Blueprint Proposal:

CFN (Computing Force Network) Ubiquitous Computing Force Scheduling

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What is CFN (Computing Force Network) ?

CFN, defined as computing force network, is a new information infrastructure that takes computing as the center, network as the foundation, and deeply integrates Network, Cloud, big Data, Artificial Intelligence, Security, Edge, Terminal and Block chain to provide integrated services .

Vision

Network is everywhere

Computing is everywhere

Intelligence is everywhere

Social level service of “access from one point, instant get and use for everyone”, just like water and electrics

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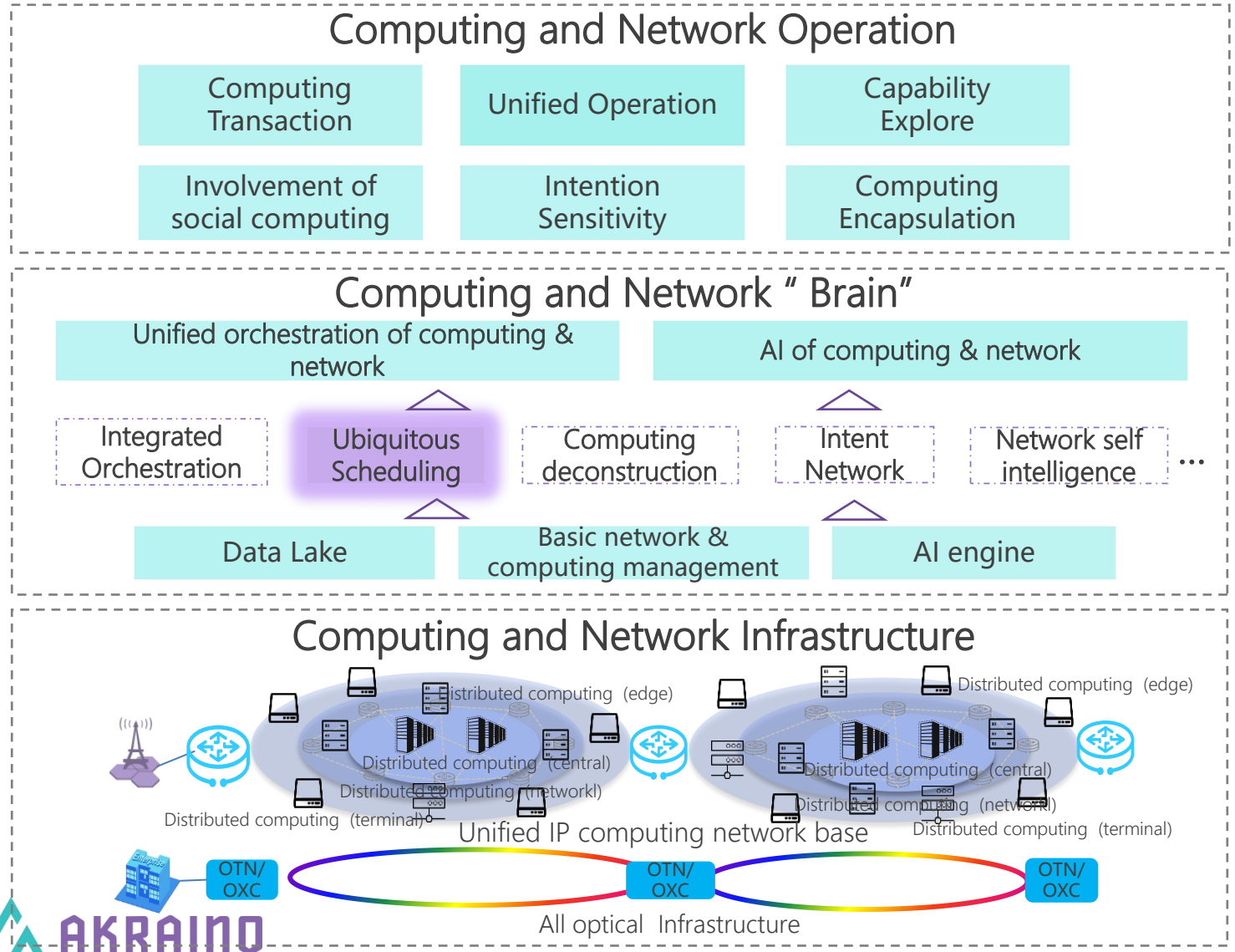
Core Architecture of CFN (Computing Force Network)



