# How Red Hat Industrial Edge achieves less Downtime and higher Automation

Morten Rohlfes,     Director Manufacturing and Edge

Luca Ferrari,          Senior Edge Solution Architect

# We're on the edge of transformation...

Red Hat

# How Red Hat Industrial Edge achieves less Downtime and higher Automation

➢ Industrial Challenges

➢ Use cases

➢ Integrated Manufacturing Edge Platform

➢ RH Device Edge –  RHDE
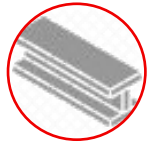
➢ Reference Clients

# Customer Problem Statements

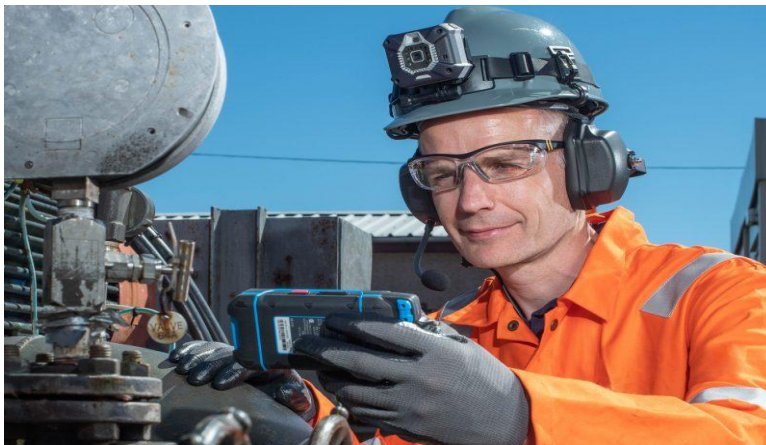| | | |
|---|---|---|
| | Lack of interoperability and portability of HW, SW, IP | Locked into a vendors entire system with high integration costs for best of breed. |
| | Fixed function, Proprietary Devices | Dedicated purpose built hardware closes doors with no deployment flexibility |
| | Inflexible, hard to upgrade systems | Taking advantage of new high value technologies is difficult and expensive |
| | Factory Downtime due to HW/SW Updates | As security patches become more frequent so does the need for RT updates |
| | Heavy Pressure on productivity without additional resources | AI and analytics continue to grow as they add value to existing infrastructure |
| IEC61131 | High learning curve for legacy systems (for example, PLCs) | Older technology and tool sets are not on the curriculum for new workforce |

Red Hat

# INDUSTRIAL EDGE USE CASES

**Digital Twins**
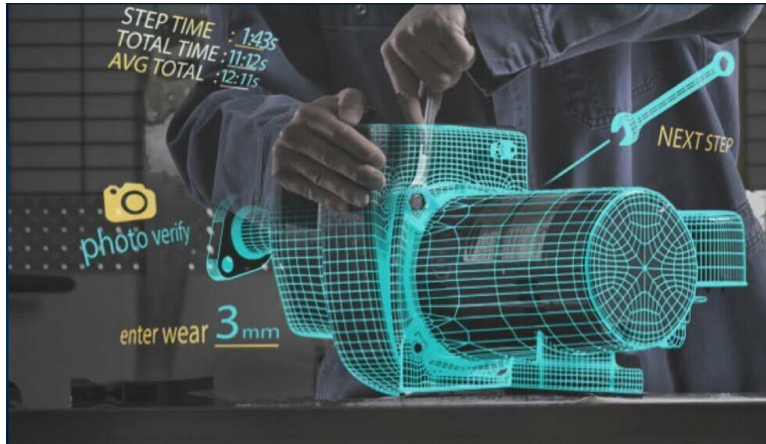
**Predictive Maintenance for production**

**Worker Safety**

**Autonomous vehicles**
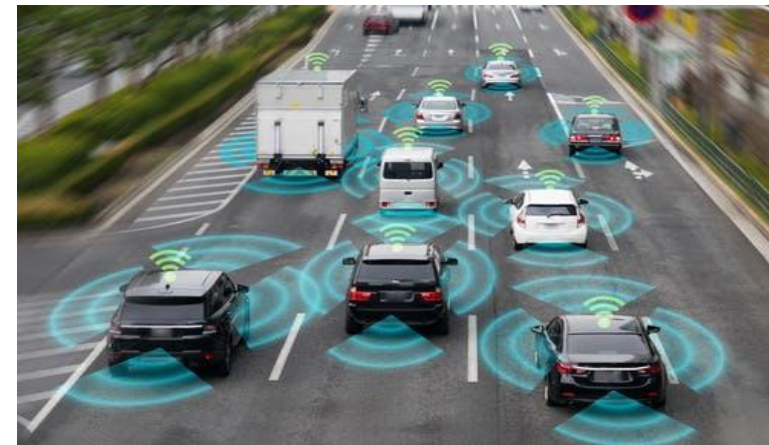
Red Hat

# Red Hat Focus Areas
# on Software-Defined Vehicle with references

Development and Testing

Connected Vehicle Platform and Operation Center

In-Vehicle

IT, Manufacturing, and other Business Lines

**Volkswagen**
Virtual Testing

**Zenseact**
CI/CD, SW Factory

**ZF**
ADAS Platform

**BMW Group & DXC**
Autonomous Driving

**Luxoft**
Software-Defined Vehicle

上汽大众
SAIC VOLKSWAGEN

TATA

Indian Car Maker

**AUDI**
Kubika O Kubernetes Platform

**Volvo AB**
Azure RH OpenShift

**FORD**
Cloud & Developer Productivity

Red Hat | gm

ETAS
DRIVING EMBEDDED EXCELLENCE

Qualcomm

## Consistent Technologies, Platforms and Operations

Details: https://red.ht/automotive

Red Hat

# Red Hat enable and empower retail use case

**Computer Vision**

| Self-Checkout |
| Theft prevention |

**Sensors and data streaming**

| Inventory management |
| Smart shelves |

**Networking & connectivity** — **Edge compute**

| Autonomous operations |
| Low Latency |

**Shopping experience**

| Loyalty program |
| Omnichannel |

**Supply chain**

| Order fulfillment |
| Forecasting demand |

Security

**Data/pipeline management and AI**

Red Hat Application Services
Red Hat OpenShift AI

**Management & Automation**

Red Hat Advanced Cluster Management for Kubernetes
Red Hat Advanced Cluster Security for Kubernetes
Red Hat Ansible Automation Platform
Red Hat Smart Management

**Common Platforms**

Red Hat Enterprise Linux
Red Hat OpenShift
Red Hat OpenShift Data Foundation
Red Hat OpenStack Platform
Red Hat Device Edge

