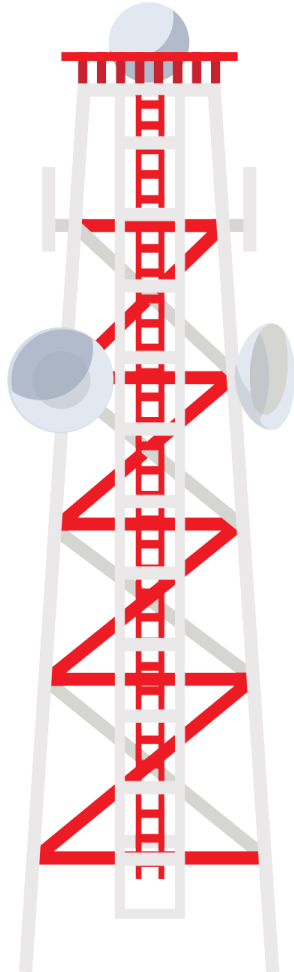


# Role of Cloud and Telco collaboration in Open RAN

Michael Tadault  
Chief Technologist Telco  
APAC

2nd   
**OPEN RAN INDIA 2022**  
INTERNATIONAL CONFERENCE  
The Future of Radio Access Networks  
16<sup>TH</sup> JUNE, 2022 • SHANGRI-LA, NEW DELHI

# RAN Evolution: Two Dimensions of Architecture Transformation



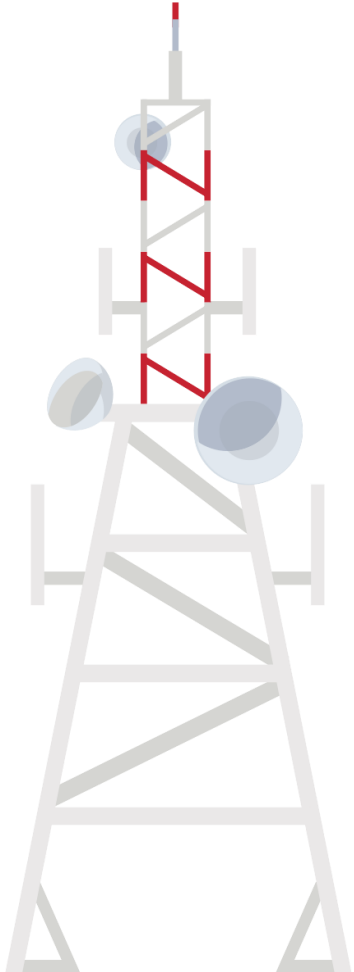
RAN Centralization  
(disaggregation)

Split baseband functionality  
from radio functionality



RAN Cloudification  
(separation of HW & SW)

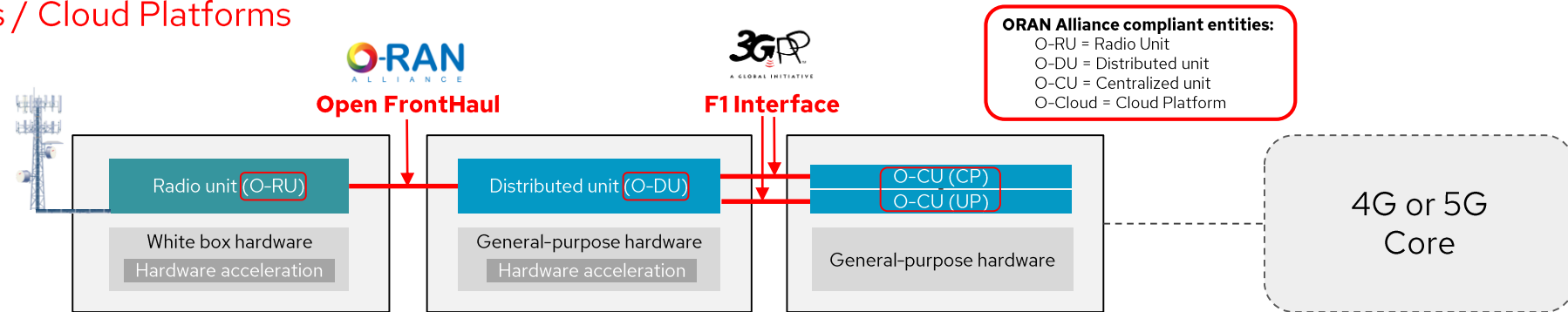
Deploy baseband units on a  
consistent cloud platform



