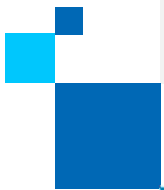


Red Hat – Intel Open Tour

# Build on Open Run on Intel

Nawras Sawsou – Strategic Alliances Manager, Nordics  
Intel Corporation



intel®



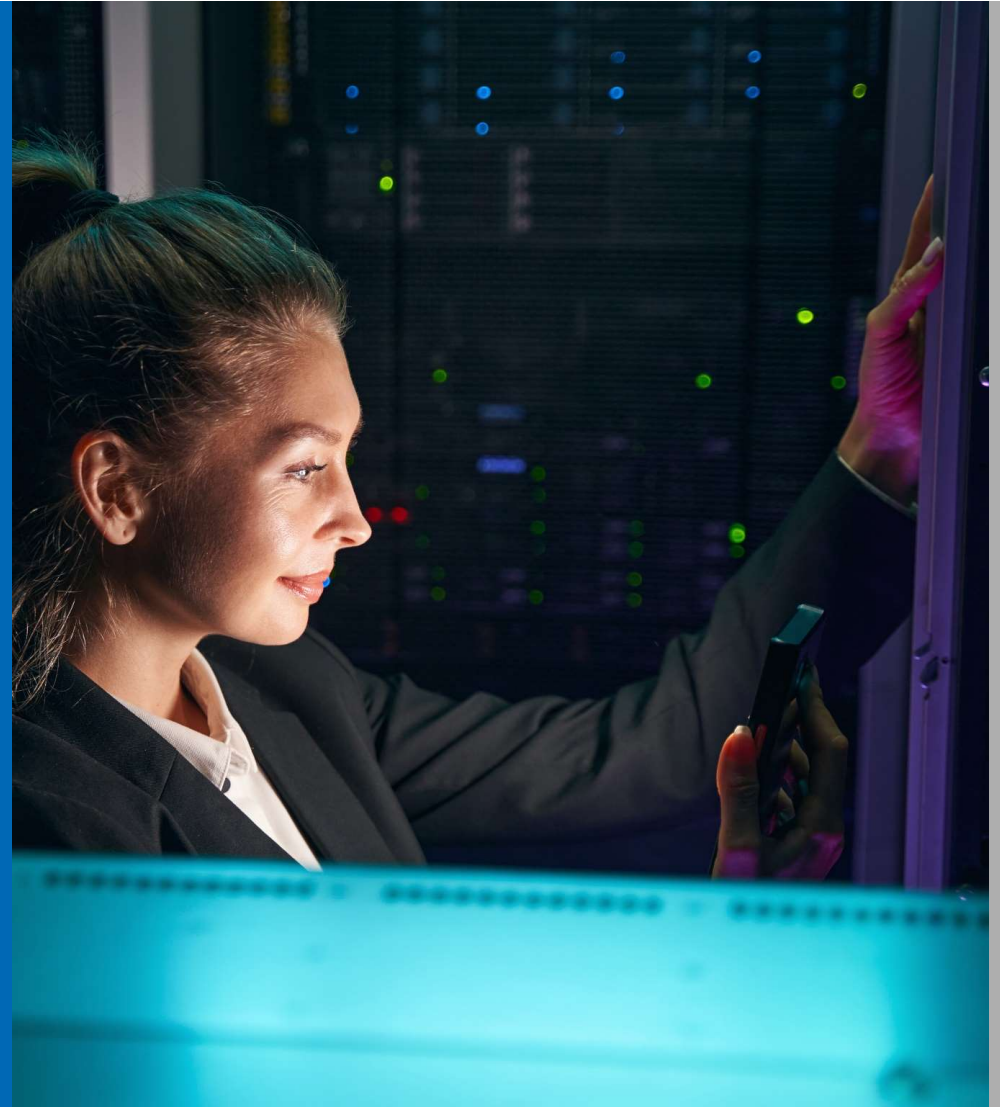
Red Hat

# Table of Contents

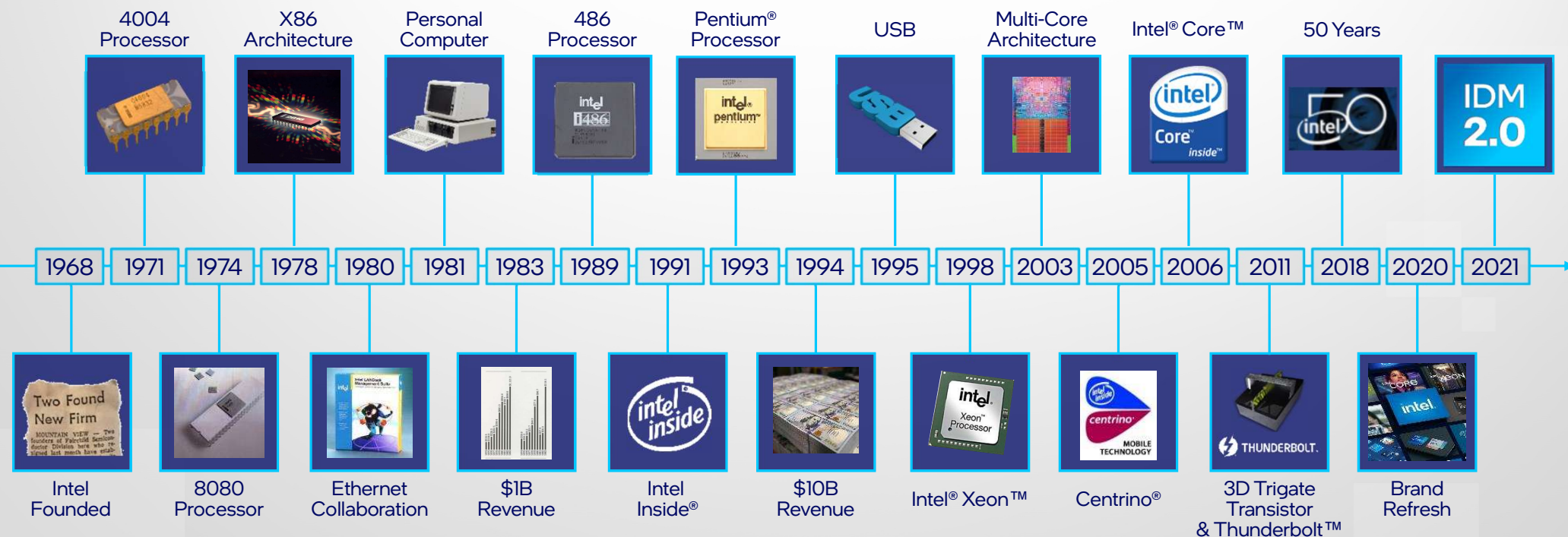
- 01** The Intel Story
- 02** Red Hat & Intel
- 03** Why Run on Intel and Red Hat
- 04** Summary

01

# The Intel Story



# Intel Journey





intel  
advantage

Software



Silicon  
& Platforms



Packaging  
& Process

At-Scale Manufacturing

**The leading provider** of silicon globally

# Intel End-to-End Product Portfolio and Solutions



## AUTONOMOUS DRIVING

**mobileye**  
An Intel Company

**moovit**



## 5G NETWORK



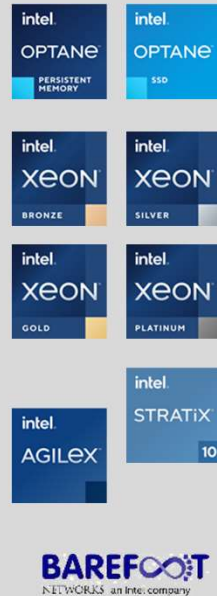
## CLIENT CONNECTIVITY



Intel® Wireless Bluetooth®  
