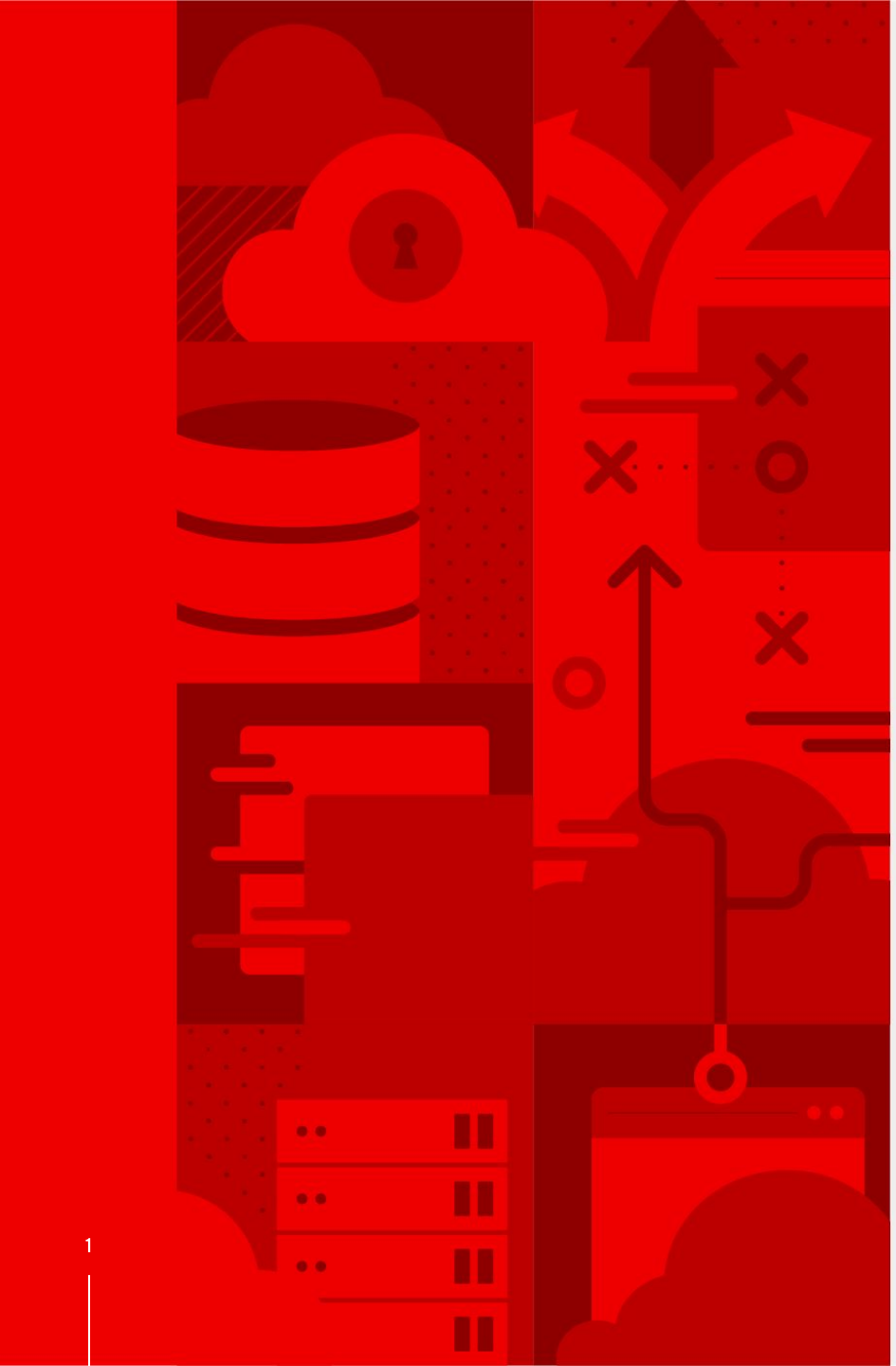


Developing Edge with Kubernetes

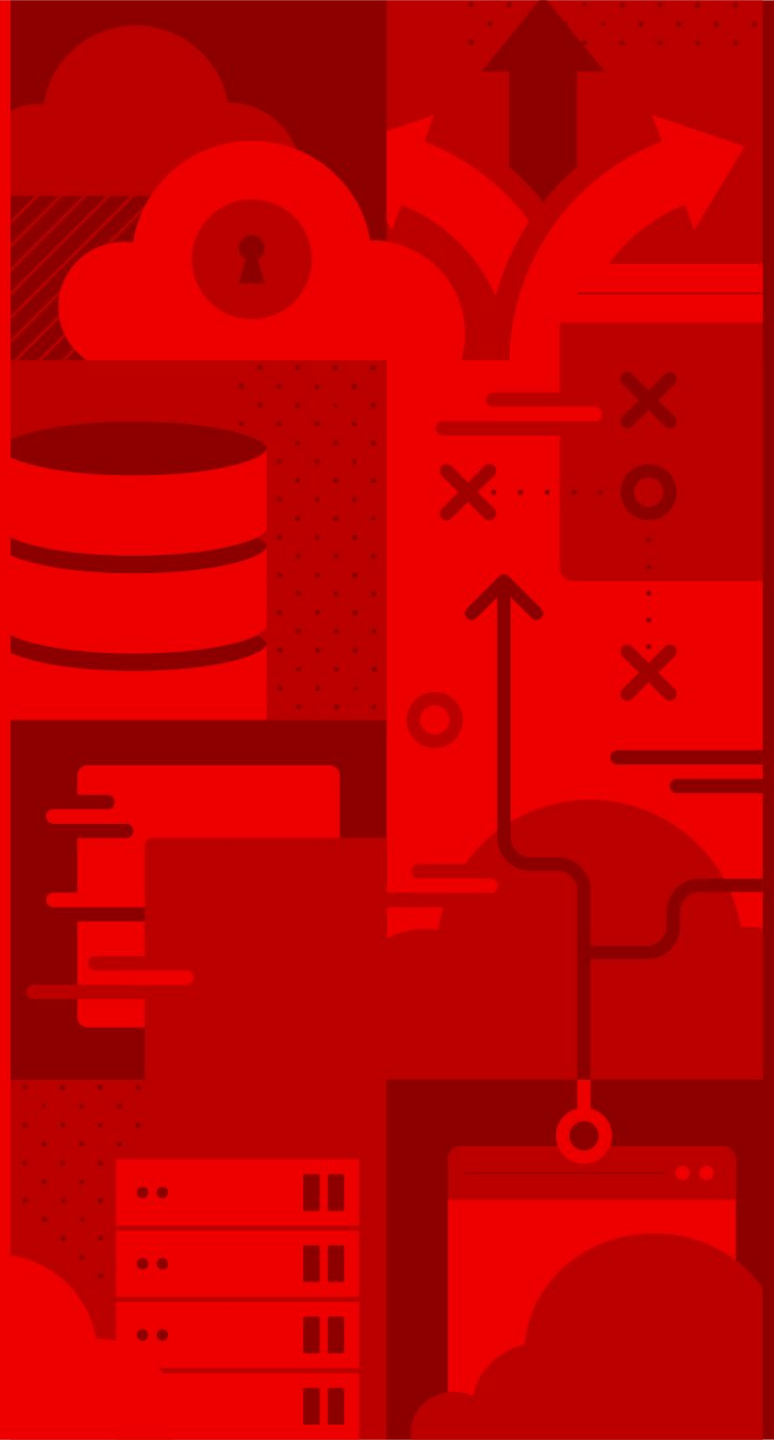
Dejan Bosanac

Ted Ross

Red Hat

Agenda

- What is Edge Computing?
- Edge Challenges
- Developer toolkit
- Use cases
- Demo



What is Edge Computing?

