



Cloud Native & DevOps Service



2024-10

Quantum C&S Co., Ltd.

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# 1. About the Company

1.1 Overview

1.2 Vision

1.3 Recent Projects

1.4 Future Roadmap

# Leading service provider for Cloud-Native and DevOps



Quantum C&S Co., Ltd. has extensive experience in building private cloud infrastructure and providing DevOps services over many years.

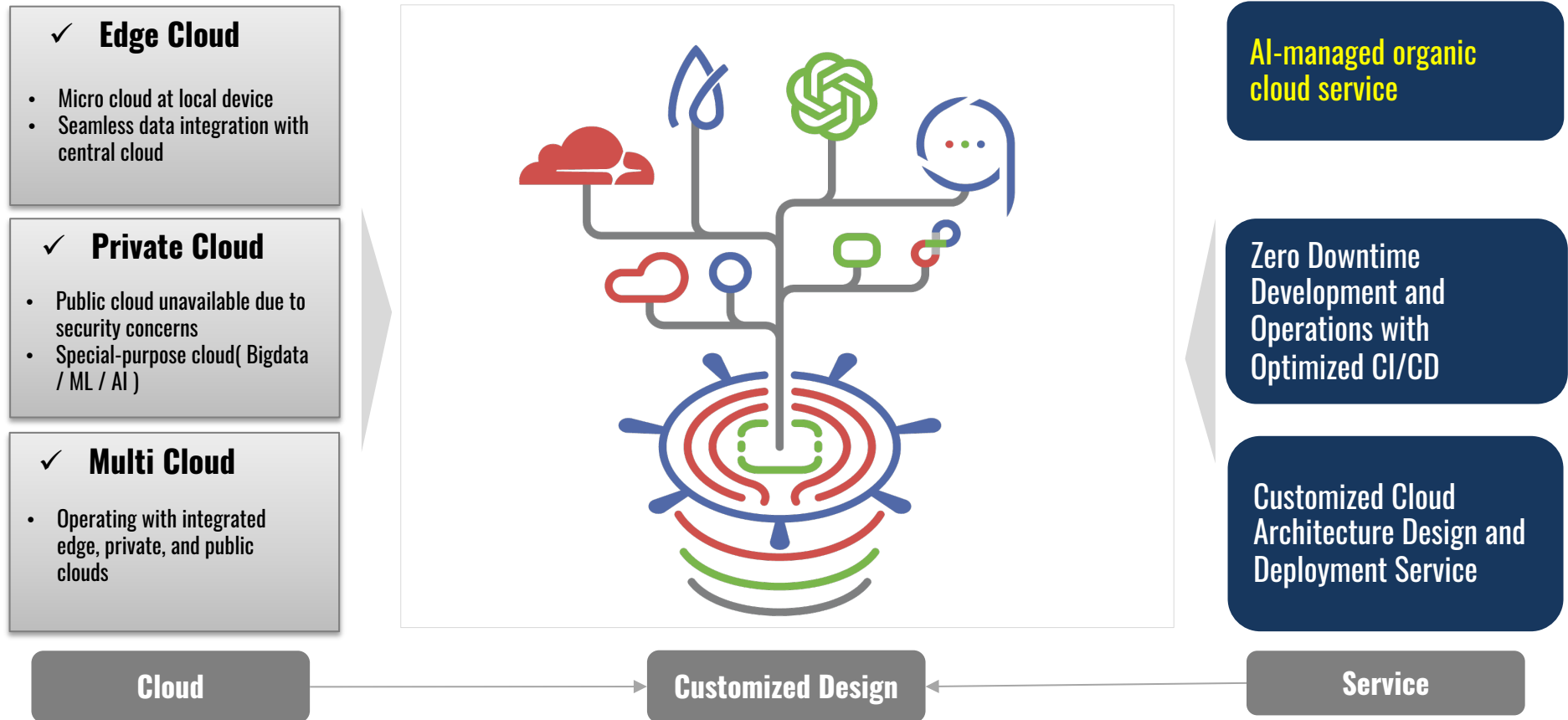
We are listed on the official [Kubernetes website as a Kubernetes Certified Service Provider \(KCSP\)](#). We have successfully delivered cloud solutions and provided technical support to major enterprises and numerous public institutions in South Korea.

Leveraging our accumulated experience and expertise, we provide customized cloud infrastructure and top-tier DevOps services to support the growth of our clients' businesses.

|                |  |
|----------------|--|
| Company Name   | QUANTUM C&S Co., Ltd.  |
| CEO            | Seongju “Steve” Jeon   |
| Business Areas | Private Cloud Deployment and Maintenance (QCS, QKS, QSS)<br>DevOps Environment Setup, Consulting, and Training<br>MLOps/LLMOps Solution Packaging, Delivery, and Technical Support<br>Cloud-Native Migration Support and K8s Helm Package Development for legacy systems   |
| Members        | 10   |
| Partners       |      |



**“We cultivate flower gardens for your services to bloom.”**



## 1.3 Recent Projects

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- **Kubernetes Cluster and CI/CD System Deployment for SK Telecom's AI Platform Development**
  - Big data and LLMOps project
  - Deployed Solution: QKS ( Kubernetes + Ceph )
  - Key Responsibilities :
    - Providing and maintaining a customized version of K8s & Ceph for installation across various on-premises OS environments, along with development and maintenance via IaC
    - Installation and maintenance of back-office systems for AI development
    - Developing and optimizing build and deployment systems for AI development, providing multi-cluster deployment and GitOps-based management features.
  - Impact of Service Adoption: Providing zero-downtime Kubernetes services through K8s HA deployment, efficient management of back-office systems, and big data infrastructure services utilizing Ceph.
  - Client : SK Telecom Co., Ltd.
  - Period : 2024.09 ~ ongoing
- **Kubernetes Custom Development and MLOps Platform (SKCC AccuInsight) Installation Automation Project**
  - Big data and MLOPS service project
  - Deployed Solution : QKS, QSS
  - Key Responsibilities :
    - Customizing K8s & Ceph for installation across various air-gapped on-premises OS environments, utilizing Terraform and Ansible
    - Development of MLOps solution (AccuInsight+) installation automation using Ansible and ArgoCD
  - Impact of Service Adoption : Significant reduction in installation time (from over a week to within 2 hours) and stable K8s and storage services
  - Client : SK INC.(C&C)
  - Companies Using the Service: NongHyup(2021), SK Siltron(2022.06), KB CAPITAL(2021.08), Public Procurement Service(2022.03), NH Insurance(2023.02), National Pension Service(2023.08)
  - 2024.01 : Registered as an official partner of SK C&C and signed a contract for K8s technical support and AccuInsight technical support

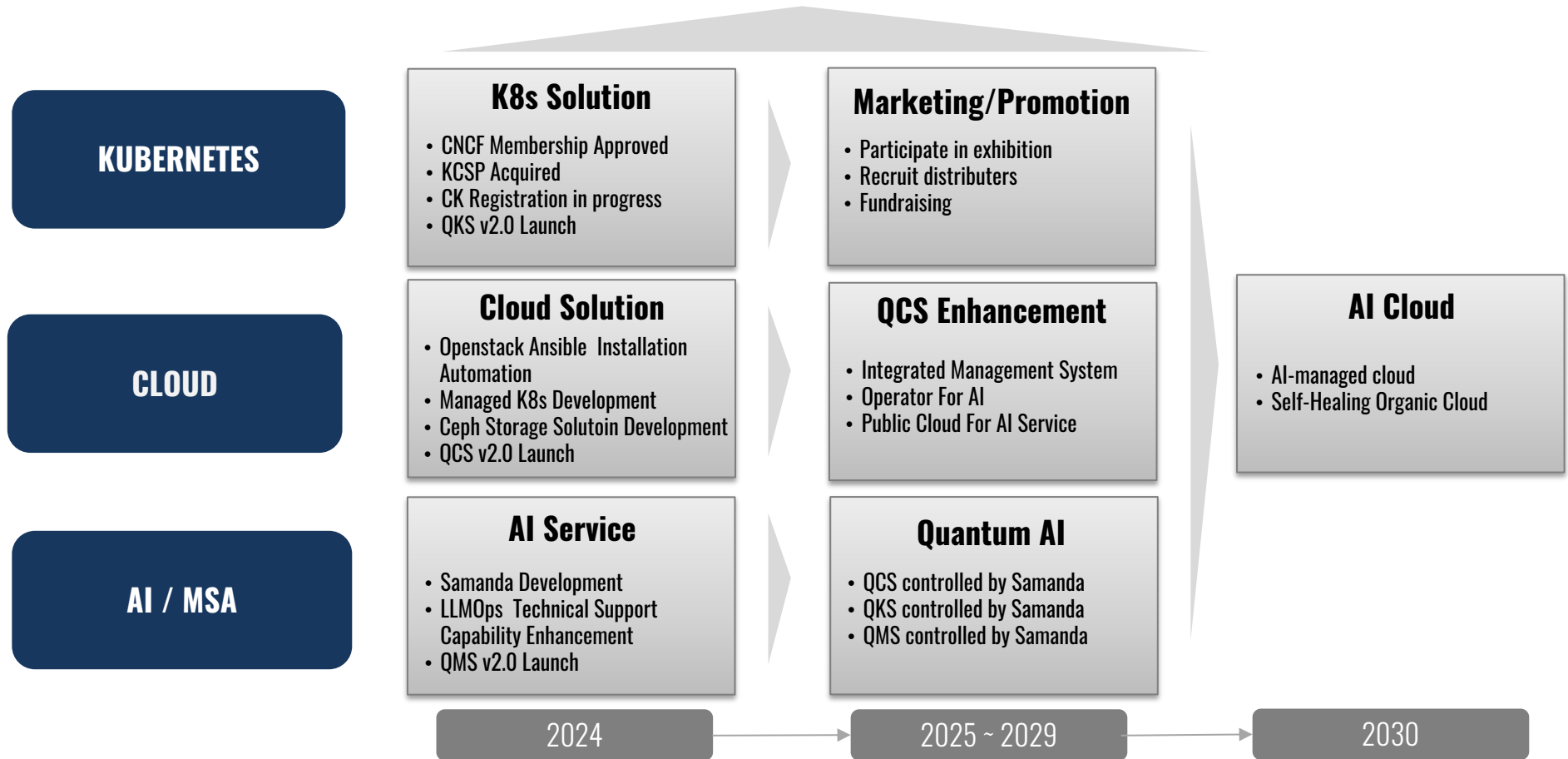
## 1.3 Recent Projects

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- **QKS Delivery and DevOps Service Provision**
  - Signed QKS solution supply contract
  - Deployed solution : QKS delivery & CI/CD consulting and training
  - Client : Smilegate Entertainment
  - Period: 2023.12 ~ 2024.3
  
- **Quantum Cloud Delivery and DevOps Service Provision**
  - Deployment of Kubernetes-based backend system using Quantum Cloud and QMS Dev Platform.
  - Deployed solution : QCS total solution( QOS + QKS + QMS )
  - Client : ACRYL inc.- Medical AI Solutions Provider
  - Period: 2021.2 ~ 2022.12.31

## 1.4 Future Roadmap

**“We innovate the AI platform to bring the multi-metaverse to life.”**



## 2. Quantum Cloud

2.1 Overview

2.2 Cloud Adoption Strategy

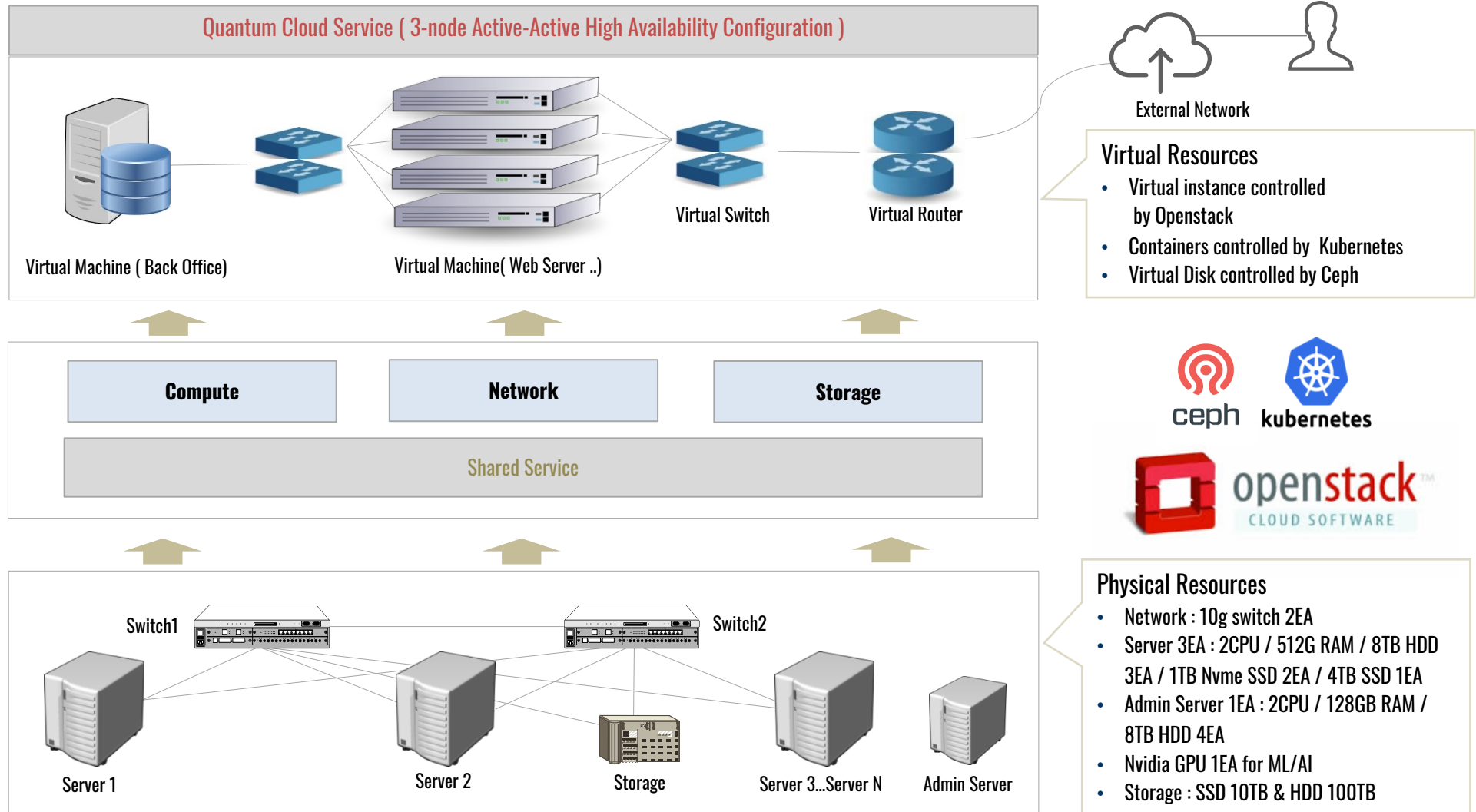
2.3 Cloud Operation Strategy



## 2.1 Overview

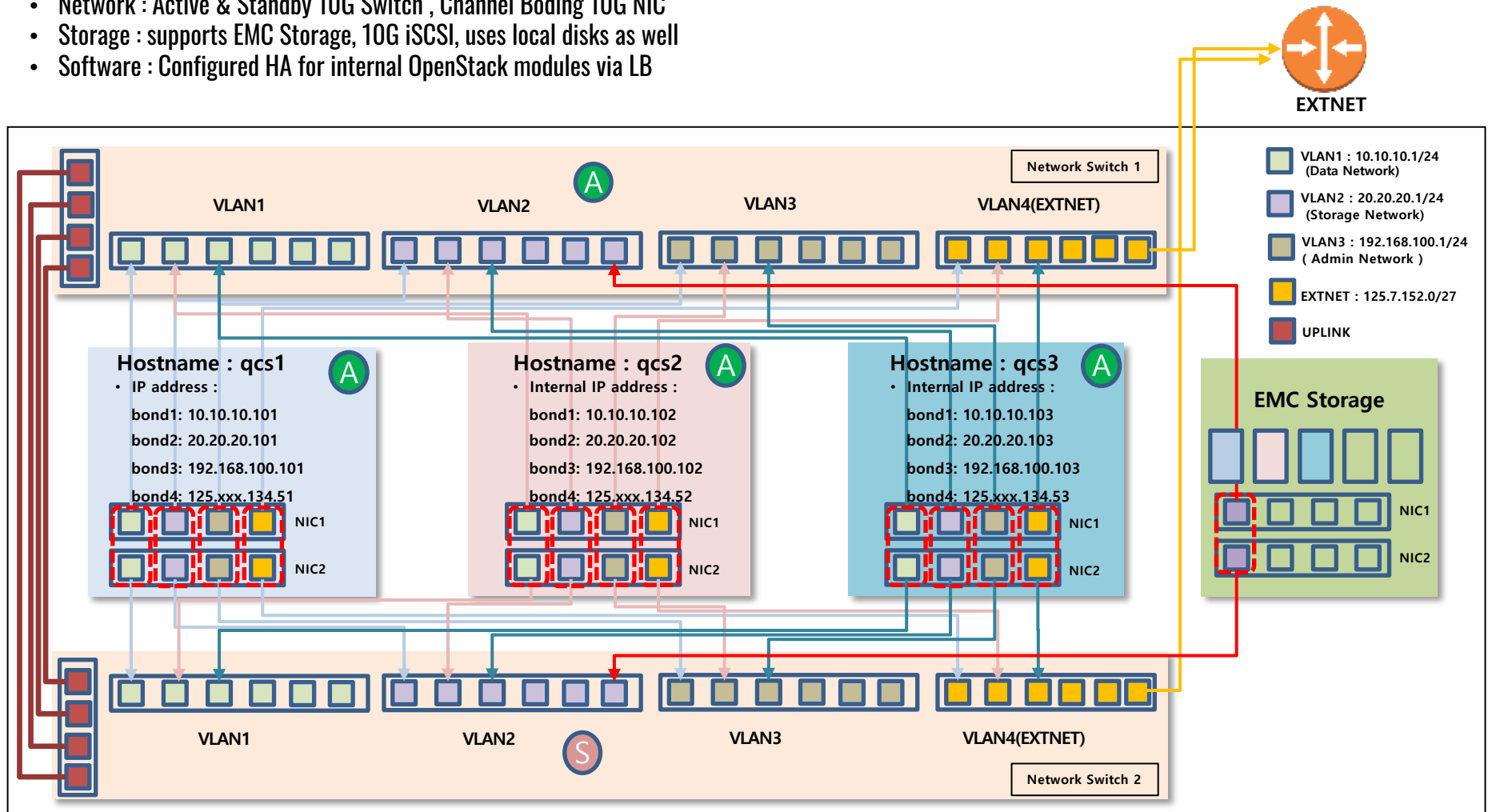
### • Quantum Cloud Service( Open Source based Private Cloud Platform )

- A private cloud platform independently developed based on open source technologies such as OpenStack, Kubernetes, and Ceph, **optimized for MSA development and operations**
- Adopted by: LG AI Research(CI/CD platform), Digital Companion Service(Gov.Project), AI Speaker Service(Company I), Jonathan AI Service Cloud (<https://www.acryl.ai>)



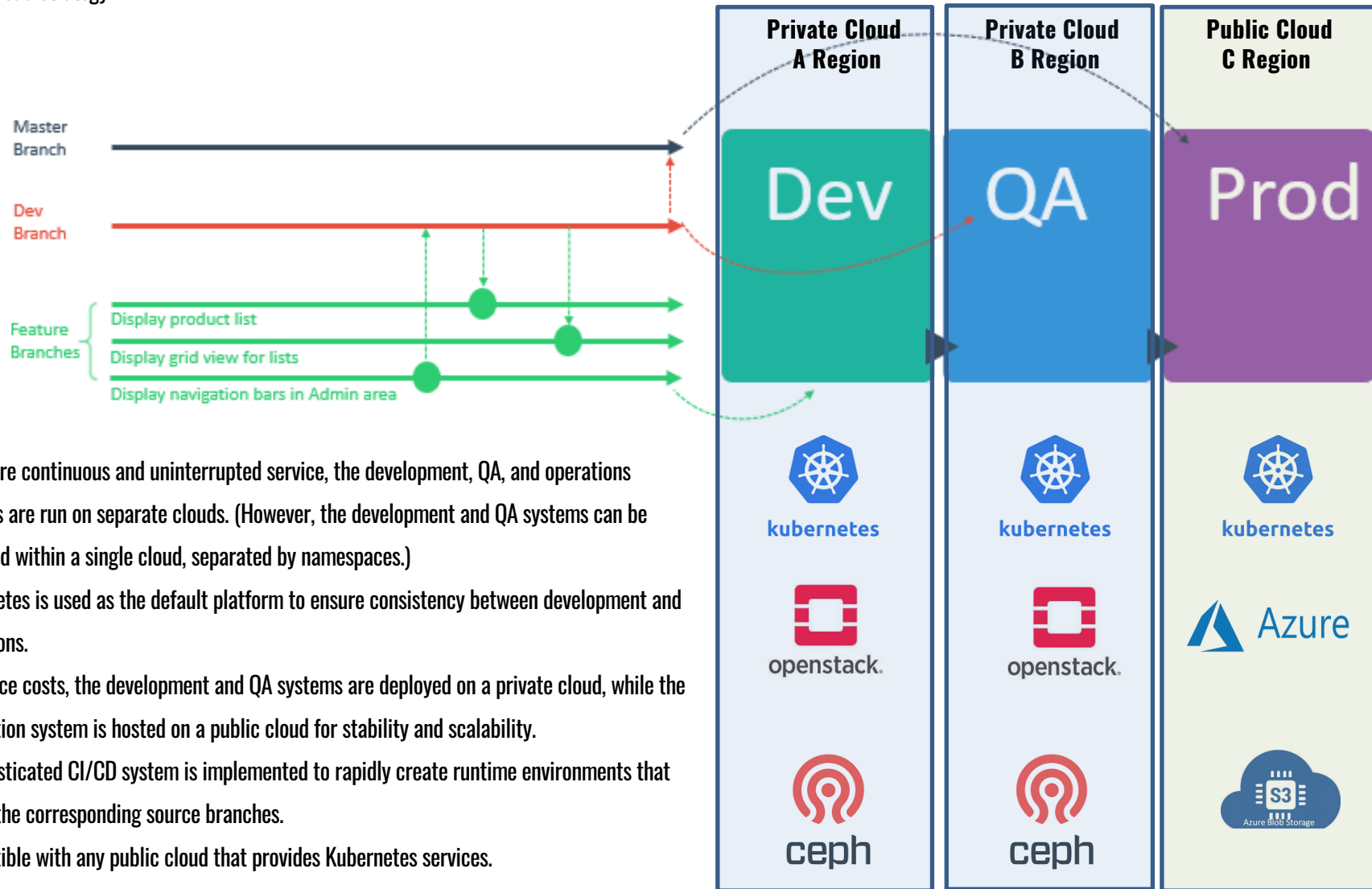
## 2.1 Overview – Case Example: Configuration of OpenStack HA

