OMDIA UNIVERSE

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Omdia Universe: Container Management Solutions, 2022–23

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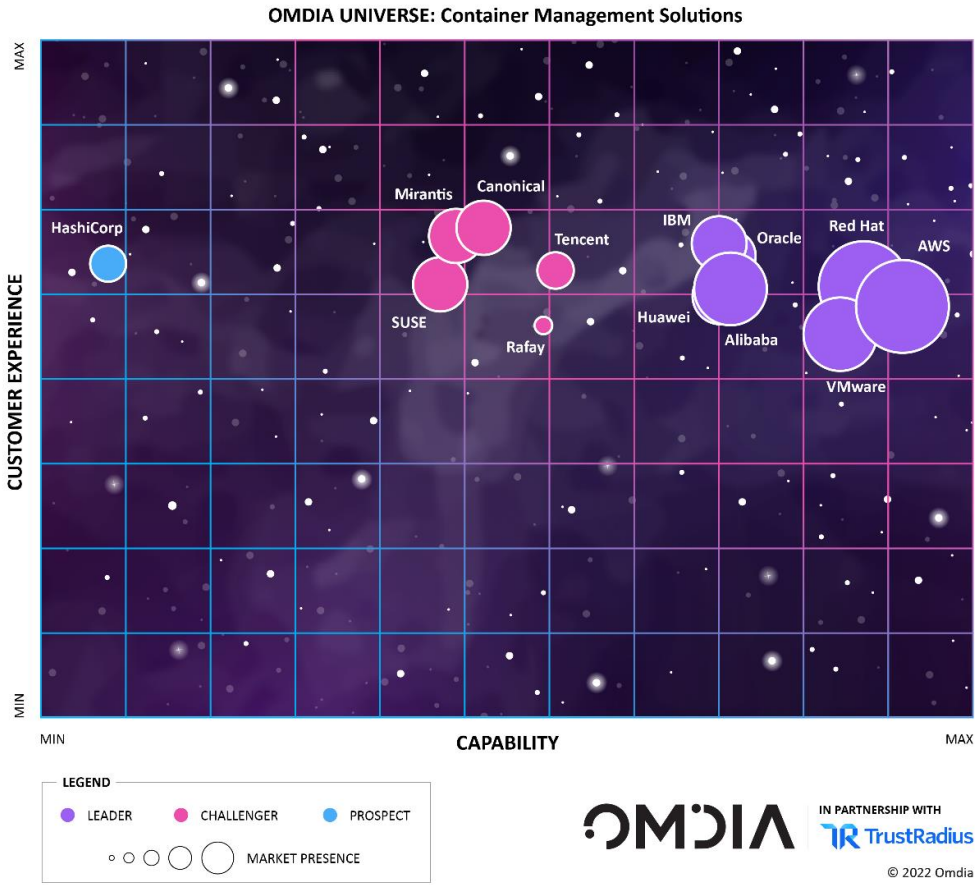
Summary

Catalyst

The growth in cloud-native applications(built to execute in the cloud independent of the underlying infrastructure) is synonymous with container use. However, container technology introduces specific challenges for CIOs, the not least of which is the lack of skills in managing large-scale container environments. It is important to understand the key challenges with adopting containers at scale from a management perspective and to discover some of the different vendor approaches to mitigating these challenges.

Figure 1: The Omdia Universe for Container Management Solutions



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All vendors included in the report were approached and provided input to this study.

Omdia view

We are shifting from a predominantly VM-based world to a more mixed cloud-native and VM-based reality. Over the next five years, VMs' dominance will erode as more workloads are developed and deployed in container-based environments. While Omdia does not believe that all workloads will become container-based, we expect this to represent a significant proportion of workloads by 2023. The developer community has been quick to see the potential of containers and has embraced the technology. However, this shift requires an equally significant cultural and skills shift to occur within operations and security teams, and this is one of the forces holding back the faster adoption of containers.

Software vendors and cloud service providers are responding to this resistance by designing solutions and services to simplify the management of a container environment. The important elements of any container management solution differ significantly from those of a traditional VM management solution. Customers are looking to build high-scale services consisting of microservices. This differs from a traditional VM management solution because containers are application-based, not machine-based. Even though container management is more application-based, the high-level capabilities required in any management solution are the same, but the detailed approach taken by container management solutions will differ. Container management solutions take into account that environments are distributed and that applications move and are ephemeral.