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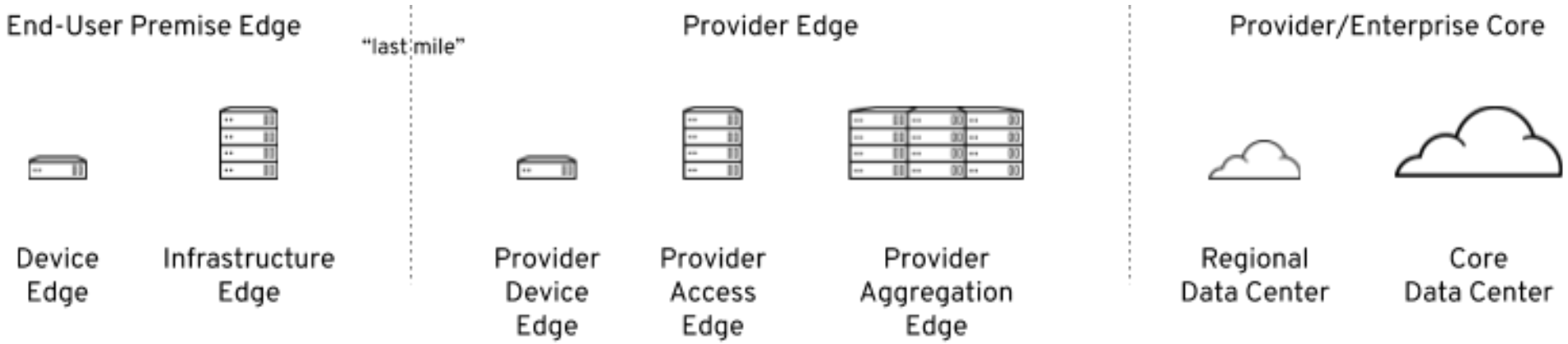
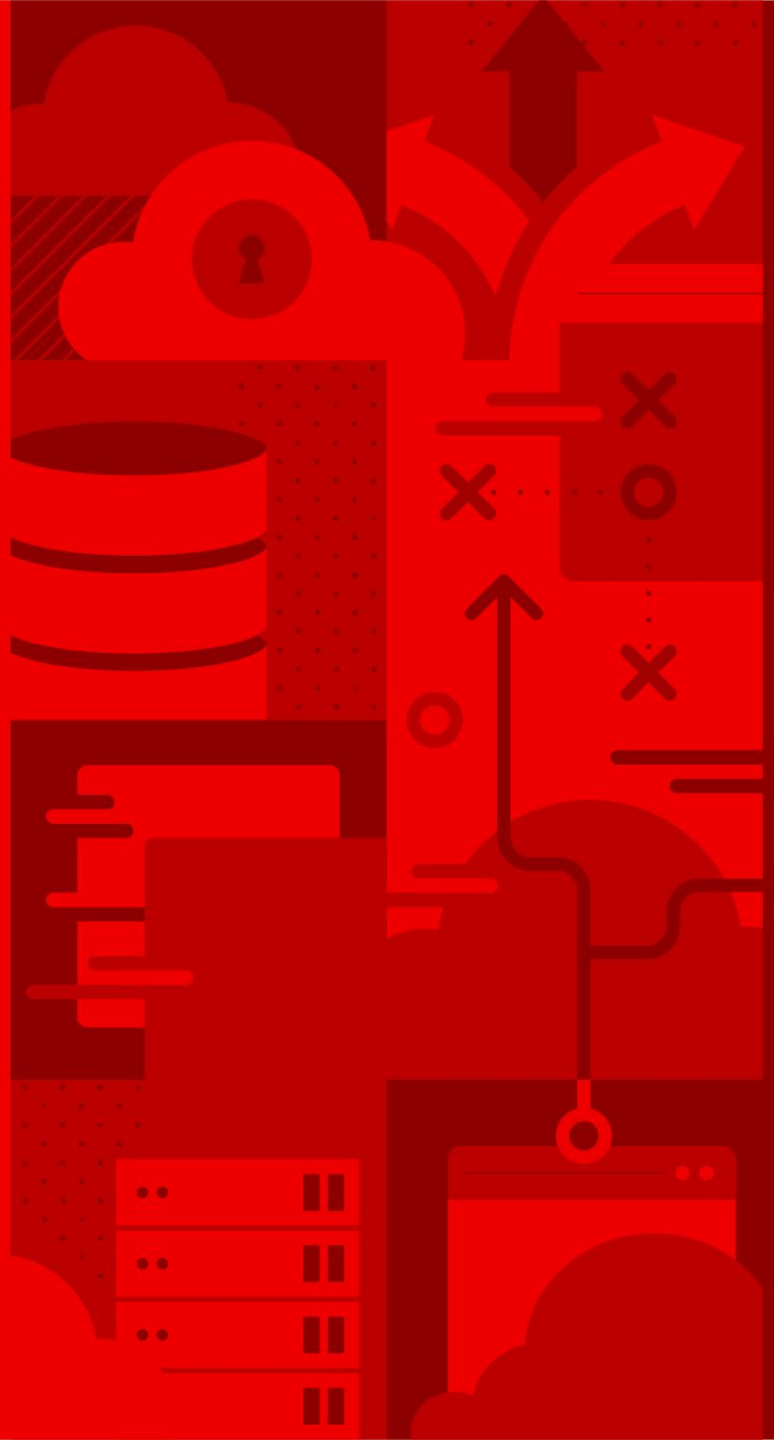
THERE ARE MANY EDGES



WHAT IS EDGE COMPUTING?

Centralize where you can,
distribute where you must



Edge Challenges

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Challenges

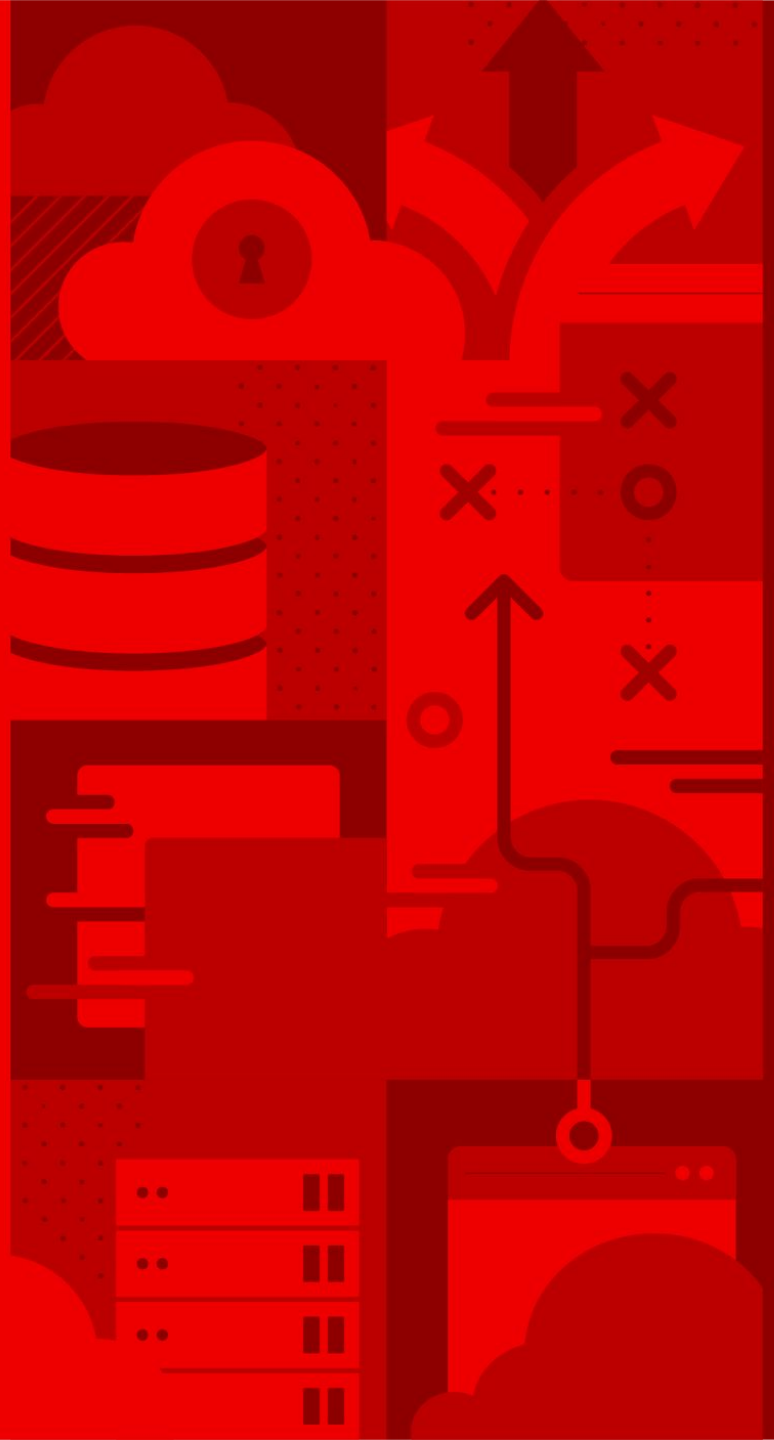
- Infrastructure
  - How to manage physical resources (nodes and clusters) on the Edge?
- Control plane
  - How to manage workloads on the Edge?
- Data plane
  - How Edge sites communicate with the cloud and between themselves?

