Quadrant
Knowledge Solutions

IoT and Digitalization

SPARK Matrix™:
Edge Management and Orchestration (EMO) Platform, Q4 2023

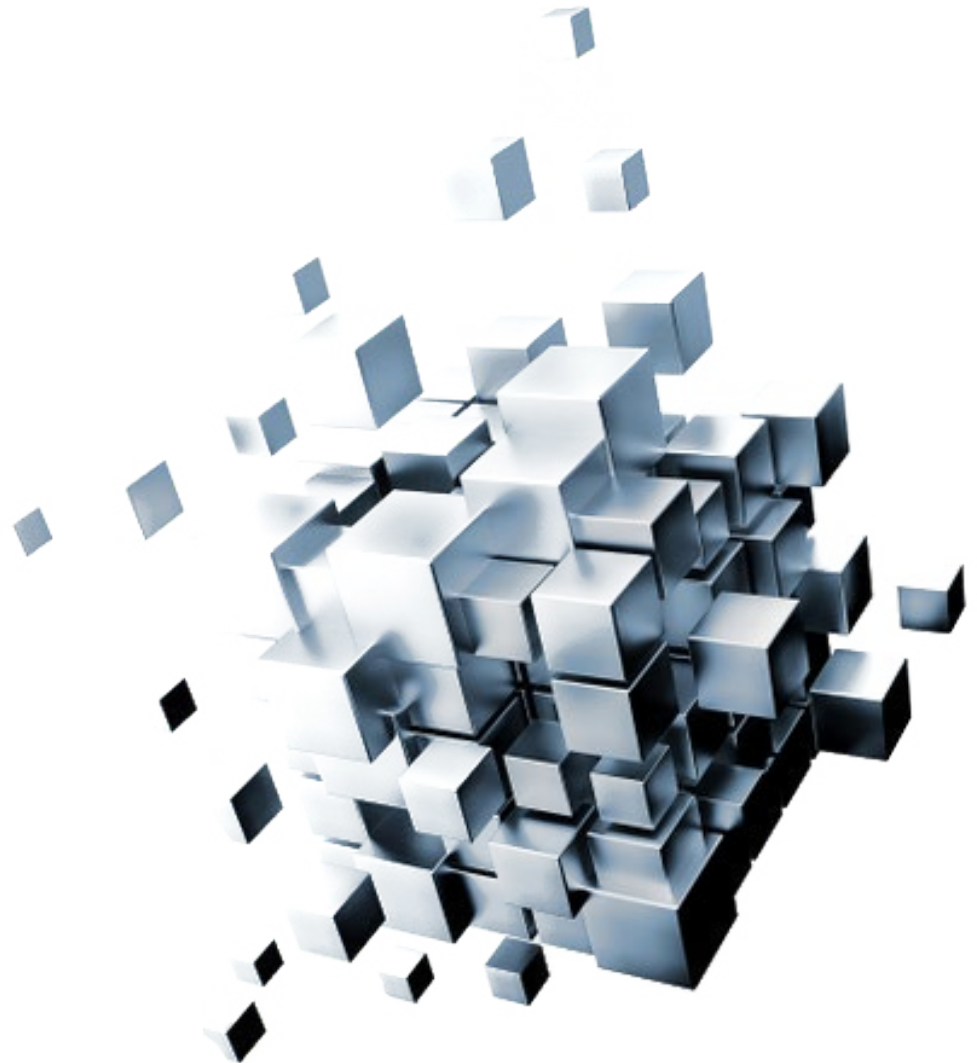Market Insights, Competitive Evaluation, and Vendor Rankings

October, 2023

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Executive Overview

This research service includes a detailed analysis of global Edge Management and Orchestration (EMO) market's dynamics, major trends, vendor landscape, and competitive positioning analysis. The study provides competition analysis and ranking of the leading Edge Management and Orchestration (EMO) platfrom vendors in the form of the SPARK Matrix. This research provides strategic information for technology vendors to better understand the market supporting their growth strategies and for users to evaluate different vendors capabilities, competitive differentiation, and its market position.

Market Dynamics and Overview

Quadrant Knowledge Solutions defines edge management and orchestration (EMO) as "the comprehensive process of efficiently administering, automating, and coordinating the deployment, operation, and synchronization of edge computing solutions, especially within the IoT landscape.The EMO platform integrates existing functions and modules into innovative edge computing solutions while harmonizing service function components with remote backend services and locally available edge/IoT devices to enable localized data processing. The edge orchestration framework encompasses various critical facets, such as discovery, provisioning, configuration, monitoring, security, performance optimization, lifecycle management, and service coordination. The EMO processes facilitate seamless execution of edge applications across diverse domains and locations, facilitating dynamic management, optimization, and delivery of edge computing services while emphasizing resource, service, application, and network management. It also supports integration with cloud computing and related technologies for transformative digital experiences at the enterprise edge."

The edge computing market is formed as an extension of the cloud computing market with its ability to process data closer to the source in real-time without latency. It is significantly advantageous due to its reliability and industrial use cases. Edge computing is driven by the imperative for instantaneous decision-making in autonomous vehicles, industrial automation, and augmented reality. By processing data at the edge, near the devices generating it, edge computing ensures that critical decisions can be made in real-time, enhancing safety, efficiency, and user experience. Edge computing software platforms enable the management, orchestration, and deployment of applications and services at the edge. These platforms also facilitate seamless integration with cloud computing resources, ensuring a harmonious hybrid computing environment.

Edge orchestration encompasses infrastructure orchestration, network service, application orchestration, lifecycle management, and closed-loop automation into one system that orchestrates a wide variety of workloads and use cases. The edge orchestrator controls network resources at the edge in real-time, automating the provisioning of services, making intelligent networking decisions for applications, streamlining application locations, and automating tasks to achieve seamless workloads across a network. Cloud-native, Kubernetes-based automation and orchestration are driving the digital transformation of the enterprise edge today. The market for edge management and orchestration platforms is dynamic,

with numerous vendors offering solutions tailored to specific industry needs and application segments. These platforms cater to various domains, such as manufacturing, telecommunications, smart cities, and autonomous vehicles, reflecting their adaptability and versatility. Vendors are investing in strategic acquisitions, in-house developments, and collaborative ecosystems to provide comprehensive solutions while meeting the evolving requirements of the industrial landscape.

The edge management and orchestration market is currently experiencing rapid expansion, driven by the widespread adoption of edge computing in diverse industries. Key platform vendors are playing a pivotal role in shaping this market by offering solutions that cater to the unique requirements of edge computing environments. The future landscape of edge management and orchestration is likely to be defined by its integration with cloud computing, standardization efforts, advanced AI integration, and heightened security and privacy measures. These trends would ensure its continued relevance in the digital transformation journey of organizations worldwide by offering a strategic edge in the competitive landscape of the IoT and edge computing.

Based on the understanding of the EMO platform, a detailed description of the requisite key capabilities is listed below.

- **Fleet Management:** The concept of fleets encompasses a group of Kubernetes clusters, devices, and other resources that can be managed and deployed across infrastructures, workloads, and networks. EMO vendors offer cloud-native technologies for managing containers, container orchestration, and service meshes, which cannot be run from a single cluster and require a multi-cluster deployment model. A fleet facilitates logical grouping and normalizes Kubernetes clusters, helping organizations uplevel their management from individual clusters to entire groups of clusters.

- **Application orchestration:** Edge management and orchestration platforms should support a wide range of workloads for containerized and virtualized applications. It is beneficial to organizations as all applications have diverse requirements in terms of resource utilization, performance, and security. By supporting a wide range of workloads, edge management and orchestration platforms can provide a flexible environment for deploying applications at the edge.

EMO platform enables coordinating & automating deployments and scaling & managing complex, distributed edge applications. It ensures applications and services interact seamlessly, resources are allocated efficiently, and configurations are maintained consistently across edge devices. This capability optimizes performance, simplifies maintenance, and enhances scalability, making it easier for organizations to leverage edge computing effectively.

- **Edge Application Management & Deployment:** Edge application management & deployment is a pivotal capability of edge management and orchestration platforms and is used for application orchestration. It streamlines the deployment of applications and services to edge devices, ensuring efficient and seamless distribution. This capability enables administrators to package and deploy applications to distributed edge nodes, optimizing resource allocation and scaling. It simplifies the complex process of making applications available on edge devices, improving agility and reducing operational overhead. Additionally, it supports version control and rollback, ensuring that the right applications run on the right devices at the right time, enhancing the reliability and performance of edge computing infrastructure. Overall, edge application management & deployment capability empowers organizations to harness the potential of edge computing by efficiently managing and orchestrating their applications at the edge.

- **Security and Governance:** The security capability empowers organizations with firewalls, access control, data security, and governance protocols for various vulnerabilities. It enforces security measures, such as authentication, authorization, encryption, and access control, to protect edge devices and data from unauthorized access and cyber threats. This capability ensures compliance with regulatory standards and industry-specific requirements, facilitating traceability for audits and reporting. By providing fine-grained control over access and modification of resources at the edge, it helps organizations maintain data integrity and operational security. Additionally, it facilitates secure device onboarding and management, helping prevent vulnerabilities. In essence, security and governance capabilities serve as the foundation for building trust and maintaining the integrity of the edge computing environment, ensuring that data and devices remain secure and compliant with regulatory frameworks.

- **Network orchestration:** The network orchestration capability of an edge management and orchestration platform is critical as it ensures the efficient and optimized operation of network resources in a distributed edge computing environment. It facilitates automated configuration, provisioning, and management of network resources, such as routers, switches, and firewalls, to support edge applications and services. The capability enables dynamic adjustments to network configurations in response to changing workload demands, traffic patterns, and resource requirements, ensuring low latency, high availability, and efficient bandwidth usage. The network orchestration capability also enables load balancing, traffic shaping, and Quality of Service (QoS) mechanisms to guarantee that data flows smoothly between edge devices and the central infrastructure, optimizing the overall performance and reliability of edge computing deployments. In essence, network orchestration is fundamental in creating a responsive and well-managed network infrastructure at the edge.

- **Multitenant support:** Multitenancy is a software architecture where a single software instance can serve multiple distinct user groups. Software-as-a-service (SaaS) offerings are an example of multitenant architecture. Multitenant support within an edge management orchestration platform is a crucial capability that enables the secure and efficient sharing of edge computing resources among multiple organizations or tenants. It allows distinct entities to operate within the same edge infrastructure while maintaining strict isolation of their data, applications, and configurations. This capability uses user authentication, access control, and resource segmentation to ensure that each tenant has restricted access only to their allocated resources and data. It also facilitates the management of edge resources on a per-tenant basis, accommodating varying needs and usage patterns. Multitenant support simplifies resource allocation, reduces operational complexity, and enhances resource utilization, making it a key component for organizations looking to deploy and manage edge computing environments with diverse stakeholders and use cases.

