Red Hat Device Edge

Running any workload, anywhere

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Today's Agenda

▶ Introductions

▶ Why Edge? Why Now?

▶ Red Hat's Edge Vision

▶ Drill Down on Device Edge

▶ Focusing in on Industrials

▶ Demo
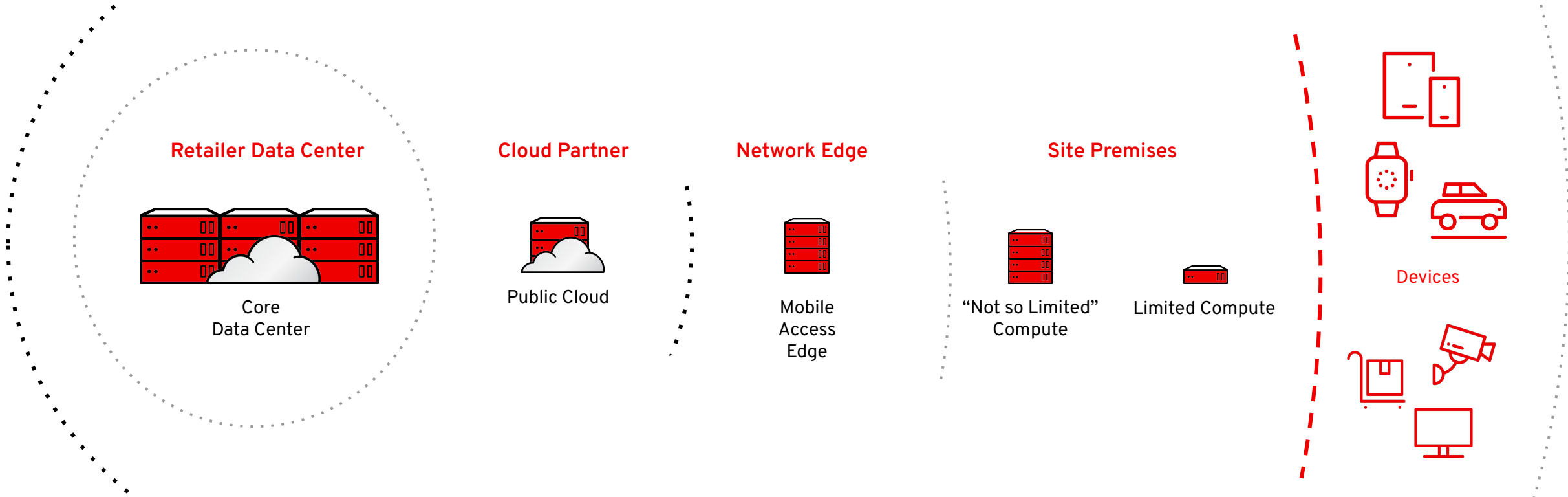
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Introductions

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Josh Swanson

Josh is a Chief Architect in the NA Central region focused on all things automation and edge. He's worked on the floor of manufacturing plants and built industrial control systems before moving over into IT infrastructure to handle IT/OT convergence.
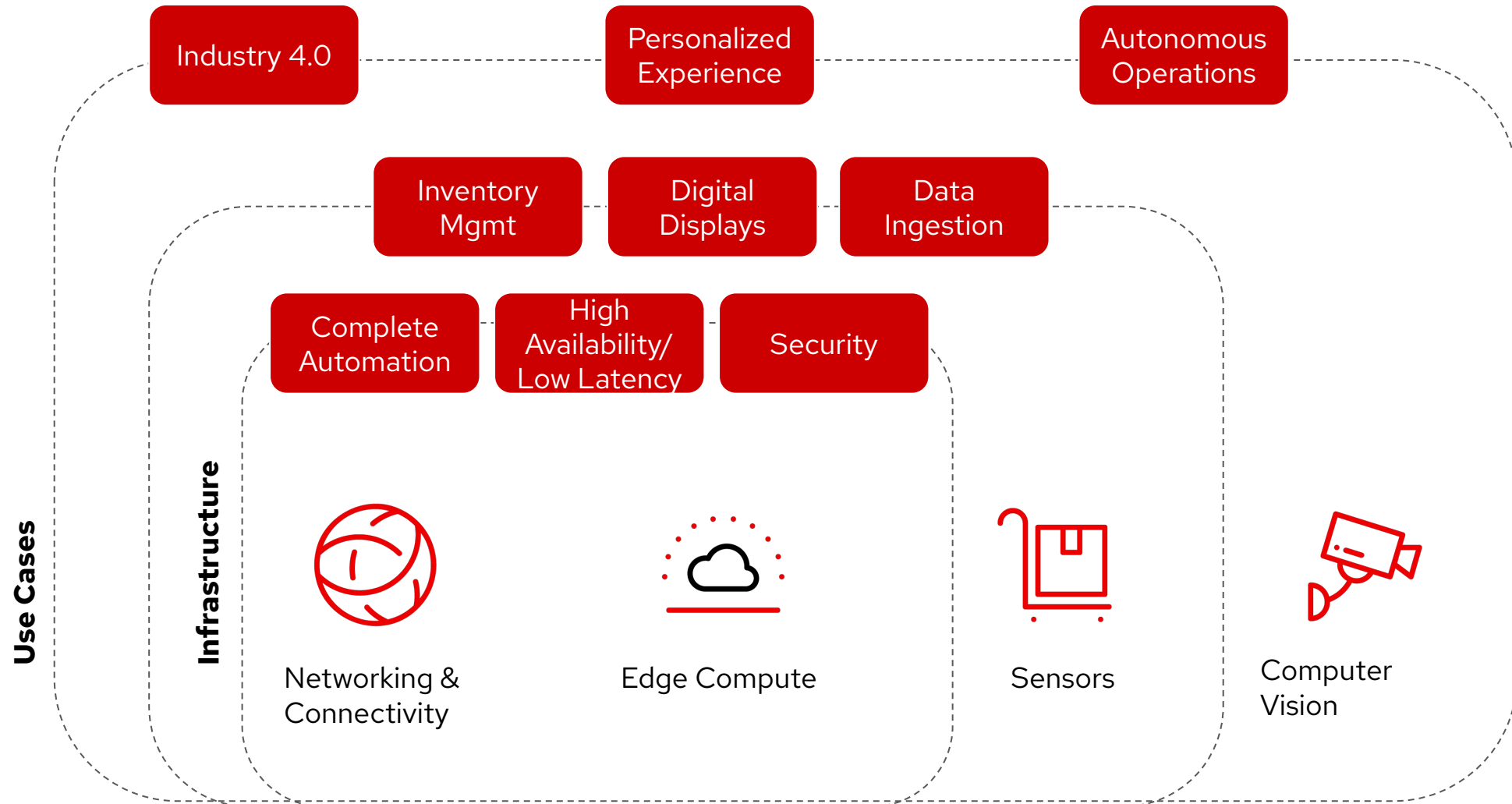
Why Edge? Why Now?

