Bell Canada Multi-Access Edge Computing (MEC) Success Story:

Declarative GitOps based Zero Touch Provisioning

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Abstract

This session will cover the Red Hat Advanced Cluster Management (RH ACM) based Declarative GitOps architecture used to deploy Bell Canada's Edge Cloud using Red Hat OpenShift . The session will be jointly presented by Red Hat and Bell Canada Architects and will outline Bell Canada's Multi-access Edge Compute (MEC) usecase, solution architecture and the declarative approach for MEC deployments at scale.

Multi-access Edge Compute (MEC) infrastructure enables a Communication Services Provider to bring services delivery closer to the end user. However, designing and deploying a Multi-access Edge Compute (MEC) cloud also presents a challenge in the sense this infrastructure may comprise hundreds of remotely located clusters spanning multiple smaller data centers, but they still need to be managed from a central location. CSP needs to streamline their processes for efficient deployment and operations of the infrastructure placed at edge locations.

This session will be structured as follows:

- A recap of Bell Canada's MEC use case, requirements and expected solution (Bell)
- Solution overview: Declarative GitOps based Zero Touch Provisioning for MEC (Red Hat)
- Challenges, solutions and workarounds (Red Hat/Bell)
- Leveraging GitOps ZTP for Continued Cloud Platform deployments (Bell)
- Next steps for Bell

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Meet today's presenters

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What we'll discuss today

- MEC @ Bell: Context & Background
- Bell's Vision and Hypothesis
- GitOps: The Red Hat Approach
- Challenges and Solutions
- Declarative GitOps: What's next at Bell Canada

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MEC @ Bell: Context and Background

"So much of design is context"

– Steve Madden.

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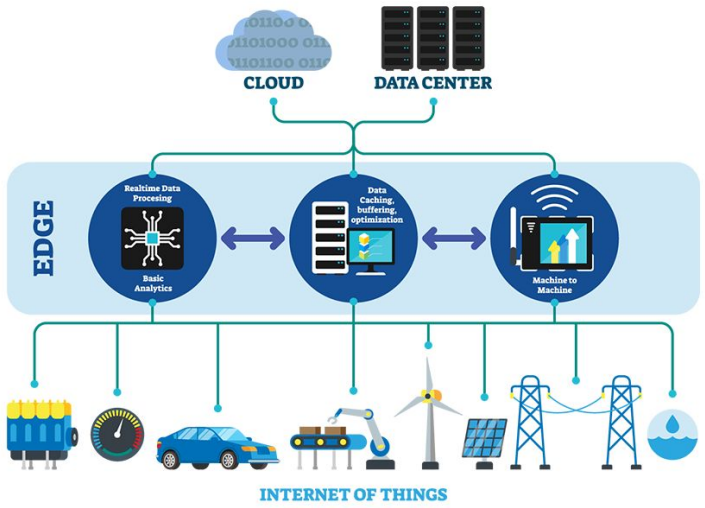
A Little Bit of Context...

Let's start with a common question: what's the difference between Edge Computing and Multi-access Edge Computing?

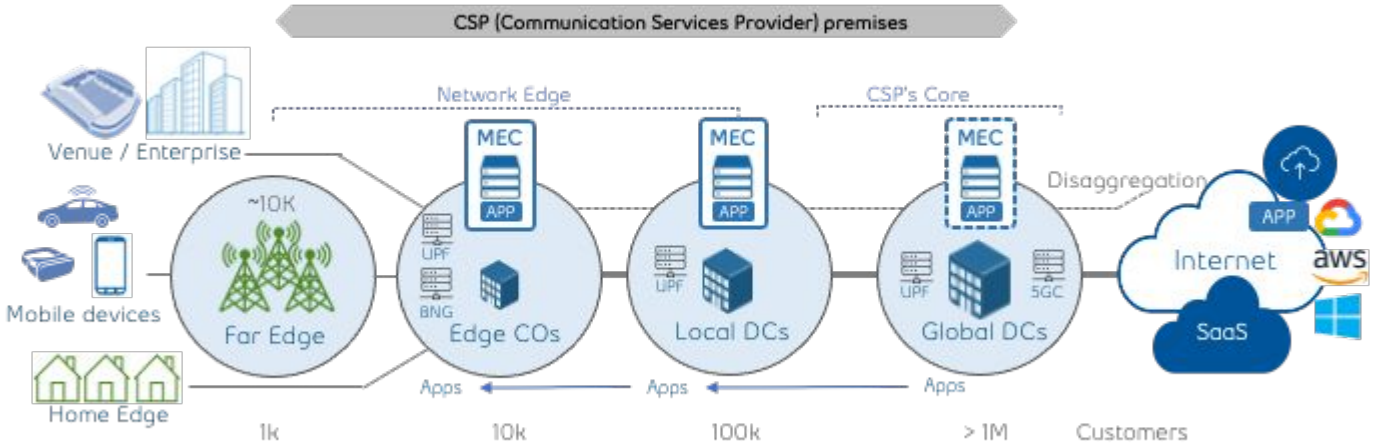
Edge Computing



Source: IEEE (https://innovationatwork.ieee.org/real-life-edge-computing-use-cases/)

- Edge Computing pre-dates MEC and started with Cloud (i.e. CDN)

Multi-access Edge Computing



Source: Bell Canada

MEC leverages the proximity of applications to network functions to reduce latency and improve user experience.

