multivendor cloud support. No support for hybrid cloud. |
| <b>Azure</b>   | Recognized for Microsoft “shops” migrating Microsoft business applications to the cloud. Ability to leverage existing Microsoft skillsets. Ability to leverage access control from on-premises to the cloud via Active Directory. Integration with Office365 is a recognized differentiator. | Not ideal for migration of enterprise applications that do not use any Microsoft technology such as .NET or SQL Server. Limited migration tooling support.   |

| Cloud Platform | Strengths  | Challenges   |
|----------------|--|--|
| <b>Oracle</b>  | Recognized for holistic support for applications, platform, and infrastructure from a single vendor. Technology support for migrating enterprise application portfolios into the cloud: migration tooling support for Oracle workloads, Ravello nest virtualization for VMware/KVM workloads, and BYOL of Windows/.NET workloads. Differentiated IaaS with sustained high performance, HA, and data integrity and protection. Support of hybrid cloud. Leverage existing licensing,* skillsets, and resources. | Perceived as not ideal for non-Oracle applications but likely effective based on next-generation infrastructure and ability to run in multivendor cloud environment. Value proposition is greater running Oracle on Oracle given the engineering, service integration, and release coordination. |

\* Regarding the last row of **Table 5** about flexibility in leveraging existing licensing, Oracle recently announced two new licensing programs to aid in cloud migration and usage decisions: Universal Credits and Bring Your Own License to PaaS. Bring Your Own License to PaaS allows transfer of on-premises database and other middleware licenses into cloud subscription credits. Universal Credits allows credits to be used for any purpose.

A study participant we spoke with articulated the importance of application migration relative to the platform choice. The CEO of a managed service provider for Oracle applications has used AWS in the past and acknowledges its pioneering work in the public cloud space but finds running Oracle applications on the Oracle cloud to be a compelling proposition. He reported, “When we put that through the lens of Oracle applications and we view options for cloud, Amazon is still available as an option, but we think because Oracle is investing in making Oracle apps run more efficiently on Oracle Cloud as opposed to Amazon, we think that the value proposition favors Oracle Cloud for Oracle applications.”

He also referred to Oracle’s roadmap for cloud and the importance of combined infrastructure, platform, and application services. In particular, he cited the application tooling in saying, “For example, the PeopleSoft applications team has built a product called Cloud Manager, that not only takes care of infrastructure and platform, but overlays that with all the application software components that are needed for PeopleSoft to work in a particular sequence in the right order with the right configurations and that is a huge burden off of the customer’s plate because otherwise all of that is manual work and manual configuration and manual validation. So that’s an excellent maintenance tool at the customer’s disposal which you otherwise would not have on-premises or even on Amazon.” Regarding management tooling, he also noted the prepackaged nature of Oracle tools and apps, particularly for systems management, and stated that AWS can provide similar tooling through third parties but not as integrated or interoperable.

“Because Oracle is investing in making Oracle apps run more efficiently on Oracle Cloud as opposed to Amazon, we think that the value proposition favors Oracle Cloud for Oracle applications.”

*CEO for Managed Service Provider*

“Now Oracle Cloud, just like Amazon, can run non-Oracle workloads, Microsoft database or Java application or a .NET application—it can support all of that—but we are in the business of discrete business solutions. My company is in the business of helping Oracle applications customers migrate to Oracle Cloud and then extend their application footprint by using other cloud services, platform services, backup and recovery services, monitoring services, and so on.”

Lastly, he talked about the importance of hybrid cloud in the context of enterprise application migration, saying, “I think Oracle has the lead on the hybrid cloud front because they’re approaching it from a business applications perspective, not simply an infrastructure or technology perspective. When you look at it through that lens, you have to realize that customers are not just going to flip a switch and say I’m going to go to cloud. It’s going to be a journey and you have to help them along that

and you have to emphasize that it's not an all-or-nothing deal. Hybrid is a reality. While you're hybrid, there are still several advantages to cloud and here's how you make it more efficient."

Another study participant was a global education provider moving most of their datacenter, databases, and applications to AWS. The key driver for them was not price or cost savings but rather freeing up resources from mundane activities as well as speed and agility. The president of the company stated, "We're no different than most IT organizations if you look at the amount of patching, regression testing, and applying upgrades that goes on in every layer of your infrastructure stack and your database. It's a ridiculous amount of hours of work. If you would have to go and ask the business if they get any value out of it, other than the fact that their stuff is maybe available and stays secure, their answer will be, 'No, I get no value out of all that.'"

"For Amazon, we had to go through a third-party consulting organization. It's not easy to buy directly from Amazon if you're not a savvy buyer."