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Unify The Technology from Online to Offline

Centralize where you can, distribute where you must

Retailer Data Center

Core
Data Center

Cloud Partner

Public Cloud

Network Edge

Mobile
Access
Edge

Site Premises

"Not so Limited"
Compute

Limited Compute

Devices

Today's Market Demands Innovation at Every Layer

Taking advantage of the latest technologies will drive business differentiation. IT investments are required to integrate the new technologies effectively and avoid operational risk.

Use Cases

Infrastructure

Industry 4.0

Personalized Experience

Autonomous Operations

Inventory Mgmt

Digital Displays

Data Ingestion

Complete Automation

High Availability/ Low Latency

Security

Networking & Connectivity

Edge Compute

Sensors

Computer Vision

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Network Considerations for Edge Deployments

Latency

How long does it take for traffic to get from the site to the compute processing it?

ERP

HR/Payroll

Many apps run well in the **Cloud**

Merchandising / Advertising

Financials / Reporting

Bandwidth

How much traffic can I move at once?

Modern Applications have both **Edge** and **Cloud** components

Redundancy

Do I have a **backup** when the main network goes down?

Point of Sale

Process Flow

Real-Time Video Analytics

Users and Customers are on the **Edge**
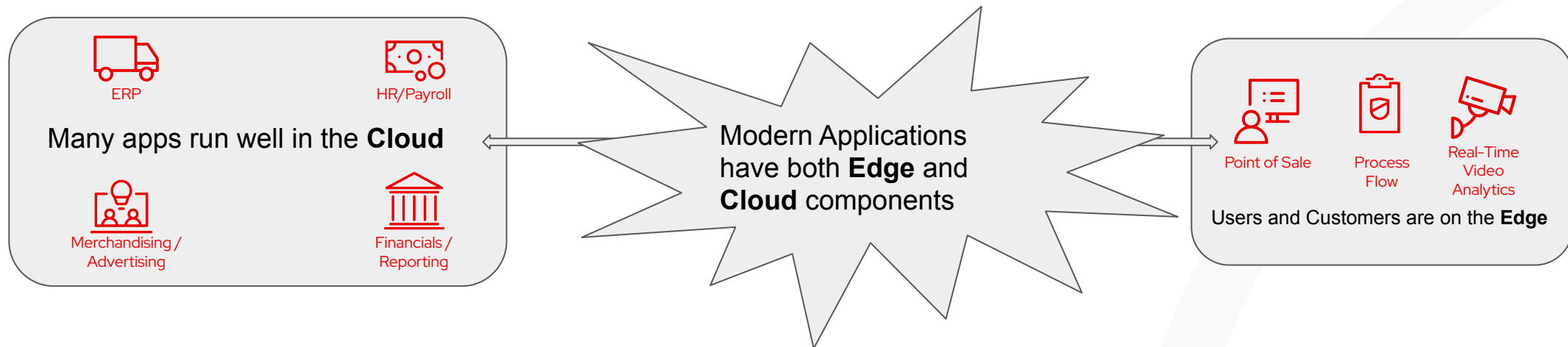
Compute belongs on the **edge** if any of the following are true:
1) It costs **too much** to be down
2) The application requires more network **bandwidth** than the site can get
3) The network cannot sustain the **latency** needed to make the application run well
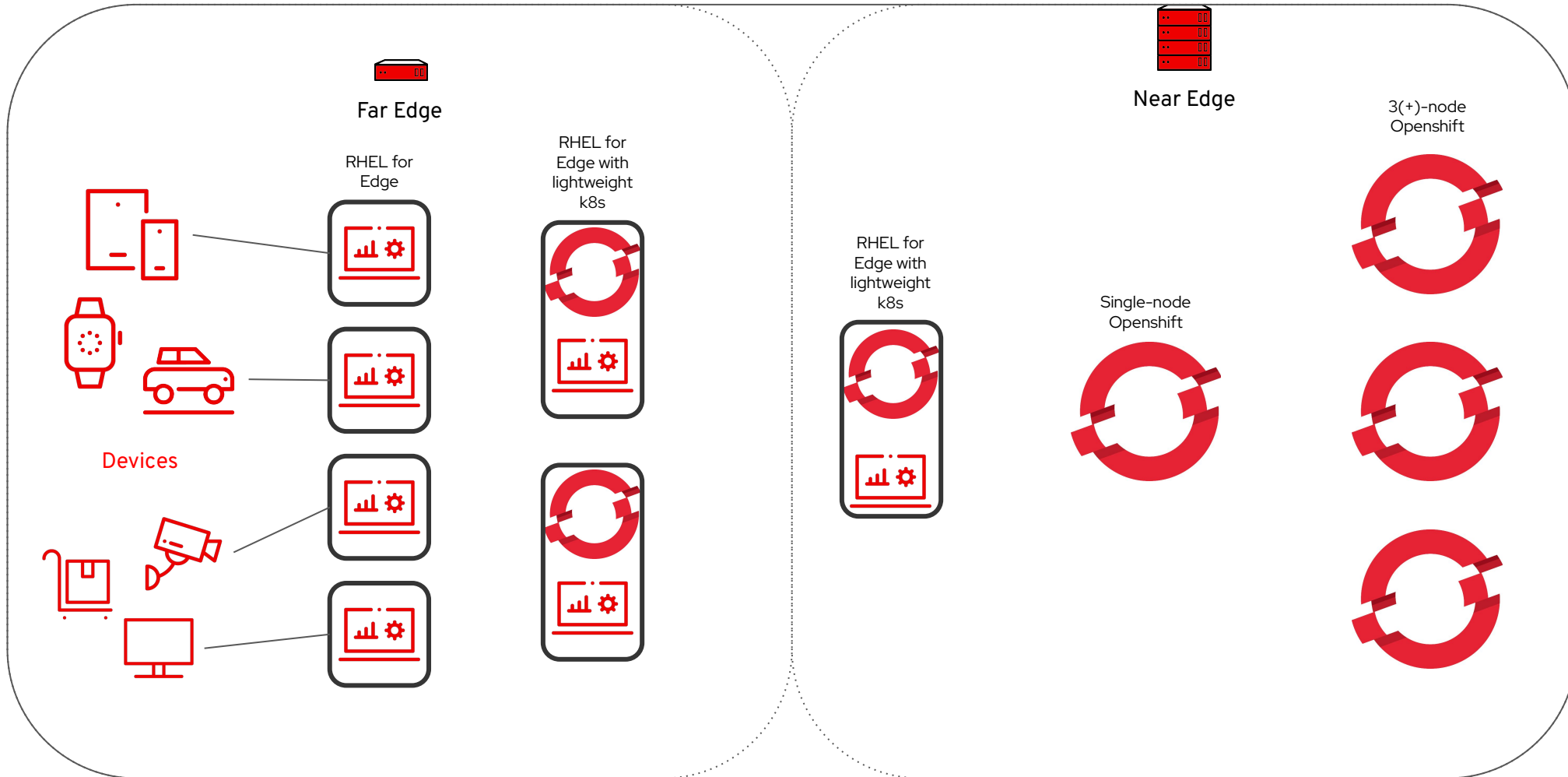
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Red Hat's Edge Vision