# Mobile Network Radio Base Station

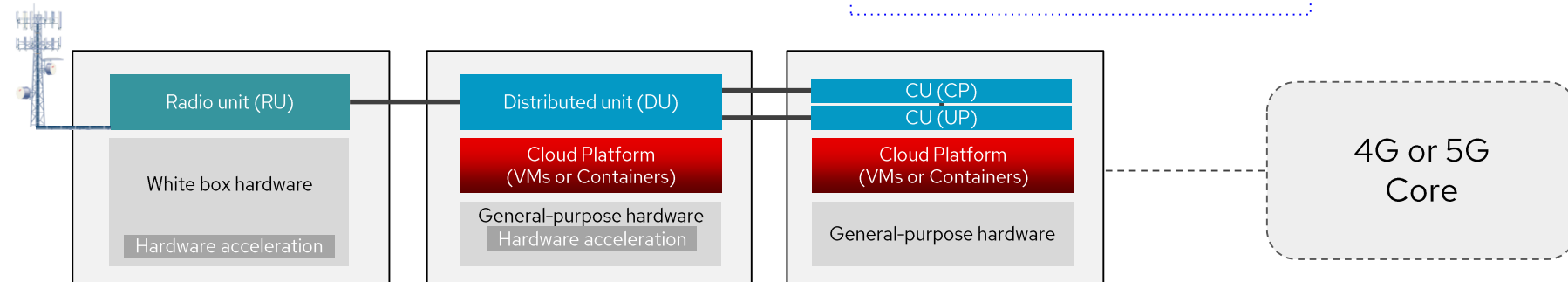
## RAN Evolution: Openness / Cloud Platforms

Open Interfaces ("Open")  
**Open RAN**

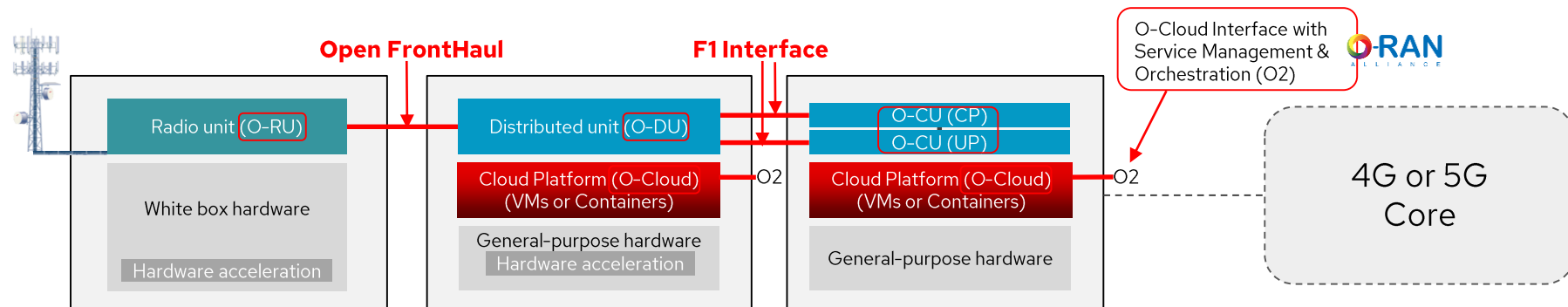


NOTE: There are many other ORAN / 3GPP interfaces than these

Cloudification ("v")  
**vRAN**



"Open" + "v"  
**Open vRAN**



# RAN evolution adds new requirements to cloud platforms

These are three of the most important new areas to cover ...