Intel® Wi-Fi 6 solutions



## CLOUD COMPUTING



## IOT



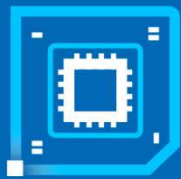
## EDGE COMPUTING



## AI AND ANALYTICS



# The Entire World is Becoming Digital



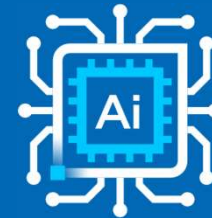
Ubiquitous  
Compute



Pervasive  
Connectivity



Cloud to  
Edge Infrastructure



Artificial  
Intelligence

Semiconductors are the underlying technology  
empowering developers and powering our customers' innovations

# How We Win

## Our Beliefs

- 1 We are in an era of sustained, long-term demand
- 2 The insatiable need for compute drives the value of Moore's Law
- 3 Open ecosystems unleash innovation and democratize compute
- 4 The world needs more balanced and resilient supply chains

## Our Strategy

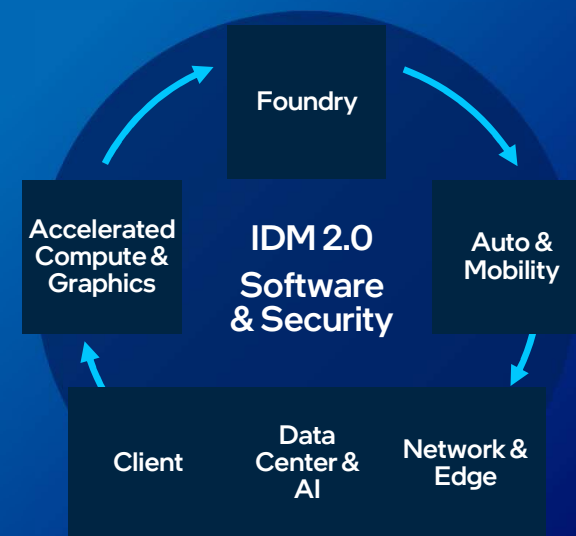
Deliver leadership products...