Operation Service Layer

- Multi factor integrated supply
- Integrated supply of social computing resources
- Integrated supply of digital-intelligence services

Orchestration and Management Layer

- Unified orchestration
- Ubiquitous scheduling: Cloud、edge、multi-cloud
- Unified management and maintenance of computing and network

Infrastructure Layer

- Multi-level and ubiquitous distributed computing force system on the cloud, edge and terminal;
- All-optical infrastructure and unified IP bearer technology

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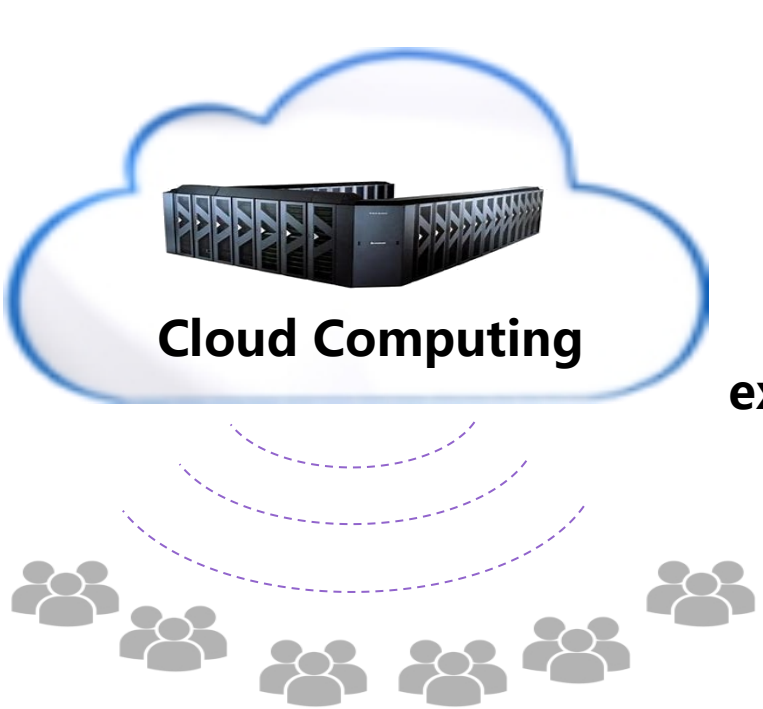
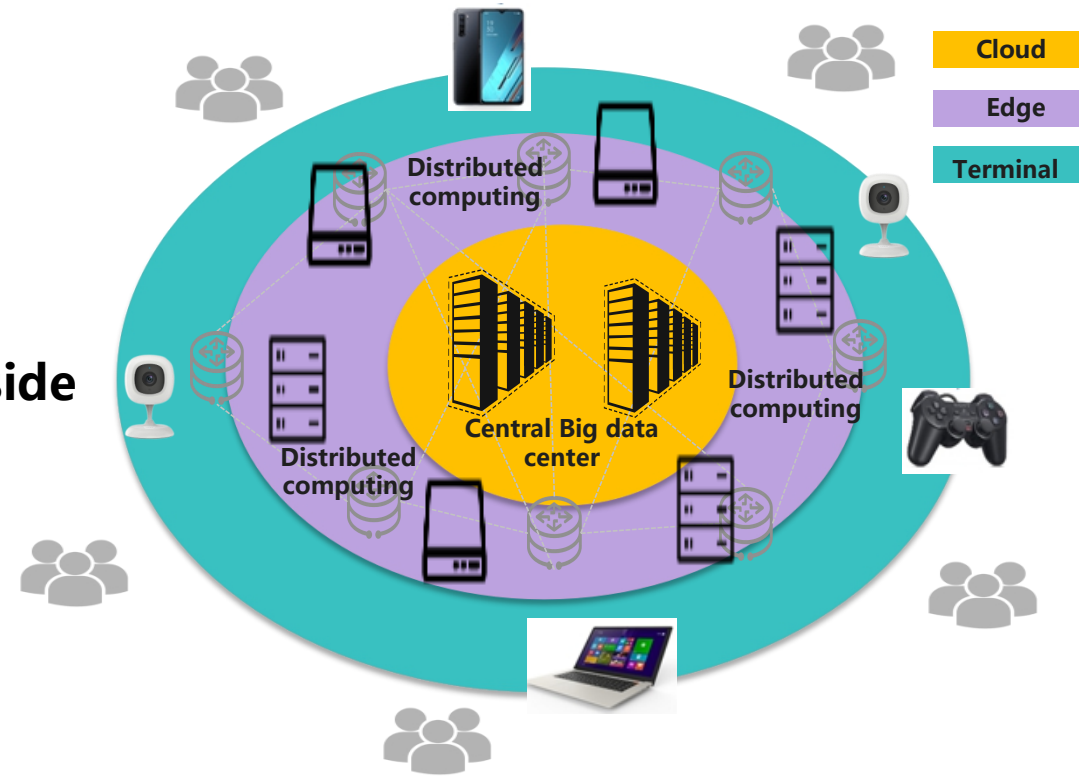
Ubiquitous Computing Force in CFN

