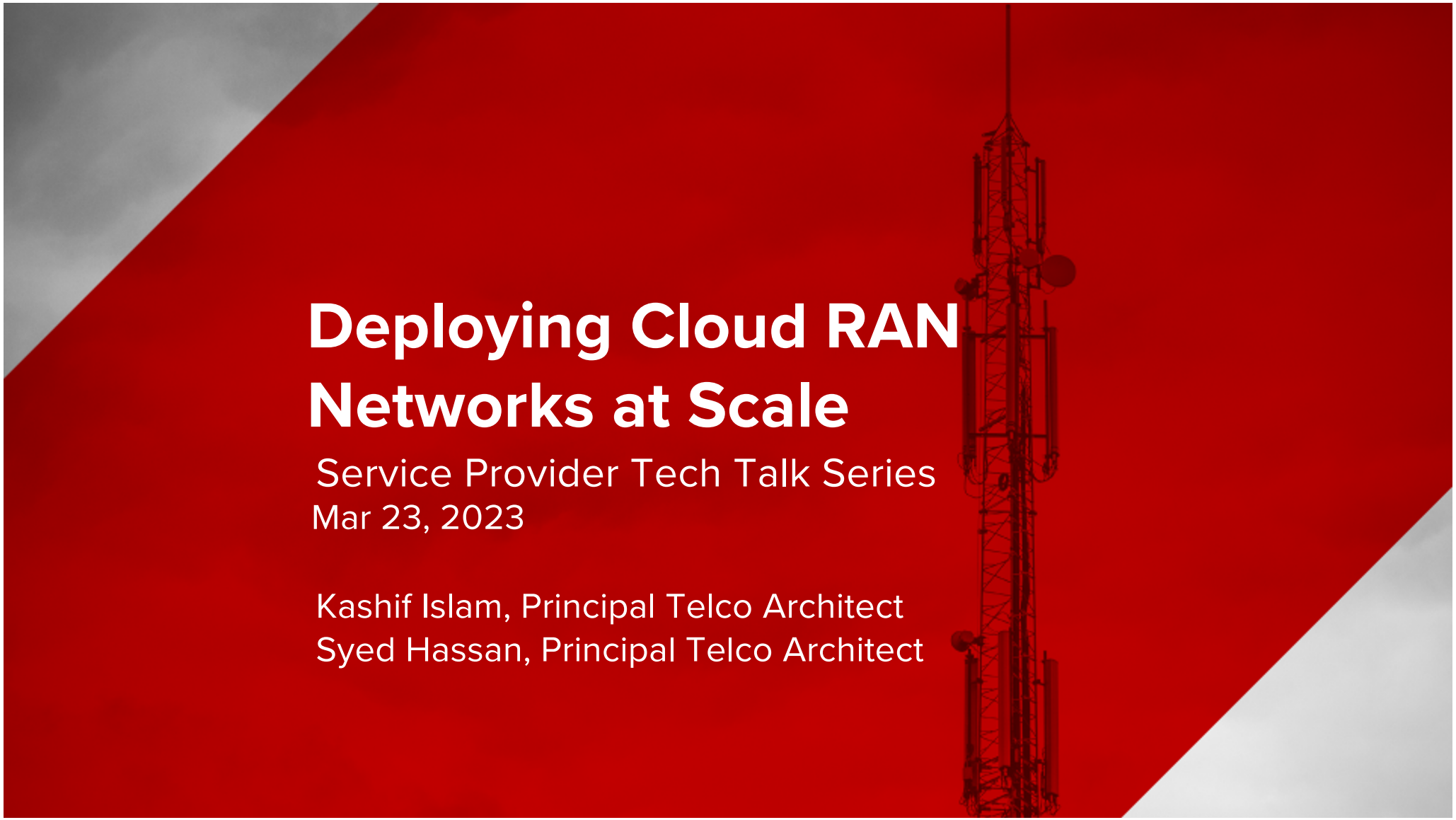


Deploying Cloud RAN Networks at Scale

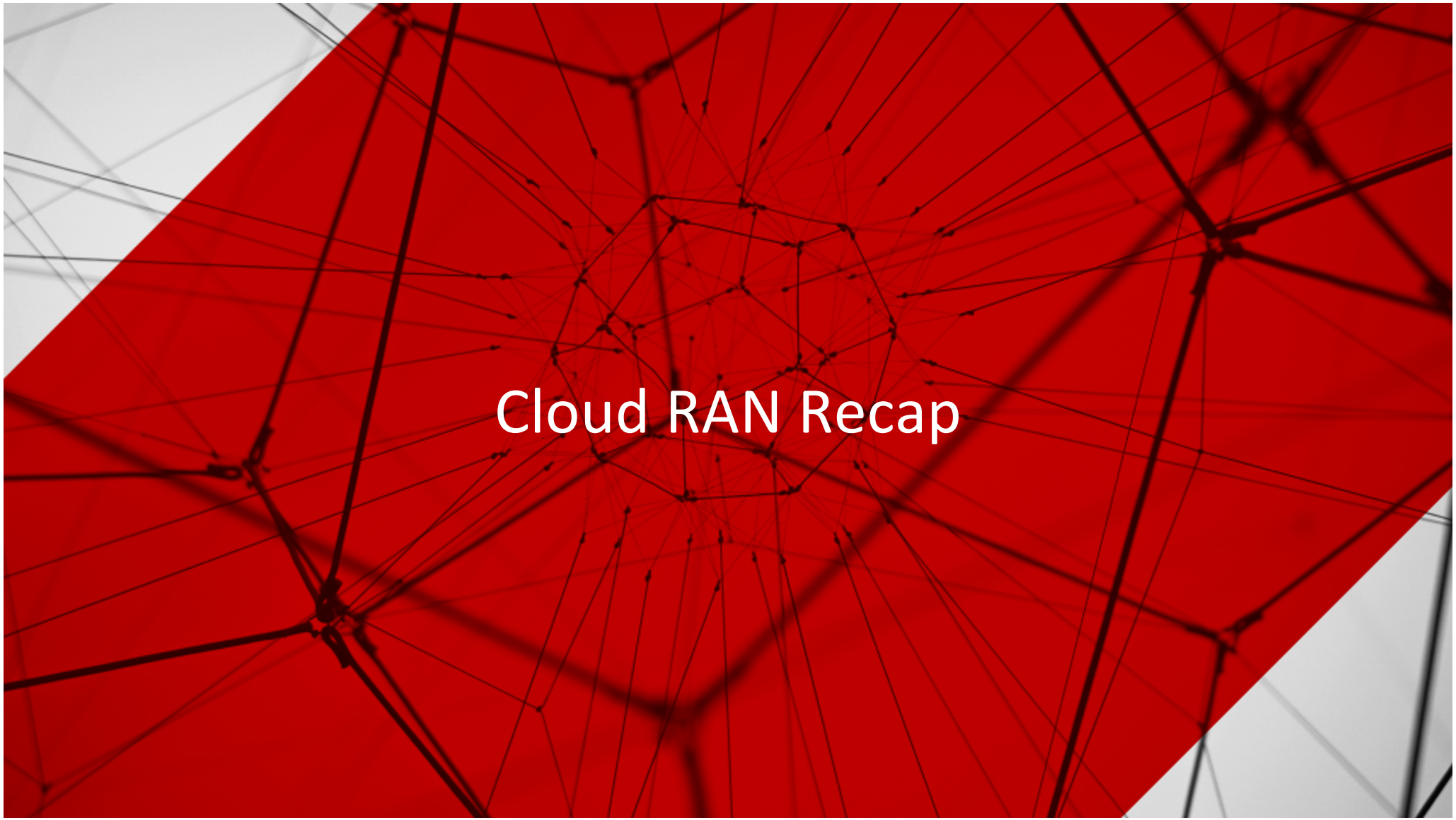
Service Provider Tech Talk Series
Mar 23, 2023

Kashif Islam, Principal Telco Architect
Syed Hassan, Principal Telco Architect

Agenda

- Cloud RAN Recap
- Scaling at Edge Speed
- Fundamentals of GitOps
- Red Hat GitOps Architecture
- Deploying Cloud RAN at Scale
- Summary