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Analyzing the container management solutions universe

Market definition

Omdia believes 10 capabilities are key to any container management solution: developer experience, runtime and registries, scale and flexibility, security operations, operational management, pricing and TCO, observability, support and training, open source credentials, and automation.

Developer experience

Developers drive the adoption of cloud-native applications, and any container management solution must recognize their needs and make the developer experience as productive and intuitive as possible.

Runtime and registries

One of the aspects of a container management solution that differs from the existing VM management solutions is that it must accommodate the developers and operational teams. The runtime and registries are a critical component of the cloud-native ecosystem, and responsibility for managing these must be an integral part of any solution.

Scale and flexibility

The big challenge is for organizations to manage container environments irrespective of where the containers are executing (on-premises or in a cloud). The other significant challenge is managing the sheer number of container images, which in a microservices architecture are likely to be an order of magnitude greater than the VMs currently managed.

Security operations

The security requirements in a container environment are different from those in a VM environment. Any solution must deal with the specific security requirements of applications as well as more traditional infrastructure security concerns.

Operational management

Managing a container differs from managing a VM. A container requires the workload to be managed separately from the host VM. This means that in a container-based environment, the containers are more portable and significantly greater in number. Therefore, resource and service management must operate at the very granular resource level, the core infrastructure level

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(Kubernetes elements such as Pods, worker, and master nodes), and the service level (the combination of many different containers).

Pricing and TCO

This capability compares suppliers on the cost and total cost of ownership (TCO) for several scenarios. Each vendor has a different set of offerings made up of different features and elements (for instance, are the infrastructure resources included, is the offering a fully managed service or a partially managed service, etc.).

Observability

One of the key management activities in a cloud-native environment is the ability to move beyond monitoring and perform observability. Monitoring is tooling or a technical solution that allows teams to watch and understand the state of their systems. Observability is tooling or a technical solution that allows teams to actively debug their systems.

Support and training

One of the main reasons for the popularity of container management solutions is a skills shortage and the need for existing IT staff to manage containers with as much familiarity as possible. This is particularly important from a developer perspective because the correct solution will empower the developers and not get in the way.

Open source credentials

The containers market is still an evolving market and, as such, has a number of competing technology standards. The key element is that any platform can manage the most popular technologies and support industry-recognized standards.

Automation

Managing any container deployment at scale requires the underlying nodes to be managed correctly. The nodes must also remain up to date with current patch levels. Automation plays a significant role in simplifying management tasks—whether they are for the customer or being delivered as a managed service—and it is key to supporting containers at scale operationally.

Market dynamics

Containerization dates back to the 1970s, when the technology was initially used solely for isolating application code. The technology initially lacked the usability and portability benefits users have come to expect since the launch of Docker and the introduction of the container engine in 2013. The containerization movement then formed around the open source project, which addresses the common pain point of “dependency hell,” the challenge of making an ever-increasing set of applications, language(s), frameworks, and more interact properly with an ever-increasing set of hardware environments. Kubernetes has its roots in work done by Google, and it launched at DockerCon in 2014. Google had been running containerized workloads in production for more than a decade, and through an internal project named Borg, it developed an orchestration engine. Kubernetes traces its lineage directly from Borg. Many of the developers at Google working on Kubernetes were formerly developers on the Borg project. However, other approaches were also being developed, most notably Service Fabric, which is Microsoft’s container orchestrator solution for deploying microservices across a cluster of machines.

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The container market is evolving rapidly, and therefore the container management solutions market is equally dynamic. The market is exhibiting great momentum for containers and equal momentum to drive standardization to accelerate adoption and industry growth. Kubernetes is a ubiquitous solution while AWS ECS and HashiCorp Nomad are widely used alternatives. Some approaches, notably Swarm and Mesos, are open source projects that did not survive. However, Kubernetes and other orchestrators and concepts are often alien to IT administrators, so the direct use of Kubernetes to orchestrate a large deployment can be challenging. The rise of container management solutions has helped IT administrators remove some of the complexities of using Kubernetes and bridge the new and existing operational activities, enabling organizations to transition at a pace that fits business demand and IT capability.