Logically, the computing force is more three-dimensional, including three levels: center, edge and terminal. Physically, resources span data centers in different regions. The kernel is heterogeneous, including general computing force (x86/ARM) and special computing force (GPU/DPU...).



Cloud Computing Force

computing force extends to the user side



Ubiquitous Computing Force

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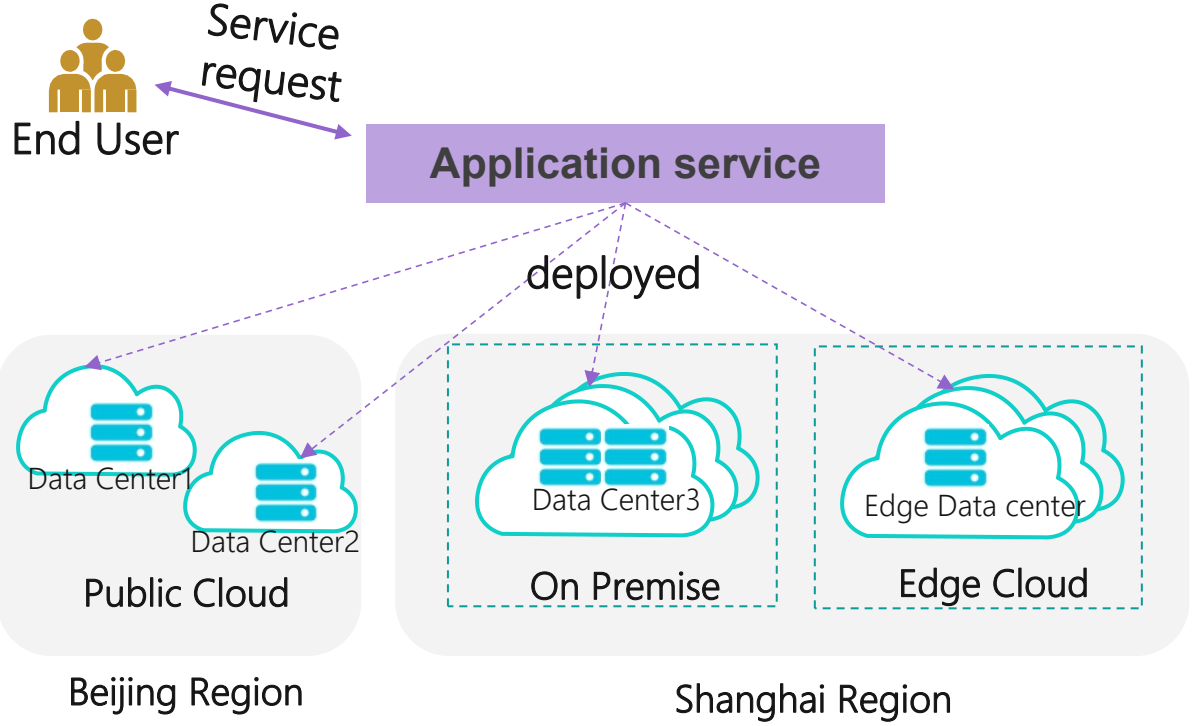
Real world business deployment environment and challenges



Real World Needs

- 92 percent of respondents reported having a multi-cloud strategy* and has multi cloud vendors.
- Hybrid cloud management including public cloud, on premise / private cloud and edge cloud.
- Multi-cluster deployment startegy to achieve high availability.
- Disaster recovery scenario. The application system is usually deployed in the geo-redundant mode.
- …