- **Multi-access edge computing (MEC):** An edge management and orchestration platform accommodates diverse access technologies and devices at the edge of the network. It enables a variety of devices, such as smartphones, IoT devices, and connected vehicles, to access

edge resources and services efficiently. MEC optimizes the delivery of applications by processing data closer to the end-users or devices, reducing latency and improving the overall user experience. This capability enables organizations to manage the allocation of resources based on various access technologies, ensuring that each type of device gets the appropriate level of service and responsiveness. MEC plays a pivotal role in supporting emerging applications for augmented reality, autonomous vehicles, and real-time IoT analytics. It allows these applications to leverage edge resources effectively while accommodating a multitude of devices and access methods.

- **Application lifecycle management:** Application lifecycle management (ALM) capability in an edge management orchestration platform facilitates end-to-end management of applications from their initial deployment to updates and eventual decommissioning. It encompasses tasks such as application provisioning, scaling, monitoring, and maintenance at the edge. ALM ensures efficient resource utilization, compliance with policies, and seamless updates, enabling organizations to meet evolving requirements of end users . It also incorporates version control, rollback mechanisms, and the ability to orchestrate application scaling based on demand. The capability also guarantees that edge applications operate optimally, adhere to security protocols, and adapt to changing workloads or conditions while minimizing downtime and maintaining reliability in a dynamic edge computing environment.

Competitive Landscape and Analysis

Quadrant Knowledge Solutions conducted an in-depth analysis of the major edge management and orchestration (EMO) platform vendors by evaluating their products, market presence, and value proposition. The evaluation was based on primary research with expert interviews, analysis of use cases, and Quadrant's internal analysis of the overall EMO market. This study mainly includes an analysis of various key vendors, namely Aarna Networks, Avassa, Azion, Hashi Corp, Nearby Computing, Platform9, Pratexo, Rakuten Symphony, Scale Computing, Sunlight, Vantiq, Veea, and ZEDEDA.

Avassa, Azion,Platform9, Scale Computing, Sunlight, and ZEDEDA are positioned as the leaders of the global EMO market with ZEDEDA, Scale Comptuing and Azion being the top three performers. Then followed by strong contentders with Hashi Corp, Pratexo, Rakuten Symphony and Vantiq. The companies were assessed based on their technology excellence and customer impact criteria. The companies are positioned as leaders because of their ability to provide comprehensive edge orchestatrion capabilities with extended edge services and hardware support including stronger customer impact through significant use cases in the EMO market

Avassa's EMO platform enables organizations to build, manage, monitor, deploy, and orchestrate applications at the edge. Its architecture is designed to manage distributed edge clouds. The platform is an easy-to-use, secure, and scalable solution for container-based applications in a distributed environment. The platform offers distributed security across its system-wide distributed services for managing compliance and policies. It also offers multitenancy and a high degree of autonomy through its Edge Enforcer application.

Azion offers a full-stack edge platform that assists developers in building applications faster. It orchestrates its applications through multi-cloud, on-premises, or remote device deployment. It also provides security capabilities to its users. Azion's Edge Application offers a built-in module, Application Acceleration, that enables developers to build edge application that runs on the Azion Edge Network and manages dynamic content requirements. Azion's Edge Orchestrator is an end-to-end encrypted orchestration solution with cloud management and zero-touch provisions, created for large-scale edge networks that manage and control edge resources in real time. Azion Edge Firewall is a security product that protects servers and applications through all layers, from the network layer to the application layer.

Platform9's Managed Kubernetes (PMK) offers a software-as-a-service (SaaS) based Kubernetes cluster management with the same ease of operation as found in native public cloud services. The company offers a complete Kubernetes cluster on any cloud, such as on-prem, with CNI, CoreDNS, Monitoring, and MetalLB. Platform9's KubeVirt is a modern self-service virtualization solution that also natively runs containers for container management and orchestration with Kubernetes. Platform9 also offers a bare metal infrastructure for cloud agility and flexibility through its cloud-based delivery model.

Scale Computing's SC//Platform empowers IT teams of organizations across various industries by providing efficient infrastructure and improved application experiences. This comprehensive platform integrates virtualization across servers, storage, and other resources using fleet management, simplifying management & orchestration for distributed edge locations. The platform is easy to use, improves business processes, offers scalability to support performance requirements & hardware specifications.

Sunlight's platform is completely made of a software-defined infrastructure using HyperConverged Edge to run applications at the edge. Edge Orchestration is a component of Sunlight's NexCenter that manages and deploys clusters at the edge. It provides a single pane of glass interface to manage and monitor resources & backups, move workloads, and deploy clusters. Sunlight's HyperConverged Edge provides a full-stack, bare-metal virtualization platform that combines computing, storage, and networking of multiple servers into a single system or cluster, thus eliminating downtime, increasing availability, and lowering costs with flexible terms.

ZEDEDA's solution seamlessly orchestrates intelligent applications at the distributed edges by leveraging critical insights, helping organizations with real-time decision-making and maximizing their operational efficiency. It empowers organizations with a vendor agnostics framework that offers a diverse mix of technology and domain expertise. A bare metal virtualization engine EVE-OS of ZEDEDA, ZEDEDA's Cloud, and its SaaS-based controller together enable deploying and updating runtimes, workloads, applications, and complex solutions across multiple nodes. ZEDEDA offers a complete edge orchestration platform for both enterprise & embedded OEMs and cloud-native services, simplifying the security and remote management of edge infrastructure and applications at scale. Nomad by HashiCorp is a flexible workload orchestrator that enables organizations to deploy and manage a wide spectrum of applications for containerized

or legacy. Nomad facilitates workflows for dockers, non-containerized microservices, and batch applications, promoting a unified approach to handling diverse workloads. Nomad streamlines the deployment of applications using a declarative infrastructure-as-code, providing an efficient solution for developers. It is compatible with macOS, Windows, and Linux, addressing the practical needs of users across various platforms.

Pratexo offers an open, flexible, scalable, and secure EMO platform. Pratexo Studios accelerates solution deployments for complex multi-tiered architectures and engineers to deploy & manage edge nodes & micro clouds in critical infrastructure environments. Pratexo Studio supports various modes of edge computing, such as standalone, distributed, and swarm, based on user requirements.

Rakuten Symphony's Symcloud™ offers a comprehensive suite with a platform, storage solutions, and orchestration solutions, all operating within a unified architecture. Its unified architecture enables the deployment of container-based cloud-native network functions (CNFs) and virtual machine-based virtual network functions (VNFs) on either the same or separate high-availability clusters, allowing resource reuse and sharing. Symcloud Orchestrator simplifies orchestration by offering a single interface for overseeing and orchestrating a wide array of elements and functions, spanning from infrastructure and network components to applications and services on a large scale.

Additionally, Symcloud's storage system can be fully automated using user-defined policies, enabling users to easily monitor all application and storage components across the solution's lifecycle, resulting in substantial time and effort savings.

Vantiq offers a comprehensive platform for the management of the entire lifecycle of agile real-time event-driven business applications. Its low-code platform enables real-time integration of data from IoT devices and various other sources on a large scale, with the flexibility to deploy within any environment. Vantiq has an event-driven architecture that offers real-time data analysis capabilities. Its platform is entirely containerized, allowing for seamless application deployment and migration across diverse edge locations. The platform facilitates straightforward management of the complete application lifecycle, encompassing design, testing, and runtime. It is deployable in a variety of settings, such as public/private cloud, on-premises, and edge locations

Aarna Networks offers Aarna Edge Services (AES), a SaaS platform that enables the designing, orchestration, monitoring, and managing of infrastructure, network services, and applications at the cloud edge and public cloud services. The SaaS version of Aarna Ne.tworks's AMCOP software, AES, also handles complex edge orchestration at both infrastructure and network levels at scale through a single interface. Nephio, Aarna Networks's Kubernetes-based cloud-native intent automation project, streamlines the deployment and management of multi-vendor cloud infrastructure and network functions across large-scale edge deployments. Nearby Computing's edge orchestration platform, NearbyOne, facilitates full lifecycle management of distributed systems, networks, and applications across all layers, from edge to the cloud, using industry standards as established by CERA (Converged Edge Reference Architecture). NearbyOne offers sophisticated orchestration functions by integrating each component's capabilities with its platform to deliver innovative services, enabling a higher degree of performance and efficiency. It enables edge deployments for infrastructure and network applications working on top function-specific components. NearbyOne can be deployed as a pure cloud-managed service, where all components sit in a public or private cloud location or self-managed services depending on the customers' requirements.

Vea's Edge Platform unifies connectivity, communication, and computation at the edge of the network. It distinguishes itself through its user-friendly installation, seamless integration, and straightforward operation. The platform streamlines operational workflows, reduces complexity, mitigates risks, and cuts costs by minimizing latency & bandwidth requirements and elevating security, privacy, scalability, and reliability. The key components of Veea's Edge Platform include vMesh, a high-performance, self-healing, and self-organizing network that automatically forms upon the deployment of VeeaHub™ devices; and vBus, a communication bus integrated within the VeeaHub Mesh Network, which further enhances communication and collaboration within the ecosystem.

Key Competitive Factors and Technology Differentiators

The following are the key competitive factors and differentiators for the evaluation of edge management and orchestration (EMO) platform vendors. While most EMO vendors may provide all the core functionalities, the breadth and depth of functionalities may differ from vendor to vendor. Driven by increasing competition, vendors are increasingly looking at improving the capabilities of their EMO platform and overall value proposition to remain competitive. Some of the key differentiators include:

Platform Architecture: The edge platform's architecture forms the foundation for edge orchestration and its ability to support containers, Kubernetes, and bare metals. The vendors distinguish their product portfolio with their ability to accommodate core capabilities and support unique vendor requirements within its architecture. The architecture should be designed to support edge hardware, edge applications, and hosting infrastructure, such as edge devices & gateways. A well-designed architecture should provide a robust foundation for managing edge resources to ensure that applications run smoothly, resources are efficiently allocated, and security measures are effectively enforced, thereby optimizing the entire edge computing environment. Thus, organizations should look for vendors whose platform architecture supports and matches their business requirements.