- Server : OpenStack Stein 3 Node AAA HA config, OS:Ubuntu18.04 LTS
- Network : Active & Standby 10G Switch , Channel Boding 10G NIC
- Storage : supports EMC Storage, 10G iSCSI, uses local disks as well
- Software : Configured HA for internal OpenStack modules via LB



## 2.2 Cloud Adoption Strategy

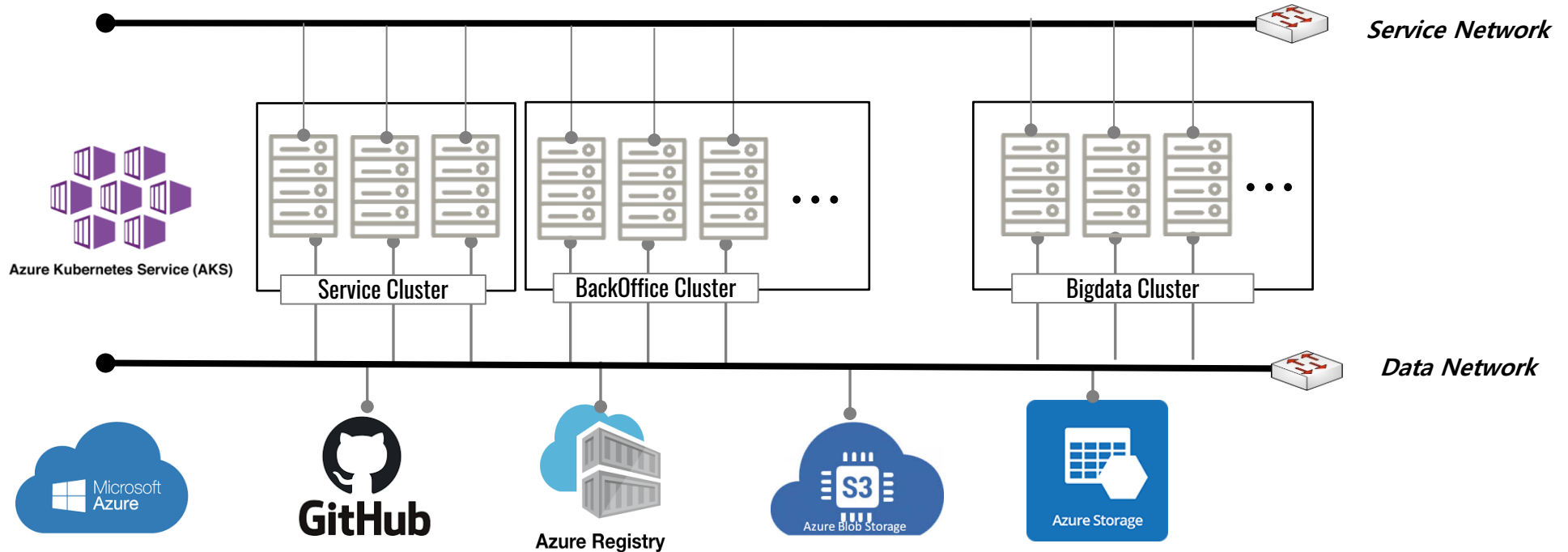
- Multi-Cloud Strategy





## 2.3 Cloud Operation Strategy – Multi Cluster (Operation)

- Operational Environments → utilize Public Cloud Managed K8s(AKS,EKS,GKS...) to ensure stable services

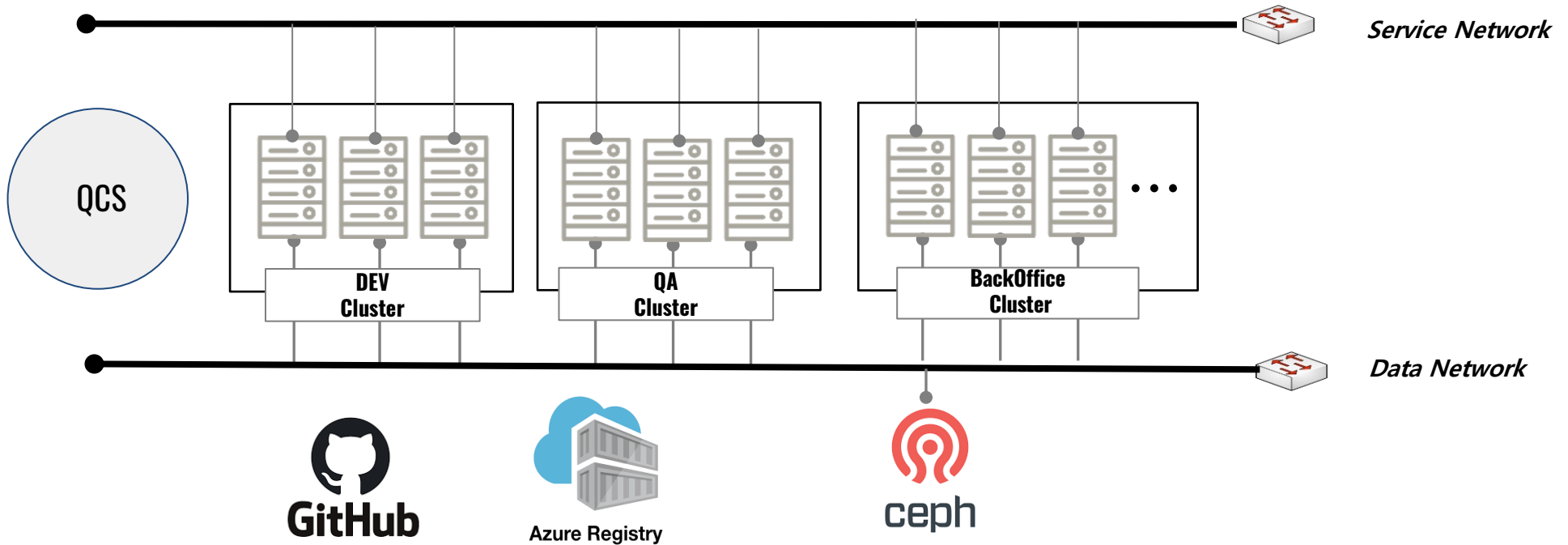


### • Key features of operational environments (When using Azure Cloud)

- Can operate multiple AKS clusters based on operational needs
  - WebService Cluster : A cluster for general web services, designed for rapid scaling in response to sudden surges in network traffic.
  - BackOffice Cluster : Designed to ensure stable service even with high resource usage from RDBMS, NoSQL, MQ, Kafka, Spark, and Hadoop, continuous monitoring is used to predict peak usage periods and pre-allocate sufficient resources in advance.
- Azure PaaS Service : Can be replaced in other clouds to avoid cloud vendor lock-in
  - Azure Github : Source Storage ( GitLab, BitBucket ... )
  - Azure Registry : Container Image Storage ( AWS ECR )
  - Azure Blob Storage : S3-Compatible Storage for File ( AWS S3 )
  - Azure Storage : Utilize CSI abstraction to use block storage for cold data. ( AWS EBS )

## 2.3 Cloud Operation Strategy – Multi Cluster (Dev/QA)

- Dev/QA System Infrastructure Configuration → Built and utilized on QCS for cost reduction

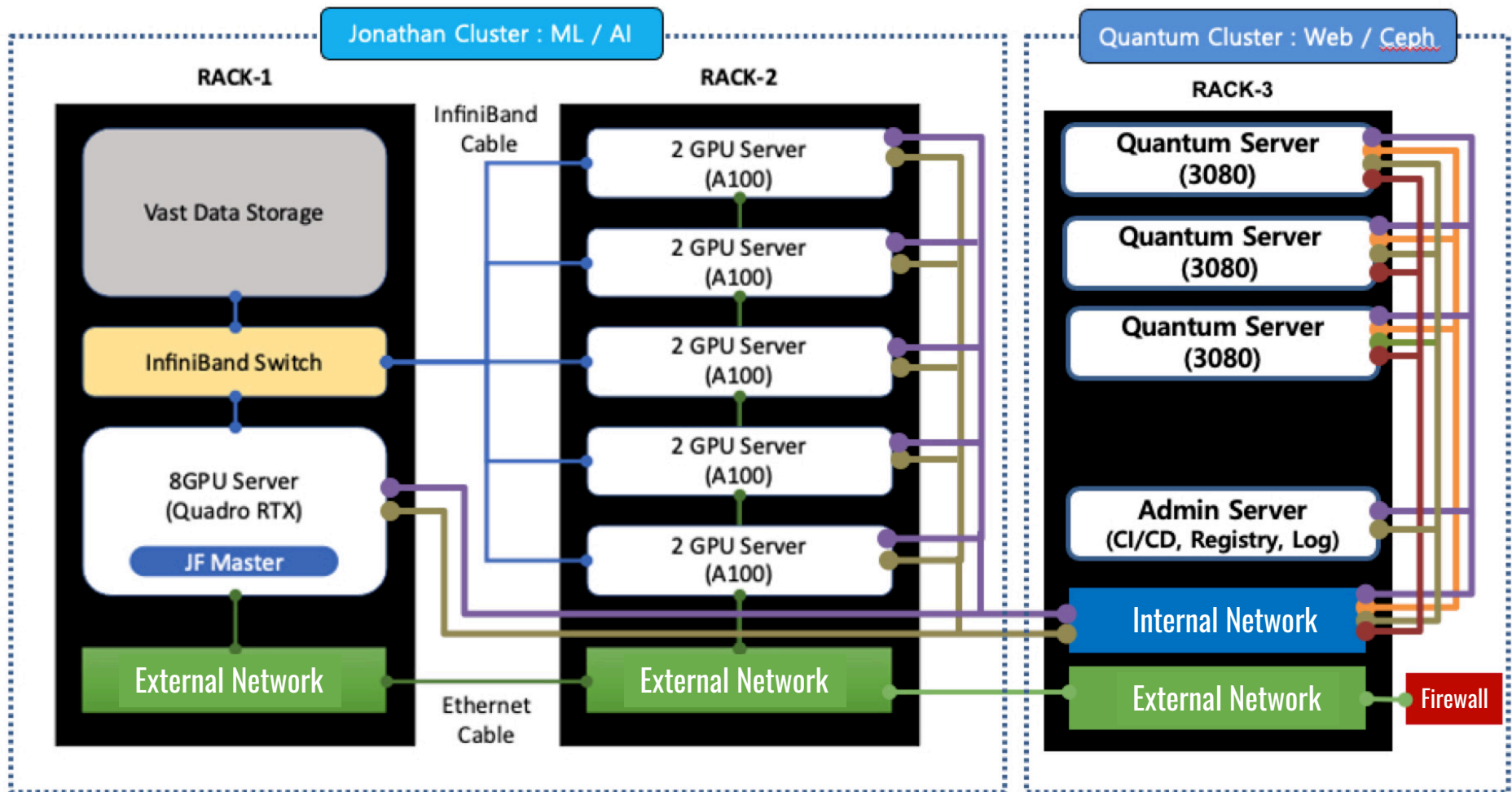


### • Elements and Key Features of Dev/QA system

- QCS, a private cloud service developed by Quantum C&S, can be utilized to reduce costs and enhance development flexibility.
- Operate three QCS clusters according to requirements: a DEV cluster for development, a QA cluster for testing, and a BackOffice cluster for back-office services.
- Implement a sophisticated CI/CD system to ensure that the same container image is deployed across development, QA, and production systems
- PaaS Service : For stable backup and operations, source code and container image repositories utilize Azure's PaaS offerings, Storage services use Ceph in the local cloud, considering speed and cost efficiency

## 2.3 Cloud Operation Strategy – System Deployment for Jonathan® AI Service

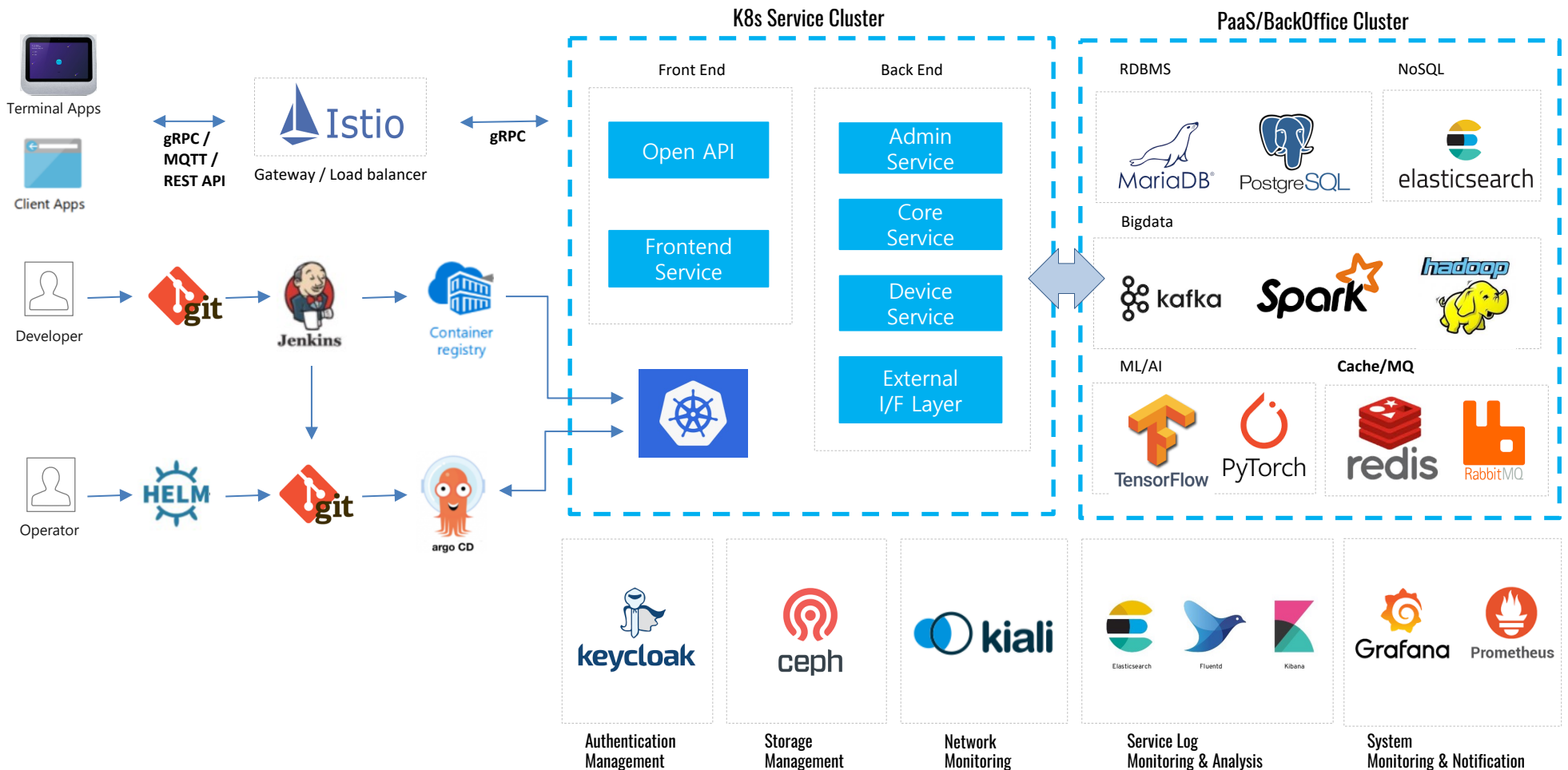
- Cloud Architecture for Jonathan AI Service
  - Jonathan Cluster : for Deep Learning / ML / AI functions
  - Quantum Cluster : for Web Services & Storage Services



## 2.3 Cloud Operation Strategy – SW Platform

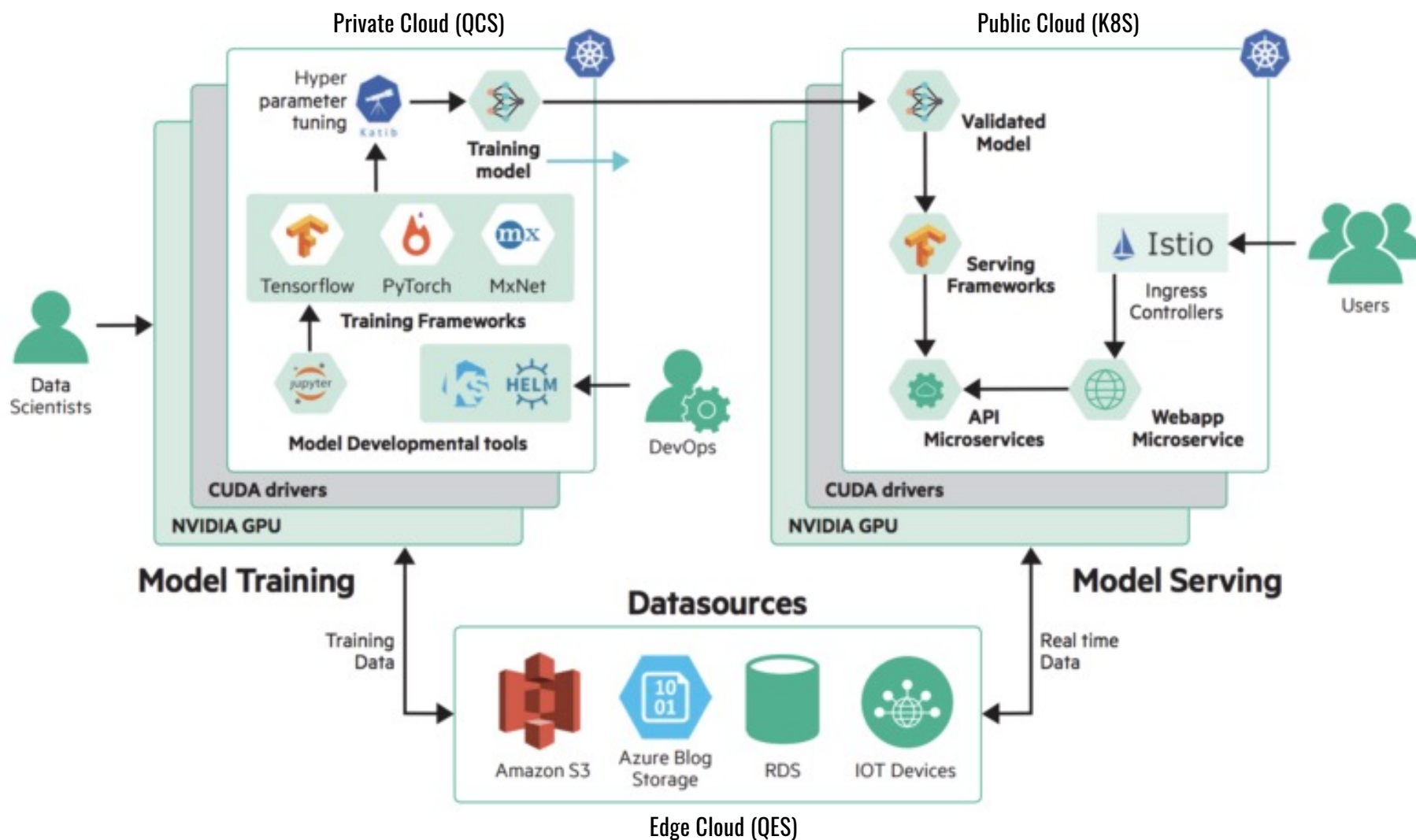
### • K8s-based MSA Platform

- Develop and operate using a K8s-based MSA approach to ensure zero-downtime service, seamless upgrades, rapid addition of new services, and quick scalability during traffic surges.
- CI/CD & GitOps : By managing both development and operations in a source-based manner and implementing a sophisticated CI/CD system, continuous development, stable and transparent operations can be ensured.
- PaaS/BackOffice : All necessary PaaS and Back Office services for development utilize open-source-based solutions that can run on K8s to ensure cloud independence.
- SaaS : To enhance processing speed between services, gRPC is adopted, while communication with devices or client apps is handled via gRPC/ MQTT/ REST API.