Red Hat

# Industrial Edge Architecture

## ISA 95 Level 0-1

### Operational Level
(Far Edge)

**Plant Application / Factory Operations**

Sensors , devices,
IoT Gateways
PLC, Scada,



## ISA 95 Level 2-3

### Plant Level
(Near Edge)

**Plant Application / Factory Operations**

Manufact. Execution (MES)
Warehouse Mgmt
Asset Mgmt



## ISA 95 Level 4

### Enterprise Level
(Core)

**Data Center Central IT**

**SAP,**
Product Lifecycle Mgmt
Supply Chain

# Industrial Edge Architecture

## ISA 95 Level 0-1
### Operational Level
(Far Edge)

**Plant Application /
Factory Operations**

Sensors , devices,
IoT Gateways
PLC, Scada,

## ISA 95 Level 2-3
### Plant Level
(Near Edge)

**Plant Application /
Factory Operations**

Manufact. Execution (MES)
Warehouse Mgmt
Asset Mgmt

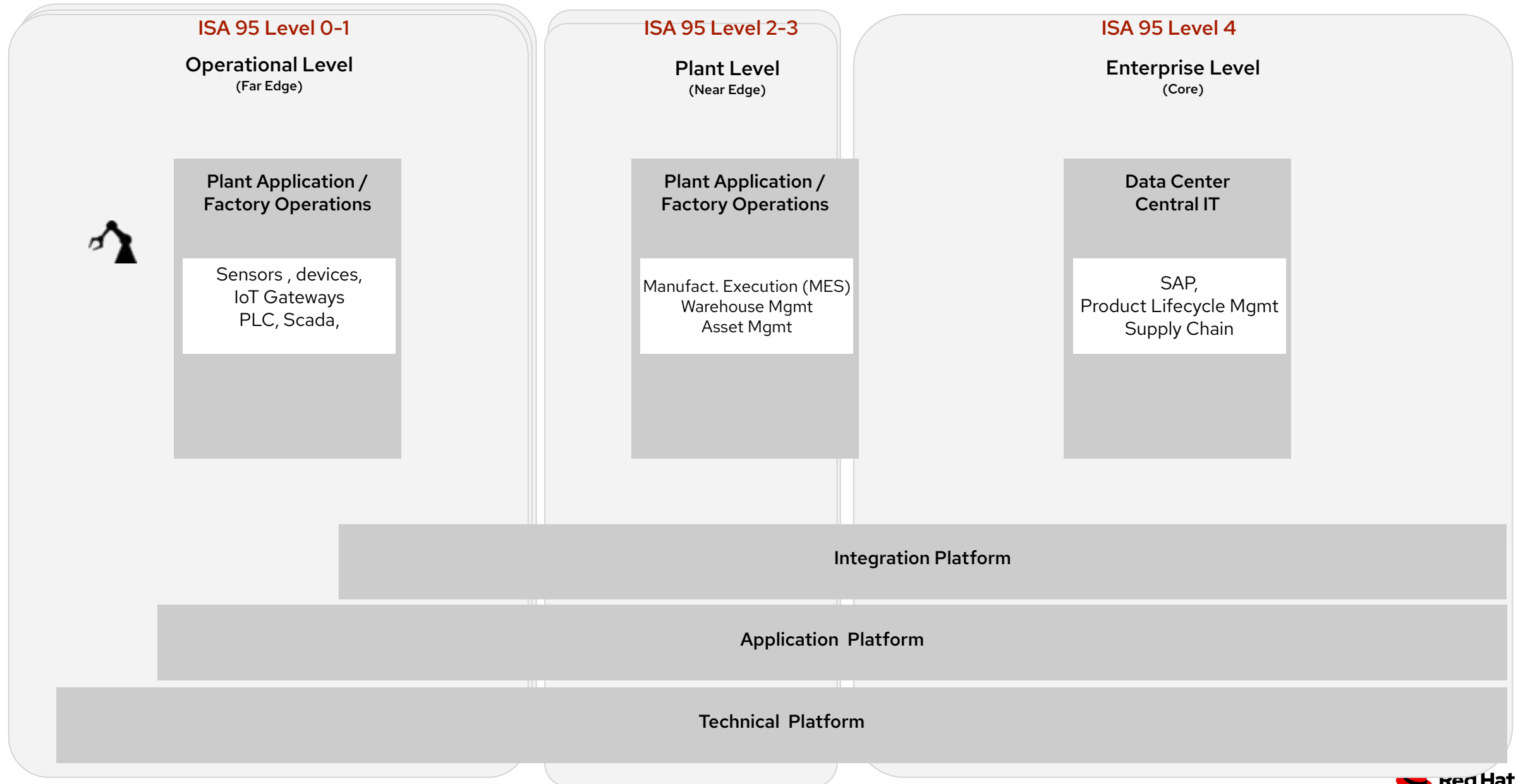## ISA 95 Level 4
### Enterprise Level
(Core)