- In 2017, ETSI changes Mobile Edge Computing to Multi-Access Edge Computing to expand the architecture focus to include requirements outside the cellular network.
- 3GPP introduces 5G on its Release 15 already specifying MEC as part of 5G Core architecture

Bell started its MEC journey early to maintain its leadership in the Canadian market during the 5G deployment

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The Beginning of Bell Canada's MEC Journey

- After monitoring the industry for a couple of years, Bell started research in 2020 on the available MEC implementation options: ***build*** vs. ***buy***

***Build**: flexible but complex*

Red Hat Advanced Cluster Management for Kubernetes

GitHub

SR Segment Routing

FRR

envoy

cilium

OPENSHIFT

kubernetes

Lanner

cisco

Hewlett Packard Enterprise

BROADCOM

***Buy**: simpler but not many choices*

aws

Outpost, available in 2020

GDC-Edge, only available in 2022

Azure Stack Edge

Azure Stack Hub

No equivalent to Outpost/GDCE yet available

Lack of maturity in hyperscalers products back in 2020 lead to hybrid strategy

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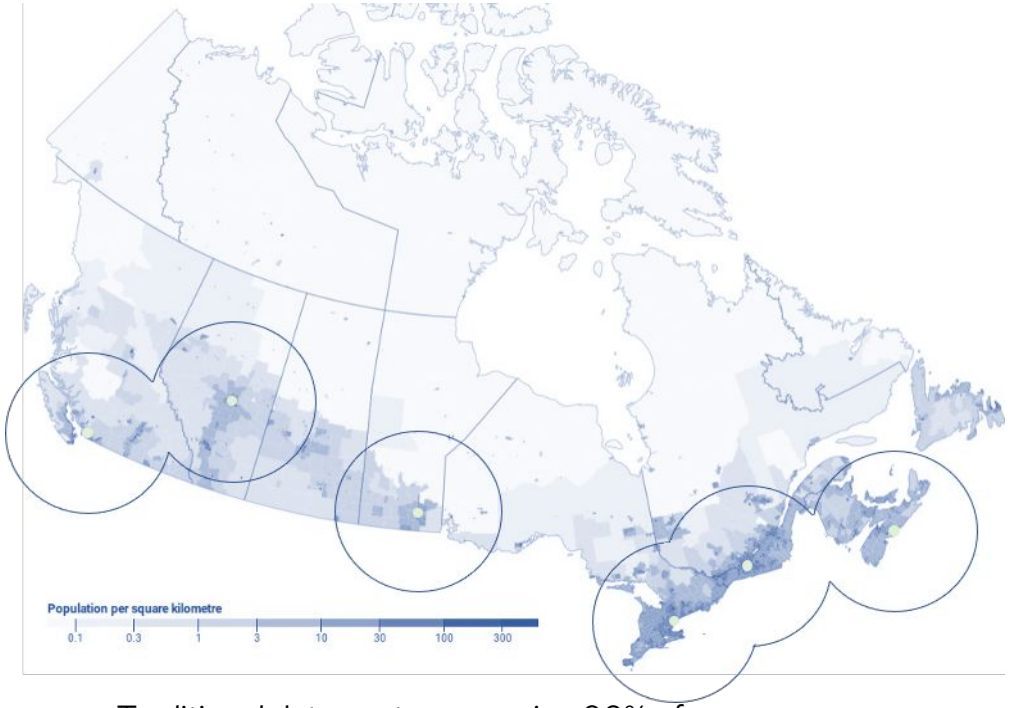
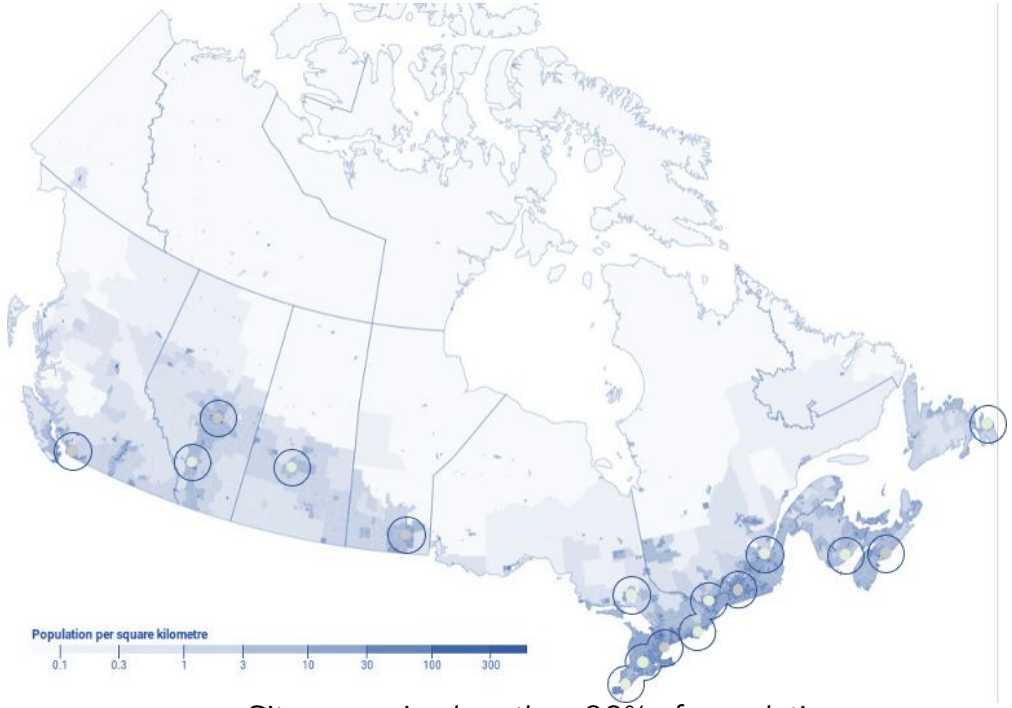
MEC Fleet Management: The Problem of Scaling Up