Challenges

- End user request scheduling based on multi-cloud & edge cooperation.
- App server depolyment based on multi-cloud & edge cooperation.
- Log & Monitoring consistency.
- …

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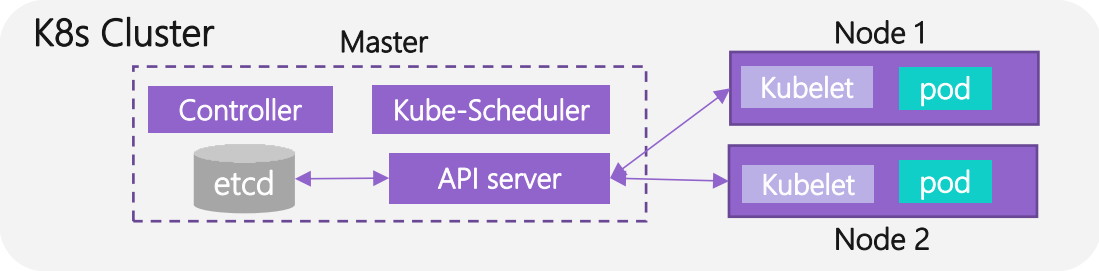
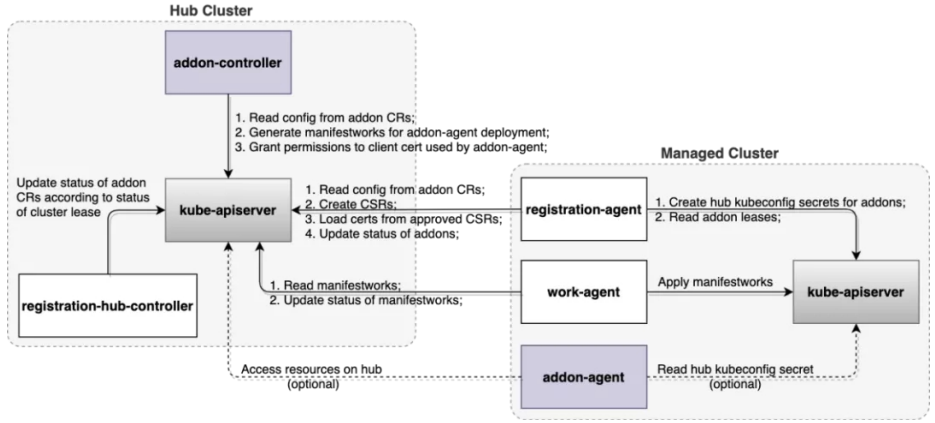
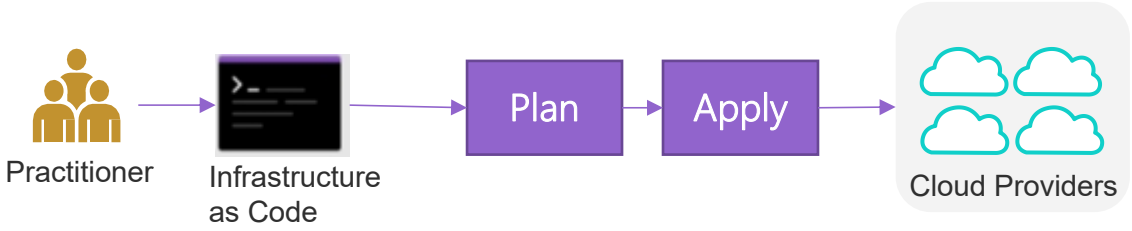
*Data source from : Flexera 2021 state of the Cloud Report

Some Existing Solutions(1)







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Kubernetes: **focus on single cluster**

- Scheduling resources in single cluster
- The scheduling strategy is simple and does not consider network or service characteristics

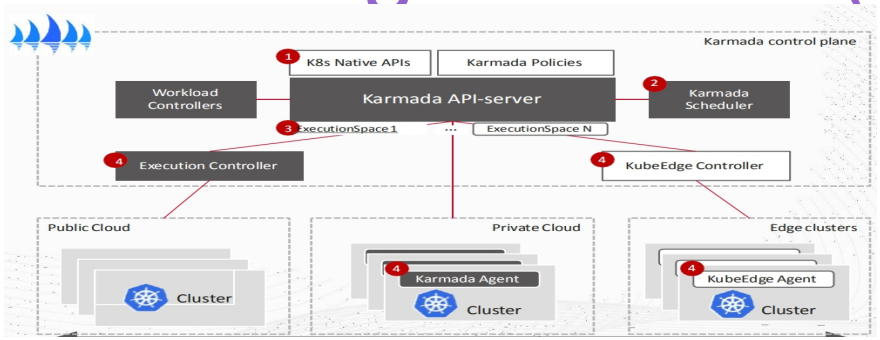
OCM: **focus on multi-cluster management**