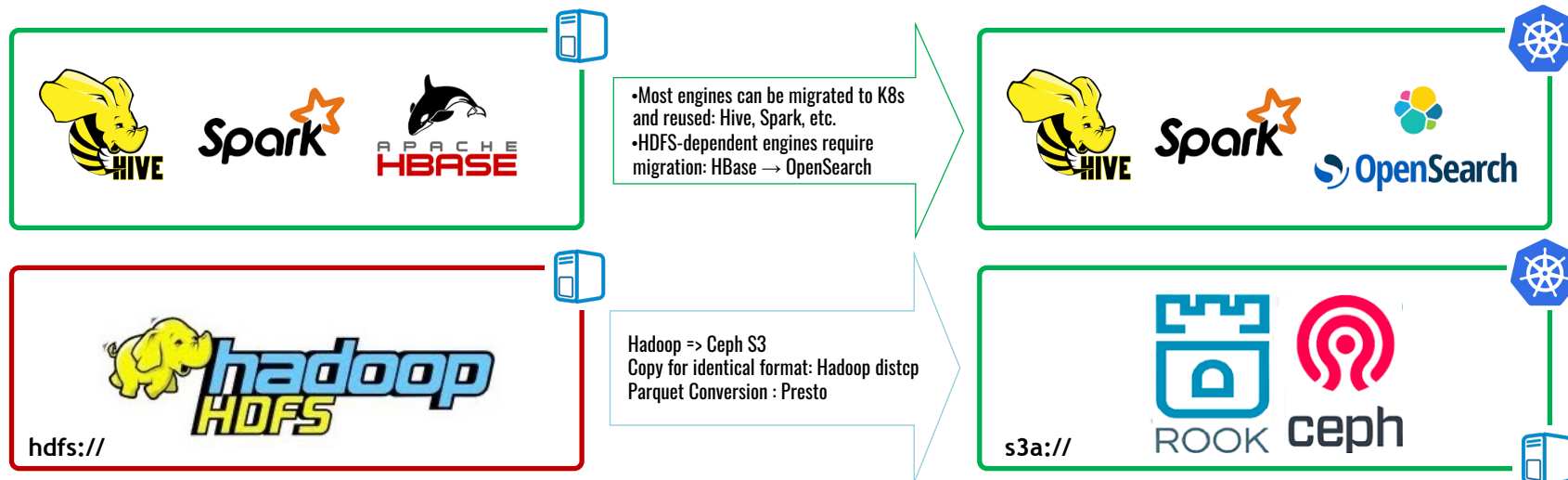
## 2.3 Cloud Operation Strategy – ML / AI

- Model Training - Private Cloud
- Model Serving - Public Cloud



## 2.3 Cloud Operation Strategy – Migration of Big Data Systems to Cloud-Native Architecture

- Migration Strategy from Hadoop/VM-Based Legacy Systems to S3/K8s-Based Cloud-Native Systems



- Background and Benefits of Migration

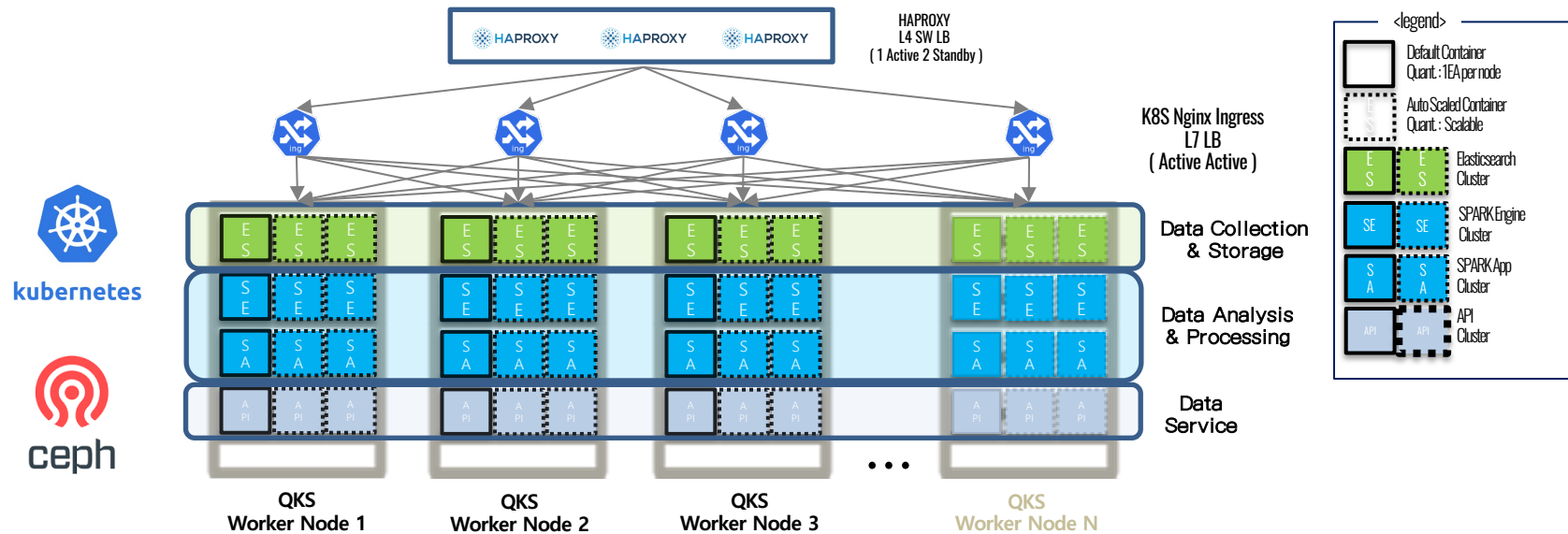
- To overcome the flexibility and scalability limitations in the Hadoop/VM-based system, migration to an S3/K8s-based cloud-native environment is necessary.
- Scalability and Cost Reduction: Optimize costs by leveraging S3's unlimited storage and K8s' auto-scaling, ensuring resources are used only when needed.
- Improved Operational Efficiency: Reduce system complexity and enhance DevOps efficiency through K8s' automated deployment and management functions.
- Improved Data Analysis Speed: Enable real-time data analysis by leveraging S3's centralized data storage and K8s-based analytics tools.
- Reference: Migration from Hadoop to S3 Using IBM Ceph Storage ( <https://www.redbooks.ibm.com/redpieces/pdfs/sg248563.pdf> )

- Services supported by Quantum C&S

- Ceph Cluster and S3 Service Deployment: Leverage years of Ceph expertise to support the efficient and scalable deployment and maintenance of S3 services.
- Big Data Dev Environment Provision: Provide the QBS service, our big data solution technology, along with Hadoop, Hive, Spark, Presto, and Jupyter services.
- Migration of Existing Analytics Engines to K8s: Containerize existing big data analytics engines to support operation in a K8s environment, providing flexibility in deployment and automatic scaling.
- Migration Performance Tuning Support: Provide performance tuning and optimization assistance during the transition from HDFS to S3.
- Enhanced Data Security and Stability: Ensure strong security and reliability in the cloud environment through data encryption and access control.
- Improved Operational Efficiency: Reduce operational complexity and enhance data access speed through integrated management of S3 and Ceph-based storage.

## 2.3 Cloud Operation Strategy – Big Data System

- Dynamic HW&SW Scaling Strategies for Zero-Downtime, High-Capacity Services, Anomalous Traffic Handling, and Performance Optimization



- HW Operation and Scaling Strategy

- Network : zero-downtime service through Active-Standby or Active-Active high availability configuration
  - L4 Switch : 3 Node 1 Active 2 Standby SW L4 Switch ( Haproxy by Corosync & Pacemaker )
  - L7 Switch : Configure Kubernetes Nginx Ingress software L7 switch for Active-Active HA and auto-scaling to handle abnormal traffic surges
- Computing : Maximize resource utilization through efficient container deployment and establish resource expansion plans through monitoring
  - Resource expansion plan : Expand CPU/Memory on existing worker nodes or add new worker nodes—all while maintaining service availability
- Storage : Provide suitable disk IOPS performance for applications and enable dynamic scaling
  - Resource expansion plan : Add disks to storage, dynamically integrate them into the Ceph system, and allocate them to containers dynamically—all while maintaining service availability

- SW Operation and Scaling Strategy

- Efficient Container Placement: Determine the baseline number of containers and configure auto-scaling through load testing. Due to the nature of distributed programs, increasing the number of containers can improve performance
- Resource Limits per Container: Necessary to prevent resource exhaustion caused by program bugs and to support auto-scaling
- Cloud-Optimized Development: Adopt CNCF development methodologies and MSA architecture for performance optimization. Consider adopting cache or MQ and develop via stateless approach.
- Adoption of Efficient Development and Deployment Methods: Implement a CI/CD system to automate the entire process from development to deployment, enabling rapid program updates

## 3. Quantum Service

3.1 Solutions and Services

3.2 IaaS

3.3 PaaS

3.4 SaaS

3.5 CI/CD





## 3.1 Solutions & Services

- **Quantum C&S excels in services required for building and operating a cloud-native Dev. Environment.**
- **We can provide customized solutions based on customer requests.**

### Quantum Kubernetes Service

- Kubernetes-Based Solution
- Ansible-Based Installation
- Supports Air gapped Environments
- Auto-Installation of Customer-Requested Packages
- **Major Customers** : SK C&C, Acryl Smilegate, SK Telecom



### Quantum OpenStack Service

- OpenStack VM Solution
- Managed K8S base Features
- Customization for customer requests
- **Major Customers** : Acryl, LG AI Research, BNSoft



### Samanda

- Fine-Tuning with LLM models
- Integrated UI for Preprocessing, Model Development, and Tuning
- In-house Model Creation without egress data transfer
- **Development in progress**



### Quantum MSA Service (MSA Dev Platform)

- MSA Solution with Istio/Keycloak Integration
- DevOps / GitOps / MLOps Solution
- Provides guide and support for MSA Dev.
- **Major Customers** : Acryl, BNSoft, Jcob Info.



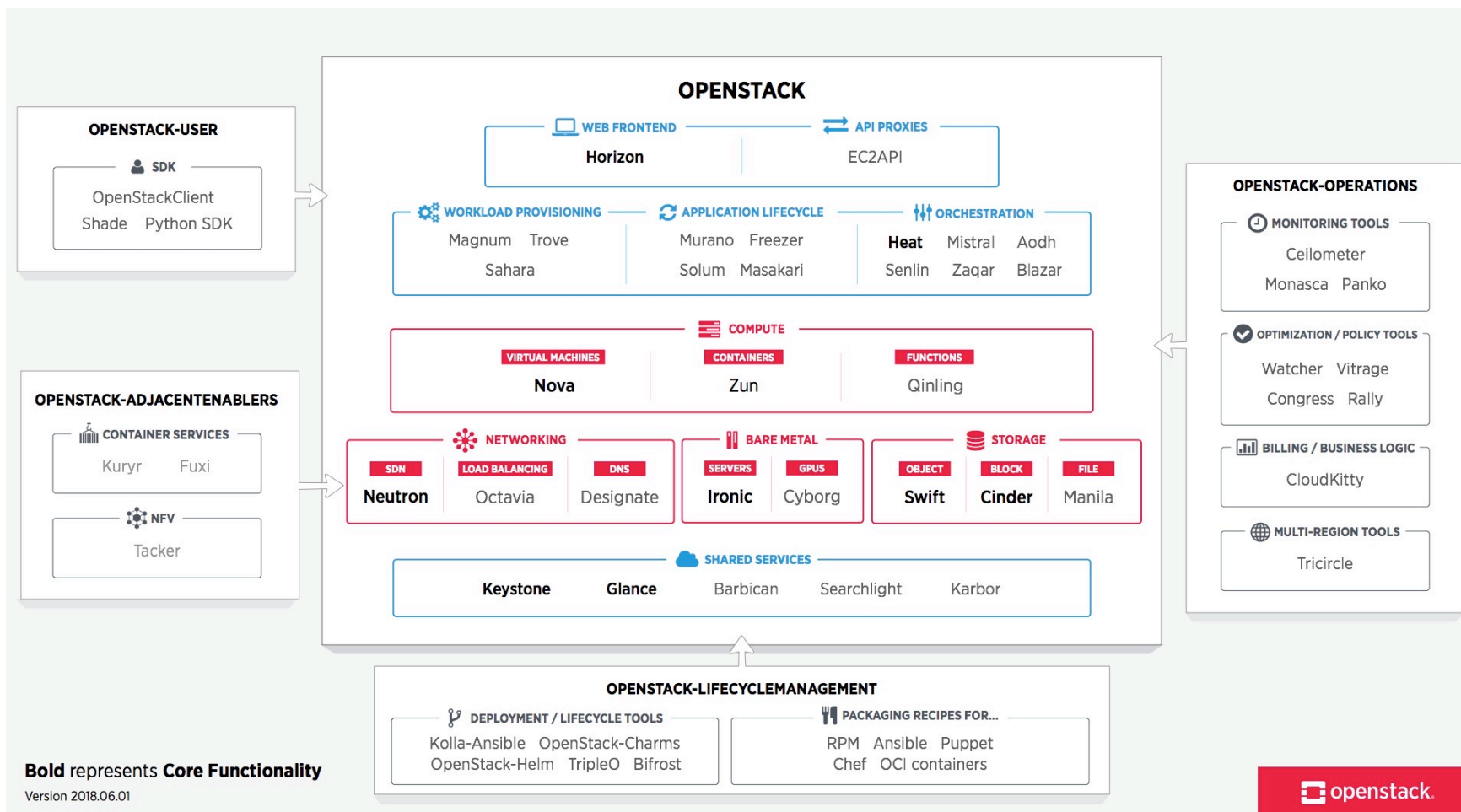
### Quantum Storage Service

- Ceph Based Solution
- Ansible-Based Installation
- Management via Rook-Ceph operator
- Developing features for DGS support
- **Major Customers** : SK C&C, Acryl, BNSoft

## 3.2 IaaS – QOS ( Quantum OpenStack Service )



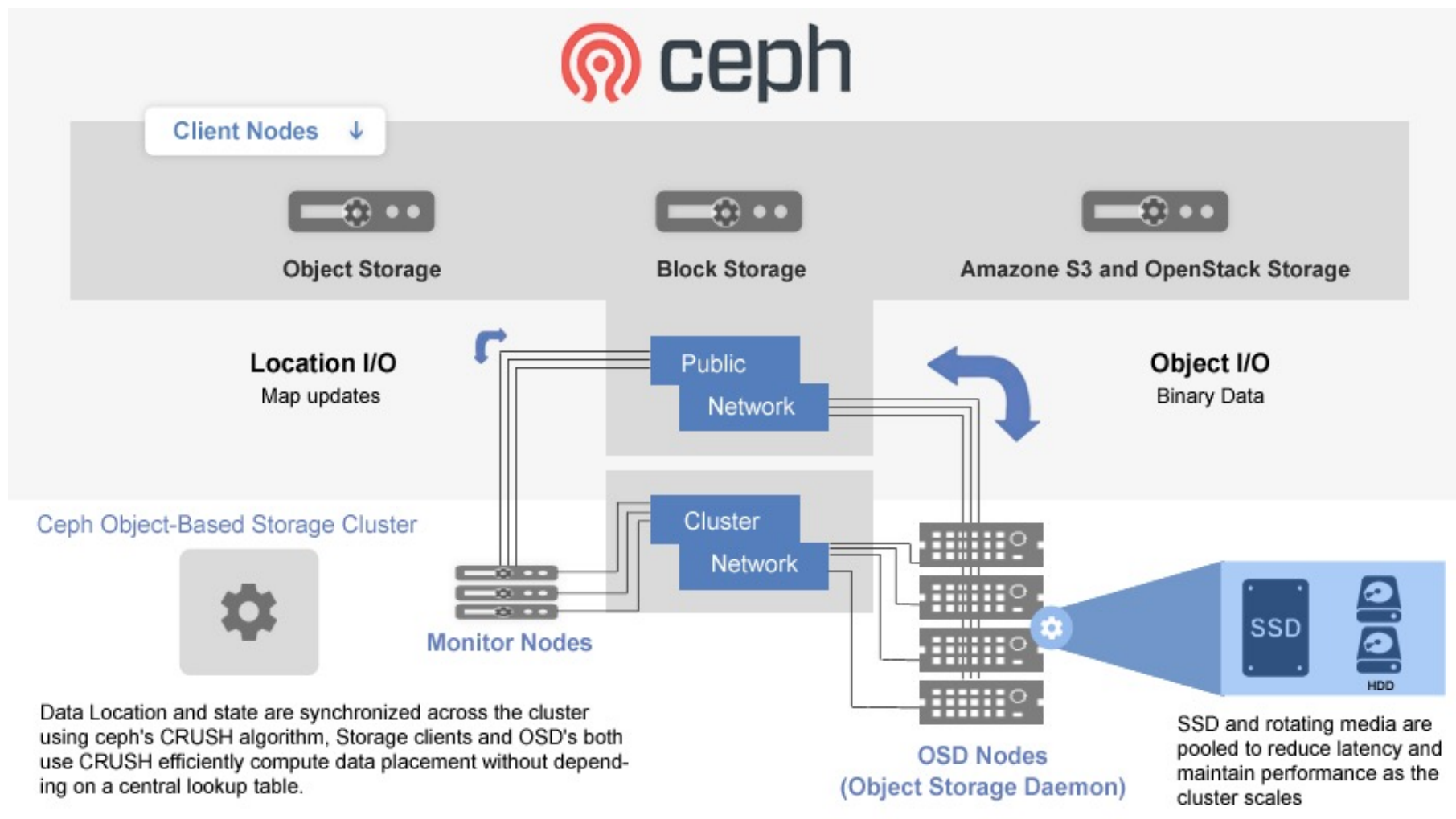
### OpenStack HA Configuration and Ceph-Integrated Private Cloud Service



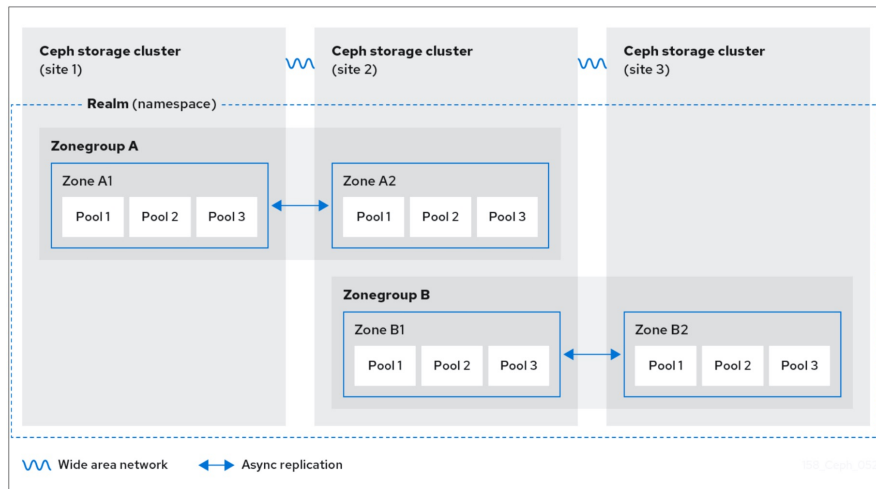
## 3.2 IaaS – QSS ( Quantum Storage Service )



### Installation Automation and Management Optimization with Rook-Ceph/Ansible S3 Service Provision and S3 Development Guide in an Air-Gapped Environment

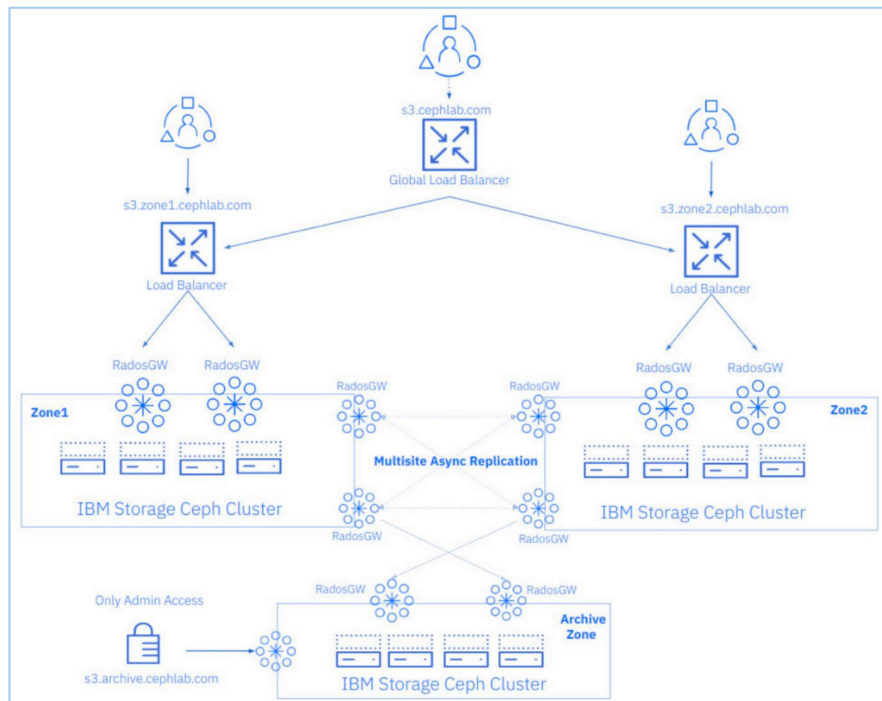


## 3.2 IaaS – QSS ( Quantum Storage Service )



### • Ceph Disaster Recovery (DR) and Replication Features

- supports DR through async replication across multiple storage clusters.
- Ensures data availability by enabling rapid recovery using data from another site in case of failure.
- Data replication is possible between zones within a zonegroup, even in geographically distributed clusters.