Challenges

- Resources
  - Limited number of nodes on the Edge
  - No “bursting” to newly provisioned capacity like a public cloud or large datacenter
  - Workloads typically have a wide range of priorities
  - Need more emphasis on prioritization, triage
- Network
  - Network capacity can be limited, and variable
  - Like resources, different workloads can have different network policies/priorities

Developer Challenges

- Deployment
- Resources
  - Pod priorities
- Communication
  - VPN vs VAN
- Security
  - Matching microservices to edge hardware
  - Unauthorized outbound



Developer Toolkit

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Cloud native for the Edge

- Cloud native technologies are main enabler for Edge computing
- Most of the tools and practices are relevant
- Some even more important in this environment

GitOps

- Configuration/environment as a code
- Use the same management process for your app resources
  - YAML definitions
  - Secrets
- Same development workflow
  - Pull requests
  - Branches
  - Testing
- Operator running in the cluster watching and applying changes

GitOps on the Edge

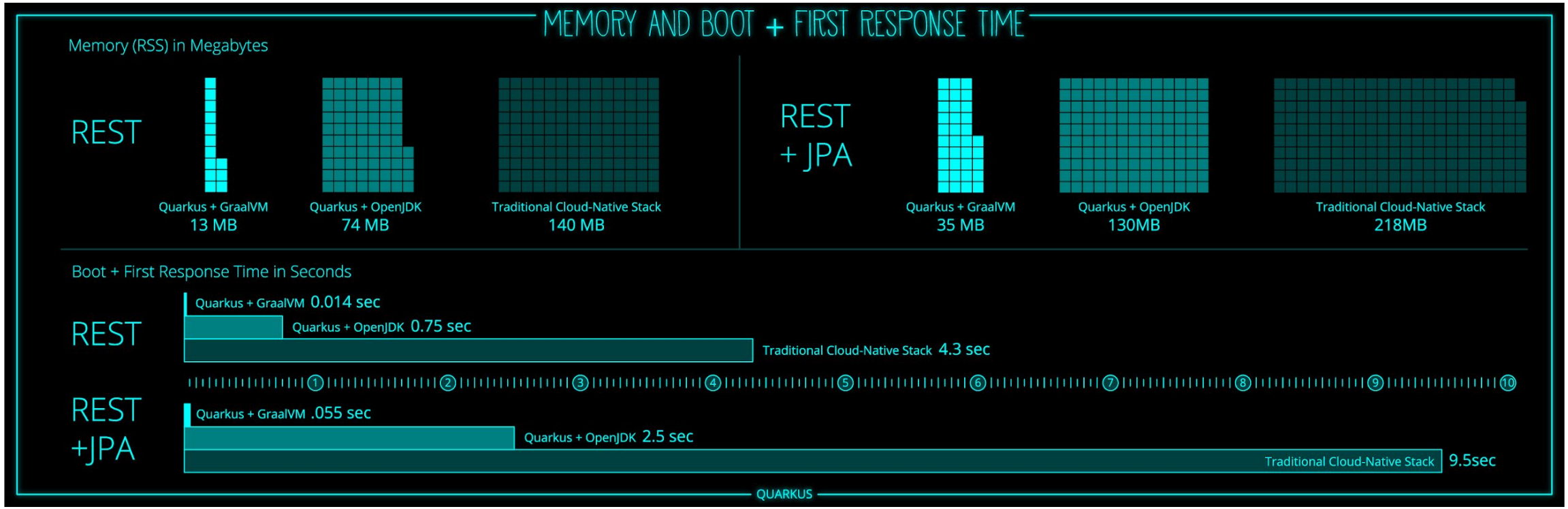
- Even more important for Edge environment
- OT people should be able just to kick off the process
- No external access to the cluster

GitOps on the Edge

- GitOps Operator
  - Flux - https://docs.fluxcd.io/en/stable/
- Creating resources
  - Helm - https://helm.sh/
  - Fabrikate - https://github.com/microsoft/fabrikate
- Storing secrets
  - Sealed Secrets - https://github.com/bitnami-labs/sealed-secrets

Quarkus

- http://quarkus.io
- Cloud-native Java



Kubernetes prioritization toolkit

Prioritization

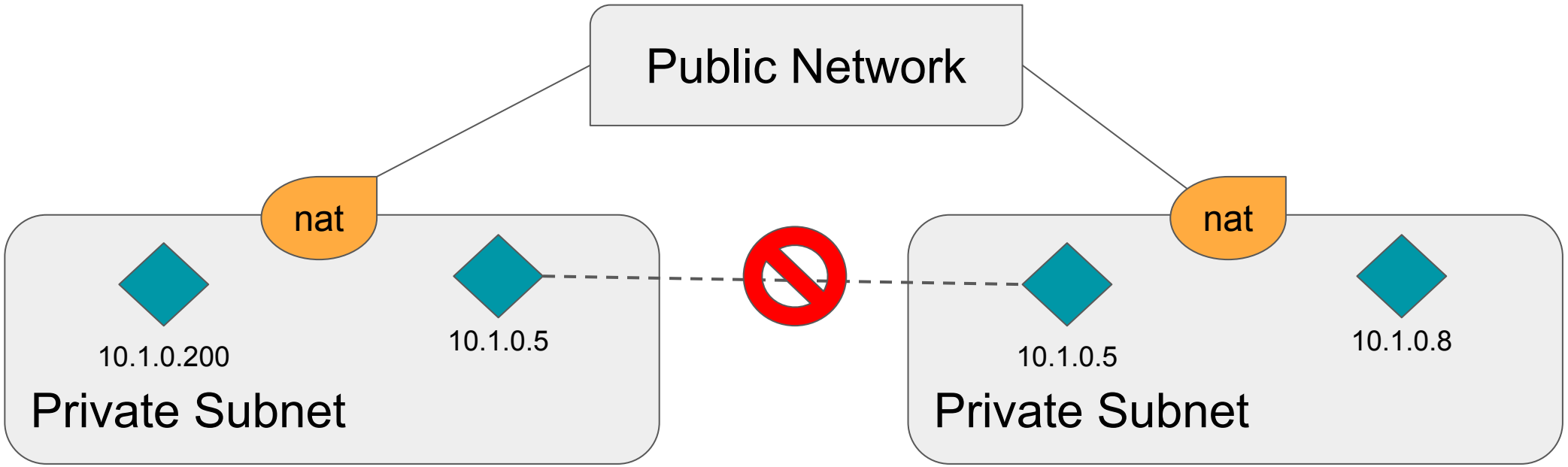
- Ranking of priority classes
- Input to pre-emption logic
- Applied to a pod, but acted on by node
- Different from resource based eviction