...Anchored on open and secure platforms

...Powered by sustainable manufacturing at scale

...Supercharged by our people and culture

## Our Execution



# Delivering Leadership Manufacturing: IDM 2.0

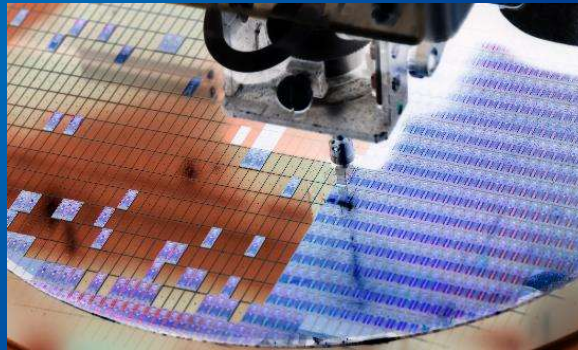
Product Leadership, Supply Resilience, Superior Cost

## Internal Factory Network



Intel's global, internal factory network for at-scale manufacturing

## External Foundries



Expanded use of third-party foundry capacity

## Intel Foundry



Building a world-class foundry business, Intel Foundry Services

Leveraging Intel's leading-edge packaging & process technology & world-class IP portfolio



**Intel  
Worldwide  
Headquarters**  
Santa Clara, California

## Geographically Diverse Manufacturing Capacity

■ Wafer Fabs ■ Assembly & Test ■ Future Site

HÄRVARA 2022-03-15 15:59

## Här är Intels massiva Europasatsning – lägger 800 miljarder på nya chippfabriker



**PRO** Processorjätten Intel ska satsa 800 miljarder kronor i Europa de kommande tio åren. Bland annat ska de bygga två nya fabriker i Tyskland. "Vi ska ta den mest avancerade tekniken till Europa och hjälpa EU att bygga nästa generations europeiska chipp-ekosystem", säger vd Pat Gelsinger.

## Intel set to build a new €17 billion chip manufacturing hub in Germany as it pours money into Europe



A rendering shows early plans for two new Intel processor factories in Magdeburg, Germany. Copyright Credit: Intel Corporation

## Building Manufacturing Capacity in Europe

# Open Platforms

Optimize more than  
**100**  
different operating  
systems

**#1**  
contributor  
to the Linux kernel

**Top-3**  
contributor to  
Chromium OS

**Top-10**  
contributor to  
OpenStack

Deliver open & secure software and hardware platforms  
with industry-defining standards



Floating Point  
Standard



DDR<sub>x</sub>

PCI  
EXPRESS



5G  
Standards

**RSS**  
Responsibility  
Sensitive  
Safety

CXL Compute  
Express  
Link

6G  
Network/Edge



## Our People



Customer First



Fearless  
Innovation



Results Driven



Integrity



Quality



One Intel



Inclusion

## Our Values

**121,000+** employees → **89%** technical

**20,000**  
Software Engineers

**~70,000**  
patent assets worldwide

"We push forward at a torrid pace with our purpose at the heart of everything we do — creating world-changing technology that improves the life of every person on the planet."

Pat Gelsinger  
Intel CEO



# Tech as a Force for Good

## Responsible

Revolutionize how technology will improve health and safety

## Inclusive

Make technology fully inclusive and expand digital readiness

## Sustainable

Achieve carbon-neutral computing to address climate change

## Enabling

Accelerate the ways we enable progress through our technology and the expertise and passions of our employees

## Leading in the Future

Means Living Up to Our Purpose

**Net-Zero Greenhouse Gas Emissions by 2040**

03

# Why Run on Red Hat & Intel



# The Demand for More

Faster digital transformation is placing extraordinary demands on an organization's infrastructure

## More Applications

Applications will

**double**  
over next  
**4 years<sup>1</sup>**



## More Data

Data will proliferate at

**4 to 5x**  
over  
**4 years<sup>1</sup>**



## More Clouds

*"Cloud in all its permutations will play ever greater, and even dominant roles across the IT industry..." (IDC<sup>2</sup>)*