### • Ceph S3 Configuration Case( IBM )

- The global load balancer distributes requests to S3 endpoints in each region, effectively balancing traffic across geographically distributed clusters.
- Multisite async replication enables asynchronous data replication between clusters.
- The archive zone serves as a storage space for long-term retention and backup data, ensuring the preservation and recovery of critical data.
- Leverage Ceph's object storage characteristics and S3 compatibility to flexibly scale storage capacity.
- Clusters can be added or existing cluster capacity can be expanded as needed, enabling flexible storage management aligned with business growth.
- Ceph S3 is more suitable for environments requiring large-scale data storage and high availability.

## 3.2 IaaS – QKS ( Quantum Kubernetes Service )

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Customizable K8s Solution Available for Both Online and Air-Gapped/On-Prem Environments

- **Key Features and Advantages of QKS**

- IaC support : VM created by Terraform, K8s installed by Ansible ( separate agreement needed for source code provision)
- Installation by Proprietary Installer ( CLI, WebUI )
  - Online version installs within 1 hour, offline version installs within 2 hours.
- Supports various K8s versions and installs submodules through a Kubernetes version compatibility verification program
  - Supported K8s versions : 1.28.x 1.29.x, 1.30.x, 1.31.x
  - OS :Validated for Ubuntu-based OS (20.04, 22.04) and Red Hat-based OS (8.4, 8.7)
  - CRI : Containerd / CRI-O
  - CNI : Cilium / Calico / Flannel / Multus
  - CSI : NFS / Ceph RBD / Cephfs ( Supports both Rook-ceph, Cephadm)
  - Customers can choose desired options for K8s validation, installation, and operation based on the above configuration.
- K8s HA Installation ( 3Node Active-Active, No additional LB Required )
- Easy K8s Node Expansion : Node Expanded by Terraform & Ansible
- Open Source PaaS Installation on Request( Istio, Ceph, MariaDB, OpenSearch, RabbitMQ, Redis, Airflow, Knative installed by default)
- Fast Access to the Latest K8s Versions Not Available on Public Cloud

- **QKS Service**

- Included by default: Infrastructure/Back-Office Monitoring, Incident Alerting, and Log Viewer Services (Prometheus / Loki Services)
- Available plans: Perpetual License, Monthly Subscription
- Maintenance Contract: Monthly inspections, 24/7 incident response and more
  - K8s version upgrade
  - K8S backup service
  - Emergency Security Patch



### QKS Enterprise Service for Customers Operating Multiple K8s Clusters

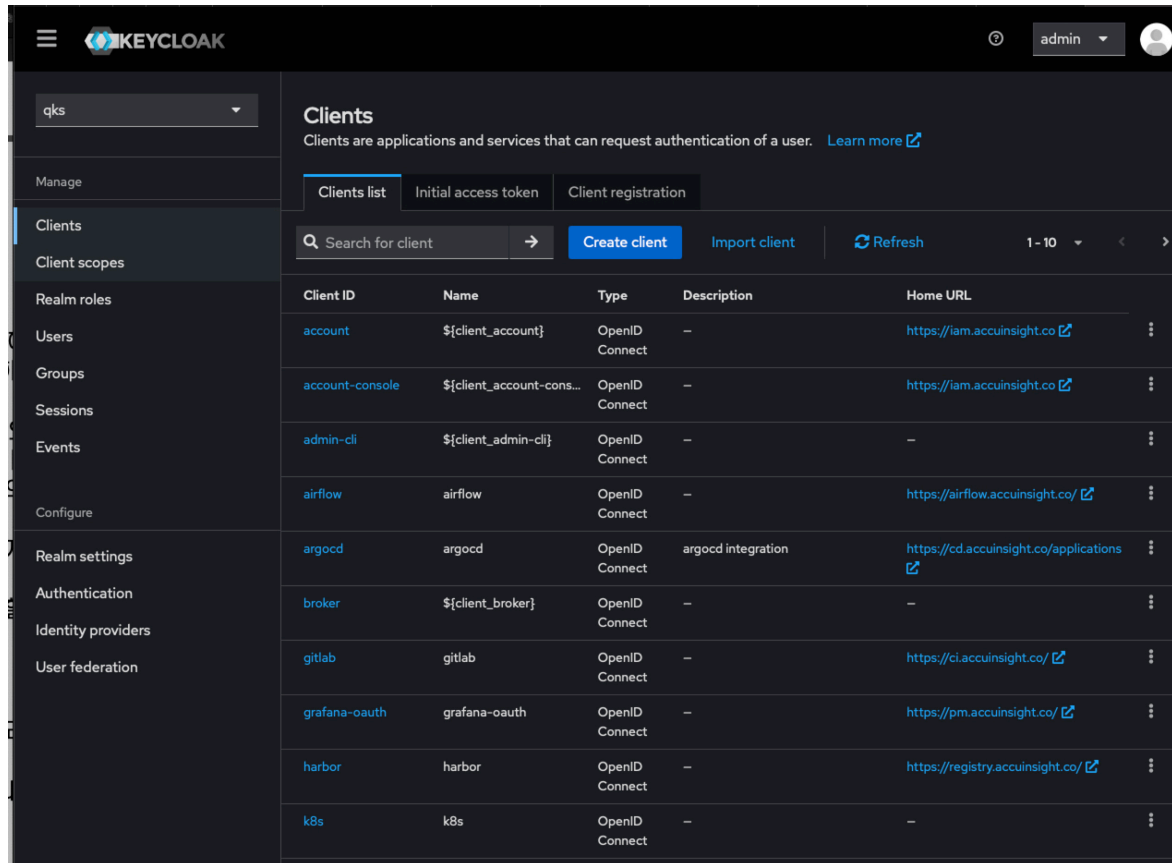
- **Overview and Major Features**

- With the rapid advancement of AI technology, the utilization of Kubernetes is significantly increasing.
- AI and big data workloads require large-scale resources and complex distributed environments, increasing the importance of multi-cluster operations.
- Major Features
  - ✓ **Single Account SSO** : Integrate not only K8s but also various open-source back-office services with Keycloak for single-account SSO, allowing seamless access to all clusters and services without separate login procedures
  - ✓ **Multi-Cluster Management Solution**: Includes a solution centered on KubeSphere for unified management of multiple K8s clusters.
  - ✓ **Multi-Cluster Monitoring** : Implement OpenTelemetry for multi-cluster status monitoring within a single graph.
  - ✓ **Legacy Workload Support** : Legacy applications that are difficult to transition to cloud-native can be integrated via KubeVirt to run on VMs within K8s environments
  - ✓ **Private Managed K8s (to be released)** : Managed K8s for air-gapped environments seamlessly integrated with OpenStack, Ceph, and K8s, with node auto-scaling capabilities to address resource shortages.

- **Expected Benefits of QKS Enterprise**

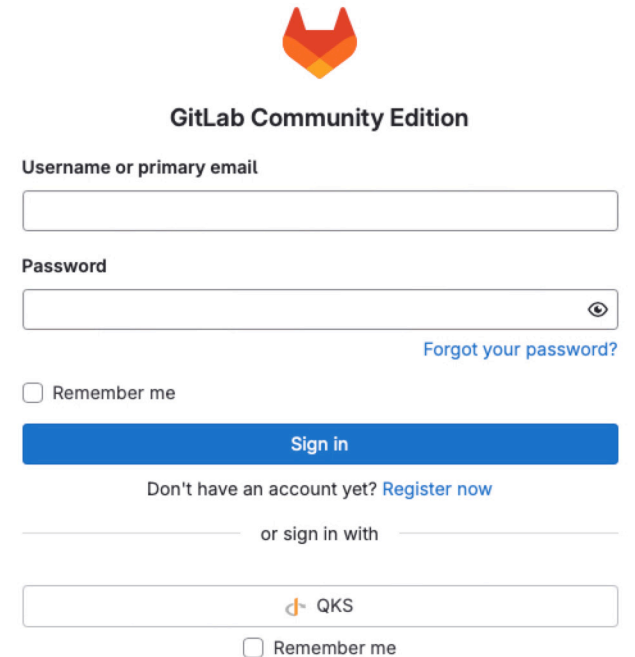
- **Maximized Operational Efficiency**: Reduce cluster and service management complexity and support operational automation through integrated multi-cluster management and SSO functionality.
- **Scalability and Flexibility**: Seamlessly integrate cloud-native workloads and VM-based legacy applications, enabling easy resource expansion aligned with business growth.
- **Cost Reduction**: Optimize resource utilization and infrastructure management in a private cloud environment to reduce operational costs.
- **Enhanced Security**: Strengthen user authentication and monitoring to ensure a secure cluster operating environment.

## 3.2 IaaS – QKS Enterprise ( Keycloak SSO )



The screenshot shows the Keycloak Admin Console interface. The left sidebar contains navigation links: Manage, Clients, Client scopes, Realm roles, Users, Groups, Sessions, Events, Configure, Realm settings, Authentication, Identity providers, and User federation. The main content area is titled 'Clients' and shows a list of clients. The 'Clients list' tab is active, displaying a table with columns: Client ID, Name, Type, Description, and Home URL. The table lists several clients, including 'gitlab' which is highlighted.

| Client ID       | Name                       | Type           | Description        | Home URL  |
|-----------------|----------------------------|----------------|--------------------|---|
| account         | \${client_account}         | OpenID Connect | –                  | <a href="https://iam.accuinsight.co">https://iam.accuinsight.co</a>                         |
| account-console | \${client_account-cons...} | OpenID Connect | –                  | <a href="https://iam.accuinsight.co">https://iam.accuinsight.co</a>                         |
| admin-cli       | \${client_admin-cli}       | OpenID Connect | –                  | –   |
| airflow         | airflow                    | OpenID Connect | –                  | <a href="https://airflow.accuinsight.co/">https://airflow.accuinsight.co/</a>               |
| argocd          | argocd                     | OpenID Connect | argocd integration | <a href="https://cd.accuinsight.co/applications">https://cd.accuinsight.co/applications</a> |
| broker          | \${client_broker}          | OpenID Connect | –                  | –   |
| gitlab          | gitlab                     | OpenID Connect | –                  | <a href="https://ci.accuinsight.co/">https://ci.accuinsight.co/</a>                         |
| grafana-oauth   | grafana-oauth              | OpenID Connect | –                  | <a href="https://pm.accuinsight.co/">https://pm.accuinsight.co/</a>                         |
| harbor          | harbor                     | OpenID Connect | –                  | <a href="https://registry.accuinsight.co/">https://registry.accuinsight.co/</a>             |
| k8s             | k8s                        | OpenID Connect | –                  | –   |



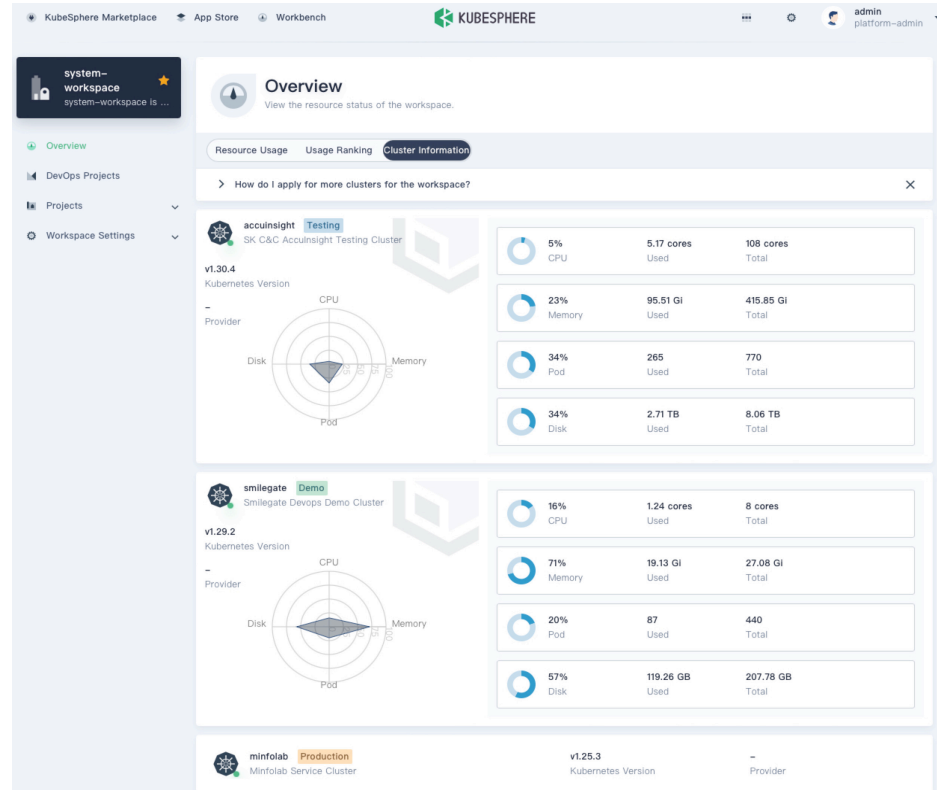
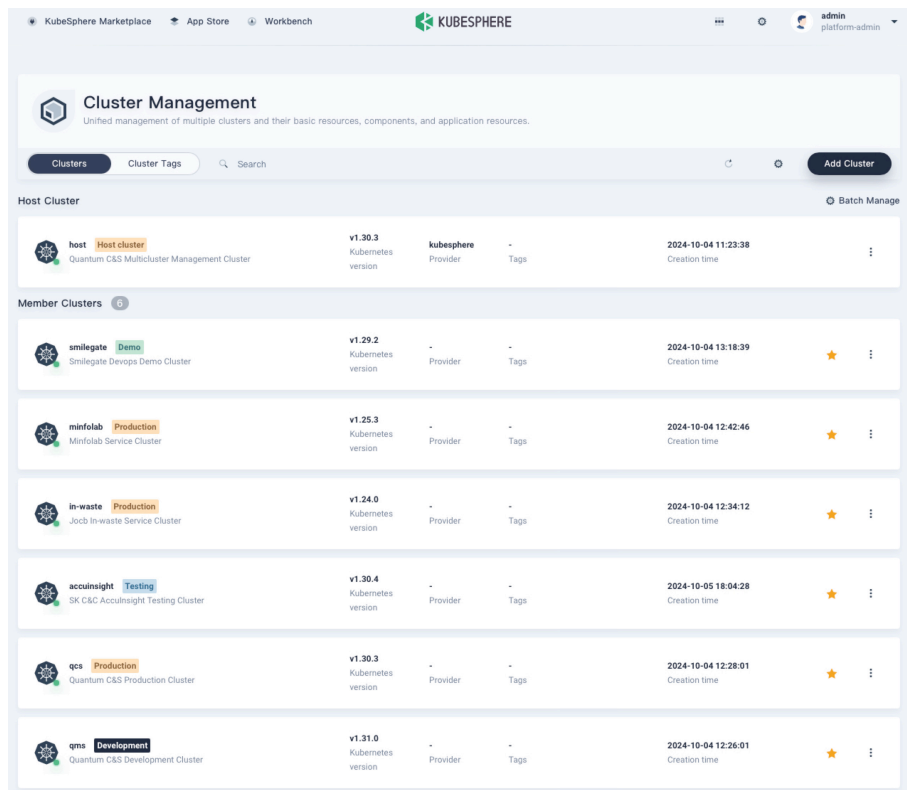
The screenshot shows the GitLab Community Edition login page. It features a login form with the following elements:

- GitLab logo
- GitLab Community Edition title
- Username or primary email input field
- Password input field with a toggle for visibility
- Forgot your password? link
- Remember me checkbox
- Sign in button
- Don't have an account yet? Register now link
- or sign in with separator
- QKS logo
- Remember me checkbox

- Implement SSO Using Keycloak
- Register OIDC-Supported Back-Office as a Keycloak Client
- Supported Back-Offices : K8s, GitLab, ArgoCD, Harbor, Grafana, etc., (planning to continuously expand the list)
- When operating multiple clusters, install Keycloak on the host cluster to enable unified account management across all clusters.
- Integrates with external authentication protocols and can also connect with the customer's membership database.



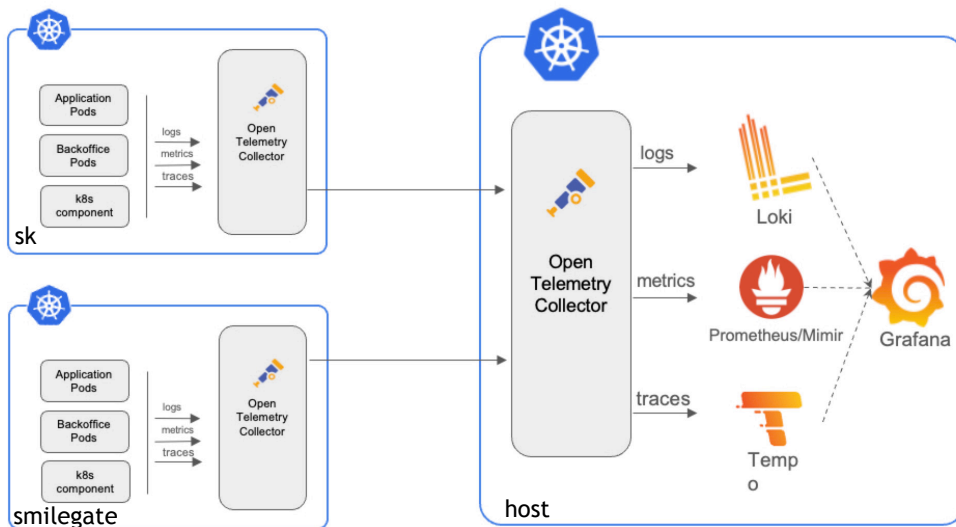
## 3.2 IaaS – QKS Enterprise ( KubeSphere )



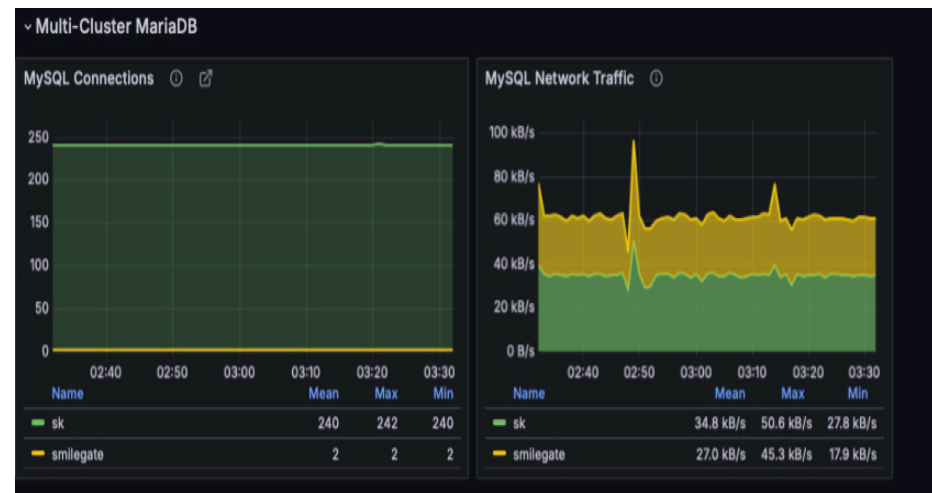
- **Centralized Cluster Management:** Monitor and manage multiple Kubernetes clusters from a single interface.
- **Resource Deployment Across Clusters:** Easily deploy and migrate workloads between multiple clusters.
- **Cluster and Application Monitoring:** Integrate with Grafana and Prometheus for visual monitoring of resource usage and application status.
- **App Store:** Provide a Helm-based App Store for open-source and commercial software, enabling easy installation and management of various applications.