- Bell's initial research for a MEC stack that we would ***build*** led into design challenges related to the scale of our eventual deployment: how to avoid overhead in many more locations for MEC provisioning?
- The goal of "zero-touch provisioning" required a new approach; the first two envisioned were insufficient.



Traditional data centers covering 90% of population with regular latency



Sites covering less than 80% of population: lower latency = less coverage area

A much larger MEC fleet is necessary for lower latency, hence central management

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Bell's Vision and Hypothesis

"The only thing worse than being blind is having sight but no vision"

– Helen Keller.

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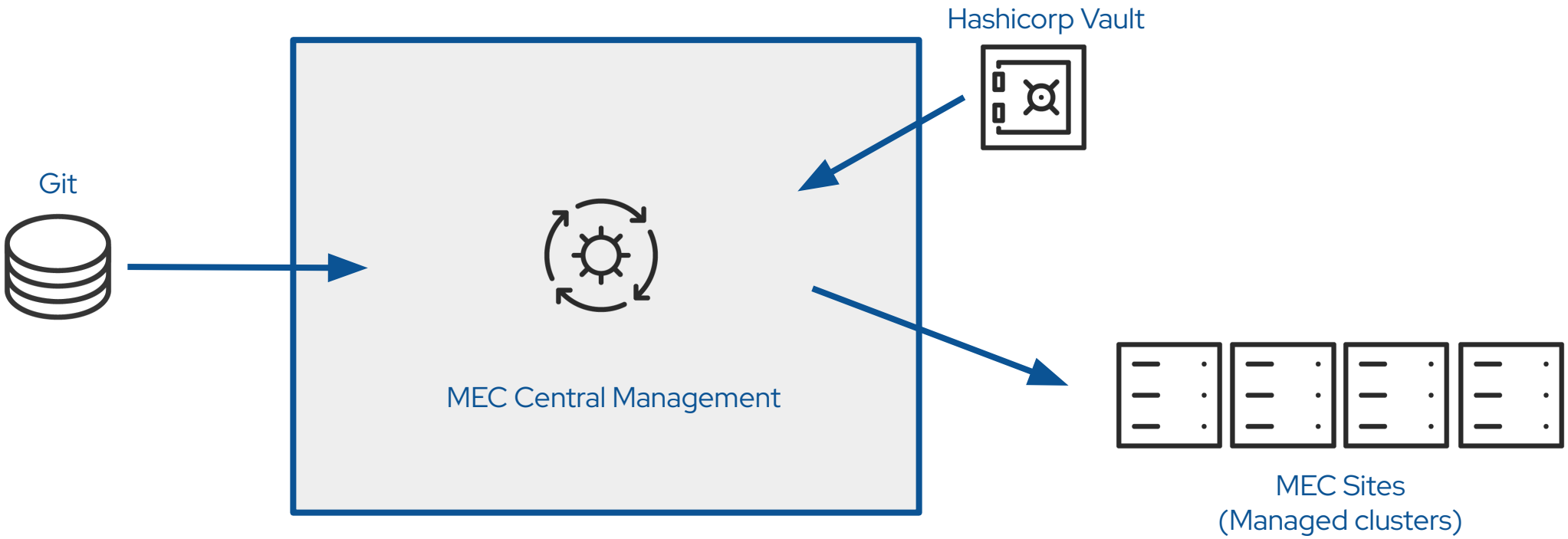
The Bell Vision: a Central Point of Management for MEC



Hypothesis: Red Hat ACM* can be the MEC central point of deployment and management

RH Advanced Cluster Management

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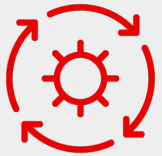
Bell's Objectives and Hypothesis to Validate