**Data Center
Central IT**

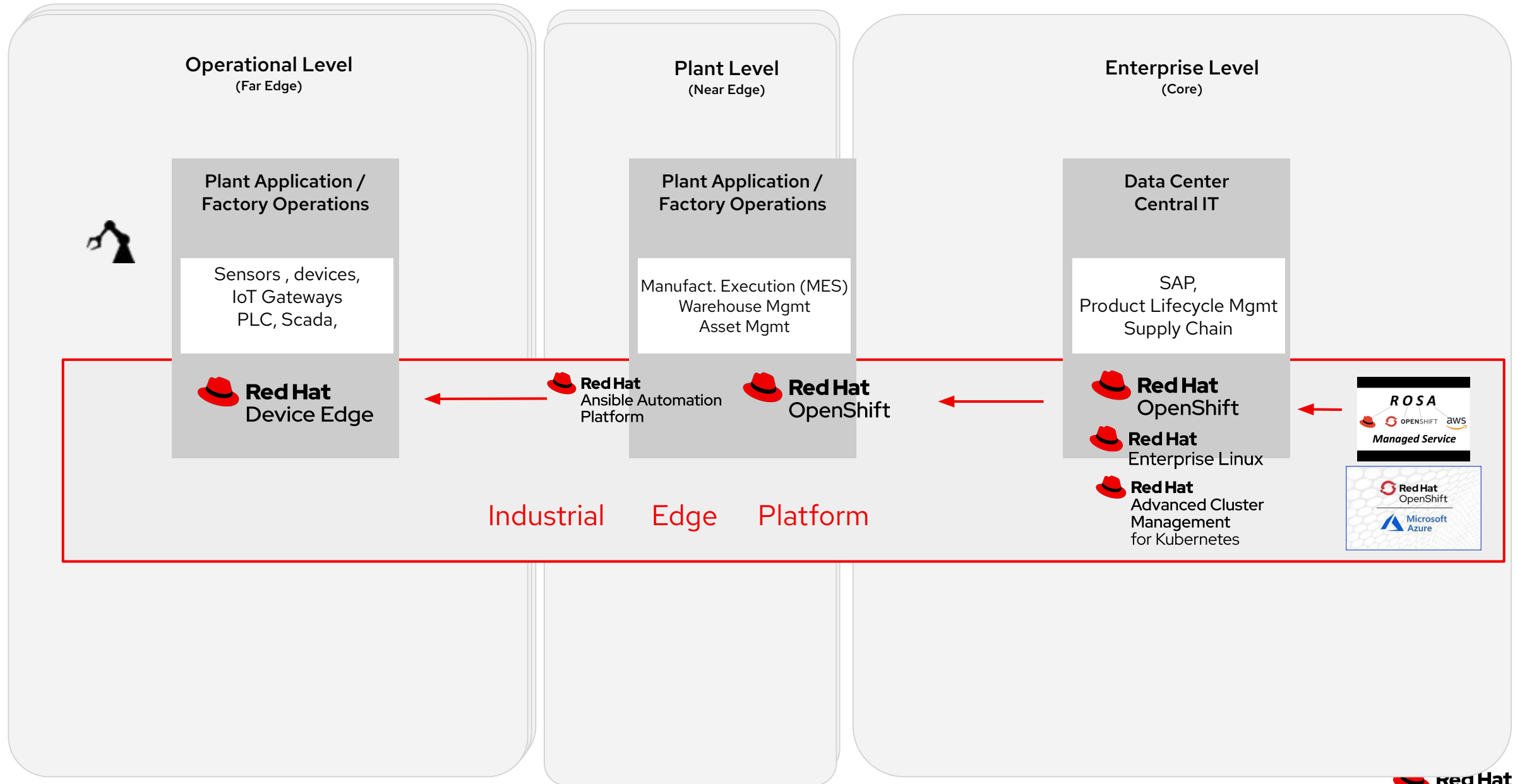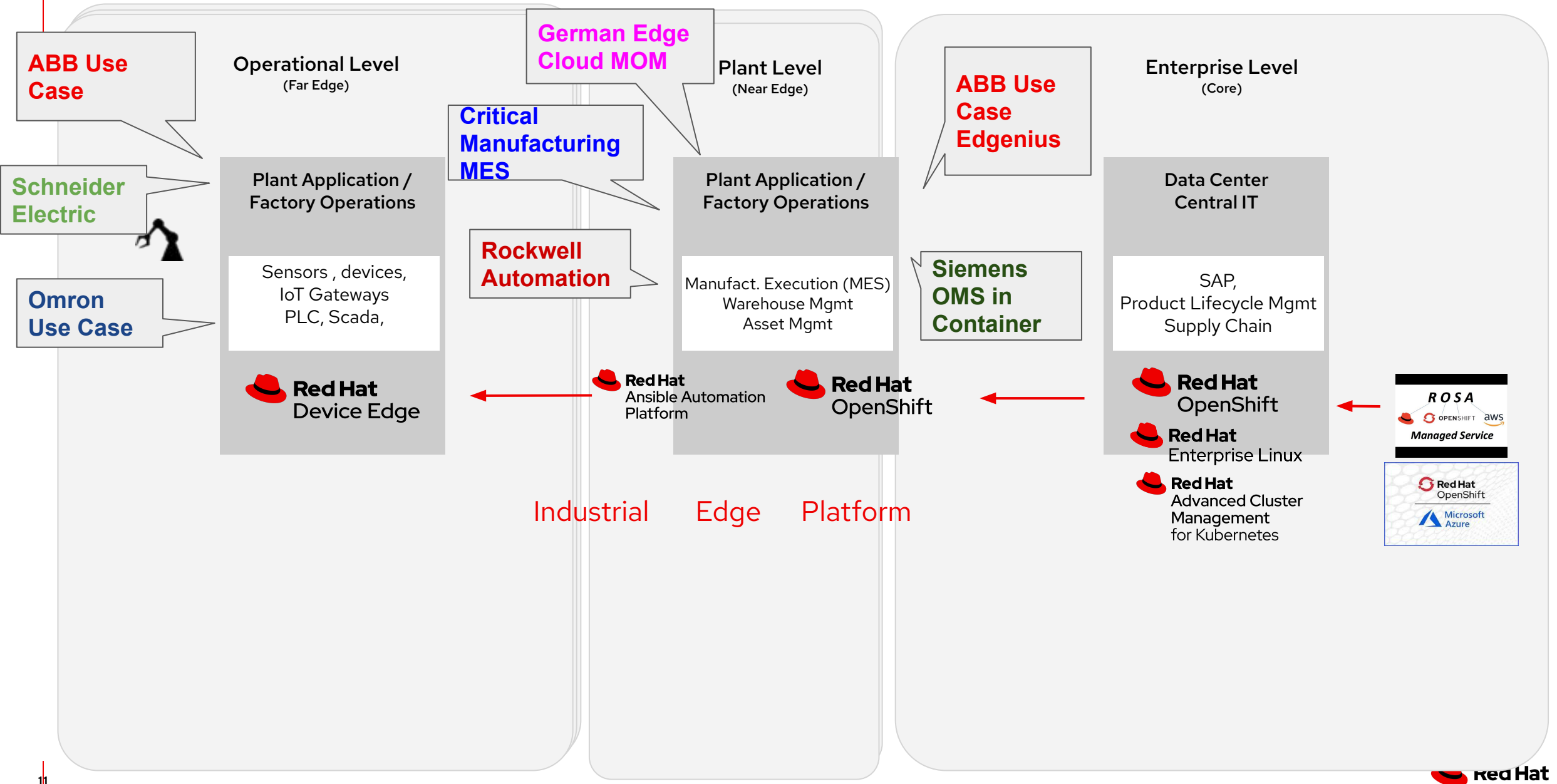SAP,
Product Lifecycle Mgmt
Supply Chain