- The scheduling strategy is oriented to one or more clusters (the cluster is selected by labelSelector or ClusterClaims)
- Do not care how to distribute the configuration and deploy the application

Terafrom: **the tool of Infrastructure as Code**

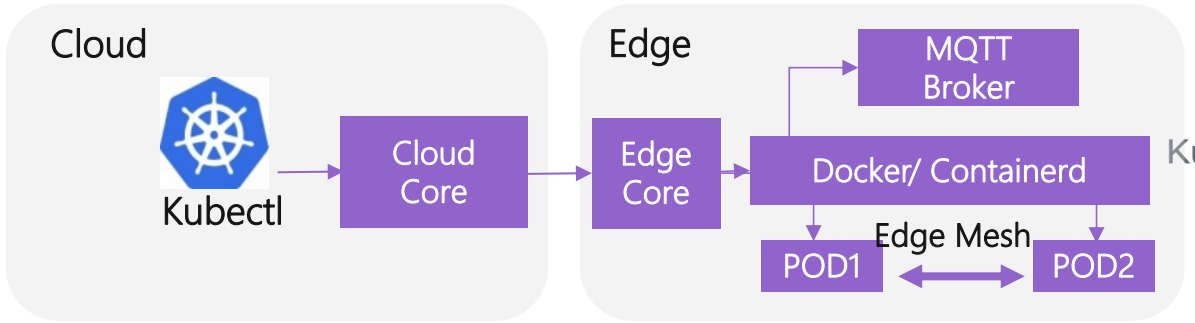
- The automatic management of cloud resources to improve deployment efficiency
- Unified templates and syntax, different cloud vendors can use different providers and define different resource templates.

Some Existing Solutions(2)



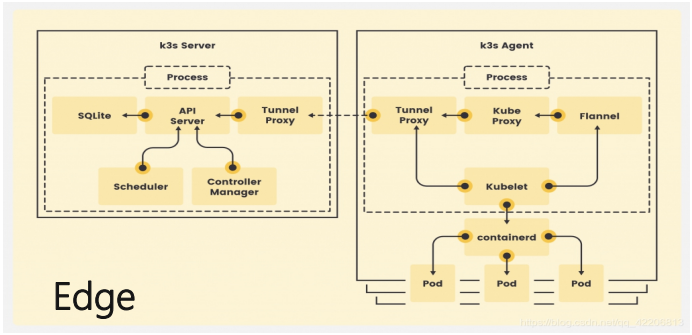
Karmada: focus on multi-cluster management

- Manage resource scheduling between clusters, multi-cluster scheduling strategy
- Configurations and Applications can be deployed in multiple clusters



KubeEdge: focus on cloud & edge collaboration

- Support cloud & edge collaboration
- Support communication between edge nodes (edge mesh)
- Support edge node autonomy



K3s: the lightweight K8s at edge

- All components (Server and Agent) run on the edge
- Do not concern cloud & edge collaboration
- No multi-cluster management solution