Hardware Support: Hardware support in an edge management and orchestration platform pertains to its ability to manage and orchestrate a diverse array of edge hardware devices. This capability encompasses the provisioning, configuration, and monitoring of various hardware components, such as servers, gateways, sensors, and specialized edge devices. Vendors should ensure that these hardware resources are effectively utilized, maintained, and optimized for specific edge computing tasks and applications. Hardware support also involves offering solutions that are compatible with the offerings of various hardware vendors and models, allowing organizations to select the most suitable hardware for their unique edge computing requirements. This capability of the vendor's offering should help organizations create a robust and flexible edge infrastructure, seamlessly integrate hardware resources into the overall edge computing ecosystem while simplifying the management, and orchestrate diverse hardware components. Organizations should monitor vendors and choose them based on the additional hardware support provided by the vendors pertaining to their requirements.

Integration and Interoperability: Integration and interoperability in an edge management and orchestration platform refer to its ability to seamlessly connect with and coordinate various devices, systems, and services, regardless of their underlying technologies or protocols. Vendors should offer this capability to ensure a smooth flow of data and commands between the edge infrastructure, cloud services, and external applications. Vendors should support industry-standard APIs, REST APIs, protocols, and data formats for enabling effortless communication and data exchange. Furthermore, they should ensure that edge components can work together cohesively, facilitating the deployment of diverse edge applications and services. Organizations should look for vendors whose integration and interoperability capabilities help them achieve a unified and efficient edge computing ecosystem, enabling them to leverage a wide range of technologies and resources while avoiding vendor lock-in and promoting flexibility in their edge deployments.

Edge Application Services: The edge application services capability within an edge management and orchestration platform delivers various essential functions that facilitate the deployment and operation of applications at the edge for governing the edge application lifecycle management. Organizations should look for vendors whose edge application service streamlines their application management, improves user experience, and fortifies the security of their edge computing infrastructure.

Artificial Intelligence, Machine Learning, and Digital Twin Support: The artificial intelligence (AI), machine learning (ML), and digital twin support capabilities of an edge management and orchestration platform enable the deployment and management of AI/ML models and digital twin applications at the edge. Vendors should offer tools and frameworks for deploying AI/ML algorithms on edge devices to enable real-time data processing and decision-making and enhance edge-based intelligence. Additionally, vendors should support the creation and management of digital twins, which are virtual replicas of physical assets or processes, allowing for simulations, monitoring, and predictive analytics. The vendor's capabilities should empower organizations across various industries, from manufacturing and healthcare to smart cities and autonomous systems, to harness advanced AI/ML capabilities at the edge, improving operational efficiency, predictive maintenance, and real-time insights. Organizations should assess vendor's capability based on the use cases and industry verticals they are catering to.

Partnership Ecosystem: The numerous vendors have developed significant partnerships with other top technology vendors to cater to multiple industries. Therefore, organizations should carefully assess each EMO vendor's partnership ecosystem and prefer vendors who leverage their partnership to offer multiple capabilities. There is a mutual relationship between the partner ecosystem and the effectiveness of a vendor solution since multiple important requirements for a vendor solution may depend on partner integrations. The vendor's partnership ecosystem should expand its platform's versatility and offer access to complementary technologies and services. It should foster interoperability and integration, allowing seamless inclusion of third-party solutions into the edge infrastructure. Organizations should choose vendors whose partnerships help them adapt to specific edge computing needs and objectives, enabling them to leverage a diverse ecosystem of tools, expertise, and resources, ultimately enhancing their ability to cater to a broad array of industry requirements and use cases.

Vendor's Domain Knowledge and Industry Experience: The vendor's domain knowledge and industry experience within an edge management and orchestration platform denotes the expertise and insights it possesses in specific domains and industries. Vendors should possess a deep understanding of verticals, such as healthcare, manufacturing, and telecommunications, and knowledge of domain-specific technologies, regulations, and best practices. Drawing from industry experience, the vendor should be able to tailor solutions, domain-specific functionalities, and compliance features to address the unique challenges and requirements of various sectors. It should empower organizations by ensuring that its platform is well-equipped to deliver domain-specific services and fostering a more efficient and compliant edge computing ecosystem that aligns with the nuances of diverse industries and their particular use cases. Organizations should evaluate the expertise and domain knowledge of EMO vendors by determining their ability to address unique and complex business challenges, use cases, and industry-specific requirements.

Ability to support use cases: The edge computing market is driven by specific industry verticals, such as telecommunications, 5G, retail, energy & utility, manufacturing, maritime, and food & beverage. Vendors should have the ability to support a wide range of industry-specific and organization-specific use cases. They should ensure that their EMO platform can adapt to diverse requirements, such as IoT deployments, real-time data analytics, and autonomous systems. This adaptability is crucial for organizations seeking to harness edge computing's

potential across different industries and applications, as it would allow them to efficiently manage and orchestrate their edge infrastructure and meet the unique demands of each use case without significant reconfiguration or customization efforts. Organizations should look for EMO vendors that provide the necessary tools and configurations to customize edge resources and facilitate computation, storage, and network-specific use cases.

Vendor's Product Strategy and Roadmap: The EMO vendors should constantly upgrade their offerings to accommodate ongoing and emerging technology disruptions and market trends. Vendors should leverage their domain expertise and partnerships to formulate strategies and roadmaps, enhance the capabilities of the EMO platform, and cater to a wide variety of industry verticals. Organizations should carefully evaluate the product strategy and roadmap of each vendor before finalizing an EMO vendor.

Pricing Model: Organizations should carefully evaluate the competitive pricing model of potential EMO platform vendors. They should prefer those EMO platform vendors who offer a flexible pricing structure and the highest value relative to the cost. Some potential vendors in the EMO platform market offer customizable pricing based on subscriptions, number of devices, or use cases.

SPARK Matrix™: Strategic Performance Assessment and Ranking

Quadrant Knowledge Solutions' SPARK Matrix provides a snapshot of the market positioning of the key market participants. SPARK Matrix provides a visual representation of market participants and provides strategic insights on how each supplier ranks related to their competitors, concerning various performance parameters based on the category of technology excellence and customer impact. Quadrant's competitive landscape analysis is a useful planning guide for strategic decision-making, such as finding M&A prospects, partnerships, geographical expansion, portfolio expansion, and similar others.

Each market participant is analyzed against several parameters of technology excellence and customer impact. In each of the parameters (see charts), an index is assigned to each supplier from 1 (lowest) to 10 (highest). These ratings are designated to each market participant based on the research findings. Based on the individual participant ratings, X and Y coordinate values are calculated. These coordinates are finally used to make the SPARK Matrix.

Technology Excellence	Weightage	Customer Impact	Weightage
Fleet Management	7%	Product Strategy & Performance	20%
Edge Application Deployment & Management	15%	Market Presence	20%
Edge Orchestration	15%	Proven Record	15%
Security and Governance	7%	Ease of Deployment	15%
Architecture	15%	Customer Service Excellence	15%
Scalability	7%	Unique Value Proposition	15%
Competitive Differentiation Strategy	7%		
Application Diversity and Use Cases	15%		
Integration & Interoperability	7%		
Vision & Roadmap	5%		

Evaluation Criteria: Technology Excellence

- **Fleet Management:** The ability to provide comprehensive functional capabilities, product features, technology innovations, product/ platform architecture, and such others.

- **Edge Application Deployment & Management:** The ability to design and deploy applications at the edge and manage the application lifecycle.

- **Edge Orchestration:** The ability to manage, automate, and coordinate the flow of resources between multiple types of devices, infrastructure, and network domains at the edge of a network.

- **Security and Governance:** The ability to provide security functionalities along with the software.

- **Architecture:** Evaluation of the vendor's products and their ability to support Kubernetes, containers, and virtual Machines(VMs.)

- **Scalability:** The ability to demonstrate that the solution supports enterprise-grade scalability along with customer case examples.

- **Differentiation Strategy:** The ability to differentiate from competitors through functional capabilities, innovations, GTM strategy, customer value proposition, and such others.

- **Application Diversity:** The ability to demonstrate product deployment for a range of industry verticals and/or multiple use cases.

- **Integration & Interoperability:** The ability to offer a product and technology platform that supports integration with multiple best-of-breed technologies to provide prebuilt out-of-the-box integrations and open API support and services.

- **Vision & Roadmap:** Evaluation of the vendor's product strategy and roadmap through the analysis of key planned enhancements to offer superior products/technology and improve the customer ownership experience.
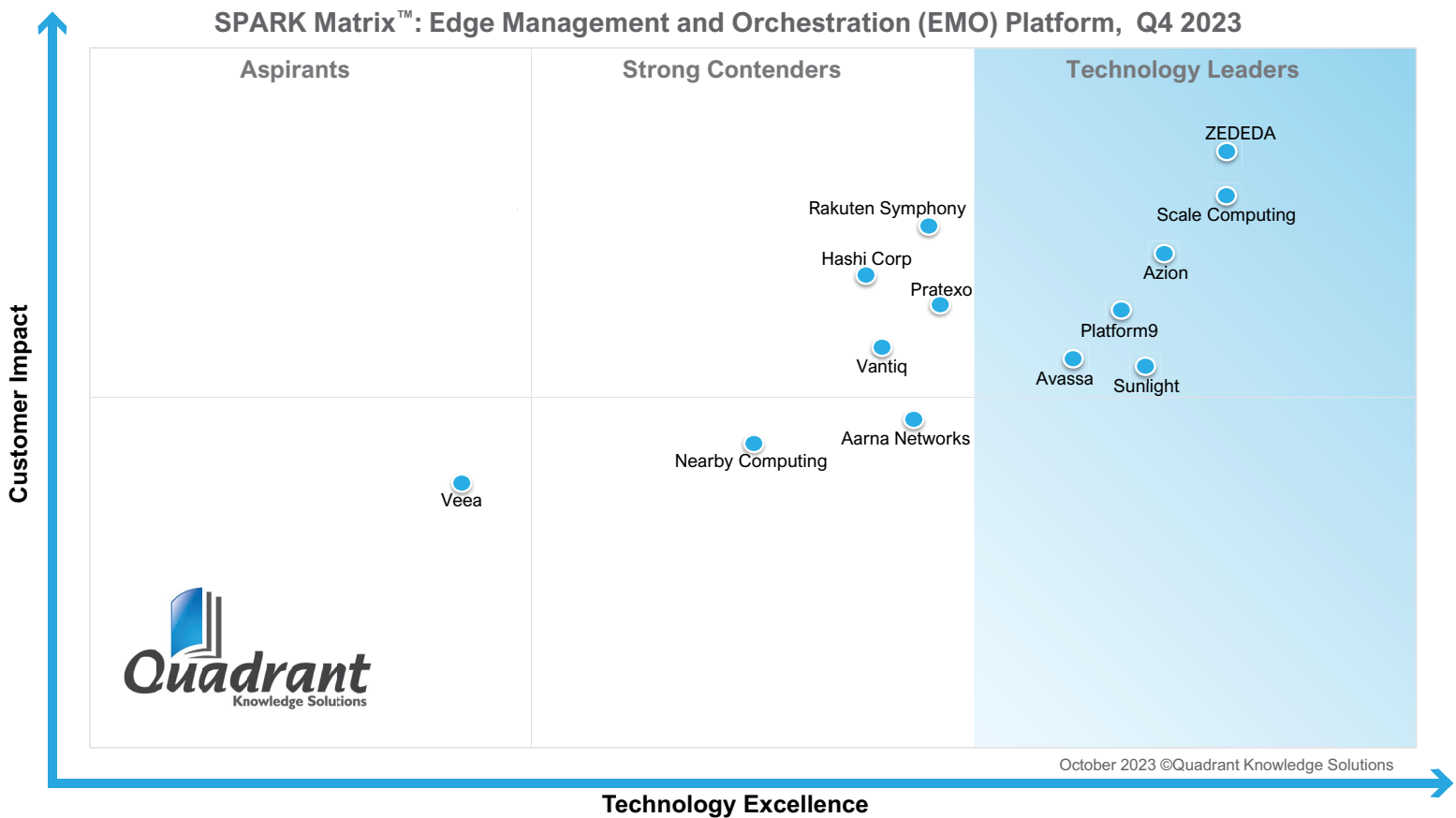
Evaluation Criteria: Customer Impact