The evolution of the container management market will almost certainly be led by solutions that augment the use of new technologies in the storage, security, and network spaces into a single management offering. Current solutions mostly take the Kubernetes orchestration solution and wrap other management functions around it, creating more of an enterprise solution. However, as the use of these solutions expands, more gaps in capability will be discovered, and the solutions must be flexible enough to accommodate these changes. Many of the solutions are designed to be “open” and extensible to support vendor-specific hardware and new operating models. Omdia expects the market to rapidly expand, with many operational management, cloud service provider, and monitoring vendors producing solutions. Ultimately, the market will coalesce on a smaller number of solutions, almost exclusively built using “open source” as the design criteria.

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Figure 2: Vendor rankings in the Container Management Solutions Universe

Vendor	Product(s) evaluated
Leaders	
Alibaba	Cloud Container Service for Kubernetes (ACK)
AWS	ECS and EKS
Huawei	Cloud Container Engine
IBM	Cloud Containers Service
Oracle	Container Engine for Kubernetes
Red Hat	OpenShift
VMware	Tanzu
Challengers	
Canonical	Charmed Operators and Fully Managed Kubernetes
Mirantis	Container Cloud
Rafay	Enterprise Kubernetes Operations Platform
SUSE	Containers as a Service Platform
Tencent	Kubernetes Engine
Prospects	
HashiCorp	Nomad

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Market overview

While the Omdia Universe classifies all the vendors into three distinct groups (**Figure 1**) based on their scores, the separation between the best- and worst-performing vendors was only 8% in terms of the overall weighted total Universe score; this gap was 5% between the leaders and the challengers. These results demonstrate that most container management solutions share a similar core set of capabilities, and the differences are more about how the solutions add value and are used.

Market leaders

The leaders (**Figure 2**) all recorded a weighted total Universe score (average of capability, customer feedback, and market impact) of over 62%, and they also scored an average weighted capability score (average of all the capabilities measured and the calculated measures) of over 64%. The leader category consists of two distinct, tightly formed groups. AWS, Red Hat, and VMware recorded an average weighted capability score of over 66% and were clear leaders. However, Alibaba, Huawei, IBM, and Oracle recorded an average weighted capability score of over 64%. The formation of clusters shows that the leader's market has some differentiation between offerings, but the differences are more nuanced than fundamental in nature. The leaders were also responsible for 70% of the sub-category leading scores, further underlining their difference from the challengers.

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The leaders did not demonstrate significant strength compared to any other classification in terms of customer feedback scores. However, the leaders' willingness to recommend scores were consistent, with all recording scores between 83% and 88%.

Market challengers

The challengers (Canonical, Mirantis, Rafay, SUSE, and Tencent) are closely grouped as they all recorded a weighted total Universe score of 59% and a weighted capability score of 62%. The challengers were responsible for only 30% of the top sub-category scores. Again, it is evident that although the leaders and challengers show areas of clear separation, these were not in any fundamental capabilities but were more related to the way some challengers' capabilities are solely based on the upstream Kubernetes capabilities whereas the leaders demonstrated they have augmented these as enhancements. The challengers were not inferior to the leaders in terms of customer feedback: a challenger achieved the top category score for customer feedback, and challengers recorded two top sub-category scores in customer experience out of the three measured. However, the challengers were less consistent as a group, with wider variation between the highest and lowest scorers.

Market prospects

The prospects (HashiCorp) recorded a weighted total Universe score of less than 56% and a weighted capability score of less than 59%. This category shows some areas where there is clear differentiation between the leaders and challengers in terms of capabilities. However, much of the prospect's scoring was due to an unwillingness/inability to provide answers to some critical questions.

Opportunities

The market for container management is growing rapidly as more organizations adopt the technology. However, in these early days of adoption, many organizations are not mature enough to have experienced all the challenges of managing containers at scale. Offering solutions that allow the customers to grow and use the most appropriate ways to manage their container estate is a key vendor capability. Omdia believes that vendor offerings that match customer needs will enable vendors to retain customers as they navigate and expand on their container journey.