## Real time Kernel (RT)

Workloads stringent low-latency determinism requirements for core kernel features such as interrupt handling and process scheduling in the microsecond ( $\mu$ s) range.

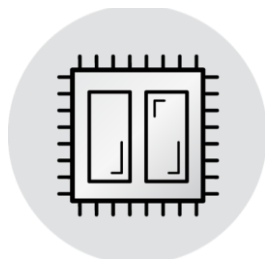


## Timing & Synchronization

Time synchronization via transport networks will be critical for 5G radios. Precision Time Protocol (PTP) remains the preferred method to deliver timing across packet-switched networks

### Red Hat Timing & Sync work presented at:

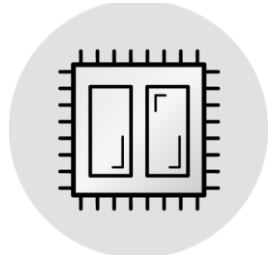
- International Timing & Synchronization Forum (Nov 5, 2020)
- OpenAirInterface Fall 2020 Virtual Workshop (Nov 12, 2020)  
Video: [OpenAirInterface Event](#)
- Workshop on Synchronization and Timing Systems (Apr 1, 2021)  
Slides: [WSTS 2021](#)
- International Timing & Synchronization Forum (Nov 3, 2021), Brighton, UK



## Hardware Acceleration

Field Programmable Gate Arrays (FPGA) , SmartNIC, and other hardware acceleration components will be vital for 5G virtualized infrastructure.

# RAN evolution adds new requirements to cloud platforms



## CPU Management

CPU Manager manages groups of CPUs and constrains workloads to specific CPUs. CPU Manager is useful for workloads that have some of these attributes: require as much CPU time as possible or are low-latency network applications.



## Zero touch provisioning

Provides all the tools required to install, upgrade and maintain the cloud infrastructure for the RAN workload with minimum user interaction in an “appliance” like deployment. Reduced complexity with increased flexibility of options and performance.



## Topology Management

Topology Manager collects hints from the CPU Manager, Device Manager, and other Hint Providers to align pod resources, such as CPU, SR-IOV VFs, and other device resources, for all Quality of Service (QoS) classes on the same non-uniform memory access (NUMA) node.



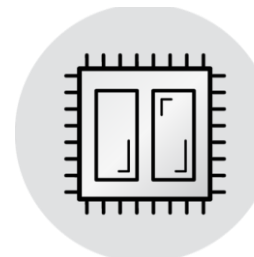
## Remote Management

Take full control of edge and RAN operation from a centralized single pane of glass. This includes, OpenShift installation and upgrade, application provisioning and monitoring.



## Low Latency

A combination of multiple factors that allow the workload the maximum processing capacity and minimizes packet delivery latencies.



## Reduced footprint

Remote Radio sites have limited space and power, therefore edge and RAN clouds would require a small cloud footprint.

# What are the edge workloads?

## Radio Access Network

Centralized Unit (CU)  
Distributed Unit (DU)

When RAN is virtualized, centralization of virtualized BBU network functions such as CU and DU improves network efficiency

## Mobile Core

4G S/P-GW-U  
5G UPF

Termination of mobile access network and traffic handover to applications at the edge to enable autonomous and low latency applications

## Edge Computing

CDN, IaaS, CaaS  
AI/ML applications  
Industry-specific B2B applications

Telco service provider can provide ready-to-be used applications or provide cloud computing services for enterprises to build/host their own applications

## A single platform for the edge

### Radio Access Network

Centralized Unit (CU)  
Distributed Unit (DU)

### Mobile Core

4G S/P-GW-U  
5G UPF

### Edge Computing

CDN, IaaS, CaaS  
AI/ML applications  
Industry-specific B2B  
applications

## A single open telco cloud platform for the edge

**Optimize** scarce resources at the edge (space, power, cooling)  
**Consistent operations**, a single platform to manage instead of three  
**Innovation and speed to market**, re-use platform to pick best of breed workloads

# Key requirements for edge platform

## Radio Access Network

Centralized Unit (CU)  
Distributed Unit (DU)

Support of RAN workloads:  
real time Linux, low latency  
kernel, PTP, hardware  
accelerator...