- **Product Strategy & Performance:** Evaluation of multiple aspects of product strategy and performance in terms of product availability, price to performance ratio, excellence in GTM strategy, and other product-specific parameters.

- **Market Presence:** The ability to demonstrate revenue, client base, and market growth along with a presence in various geographical regions and industry verticals.

- **Proven Record:** Evaluation of the existing client base from SMB, mid-market and large enterprise segment, growth rate, and analysis of the customer case studies.

- **Ease of Deployment & Use:** The ability to provide superior deployment experience to clients supporting flexible deployment or demonstrate superior purchase, implementation and usage experience. Additionally, vendors' products are analyzed to offer user-friendly UI and ownership experience.

- **Customer Service Excellence:** The ability to demonstrate vendors capability to provide a range of professional services from consulting, training, and support. Additionally, the company's service partner strategy or system integration capability across geographical regions is also considered.

- **Unique Value Proposition:** The ability to demonstrate unique differentiators driven by ongoing industry trends, industry convergence, technology innovation, and such others.

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Strategic Performance Assessment and Ranking

Figure: 2023 SPARK Matrix™
Strategic Performance Assessment and Ranking)
Edge Management and Orchestration (EMO) Platform

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Aspirants | Strong Contenders | Technology Leaders

ZEDEDA
Scale Computing
Rakuten Symphony
Hashi Corp
Azion
Pratexo
Platform9
Vantiq
Avassa   Sunlight
Aarna Networks
Nearby Computing
Veea

Customer Impact

Technology Excellence

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Vendor Profiles

Following are the profiles of the leading edge management and orchestration market vendors that have a global impact. The following vendor profiles are written based on the information provided by the vendor's executives as part of the research process. Quadrant research team has also referred to the company's website, whitepapers, blogs, and other sources for writing the profile. A detailed vendor profile and analysis of all the vendors, along with various competitive scenarios, are available as a custom research deliverable to our clients. Users are advised to directly speak to respective vendors for a more comprehensive understanding of their technology capabilities. Users are advised to consult Quadrant Knowledge Solutions before making any purchase decisions, regarding edge management and orchestration vendors and vendor selection based on research findings included in this research service.

Aarna Networks

URL: http://www.aarnanetworks.com

Founded in 2018 and headquartered in San Jose, California, USA, Aarna Networks offers zero-touch edge orchestration at scale for enterprise edge and private 5G networks. Aarna Networks's software and SaaS solutions leverage open source, cloud-native, and DevOps methodologies to provide zero-touch edge and 5G service orchestration and management services.

Aarna Network's product portfolio includes Nephio Kubernetes-based support, Aarna Networks Multi Cluster Orchestration Platform (AMCOP) for SaaS-based edge and 5G services, and Aarna Edge Services (AES). AES is a zero-touch SaaS platform that provides lifecycle management, optimization of resources, and services assurance, solving edge orchestration complexity in both edge and public clouds through a single pane of glass.

Analyst Perspective

Following is the analysis of Aarna Networks's capabilities in the global edge management and orchestration market:

• Aarna Networks's AES is a SaaS platform for designing, orchestrating, monitoring, and managing infrastructure, network services, and applications at the cloud edge and public cloud. The SaaS version of Aarna Networks's AMCOP software, AES, handles complex edge orchestration at both infrastructure and network levels at scale through a single interface. Nephio, a Kubernetes-based cloud-native intent automation project, streamlines the deployment and management of multi-vendor cloud infrastructure and network functions for large-scale edge deployments.

• Some of the key capabilities of Aarna Networks's platform include its edge infrastructure orchestration, CNF orchestration and management, lifecycle management for cloud infrastructure, and APIs for integration with service orchestration layers.

- AMCOP facilitates edge infrastructure, network services, and applications management by interfacing with OSS/BSS systems. It facilitates orchestration across diverse Kubernetes (K8s) clusters and offers extensive support for 5G services, such as Core, RAN, Network Slicing, real-time analytics, CNFs, VNFs, and PNFs.

- The key differentiators of Aarna Networks's solution include the architecture of AMCOP that supports network and infrastructure orchestration, zero-touch orchestration services, multi-access edge computing, and scalability.

- AMCOP offers O-RAN SMO, a cloud-native application responsible for orchestrating and overseeing O-RAN network functions. O-RAN SMO enables network operators and vendors to effectively manage multi-vendor RAN environments and select optimal network functions for validation and interoperability testing.

- The top use cases of Aarna Networks include providing private 5G, edge multi-cloud networking, and telecommunication cloud.

- From a geographical perspective, Aarna Networks has a presence in the North American and APAC regions. From an industry vertical perspective, it caters to industries such as telecommunication and private 5G.

- Aarna Networks's primary challenge is the increasing competition from emerging vendors in the edge application orchestration field. These vendors are in a constant market expansion phase and are continuously venturing into new industry verticals.

Avassa

URL: https://avassa.io/

Founded in 2020 and headquartered in Stockholm, Sweden, Avassa is a software development company specializing in application-centric edge platform as a service (PaaS). The company provides a comprehensive purpose-built solution to manage edge application orchestration within its distributed edge clouds. Avassa's solution manages distributed applications on-premises and on the cloud. It offers application lifecycle management, monitoring, and infrastructure services for effective management of edge applications.

The two major components of Avassa's platform includes the Avassa Control Tower, which manages all the edge resources and containerized application through application programmable interfaces (APIs) deployed as a service, and the Avassa Edge Enforcer, which provides zero-touch host registration functions, local cluster management, and local container registry in all edge sites.

Analyst Perspective

Following is the analysis of Avassa's capabilities in the global edge management and orchestration market:

•   Avassa's platform is specifically designed to build, manage, monitor, deploy, and orchestrate applications at the edge. Its architecture is designed for managing distributed edge clouds. The platform is an easy-to-use, secure, and scalable solution for container-based applications in a distributed environment. The platform offers distributed security through its system-wide distributed services for managing compliance and policies. It also offers multitenancy and a high degree of autonomy through its Edge Enforcer application.

•   Some of the key capabilities of the platform include fleet monitoring, edge application, management and deployment, security and governance, and integration.

- Avassa's platform offers edge native site monitoring and observability capability that monitors the health of the deployed application and the site. Avassa also provides distributed logging at each site and real-time search into the site-local logs and metrics through its Control Tower. Its distributed approach is highly efficient and can scale thousands of sites simultaneously.

- Avassa's security and governance capability enables distributed security management, multitenancy-based deep isolation, and policy language usage for granular access control. Its integration capability provides REST APIs for application lifecycle management, monitoring & observability features, and easy integration with other vendors & cloud providers.

- The key differentiators of Avassa include its platform architecture, distributed security, deep multi-tenancy, extensive application monitoring & hosting, and extensive partnership ecosystem.

- Avassa differentiates its robust platform architecture with its Control Tower and Edge Enforcer, which provides complete application lifecycle management, monitoring, and infrastructure services for containerized applications. It offers distributed security for a system-wide security framework that manages per-cluster distribution and tenant-specific data encryptions. Avassa's platform features a distributed event logging system that provides system-level data of resource consumption across the application hosting stack on an application.

- The top use case of Avassa in edge orchestration and management is applying a hybrid approach by combining in-store and cloud software for the digital transformation of retail stores. Avassa bridges the tooling gap between previously implemented cloud tools and edge environments, allowing teams to save time for developing, deploying, and monitoring mission-critical applications instead of maintaining their orchestration tooling in two parallel environments.

- From a geographical perspective, Avassa has a strong presence in Europe and is expanding its presence into North America. From an industry vertical perspective, the company caters to retail, telecommunications, mining, manufacturing, and food & beverages segments.

- The key challenges of Avassa include market expansion and the emergence of new vendors in the marketplace. However, the company, with its strong partnership ecosystem and market presence in the European region, is well-positioned to maintain and grow its market share.

- The future roadmap of Avassa focuses on market expansion and constant updation of its platform in order to cater to new use cases from different industry verticals.

Azion

URL: https://www.azion.com

Founded in 2011 and headquartered in Palo Alto, California, USA, Azion is a technology & software development company specializing in edge computing, edge functions, web application firewalls, big data, data streaming, application acceleration, real-time analytics, and 5G. Azion's edge computing platform helps developers build edge applications at the distributed edge with the flexibility to respond to agile demands in the marketplace. Azion helps service providers virtualize their with Multi-Access Edge Computing (MEC) and allows both developers and service providers to improve performance and security with cost efficiency.

Azion's product portfolio includes an end-to-end edge computing solution that enables building edge applications, securing with edge firewall, deploying for edge orchestration, and monitoring through data streaming of real-time events. Its edge orchestration and management solution enables application development, monitoring, and deployment at the edge.

Analyst Perspective

Following is the analysis of Azion's capabilities in the global edge management and orchestration (EMO) market:

- Azion offers a full-stack edge platform that assists developers in building applications faster. It orchestrates its applications through multi-cloud, on-premises, or remote device deployment. It also provides security capabilities to its users. Azion's Edge Application consists of a built-in Application Acceleration module that allows developers to build edge application that runs on Azion Edge Network and manages dynamic content requirement. Azion's Edge Orchestrator is an end-to-end encrypted orchestration service with cloud management and zero-touch provisions, created for large-scale edge networks that manage and control edge resources in real time. Azion Edge Firewall is a security product that protects servers and applications through all layers, from the network layer to the application layer.