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Background and Requirements

▶ Basically: mission critical systems in hostile environments

▶ Systems directly tied to revenue generation, however:

- Managed by non-technical personnel

- Geographically distributed

- Limited bandwidth/limited connectivity

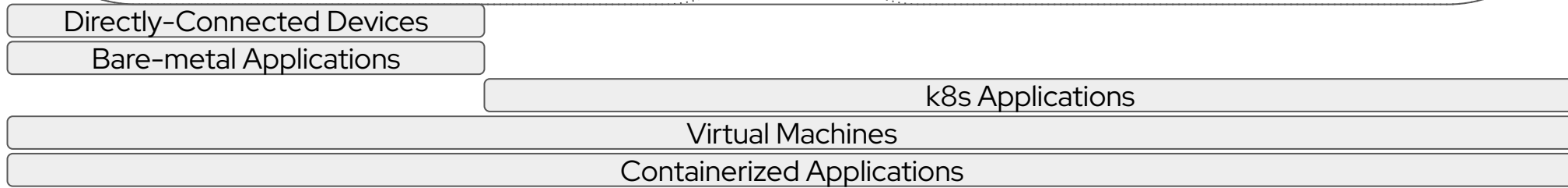- No real "out of band" management

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The guiding principles for edge architecture

- ▸ Seamless deployment and onboarding of new locations

- ▸ Single touch updates, upgrades, and application deployment across any remote site

- ▸ Focus on availability of systems – all routine maintenance handled during off hours

- ▸ Automatic rollback to ensure availability for business

- ▸ Extensibility into new features and functionality throughout the deployment lifecycle

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Red Hat's Edge Compute Platform