Red Hat

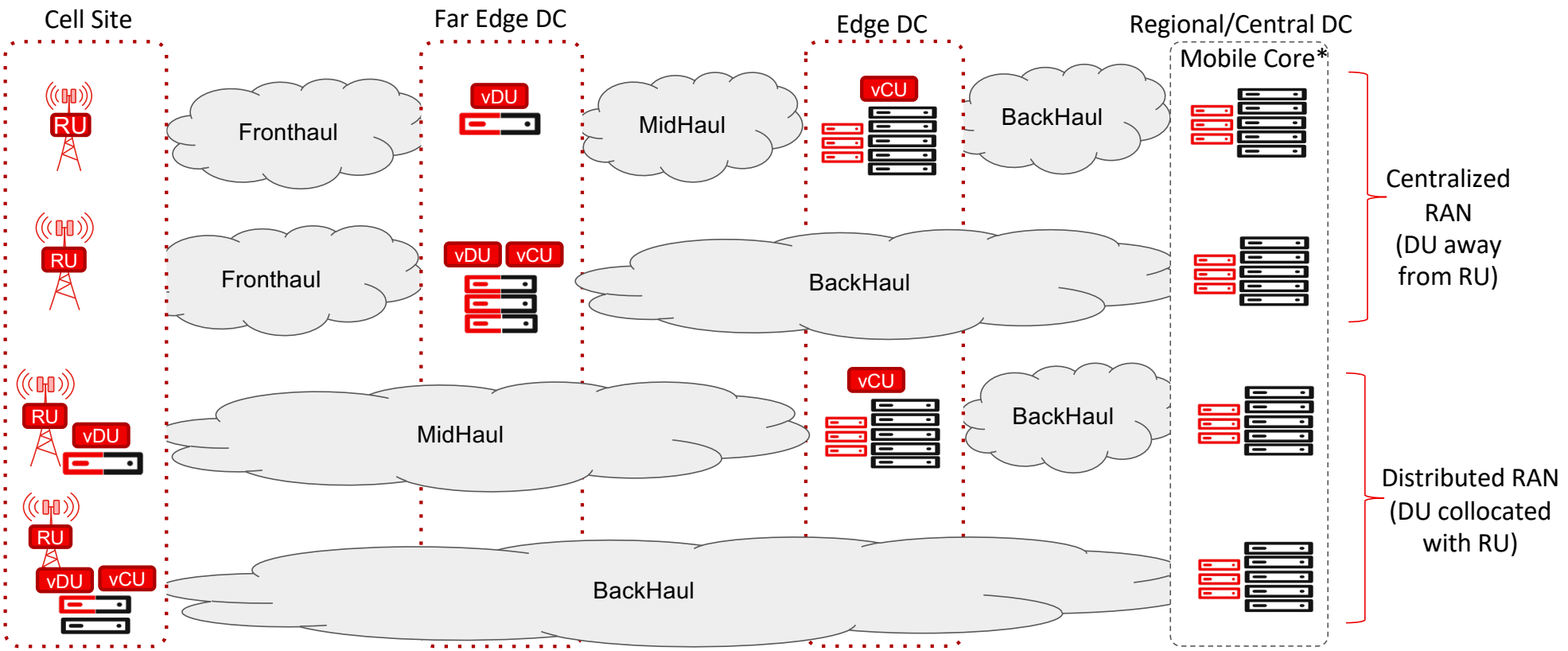

Cloud RAN Recap

Cloud RAN - A Quick Recap of Characteristics

Decomposed	• Splitting the BBU and RRU functions into: Radio Unit (**RU**), Distributed Unit (**DU**) & Centralized Unit (**CU**) • Various options to split the functions defined by 3GPP and others
Disaggregated	• RAN software disaggregated from custom hardware • Allows virtualization, especially of the DU **(vDU)** and CU **(vCU)**
Cloud Native	• DU and CU software functions designed to be cloud-native (containers, microservices, etc)
Cloud RAN	• vRAN architecture where the vDU/vCU are cloud-native • By definition, a subset of vRAN • Not necessarily hosted on Public Cloud

Red Hat

RAN Functional Components Placement



*Some Mobile Core components (such as UPF) can be moved closer to the subscriber and placed a the Edge DC collocated with the CU as part of Control Plane User Plane Separation (CUPS)

Need to Catchup in Detail on Cloud RAN?

The Road to Cloud RAN: From 1G to 5G
https://www.redhat.com/architect/mobile-architecture-cloud-ran

20 radio access networ
https://www.redhat.c ss-network-definitions

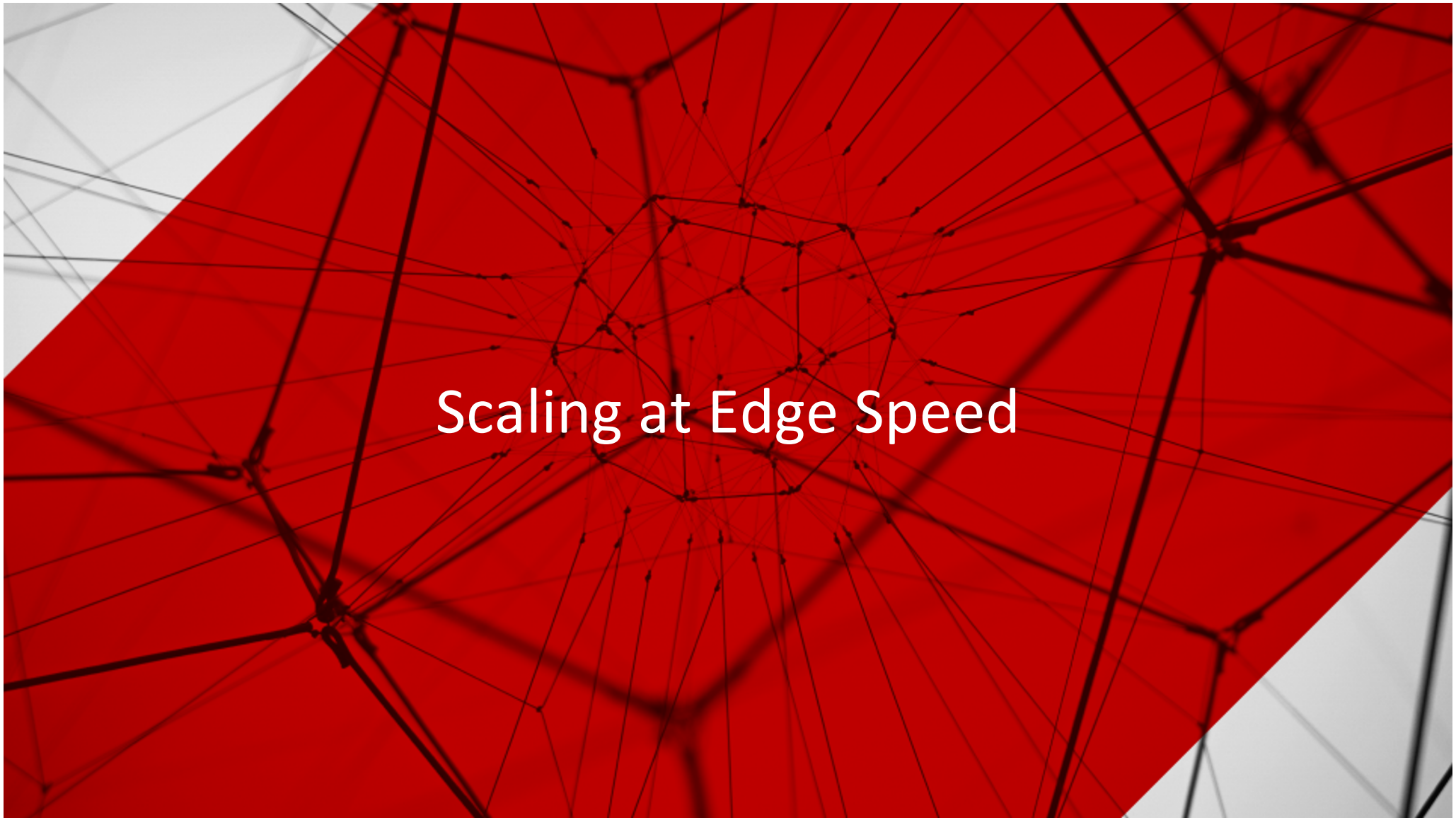
What is Open RA
https://www.red chitect/what-op

What does Re nShift have to do w RAN?
https://www.re rchitect/openshift-

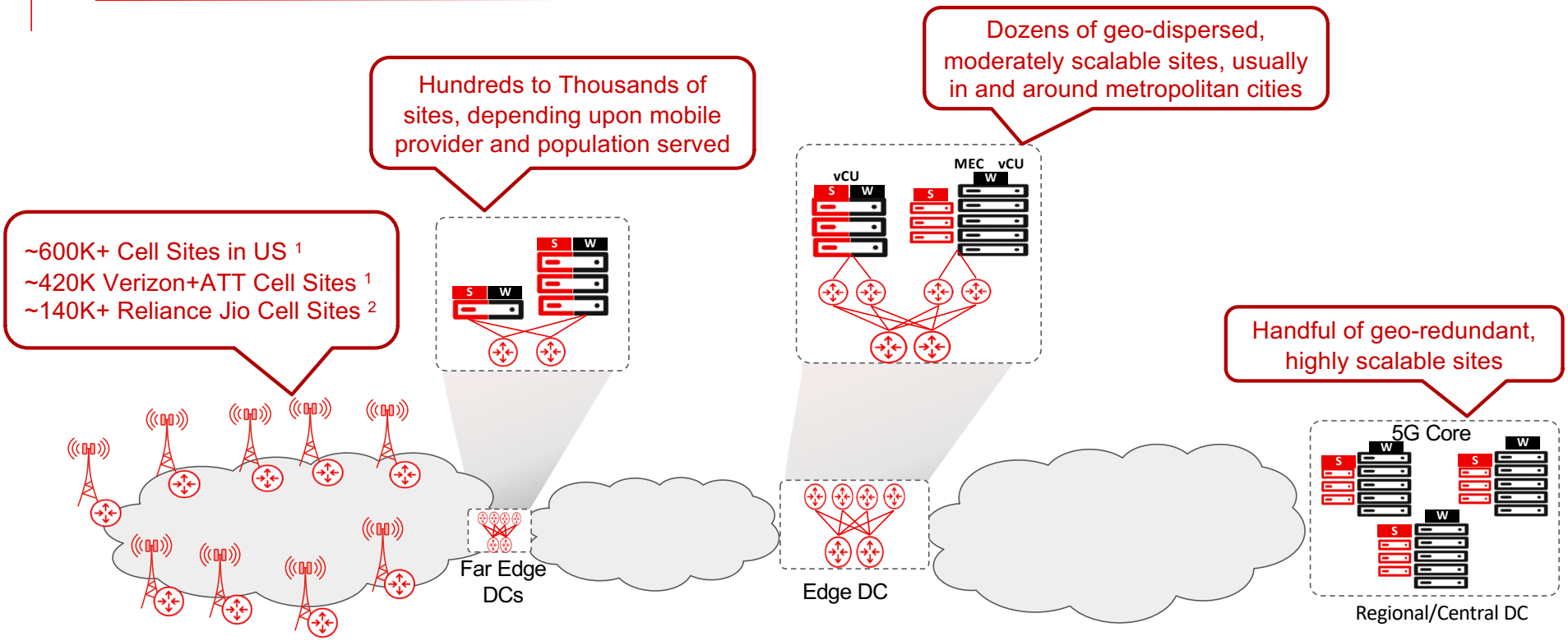
Red Hat OpenSh ment Models f AN
https://cloudify.net

Red Hat Telco Enablem lution and Products
https://www.redhat.com/architect/
https://www.redhat.com/telco

Blog Series on Red Hat Powered Cloud RAN and other topics
https://cloudify.network/