**Ecosystem** of RAN network  
functions

## Mobile Core

4G S/P-GW-U  
5G UPF

Support of mobile user plane  
NFs: CPU pinning, NUMA  
topology, SR-IOV, DPDK,  
huge pages...

**Ecosystem** of mobile core  
network functions

## Edge Computing

CDN, IaaS, CaaS  
AI/ML applications  
Industry-specific B2B  
applications

Support for cloud computing  
services: IaaS, CaaS, block,  
object, file storage, vGPU  
Developer tools

**Ecosystem** of IT PaaS and  
applications ISVs

Small footprint (minimal amount of servers), management at scale of 100's, 1000's of edge clusters



# Red Hat OpenShift for the open telco cloud



Multi-cluster layer

## ACM: multicluster management

Observability : Discovery : Policy  
: Compliance : Configuration : Workloads

## Quay: container registry

Container Builds : Security Scanning : Geo  
Replication

## ACS: multicluster security

Kube native declarative security |  
DevSecOps

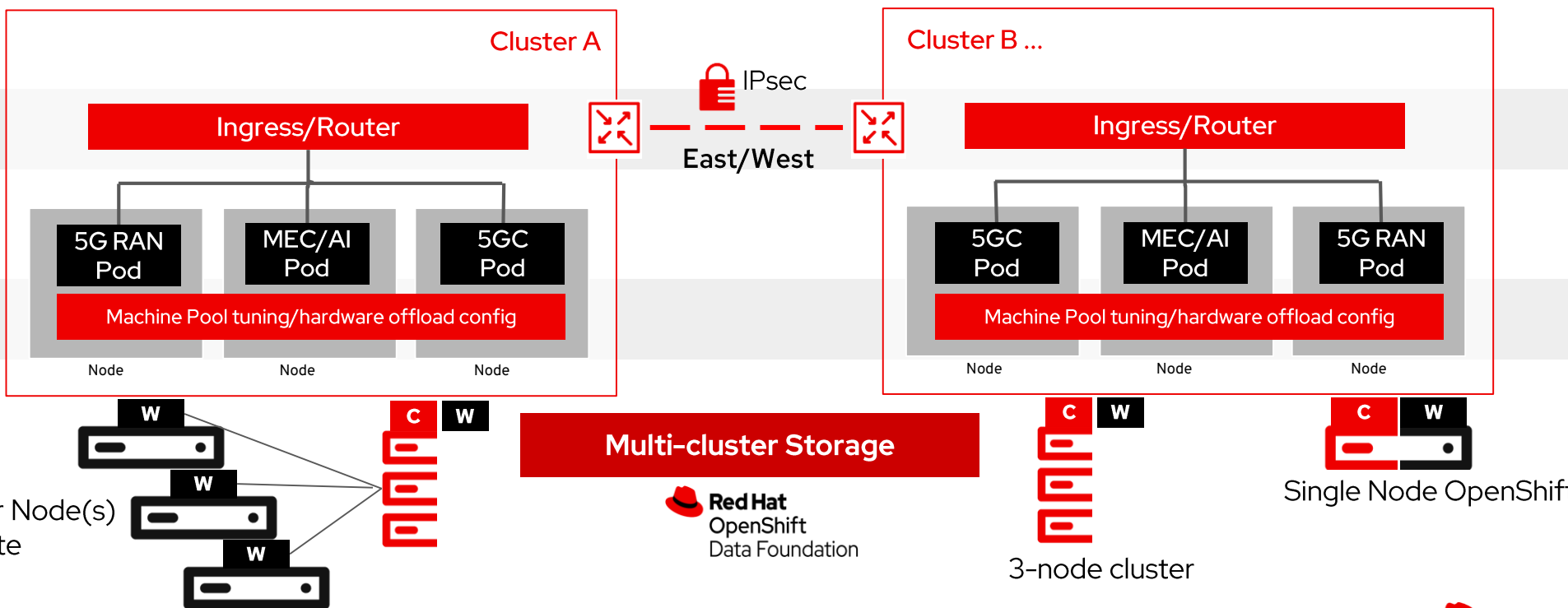
Global Ingress/Egress | Global LB | Service Mesh Federation