Far Edge

Near Edge

Devices

RHEL for Edge

RHEL for Edge with lightweight k8s

RHEL for Edge with lightweight k8s

Single-node Openshift

3(+)-node Openshift

Align to requirements

Directly-Connected Devices

Bare-metal Applications

k8s Applications

Virtual Machines

Containerized Applications

12

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The Management Story

Far Edge

Near Edge

3(+)-node
Openshift

RHEL for
Edge

RHEL for
Edge with
lightweight
k8s

RHEL for
Edge with
lightweight
k8s

Single-node
Openshift
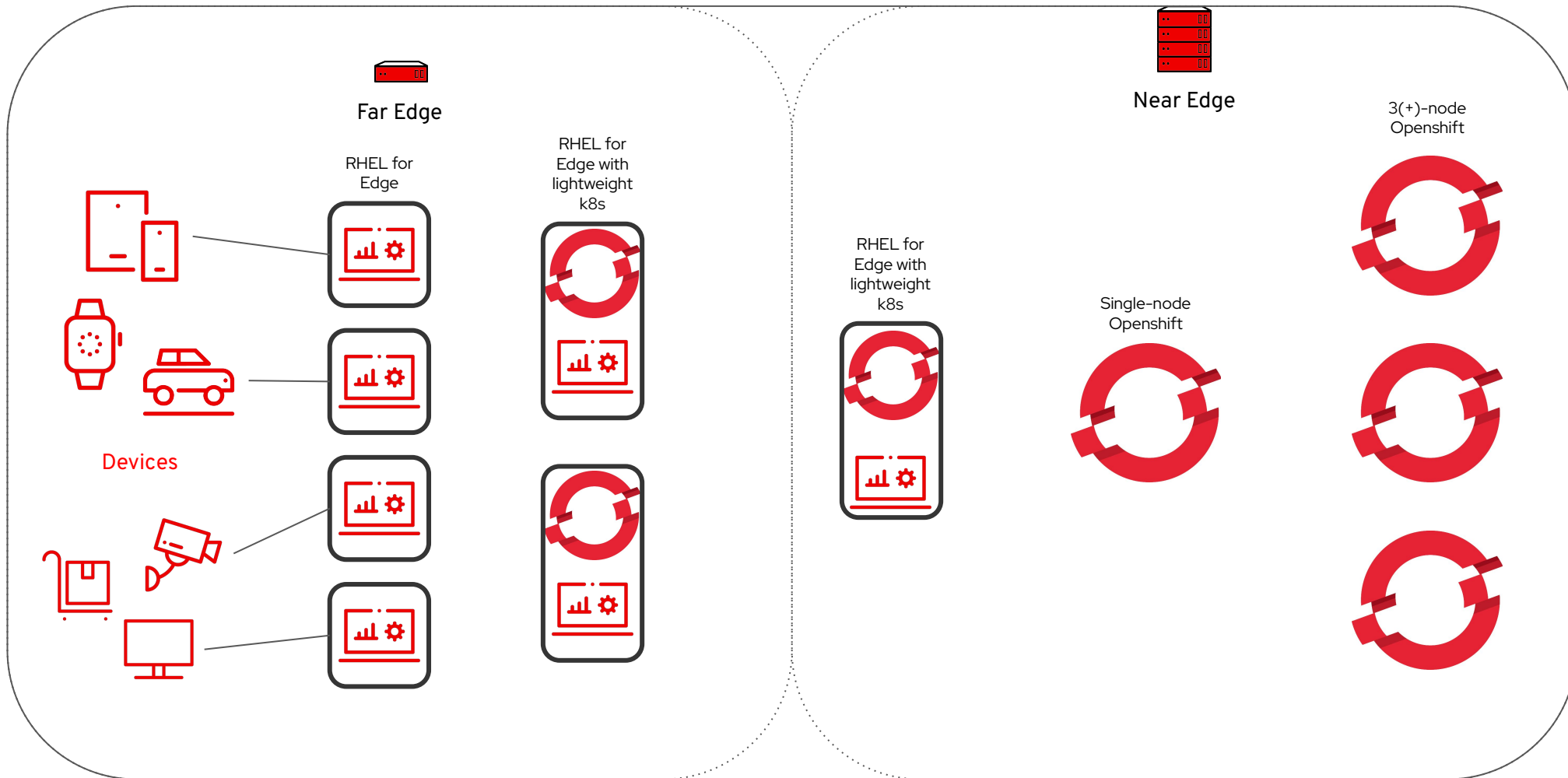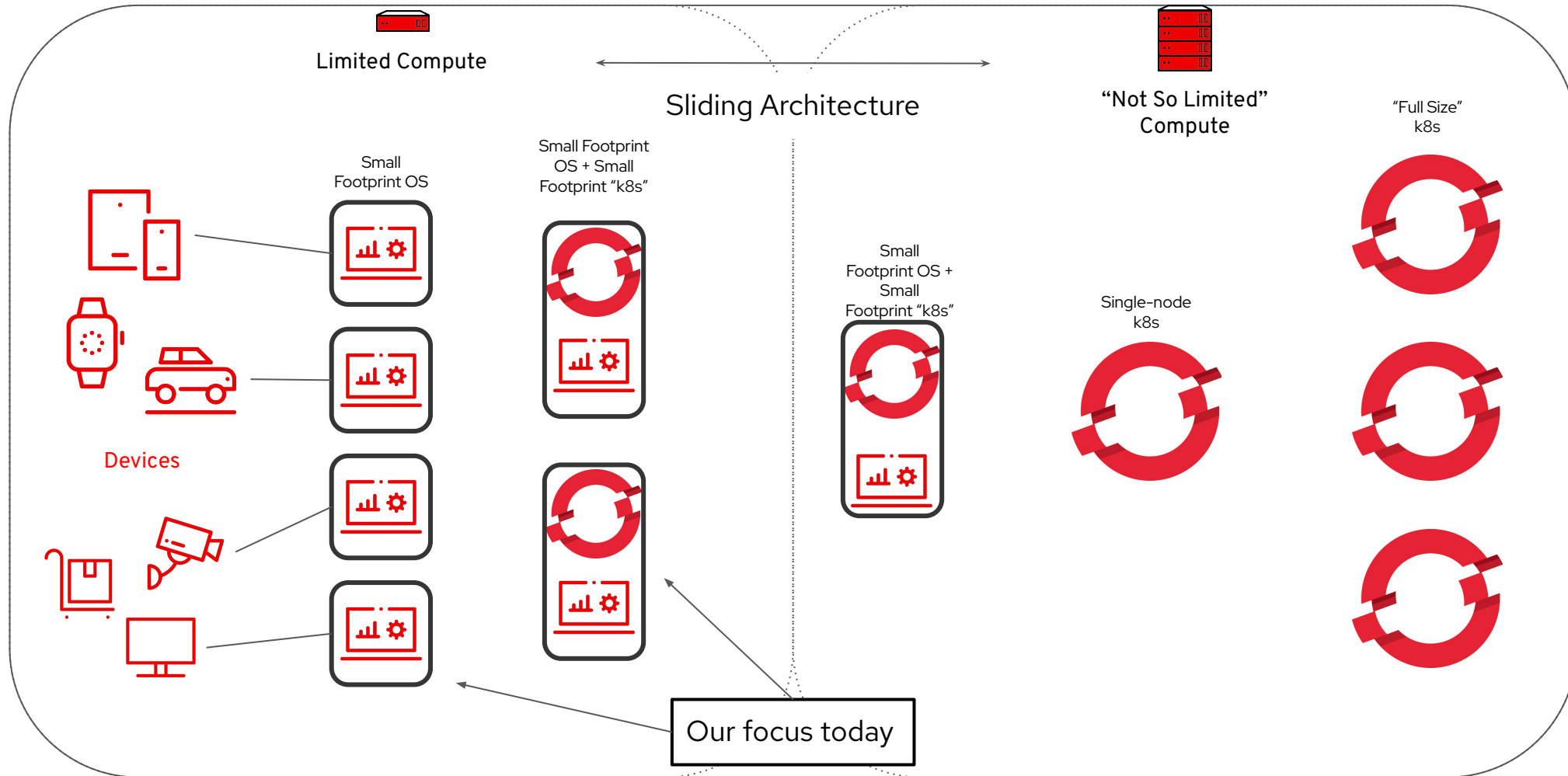
Devices