Threats

The current market has many different vendor solutions that offer similar capabilities. However, customers are increasingly looking to adopt solutions for managing and executing containers in multiple environments that cross public cloud providers and on-premises and off-premises environments. According to Omdia's research, the edge will be predominantly based on containers, representing a highly distributed and diverse environment. Omdia believes that any solution that does not address the need of the edge and include interoperability with different technology stacks will struggle to win and retain users. The other main threat to the market is forcing customers to only use a solution that has its control plane hosted in a single vendor's environment. While this approach (central control plane) delivers the simplicity customers seek, it fails the flexibility test. Therefore, any container management solution must offer a choice of how the solution is managed (self-managed or managed service) and where any control plane is hosted (in a single vendor's environment or in any environment).

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Market outlook

The software forecast for container management solutions/platforms shows a CAGR of nearly 25% 2020 to 2025, and the market will be worth nearly $7.5 billion in 2025. Unlike some other technologies (i.e., the hybrid and multicloud management market), the container management market shows greater variation between industry verticals and geographies. The industry vertical with the slowest growth and smallest market worth by 2025 is the energy sector, with a CAGR of 19% and a market worth of $177 million in 2025. By contrast, the fastest-growing vertical with a CAGR of just over 28% is media and entertainment, and the largest market vertical by value in 2025 will be retail at $727 million (nearly 10% of the total market). Omdia's *IoT, Cloud, 5G, and Digital Workplace – IT Enterprise Insights 2022* survey data confirms this variation among industries. The percentage of workloads running cloud-native environments in 2021 for the retail sector was just over 35%, and the energy sector reported less than 30% of workloads running in cloud-native environments.

Indonesia is the fastest growing geography for container management solutions with a 2020–25 CAGR of 41%, and Japan is the slowest with a CAGR of just below 21%. Again, looking at cloud-native workloads, this time by geography, Indonesia has 35% of workloads running as cloud-native in 2021 compared to less than 33% in Japan. This variation in workload percentages appears too small compared to the difference in CAGR. However, Japan expects to show a minimal increase to just less than 34% of workloads in cloud-native environments in 2023, compared to Indonesia, where nearly 37% of workloads are expected to be in cloud-native environments, indicating faster growth in Indonesia. The other factor is the market size in these two countries: by 2025, Japan is expected to be worth $255 million ($99 million in 2020) and Indonesia $125 million ($22 million in 2020).

When it comes to market value, the US is the largest market with a forecast of $2.4 billion by 2025 (and a CAGR of just 22%), but China is the second-largest market with a forecast of nearly $1 billion by 2025 (actual figure $939 million) but a CAGR of 39%. The US expects 34% of workloads to be running in a cloud-native environment in 2023, up from 32% in 2021. In comparison, China in 2021 reported that 33% of workloads were running in cloud-native environments, which is expected to increase to 36% in 2023. In both cases, this shift is at the expense of virtualized workloads, with legacy non-virtualized workloads remaining fairly consistent at approximately 19%.