Scaling at Edge Speed

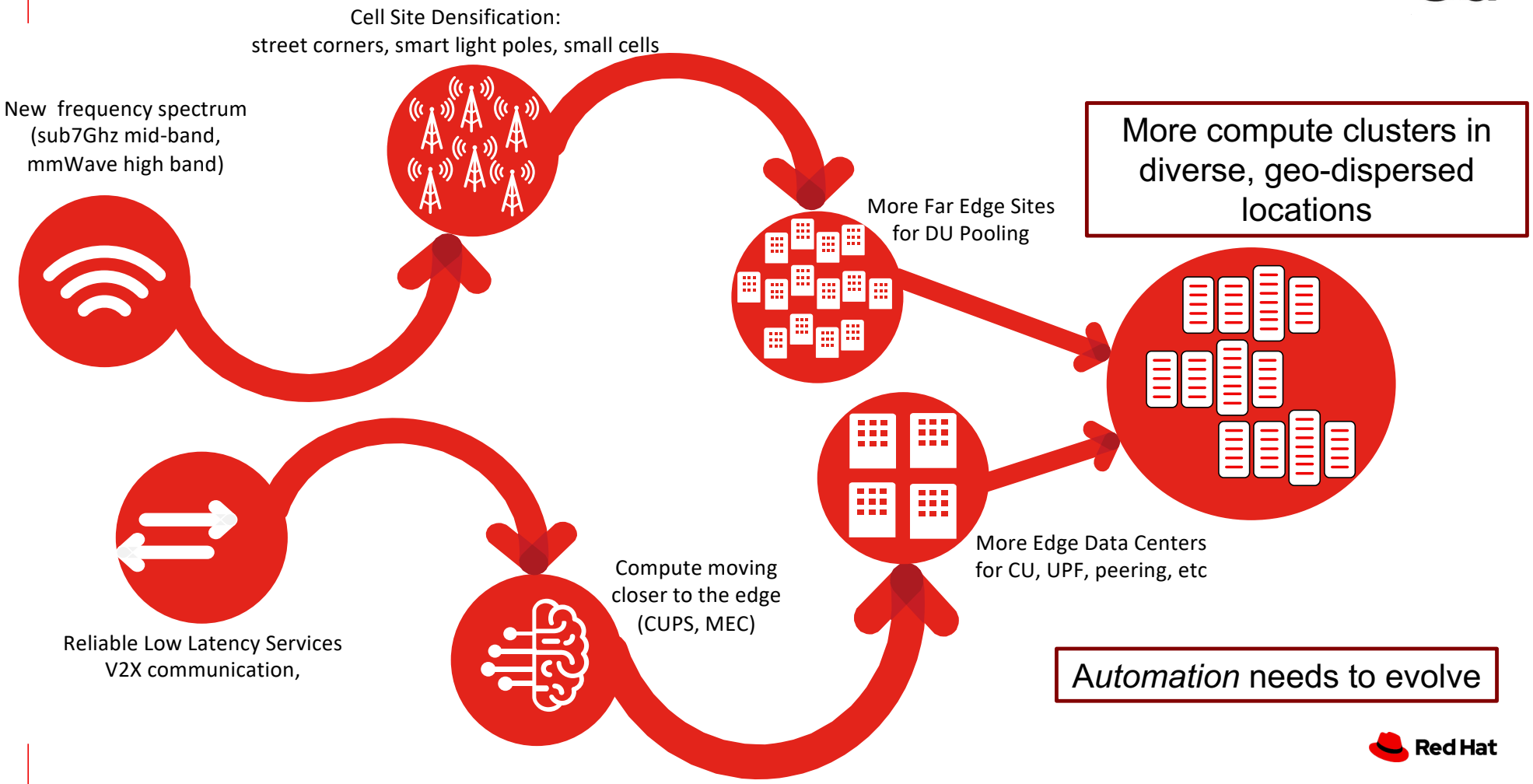
Grasping the scale of mobile deployment

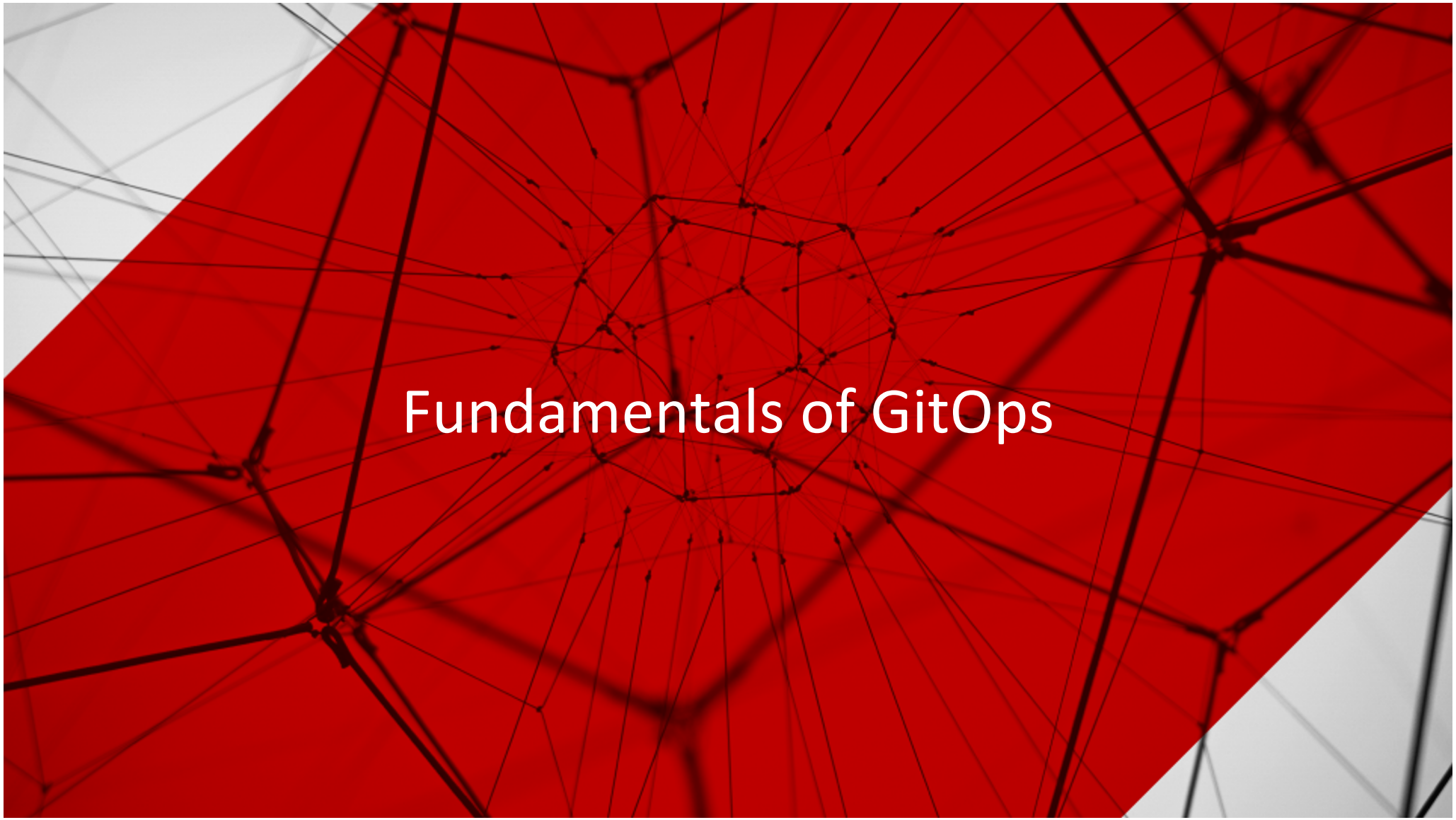


1. https://www.lightreading.com/digital-infrastructure/us-cell-towers-and-small-cells-by-numbers/d/d-id/783929?itc=lrnewsletter_lrdaily&utm_source=lrnewsletter_lrdaily&utm_medium=email&utm_campaign=03212023
2. Network architect's guide to 5G – ISBN: 978-0137376841

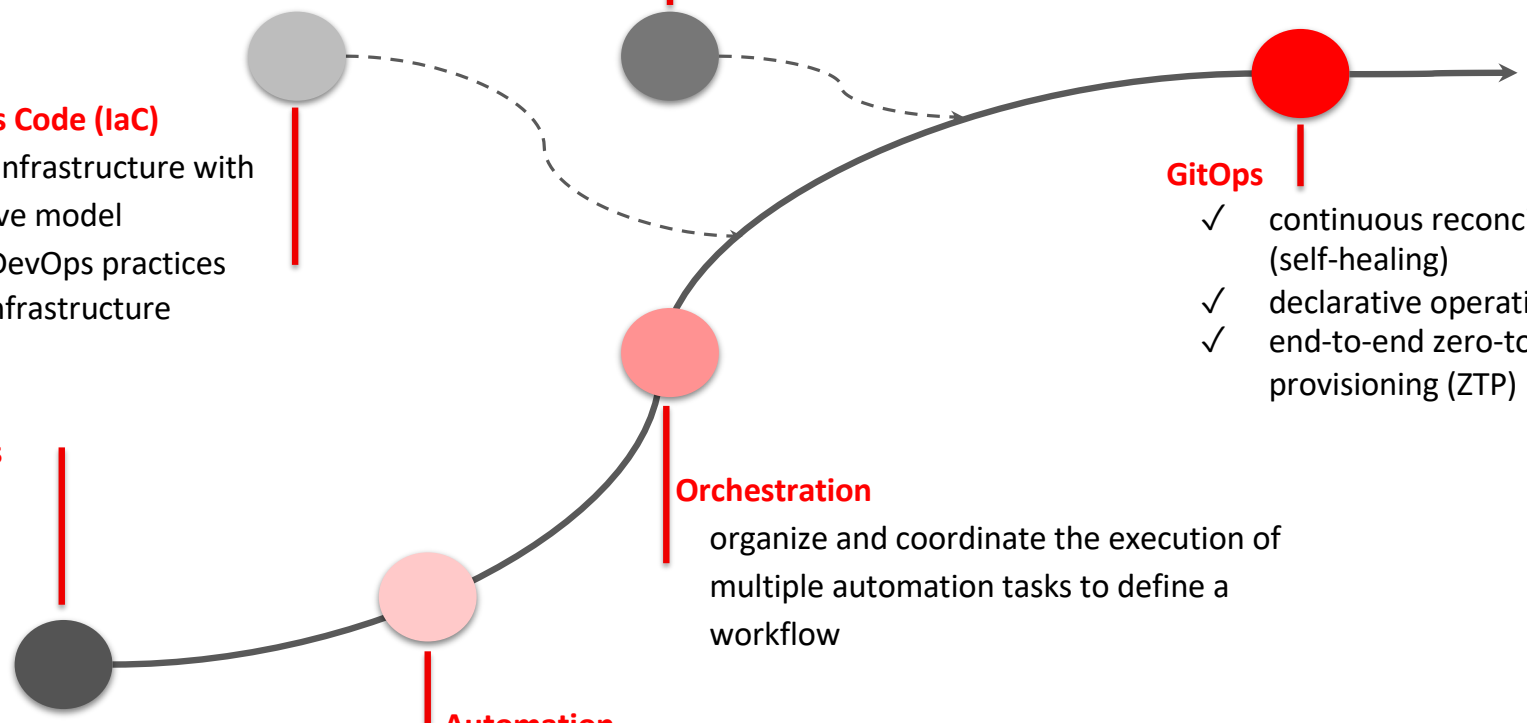
Red Hat

Mobile Scale is about to Meet Edge Scale




Fundamentals of GitOps

The Evolution of Automation



Manual deployments
- ✓ slow
- ✓ error prone
- ✓ hard to scale

Automation
- ✓ repeatable outcomes for specialized tasks
- ✓ no human intervention