- Some of the key capabilities of Azion's platform in the edge management and orchestration market include application orchestration, security, edge application management & deployment, edge network, and real-time metrics.

- Azion's solution facilitates the creation of edge applications directly at the edge and allows access through a distributed edge network. The Edge Orchestrator offers features such as edge application management, updates, integration with external service providers, and comprehensive end-to-end encrypted control over remote nodes. Edge Nodes enables device creation and management and seamless integration with Azion, helping users orchestrate device settings and establish secure communication between these devices and the Azion network.

- Azion secures its products with Edge Firewall and its modules. Edge Firewall uses real-time metrics to provide statistics about the applications and products configured in the Azion platform for effective governance and operational efficiency.

- The key differentiators of Azion's platform include its edge application development, marketplace, extended services, and security.

- The Azion Marketplace serves as a digital repository that simplifies the discovery, testing, and deployment of edge-running software. It provides users with the tools to enhance, assemble, or tailor their applications as needed through a diverse array of solutions. Azion also offers services for standard integration and managed integration to address complex demands and technical & business requirements.

- The top use cases of Azion's edge computing solution include increasing operational efficiency, offering security solutions, improving response time, automating image processing tasks, and event-driven serverless applications at the Azion Edge.

- From a geographical perspective, Azion has a presence in North America, South America, Europe, the Middle East, Africa, and APAC regions. From an industry vertical perspective, it caters to the education, media, technology, retail, and finance segments.

- Azion's primary challenge is its need for market expansion and addressing a diverse range of use cases. In the rapidly evolving edge computing market, many emerging vendors prioritize market penetration. In contrast, Azion's product portfolio is oriented towards meeting the demands of customers with intricate and specialized requirements.

- The future roadmap of Azion includes continued development of its entire product portfolio and expansion of its edge network across the globe.

HashiCorp

URL: http://www.hashicorp.com

Founded in 2012 and headquartered in San Francisco, California, USA, HashiCorp is a software development company specializing in DevOps, cloud adoption, and Infrastructure as Code (IaC). HashiCorp builds workflows to solve real-world problems of IT operators working with multi-cloud environments. The company offers a wide portfolio of products, such as Terraform, Vault, Boundary, Consul, Nomad, Packer, Vagrant, and Waypoint, that are available as both paid and open-source codes.

Nomad by HashiCorp is a flexible workload orchestrator that enables organizations to deploy and manage a wide spectrum of applications for containerized or legacy. Nomad facilitates workflows for dockers, non-containerized microservices, and batch applications, promoting a unified approach to handling diverse workloads. Nomad streamlines the deployment of applications using a declarative infrastructure-as-code, providing an efficient solution for developers. It is compatible with macOS, Windows, and Linux, addressing the practical needs of users across various platforms.

Analyst Perspective

Following is the analysis of HashiCrop's Nomad capabilities in the global edge management and orchestration market:

- Nomad supports adaptable workloads, enabling organizations to use containerized, non-containerized, and batch applications, promoting a seamless transition of workloads while maintaining a unified workflow. Nomad offers native support for running legacy applications, static binaries, Java JARs, QEMU virtual machines, and basic OS commands without necessitating extensive rewriting or refactoring. It incorporates modern orchestration features such as bin packing, automation, and multi-upgrade strategies.

- The key capabilities of Nomad include container deployment, device plugins, multi-region support, scalability, and partnership ecosystem.

- Nomad's versatility as an orchestrator facilitates the simultaneous operation of containers, legacy systems, and batch applications on a single infrastructure. It functions as a self-contained, single-binary system, enabling resource management and scheduling independently without reliance on external services for storage or coordination.

- Nomad offers GPU workload support using machine learning and artificial intelligence to enable device plugins for resource detection and utilization. Native multi-region federation is a built-in feature of Nomad that enables the interconnection of multiple clusters and the deployment of jobs across various regions. Nomad's concurrent architecture enables organizations to enhance throughput and reduce latency for workloads. It facilitates scalability in real-world production environments, helping organizations accommodate clusters with thousands of nodes. Nomad seamlessly integrates with HashiCorp's products to streamline provisioning, service discovery, and secrets management.

- Nomad differentiates itself in the edge management and orchestration market with its simplicity, flexibility, scalability, and high performance. Its integration with HashiCorp's Terraform, Consul, and Vault helps organizations align well with existing workflows, expediting the implementation of essential initiatives. Nomad integrates with Vault to offer secrets management and Consul to offer service discovery & dynamic configuration.

- The top use cases of Nomad include its docker container orchestration, microservices, and service-oriented architectures (SOA) designed for services with narrow scope, tight state encapsulation, and API-driven communication to interact together and form a larger solution. Nomad is also used to handle multi-datacenter and multi-region deployments and is cloud agnostic.

- From a geographical perspective, HashiCorp has a presence in the North Americas and APAC regions. From an industry vertical perspective, it has a presence in industries such as manufacturing, healthcare, media & entertainment, retail, financial services, and telecommunication.

Nearby Computing

URL: https://www.nearbycomputing.com

Founded in 2018 and headquartered in Barcelona, Spain, Nearby Computing is a software development company specializing in 5G, Internet of Things, orchestration, software-defined infrastructures, multi-access edge computing (MEC), virtualization, and containerization.

Nearby Computing assists both telecommunication and enterprise customers in harnessing the potential of edge computing solutions by implementing orchestration and automation for MEC and 5G. Its platform, NearbyOne, serves as an orchestration solution capable of managing all network tiers, ranging from the cloud and data center to the edge, all through a unified interface. The platform offers end-to-end, cross-domain orchestration capabilities that prioritize speed, performance, and availability, making it particularly suitable for applications that require low latency, handle large volumes of data, and are mission-critical. The Nearby computing's solution encompasses all critical aspects of deployment automation, starting from edge node provisioning to application integration, lifecycle management, quality of service (QoS) assurance, and monitoring compliance with service level agreements (SLAs).

Analyst Perspective

Following is the analysis of Nearby Computing's capabilities in the global edge management and orchestration (EMO) market:

- NearbyOne, an edge orchestration platform, covers the full lifecycle management of distributed systems, networks, and applications across all layers, from edge to the cloud, based on industry standards as established by CERA (Converged Edge Reference Architecture). NearbyOne performs sophisticated orchestration functions, enabling a higher degree of performance and efficiency. It integrates each component's capabilities to deliver innovative services. It also facilitates edge deployments for infrastructure, networks, and applications, working on top function-specific components. NearbyOne can be deployed as a pure cloud-managed service, where all components sit in a public or private cloud location or self-managed services depending on the customers' requirements.

- Some of the key capabilities of NearbyOne include micro and macro-orchestration, infrastructure management, workload management, connectivity management, and multitenant orchestration.

- NearbyOne's micro and macro-orchestration enables organizations to allocate resources as per requirement and offer high-level visibility and management to all points of presence (POP) in the field for macro-orchestration. Its Nearby SDK facilitates the seamless integration of edge services for lifecycle management, KPI monitoring, and automation functions. Its MEC stack enables communication service providers to deliver better services by leveraging new capabilities at the network edge.

- The full multi-tenancy feature of NearbyOne enables organizations to optimize their investments by offering them differentiated access to monitor, manage, deploy, and orchestrate the entire ecosystem. NearbyOne offers a modular and multitenant platform that facilitates near zero-touch provisioning (nZTP) infrastructure from the data center to the far edge, VNFs, and edge applications using a unified dashboard. The dashboard manages everything from network to infrastructure to applications for control through a single pane of glass.

- The key differentiators of Nearby Computing include its platform architecture, partnership ecosystem, scalability, integration, and flexibility to adopt wide use cases.

- The top use cases of Nearby Computing include the management of drones, unmanned vehicles, & robots for warehouse fulfillment, remote monitoring of people & assets, management of smart grids and smart city nodes & sensors, condition-based monitoring, predictive maintenance, precision monitoring & control, patient monitoring, cloud gaming, and content delivery.

- From a geographical perspective, Nearby Computing has a presence in North America, Europe, and the APAC region. From an industry vertical perspective, it caters to industries such as telecommunication, oil & gas, energy & utilities, transportation, and gaming.

- The key challenge of Nearby Computing is the increasing competition from emerging vendors in this marketplace, as edge computing is a niche market and is still in the emerging phase. However, Nearby Computing, with its structured portfolio, vendor agnostics in the market, and robust partnerships, stands out in the edge orchestration field.

Platform9

URL: https://platform9.com

Founded in 2013 and headquartered in Mountain View, California, USA, Platform9 is a software development company specializing in cloud computing, infrastructure automation, private cloud, KVM management software, docker & container orchestration, Kubernetes, hybrid cloud, DevOps, cloud orchestration, and distributed clouds. Platform9 offers faster and more effective cloud-native, fully automated container management and orchestration solutions. It also manages virtual machines & Kubernetes that manage self-contained workloads at the edge and on-premise.

Platform9's managed Kubernetes service's distributed architecture facilitates telecommunication companies, retailers, manufacturers, enterprises, independent software vendors (ISVs), and SaaS vendors with applications across edge computing use cases. Platform9's unified management platform offers components such as management services, infrastructure services, virtualization & container as a service, bare metal as a service, and infrastructure for a complete service level agreement (SLA).

Analyst Perspective

Following is the analysis of Platform9's capabilities in the global edge management and orchestration market:

- Platform9's Managed Kubernetes (PMK) offers software-as-a-service (SaaS) based Kubernetes cluster management with the same ease of operation found in native public cloud services. The company offers a complete Kubernetes cluster on any cloud, such as on-prem, with CNI, CoreDNS, Monitoring, and MetalLB. Platform9's KubeVirt is a modern self-service virtualization solution that offers container management and orchestration with Kubernetes. Platform9 also offers a bare metal infrastructure with cloud agility & flexibility using its cloud-based delivery model.

- Some of the key capabilities of the Platform9 solution include its Kubernetes platform with CNCF certification, catapult remote monitoring, single pane

management, and security management across bare metals, VMs, and containers.

- Platform9 offers a fully managed Kubernetes platform certified by the cloud native computing foundation (CNCF). It facilitates remote installation, operation, and upkeep of customer clusters through a dedicated SaaS management system. The platform provides various features, such as catapult remote monitoring, autonomous cluster recovery, automated security patching for CVEs, multi-version support, and on-demand upgrade. Platform9 also offers add-ons for Kubernetes applications, such as core DNS, MetalLB, cluster Auotscaler, and Calico CNI, which are configured and managed by Platform9.