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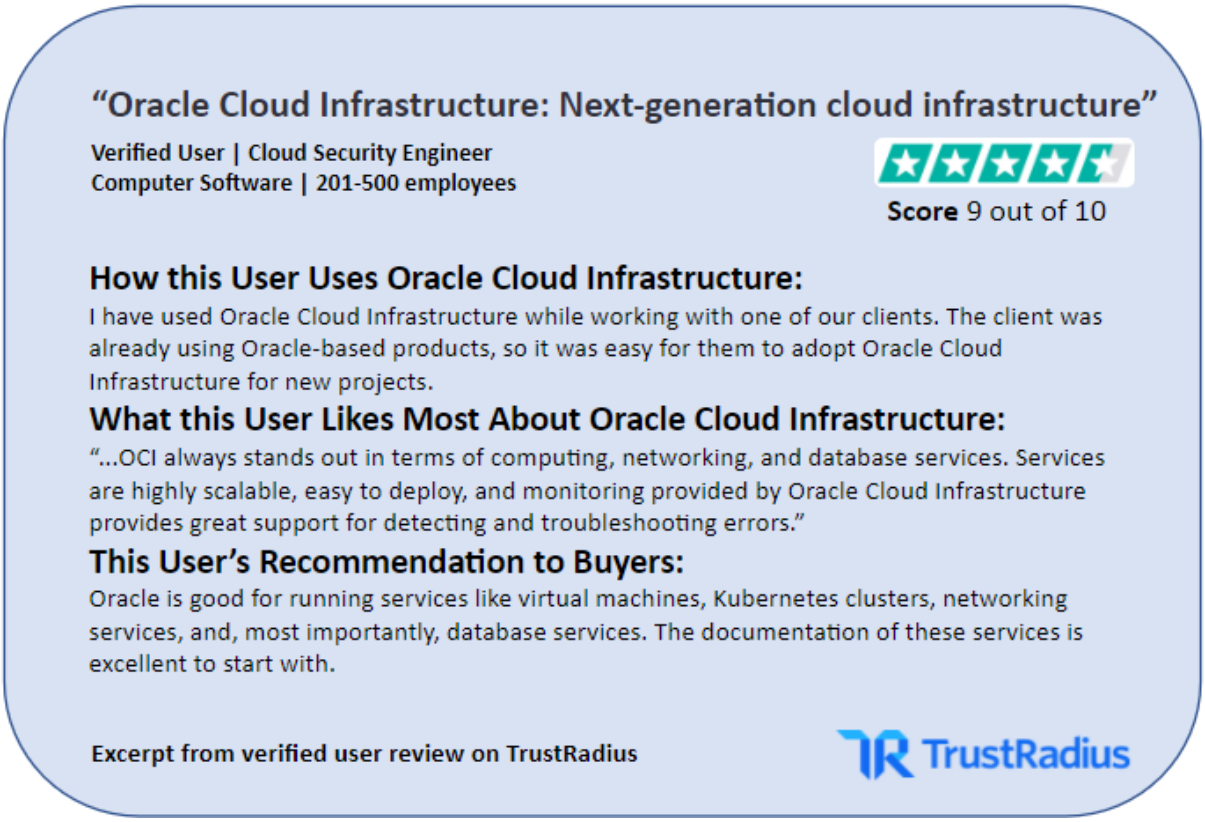
Vendor analysis

Oracle (Omdia recommendation: Leader)

Oracle should appear on your shortlist if you are looking for a solution that separates the control and data plane, giving the customer complete data protection and control.

Figure 11: Oracle Voice of the Customer



Oracle's solution is Customer Verified by TrustRadius

Overview

Oracle is classified as a leader in the Omdia Universe because it obtained a weighted capability score of nearly 64.5% and a weighted total Universe score of 62%. Oracle recorded one top sub-category score. The vendor was above average in 11 of the sub-category scores, in line with the average in 3

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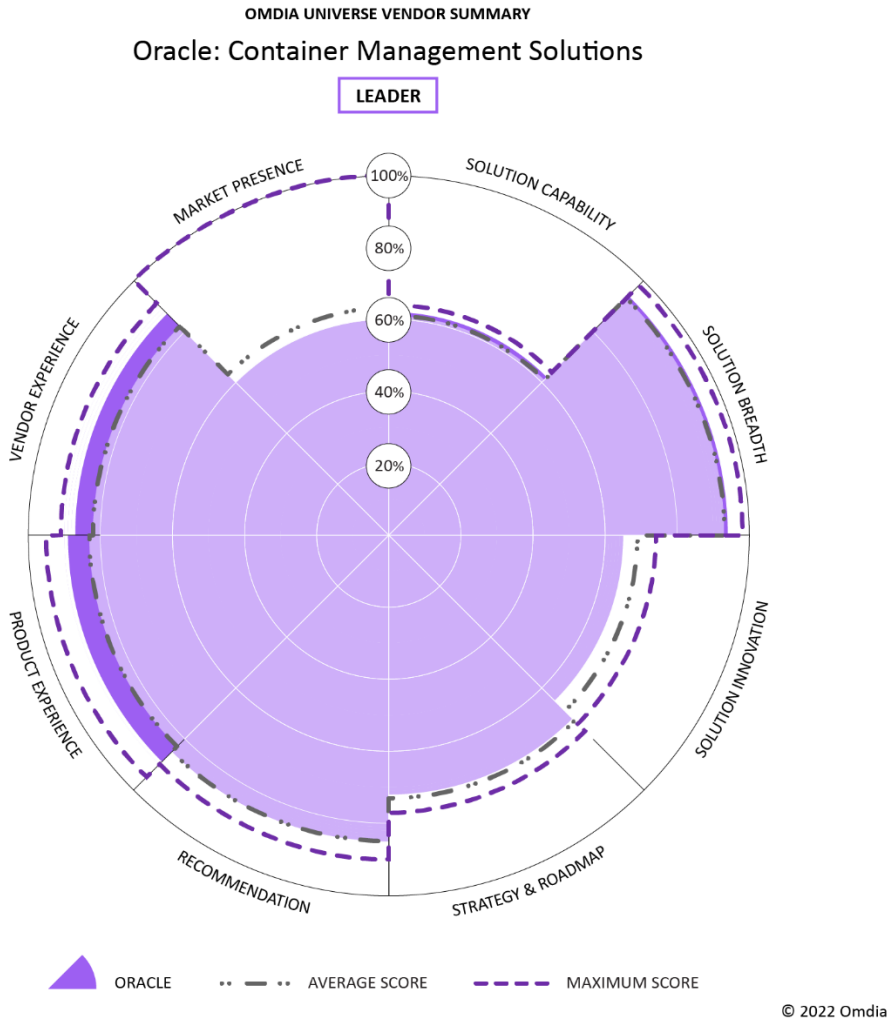
sub-categories, and below average in only 1 of the 15 sub-categories across the total capabilities in all sections. Oracle performed well in the customer experience questions and was selected for a Voice of the Customer statement (**Figure 11**). Its weighted average customer experience score was above average at 86% and not far behind the top score of 90%. Oracle recorded 85% willing to recommend the vendor, in line with the average. For product experience and vendor experience, Oracle was well above average with scores of 89% and 87%, respectively. In both instances, Oracle was the fourth-highest at only 6% behind the top score for product experience and 4% behind the top score for vendor experience. However, as Oracle was unable to answer some questions in one sub-category, its variance score (the difference between its strongest and weakest scores) was 24 percentage points, which was marginally above the average.