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Ansible Automation
Platform

Red Hat
Advanced Cluster Management
for Kubernetes

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Red Hat's Edge Vision

Limited Compute

Sliding Architecture

"Not So Limited" Compute

"Full Size" k8s

Small Footprint OS

Small Footprint OS + Small Footprint "k8s"

Small Footprint OS + Small Footprint "k8s"

Single-node k8s

Devices

Align to requirements

Our focus today

Directly-Connected Devices

Bare-metal Applications

k8s Applications

Virtual Machines

Containerized Applications

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Drill Down on Device Edge

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Red Hat Device Edge: Single View

Management

Automation

Red Hat Ansible Automation Platform

Bare Metal Applications/ VMs

Containers

k8s Applications

Edge Ready Operating System

Edge Device (OnLogic, Intel, etc)
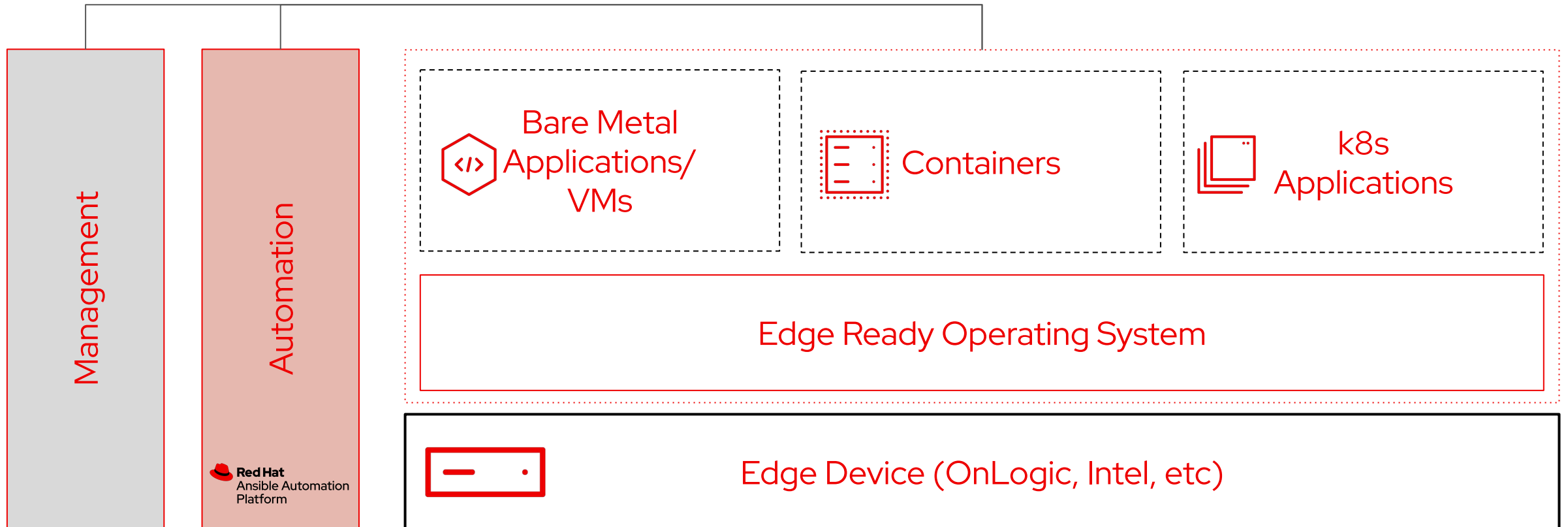
Red Hat Enterprise Linux

What's new for edge

Workloads deployed at the edge rely on a nimble operating system that runs on a wide variety of hardware, is resilient to network outage, can be deployed and managed at scale and mitigates business risk by ensuring the longest possible availability of service. Red Hat's solutions for edge powered by Red Hat Enterprise Linux ably meet these challenging demands.

OS image generation and management
Streamline OS image generation and management of updates using container images to make it easier for operations teams to meet the scale of their fleets using cloud-native infrastructure such as OpenShift.

Image Builder
Create custom media, simplifying bare metal deployments and solving provisioning challenges common to disconnected environments

Podman
Ensure the latest security fixes are deployed for containerized workloads with new automatic updates for the container engine Podman; manage container versions centrally from a registry no matter where you choose to deploy.

Red Hat Ansible Automation Platform

Combines the universal automation language with cloud services and certified content for automating, deploying and operating applications, infrastructure and services securely at enterprise scale.
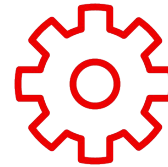
Ansible automation

Providing scalable, security-focused implementation for describing, building, and managing the deployment of enterprise IT applications across diverse enterprise architectures.