## 3.2 IaaS – QKS Enterprise ( OpenTelemetry )



OpenTelemetry Multi-Cluster Architecture Diagram



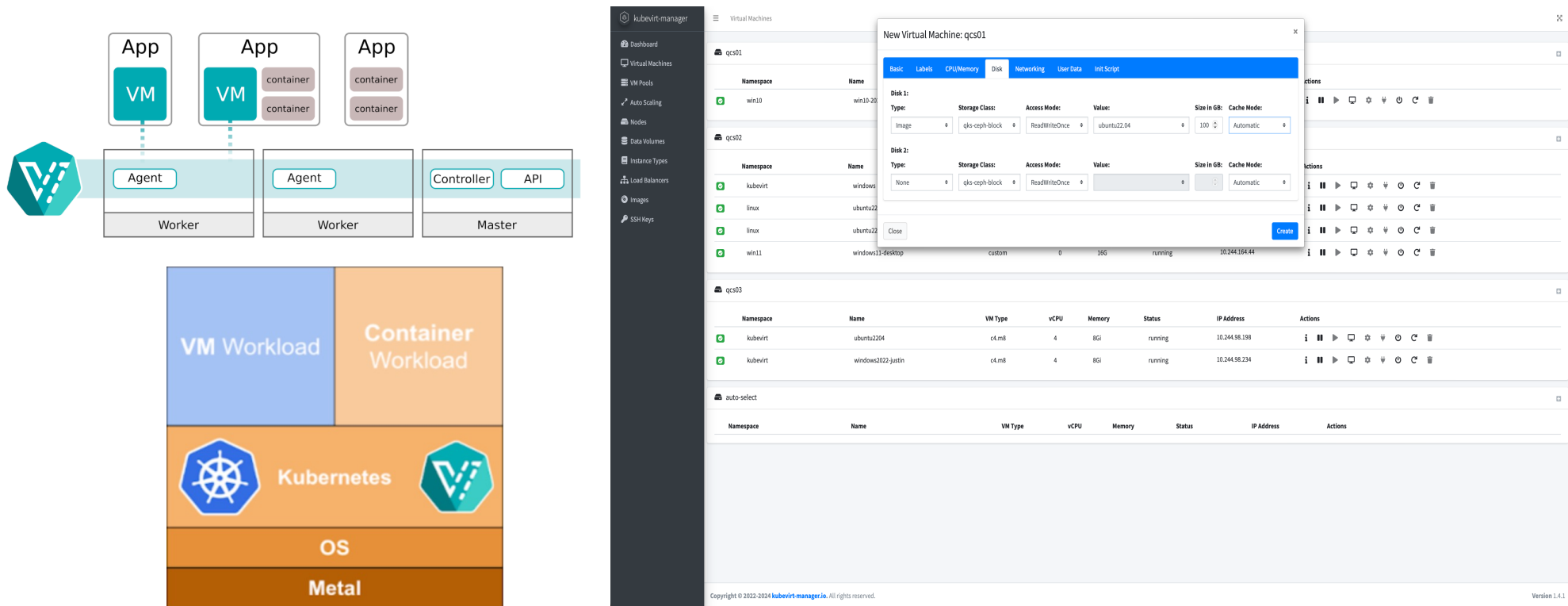
Visualize cluster-specific metrics in a single graph

- OpenTelemetry consolidates the collection of metrics, logs, and traces into a single tool
- Monitor the overall system status and identify relationships between data
- In a multi-cluster environment, a collector is deployed in each cluster, but a single centralized backend can store and process all data for unified management.
- OpenTelemetry, a CNCF project, is based on open standards and can integrate with various backends, enabling flexible usage without vendor lock-in.

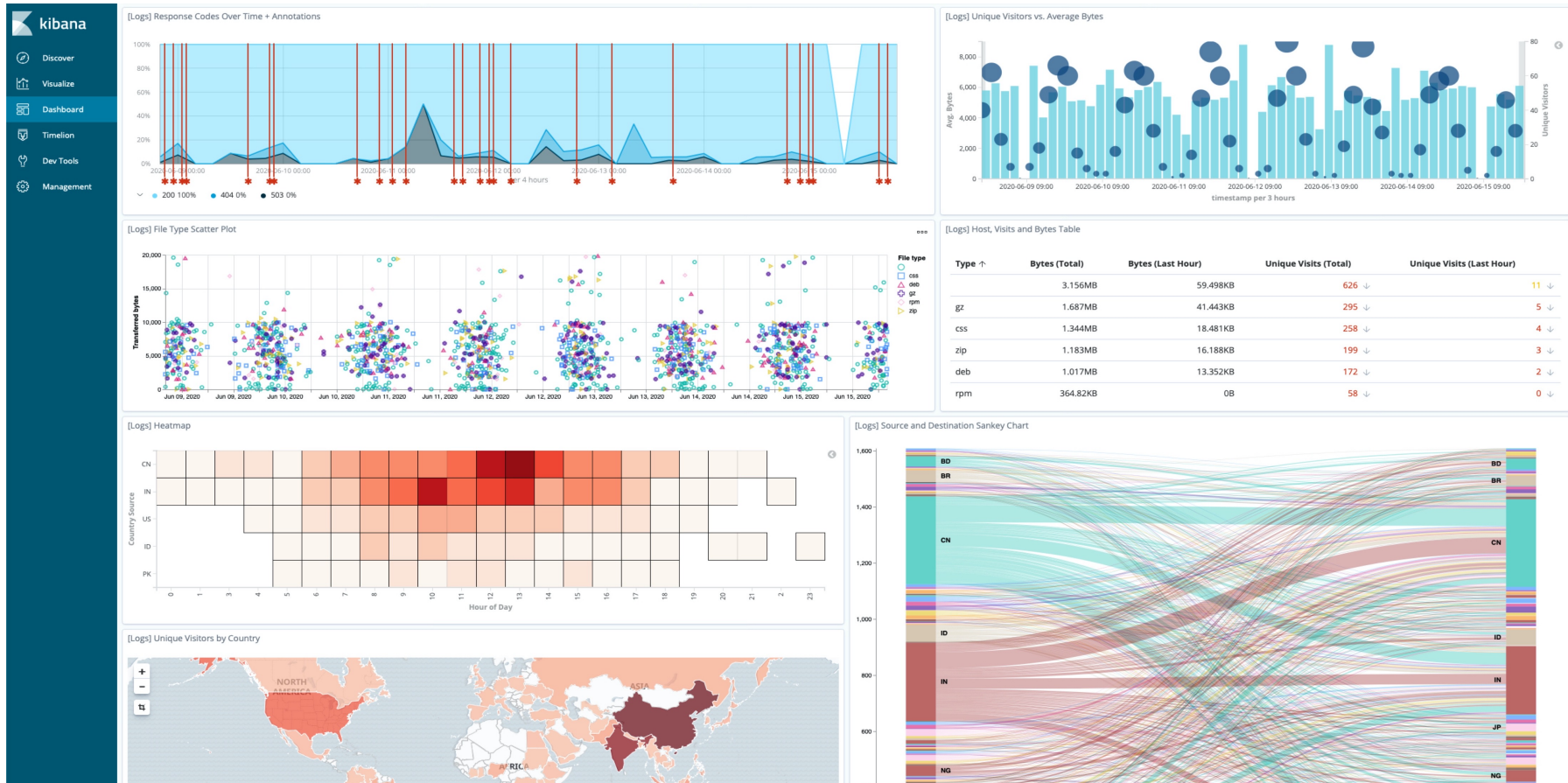
## 3.2 IaaS – QKS Enterprise ( KubeVirt )

### • KubeVirt

- An open-source project that enables native execution and management of virtual machines within a Kubernetes cluster
- Allows containerized applications and legacy VM workloads to be integrated and operated on the same Kubernetes infrastructure.
- A cost-effective alternative to VDI solutions
- VM management, logging, and console access using KubeVirt-Manager
- Since VMs run as Pods, recovery can be easily executed from another node in case of server failure
- Since VMs are created very quickly, test K8s clusters can be created automatically, tested and deleted during CI/CD process
- Supported VM : Windows10,11,2022 Server, Almost All Linux Distributions
- Support for converting servers running in the existing on-premises environment into images and transitioning them to KubeVirt VMs

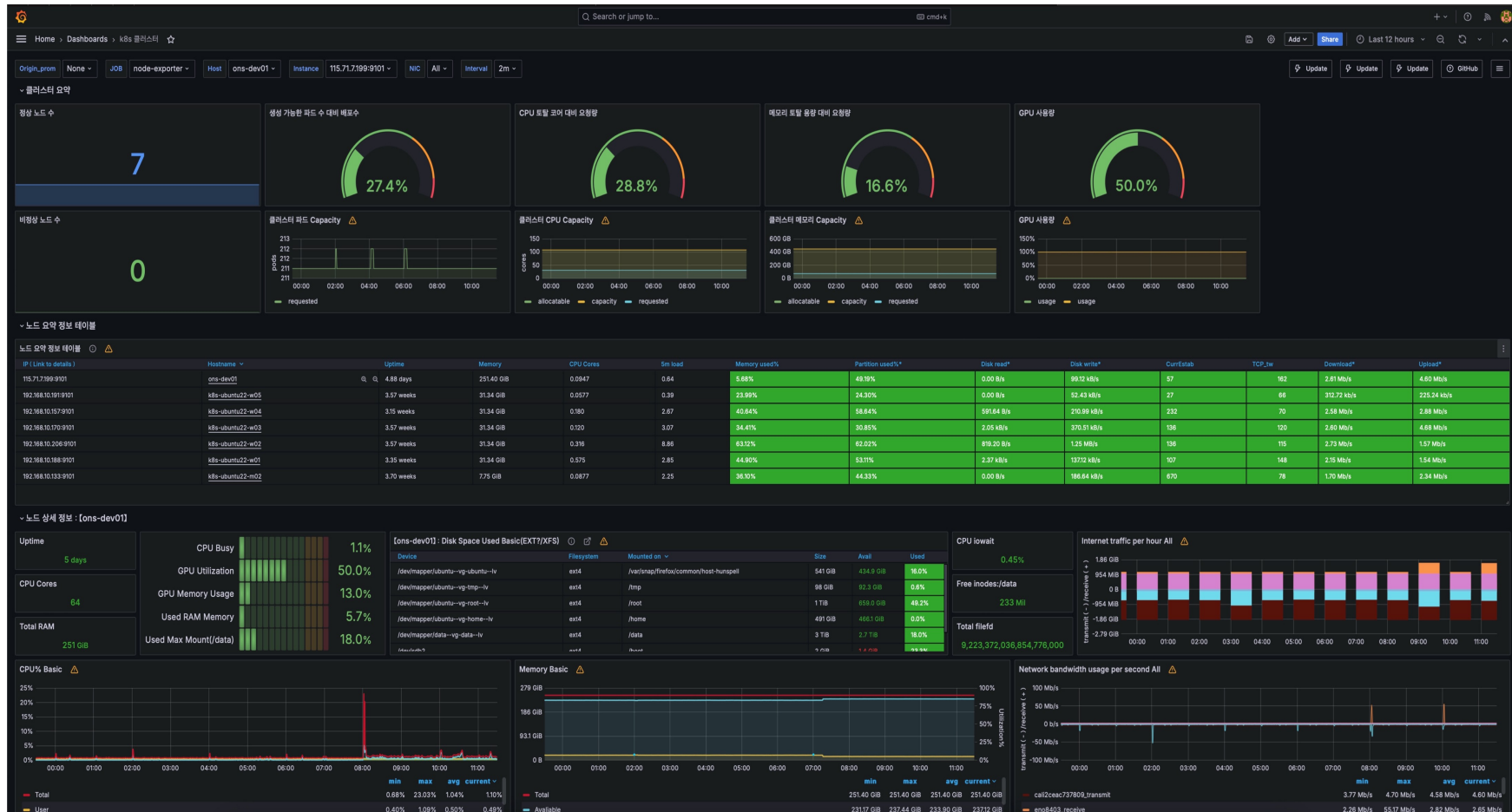


## 3.2 IaaS – Log Service



- EFK Stack Service / Loki Service
- K8s Platform Service Log Analysis
- Collection and Analysis of Application Pod Log
- Visualized dashboard via Kibana/Grafana
- Provides basic functionality setup service, while advanced features need customization and development

## 3.2 IaaS – Monitoring Service

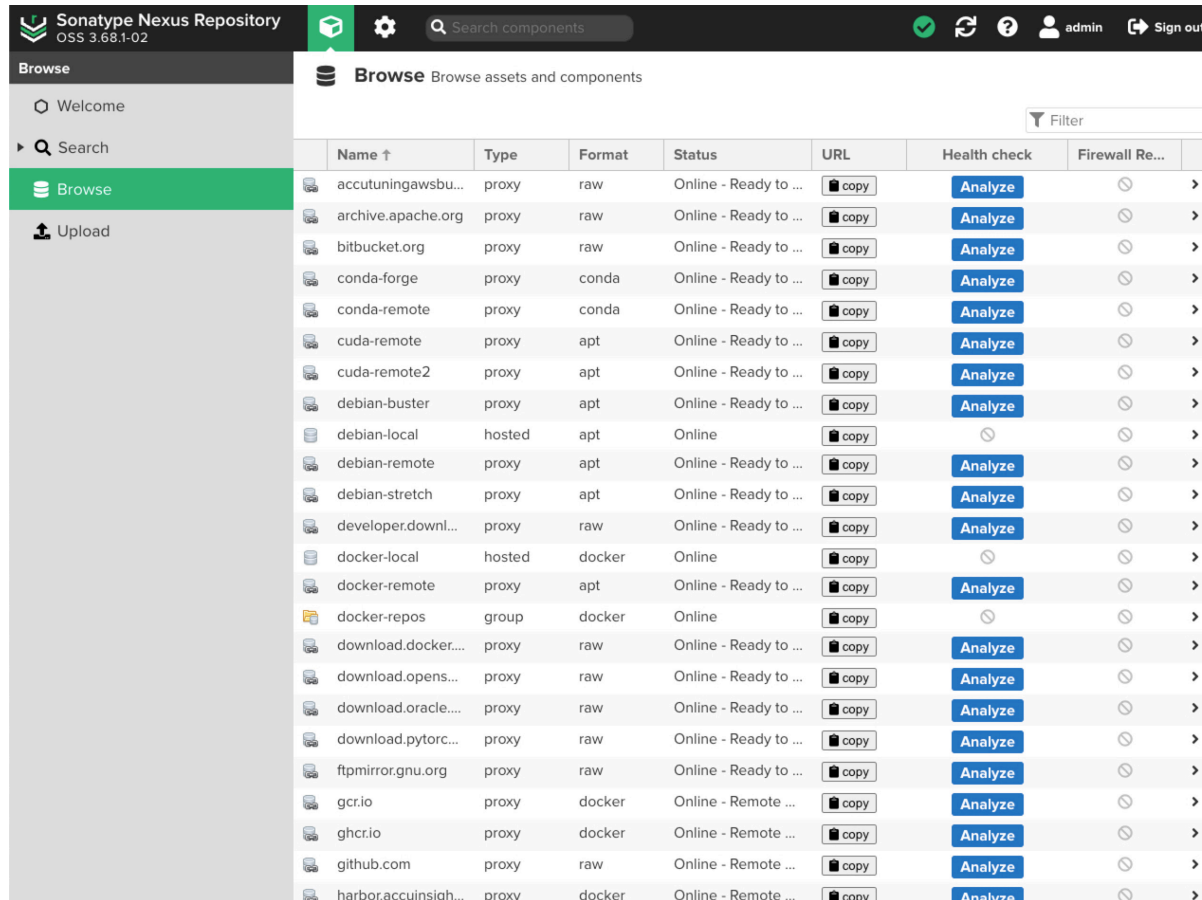


- Prometheus & Grafana service
- Resource monitoring and management services for GPU, DB, VM, containers, and more.
- Provides basic setup service. Additional features beyond the basic functionality require customization.
- Alarm service configuration available for Email, Slack, etc.

## 3.2 IaaS – Repository Proxy Service

- **Nexus**

- **Storage Service for Air-Gapped Environments**
- **Compatible with Docker Image, Linux package, Python Library, R Library, Conda, etc.**
- **Load build-required files into Nexus and import them into the site, then establish a CI/CD system within the site**
- **Provide proxy functionality to enable usage without changing image tags, even in air-gapped environments**

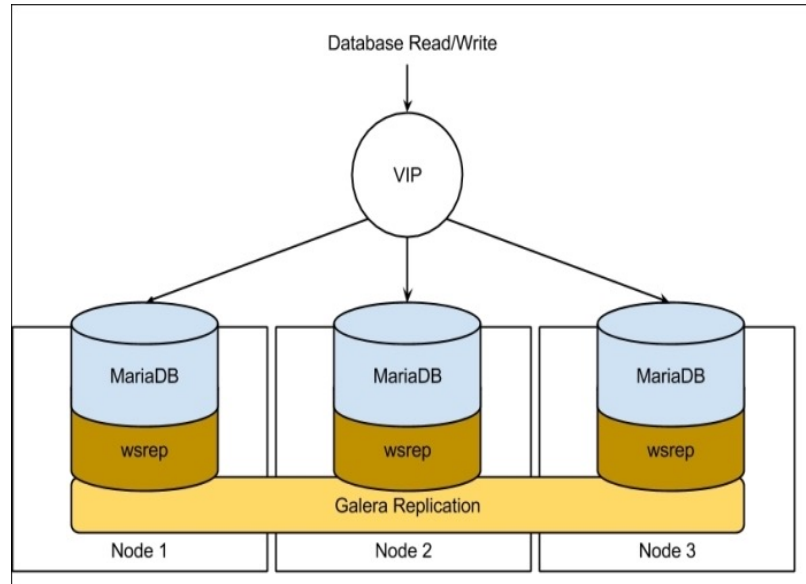


The screenshot displays the Sonatype Nexus Repository OSS 3.68.1-02 interface. The top navigation bar includes the Sonatype logo, version information, a search bar, and user controls (admin, Sign out). The left sidebar shows the 'Browse' menu with options like 'Welcome', 'Search', 'Browse', and 'Upload'. The main content area is titled 'Browse' and contains a table of repository assets. The table has columns for Name, Type, Format, Status, URL, Health check, and Firewall Re... (likely Firewall Rules). The table lists various repository assets, including proxy and hosted repositories, with their respective formats and statuses. Each row includes a 'copy' icon for the URL and an 'Analyze' button for the health check.

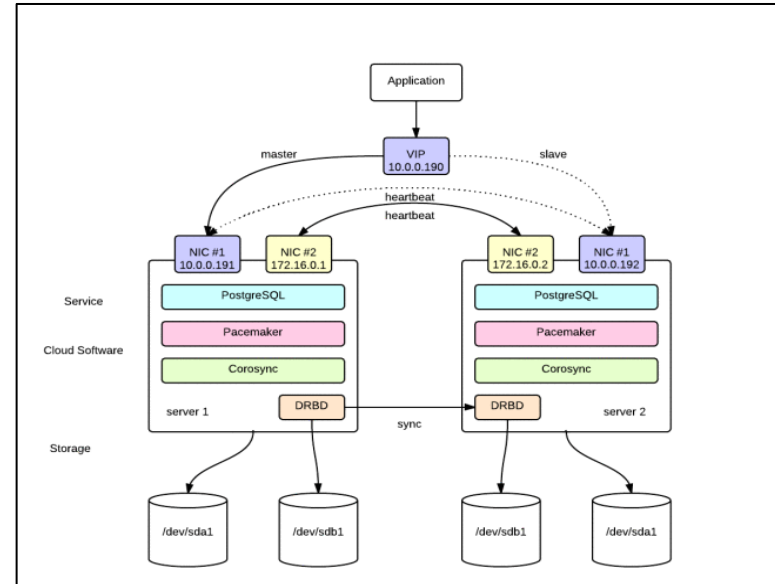
| Name ↑               | Type   | Format | Status                | URL  | Health check | Firewall Re... |
|----------------------|--------|--------|-----------------------|------|--------------|----------------|
| accutuningawsbu...   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| archive.apache.org   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| bitbucket.org        | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| conda-forge          | proxy  | conda  | Online - Ready to ... | copy | Analyze      |                |
| conda-remote         | proxy  | conda  | Online - Ready to ... | copy | Analyze      |                |
| cuda-remote          | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| cuda-remote2         | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| debian-buster        | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| debian-local         | hosted | apt    | Online                | copy |              |                |
| debian-remote        | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| debian-stretch       | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| developer.downl...   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| docker-local         | hosted | docker | Online                | copy |              |                |
| docker-remote        | proxy  | apt    | Online - Ready to ... | copy | Analyze      |                |
| docker-repos         | group  | docker | Online                | copy |              |                |
| download.docker...   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| download.opens...    | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| download.oracle...   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| download.pytorc...   | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| ftpmirror.gnu.org    | proxy  | raw    | Online - Ready to ... | copy | Analyze      |                |
| gcr.io               | proxy  | docker | Online - Remote ...   | copy | Analyze      |                |
| ghcr.io              | proxy  | docker | Online - Remote ...   | copy | Analyze      |                |
| github.com           | proxy  | raw    | Online - Remote ...   | copy | Analyze      |                |
| harbor.accuinsigh... | proxy  | docker | Online - Remote ...   | copy | Analyze      |                |

## 3.3 PaaS – Database

- Database HA Service over OpenStack or Kubernetes
  - Configuration : Active-active / Active-standby (AA recommended)
  - Compatible databases :
    - RDBMS : Mysql, MariaDB, PostgreSQL
    - NoSQL : Elastic Search, MongoDB, Couchbase, Cassandra, Hadoop
  - Installation of open-source databases can be supported on customer request



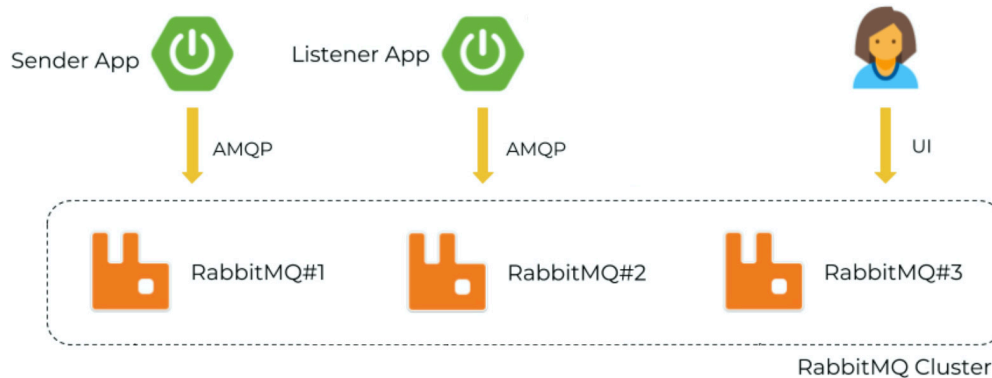
Active-Active : Mariadb,Mysql Galera Cluster