Router layer



Node layer



# OpenShift CNF ecosystem

## Freedom to choose any vRAN / Open RAN

vRAN / Open RAN CNFs vendor-validated on OpenShift (April 2022)



Vendor	CNF
<b>ALTIOSTAR</b> <small>Leading Network Transformation</small>	4G and 5G Open vRAN
<b>Bicells</b>	Aurora Airband RAN
<b>MAVENIR</b>	5G RAN CU
<b>NEC</b>	5G vRAN
<b>JUNIPER</b> <small>NETWORKS</small>	RAN Intelligent Controller (RIC)

[Open RAN Ecosystem Evolution](#), February 2022 with Eric Parsons, VP, Cloud RAN at Ericsson

[Accelerating cloud RAN technology innovation in the 5G era](#), February 2022, with Jane Rygaard, Head of Dedicated Wireless Networks and Edge Clouds at Nokia

[Samsung Joins Forces With Industry Leaders To Advance 5G vRAN Ecosystem](#), February 2022



## Freedom to choose any 5G core

5G core CNFs vendor-validated on OpenShift (April 2022)

Vendor	CNF	Vendor	CNF
<b>affirmed</b>	UnityCloud 5G Core	<b>Hewlett Packard Enterprise</b>	5G Authentication, Core Charging, Policy Control Data management
<b>alepo</b>	Alepo Converged Core Solution	<b>MAVENIR</b>	5G Core
<b>casa systems</b>	Axyom™ 5G Multi Access Core	<b>NEC</b>	5G Core
<b>Cumucore</b>	5G Core with Network Slice Manager and 5GLAN, TSN support functions	<b>NOKIA</b>	5G Core, Converged Charging
<b>EXIUM</b>	Secure 5G Core	<b>SAMSUNG</b>	5G Core CNF
		<b>ZTE</b>	5G Common Core i5GC



[Ericsson and Red Hat collaborate to deliver multivendor solutions to Communication Service Providers \(CSPs\)](#)



[Certified cloud-native network functions for OpenShift](#)

# OpenShift for edge computing / MEC

## A single platform for all edge workloads

vRAN 5G core Edge Computing MEC



Compact 3-node cluster



Single node



Remote worker node

## Edge cloud computing

- IaaS (VMs)
- Container as a Service (CaaS)
- Block, file, and object storage
- Serverless
- Developer tooling such as Service Mesh
- NVIDIA support for AI/ML apps



## DevSecOps

**Red Hat**  
Advanced Cluster Security  
for Kubernetes

## Management at scale

**Red Hat**  
Advanced Cluster Management  
for Kubernetes

## Extensive developer tools

**Developer Tools**

Red Hat Developer Tools Software helps you enhance your IDE, streamline DevOps or leverage application services to build powerful applications whether on prem or in the cloud.

**Developer Tools for Kubernetes**

Kubernetes gives you the ability to scale from on-prem to cloud providers across the world. With those abilities you may have to adopt new processes for deployment and new approaches to programming to be effective. Red Hat's developer tools for Kubernetes remove many of the most challenging changes to your workflow while giving you the capabilities of this powerful platform.