Objectives

Be declarative

Hypothesis

- GitOps solution based on declarative tooling
- Provision Openshift clusters with all Telco Enhancements (5G Core requirements)
- Enforce policies to comply with Bell Security Controls



Commoditize deployments

- ACM is mature enough to handle MEC Openshift clusters deployment with zero touch provisioning
- Technical support for MEC Openshift cluster provisioning (with Telco Enhancements)

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Bell's objectives and hypothesis to validate

Objectives

Hypothesis

Accelerate development

- ACM deployed as per RH requirements will not require customizations
- Red Hat can quickly change configs to react to new tenants requirements or Telco enhancements

Facilitate handoff to operations

- ACM is mature enough to handle MEC Openshift clusters deployment with zero touch provisioning
- Technical support to the MEC Openshift cluster provisioning (with Telco Enhancements)

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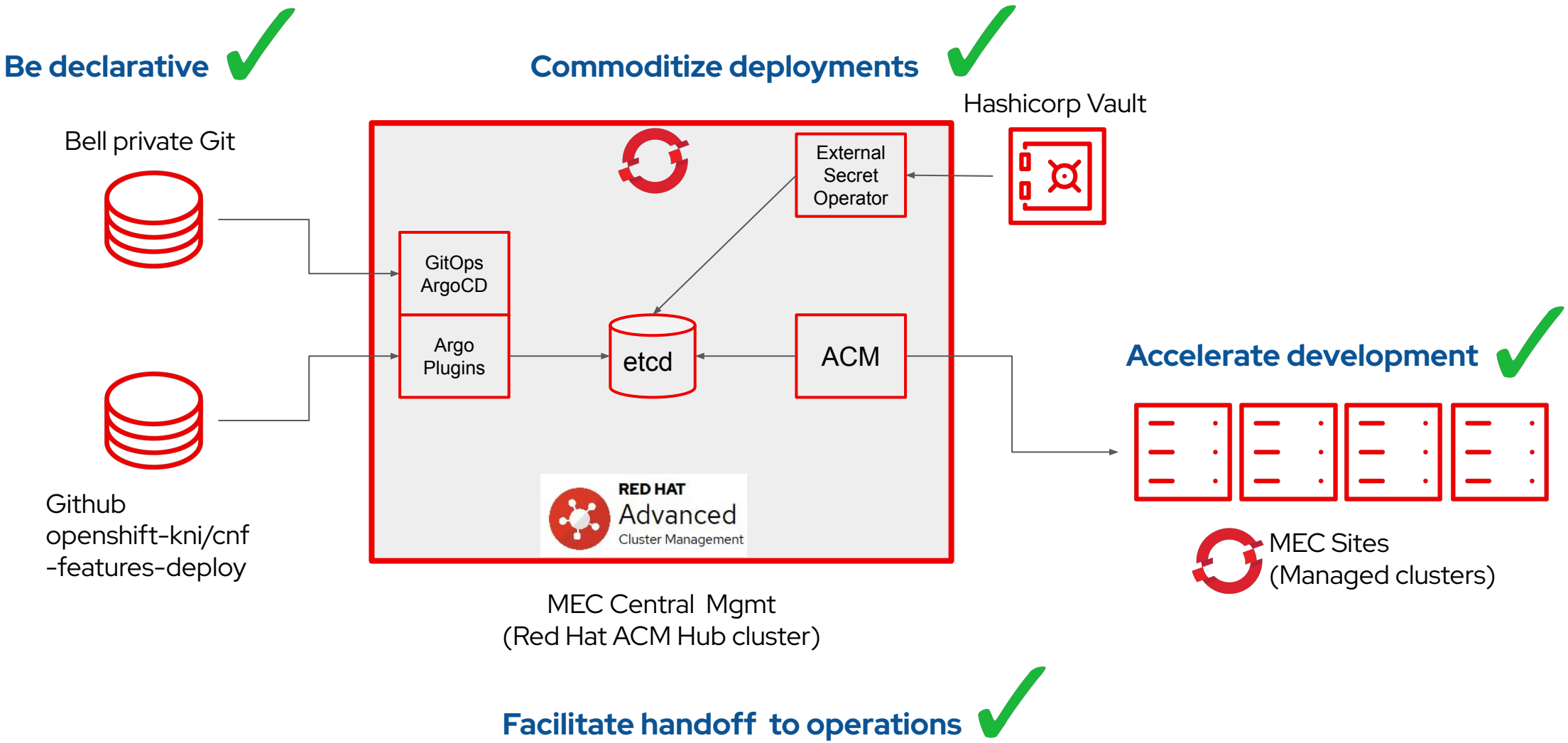
Target Architecture



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GitOps: The Red Hat Approach

"Our goals can only be reached through the vehicle of a plan … There is no other route to success"

– Pablo Picasso.