More 5G Edge Platforms  
Gartner estimates that by 2025,

**80%**

of enterprises will have shut down their traditional data center versus

**10%** in 2020<sup>3</sup>



## More Security Demands

Devices are doubling every

**5 years<sup>4</sup>**

and connecting to infrastructures, increasing security risks



The demand for more is creating an urgency to get an infrastructure ready for digital everything

<sup>1</sup> [Today's Trends in Cloud and the Future of Enterprise](#), December 14, 2020, Matt Eastwood

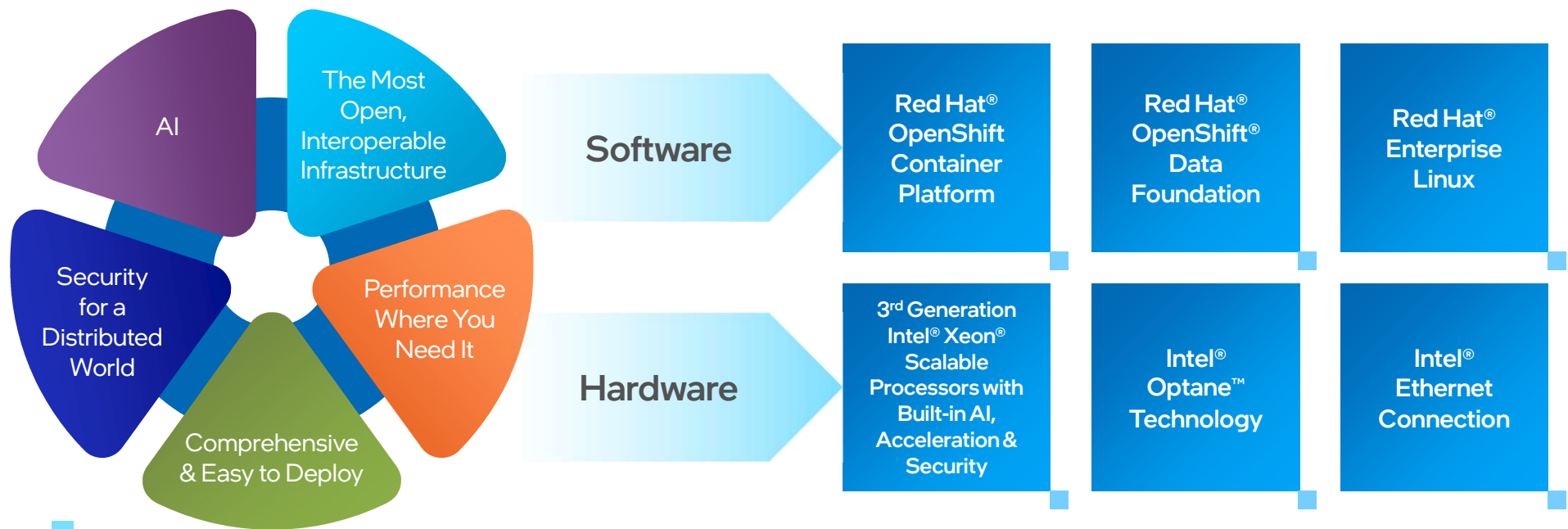
<sup>2</sup> IDC: [Cloud Adoption and Opportunities Will Continue to Expand Leading to a \\$1 Trillion Market in 2024, According to IDC](#)

<sup>3</sup> Gartner, [2021 Planning Guide for Cloud and Edge Computing](#), Oct. 9, 2020

<sup>4</sup> Gartner: [Predicts 2021: Cloud and Infrastructure](#), December 2020, John McArthur, Arun Chandrasekaran, Thomas Blittman, Tim Zimmerman

# A New Digital Infrastructure Tailored for You

The Intel® solution for Red Hat OpenShift Container Platform scales for today & tomorrow



Red Hat & Intel combine best-in-class technologies for a new era of digital everything

# An Open Foundation

Modernize and migrate mission-critical workloads on a common platform that keeps pace with business shifts

## Hybrid cloud portability on your terms:

- Combination of Red Hat OpenShift Container Platform and 3rd Gen Intel® Xeon® Scalable processors provide container-based apps on a consistent foundation to easily move across different cloud environments

## Address workload diversity & complexity:

- Red Hat is the leader in enterprise Kubernetes to build and migrate business-critical applications with ease
- The latest Intel Xeon processors are built on open standards and APIs



# Performance Made Flexible

## Drive business results with performance across the platform

### Increase business continuity

- 62% more performance on network and 5G workloads<sup>1</sup> with 3rd Gen Intel® Xeon® Scalable processors
- Achieve 50% more performance<sup>2</sup>, on average gen over gen, for workload efficiencies

### Achieve a faster return on your data

Process data from cloud to edge with built-in acceleration technologies in 3rd Gen Intel Xeon Scalable processors.