Cloud services

Cloud services that facilitate team collaboration and provide operational analytics for automating heterogeneous, hybrid environments.

Certified content

Extends native platform capabilities with certified, supported content designed to expand automation domain and accelerate adoption for enterprise customers.

Red Hat Ansible Automation Platform

▶ "Operational Orchestrator" for Devices:

(Unique to the edge)

- Listens for devices being provisioned and triggers appropriate workflows
- Integrated with application development pipeline for staging updates
- Build new images within Image Builder
- Triggers updates for devices
- Host images on a web server at disconnected sites
- Point systems at the appropriate update location
- Positions systems into the correct inventory groups based on context/site information

▶ Direct Automation against Edge Systems:

(more traditional ansible automation)

- Installs RPMs
- Applies OS customizations for security and logging
- Templates out systemd files so containers are monitored and automatically restarts upon failure
- Triggers reboots/roll [forward, backward] of R4E when testing OS layer updates
- Performs initial pull of container images
- Configures Greenboot to watch container images after roll forward
- Scheduled enforcement of security and compliance standards

Quick Review: Where are we Today?

The "modern" shop floor largely remains untouched for decades, isolated from other sites and central services. The data contained within and the direct connections to command and control devices are both highly valuable, however the technologies, architecture, and practices to support and enable modern workloads are not ready or simply not present.

What We Want

- Seamless deployment and onboarding of new locations

- Single touch updates, upgrades, and application deployment across any remote site

- Focus on availability of systems – all routine maintenance handled during off hours

- Automatic rollback to ensure availability for business

- Extensibility into new features and functionality throughout the deployment lifecycle

- MES Integration for Line Scheduling

- Automatic "digital twin" representation of lines and processes

- Data visualization and portability for cross-site inferencing

- Trained models deployed to edge systems for decision making

- Portability across site, cloud, distributed, and core compute footprints

What We Got

- Disparate, untracked "networks" of devices

- Vendor/point solution sprawl

- No upgrade/lifecycle path

- Not resilient/not easily replaced hardware and software stacks

- No extensibility, configurability, or agility

- Disconnected systems with different data schemes

- No real insight into deeper metrics/analytics

- No connections across sites, or even connections across lines within a site

- No path to AL/ML type functionality

- Locked within the four walls of the site

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Focus on Industrials

Why Modernize the Shop Floor?

The higher level features and functionality required to remain competitive demand greater agility and security than what current OT spaces provide today. Everything from the PLC to firewalls must be adaptable to new requirements, allowing for the rapid introduction of new features and functionality built on top of foundational components.

Agility

Rapidly reconfigure lines programmatically, automatically adjust to changes

Extensibility

Introduce new functionality to physical systems while integrating with existing technologies

Scalability

Manage and deploy features/functionalities across the globe

Security

Operate intrinsically secure regardless of carrier or compute

Reliability

Availability and consistency for business continuity

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How Do We Approach This?

Meet the workloads where they are, with a vision of the future

Edge Compute Platform — *Prepare and Converge* — *Modernize and Transform* — *Train and Deploy Rapidly*

Critical Now

Critical Tomorrow

Return on Investment

Network Automation

Deterministic/ SoftPLCs

OS/Workload Automation

Intrinsic Security

IaC Builds

CI/CD, GitOps

62443/SIL.X Compliance

Secured Supply Chain

Workload Modernization

Edge OS Takeover

Multi-Cloud Data Portability

Decisions at the Edge

Trained Models to the Edge

Model Training

AI/ML Introduction

MES Tie-Ins

Data Standardization

Data Endpoints/Relays

Straight to K8s

Existing IT to OT

Unapproachable Platforms

No compliance/ security

Meet and Automate	Infra/App Deploy as Code	Device Edge to Near	Entry Platform	Focus on Data	Data to Decisions	Secured Hybrid Cloud

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What Do We Approach This With?
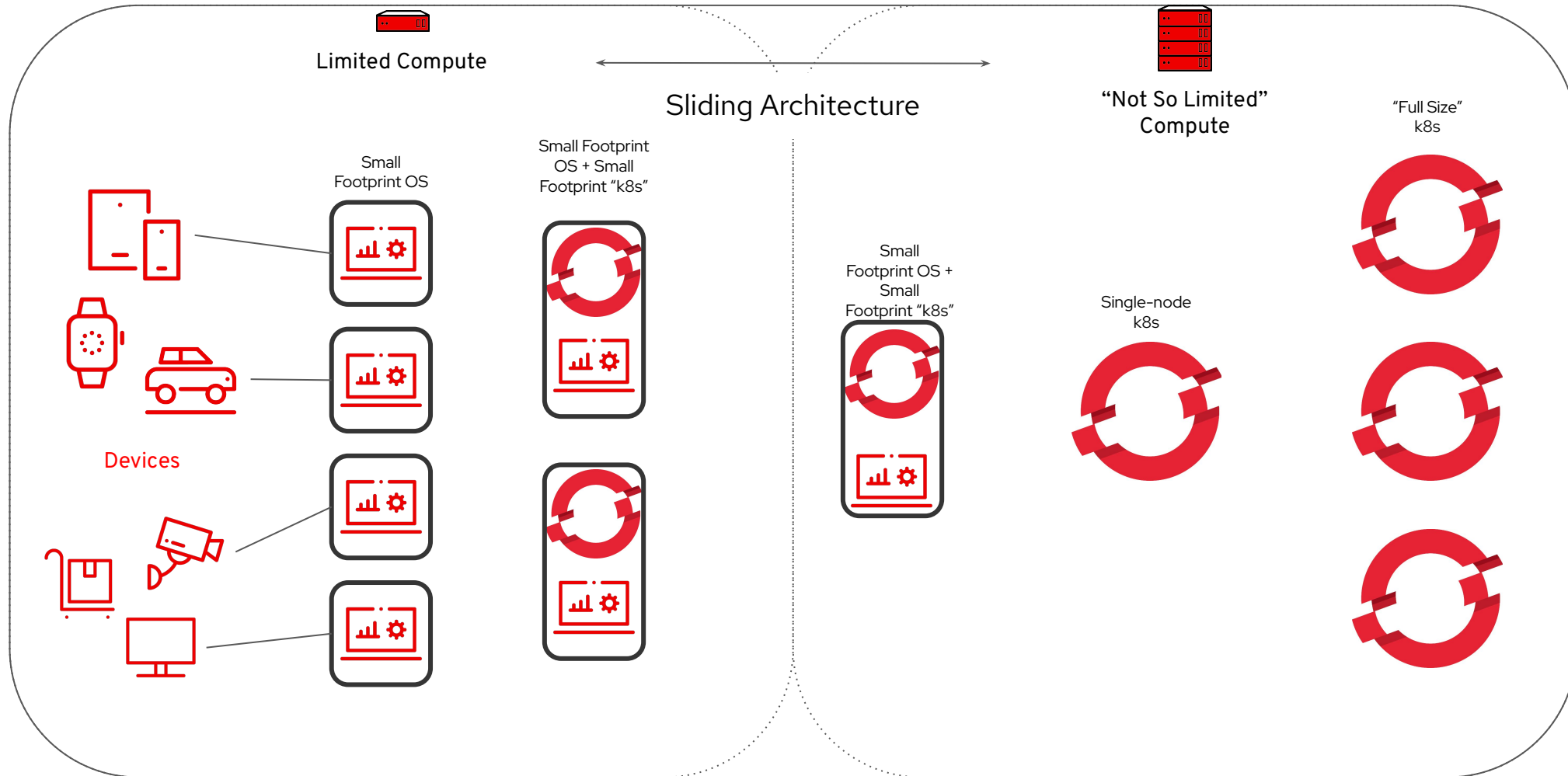
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The Journey to Modernization of the Shop Floor