Quality of Service

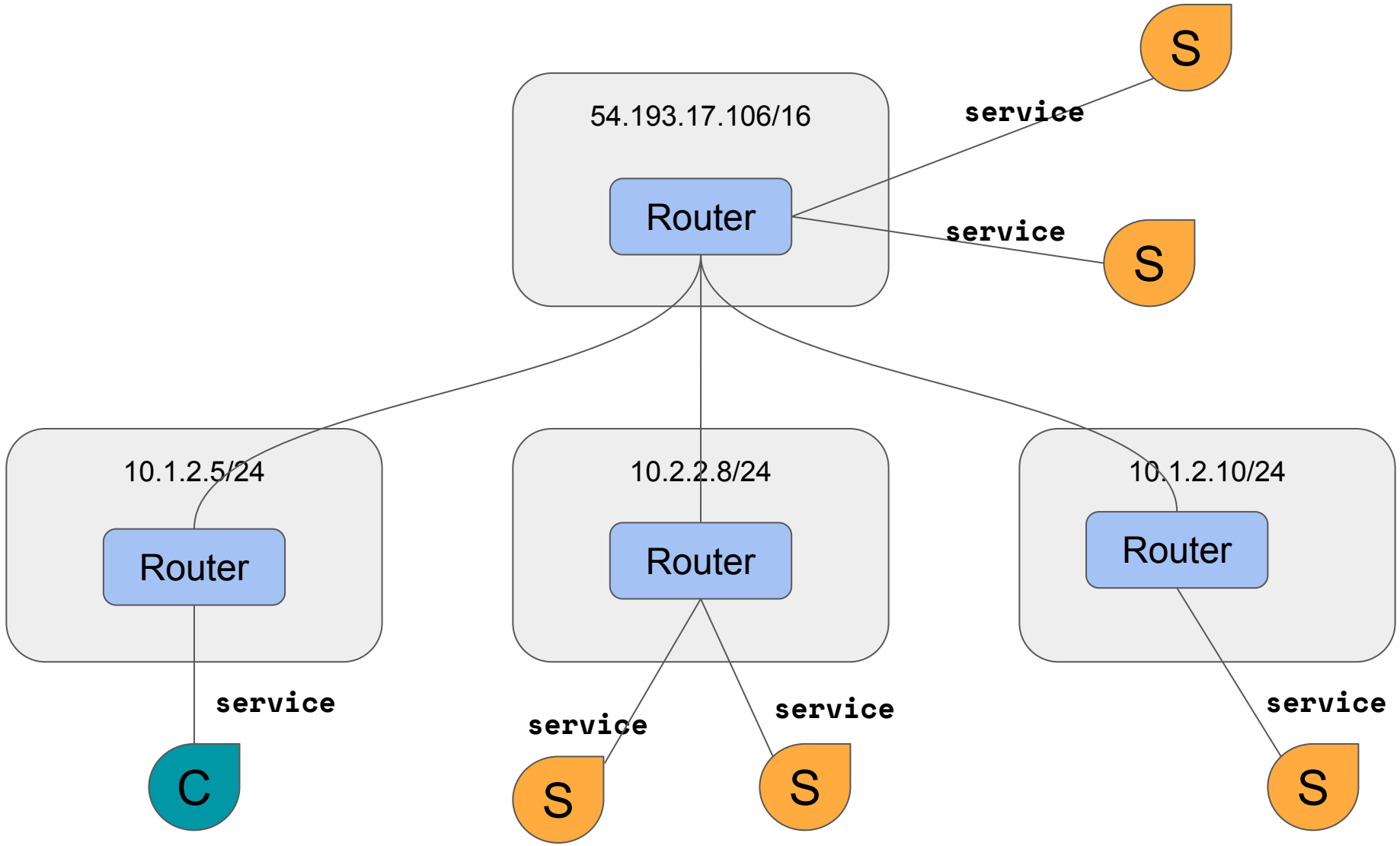
- Three levels
  - Guaranteed
  - Burstable
  - Best Effort
- These are implicit from pod spec
- Is NOT considered for preemption
- IS considered in the case of eviction
- preemption != eviction

A word about networking...

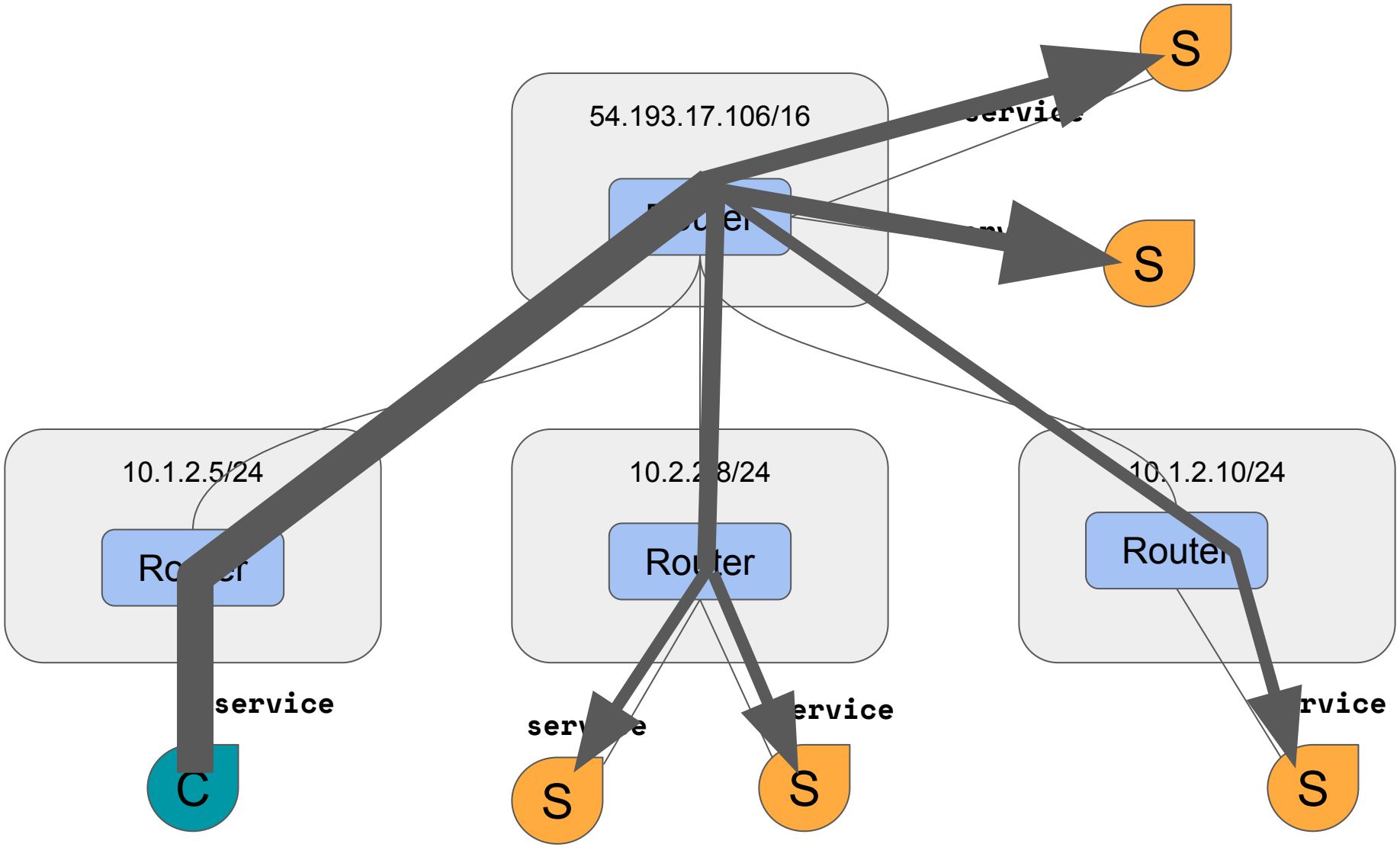
- Hybrid cloud, microservice architecture, agile integration, etc.
  - Not client/server
  - Services/processes want to be deployable and addressable everywhere (north/south/east/west)
  - Edge computing - Lots of private subnetworks