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Embrace GitOps Principles

Declarative

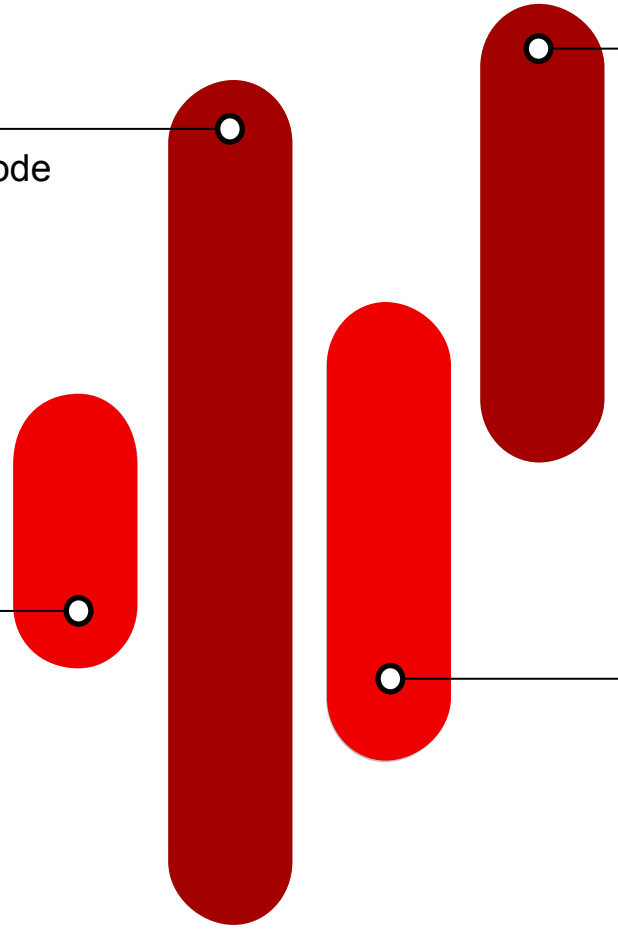
Declare the desired infrastructure as code