**Integration Platform**

**Application  Platform**

**Technical  Platform**

Red Hat

# Industrial Edge Architecture

## Operational Level
### (Far Edge)

**Plant Application /
Factory Operations**

Sensors , devices,
IoT Gateways
PLC, Scada,

**Red Hat**
Device Edge

## Plant Level
### (Near Edge)

**Plant Application /
Factory Operations**

Manufact. Execution (MES)
Warehouse Mgmt
Asset Mgmt

**Red Hat**
OpenShift

## Enterprise Level
### (Core)

**Data Center
Central IT**

SAP,
Product Lifecycle Mgmt
Supply Chain

**Red Hat**
OpenShift

**Red Hat**
Enterprise Linux

**Red Hat**
Advanced Cluster
Management
for Kubernetes

**Red Hat**
Ansible Automation
Platform

**Industrial   Edge   Platform**

*ROSA*
OPENSHIFT aws
*Managed Service*

OpenShift
Microsoft Azure

Red Hat

# Industrial Edge Architecture

**ABB Use Case**

**German Edge Cloud MOM**

**Operational Level**
(Far Edge)

**Plant Level**
(Near Edge)

**ABB Use Case Edgenius**

**Enterprise Level**
(Core)

**Critical Manufacturing MES**

**Schneider Electric**

Plant Application / Factory Operations

Plant Application / Factory Operations

Data Center Central IT

**Rockwell Automation**

**Siemens OMS in Container**

**Omron Use Case**

Sensors , devices, IoT Gateways PLC, Scada,

Manufact. Execution (MES) Warehouse Mgmt Asset Mgmt

SAP, Product Lifecycle Mgmt Supply Chain

**Red Hat** Device Edge

**Red Hat** Ansible Automation Platform

**Red Hat** OpenShift

**Red Hat** OpenShift

**Red Hat** Enterprise Linux

**Red Hat** Advanced Cluster Management for Kubernetes

**ROSA** OPENSHIFT aws
*Managed Service*

OpenShift Microsoft Azure

Microsoft Azure

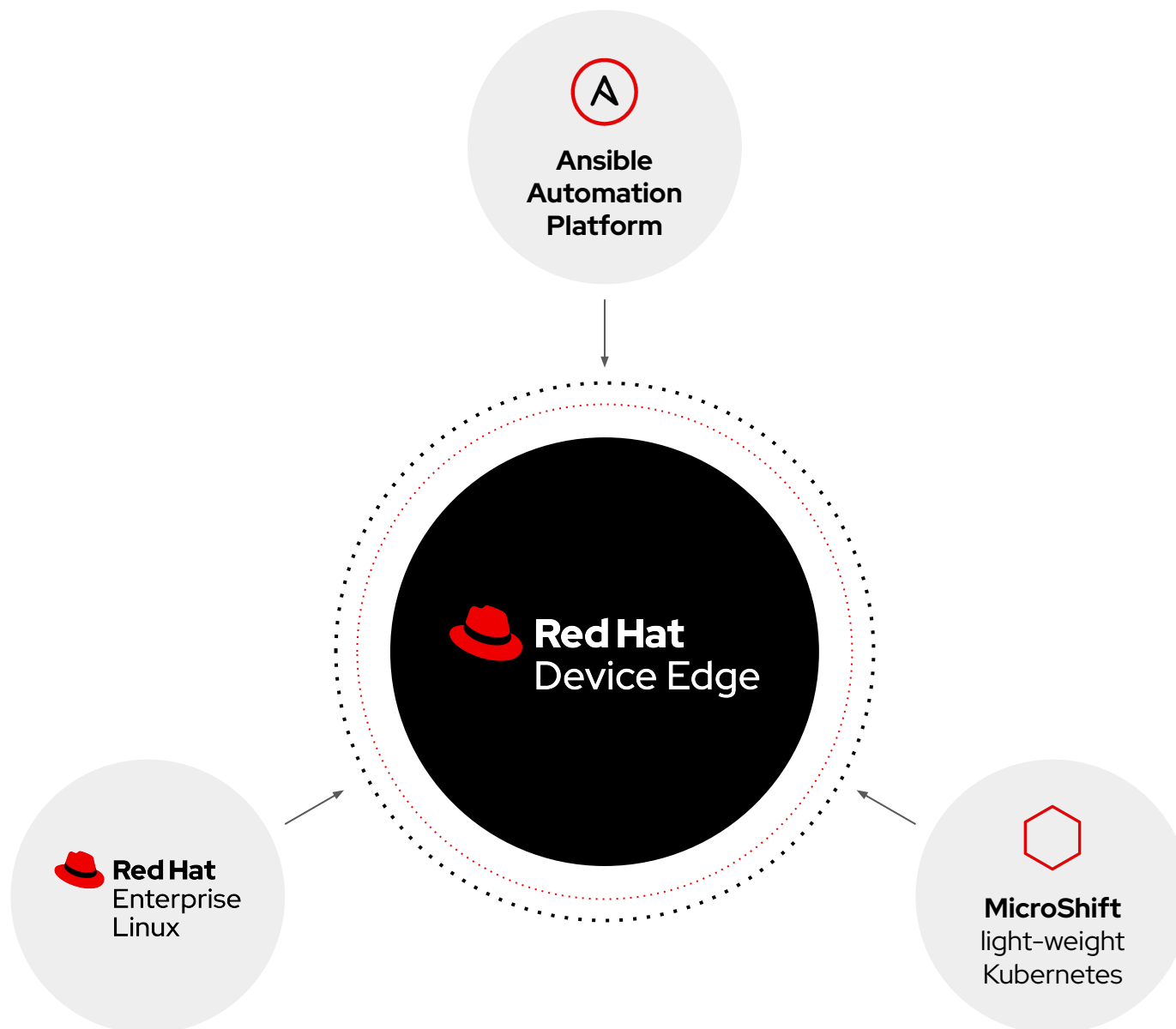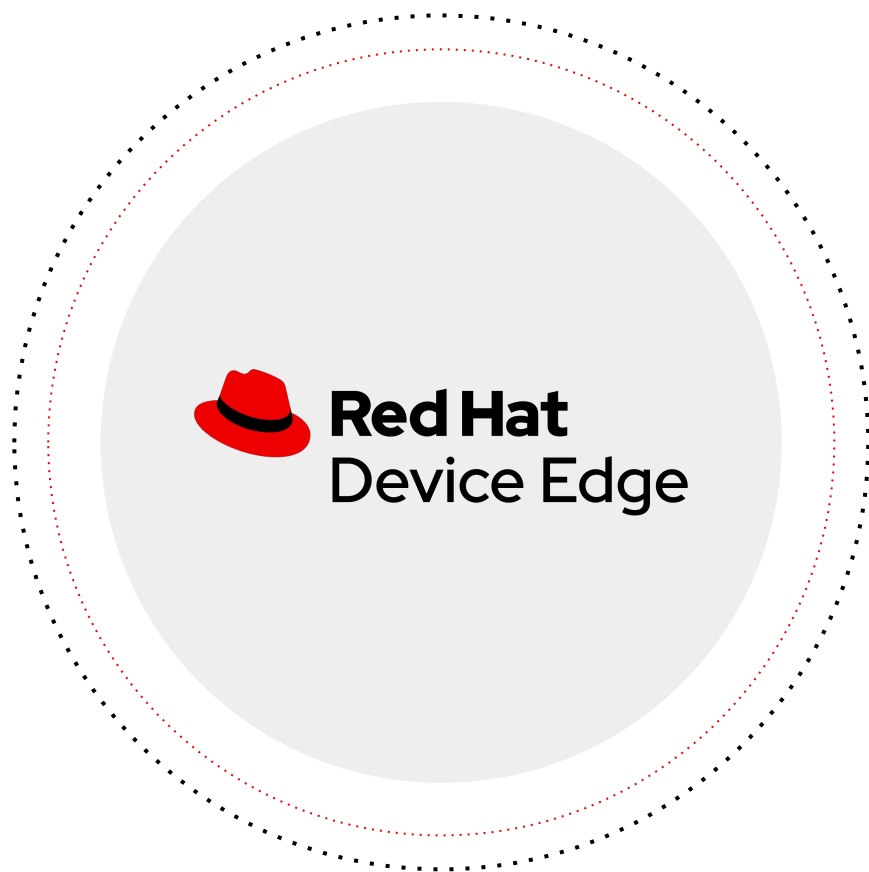Industrial   Edge   Platform