### Innovate with ease and speed

OpenShift Data Foundation delivers critical data services using Intel® Optane™ SSDs with the world's fastest performance<sup>3</sup> and reliability for your demanding AI, analytics and database workloads.

### A more flexible path to 5G services

Accelerate cloud-native networks with agility. Red Hat OpenShift is combined with Intel Xeon Scalable processors, Intel Ethernet Network Adapters, and software toolkits to realize a 5G infrastructure with flexible deployment models from hybrid to edge.



1. See [91] at [www.intel.com/3gen-xeon-config](http://www.intel.com/3gen-xeon-config) for details. Results may vary; 2. See [98,97,81] at [www.intel.com/3gen-xeon-config](http://www.intel.com/3gen-xeon-config) for details. Results may vary; 3. See claim [14] at <https://edc.intel.com/content/www/us/en/products/performance/benchmarks/intel-optane-ssd-p5800x-series/>

# Realizing the Power of AI

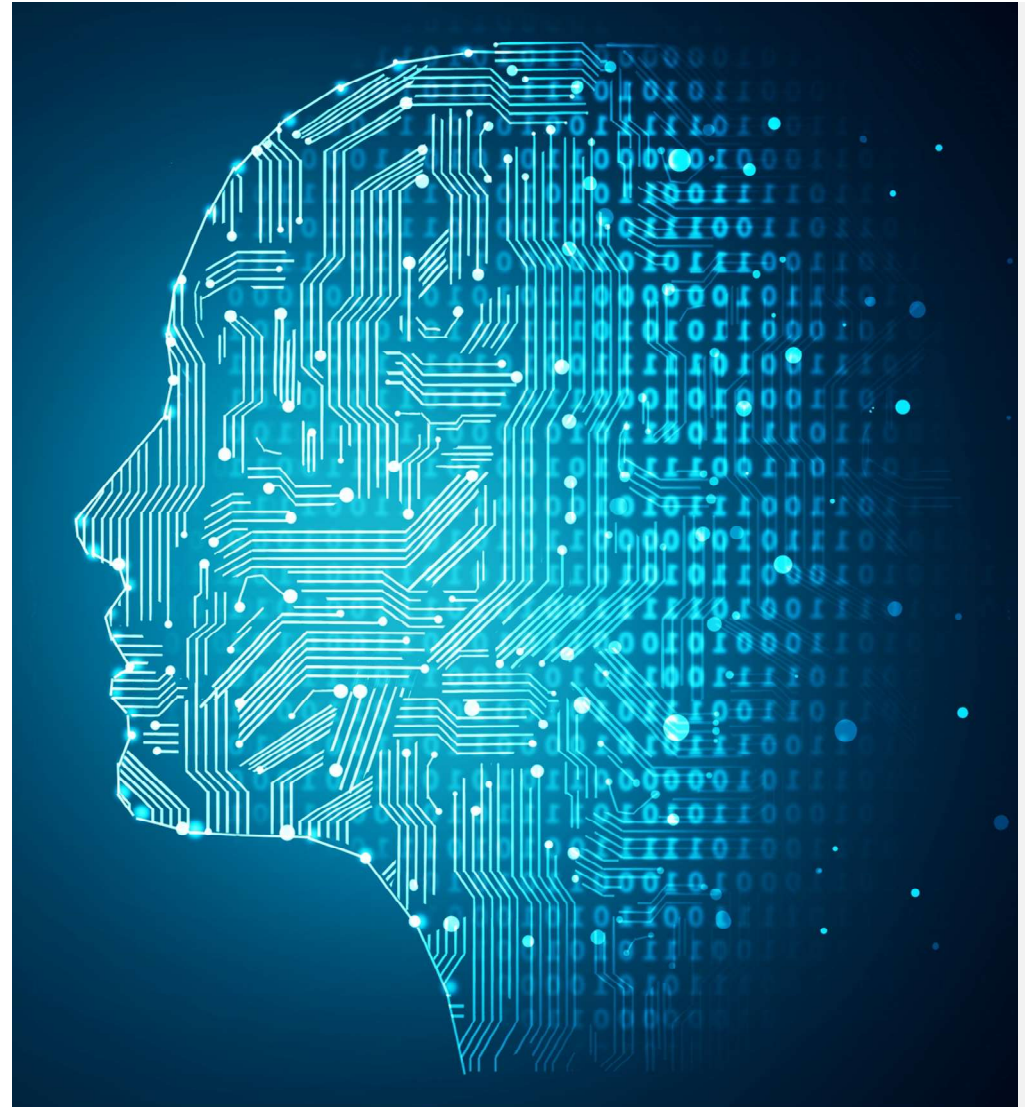
## A new way to extract the value of AI

### Drive cost savings

Only x86 datacenter CPU with built-in AI; the integration can save customers space, cost and energy.