Orchestration

organize and coordinate the execution of multiple automation tasks to define a workflow

Infrastructure as Code (IaC)
- ✓ Manage infrastructure with declarative model
- ✓ Follows DevOps practices
- ✓ ZTP for infrastructure

Self-Organizing Networks (SON)

Automation for configuration, optimization and healing of RAN

GitOps
- ✓ continuous reconciliation (self-healing)
- ✓ declarative operations
- ✓ end-to-end zero-touch provisioning (ZTP)

Red Hat

GitOps Concepts and Principles

Declarative

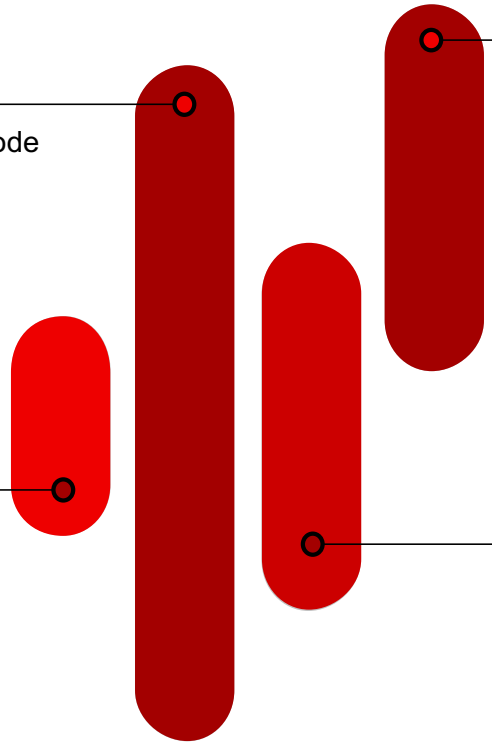
Declare the desired infrastructure as code

Single source of truth in Git

Versioned and Immutable

Auditable, version controlled in Git

Enforces immutability



Automatic Sync

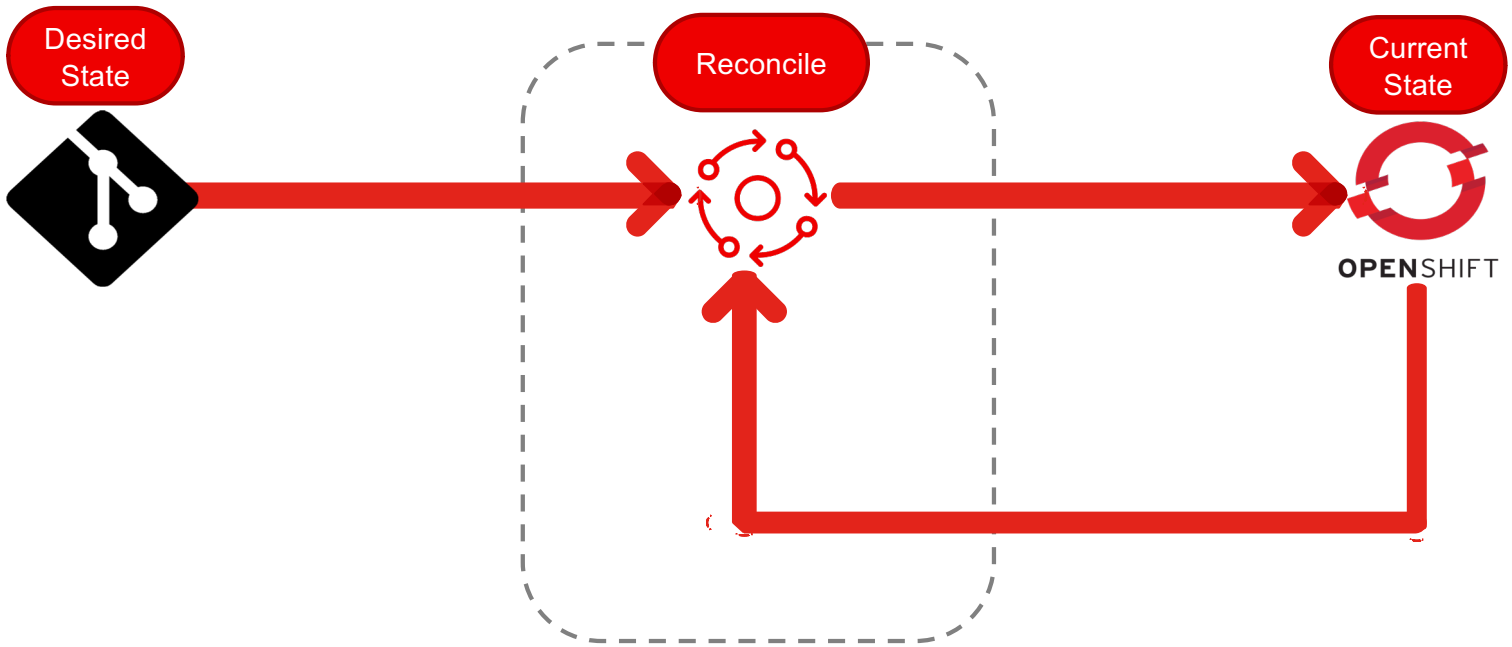
GitOps agents provides automatic sync without manual intervention.

Continuous Reconciliation

GitOps Agents learns current state and reconcile with declared state

Red Hat

GitOps – The Approach



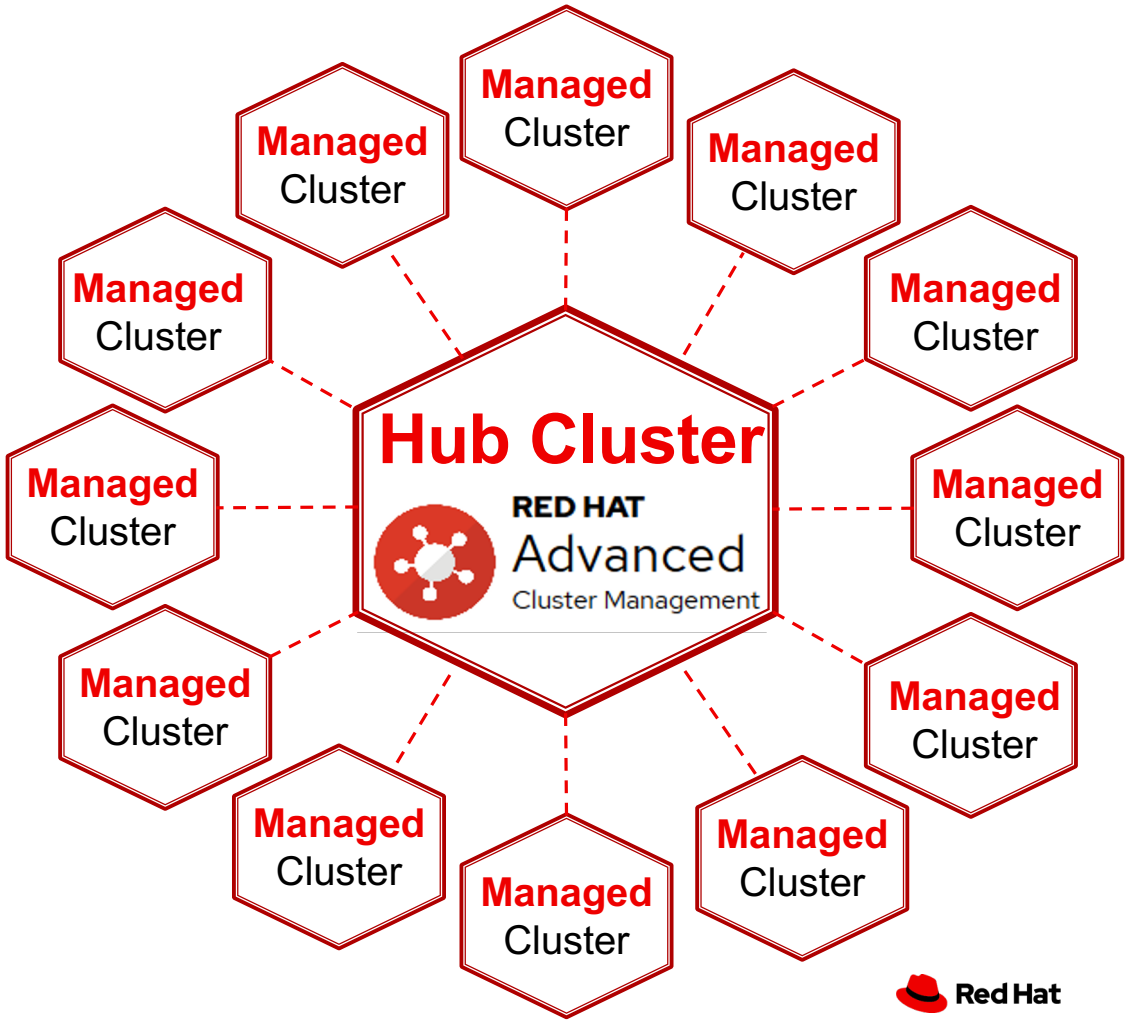
Git stores desired infrastructure as code.
Reconciliation engine compares and ensures parity between desired and current states