Active-Standby : PostgreSQL

## 3.3 PaaS – Messaging Service

- RabbitMQ Cluster HA mode



- Kafka Cluster HA mode

UI for Apache Kafka ⚠ b0c367c v0.6.2

Dashboard

auction-kafka ^

Brokers

Topics

Consumers

recycle-kafka ^

Brokers

Topics

Consumers

### Brokers

Uptime

|              |                   |         |
|--------------|-------------------|---------|
| Broker Count | Active Controller | Version |
| 3            | 0                 | 3.2-IV0 |

Partitions

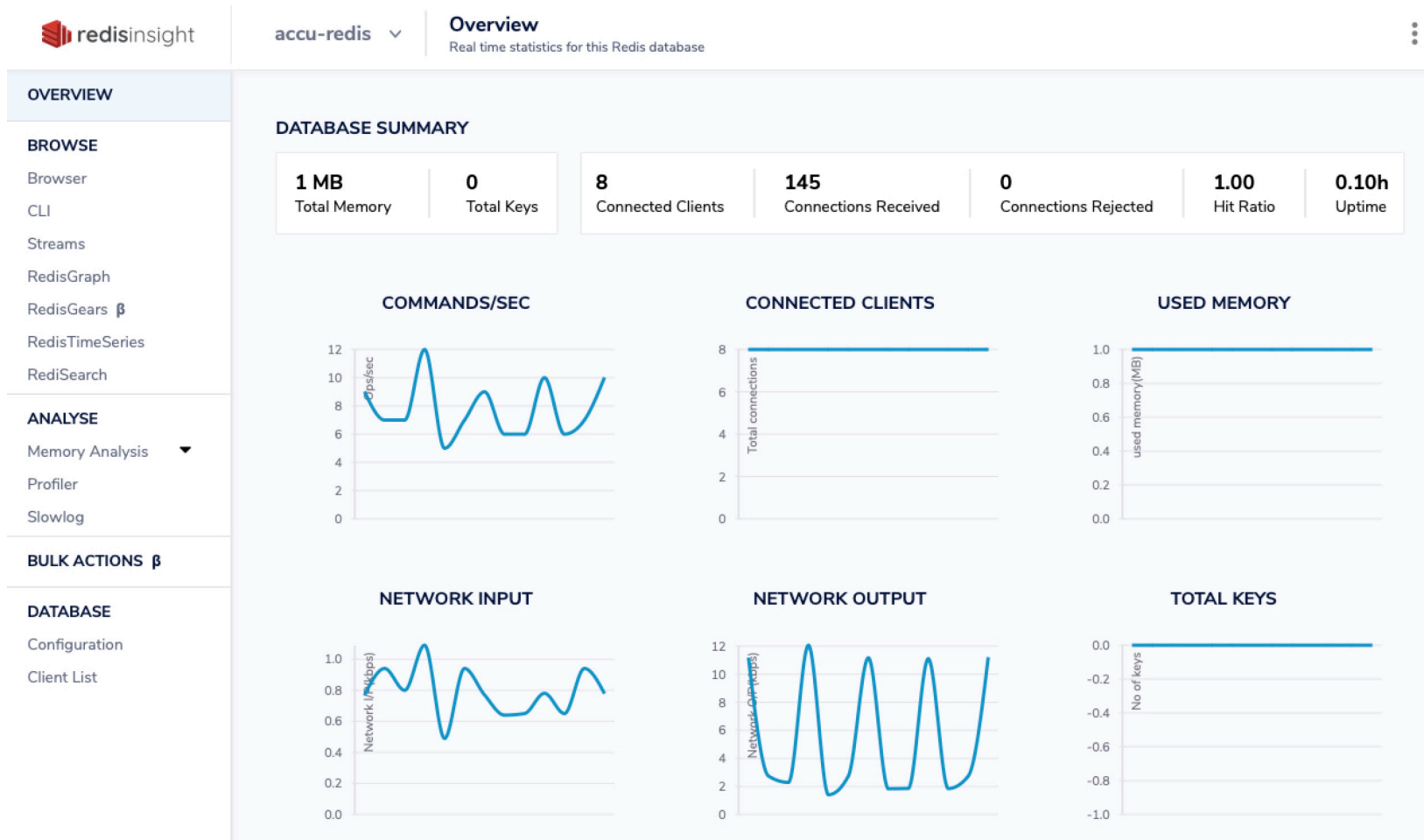
|          |     |                  |                      |
|----------|-----|------------------|----------------------|
| Online   | URP | In Sync Replicas | Out Of Sync Replicas |
| 65 of 65 | 0   | 65 of 65         | 0                    |

| Broker ID        | Segment Size | Segment Count | Port | Host  |
|------------------|--------------|---------------|------|---|
| 0                | 90 MB        | 24            | 9092 | jcob-kafka-0.jcob-kafka-headless.jcob.svc.cluster.local |
| 1 <span>✓</span> | 63 MB        | 21            | 9092 | jcob-kafka-1.jcob-kafka-headless.jcob.svc.cluster.local |
| 2                | 136 MB       | 20            | 9092 | jcob-kafka-2.jcob-kafka-headless.jcob.svc.cluster.local |



## 3.3 PaaS – Cache Service

- Redis Cluster





## 3.3 PaaS – Elasticsearch / OpenSearch

- OpenSearch Cluster

OpenSearch Dashboards

Index Management / Indices

a

Index Management

Index Policies

Managed Indices

Indices

Rollup Jobs

Transform Jobs

Snapshot Management

Snapshot Policies

Snapshots

Repositories

Indices

Apply policy

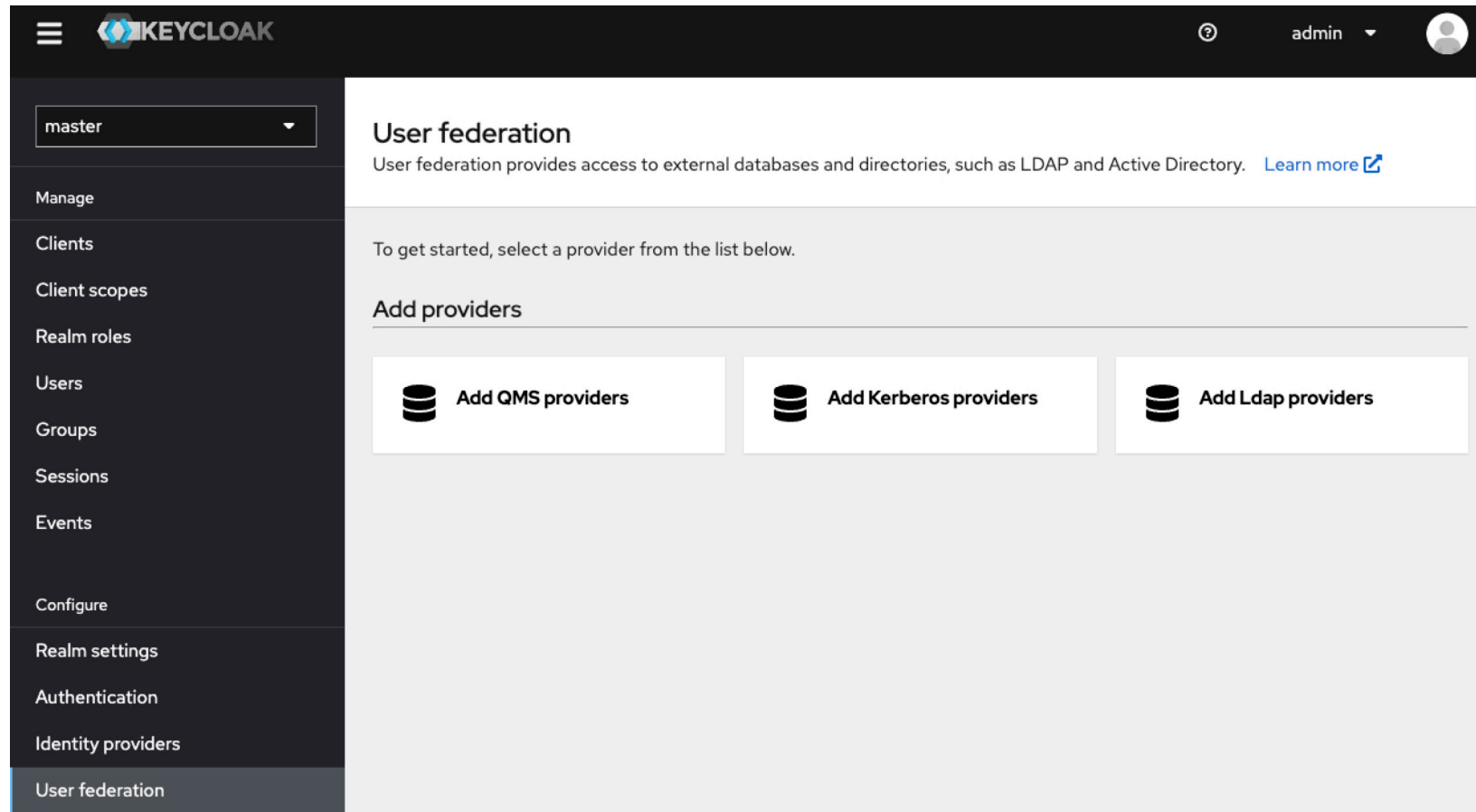
☐ Show data stream indices

| <input type="checkbox"/> Index ↓                      | Health | Managed by Policy | Status | Total si... | Primari... | Total d... | Delete... | Primari... | Replicas |
|---|--------|-------------------|--------|-------------|------------|------------|-----------|------------|----------|
| <input type="checkbox"/> security-auditlog-2024.08.28 | green  | No                | open   | 577.6...    | 252.6...   | 23         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.27 | green  | No                | open   | 235.4...    | 91.3kb     | 12         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.26 | green  | No                | open   | 311.6...    | 127.7...   | 39         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.25 | green  | No                | open   | 235.1...    | 91.2kb     | 12         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.24 | green  | No                | open   | 193.3...    | 70.3kb     | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.23 | green  | No                | open   | 164.2...    | 90.9kb     | 12         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.22 | green  | No                | open   | 256kb       | 128kb      | 7          | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.21 | green  | No                | open   | 138.5...    | 69.2kb     | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.20 | green  | No                | open   | 285.6...    | 142.8...   | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.19 | green  | No                | open   | 223.2...    | 127.9...   | 7          | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.18 | green  | No                | open   | 181.2...    | 90.6kb     | 12         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.17 | green  | No                | open   | 242.4...    | 121.2...   | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.16 | green  | No                | open   | 382.2...    | 191.1...   | 10         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.15 | green  | No                | open   | 139.3...    | 69.6kb     | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.14 | green  | No                | open   | 282.2...    | 141.1...   | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.13 | green  | No                | open   | 137.7...    | 68.8kb     | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.12 | green  | No                | open   | 172.6...    | 86.3kb     | 12         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.11 | green  | No                | open   | 245kb       | 122.5...   | 11         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.10 | green  | No                | open   | 380.9...    | 190.4...   | 10         | 0         | 1          | 1        |
| <input type="checkbox"/> security-auditlog-2024.08.09 | green  | No                | open   | 178.2...    | 89.1kb     | 12         | 0         | 1          | 1        |

Rows per page: 20

< 1 2 3 4 5 6 >

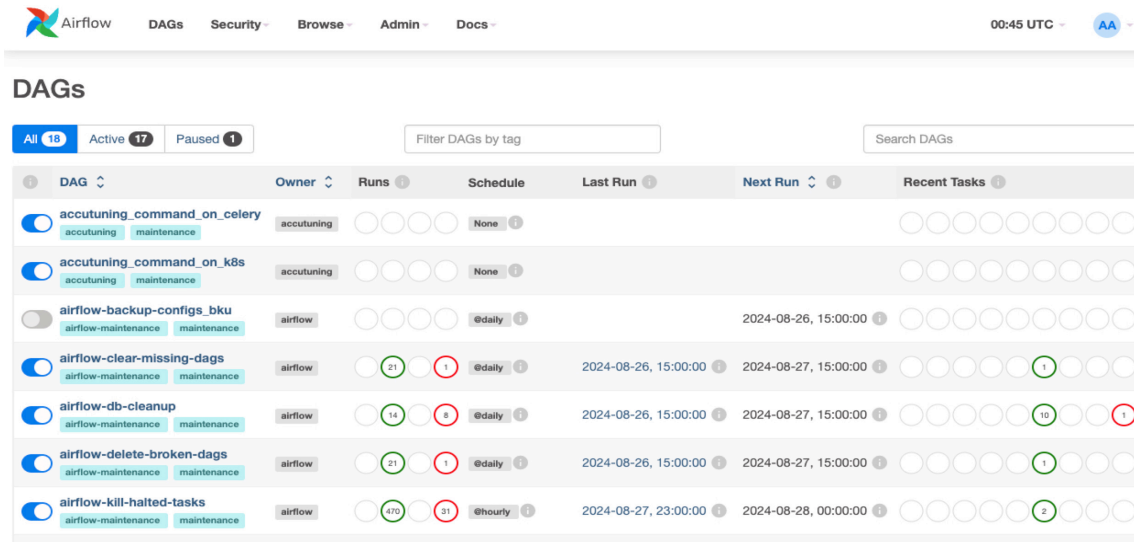
- **Keycloak**



- **Can be integrated with external DB ( QMS Providers )**

## 3.3 PaaS – ML / AI Service

- Airflow



The screenshot shows the Apache Airflow web interface. At the top, there's a navigation bar with links for DAGs, Security, Browse, Admin, and Docs. The current time is 00:45 UTC. Below the navigation bar, the 'DAGs' section is active. It features a filter bar with 'All 15', 'Active 17', and 'Paused 1' buttons, along with a 'Filter DAGs by tag' input and a 'Search DAGs' search bar. The main table lists various DAGs with columns for DAG name, Owner, Runs, Schedule, Last Run, Next Run, and Recent Tasks. The DAGs include 'accutuning\_command\_on\_celery', 'accutuning\_command\_on\_k8s', 'airflow-backup-configs\_bku', 'airflow-clear-missing-dags', 'airflow-db-cleanup', 'airflow-delete-broken-dags', and 'airflow-kill-halted-tasks'.

| DAG                          | Owner      | Runs    | Schedule             | Last Run             | Next Run | Recent Tasks |
|------------------------------|------------|---------|----------------------|----------------------|----------|--------------|
| accutuning_command_on_celery | accutuning | None    | None                 |                      |          |              |
| accutuning_command_on_k8s    | accutuning | None    | None                 |                      |          |              |
| airflow-backup-configs_bku   | airflow    | @daily  | 2024-08-26, 15:00:00 |                      |          |              |
| airflow-clear-missing-dags   | airflow    | @daily  | 2024-08-26, 15:00:00 | 2024-08-27, 15:00:00 |          |              |
| airflow-db-cleanup           | airflow    | @daily  | 2024-08-26, 15:00:00 | 2024-08-27, 15:00:00 |          |              |
| airflow-delete-broken-dags   | airflow    | @daily  | 2024-08-26, 15:00:00 | 2024-08-27, 15:00:00 |          |              |
| airflow-kill-halted-tasks    | airflow    | @hourly | 2024-08-27, 23:00:00 | 2024-08-28, 00:00:00 |          |              |

- Knative Serving / Kserve / Cert Manager / Istio / Tekton

```
ubuntu sk-dev * SK knative-operator ~ $ kubectl get pod -n knative-operator
```

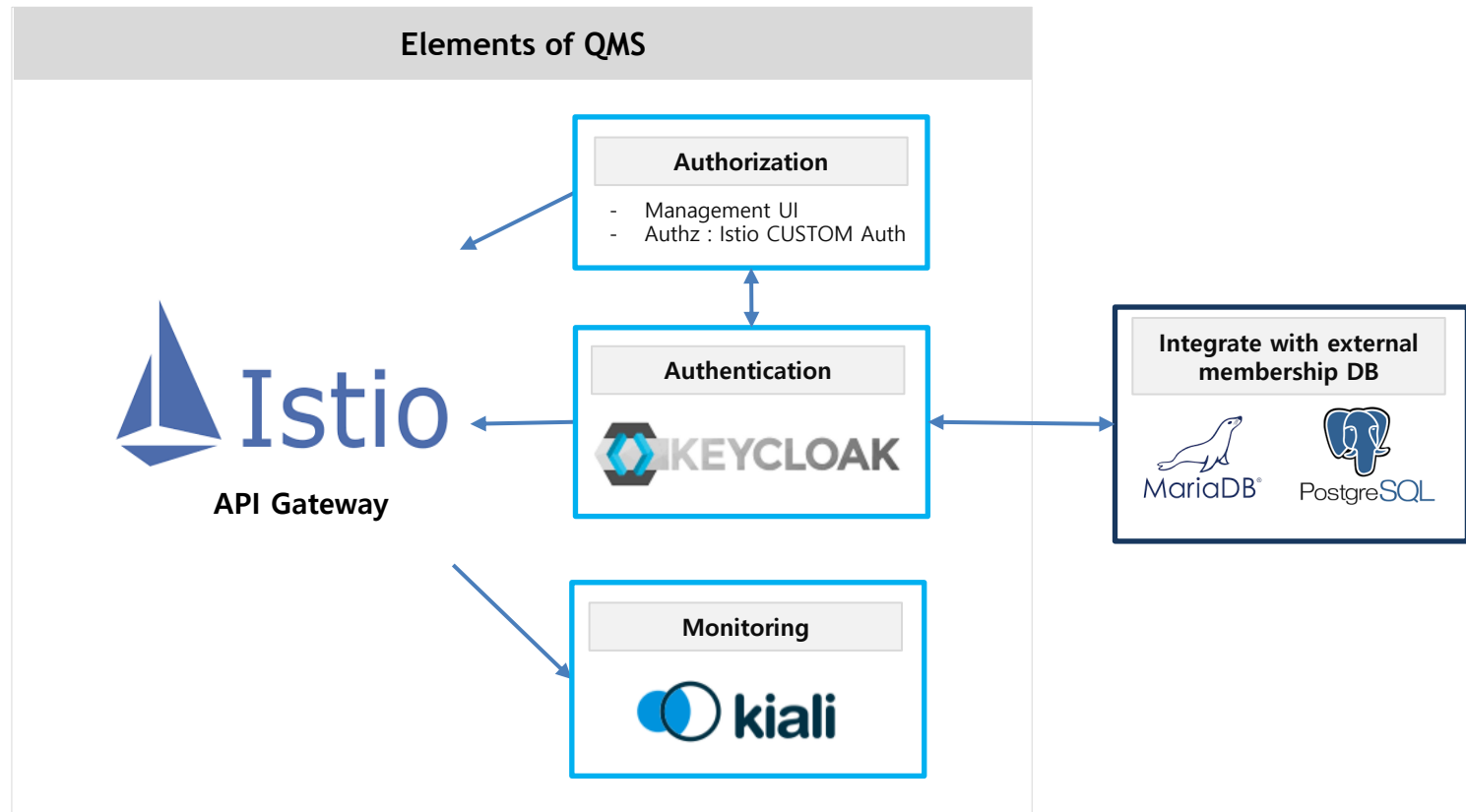
| NAME                              | READY | STATUS  | RESTARTS    | AGE |
|-----------------------------------|-------|---------|-------------|-----|
| knative-operator-6dfd6c7479-2rsth | 1/1   | Running | 3 (25d ago) | 37d |
| operator-webhook-6f44b4fb9f-lpjj2 | 1/1   | Running | 5 (25d ago) | 37d |

```
ubuntu sk-dev * SK knative-operator ~ $ kubectl get pod -n knative-serving
```

| NAME  | READY | STATUS  | RESTARTS      | AGE |
|---|-------|---------|---------------|-----|
| activator-55d856fccd-p8lkn                  | 1/1   | Running | 2 (24d ago)   | 36d |
| autoscaler-5fb49c64c7-84wzs                 | 1/1   | Running | 3 (24d ago)   | 36d |
| autoscaler-hpa-6cc9d9d784-csrbp             | 1/1   | Running | 2 (24d ago)   | 36d |
| controller-ddbb9d4f-cj4rp                   | 1/1   | Running | 2 (24d ago)   | 36d |
| net-certmanager-controller-66bd995955-6hkzr | 1/1   | Running | 3 (24d ago)   | 36d |
| net-certmanager-webhook-68657dd744-clnnq    | 1/1   | Running | 2 (24d ago)   | 36d |
| net-istio-controller-cc877c4dc-tfjsl        | 1/1   | Running | 4 (24d ago)   | 36d |
| net-istio-webhook-69cd4975b8-8xb9q          | 1/1   | Running | 7 (6d21h ago) | 36d |
| webhook-85b9744fc5-qfd42                    | 1/1   | Running | 12 (3d9h ago) | 36d |