Single source of truth in Git

Versioned and Immutable

Auditable, version controlled in Git

enforces immutability



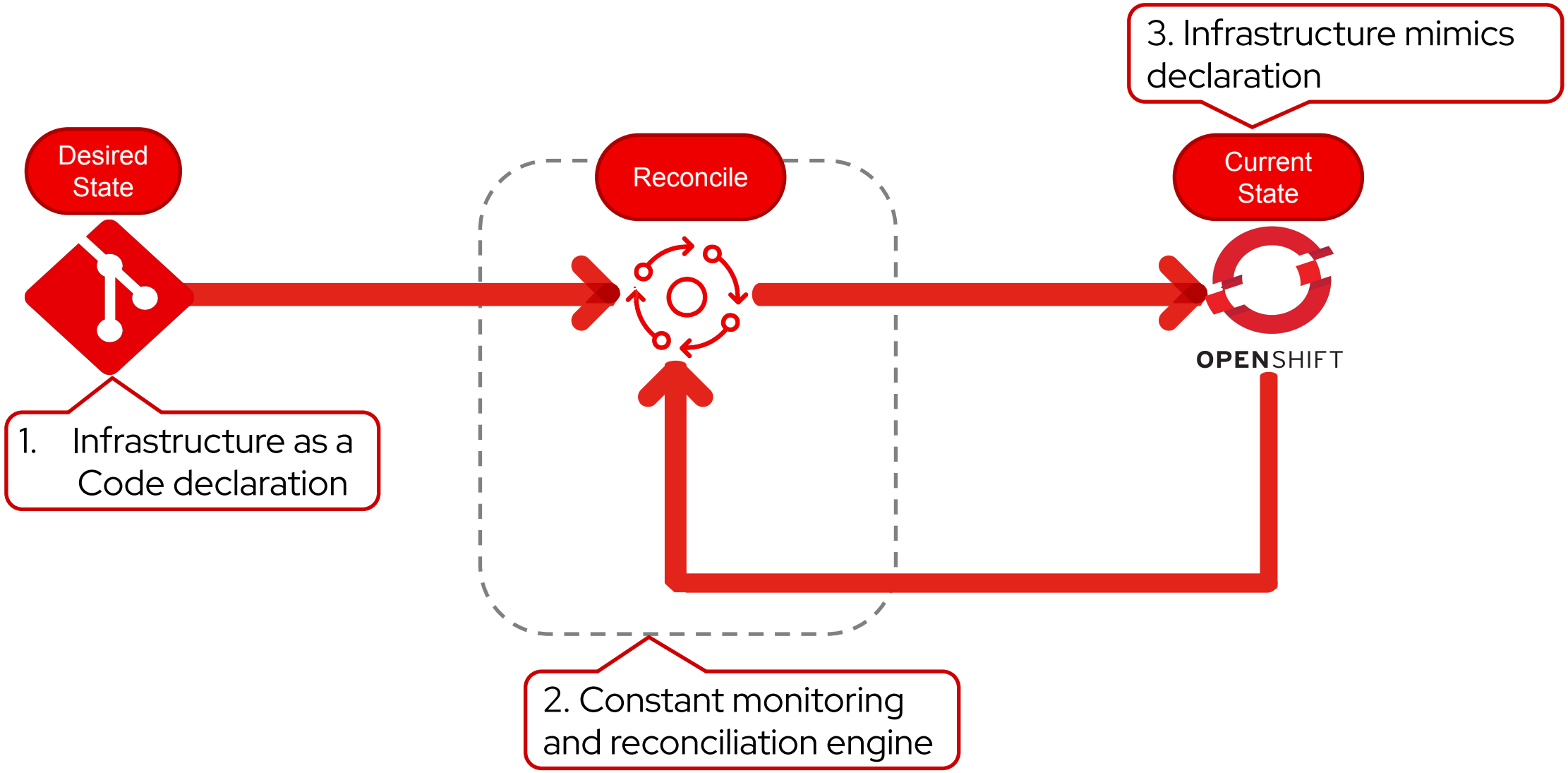
Automatic Sync

GitOps agents provides automatic sync without manual intervention.

Continuous Reconciliation

GitOps Agents learns current state and reconcile with declared state

GitOps – The Approach



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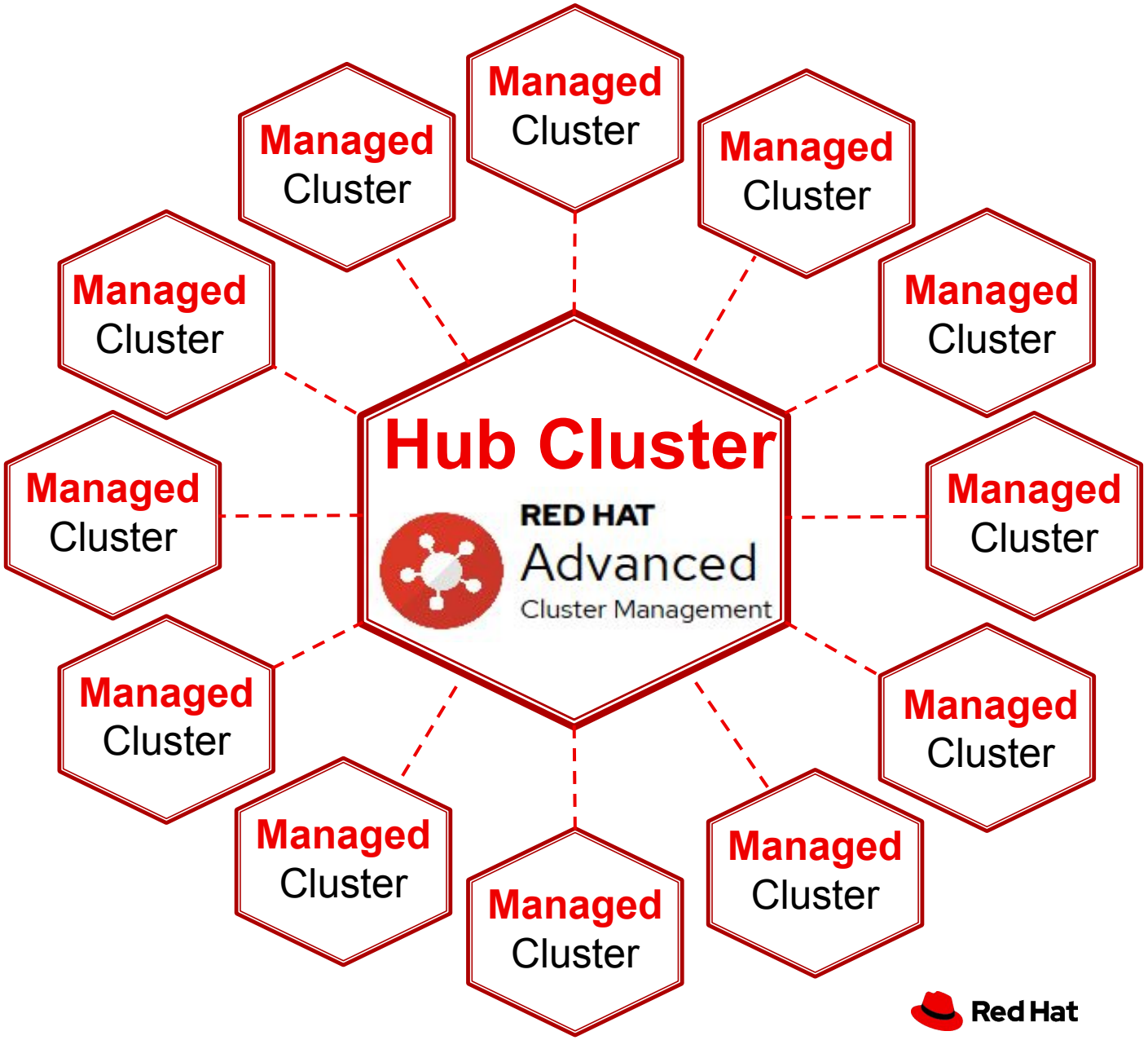
Red Hat Advanced Cluster Management (RH ACM) As Hub Cluster