Figure 12: Omdia Universe ratings—Oracle



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Strengths

Oracle's strongest sub-category was scale and flexibility, where it recorded a score of 68%. Omdia considers Oracle's approach to the control and data planes to be impressive. Oracle has opted to completely and transparently manage the cluster control plane for customers using Oracle Kubernetes Engine (OKE). The control plane is automatically patched, updated, and scaled to meet the cluster workload needs without any user involvement. Customers manage the OKE cluster data plane, and they are provided with cluster node autoscaling, horizontal Pod autoscaling, and vertical Pod autoscaling mechanisms to dynamically optimize the data plane resources to fit the application needs. This approach provides a separation of responsibility between the control and data planes and has the added benefit of being a more secure way to deal with the management of any cluster.

Oracle's other key strength is that there are no theoretical limits to how the platform scales to meet demand. OKE customers have a default limit of 1,000 nodes per cluster and 110 Pods per node. However, by requesting an increase to the default service limit for clusters (15 for customers who pay monthly and 1 for pay-as-you-go customers), customers can have more than 100 clusters per account. This translates to up to 5,000 nodes per cluster and up to 110 Pods per node, which can support up to 150,000 Pods and 300,000 containers. Oracle was also strong in its flexible charging for control plane management. Oracle does not charge a fee for fully managing the OKE cluster control plane and includes enterprise support for free. It makes OKE available as a Day-1 service in every new region where it launches and currently offers managed container orchestration in more regions in the world than any other public cloud provider (37 versus 35 from the next closest competitor).

Oracle's second strongest sub-categories were runtime and registries and operational management, both scoring 67%. In runtime and registries, Oracle was above average in the supported runtimes because with the release of Kubernetes version 1.20 in July 2021, OKE switched from Docker to CRI-O as the container runtime. CRI-O is an Open Container Initiative compliant implementation of Container Runtime Interface (CRI). Omdia believes that Oracle's key strength in runtime and registries is how the resources are linked to the runtime. Customers can choose the infrastructure resources they anticipate for their applications at the time of OKE cluster creation. They can further leverage cluster node scaling, horizontal Pod autoscaling, and vertical Pod autoscaling mechanisms to optimize OKE cluster resources dynamically to fit their application needs. OCI also offers flex compute shapes so customers can pick the exact CPU and memory resources needed for rightsizing the compute needs of Kubernetes nodes. Another notable strength of Oracle in this sub-category is how it deals with auto-restart of applications that have an error condition. OKE provides a self-healing platform for automatically managing the "desired" state of Kubernetes workloads. Therefore, if a worker node or Pod is accidentally removed, a new node or Pod is automatically spun up to meet the desired state of the cluster. In addition, all OKE worker nodes ship with a utility called Node Doctor, which can troubleshoot and remediate any issues with the worker nodes that prevent Pods from being properly scheduled to run on them.