Red Hat

Red Hat GitOps Architecture
for Cloud RAN

Red Hat Advanced Cluster Management (RH ACM) As Hub Cluster

1000’s of Red Hat OpenShift Clusters as Managed Clusters

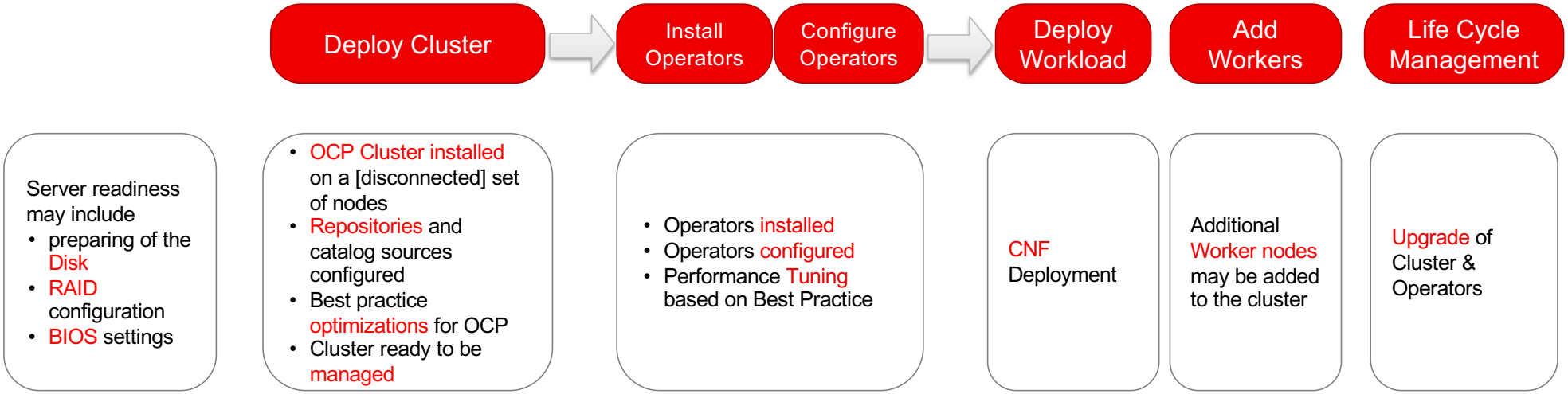


Red Hat Advanced Cluster Management

- Single Pane of Glass for Management, Monitoring, & Deploying
- Runs on top of OpenShift Cluster
- Rich API for Integration with Enterprise tools
- Simplified Operations & Maintenance
- Hub-Spoke architecture