Virtual Application Network



Virtual Application Network

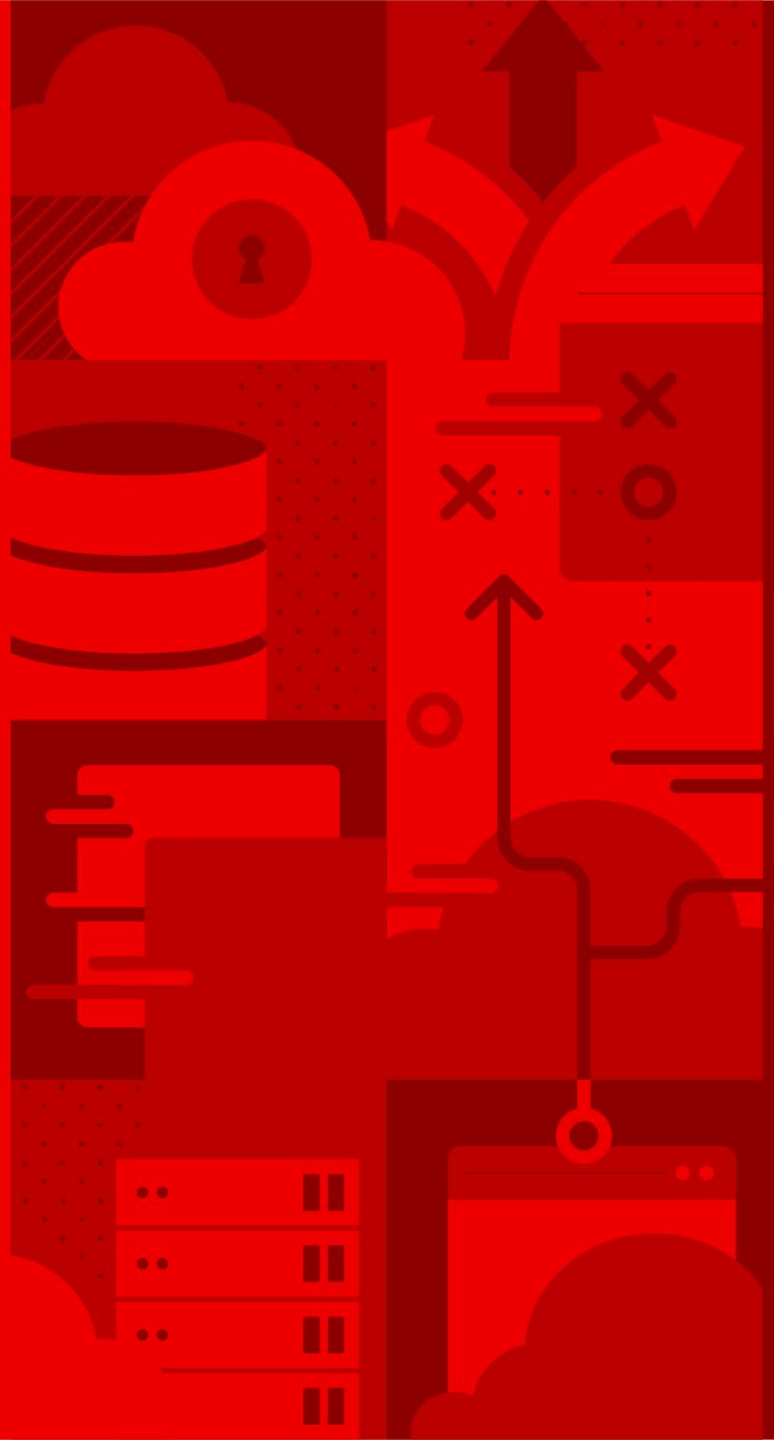


Implications of Application Addressing

- Security
  - Access control for addresses - at the service/process/business resolution
  - Locked-down network membership - Mutual TLS for inter-site connections
  - Cross-cluster applications not exposed via Kube networking
    - Public exposure limited to ingress
  - Trusted and untrusted edges
- Management
  - Metrics collected at business resolution

Skupper.io - Open Source VAN Implementation

- Operational Ease
  - Easy to deploy in a multi-cluster network
  - No advanced networking (SDN, VPNs, Tunnels, Firewall rules, etc.)
  - No need for elevated or admin privileges
  - No problem with overlapping CIDR subnets or mixes of IPv4 and IPv6
  - No single point of failure - use redundant topology
- Not just for messaging
  - Proxy maps HTTP, TCP, UDP, etc. to AMQP
- http://skupper.io
  - Examples, demo-videos, etc.
  - New, emerging project