**Red Hat**

# The Industrial Edge Solution:
# **Red Hat Device Edge**

Red Hat

# Introducing Red Hat Device Edge



**Right-sized** to meet the needs of small, resource-constrained devices and their workloads
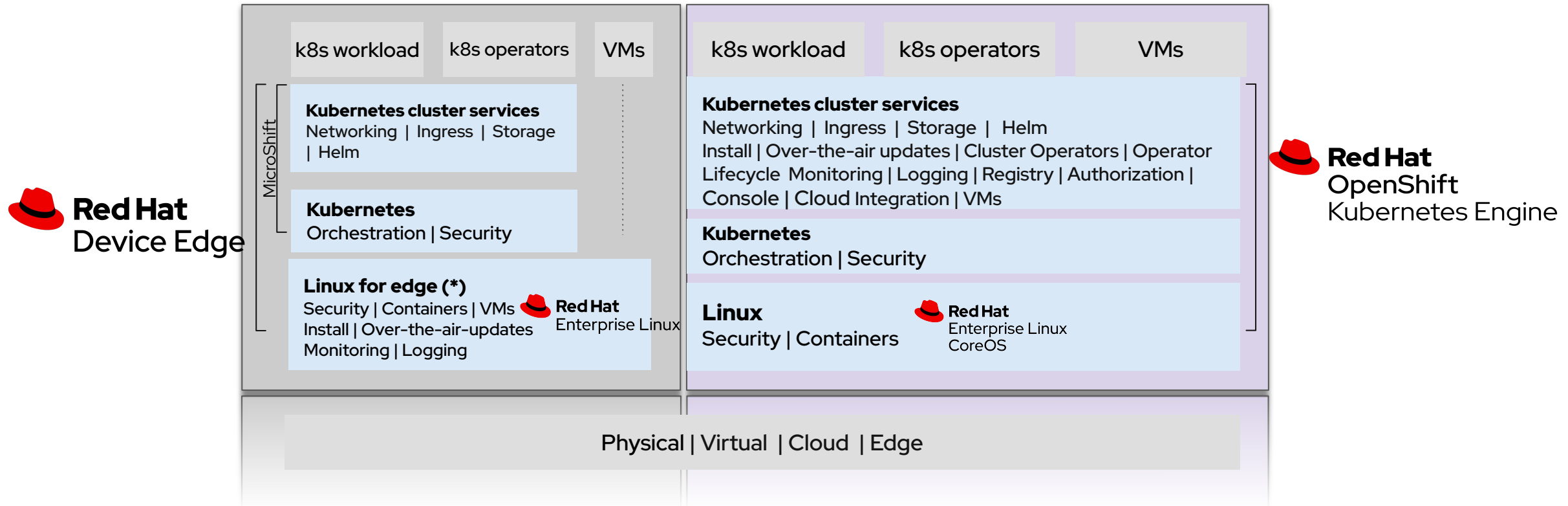
Choice so you can deploy only what your use case requires.

Flexible to meet organizations where they are in their workload strategy.

Operational consistency that lets your teams scale securely.

# Device Edge incl MicroShift compared to OpenShift



**Red Hat**
Device Edge

| k8s workload | k8s operators | VMs |

**Kubernetes cluster services**
Networking | Ingress | Storage | Helm

**Kubernetes**
Orchestration | Security

**Linux for edge (*)**
Security | Containers | VMs
Install | Over-the-air-updates
Monitoring | Logging

**Red Hat**
Enterprise Linux

*MicroShift*

**Red Hat**
OpenShift
Kubernetes Engine

| k8s workload | k8s operators | VMs |

**Kubernetes cluster services**
Networking | Ingress | Storage | Helm
Install | Over-the-air updates | Cluster Operators | Operator
Lifecycle Monitoring | Logging | Registry | Authorization |
Console | Cloud Integration | VMs

**Kubernetes**
Orchestration | Security

**Linux**
Security | Containers

**Red Hat**
Enterprise Linux
CoreOS

Physical | Virtual | Cloud | Edge

**Microshift:** If HA is required, two MicroShift deployments in parallel with an active/active setup is in need.

*recommended for edge deployments:  Red Hat  Enterprise Linux for Edge Images, rpm-ostree, immutable, atomic upgrade,  over the air flavour of Red Hat Enterprise Linux.

**Red Hat**

# Image builder

## Fast image assembly and configuration



**Edge profile generates a small, rpm-ostree image from the latest Red Hat Enterprise Linux 8.3+**

——

OS contents include:

- @core packages (small base install)
- Podman as the container engine
- Additional RPM content (optional)

# rpm-ostree

## Immutable operating system (OS) and stateful configuration and storage

**Data and apps**

**Update**

**Data and apps**

a1    a2    a1    a2

**Major release**
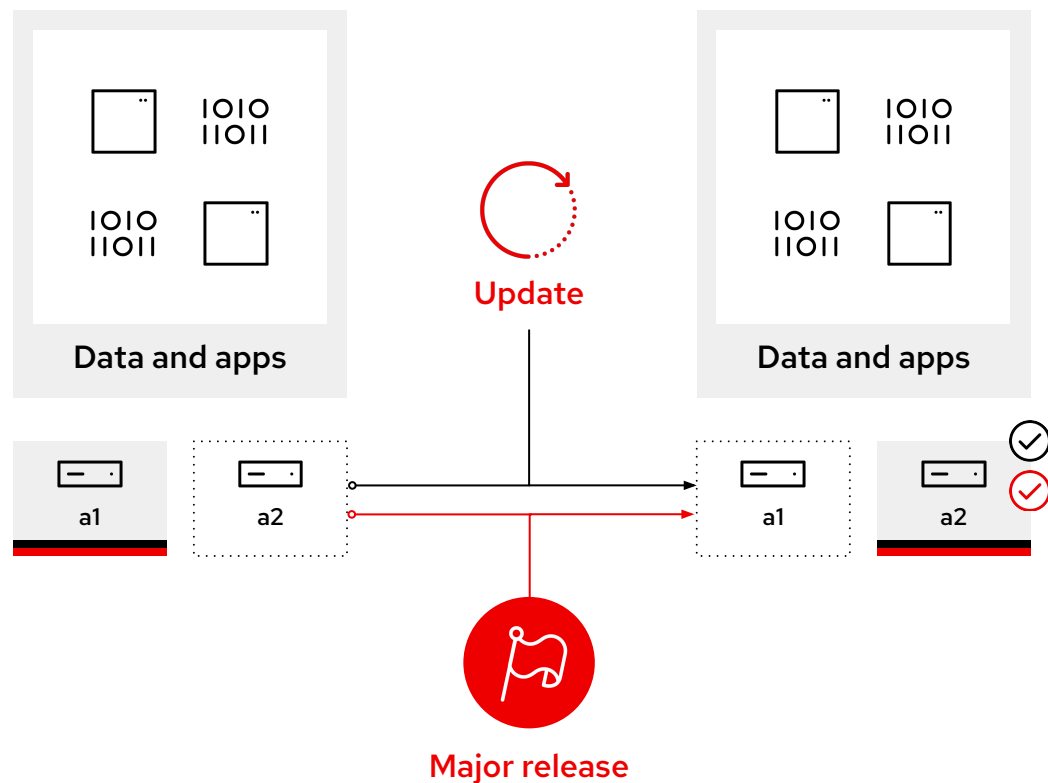
### Transactional updates (A → B model)

- OS binaries and libraries (/usr*) are immutable and read-only

- State (r/w) is maintained in /var and /etc

- No in-between state during updates

- Updates are staged in the background and applied upon reboot

- Reboots can be scheduled with maintenance windows to ensure the highest possible uptime

