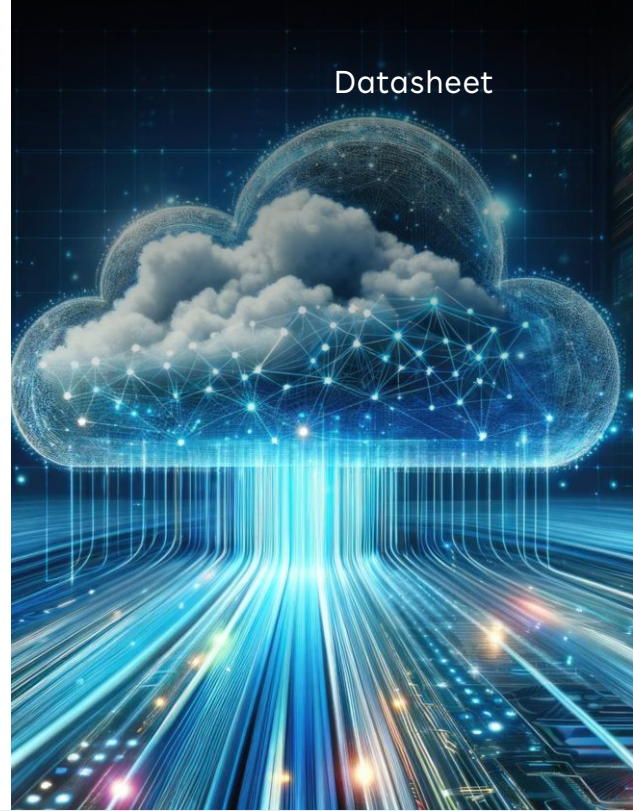**Rakuten** Symphony

Rakuten Cloud Native Orchestrator

Bare-metal-to-service orchestration with massive scale using closed-loop automation - day 0/1/2 lifecycle management

Rakuten Cloud Native Orchestrator's hyperautomation orchestrates and manages the lifecycles of your bare-metal infra, 3rd party appliances, Virtual Network Functions (NVFs), Cloud-Native Network Functions (CNFs) and service chains, with built-in logging, monitoring and policy engine, for closed loop automation that is managed through a single pane of glass. All of this is driven by an intuitive, context-aware and easy-to-use work-flow manager.

Rakuten Cloud Native Orchestrator provides 1-click application & Network Function (NF) onboarding, pulled from a large, pre-integrated, vendor ecosystem encompassing telco, cloud and enterprise applications. Ingest any scripting, such as helm charts, to automate Methods Of Procedures (MOPs), orchestrating any network element, application or process.

Our customers now do in minutes, what took days and weeks in the past, by integrating multiple layers of orchestration and workflows into a single platform - ideal for rapid scale-out of 5G, Open RAN and Multi-access Edge Computing (MEC) applications, such as Content Delivery Network (CDN) streaming, gaming and more.

KEY BENEFITS

- Accelerates infrastructure and service turn-up timeliness

- Eliminates integration touch-points and orchestration silos

- Improves performance and utilization of services

- Enables truly shared resource pools, with containers and VMs deployable in the same cluster

- Small footprint and scales to over million appliances

- Single pane management and large-scale orchestration of wide variety of elements and functions ranging from infrastructure, network to applications and services

CUSTOMER VALIDATED EFFICIENCIES

- First in-production containerized 5G stack with millions of subscribers - full stack deployment and in-service Open RAN

- 40% reduction in opex scalable orchestration and automation for RAN and Core

- 50% reduction in capex by enabling Open RAN and Core on commercial hardware

- Reduced deployment times - from weeks to minutes

- When combined with Rakuten Cloud Native Platform - 30% faster when running VNFs and 3x faster storage performance

SOLUTION HIGHLIGHTS

Full stack orchestration & lifecycle management - bare metal to service orchestration

Manages lifecycles and turn-up of your HW infrastructure, cloud platform, NFs, supporting applications and services, on one platform. This includes remote turn-up of completely bare servers.

Orchestration simplification and agility

Remove orchestration and MOPs silos with a single, unified engine for the entire stack, with access to all of the workflows, packaged with an easy-to-use interface utilizing programmable, context-aware and reusable elements simultaneously across the entire landscape. Combine multiple layers of orchestration and MOPs into single, 1-click, workflows.

Harmonized container and virtual machine (VM) support

You are no longer tied to your vendor's containerization roadmap, licensing or support contracts. Realize sharable resource pools today. Deploy CNFs and VNFs on the same or separate high availability clusters, reusing and sharing resources.

Applicable to any network element or application

No vendor or technology lock-ins. Configuration management support for not only compute/ storage/ network infrastructure, but also proprietary 3rd party equipment including top of rack switches, 5G radio, security, content delivery appliances and other Physical Network Functions (PNFs).

New paradigm in monitoring that reduces outages

Go beyond simple lists, logs and utilization graphs. Our clusters and the policies they enforce are application-aware, calculating placement based on detailed resource policy models with topology awareness, affinity/anti-affinity rules and service composition, to name just a few. Rakuten Cloud Native Orchestrator's multicluster, multi-data-center monitoring and policy engine drives workload scaling, healing and migration anywhere in any cloud. It intuitively relates the dependencies and how they impact services. This enables the operator to better understand the system as a whole and make more informed decisions. For example, service impacts due to the addition of new service types, server migrations, OS upgrades, security patches, database rebuilds, etc., These capabilities help the operator plan quicker, easier, and with better confidence, reducing service-impacting events and human error.