*President for Global Education Provider*

"One of the things that Oracle does very well is that it has standardized its tools for its data center usage, private cloud usage and public cloud usage, and that is a huge value at the enterprise level."

*Digital Practice Director for Large IT Services Company*

While largely achieving his company objectives in moving to AWS, he did acknowledge some of the complexities echoed by other study participants—namely, the granularity of service and pricing options and the rapidly changing nature of them over a short amount of time. He admitted, "For Amazon we had to go through a third-party consulting organization who understood the complexity and could select and properly configure the proper mix of services. It's not easy to buy directly from Amazon if you're not a savvy buyer."

In terms of evaluating the cloud vendor platforms, he acknowledged AWS particularly for their partner ecosystem and the importance of that to customers. Choice in application and tooling can certainly be an advantage, but he also acknowledged the other side of the spectrum, which is standardization. He noted Oracle's strength by stating, "The transfer of data between datacenter, private and public cloud and the ability to function in an hybrid cloud environment is a huge challenge and nowhere is that challenge felt more painfully than at the database level. One of the things that Oracle does very well is that it has standardized its tools for its datacenter usage, private cloud usage, and

public cloud usage, and that is a huge value at the enterprise level. So, there is no question that Oracle has a winner."



## Conclusion

There is no doubt that enterprise cloud is a new and improved IT strategy. Cloud services have proven to improve organizational agility and reduce the burden of IT infrastructure and cost. Moving to the cloud is no longer a question of “if” but “when” and “how.” Most enterprises we interviewed are moving to cloud in phases over time and matching workloads to their perceptions of a vendor’s cloud capabilities that will best support their objectives. Many will require the ability and flexibility to support multivendor cloud and multiple deployment choices (e.g., public cloud, private cloud, and hybrid cloud). Based on our research, the key findings and implications for business executives are as indicated in [Table 6](#).

**Table 6. Summary Points and Business Implications**

| Key Finding  | Business Implication   |
|--|--|
| Oracle’s innovative, next-generation cloud infrastructure is considered better aligned with enterprise requirements from a service, pricing, and agreement perspective, as compared to AWS and Azure.  | Makes it easier for enterprises to execute on billing and charge-backs, particularly in a global business scenario. Simplifies cloud agreements by not having to choose specific cloud services. Simplifies cloud migration with conversion of on-premises licenses to cloud subscription credits. |
| Oracle Cloud Infrastructure is considered better suited for predictable high performance, DR, and HA, as compared to AWS and Azure.  | Reduces service variability and service interruption.  |
| Unlike AWS, which requires “do-it-yourself” using third-party tools, Oracle Cloud provides a full breadth of integrated DevOps tooling, including curated open-source options for cloud-native development and extensions of SaaS applications.                      | Enables faster time to market for applications developed in the cloud, in addition to higher developer productivity and lower cost of development and deployment.  |
| Oracle offers superior support for advanced capabilities such as containers and other PaaS capabilities such as polyglot AppDev, mobile, API, analytics, integration, and low-code development.  | Facilitates a higher innovation potential for the enterprise, improving operational efficiencies and delivering a better experience for customers.   |
| Oracle Database Cloud provides more performance options, as well as unparalleled automation, scalability, and availability, as compared to AWS and Azure.  | Allows enterprises to scale massive workloads while maintaining higher performance and to better support their requirements as their businesses grow.  |
| Migration of applications to the cloud is well suited to providers such as Oracle and Microsoft, which have a full IaaS, PaaS, and SaaS portfolio. Oracle provides migration tooling and support as well as Universal Credits to ease the migration to Oracle Cloud. | Allows enterprises to leverage subject matter expertise and support from their cloud provider to ease their migration and modernization initiatives.   |
| Oracle’s support for hybrid and on-premises cloud was found superior to that of AWS and, to a lesser degree, to Azure, as it offers the same standards, technology, and tooling for on-premises and cloud services.  | Enables simpler, phased cloud migration due to identical software and skills across deployments, meets data sovereignty requirements with on-premises option, and provides flexibility and agility with a more effective orchestration between on-premises and cloud workloads.                    |

Given its deep support of hybrid cloud, customers interviewed in our study cited the substantive benefits of running Oracle workloads, and even non-Oracle workloads, on the Oracle Cloud platform. The breadth of Oracle’s cloud services for infrastructure, platform, and applications, as well as the interoperability with traditional on-premises applications and systems, is a compelling proposition for enterprise customers. Additionally, Oracle uniquely offers customers the flexibility to execute their IT strategy at their own pace and maintain a high degree of confidence in their ability to scale and maintain consistently high performance with predictable cost of ownership.