### Support seamless major release upgrades from Red Hat Enterprise Linux 8 → 9

- Help extend the serviceable life of hardware in the field

The rpm-ostree tool provides a new way to deploy and manage RPM-based operating systems. Instead of performing a package-by-package install and upgrade on each client machine, the tooling supports "composing" sets of packages on a server side, and then clients can perform atomic upgrades as a tree.
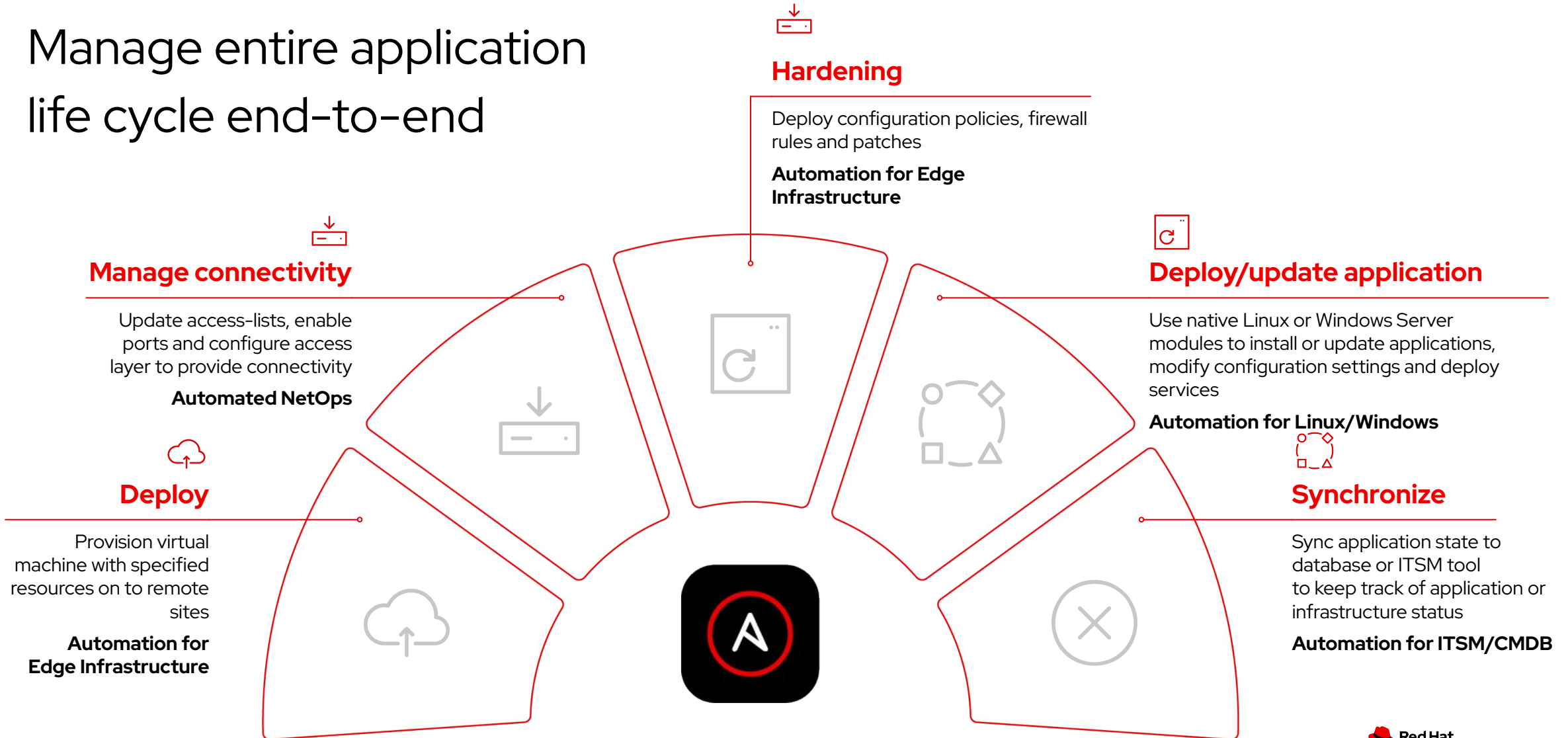
# Intelligent rollbacks: Greenboot

## Additional safeguard for application and OS compatibility



**Data and apps**

**Update**

**Data and apps**

a1 a2 a1 a2

a1 a2 a1 a2
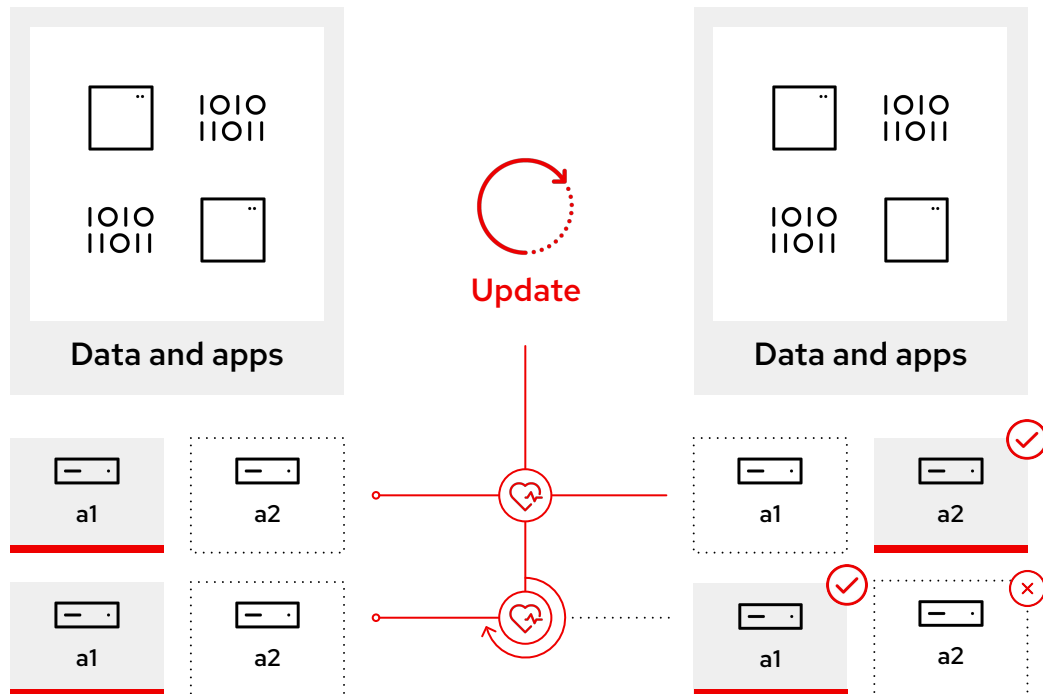
### Custom healthchecks can determine if nodes are functioning properly