- Azure DevOps Plugins**  
Ease common OpenShift tasks in Azure DevOps.
- Red Hat CodeReady Containers**  
Red Hat CodeReady Containers brings a minimal, preconfigured OpenShift 4.3 or newer cluster to your local laptop or desktop computer for development and testing purposes.
- Eclipse JKube**  
Eclipse JKube is the reincarnation of the Fabric8 Maven plugin with three components - the JKube Kit, Kubernetes Maven plugin, and OpenShift Maven plugin.
- JBoss and Wildfly Visual Studio Connector**  
This extension provides build tasks to manage and deploy WAR and EAR file to JBoss Enterprise Application Platform (EAP) 7 or WildFly 8 and above.
- odo - Developer focused CLI for Kubernetes & OpenShift**
- Red Hat CodeReady Workspaces**  
A collaborative Kubernetes-native development solution that delivers OpenShift workspaces and in-browser IDE for rapid cloud application development.
- Red Hat Container Development Kit**  
A pre-built Container Development Environment using our platform-as-a-service solution, OpenShift Container Platform 3.
- VS Code Dependency Analytics**  
Insights about your application dependencies: Security, License compatibility and AI based guidance to choose appropriate dependencies for your application.
- VS Code OpenShift Connector**  
Interacting with Red Hat OpenShift clusters and providing a streamlined developer experience using Visual Studio Code.
- Dekorate**  
Dekorate is a collection of Java compile-time generators
- VS Code OpenShift Extension Pack**  
The OpenShift Extension Pack is the ultimate collection of extensions for working with OpenShift resources in VS Code.
- VS Code Project Initializer**  
A lightweight extension based on Red Hat launcher to generate quickstart projects using VSCode.
- VS Code XML**  
XML Language Support by Red Hat.
- VS Code YAML**  
Provides comprehensive YAML Language support to Visual Studio Code, via the yaml-language-server, with built-in Kubernetes and Kedge syntax support.
- Java Operators DSK**  
java-operator-sdk is based on the fabric8 Kubernetes client and will make it easy for Java developers to create Kubernetes Operators.

<https://developers.redhat.com/developer-tools>

# OpenShift ecosystem for IT

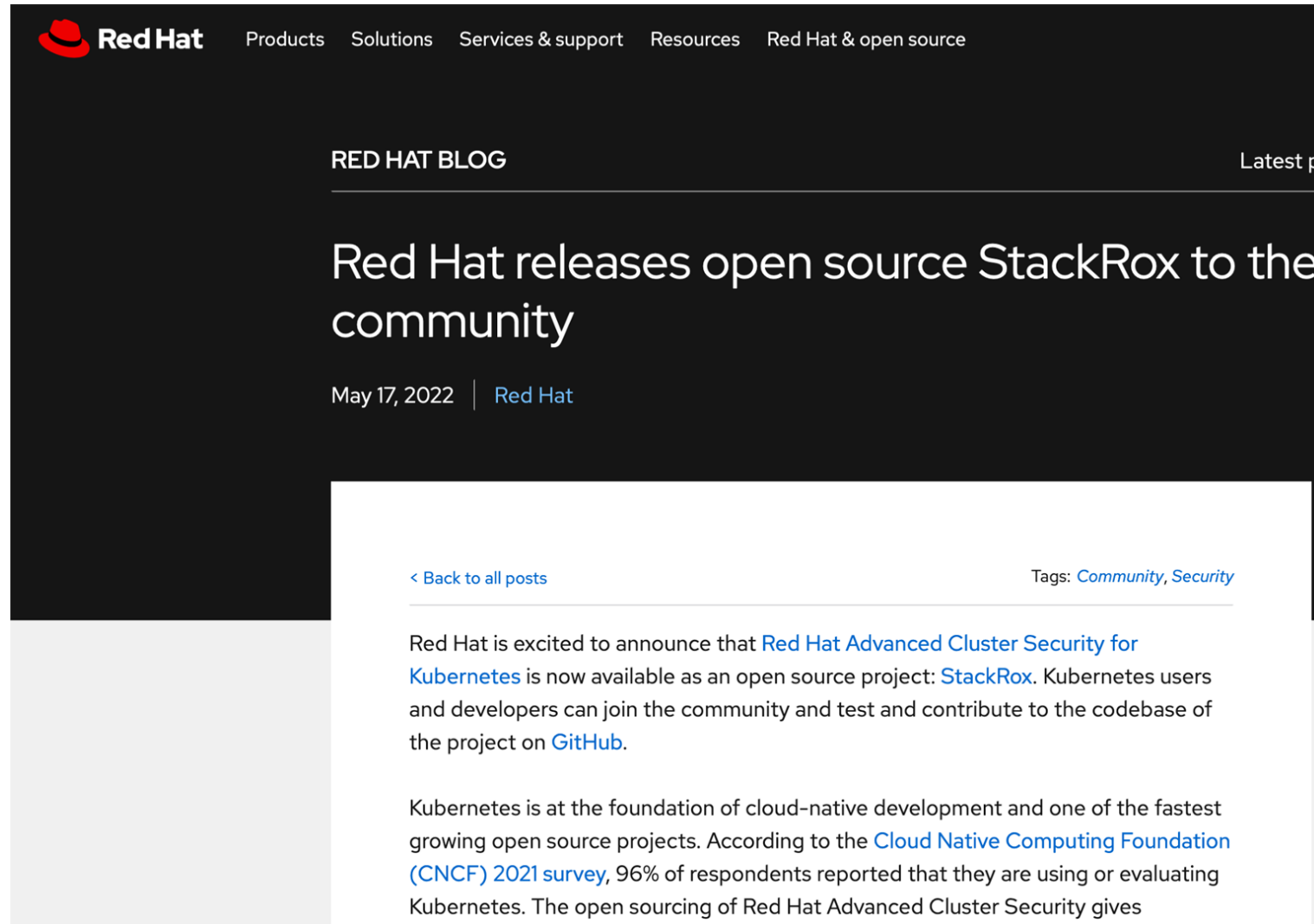
Most extensive container ecosystem to build edge computing applications