### MSA Development Platform (Authentication + CI/CD) Integrated Solution for API Gateway and Authentication



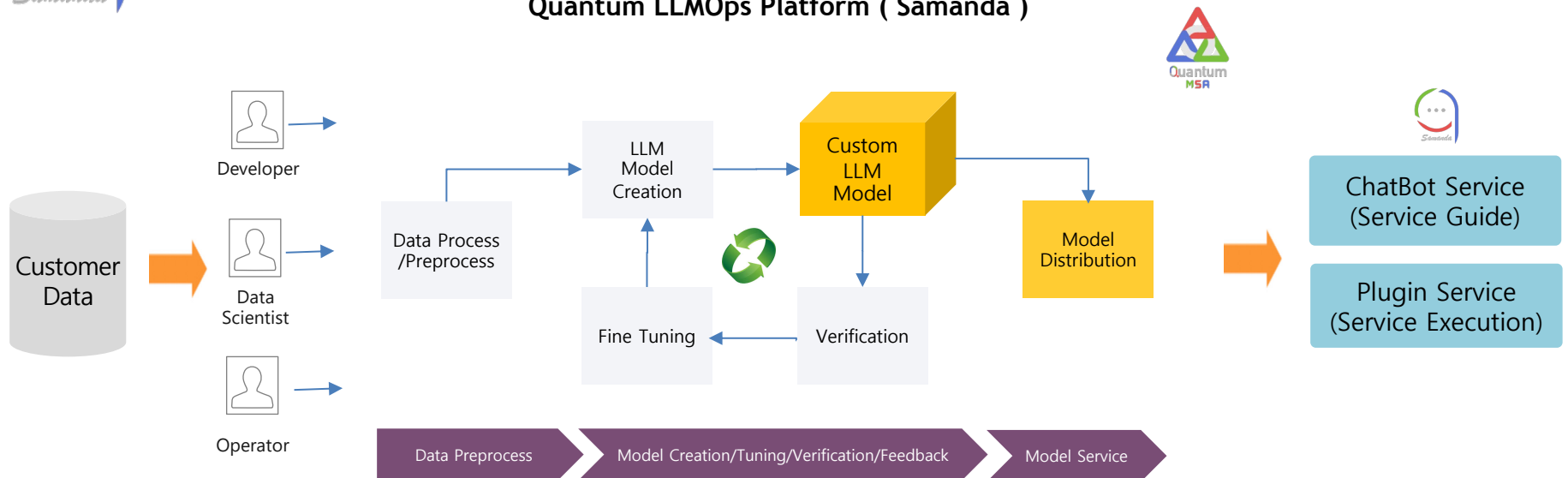
- Integrate Istio with Kiali for monitoring services, applications and workloads
- Integrate Istio with Keycloak to implement authentication and authorization
- Integrate external member DB for authentication, JWT Token Customization and SSO service.
- Control the Authz module via K8s Operator

## 3.4 SaaS – Samanda ( Quantum AI Service )



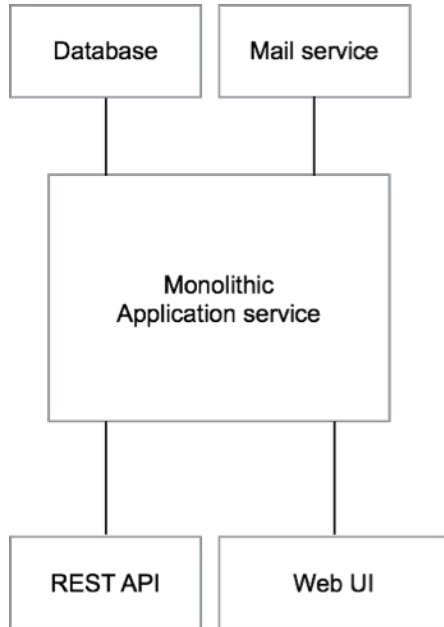
Customer data-based chatGPT service , LLMOps are provided for self-upgrade  
Integrate Samanda and customer service API to provide new UI services

Quantum LLMOps Platform ( Samanda )

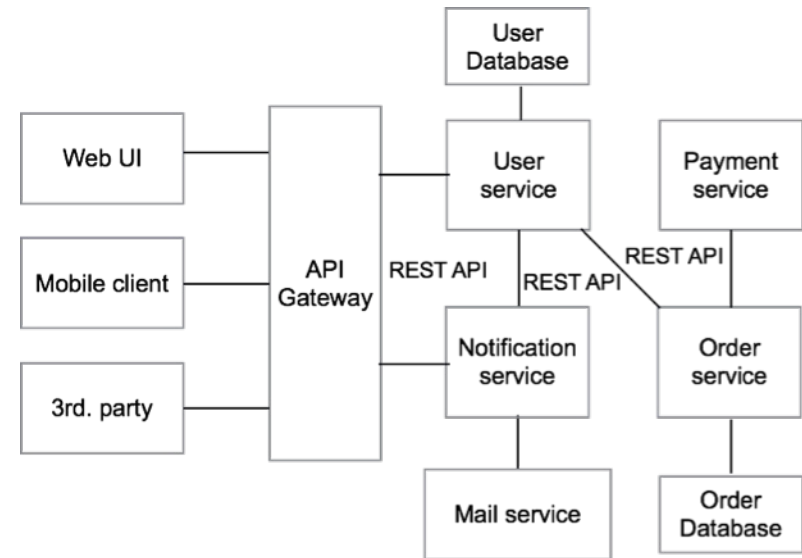


- **Samanda Backbone Model : Adopted Polyglot-Ko ( better than LLaMA in Korean Language processing capability )**
  - Unleashed after training in EleutherAI
  - Trained using 1.2TB of Korean data collected by TuNiB AI, can be used commercially
- Customized chatbot service by fine-tuning the Polyglot-Ko model with customer data
- ChatBot and Customer Service API can be integrated by developing plugin
- Provide an integrated development and operation platform that supports the entire process from data preprocessing to application services, available for both on-premises and public cloud environments.
- Currently researching transfer learning and federated learning technologies to prevent exposure of customer data during the fine-tuning process

## 3.4 SaaS – MSA Development Consulting



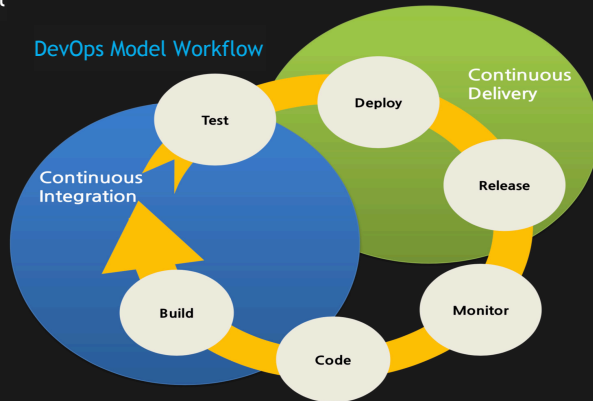
- Current Predominant Architecture Type
- Suitable for simple services / Easy to develop
- Harder to maintain for more complex services
- Framework change is not possible.
- Difficulty in adding new services



- Architectuer suited for the recent cloud era
- Suitable for continuous addition of services
- Services can be updated partially
- Can use plural types of languages and DBs
- Requires highly sophisticated CI/CD automation

## 3.5 CI/CD Overview

### DevOps Model



#### 항목

#### 내용

##### 지속적 통합

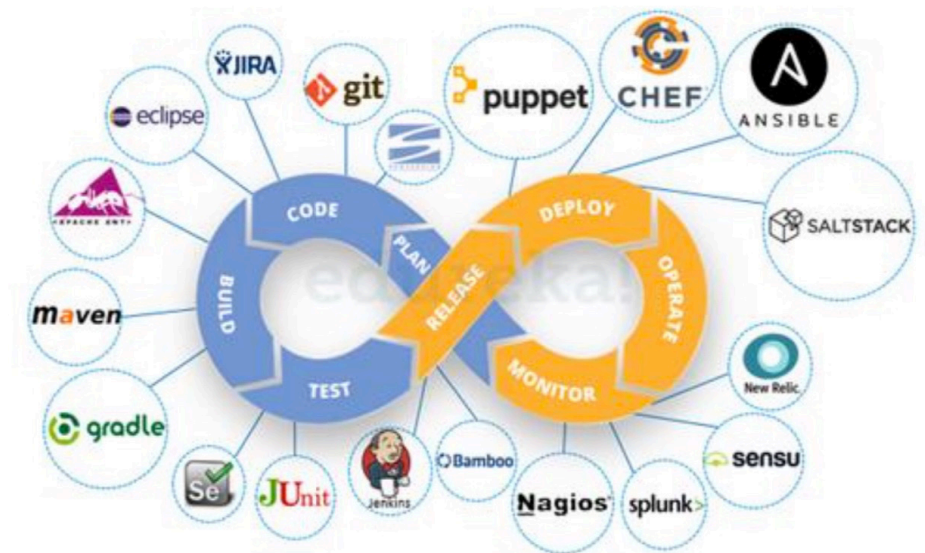
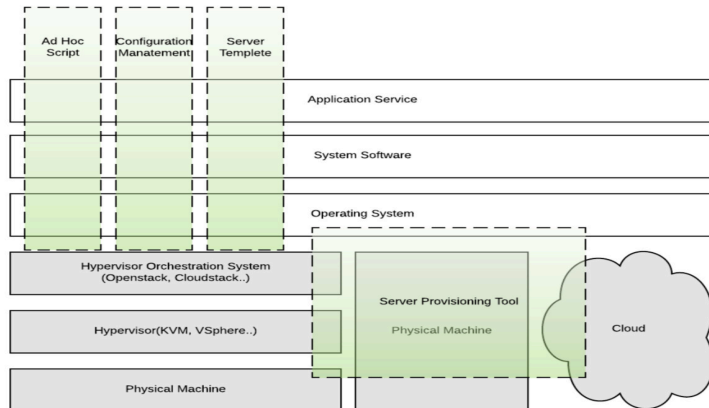
빌드 및 테스트가 수행된 후 개발자가 코드 변경을 중앙 레포지토리에 정기적으로 통합하는 소프트웨어 개발 방식이며 빌드/ 통합 단계를 일컫는다. 주요한 목적은 버그를 신속하게 찾아 해결 하고, 소프트웨어 품질을 높이고, 업데이트 검증 및 릴리즈 시간을 단축 시키는 것 이다.

##### 지속적 전달

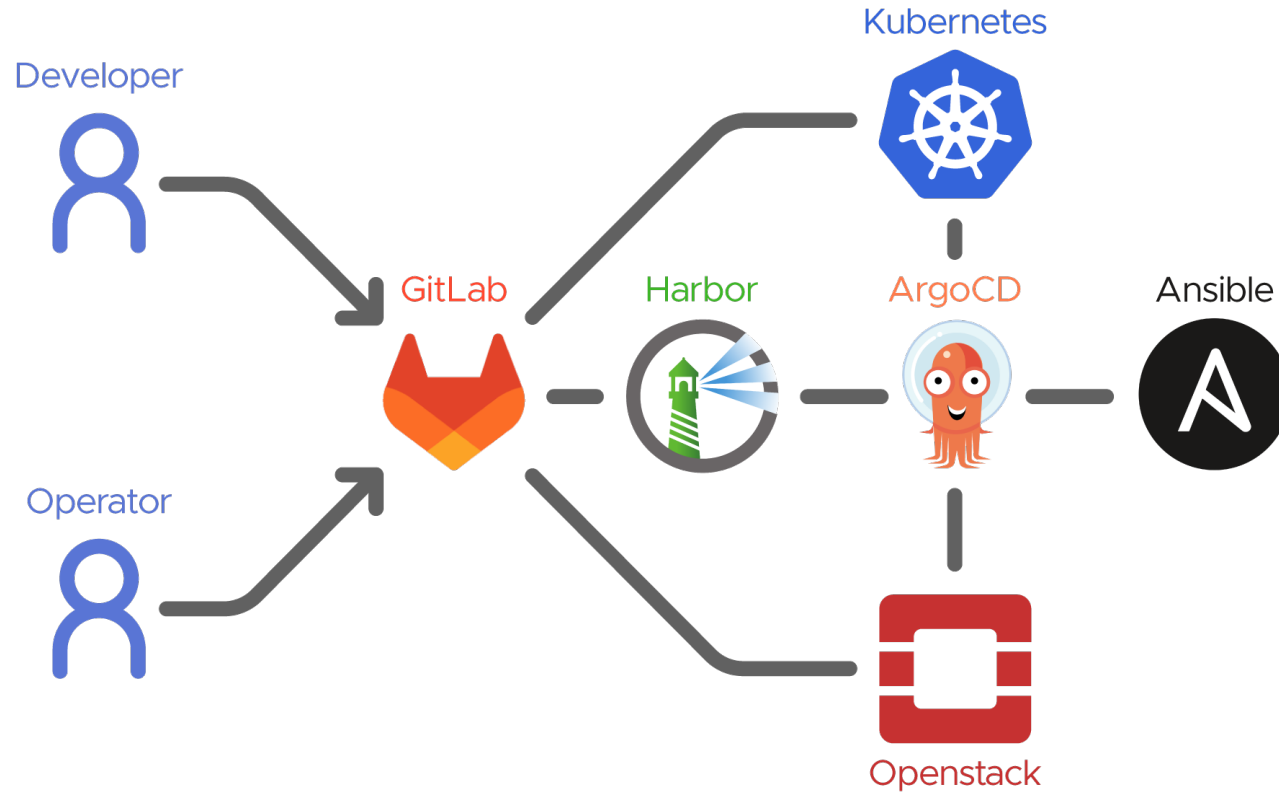
상용 환경으로 릴리즈 하기 위한 코드 변경이 자동으로 빌드, 테스트 및 준비 되는 소프트웨어 개발 방식이다. 빌드 단계 이후 모든 코드 변경을 개발 환경 및 상용환경에 배포 함으로써 지속적 통합을 확장한다

##### 지속적 배포

전체적인 소프트웨어 릴리즈 절차가 자동화 되어 명시적인 승인 없이 자동으로 상용환경에 배포되는 소프트웨어 개발 방식



## 3.5 CI/CD Service Flow



- Development and Operation managed by Git ( DevOps + GitOps )
- CI/CD Toolchain : Gitlab / Harbor / ArgoCD
- IaC Toolchain : Ansible / Terraform
- Automated K8s installation solution for air-gapped environments
- CI/CD policies can be established and tools selected and customized according to the customer's environment



## 4. Why Quantum C&S ?

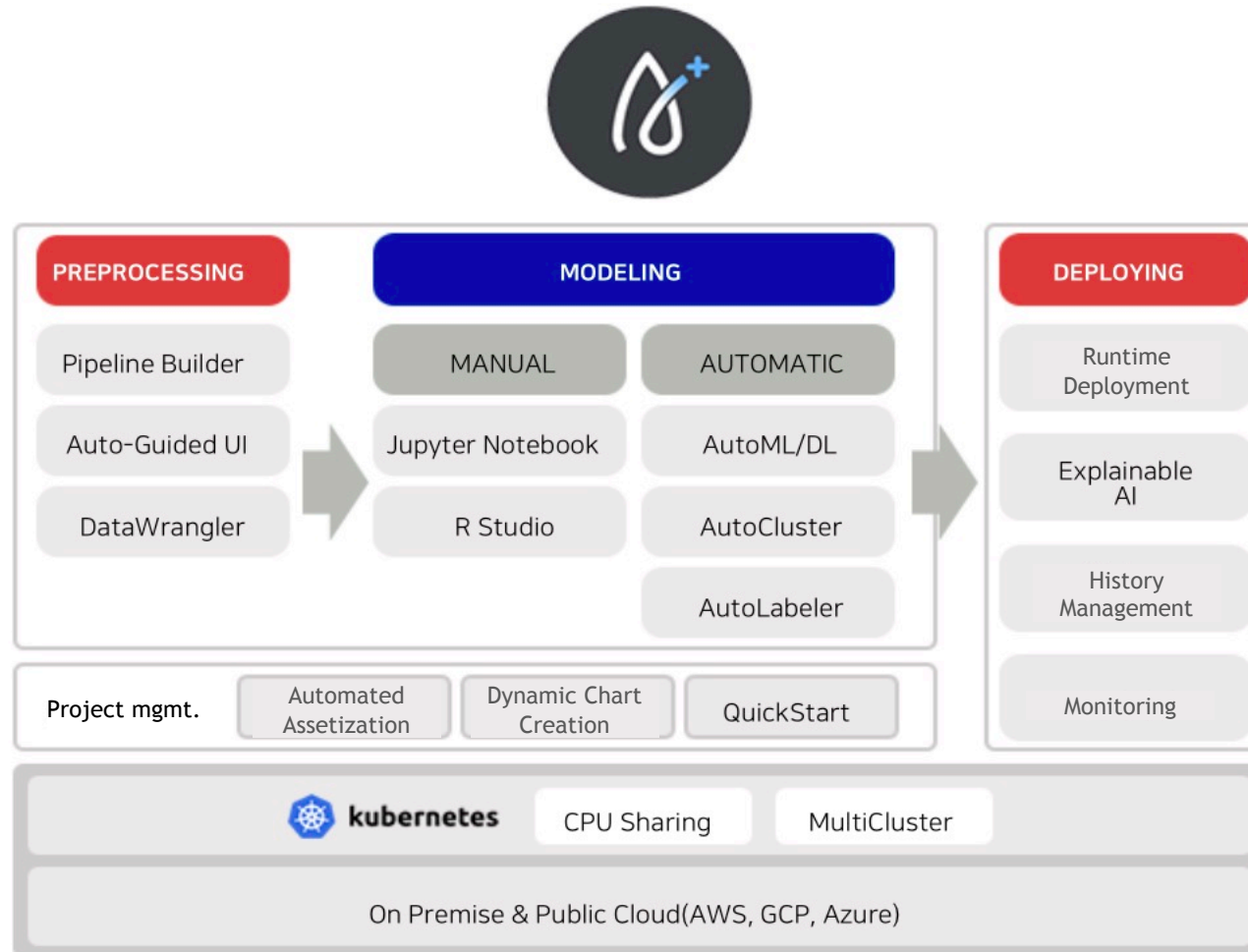
4.1 QCS Clients and Projects

4.2 QCS Key Features



## 4.1 QCS Clients and Projects

- **SK C&C Big Data Analysis Service Partner ( IaaS, PaaS and CI/CD )**
  - Big Data-Based MLOps Service Project
  - Client : SK C&C
  - Project Period : 2021.11 ~
  - Description: Kubernetes , Ceph Installation and Maintenance, AccuInsight Packaging, CI/CD
  - Installation Site : NH Bank, KB Capital, Public Procurement Service, National Pension Service ,NH Insurance, KB Insurance

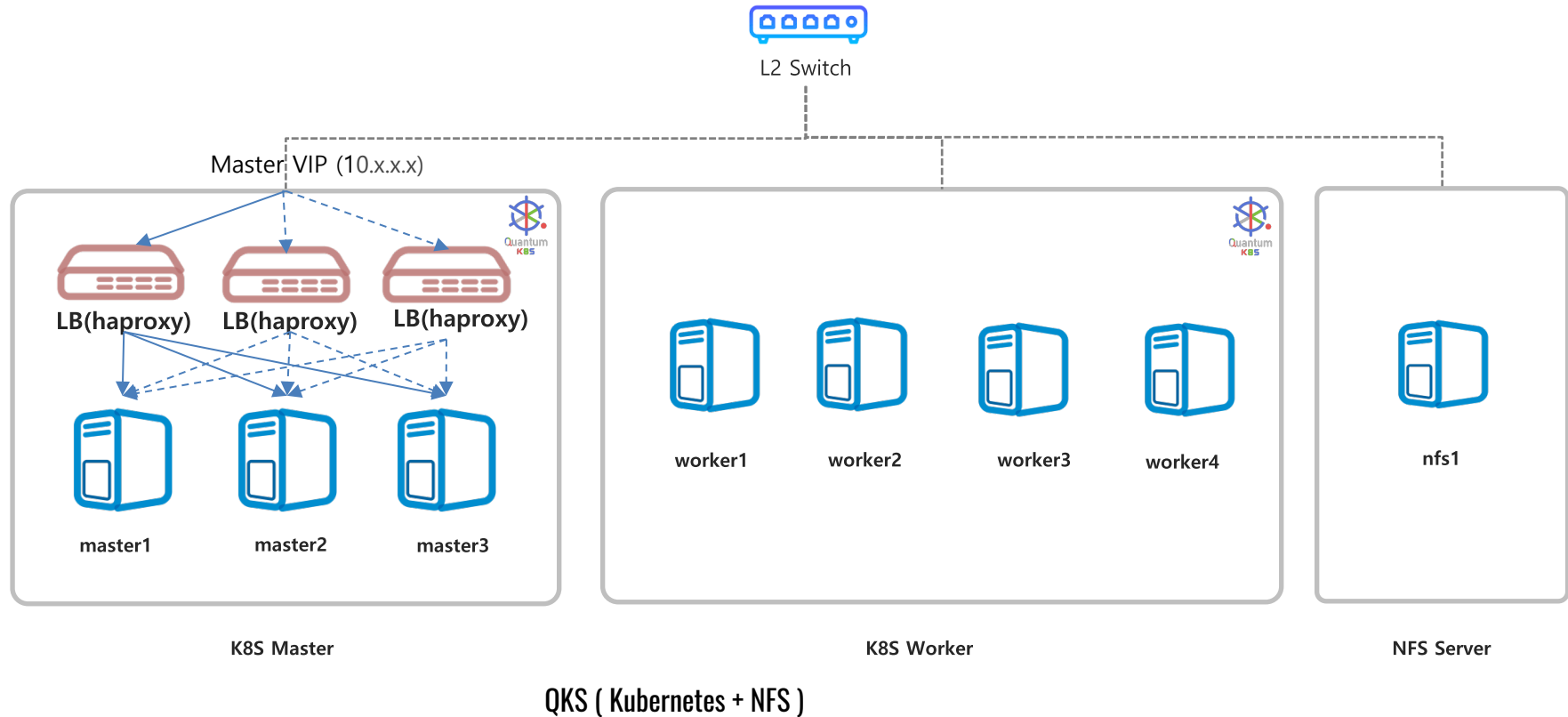


**QKS ( Kubernetes + Ceph )**

## 4.1 QCS Clients and Projects

- Smilegate QKS Delivery ( Perpetual License )

- Smilegate Internal AI Service Development Project
- Client : Smilegate
- Period : 2023.12 ~ 2024.4
- Description: QKS Installation ( IaaS, PaaS , CICD ) , DevOps Consulting and On-site Training