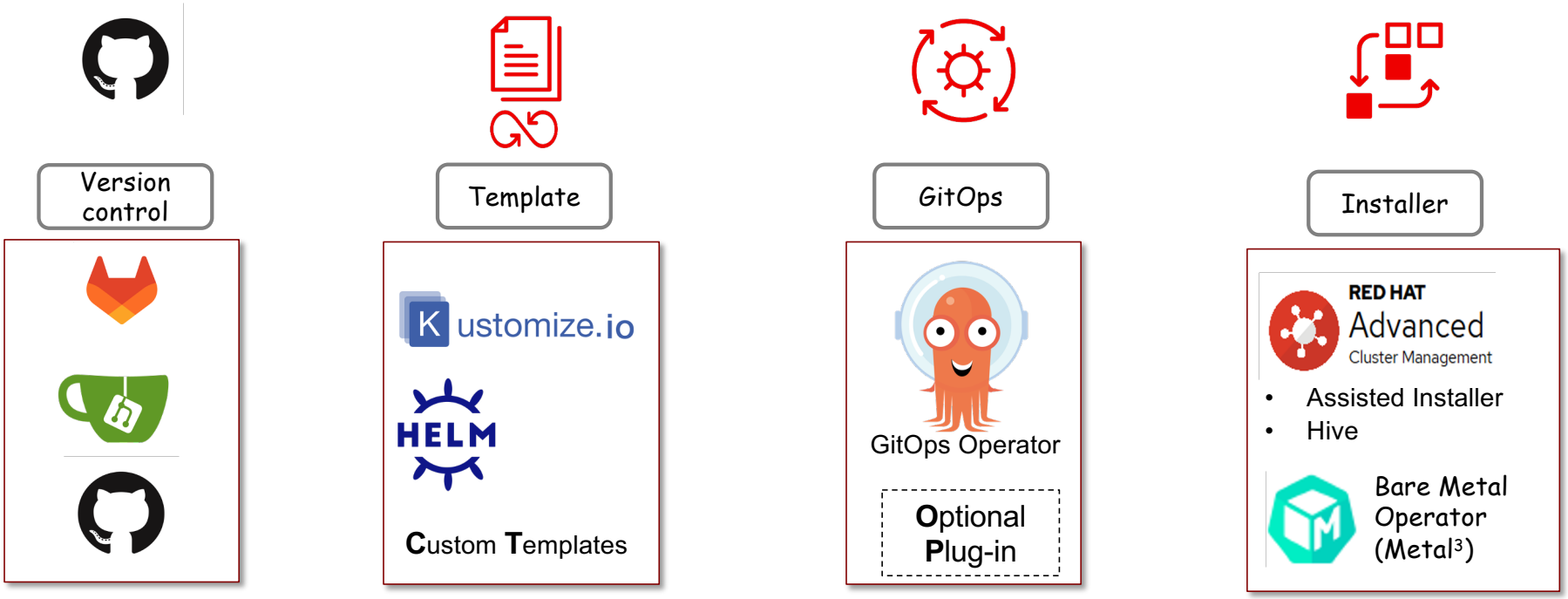
Red Hat

Deploying OpenShift Cluster



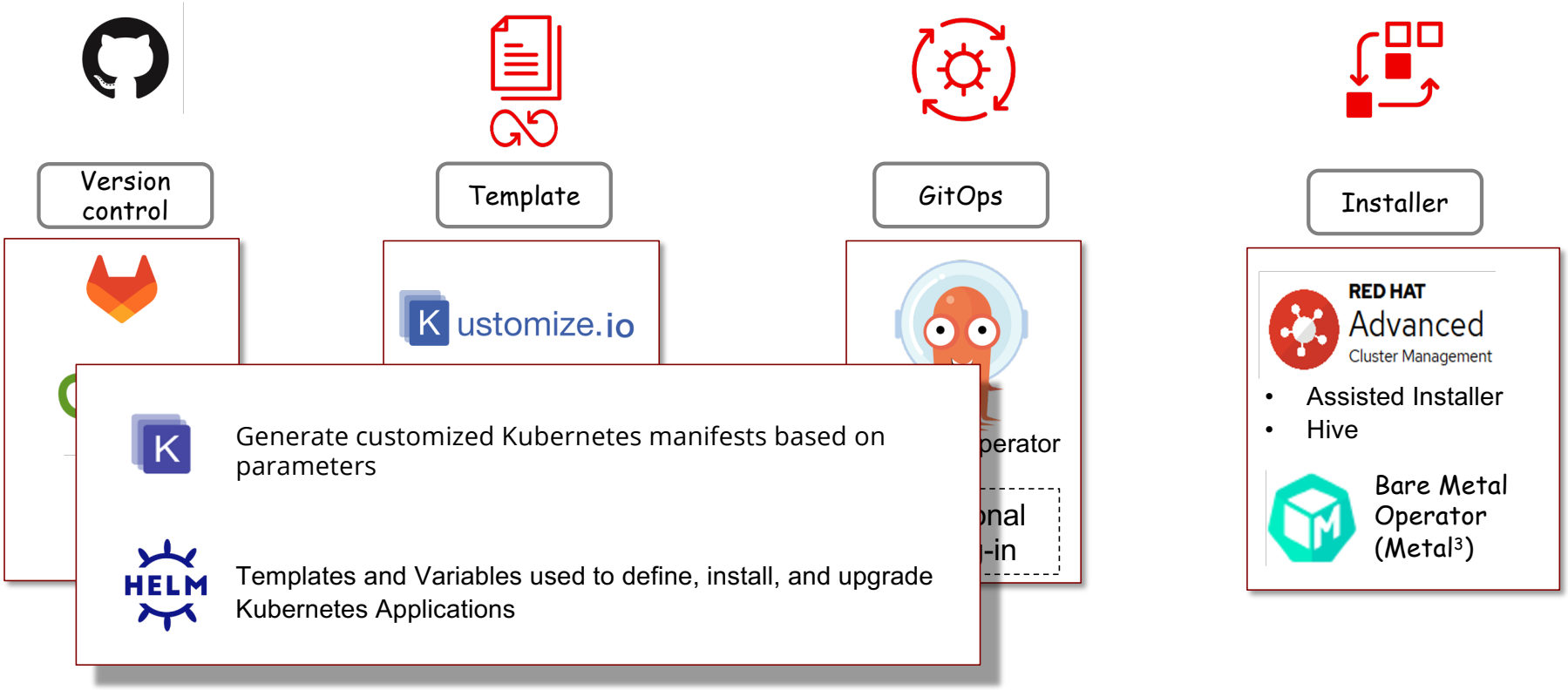
Red Hat

Deploying OpenShift using GitOps – Building Blocks



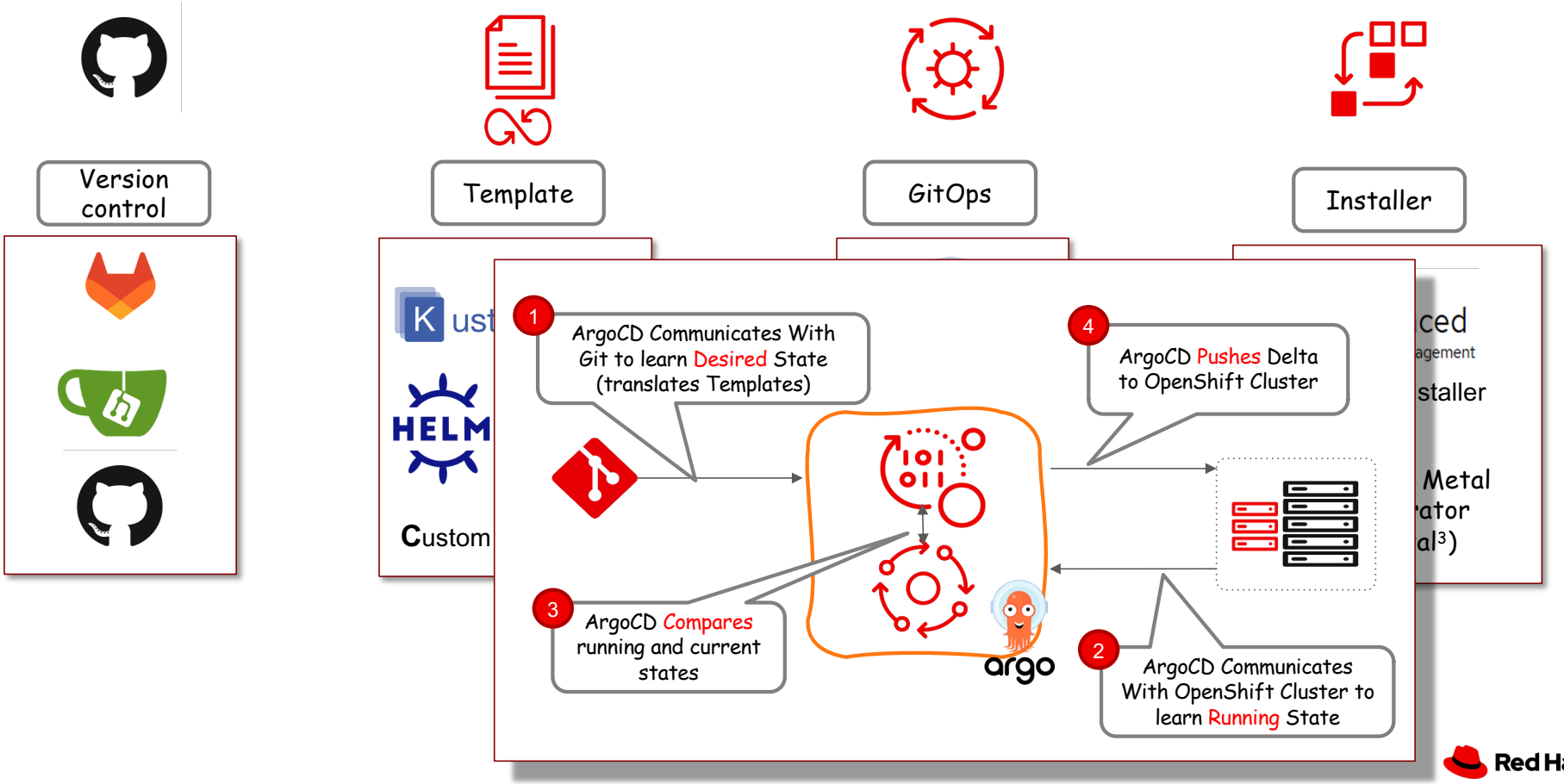
Red Hat

Deploying OpenShift using GitOps – Building Blocks



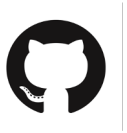
Red Hat

Deploying OpenShift using GitOps – Building Blocks



Red Hat

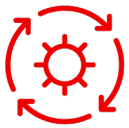
Deploying OpenShift using GitOps – Building Blocks



Version control

Template

Custom Templates



GitOps

GitOps Operator

Installer

- Assisted Installer
- Hive

Assisted Installer

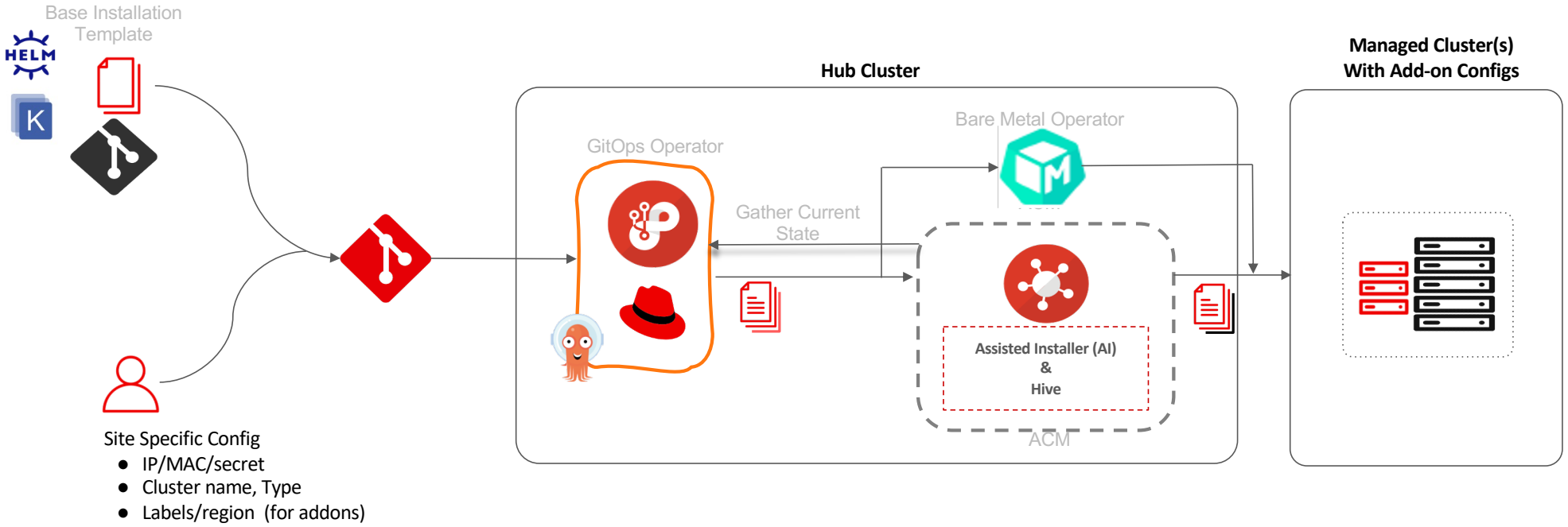
- Managed Service to Install OpenShift Cluster – including CoreOS
- Progress, monitoring and error handling
- GUI to monitor installation flow
- REST API driven

Hive

API Driven OpenShift Cluster Provisioning & Management

Metal³ based Bare Metal provisioning for Kubernetes

Deploying OpenShift With GitOps



Red Hat

Deploying Cloud RAN at Scale
Red Hat

Plan your Cloud RAN Journey

- Radio planning
- RAN Components
- RAN Architecture
  - Centralized RAN
  - Distributed RAN
- Transport Infrastructure
- Site location
  - Power, Real estate, cooling, etc
- OpenShift: Horizontal Cloud Platform

- CU/DU integration with Cloud Platform
- Reference Architecture
- Functional validation
- Scale and performance validation
- Redundancy and high availability validation

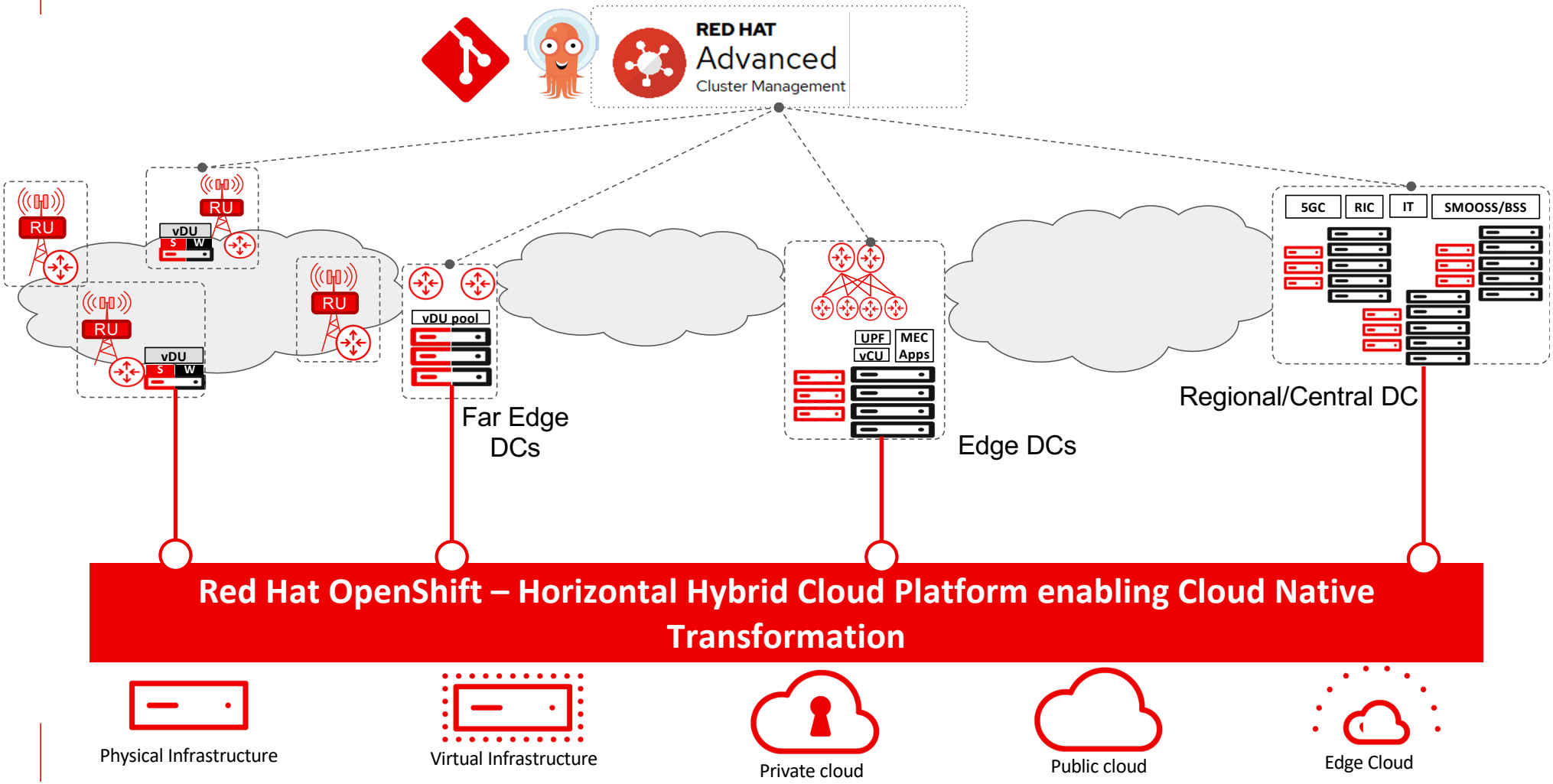
- Mobile provider specific customization
  - Secrets management
  - RBAC
  - Security policies
  - Operational policies
- Git Repo Structure and access policies
- Create deployment templates

- First Office Application (FOA)
- Limited friendly deployment
- Tune-up deployment blueprint
- Ready for roll out