Unified Day 0/1/2 Lifecycle Management
Quickly combine any of these lifecycle management domains into a 1-click, operation

Advanced Inventory & Service Management

Our inventory management goes beyond comprehensive dashboards for health/usage/alarms and focuses on dependencies. Rakuten Cloud Native Orchestrator's multi-cluster monitoring and closed-loop automated policy engine intuitively relates those layers of dependencies and how they impact services. Drill down into a flagged cluster, or hardware nodes and see the impacted services and exactly what elements have failed or degraded. Perform blast-radius analyses to model the impact of any device, node or process.

- Action center: Visualize multi-data center, multi-cluster resource-aware dependencies
- Fault domain detection and blast radius service impact mapping
- Data drilldown
- Service-mesh and resource visibility mesh

Bare-Metal Lifecycle Management

Manage your HW hardware infrastructure with numerous, intent-driven and contextually aware checks that guide your exacting declarations. Transform a bare server, without configuration or an operating system via a remote Baseband Management Controller (BMC) Ethernet or Serial connection.

- Verify, install, upgrade, patch and configure the OS
- Supports many Intel and AMD-based vendors and SKUs including HP, SuperMicro, Quanta Cloud Technologies (QCT) and Dell
- Add and configure supporting drivers, services and software packages
- Upgrade and configure OS and BIOS settings
- Upgrade, configure and patch different firmware components including NIC, SSD, FPGA, NVMe, RAID

Cloud Platform/Kubernetes Cluster Lifecycle Management

Zero-touch automation of Kubernetes cluster deployments across thousands of edge locations. Rakuten Cloud Native Orchestrator + Rakuten Cloud Native Platform enable a huge feature boost. Rakuten Cloud Native Platform is based on open source Kubernetes, with value-added features including, resource modeling, advanced placement algorithms, providing NUMA-awareness, CPU Pinning, HugePages support, affinity/anti-affinity rules, multi-CRIs (Containers, VMs). Furthermore, Rakuten Cloud Native Platform ships with built-in application-aware enterprise-grade storage and numerous carrier-grade virtual networking options. See the Rakuten Cloud Native Platform data-sheet for more details.

- Verify, install, upgrade, patch and configure Kubernetes clusters
- Design cluster, configure roles-based access via user: element parameters, as well as per cluster, site and Kubernetes name-space
- Centralized policy and resource inventory management
- Supports numerous Kubernetes distributions including Rakuten Cloud Native Platform on prem, for AWS/GCP/Azure

Network Function Lifecycle Management

Manage both CNFs and VNFs, even on the same cluster, for high density, reusable, resource pooling. The NF lifecycle manager works with Rakuten Cloud Native Platform to take advantage of advanced workload placement, networking and application-aware storage.

- Onboard, monitor, start, stop, add, delete, scale, heal and migrate with easy to config and intuitive rules engine
- Supports bundles, helm charts, operators, YAML, 3rd party scripts
- NFs can leverage Rakuten Cloud Native Platform's advanced compute, network and storage placement directly from helm charts, without writing a single line of code

Application Lifecycle Management

Application management focuses on software that is not considered to be an NF, but is still necessary as part of the overall solution databases, big data solutions, AI/ML, analytics stacks, load balancers, message queues, controllers etc. The application life cycle manager works with Rakuten Cloud Native Platform to take advantage of advanced workload placement, networking and application-aware storage.

· Onboard, monitor, start, stop, add, delete, scale, and heal with easy-to-configure and intuitive rules engine
· 1-click migration of the entire application to/from other clusters
· Data management, including snapshot, clone, backup, restore, import, for entire applications, not just storage volumes
· Supports bundles, helm charts, operators, YAML, 3rd party scripts

Methods of Procedures Management (MOPs) And 3rd Party Appliances Lifecyle Management

· Configure and create custom processes for 3rd party appliances, supporting applications such as load balancers, databases and analytics stacks
· Create workflows that extend beyond that of typical infrastructures, platforms and services
· For example, raising alarms, sending texts or amending logs when a 5G radio or MEC application initializes, fails or reaches a user-defined threshold

Network (NS) Service Life Cycle Management

Design and manage complete services chains consisting of VNFs, CNFs, PNFs and other application elements, mixing and matching, using programmable, contextual and state aware work-flows. Deploy one-by-one in automated batches. The NS lifecycle manager works with Rakuten Cloud Native Platform to take advantage of advanced placement, networking and application-aware storage. Network services can be monitored using complete observability stacks that include policy dependencies, resource metrics, event logs, alerts and statistical drill down.

· Create, monitor, start, stop, add, delete, heal, migrate and scale service chains
· Design NSs distributed in different clusters contextual, readiness aware, serial and parallel NS turn-up
· Supports bundles, helm charts, operators, YAML, custom NS policy pinning

Intuitive & Declarative Day 0/1/2 Lifecycle Management

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