Kubernetes and other modern technologies open the door to next generation feature and functionality, such as rapid prototyping, data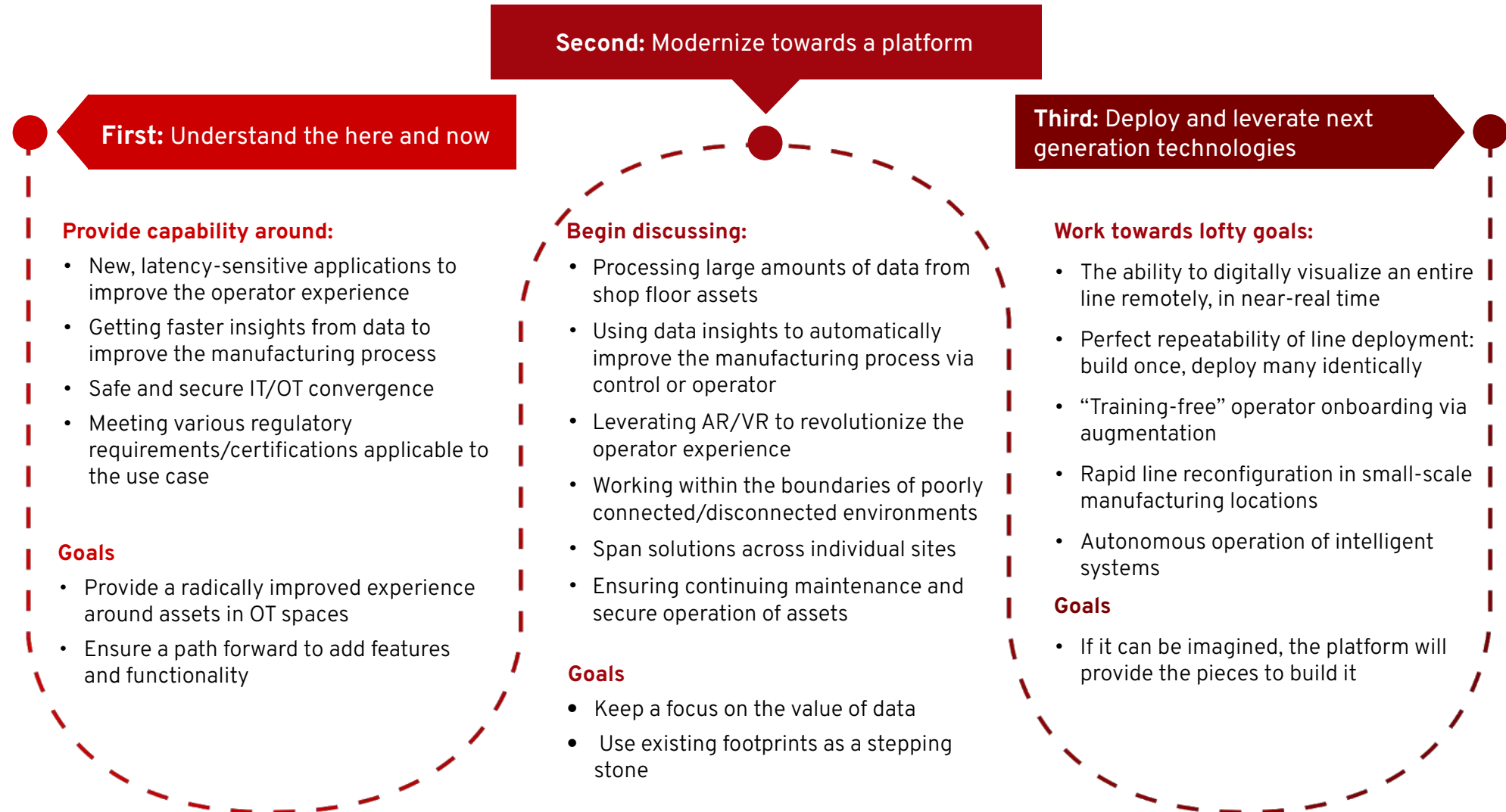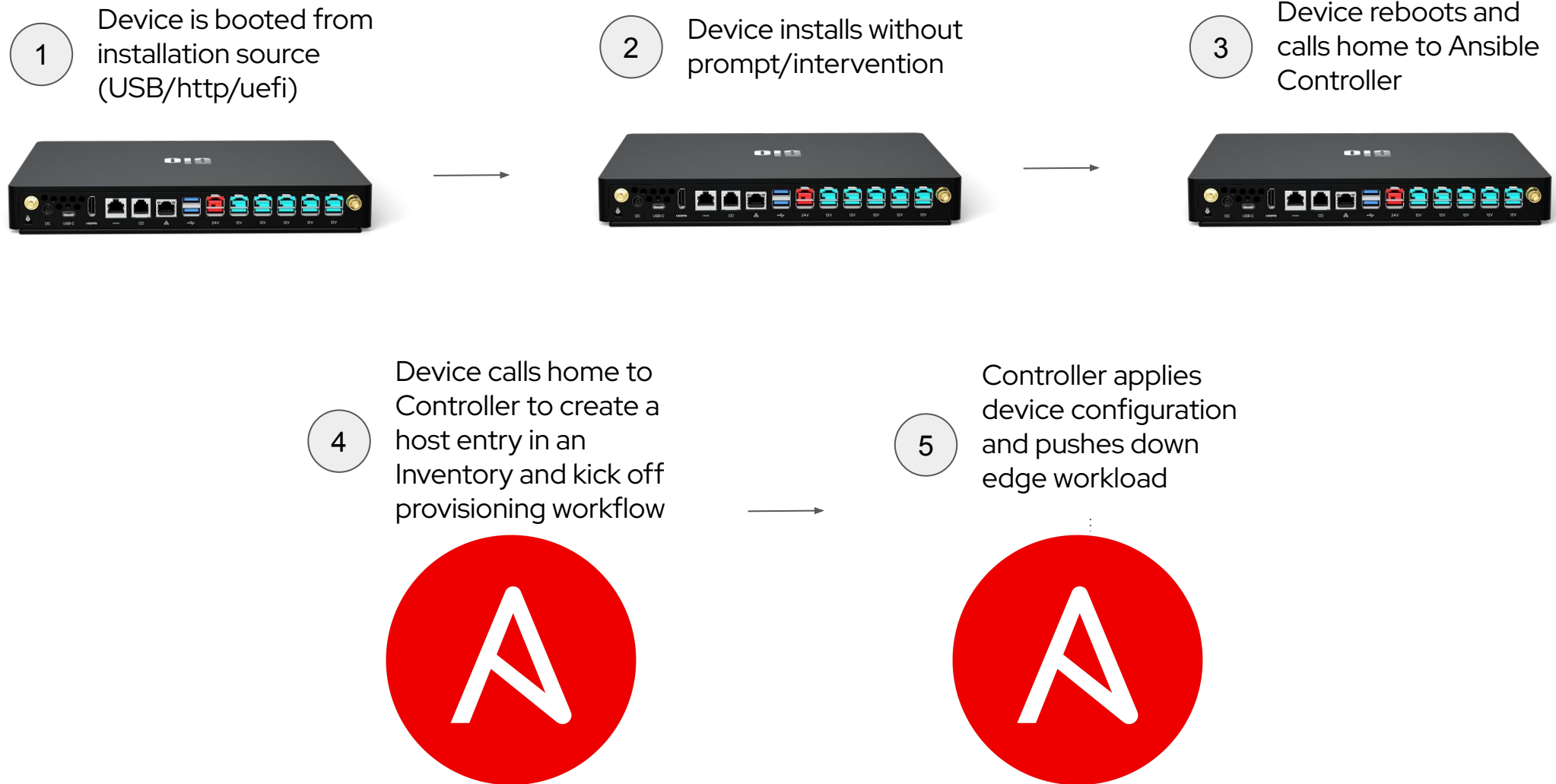 inferencing and visualization, digital representation and augmententing of operators, however getting there isn't a straightforward path