1000's of Red Hat OpenShift Clusters as Managed Clusters



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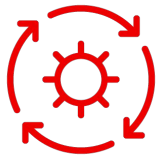
Deploying OpenShift using GitOps – Building Blocks

Version control

Template

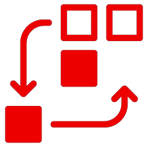
Custom Templates



GitOps

GitOps Operator

Optional Plug-in



Installer

RED HAT Advanced Cluster Management

- Assisted Installer
- Hive
- ACM GRC Engine

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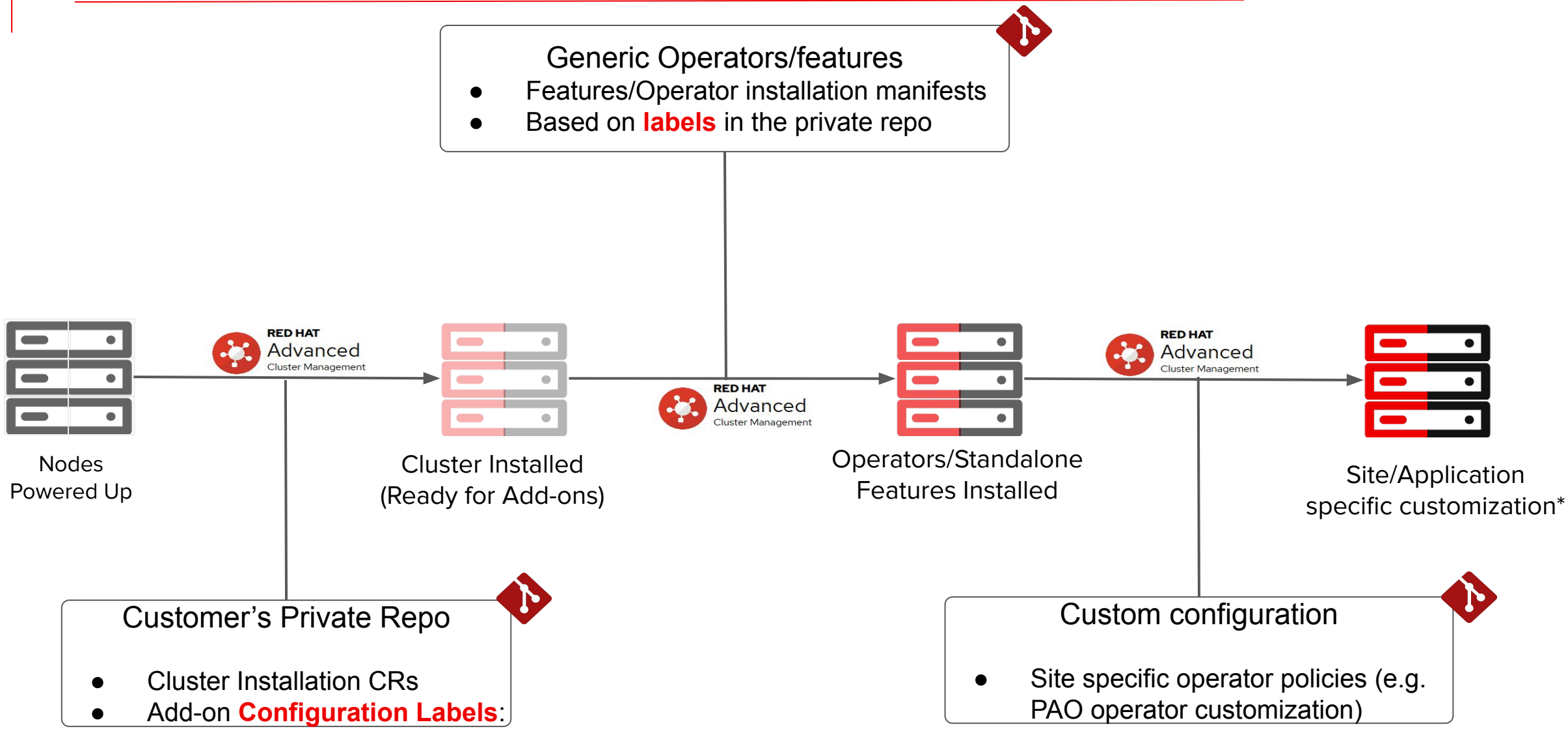
Zero Touch Provisioning Process for a New Cluster



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Challenges and how we solved them

"Complaining about a problem without proposing a solution is called whining"

– Teddy Roosevelt.