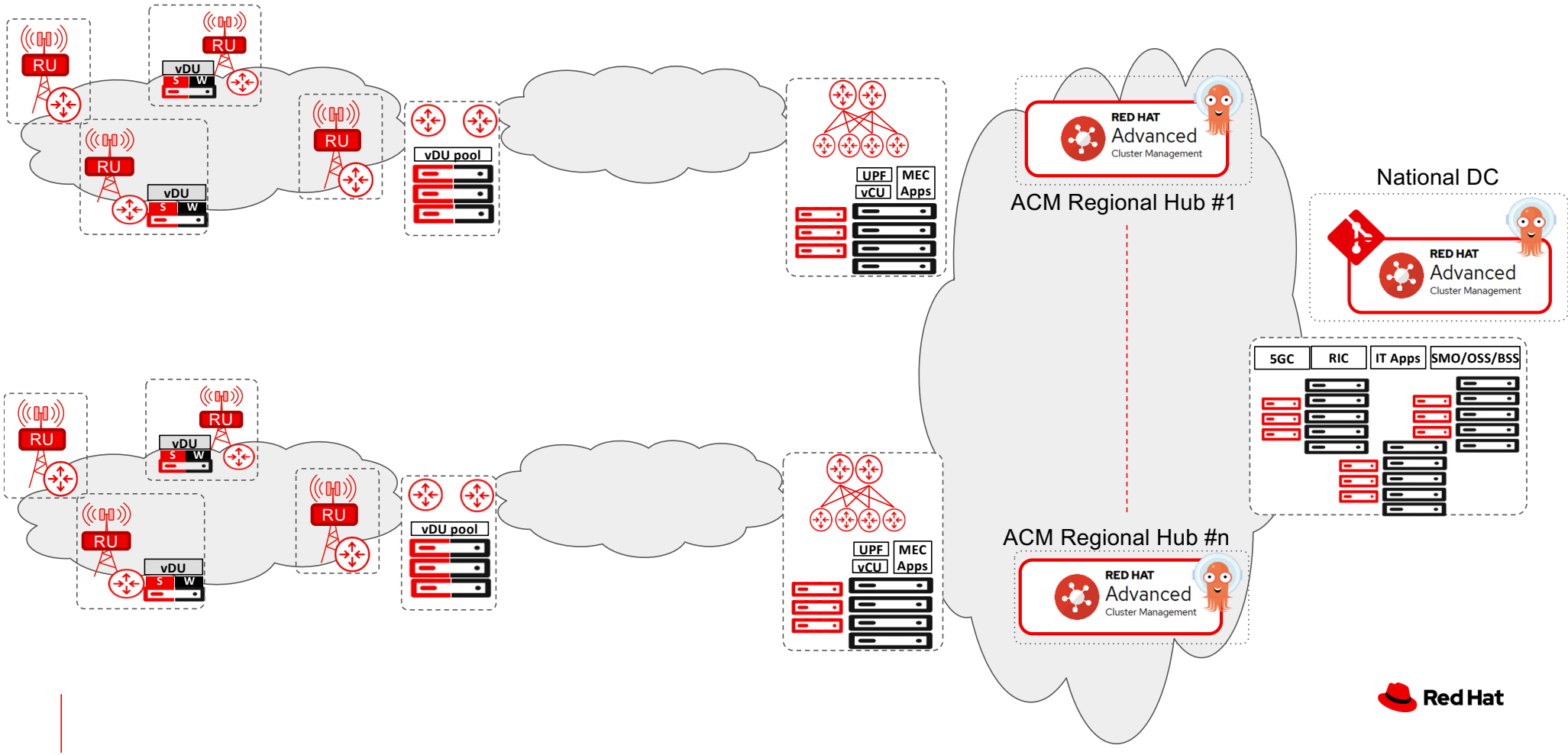
- Create manifests for new sites
- Commit to Git Repo
- Let Red Hat GitOps reconcile desired and declared state

Red Hat

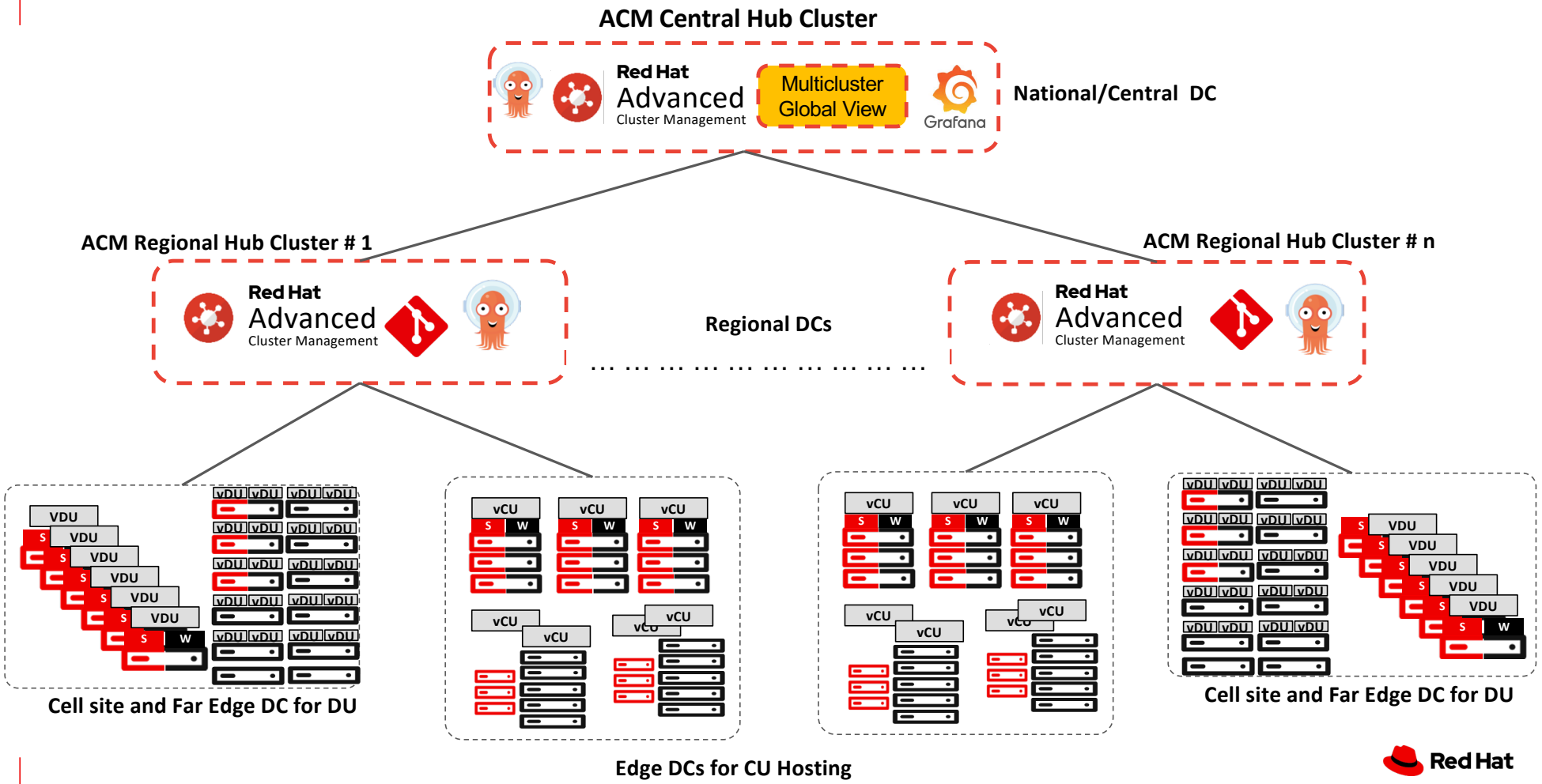
Declarative GitOps Across the End to End Mobile Network



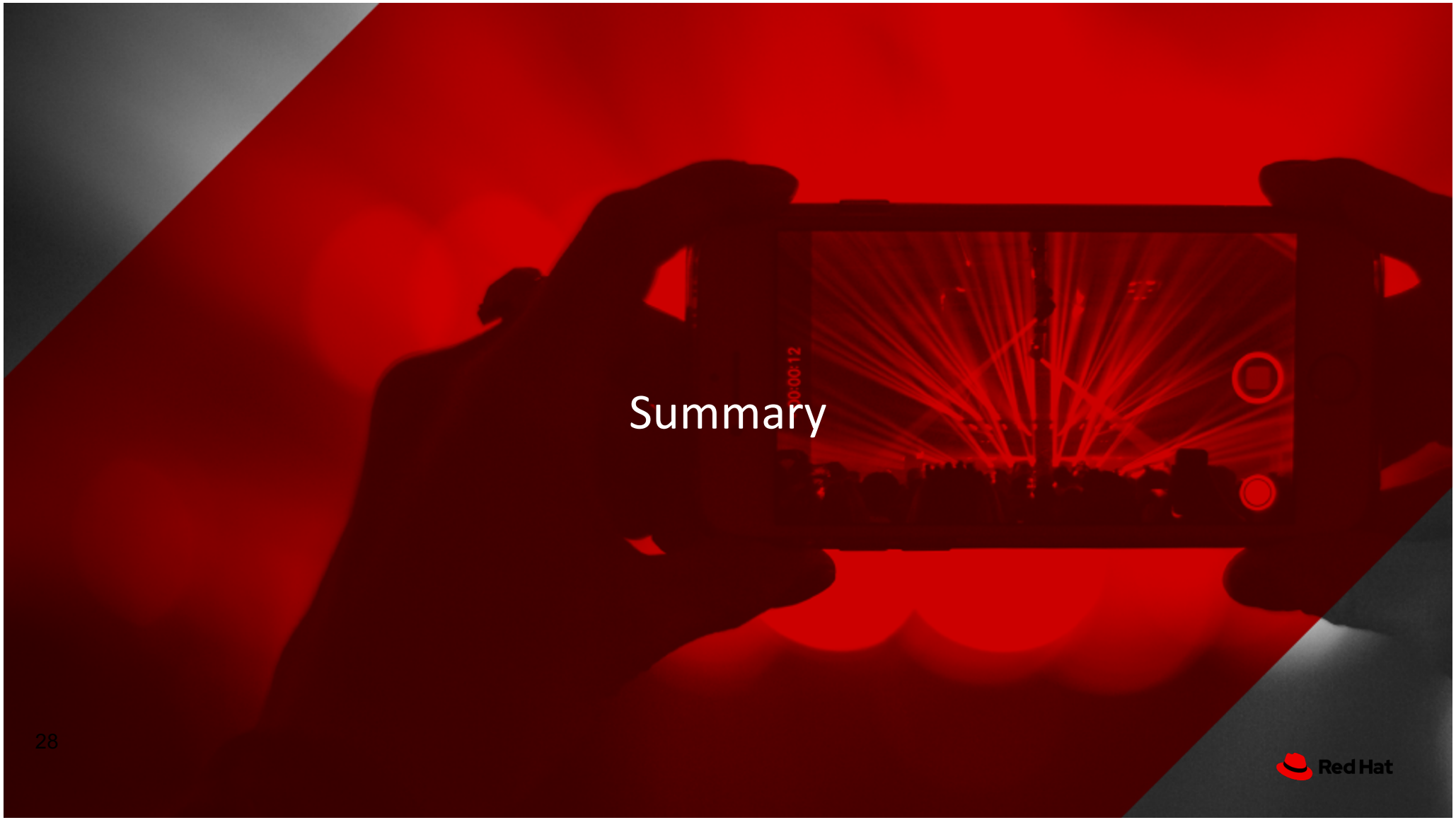
Scaling for Cloud RAN based Mobile Network Infrastructure