In terms of operational management, Oracle was noteworthy for its approach to managing storage and ensuring downtime is minimized. OKE offers broad container storage options through native integration with OCI Block, File, and Object storage services. Customers can use either Container Storage Interface (CSI) or Flex Volume drivers for provisioning storage resources using Kubernetes constructs such as Persistent Volumes (PVs) and Persistent Volume Claims (PVCs). To protect against

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region-level disaster scenarios, customers can use cross-region replication capabilities provided by OCI storage services. OCI Storage services replicate data across fault and availability domains at all times so that no single failure impacts the availability of application data. Customers can also provision the Kubernetes cluster to ensure that the worker nodes are deployed across fault/availability domains to automatically take advantage of the resilient fault isolation patterns built into OCI.

Limitations

Oracle's weakest sub-category was open source credentials, where it scored 44%. However, it must be noted that Oracle did not answer four of the eight questions, which seriously influenced the score. In fact, Oracle is actively involved with several Kubernetes project contributions. The list includes but is not limited to Kubernetes operators for Oracle services (e.g., ATP/ADW, Oracle DB, MySQL, Streaming, Coherence, Weblogic.), Verazzano for on-premises/hybrid/multi-cloud orchestration of containers, Kubernetes Cloud Control manager implementation for Oracle Cloud, Kubernetes Cluster Autoscaler, and ExternalDNS.

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Appendix

Methodology

Omdia Universe

The process for writing a Universe is comprehensive and extensive :

- Omdia analysts perform an in-depth review of the market using Omdia's market forecasting data and IT Enterprise Insights survey data.
- Omdia creates a matrix of capabilities, attributes, and features that it considers to be important now and in the next 12–18 months for the market.
- Vendors are interviewed and provide in-depth briefings on their current solutions and future plans.
- Analysts supplement these briefings with other information obtained from industry events and user conferences.
- Customer experience is measured by using TrustRadius as a partner and taking the scores from verified customers. This data can be supplemented/replaced by an anonymous customer survey with the vendors supplying the contact names of willing participants and Omdia sending the customers a questionnaire.
- The vendor capability responses are scored by a group of analysts using a scoring model, and the average score is recorded for each category.
- The Universe is peer reviewed by other Omdia analysts before being proofread by a team of dedicated editors.

Omdia ratings

The scoring for the Universe is performed by independent analysts against a common maturity model, and the average score for each sub-category and dimension is calculated. The overall position is based on the weighted average score, where each sub-category in a dimension is allocated a significance weighting based on the analyst's assessment of its relative significance in the selection criteria:

- Market leader: This category represents the leading solutions that Omdia believes are worthy of a place on most technology selection shortlists. The vendor has established a commanding market position with a product that is widely accepted as best of breed.

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- Market challenger: The vendors in this category have a good market positioning and are selling and marketing the product well. The products offer competitive functionality and a good price-performance proposition and should be considered as part of the technology selection.

- Market prospect: The solutions in this category provide the core functionality needed but either lack some advanced features or suffer from a low customer satisfaction rating. A niche or relatively new vendor with select innovative products and strategies may fall into this category and should be explored as part of the technology selection.

Inclusion criteria

The criteria for the inclusion or exclusion of a vendor solution in the *Omdia Universe: Container Management Solutions, 2022–23* are as follows.

Inclusion criteria

- The vendor must be a global solution provider and have customers in three of the four regions: Asia & Oceania, EMEA, Latin America & the Caribbean, and North America.

- The vendor must have at least 500 customers, and they must be a mixture of mid-sized enterprises and large enterprises.

Exclusion criteria

- The vendor's offerings are only applicable to 5 of 10 different classifications in the feature's questionnaire.

- The vendor's services are more than 50% made up of partner solutions or third-party solutions.

Further reading

Software infrastructure market forecast 2020-25 report (September 2021)

Data Center Automation Strategies and Leadership (March 2021)

IoT, Cloud, 5G, and Digital Workplace – IT Enterprise Insights 2022 (October 2021)

Understanding the People and Process Challenges with Deploying Data Center Automation Technologies (March 2021)

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