Second: Modernize towards a platform

First: Understand the here and now

Third: Deploy and leverate next generation technologies

Provide capability around:

- New, latency-sensitive applications to improve the operator experience
- Getting faster insights from data to improve the manufacturing process
- Safe and secure IT/OT convergence
- Meeting various regulatory requirements/certifications applicable to the use case

Goals

- Provide a radically improved experience around assets in OT spaces
- Ensure a path forward to add features and functionality

Begin discussing:

- Processing large amounts of data from shop floor assets
- Using data insights to automatically improve the manufacturing process via control or operator
- Leverating AR/VR to revolutionize the operator experience
- Working within the boundaries of poorly connected/disconnected environments
- Span solutions across individual sites
- Ensuring continuing maintenance and secure operation of assets

Goals

- Keep a focus on the value of data
- Use existing footprints as a stepping stone

Work towards lofty goals:

- The ability to digitally visualize an entire line remotely, in near-real time
- Perfect repeatability of line deployment: build once, deploy many identically
- "Training-free" operator onboarding via augmentation
- Rapid line reconfiguration in small-scale manufacturing locations
- Autonomous operation of intelligent systems

Goals

- If it can be imagined, the platform will provide the pieces to build it

Demo

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Initial Install Process and Call Home

1 Device is booted from installation source (USB/http/uefi)

2 Device installs without prompt/intervention

3 Device reboots and calls home to Ansible Controller

4 Device calls home to Controller to create a host entry in an Inventory and kick off provisioning workflow

5 Controller applies device configuration and pushes down edge workload

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