Cloud Infrastructure for Scalable Cloud RAN Networks



Red Hat



Summary

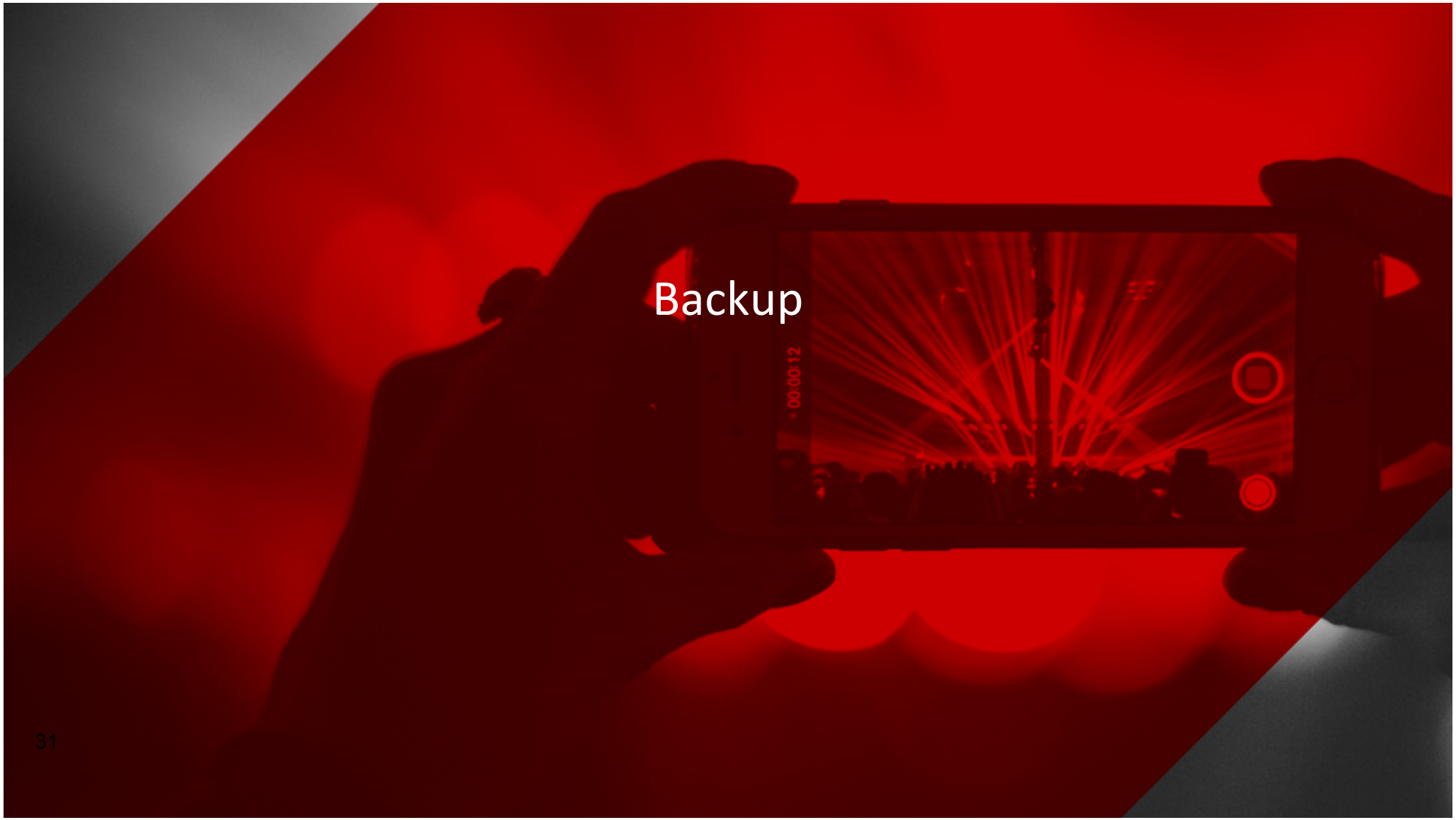
Red Hat

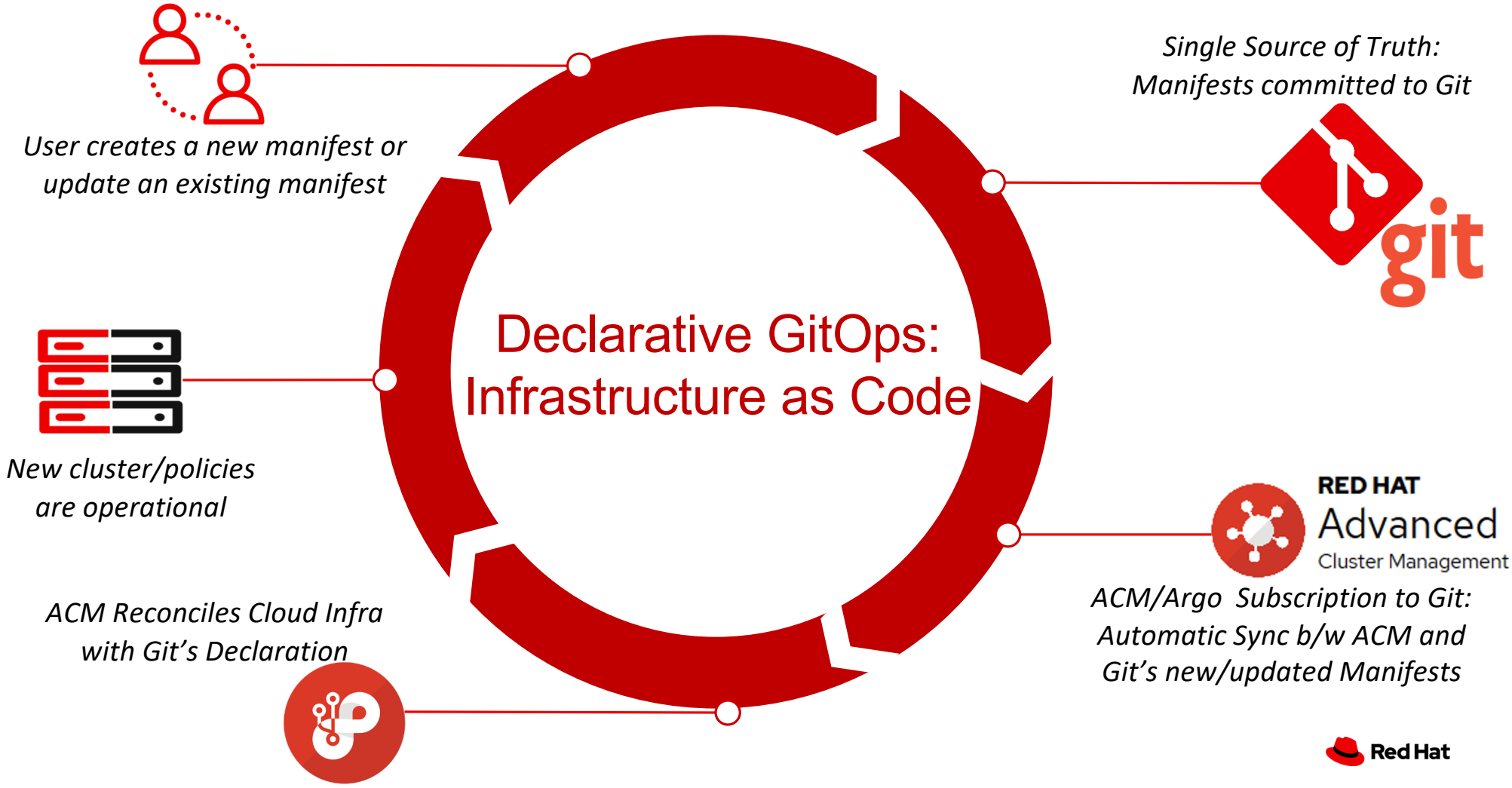
Summary

- Cloud RAN necessitates a horizontal cloud infrastructure across the mobile network
- Cell site densification and low latency services driving exponential growth and placement of compute resources closer to subscriber
- GitOps: a declarative, infrastructure as code approach provide automation at scale
- Git provides a single source of truth for the desired cloud infrastructure
- Red Hat Advanced Cluster Management (ACM) in the hub cluster deploys managed clusters as defined in Git
- Continuous reconciliation between desired state and current state
- Hierarchical architecture for scaling the cloud RAN

Red Hat

Red Hat
THANK YOU
plus.google.com/+RedHat
facebook.com/redhatinc
linkedin.com/company/red-hat
twitter.com/RedHatNews
youtube.com/user/RedHatVideos


Backup


User creates a new manifest or update an existing manifest
Single Source of Truth: Manifests committed to Git
git
Declarative GitOps: Infrastructure as Code
New cluster/policies are operational
RED HAT
Advanced
Cluster Management
ACM/Argo Subscription to Git: Automatic Sync b/w ACM and Git's new/updated Manifests
ACM Reconciles Cloud Infra with Git's Declaration
Red Hat