- The key differentiators of Platform9 include its zero-touch operation, unified infrastructure management, high availability & SLA, distributed architecture of managed Kubernetes, scalability, and lower cost.

- Platform9 manages thousands of remote sites to accelerate edge application delivery with zero-touch operation and ensure application deployments across locations. The company provides developers with self-service capabilities that automate application deployment using API-driven continuous integration and continuous deployment (CI/CD).

- The top use cases of Platform9 include providing flexible, scalable, on-demand cloud-native management for DevOps and CI/CD pipelines while helping developers speed the application's time-to-market. Its SaaS management model automates the entire lifecycle of Kubernetes deployment management for all the operational complexity.

- From a geographical perspective, Platform9 has a strong presence in North America, Europe, and the APAC regions. From an industry vertical perspective, it caters to the retail, telecommunication, and real estate segments.

- Some of the key challenges of Platform9 include the increasing competition from emerging vendors in this edge computing market space and catering to more industry verticals. However, Platform9, with its strong managed Kubernetes platform, zero-touch operation, and ability to address complex use cases in the market, is well-positioned to maintain and grow its market share.

Pratexo

URL: https://pratexo.com/

Founded in 2019 and headquartered in Austin, Texas, USA, Pratexo is a software development company specializing in edge computing, distributed cloud, micro cloud, machine learning, Internet of Things (IoT), and application orchestration.

Pratexo offers an edge-to-cloud solution through its acceleration platform that combines hybrid and distributed cloud computing on the edge and accelerates the organization's ability to deploy & manage solutions for complex operations.

Pratexo's product lineup includes Pratexo Studio, AI at the edge, edge appliances, and Flex Solutions™. Pratexo Studio is a no-code platform that significantly enhances the capabilities of engineers in designing, testing, deploying, and managing intricate, decentralized software architectures spanning from edge devices to central cloud environments.

Analyst Perspective

Following is the analysis of Pratexo's capabilities in the global Edge Management and Orchestration market:

*   Pratexo's Pratexo Studios is an open, flexible, scalable, and secure platform. The platform accelerates solution deployments for complex multi-tiered architecture and for engineers to deploy & manage edge nodes & micro clouds in critical infrastructure environments. Pratexo Studio supports multiple modes of edge computing, such as standalone, distributed, and swarm, that are used based on the requirement.

*   Some of the key capabilities of the platform include design, simulation, deploying, managing, monitoring, and evolving. The extended capabilities of the platform include its scalability, streamlined & remote management, data security, and reduced operation cost.

*   Pratexo Studio, with its intuitive interface, enables organizations to deploy and manage edge nodes & micro clouds for complex operations. The platform

builds, deploys, and configures complex multi-tiered architectures using drag-and-drop functionality to enable data collection and advanced analytical processing for more connected edge infrastructure at scale. Consequently, it offers shorter deployment times, sustained operational functionality even during server disconnections, and an enhanced, secure, and dependable approach for utility grid monitoring and management.

• The key differentiators of Pratexo include its Flex Solutions™, edge hardware, integrated digital twin, partnership ecosystem, and agility & innovation.

• Pratexo Studio has a templated architecture to provide flexibility for creating and deploying custom features quickly. Its drag-and-drop capabilities enable developers to seamlessly choose and allocate features based on requirements. Pratexo Studio enables the deployment of resources in the real world or through stimulation using its digital twins. The simulation allows end-to-end IoT device or edge hardware testing without using any real-world resources.

• Pratexo's strategic partnership ecosystem with technology players in the marketplace helps it offer improved hardware support and develop its Flex Solutions™.

• The top use cases of Pratexo in the electrification business include deploying on the edge nodes to run at each substation, grouping them into regional micro clouds that share and compute resources, processing data locally, and helping organizations improve security and reduce the risk of a data breach. Pratexo is also used to develop edge computing infrastructures in which applications can be hosted for analyzing data streams and training future machine learning models.

• From a geographical perspective, Pratexo has a strong presence in North America, Europe, and the APAC region. From an industry vertical perspective, it caters to industries such as maritime, manufacturing, defense, smart building, and energy & utility.

Rakuten Symphony

URL: https://symphony.rakuten.com/

Founded in 1997 and headquartered in Tokoyo, Japan, Rakuten Symphony is a part of Rakuten Group, Inc., which specializes in telecommunication, virtualization, and telecommunications. Symcloud™ platform by Rakuten Symphony is a Kubernetes-based cloud platform that supports both containers and virtual machines (VMs), offering flexibility and automation for complex applications. The platform combines the agility of cloud-native solutions with scalability, making it suitable for data-centric applications. Rakuten Symphony's Symcloud™ is a cloud-native Kubernetes-powered platform that supports network service delivery, improves the efficiency & scalability, and lowers the cost of cloud-native network solutions, such as open radio access networks (Open RAN), 5G core, private 5G, multi-access edge compute (MEC), and enterprise applications. It uses a software-as-a-service model within a secure, multitenant, and role-based environment.

Symcloud Orchestrator is a hyper-automation orchestrator that features capabilities to orchestrate and manage the lifecycles of various components, such as bare-metal infrastructure, third-party appliances, virtual network functions (VNFs), cloud-native network functions (CNFs), and service chains. It offers built-in logging, monitoring, and a policy engine for closed-loop automation managed through a unified interface.

Symcloud Storage enhances storage and data management capabilities for Kubernetes deployments, both on-premises and in various cloud environments. It seamlessly integrates with Kubernetes-native administrative tools, such as Kubectl, Helm Charts, and Operators, using a standard application programmable interface (APIs), a command-line interface (CLI), and a user-friendly graphical user interface (GUI).

Analyst Perspective

Following is the analysis of Rakuten Symphony's capabilities in the global edge management and orchestration (EMO) market:

- Rakuten Symphony's Symcloud™ encompasses a comprehensive suite with a platform, storage solutions, and orchestration solutions, all operating

within a unified architecture. This architecture facilitates the deployment of container-based cloud-native network functions (CNFs) and virtual machine-based virtual network functions (VNFs) on either the same or separate high-availability clusters, allowing resource reuse and sharing.

- Symcloud Orchestrator simplifies orchestration by offering a single interface for overseeing and orchestrating a wide array of elements and functions, spanning from infrastructure and network components to applications and services on a large scale. Additionally, Symcloud's storage system can be fully automated using user-defined policies, enabling users to automatically monitor all application and storage components across the solution's lifecycle, resulting in substantial time and effort savings.

- Some of the key capabilities of the Symcloud platform include its full-stack orchestration & lifecycle management, container and virtual machine (VM) support, cloud platform/Kubernetes cluster lifecycle management, bare-metal lifecycle management, network function (NF) lifecycle management, and network service (NS) lifecycle management.

- Automating Kubernetes cluster deployments at numerous edge locations without manual intervention is achieved seamlessly through the combination of Symcloud Orchestrator and Symcloud Platform, ensuring efficient application operation. The Symcloud Platform, using open-source Kubernetes, offers additional features such as resource modeling, advanced placement algorithms, NUMA-awareness, CPU Pinning, HugePages support, affinity/anti-affinity rules, and multi-CRIs (Containers, VMs).

- The Symcloud Platform incorporates built-in enterprise-grade storage with application awareness to provide a variety of carrier-grade virtual networking options.

- The key differentiators of Rakuten Symphony include its Symcloud storage, platform architecture, partnership ecosystem, full-stack orchestration, and application lifecycle management.

- Symcloud Storage is easy to use and offers unprecedented automation while delivering bare-metal performance at scale for stateful, cloud-native applications (data + metadata + Kubernetes configuration). Symcloud Storage is built from the ground up using cloud-native constructs that are designed to provide a unique, automated cloud-native experience.

- The top use cases of Rakuten Symphony include the delivery of edge applications using an App-Store-like experience consistently across all edge sites and managing, deploying, & orchestrating network and edge applications.

- From a geographical perspective, Rakuten Symphony has a strong presence in North America, Europe, and the JAPAC region. From an industry vertical perspective, the company caters to industries such as telecommunication and private 5G.

Scale Computing

URL: http://www.scalecomputing.com

Founded in 2007 and headquartered in Indianapolis, Indiana, USA, Scale Computing is a software development company specializing in storage, virtualization, hyperconverged architecture, edge computing, Containers, and Kubernetes. Scale Computing offers an IT infrastructure solution with its Scale Computing HyperCore software. It also offers a fully integrated platform, Scale Computing Platform, for running applications at scale and enabling applications to process data outside centralized data centers or at distributed edges.

Scale Computing Platform, with its simplified design, robust automation, and streamlined management, helps businesses, such as small businesses, edge computing sites, midmarket organizations, and enterprise data centers, to improve operational efficiency. The product portfolio of Scale Computing (SC) includes SC//Platform, a fully integrated IT Infrastructure platform for running virtual machines; SC//Fleet Manager, a cloud-hosted monitoring and management tool; SC//HyperCore, an application ensuring uptime that identifies, reduces, and corrects problems in real-time; and SC//Hardware that improves virtualization infrastructure.

Analyst Perspective

Following is the analysis of Scale Computing's capabilities in the global edge management and orchestration market:

- Scale Computing's SC//Platform empowers IT teams to provide efficient infrastructure and improved application experiences across various industries. This comprehensive platform integrates virtualization across servers, storage, and other resources with fleet management, simplifying management & orchestration for distributed edge locations. The platform is easy to use, improves business processes, offers scalability to support performance requirements & hardware specifications, and has a high availability with intelligent automation.

- Some of the key capabilities of the SC platform include fleet monitoring, managing & monitoring applications at edge, remote access, scalability, and security & data privacy.

- SC//Fleet Manager securely monitors and manages entire fleets of clusters in real time. It is built for creating hyperconverged edge computing infrastructures that run on SC//HyperCore. The fleet manager manages thousands of clusters through a comprehensive tool, making it scalable and simple to configure & monitor from a single cloud-hosted application. The fleet manager offers real-time monitoring of resources, role-based access control, and secure firmware upgrades. It uses secure links for simplicity of administration and to securely access the HyperCore UI from any SC//HyperCore cluster in its global fleet. Its Zero-Touch Provisioning (ZTP) feature assists users in managing and prioritizing nodes & clusters, thereby decreasing the installation time & cost.

- The SC//HyperCore software layer serves as a minimalistic type 1 (bare metal) hypervisor that seamlessly integrates with the operating system kernel. It harnesses the virtualization offload features inherent in modern CPU designs. Additionally, it directly incorporates Scale Computing's Reliable Independent Block Engine (SCRIBE) storage architecture into the kernel-based virtual machines (KVM) hypervisor. To use SC//HyperCore, users can deploy a container-optimized operating system based on their preferred container runtime, such as Docker, especially in Kubernetes environments or container-based setups.