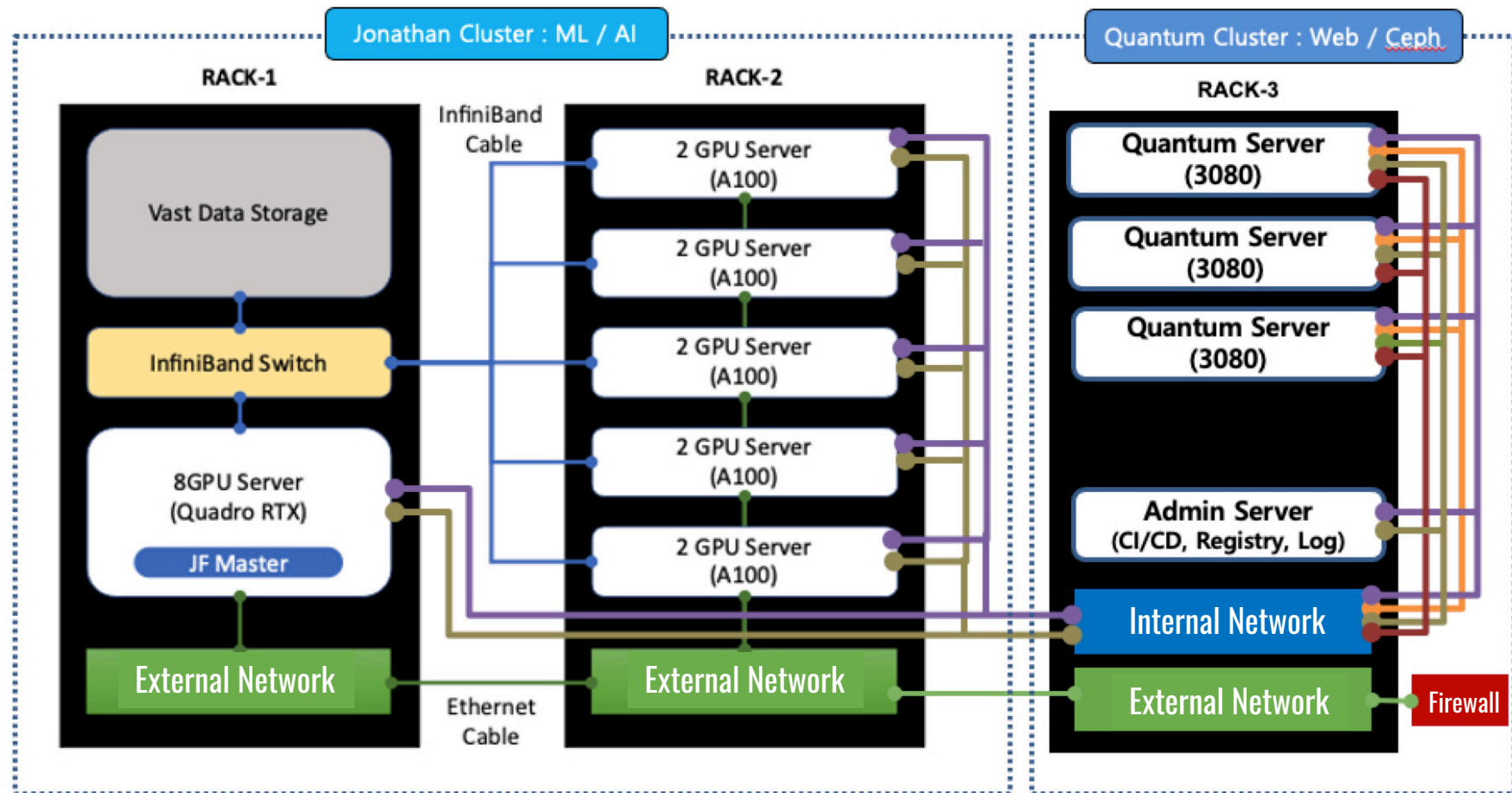
- Architecture

- K8S Stability through HA : HAProxy SW LB is embedded on the master servers, HAProxy is set Keepalived to ensure HA
- Enabled zero downtime service without the need for separate hardware

## 4.1 QCS Clients and Projects

- **Acryl's Jonathan Service – AI & MLOps Project**

- Big Data and AI Service Project
- Configuring all backend systems based on Kubernetes, Separating deep learning clusters and web service clusters, Migrating from Public Cloud to QCS
- Client : Acryl
- Period : 2021.2 ~ 2021.4

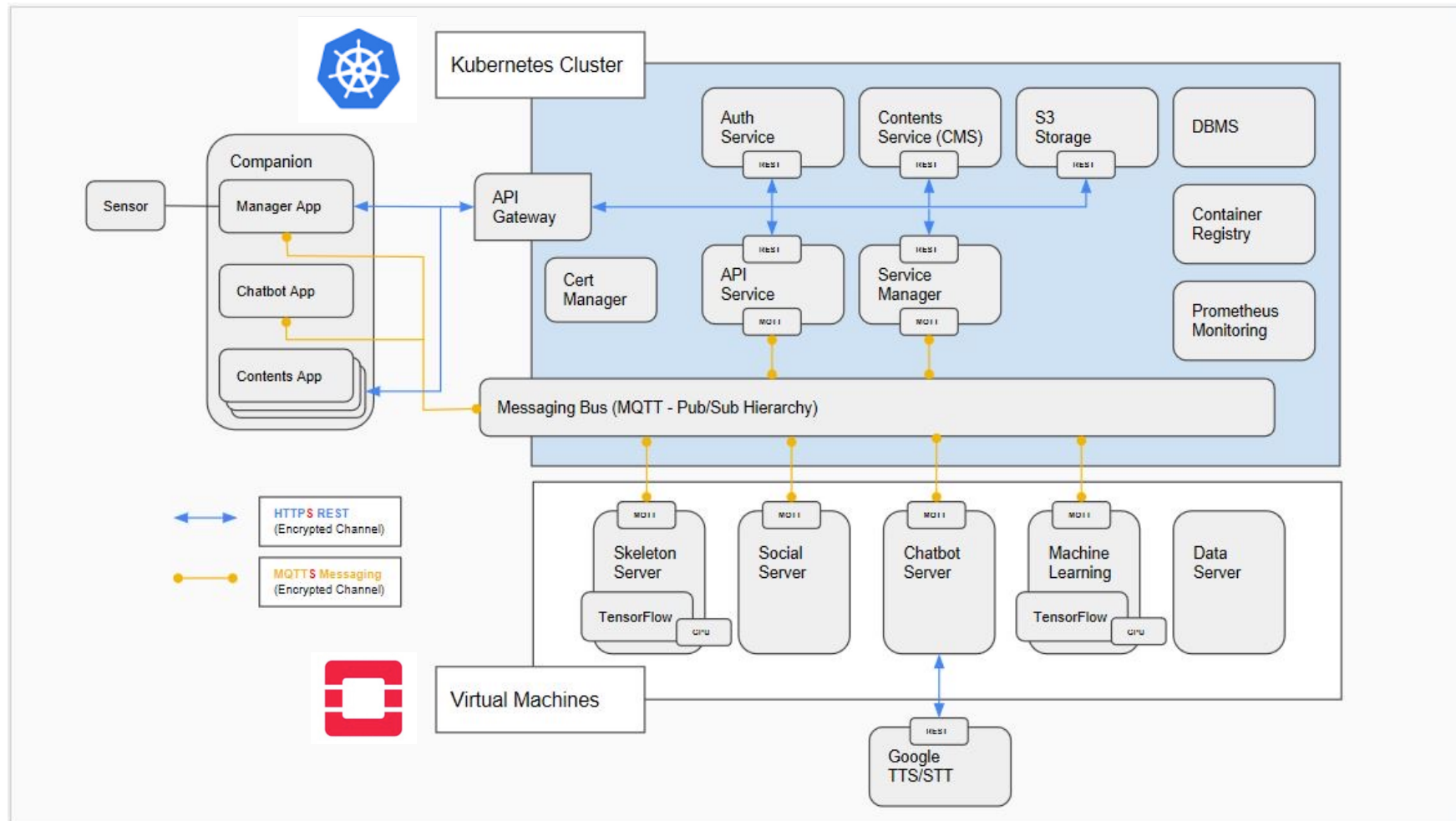


QOS + QKS + QSS (OpenStack + Kubernetes + Ceph)

## 4.1 QCS Clients and Projects

- **DigitalCompanion – ML & AI Project**

- A service project that collects and analyzes data transmitted from companion robots to provide real-time information to owners' smartphones
- Backend system was configured on QCS for data collection, storage, analysis, and service
- Client : Government funded project
- Period : 2018 ~ 2020

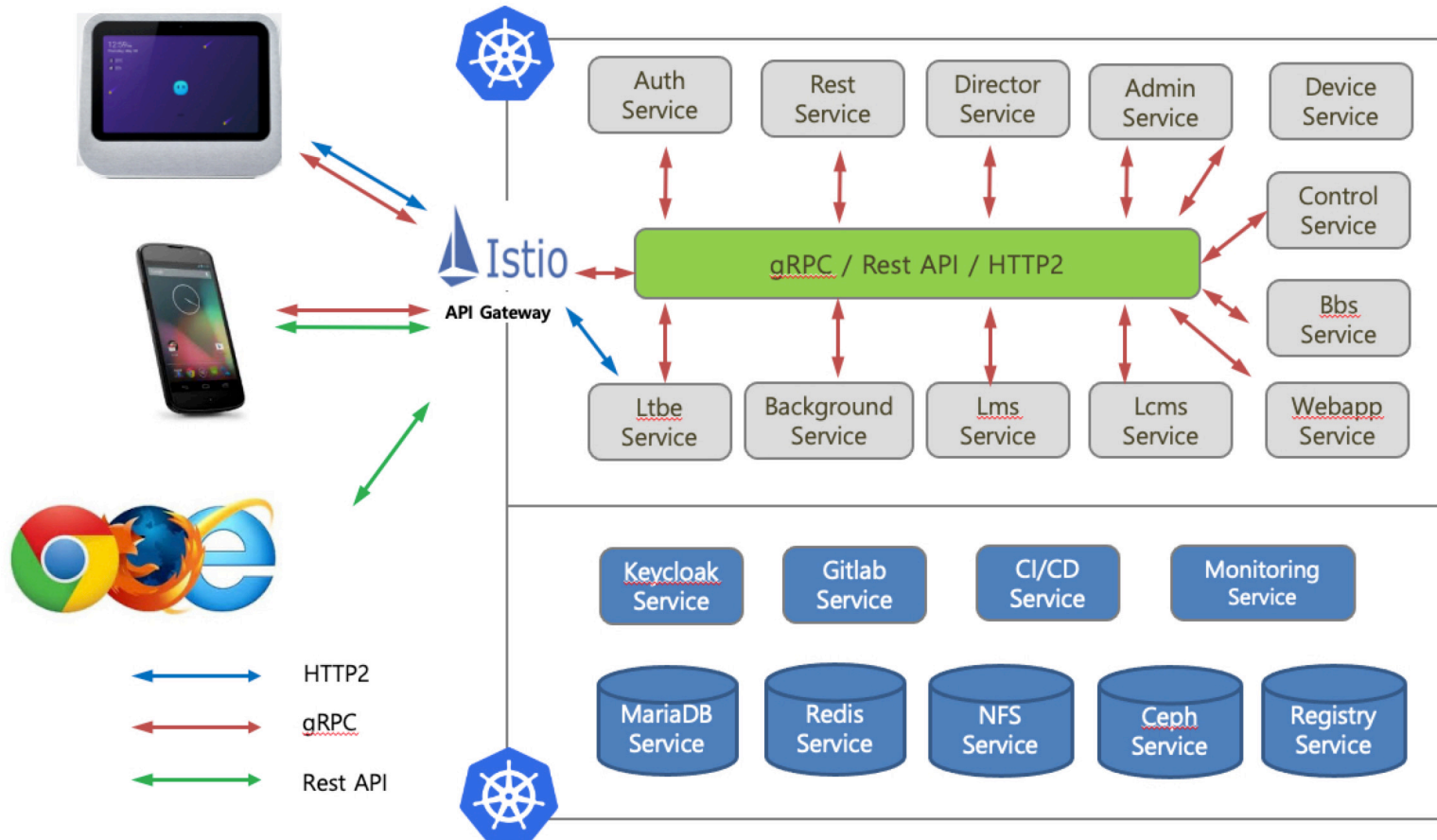


QCS ( Openstack + Kubernetes )

## 4.1 QCS Clients and Projects

- **Speakingbuddy – AI & MSA Project**

- Collecting and analyzing data from an educational AI speaker to provide personalized content and deliver English education services through a voice chatbot
- All the backend systems were configured on Kubernetes with MSA over K8s technology
- Client : Company I
- Period : 2019 ~ 2020

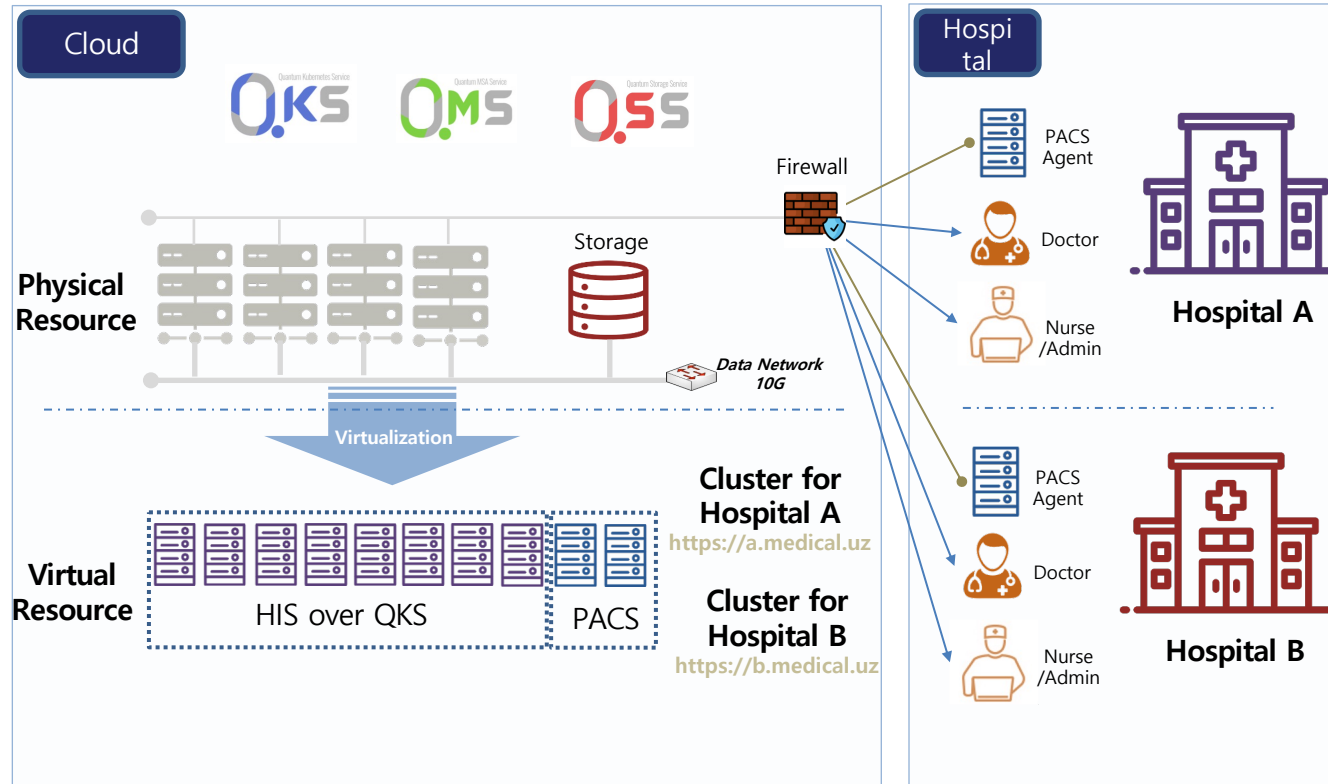


QOS + QKS + QSS ( Openstack + Kubernetes + Ceph )

## 4.1 QCS Clients and Projects

- **HIS(Medical AI) Development Project**

- Project for Uzbekistan National Healthcare System Development
- All the backend systems were built on Kubernetes, MSA architecture development on QMS service, One Source Multi Site architecture
- Client : Government funded project
- Period : 2022.2 ~

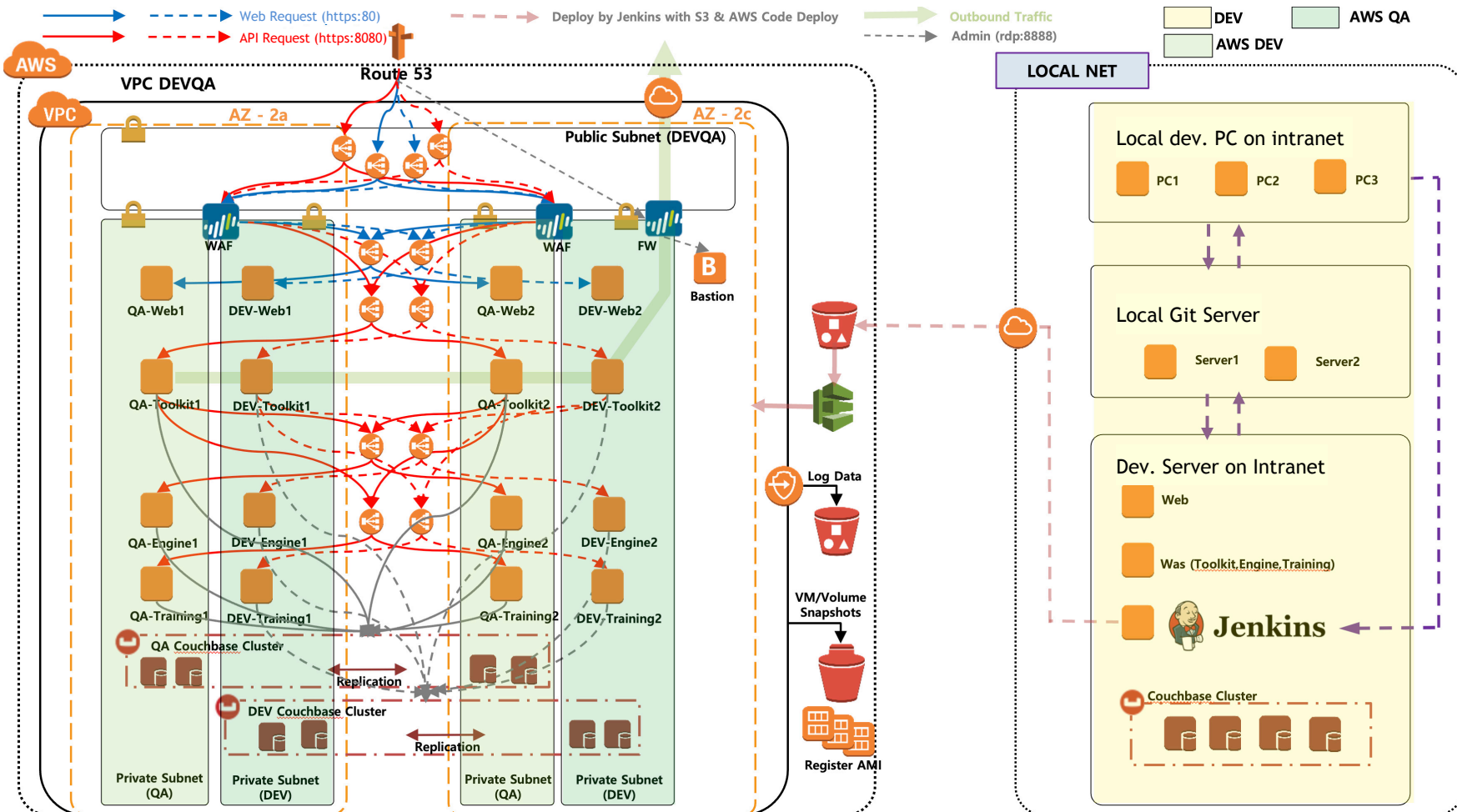


QKS + QSS + QMS ( Kubernetes + Ceph + Istio + Keycloak )

## 4.1 QCS Clients and Projects

### • LG AI Research CI/CD System Development Project

- Development of CI/CD system and pipeline on multi-cloud architecture for LG AI Research,
- Client : LG Electronics
- Period : 2018.6 ~ 2018.12





## 4.2 QCS Key Features

### Stable/Continuous Service Support

- A stable infrastructure and platform where all key services are configured with HA
- Designed for hardware failure resilience to ensure continuous service availability
- Exceptional cost savings compared to public cloud
- Stable cloud security through firewall redundancy and security policy enforcement

### Competitiveness

- Optimized cloud architecture for applications as compared to infrastructure company products
- Rapid bug fixes and quick adoption of the latest technologies can be applied (as an open-source platform)
- Provides not only infrastructure services but also integrated dev platform with MSA and CI/CD support
- Kubernetes customization expertise to optimize for various customers' SaaS

### Providing Service

- Infrastructure maintenance service (Online management or on-site dispatch, incident alert, and training)
- K8s/back-office application upgrades and maintenance
- Basic CI/CD services provided for free, pipeline development services offered as a paid option
- One-year free defect warranty, with incident resolution within two hours under a maintenance contract

### Service Benefit

Quantum Cloud & Service (QCS) lets you focus solely on developing your business logic without worrying about infrastructure and platform operations.