### Making AI more accessible

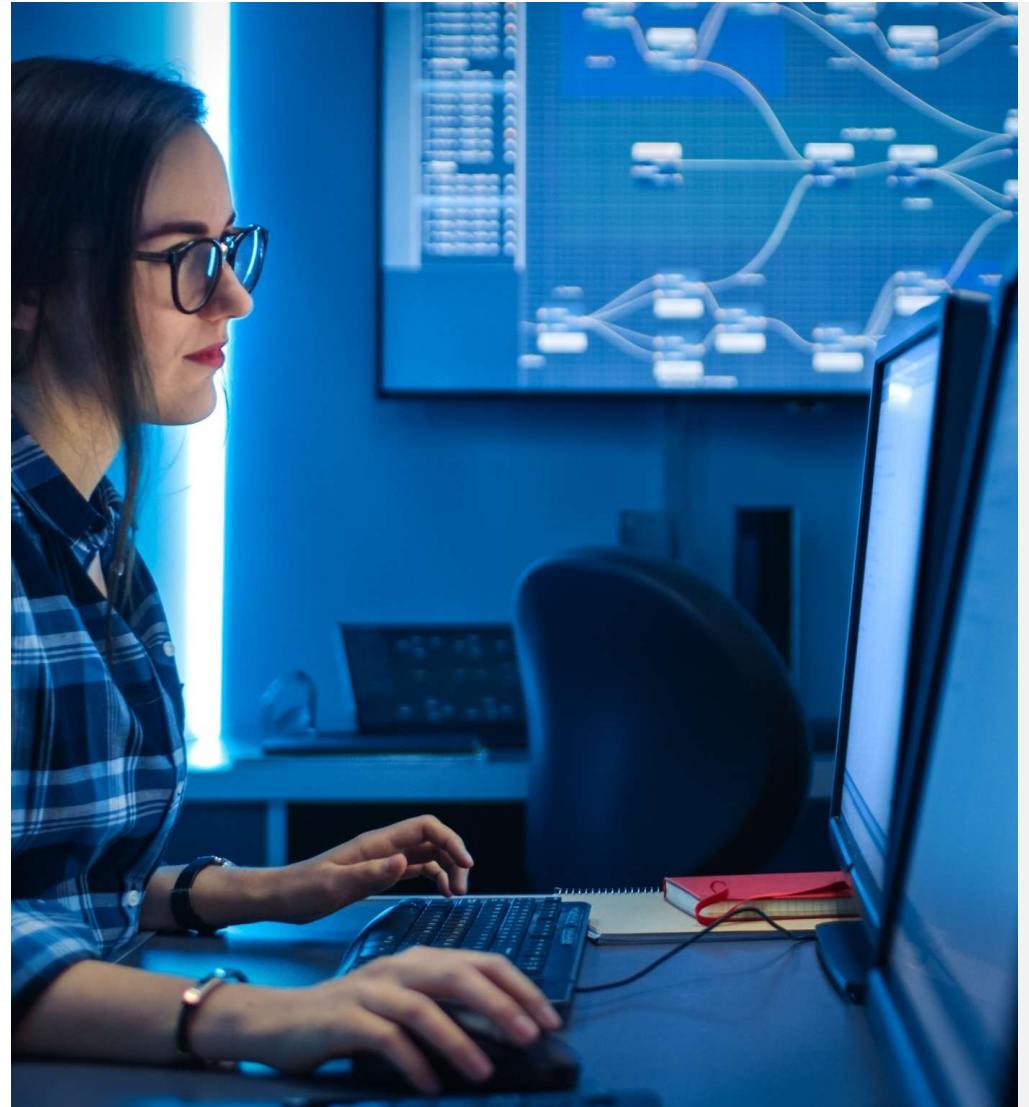
Data usability increases with Red Hat OpenShift Data Science that takes advantage of Intel's built-in AI capabilities in 3rd Gen Intel Xeon processors; automates data pipeline process for smarter ingesting, modeling and time to insight.