- The key differentiators of Scale Computing include its hardware support, flexibility, partnership ecosystem, integration support, and cost efficiency.

- Scale computing eliminates the need for third-party components or licensing by providing its own hardware components. Hardware appliances of different sizes can be added to the same cluster storage pool. The SC//HyperCore also offers software-defined storage and software-managed computing along with REST API support for cloud integration.

- Inside the SC//HyperCore, the Autonomous Infrastructure Management Engine (AIME) is used as an orchestration and management engine. AIME drastically reduces the amount of effort required to deploy, secure, manage, and maintain on-premises infrastructure. Scale Computing offers distinguished partners for technology providers, OEMs, resellers, and manager service providers.

- The top use cases of Scale Computing include fleet monitoring & management with reduced downtime, simplified IT infrastructure for edge computing strategy with easy remote management, connectivity, & reliability, and disaster recovery with effective cost management.

- From a geographical perspective, Scale Computing has a strong presence in North America, Europe, the Middle East, Africa, Latin America, and the APAC regions. From an industry vertical perspective, it caters to industries such as IT service, education, manufacturing, maritime, retail, transportation, healthcare, and financial services.

- The key challenge for Scale Computing includes focused market expansions and increasing competition from emerging vendors in this market. The rapidly evolving technology landscape is also a constant challenge that necessitates continuous innovation, the ability to anticipate emerging trends, and competitiveness.

Sunlight

URL: https://sunlight.io/

Founded in 2018 and headquartered in Cambridge, England, Sunlight is a software development company specializing in hyperconverged infrastructure (HCI), big data, private cloud, storage, networking, security, cloud, and high-performance computing. Sunlight is a provider of a complete HCI stack that can be deployed on-premises on standard data center hardware and resource-constrained far-edge devices.

Sunlight's product portfolio includes Sunlight NexCenter, which enables users to deploy, manage, and monitor edge applications and to support infrastructure at scale; HyperConverged Edge, which runs virtual and containerized applications on highly available, purpose-built edge server infrastructure; and NexVisor Hypervisor, which offers software-defining storage, software-defined networking, and an edge stack console.

Analyst Perspective

Following is the analysis of Sunlight's capabilities in the global edge management and orchestration market:

- Sunlight's platform is made of a complete software-defined infrastructure using HyperConverged Edge and is built to run applications at the edge. Edge Orchestration is a component of Sunlight NexCenter that manages and deploys clusters at the edge. It provides a single pane of glass interface to manage and monitor resources & backups, move workloads, and deploy clusters. Sunlight's HyperConverged Edge provides a full-stack, bare-metal virtualization platform combining the computing, storage, and networking of one to multiple servers into a single system or cluster, thus eliminating downtime, increasing availability, and lowering the cost with flexible terms.

- Some of the key capabilities of the platform include fleet management, edge orchestration, application deployment, and scalability.

- The Edge Orchestration component of Sunlight NexCenter offers a centralized console to manage & deploy remote clusters through API and manage workloads & applications through a single pane of glass interface. It also efficiently manages thousands of remote clusters using its supporting infrastructure. Sunlight provides security at its core and protects against memory exploits. It controls the IO interface to enable the separation of content and network traffic, ensuring the non-sharing of physical drives or networks.

- Sunlight's platform offers zero-touch edge computing solutions to configure and compute infrastructure across highly distributed locations, eliminating the need for technical expertise.

- The key differentiators of Sunlight include its HyperConverged Edge application, partnership ecosystem, low-cost model, and the AppLibrary of NexCenter.

- The Sunlight HyperConverged Edge is a full-stack, bare-metal virtualization platform that can consolidate multiple instances of Windows, Linux, and containers of x86, AMD, ARM, and Nvidia Jetson.

- The Sunlight AppLibrary is a part of Sunlight NexCenter that allows Sunlight users to fully automate the end-to-end deployment of applications. The Sunlight AppLibrary uses the capabilities of the Ansible framework to control the deployment of applications.

- Lenovo is a strategic partner of Sunlight, and the Sunlight HyperConverged Edge is optimized to run on Lenovo's ThinkEdge hardware line.

- The top use cases of Sunlight's edge-as-a-service model include increasing the ease of consolidating, deploying, & managing distributed infrastructure and data-intensive applications in remote or centralized locations and reducing the cost of infrastructure. It also enables centralized management of data using its autonomous operations capability for non-stop business continuity.

- From a geographical perspective, Sunlight has a presence in North America, Europe, the Middle East, Africa, and the APAC region. From an industry vertical perspective, it caters to the food & beverage, oil & gas, manufacturing, education, and entertainment segments.

- Some of the key challenges of Sunlight include venturing into other industry verticals and market expansion due to competition from other vendors in the marketplace. However, with its HCI stack and strong technology partnership ecosystem, Sunlight has gained a favorable position in the market.

- The future roadmap of Sunlight includes constant updation of its product portfolio in terms of HCI and AppLibrary, incorporating new technologies, and building partnerships to expand its market presence.

Vantiq

URL: http://www.vantiq.com

Founded in 2015 and headquartered in Walnut Creek, California, USA, Vantiq is a software development company that specializes in edge devices, the Internet of Things (IoT), streaming analytics, smart systems, machine learning, predictive analytics, and microservices.

Vantiq's platform enables organizations to rapidly build real-time event-driven applications that convert raw streaming data into situational awareness and orchestrated intelligence. Vantiq also enables real-time distribution of complex solutions by providing highly agile tools and abstractions that cover the complete application development lifecycle from ideation to runtime management.

Analyst Perspective

Following is the analysis of Vantiq's capabilities in the global edge management and orchestration (EMO) market:

- Vantiq offers a comprehensive platform for the management of the entire lifecycle of agile real-time event-driven business applications. Its low-code platform enables real-time integration of data from IoT devices and various other sources on a large scale, with the flexibility to deploy within any environment. Vantiq has an event-driven architecture that offers real-time data analysis capabilities. Its platform is entirely containerized, allowing for seamless application deployment and migration across diverse edge locations. The platform facilitates straightforward management of the complete application lifecycle, encompassing design, testing, and runtime. It is deployable in a variety of settings, such as public/private cloud, on-premises, and edge locations.

- Some of the key capabilities of Vantiq's platform include low-code deployment, flexible integration, distributed multi-cloud & multi-edge deployments, scalability, and security.

- Vantiq's low-code platform empowers users to create services that can operate within various distributed infrastructures, such as the cloud and the edge, facilitating the deployment of applications capable of real-time processing. Vantiq also offers functionalities that enable technicians to effortlessly update the application's status using a mobile interface. The Vantiq platform facilitates seamless integration with a wide array of devices and enterprise systems and protocols, such as IoT devices, enterprise resource planning (ERP) systems, supervisory control and data acquisition (SCADA) systems, message queuing telemetry transport (MQTT) systems, advanced message queuing protocol (AMQP), Kafka, and REST APIs.

- The key differentiators of Vantiq include its platform architecture, multi-access edge computing, partnership ecosystem for 5G support, and ability to support & integrate with digital twins.

- The top use cases of Vantiq include asset management tracking, environmental monitoring, building and deploying applications for smart cities, IoT device data management, and analysis for retail stores. Its real-time, event-driven application development platform also enables real-time product interaction, edge-native architecture, and scalable data management.

- From a geographical perspective, Vantiq has a strong presence in North America, the Middle East, and Japan regions. From an industry vertical perspective, it caters to industries such as telecommunication, healthcare, energy & utilities, retail, military & defense, and smart building.

- The key challenge for Vantiq is the increasing competition from emerging vendors in the edge computing market with strong core capabilities in edge management and orchestration. These vendors cater to a wide variety of use cases in various industry verticals. However, Vantiq, with its comprehensive platform & low code capabilities, enables easy application deployment using real-time analysis at the edge.

Veea

URL: http://www.veea.com

Founded in 2014 and headquartered in New York, New York, USA, Veea is a provider of computer networking products. Its areas of expertise encompass edge computing, wireless communications, the Internet of Things, SD-WAN, security applications, machine learning, artificial intelligence, and omnichannel operations. Veea's flagship offering, Edge Platform, enables the development and deployment of Industry 4.0 applications. This comprehensive platform offers a wide array of features and capabilities, making it an ideal choice for businesses seeking to embrace the future of technology.

Veea's Edge Platform unifies connectivity, communication, and computation at the edge of the network. It distinguishes itself through its user-friendly installation, seamless integration, and straightforward operation. The platform streamlines operational workflows, reduces complexity, mitigates risks, and cuts costs by minimizing latency & bandwidth requirements and elevating security, privacy, scalability, and reliability. The key components of Veea's Edge Platform include vMesh, a high-performance, self-healing, and self-organizing network that automatically forms upon the deployment of VeeaHub™ devices; and vBus, a communication bus integrated within the VeeaHub Mesh Network, which further enhances communication and collaboration within the ecosystem

Analyst Perspective

Following is the analysis of Veea's capabilities in the global edge management and orchestration market:

- Veea offers a comprehensive edge platform that delivers edge connectivity based on the secure access service edge (SASE) principles. It combines server-grade edge processing using streamlined edge applications and service management across a scalable mesh network of VeeaHubs. It is accessible by both IT teams and store managers. It simplifies network installation, maintenance, connectivity expansion, and application deployment.

- VeeaCloud facilitates Veea Edge Platform deployment by providing essential installation, configuration, and management services. VeeaCloudklso offers application insights and performance monitoring for the vMesh network. It combines central and local orchestration to ensure uninterrupted application functionality, even in cases of unreliable or disrupted public network connections. VeeaCloud hosts back-end services for base software installation on each VeeaHub following the initial authentication handshake through the VeeaHub Manager on a mobile device.

- Key capabilities of Veea's platform encompass network orchestration, device management, application management, and edge services.

- The computing capabilities of the Veea Edge Platform facilitate the migration of applications from diverse hardware vendors to a simplified download process on a unified hardware platform. VeeaHub features industry-standard hardware and software chain-of-trust alongside containerized applications for robust application and data security. The platform enables local data collection and processing closer to data sources, enhancing the speed and effectiveness of decision-making and actions.

- The differentiators of Veea's platform include its hardware support, extended services, control center for device management, and the Veea Hub for mobile applications.

- The top use cases of Veea include smart building, data collection, and monitoring. Veea's solution drastically increases flexibility for operators to deliver core network-managed Wi-Fi and cellular-like capabilities directly to devices for homes and businesses.