Use Cases

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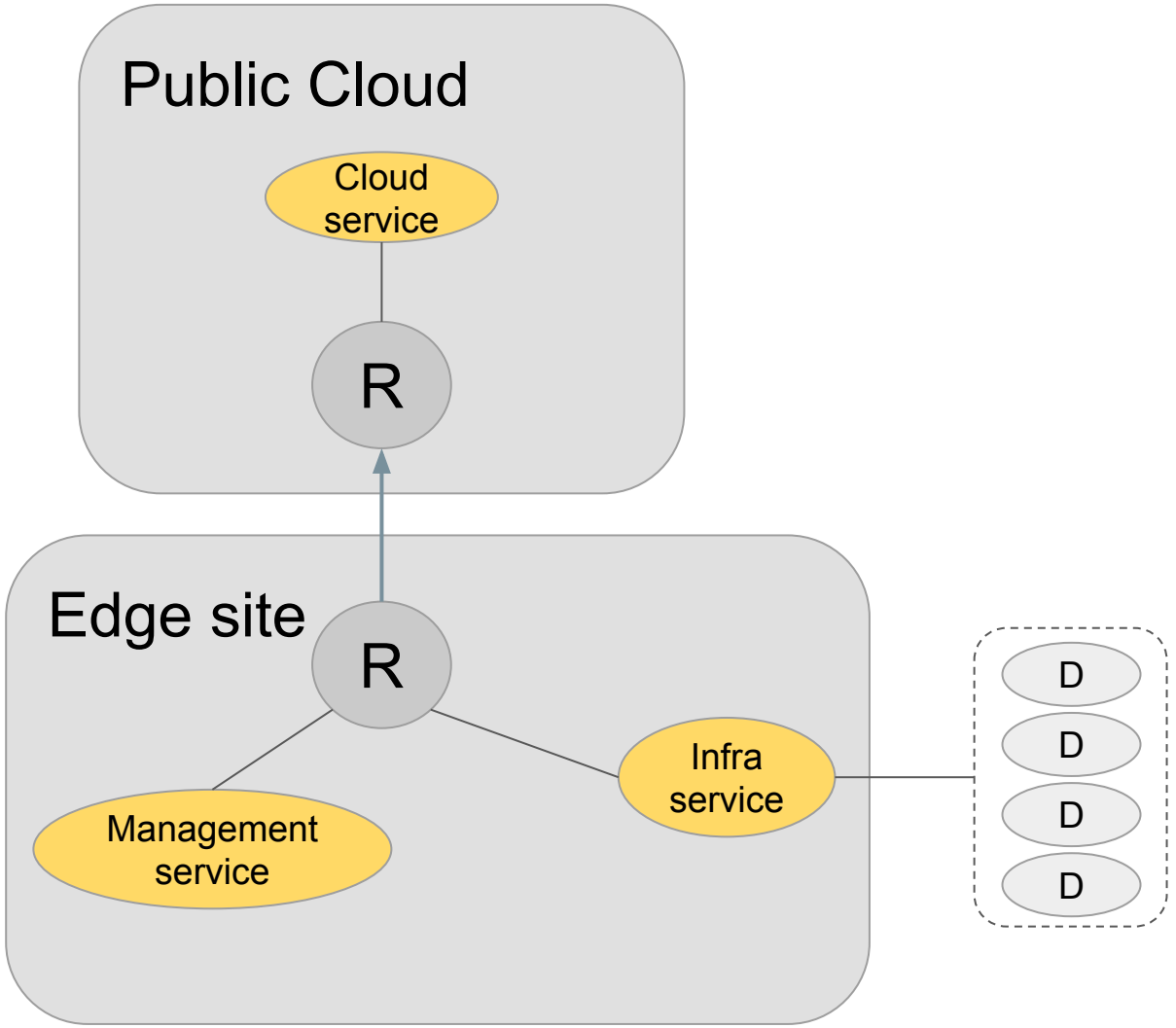
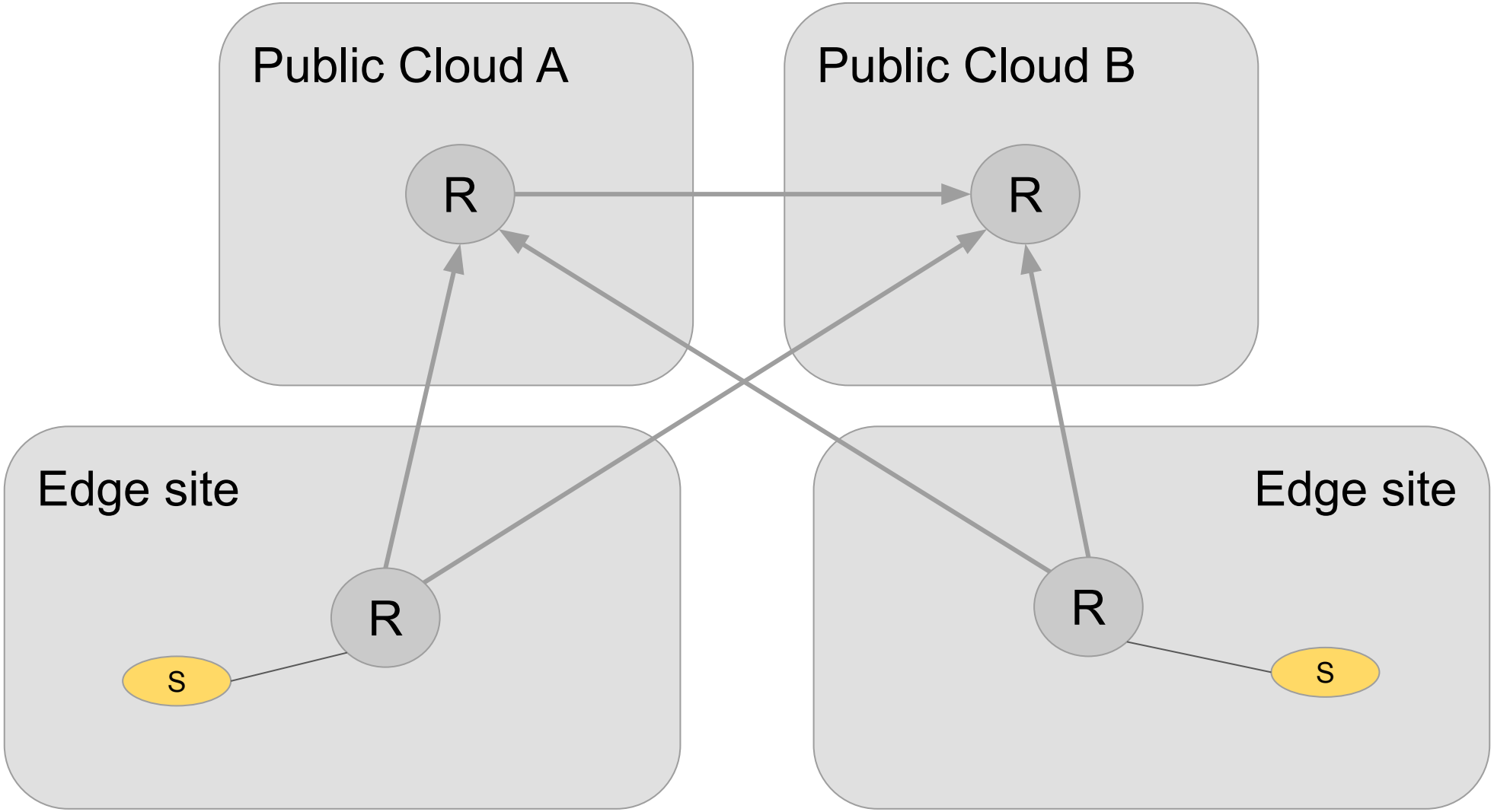
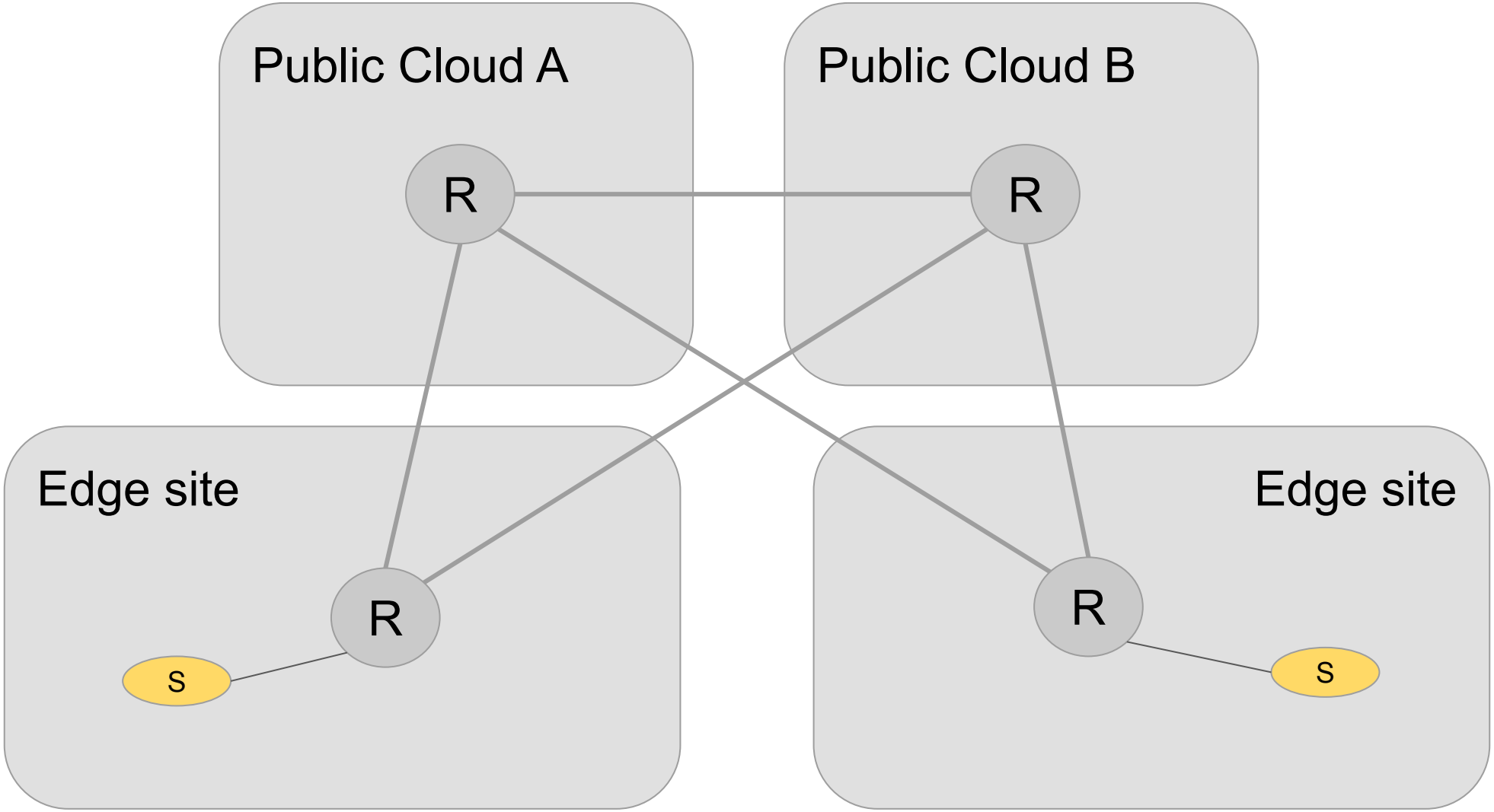
Case - Highly available site