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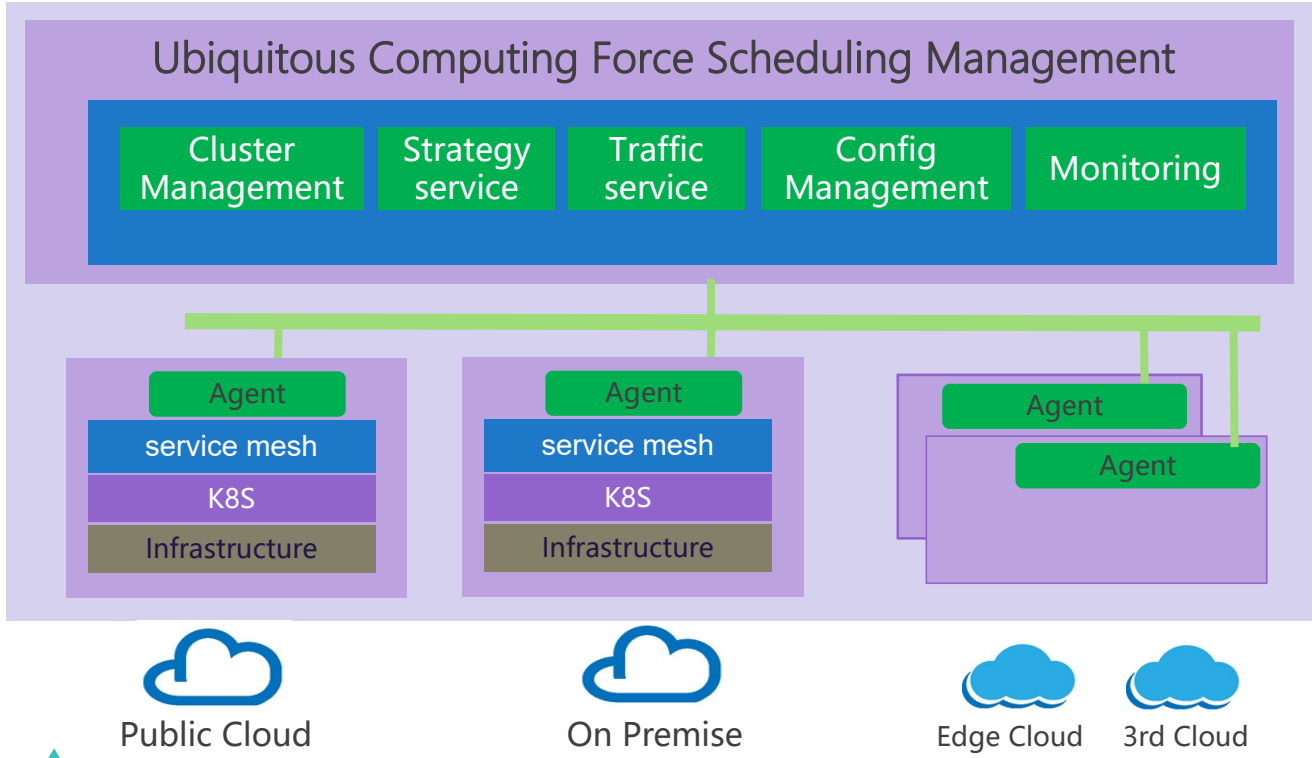
Existing solutions are solved problems in some specific fields. The real world environment is usually complex, and individual products cannot fully meet the needs of customers.

Next Step and What We Would Like to Do

- According to the unified ubiquitous scheduling management layer, the computing force of public cloud, on premise, edge cloud or external third parties is managed to achieve consistent cluster, strategy, configuration and traffic management, and to achieve resource-level and task-level scheduling.
- The cloud-native technology stack is adopted to perform consistent configuration management, network accessibility and scheduling across K8s environments by deploying agents.



- Unified life cycle management of computing force; (including clusters of cloud, edge)
- Global scheduling;
- Enrich scheduling strategy;
- Global monitoring of computing resource;
- Large scale node and cluster management;
- Service mesh in multi-cloud or cloud & edge environment;
- …

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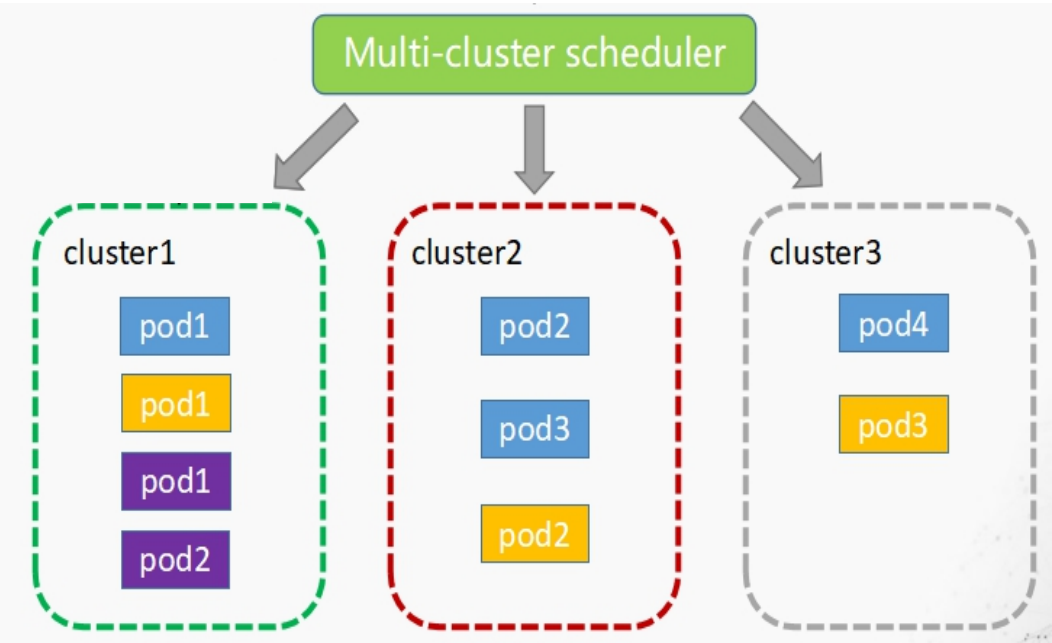
BP Phase 1 ：Multi-cluster management