# Turnkey

Optimizes existing investments;  
simple to deploy

- Deploy solution in **60 minutes** or less
- Fully integrated, tested and verified
- Works with existing IT environment\*
- Build applications once, run them anywhere
- Automated, easy to maintain



\*For OpenShift Container Platform version 4.x and beyond

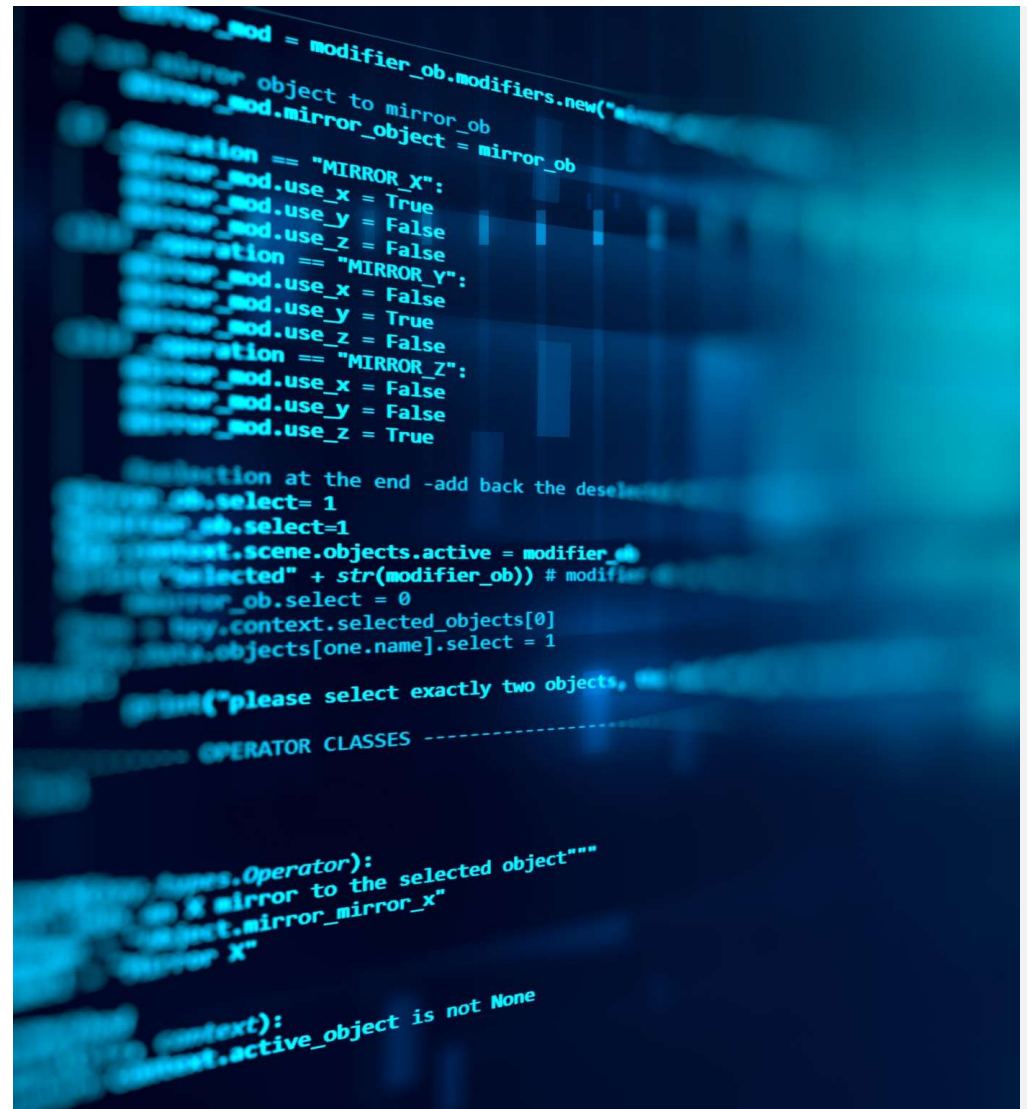
# Built-in Security

Encrypt and protect your most critical business assets while reducing costs

## Advanced enterprise-class security

Red Hat OpenShift lights up Intel's crypto technology

- Intel® Crypto Acceleration increases the performance of encryption-intensive workloads including SSL web serving, 5G infrastructure, and VPN/firewalls and reduces the performance impact of pervasive encryption.