- Healthchecks are run during the boot process.
- If checks fail, a counter will track the number of attempts.
- In a failure state, the node will use rpm-ostree to rollback the update.
- Examples can include:
  - Basic name resolution
  - Service or container status or health

**Also exists for Podman : It will automatically roll back containers if new application versions exit on fail**

Red Hat

# Manage entire application life cycle end-to-end

**Hardening**

Deploy configuration policies, firewall rules and patches

**Automation for Edge Infrastructure**

**Manage connectivity**

Update access-lists, enable ports and configure access layer to provide connectivity

**Automated NetOps**

**Deploy/update application**

Use native Linux or Windows Server modules to install or update applications, modify configuration settings and deploy services

**Automation for Linux/Windows**

**Deploy**

Provision virtual machine with specified resources on to remote sites

**Automation for Edge Infrastructure**

**Synchronize**

Sync application state to database or ITSM tool to keep track of application or infrastructure status

**Automation for ITSM/CMDB**

19

**Red Hat**
Ansible Automation Platform

**Red Hat platforms for the edge**

**Red Hat**
Enterprise Linux

**Small footprint edge OS**
RHEL minimal profile and tooling for Edge devices

**MicroShift**
Small footprint OpenShift Optimized Profile on RHEL
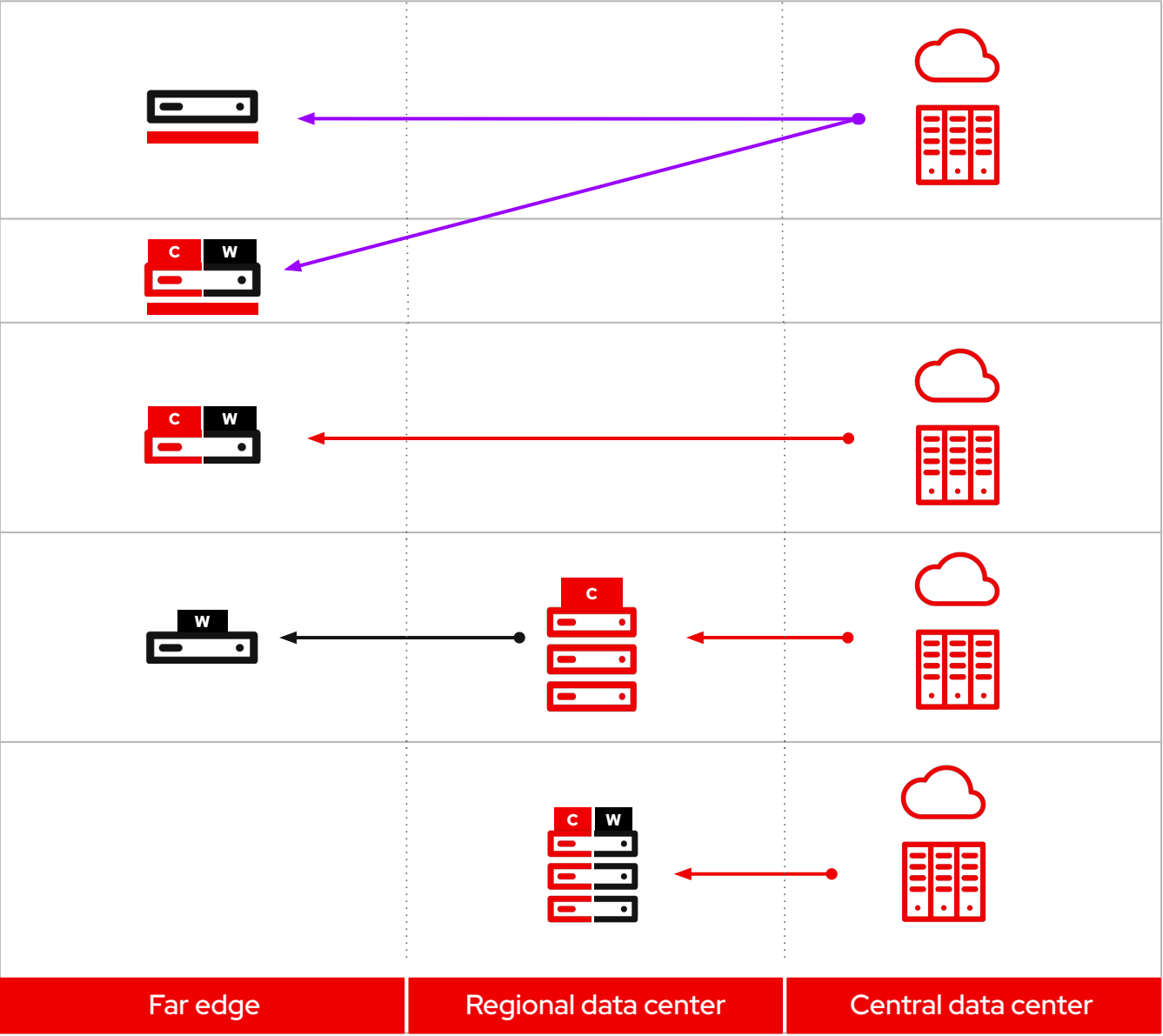
**Single-node edge servers**
Low bandwidth or disconnected sites