- Set up, infrastructure environment preparation;
- Access and manage multiple clusters;
- Multi-cluster monitoring;
- Multi-cluster lifecycle management;
- Multi-cluster resource scheduling strategy;
- …

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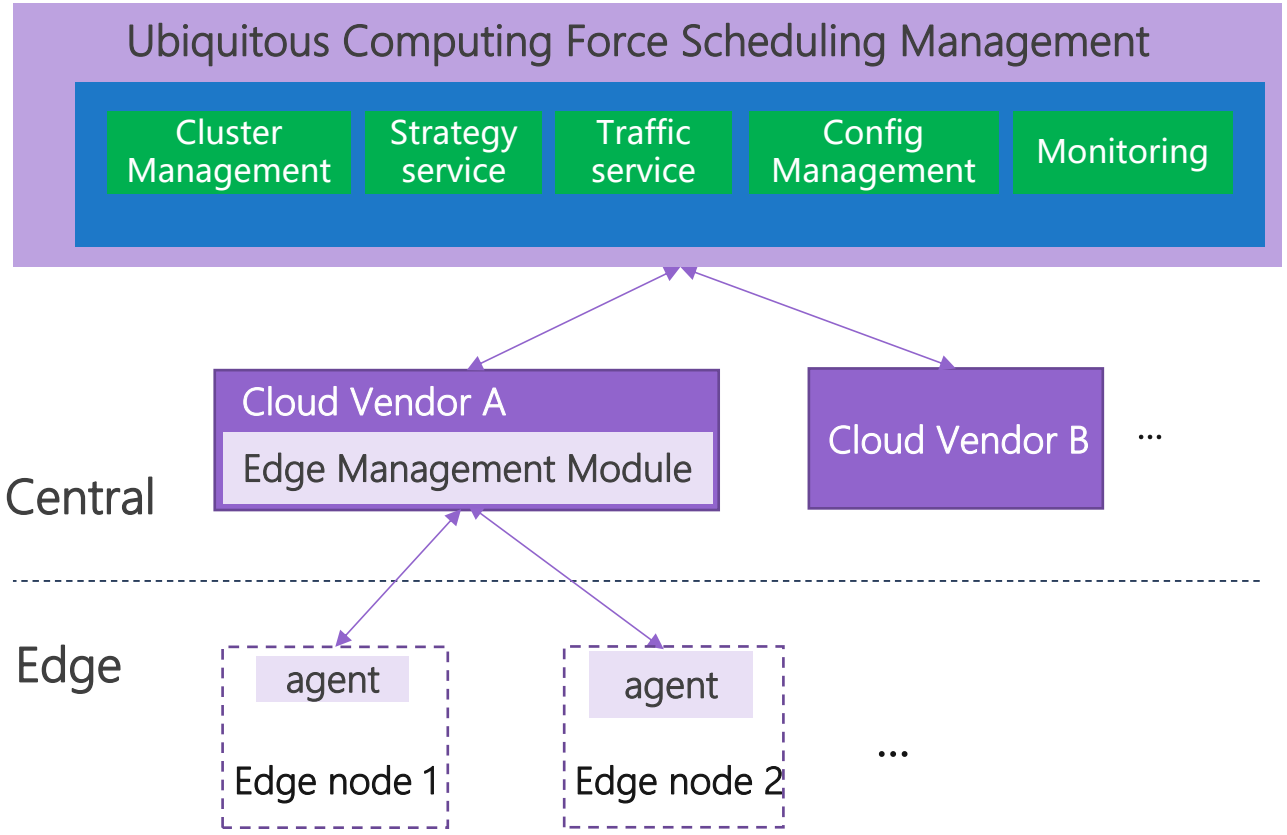
BP Phase 2：Expand to edge node and manage the edge cluster