5000+ OpenShift certified container images

300+ OpenShift certified containerized products

200+ OpenShift certified operators



The screenshot shows a Red Hat blog post. At the top left is the Red Hat logo. To its right are navigation links: Products, Solutions, Services & support, Resources, and Red Hat & open source. Below the navigation is the text 'RED HAT BLOG' and 'Latest posts'. The main heading of the post is 'Red Hat releases open source StackRox to the community'. Below the heading is the date 'May 17, 2022' and the author 'Red Hat'. There are two paragraphs of text. The first paragraph starts with 'Red Hat is excited to announce that Red Hat Advanced Cluster Security for Kubernetes is now available as an open source project: StackRox. Kubernetes users and developers can join the community and test and contribute to the codebase of the project on GitHub.' The second paragraph starts with 'Kubernetes is at the foundation of cloud-native development and one of the fastest growing open source projects. According to the Cloud Native Computing Foundation (CNCF) 2021 survey, 96% of respondents reported that they are using or evaluating Kubernetes. The open sourcing of Red Hat Advanced Cluster Security gives'. There are also navigation links: '< Back to all posts' and 'Tags: Community, Security'.

Red Hat

Products Solutions Services & support Resources Red Hat & open source

RED HAT BLOG Latest posts

# Red Hat releases open source StackRox to the community

May 17, 2022 | Red Hat

[< Back to all posts](#) Tags: [Community](#), [Security](#)

Red Hat is excited to announce that [Red Hat Advanced Cluster Security for Kubernetes](#) is now available as an open source project: [StackRox](#). Kubernetes users and developers can join the community and test and contribute to the codebase of the project on [GitHub](#).

Kubernetes is at the foundation of cloud-native development and one of the fastest growing open source projects. According to the [Cloud Native Computing Foundation \(CNCF\) 2021 survey](#), 96% of respondents reported that they are using or evaluating Kubernetes. The open sourcing of Red Hat Advanced Cluster Security gives



# THE POWER OF



Share • Solve • Create

# 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.



[linkedin.com/company/red-hat](https://www.linkedin.com/company/red-hat)



[youtube.com/user/RedHatVideos](https://www.youtube.com/user/RedHatVideos)



[facebook.com/redhatinc](https://www.facebook.com/redhatinc)



[twitter.com/RedHat](https://twitter.com/RedHat)