- From a geographical perspective, Veea has a strong presence in North America and Europe. From an industry vertical perspective, it caters to the commercial real estate, retail, telecommunication, energy & utility, and transportation segments.

ZEDEDA

URL: http://www.zededa.com

Founded in 2016 and headquartered in San Jose, California, USA, ZEDEDA is a software development company specializing in edge computing, edge orchestration, edge virtualization, Kubernetes, enterprise infrastructure, distributed edge, and 5G at the edge.

ZEDEDA is a cloud-native SaaS solution that extends cloud capabilities to the edge. It enhances edge agility and provides improved visibility, security, and control by effectively managing and orchestrating distributed edge infrastructure and applications. It offers a robust product portfolio and comprehensive remote management & observability features for various distributed edge computing components, such as hardware and applications in both on-premises and cloud environments.

ZEDEDA's solution is built using zero limits, zero-touch, and zero trust models, enabling it to support the orchestration of edge hardware and application, simplify field deployments of edge nodes, and offer robust physical security and cybersecurity. ZEDEDA's solution is composed of two key components, namely ZEDEDA Cloud for orchestration and the open-source EVE-OS. These components are optimized based on the unique requirements of distributed edges, enabling users to leverage existing infrastructure.

Analyst Perspective

Following is the analysis of ZEDEDA's capabilities in the global edge management and orchestration market:

- ZEDEDA's solution can seamlessly orchestrate intelligent applications at the distributed edges, helping in real-time decision-making by leveraging critical insights and maximizing operational efficiency. It provides customers with a vendor agnostics framework that offers a diverse mix of technology and domain expertise. ZEDEDA's EVE-OS, a bare metal virtualization engine; ZEDEDA's

cloud, ZEDCloud; and a SaaS-based controller together enable deploying and updating runtimes, workloads, applications, and complex solutions across multiple nodes. ZEDEDA offers a complete edge orchestration platform for both enterprises & embedded OEMs and cloud-native services, simplifying the security and remote management of edge infrastructure and applications at scale.

• Some of the key capabilities of the platform include application orchestration, manageability and visibility, edge networking, edge security, and remote management.

• The EVE-OS supports various distributed edge computer hardware, legacy applications, and embedded hypervisor. It is flexible and modular for supporting immediate-scale deployments. ZEDEDA Cloud, along with virtual machines (VMs), Docker containers, and Kubernetes clusters, enables bulk orchestration and full lifecycle management so developers can easily integrate the ZEDEDA solution with their existing continuous integration and continuous deployment(CI/CD) pipeline and perform user-specific tasks.

• ZEDEDA enables deployment at the edge using the virtual private cloud (VPC) for ease and security. It can function without requiring deep networking expertise, and it offers connectivity to all operation technology (OT) assets, ensuring robust edge networking. Zededa's solution also offers security capabilities through built-in frameworks such as trusted platform modules (TPM), standard encryption on networks that offer data encryption, role-based access control, and distributed firewalls to ensure security at the hardware, firmware, and application level.

• The key differentiators of ZEDEDA's solution include its full-stack remote orchestration, open ecosystem & marketplace, partnership ecosystem, zero trust security model, and edge application services.

• ZEDEDA offers full-stack remote orchestration and observability for edge hardware and software using APIs that are supported by virtual machines (VMs), containers, and clusters for workload consolidation and future-proofing edge deployments. ZEDEDA has developed a strong partnership ecosystem with technology vendors, software integrators, and OEMs for improved integrations and implementations, ensuring a variety of use cases across industry verticals.

- ZEDEDA offers an open-edge ecosystem for customers to build their applications with the option of curating private stores. It also offers an open foundation, eliminates lock-in, and facilitates hardware, application, & cloud interoperability. ZEDEDA Edge Application Services are distributed, cloud-native services simplifying the security and remote management of edge infrastructure and applications at scale.

- The top use cases of ZEDEDA include workload consolidation that enables legacy applications to run within VMs on modern hardware with improved security and performance capabilities with containerized applications, remote application management, edge orchestration, and predictive maintenance.

- From a geographical perspective, ZEDEDA has a presence in North America, Europe, and the APAC region. From an industry vertical perspective, it caters to the retail, oil & gas, manufacturing, renewable energy, and automotive segments.

- The key challenge for ZEDEDA is the increasing competition from emerging vendors in this marketplace, as edge computing is a niche market and is still in the emerging phase. However, ZEDEDA, with its structured portfolio, vendor agnostics in the market, and robust partnerships, stands out in the edge orchestration field.

Research Methodologies

Quadrant Knowledge Solutions uses a comprehensive approach to conduct global market outlook research for various technologies. Quadrant's research approach provides our analysts with the most effective framework to identify market and technology trends and helps in formulating meaningful growth strategies for our clients. All the sections of our research report are prepared with a considerable amount of time and thought process before moving on to the next step. Following is the brief description of the major sections of our research methodologies.
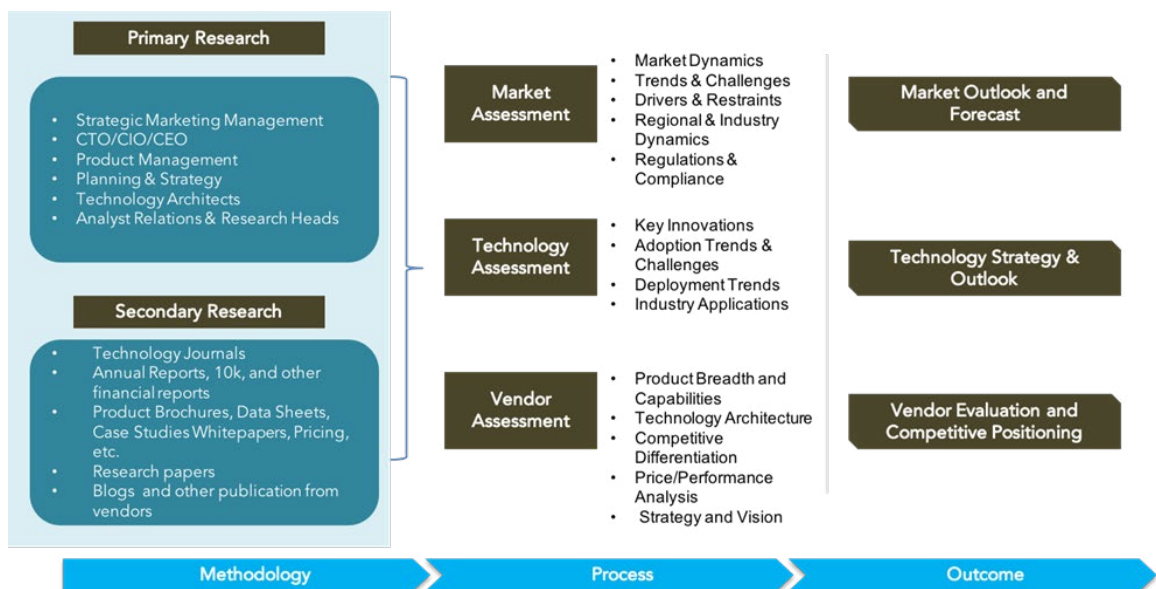
Secondary Research

Following are the major sources of information for conducting secondary research:

Quadrant's Internal Database

Quadrant Knowledge Solutions maintains a proprietary database in several technology marketplaces. This database provides our analyst with an adequate foundation to kick-start the research project. This database includes information from the following sources:

- Annual reports and other financial reports
- Industry participant lists
- Published secondary data on companies and their products
- Major market and technology trends

Literature Research

Quadrant Knowledge Solutions leverages on several magazine subscriptions and other publications that cover a wide range of subjects related to technology research. We also use the extensive library of directories and Journals on various technology domains. Our analysts use blog posts, whitepapers, case studies, and other literature published by major technology vendors, online experts, and industry news publications.

Inputs from Industry Participants

Quadrant analysts collect relevant documents such as whitepaper, brochures, case studies, price lists, datasheet, and other reports from all major industry participants.

Primary Research

Quadrant analysts use a two-step process for conducting primary research that helps us in capturing meaningful and most accurate market information. Below is the two-step process of our primary research:

Market Estimation: Based on the top-down and bottom-up approach, our analyst analyses all industry participants to estimate their business in the technology market for various market segments. We also seek information and verification of client business performance as part of our primary research interviews or through a detailed market questionnaire. The Quadrant research team conducts a detailed analysis of the comments and inputs provided by the industry participants.

Client Interview: Quadrant analyst team conducts a detailed telephonic interview of all major industry participants to get their perspectives of the current and future market dynamics. Our analyst also gets their first-hand experience with the vendor's product demo to understand their technology capabilities, user experience, product features, and other aspects. Based on the requirements, Quadrant analysts interview with more than one person from each of the market participants to verify the accuracy of the information provided. We typically engage with client personnel in one of the following functions:
- Strategic Marketing Management
- Product Management
- Product Planning
- Planning & Strategy

Feedback from Channel Partners and End Users

Quadrant research team researches with various sales channel partners, including distributors, system integrators, and consultants to understand the detailed perspective of the market. Our analysts also get feedback from end-users from multiple industries and geographical regions to understand key issues, technology trends, and supplier capabilities in the technology market.

Data Analysis: Market Forecast & Competition Analysis

Quadrant's analysts' team gathers all the necessary information from secondary research and primary research to a computer database. These databases are then analyzed, verified, and cross-tabulated in numerous ways to get the right picture of the overall market and its segments. After analyzing all the market data, industry trends, market trends, technology trends, and key issues, we have prepared preliminary market forecasts. This preliminary market forecast is tested against several market scenarios, economic most accurate forecast scenario for the overall market and its segments.

In addition to market forecasts, our team conducts a detailed review of industry participants to prepare a competitive landscape and market positioning analysis for the overall market as well as for various market segments.

SPARK Matrix:
Strategic Performance Assessment and Ranking

Quadrant Knowledge Solutions' SPARK Matrix provides a snapshot of the market positioning of the key market participants. SPARK Matrix representation provides a visual representation of market participants and provides strategic insights on how each supplier ranks in comparison to their competitors, concerning various performance parameters based on the category of technology excellence and customer impact.

Final Report Preparation

After finalization of market analysis, our analyst prepares necessary graphs, charts, and table to get further insights and preparation of the final research report. Our final research report includes information including competitive analysis; major market & technology trends; market drivers; vendor profiles, and such others.

Client Support

For information on hard-copy or electronic reprints, please contact Client Support at
ajinkya@quadrant-solutions.com | www.quadrant-solutions.com