- Function and structure enhanced, the computing nodes are extended to the edge;
- The management and monitoring of cloud and edge clusters;
- Enrich scheduling strategy; (latency, task type, etc.)
- Multi-cluster resource scheduling mechanism based on cloud-edge collaboration, such as traffic governance and scheduling across nodes;
- ...

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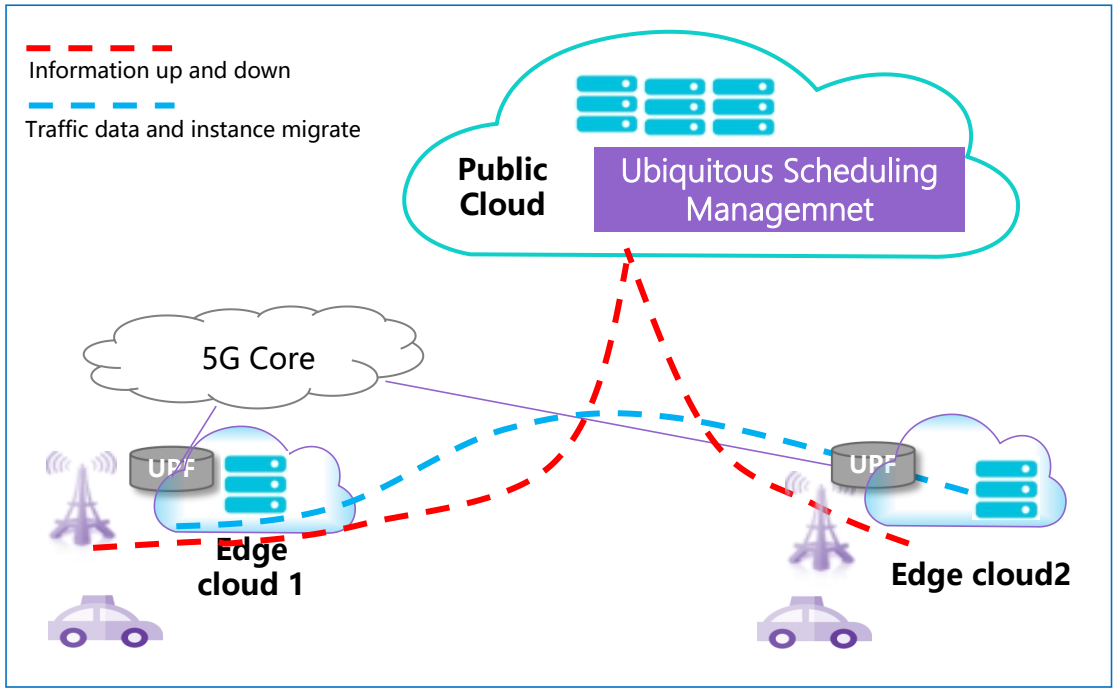
BP Phase 3：Verify Multi-cluster Collaborative Scheduling



The specific application may be re-selected according to the project progress.

Traffic Requirements

1. The collection results of many sensor devices on the road and the data collected by the vehicle dynamic sensor devices are uploaded to the edge nodes;
2. The edge node analyzes road conditions, accident information, vehicle information, and environmental information (location), and transmits it to the vehicle;
3. Predict vehicle action trajectories in advance, and migrate traffic vehicle context data to adjacent edge nodes in advance;

- Coordinated scheduling of edge cloud nodes: Coordinated and interoperable scheduling of multiple edge cloud nodes.
- Continuity service: Scheduling switching of services that provide computing power and network assurance.

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Summary

- With 5G / B5G, more and more users will be using edge computing tech and multi-clusters (usually are multi-cloud vendors). How to efficiently and conveniently manage multi-clusters including public cloud，edge cloud or private cloud is an invaluable issue to be discussed, especially in open source community.
- Bringing opensource solutions in the real world and enhance them, however, is often challenging, not just for the developers, but for the real-world end-users who need to stitch multiple open source and solutions together.

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Thank you!