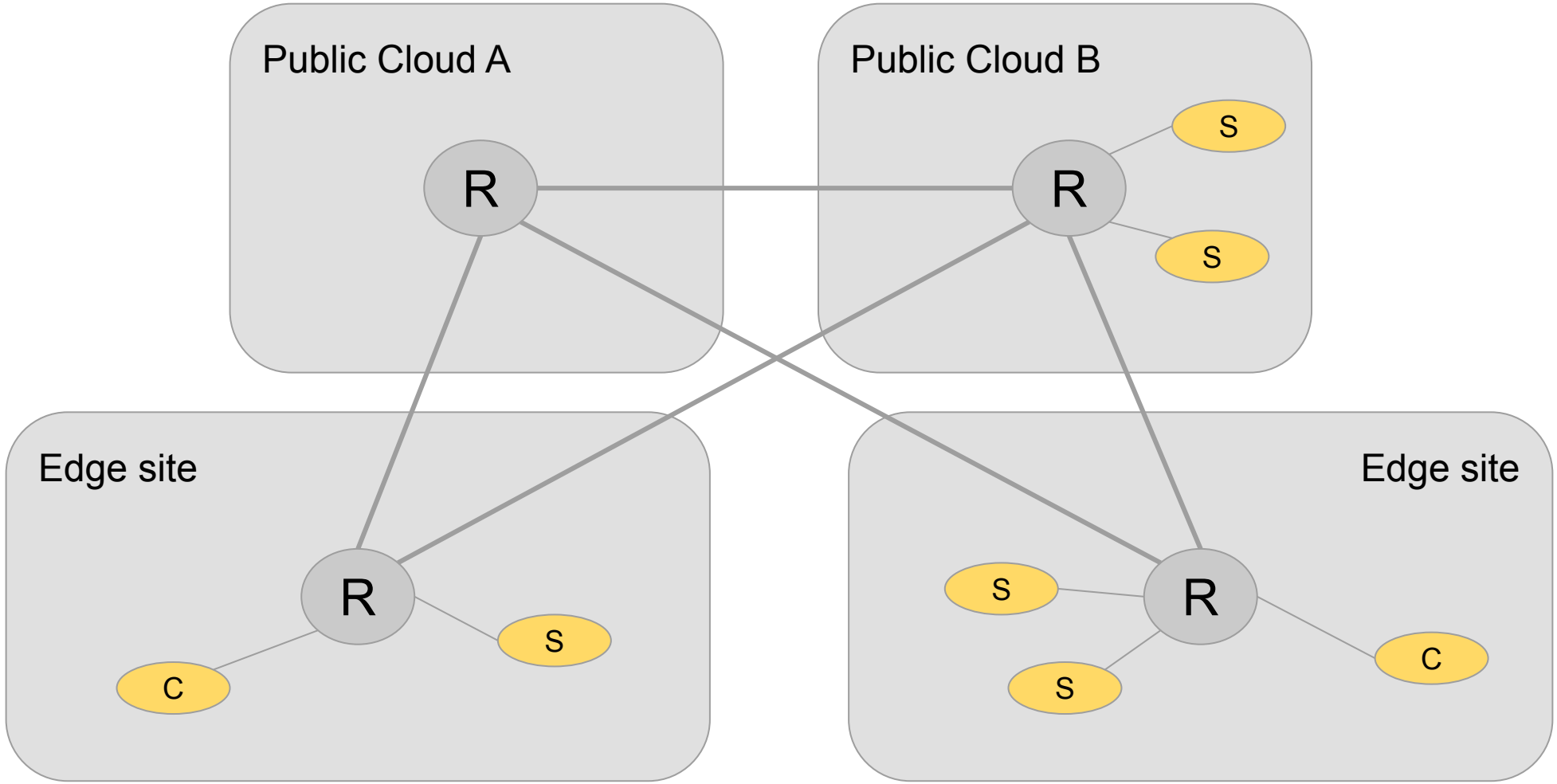
Case - Edge to Edge integration



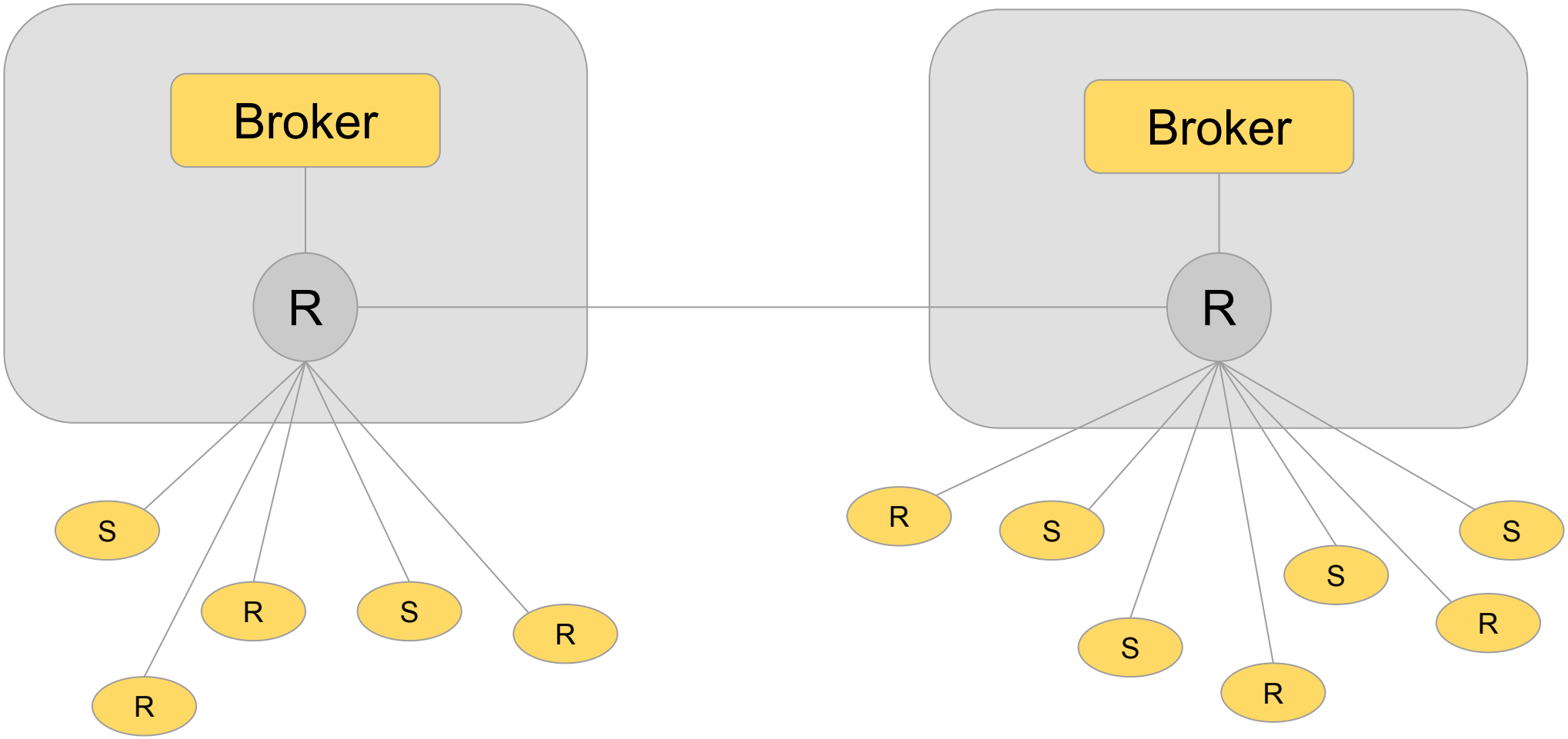
Case - Edge to Edge integration

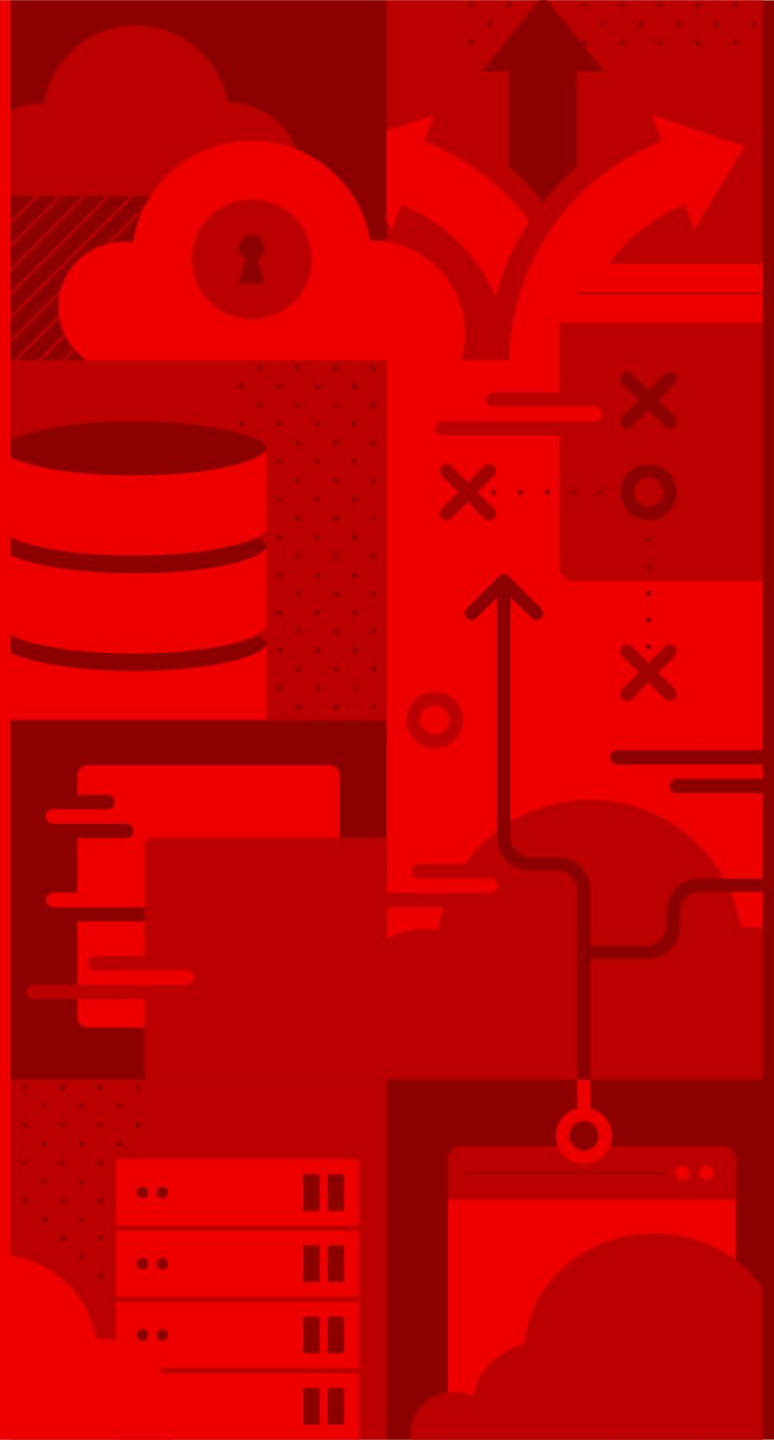


Case - Ingress Load Balancing with Locality



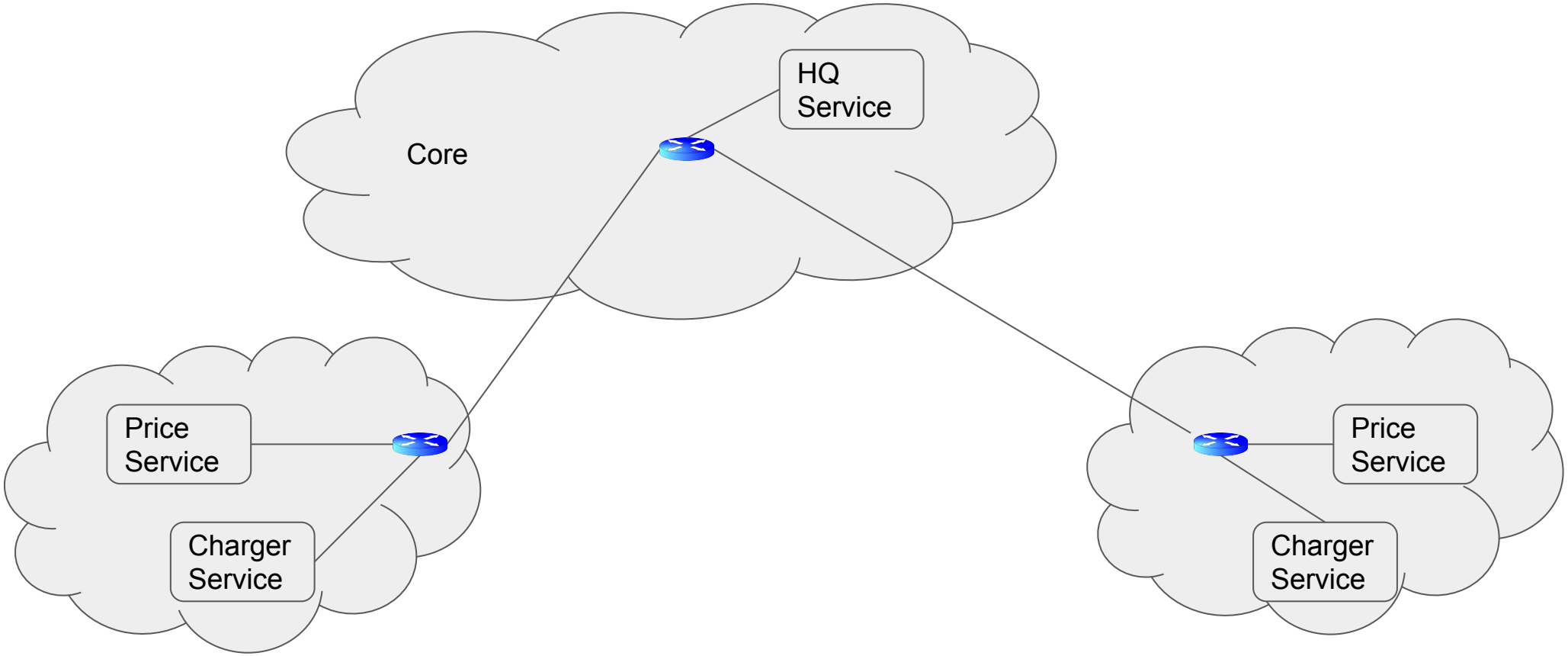
Case - HA producing





Demo

Demo


Core
HQ
Service
Price
Service
Charger
Service
Price
Service
Charger
Service

Red Hat

Takeaways

- Deployment considerations
- Service size and priorities
- Networking considerations

- K8s IoT Edge working group - https://github.com/kubernetes/community/tree/master/wg-iot-edge
- Thursday, November 21 • 4:25pm - 5:55pm - Intro + Deep Dive: Specialized Network Protocols for IoT+Edge with Kubernetes - https://sched.co/UakM