**Remote worker nodes**
Space-constrained environments

**3 node Clusters**
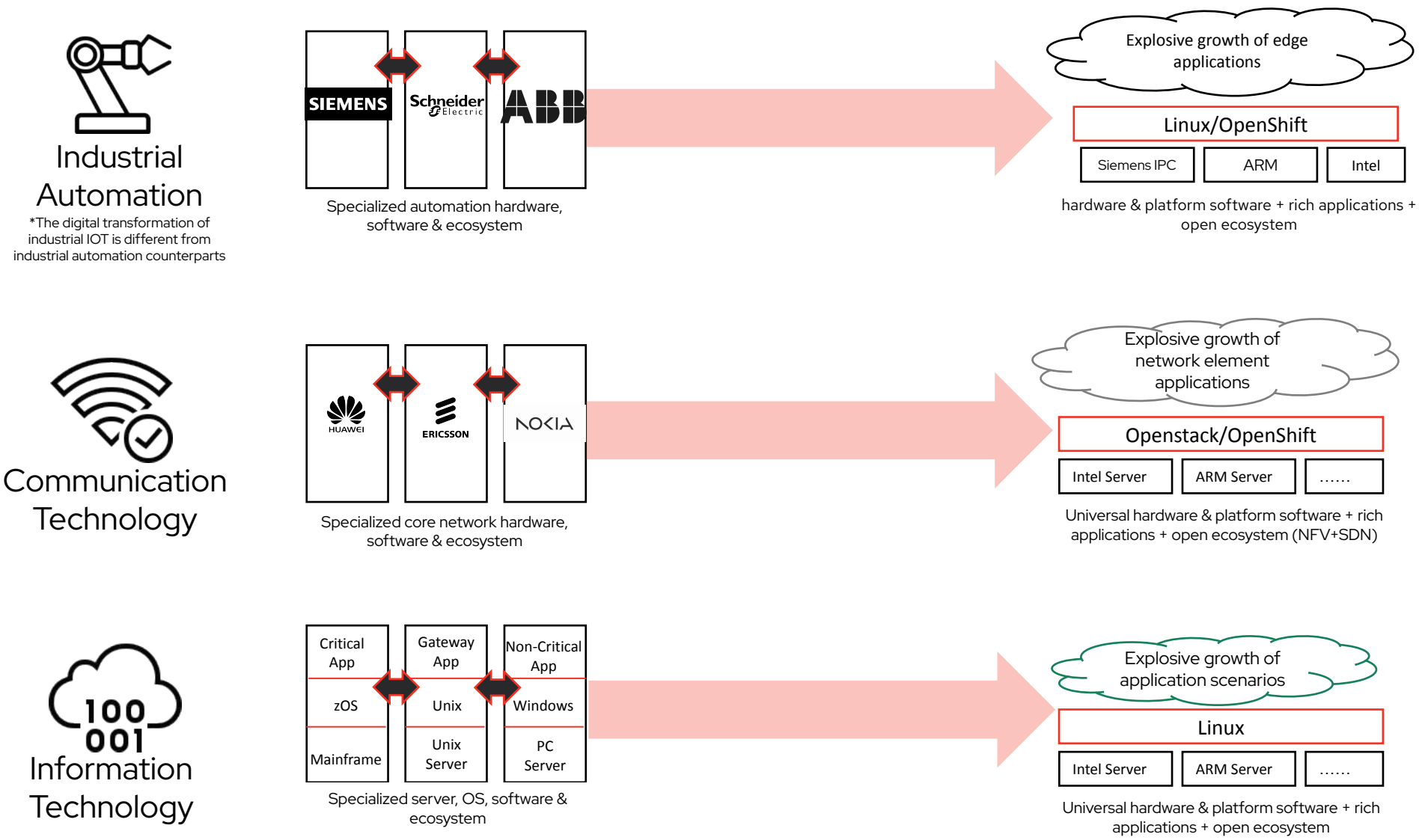Low footprint clusters with high availability

**Red Hat**
Management

1 Core
2GB min
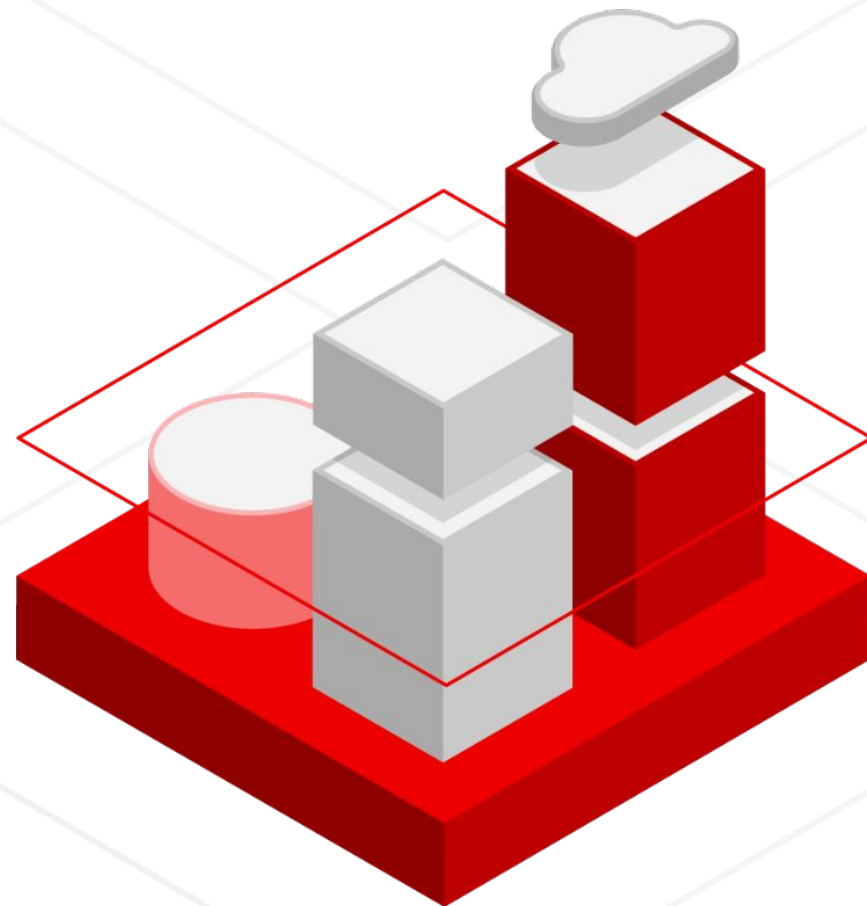
2 Core
2GB min

8vCPU
16GB min

2vCPU
8GB min

6vCPU
24GB min

| Far edge | Regional data center | Central data center |
|---|---|---|

Ansible Managed    RHACM Managed    Kubernetes node control    C Control node    W Worker node

**Red Hat**

# Transformation from closed platforms to open platforms

## Industrial Automation

*The digital transformation of industrial IOT is different from industrial automation counterparts

SIEMENS | Schneider Electric | ABB

Specialized automation hardware, software & ecosystem

Explosive growth of edge applications

Linux/OpenShift

| Siemens IPC | ARM | Intel |

hardware & platform software + rich applications + open ecosystem

## Communication Technology

HUAWEI | ERICSSON | NOKIA

Specialized core network hardware, software & ecosystem

Explosive growth of network element applications

Openstack/OpenShift

| Intel Server | ARM Server | ...... |

Universal hardware & platform software + rich applications + open ecosystem (NFV+SDN)

## Information Technology

| Critical App | Gateway App | Non-Critical App |
| zOS | Unix | Windows |
| Mainframe | Unix Server | PC Server |

Specialized server, OS, software & ecosystem

Explosive growth of application scenarios

Linux

| Intel Server | ARM Server | ...... |

Universal hardware & platform software + rich applications + open ecosystem

# Client References

Red Hat

# Industrial Edge Case Studies

**IPCs and PLCs for Industrial OT**

OMRON

**Edgenius - Operations Data Manager**

ABB

**Factory Modernization**

SIEMENS

**IT/OT Automation**

RA Rockwell Automation

**Manufacturing Execution Sys**

LUMENTUM

**Edge AI Advanced sensing**

LOCKHEED MARTIN

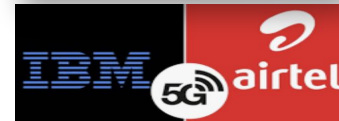**ONCITE - Industrial Edge platform**

minsait ACS
An Indra company

**ONCITE - Industrial Edge platform**

GERMAN EDGE CLOUD

**Container & Microservices -Agile Mfg**

Critical manufacturing

**5G Edge for Industrial**

IBM 5G airtel

**Plant Service Bus**

VW

Red Hat

# Thank you

Red Hat is the world's leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.

in linkedin.com/company/red-hat

f facebook.com/redhatinc

youtube.com/user/RedHatVideos

twitter.com/RedHat

Red Hat