Challenges: Integration and Deployment

Task Sequencing for Zero Touch Validation

- *Sequencing* is a challenge in a declarative model
  - Need to execute functional tests for every policy once its applied
- Solution: use of operator orientation and Testkube for applying policies (in absence of *sequencing*) and making sure all tests are executed

Infrastructure Considerations

- Secrets Management:
  - Use of External Secrets Operator for integration with Vault (e.g. HashiCorp)
  - Go Templates for policies interacting with ESO to retrieve secrets

Challenges: Optimization

Optimize Lines of Codes

- *Challenge*: Large number of k8s objects, lines of codes and individual yaml files for (9+ files for each new cluster)
- *Solution*: SiteConfig and PolicyGen templates to reduce code duplication
  - Single file per cluster
  - Policy Grouping

Streamline General vs Custom Configs

- Careful demarcation between general and customized manifests in Git
- General Manifests: Public vs Private repository concept
  - Base Cluster installation
  - Required operators onboarding and general Telco Enhancements
- Custom Manifests
  - Site and/or application specific configuration
  - Configuring operator for applications

What's next for ACM and GitOps at Bell Canada

"Ask yourself if what you are doing today is getting you closer to where you want to be tomorrow"

– Anonymous.

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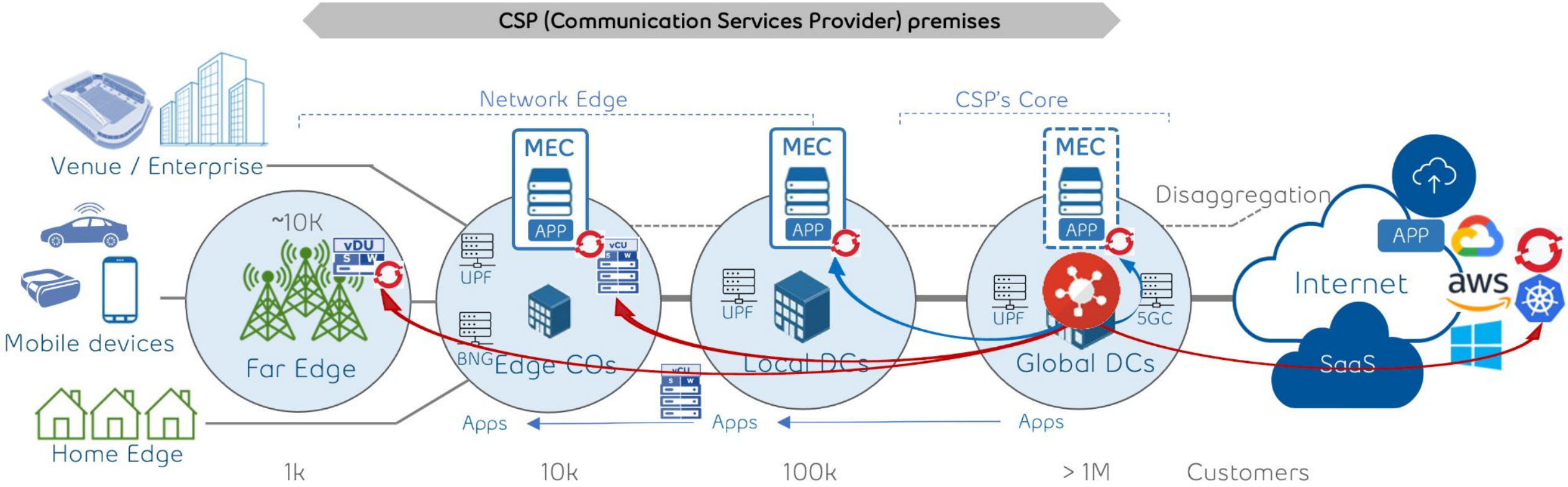
Bell Vision: Expand Kubernetes Central Cluster Management



Hypothesis: Red Hat ACM can be leveraged by Bell not only to manage vRAN at the Far Edge, but also Cloud k8s engines

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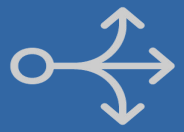
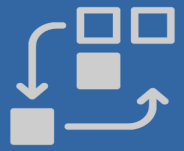
Beyond Edge: Expanding the Role of ACM



Beyond Openshift management

- ACM managing clusters in Cloud k8s engines (GKE, EKS, AKS)
- Lightweight deployments: ACM + Hypershift



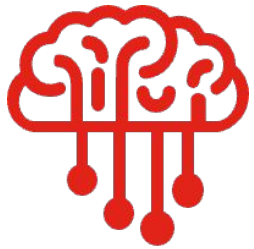
Proactive Management

- Scaling ACM: growing beyond single Hub (i.e. the Multi-cluster Global Hub concept)
- Telemetry collection with ACM

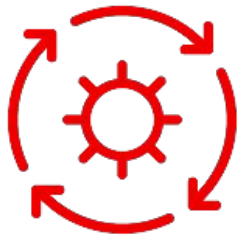
Sustainability

- Improve sustainability of the OpenShift Ecosystem
- ACM to hibernate OCP on Public Clouds (GCP, AWS, Azure)

Call to Action!



Think: How can Declarative GitOps help you with Red Hat OpenShift deployments at the Edge (and beyond) ?



Reuse: The public policies already been made available https://github.com/openshift-kni/cnf-features-deploy

Accelerate your Edge deployments using Red Hat ACM and a Bell Canada proven GitOps deployment methodology

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? Questions?

Merci!

Bell

Obrigado!

Thank you!

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Thank you

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