02

# Red Hat & Intel



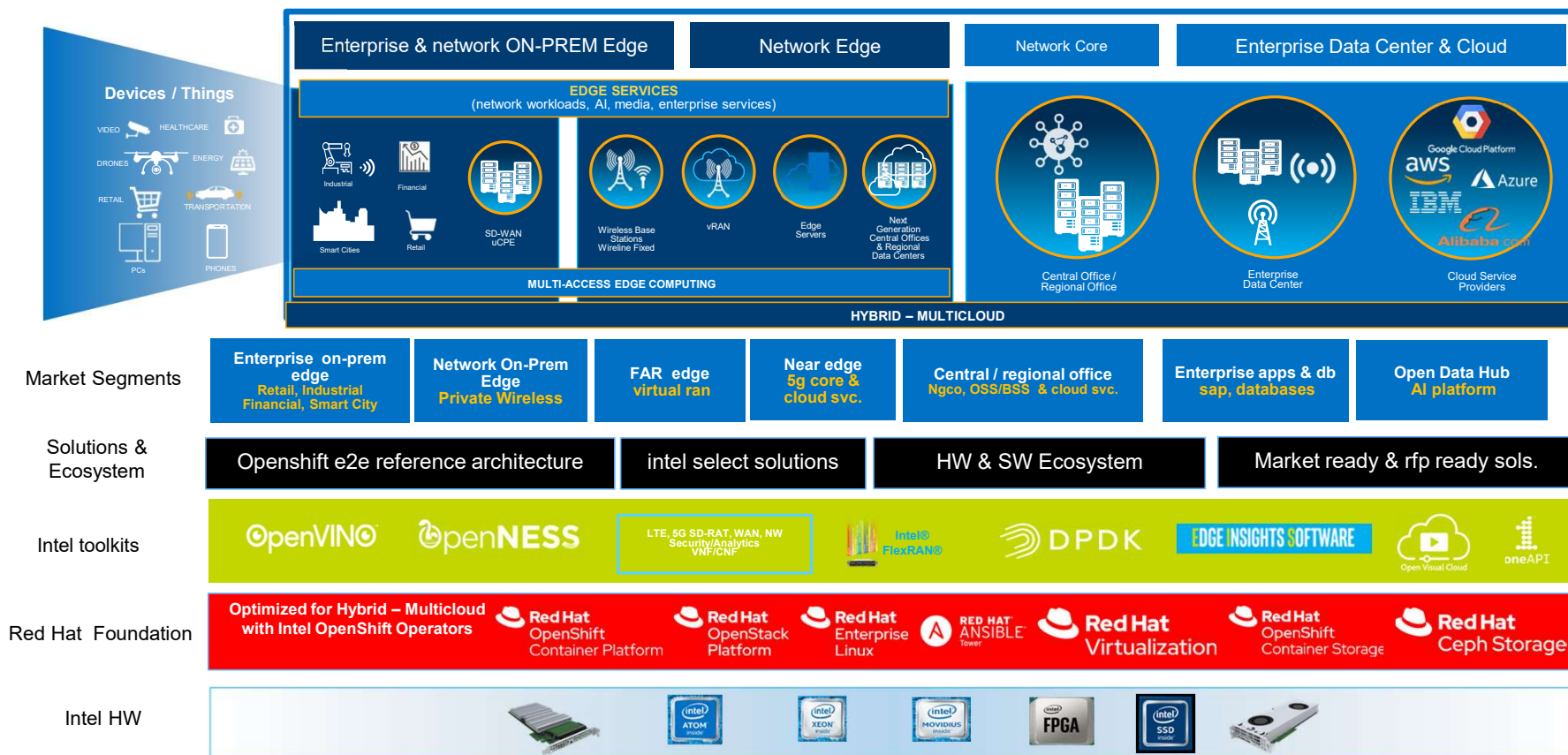
# The Intel + Red Hat Partner Ecosystem

 <p>Red Hat software</p>	<p>the default platform for digital transformation</p> <ul style="list-style-type: none"> <li>25+ years of working together</li> <li>Share a vision for the future</li> <li>Help organizations navigate digital transformation</li> </ul>
<p>Better Together</p>	<div>      </div>
 <p>Intel silicon</p>	<ul style="list-style-type: none"> <li>Joint engineering collaboration in Kubernetes and Cloud-Native container development community</li> <li>Best on Intel: Automation Manageability, Security, Reliability &amp; performance</li> </ul>
<p>Majority of Fortune 500 companies use Red Hat Enterprise Linux<sup>1</sup></p>	<div> <div>  <p>100%</p> <p>of airlines in the Fortune Global 500 rely on Red Hat.</p> </div> <div>  <p>100%</p> <p>of communication service providers in the Fortune Global 500 rely on Red Hat.</p> </div> <div>  <p>100%</p> <p>of commercial banks in the Fortune Global 500 rely on Red Hat.</p> </div> <div>  <p>100%</p> <p>of healthcare companies in the Fortune Global 500 rely on Red Hat.</p> </div> </div>

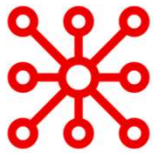


Source: Red Hat client data and Fortune 500 list, 2020. <https://www.redhat.com/en/about/company>.

# Intel + Red Hat Solutions



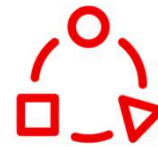
# What's in a modern application platform?



Unified platform for  
Dev, Sec and Ops



Transparent to developers



Extensible - works with  
what you have



Observability,  
management and  
monitoring



Runs on any  
infrastructure or cloud



Security configuration  
management and  
enforcement

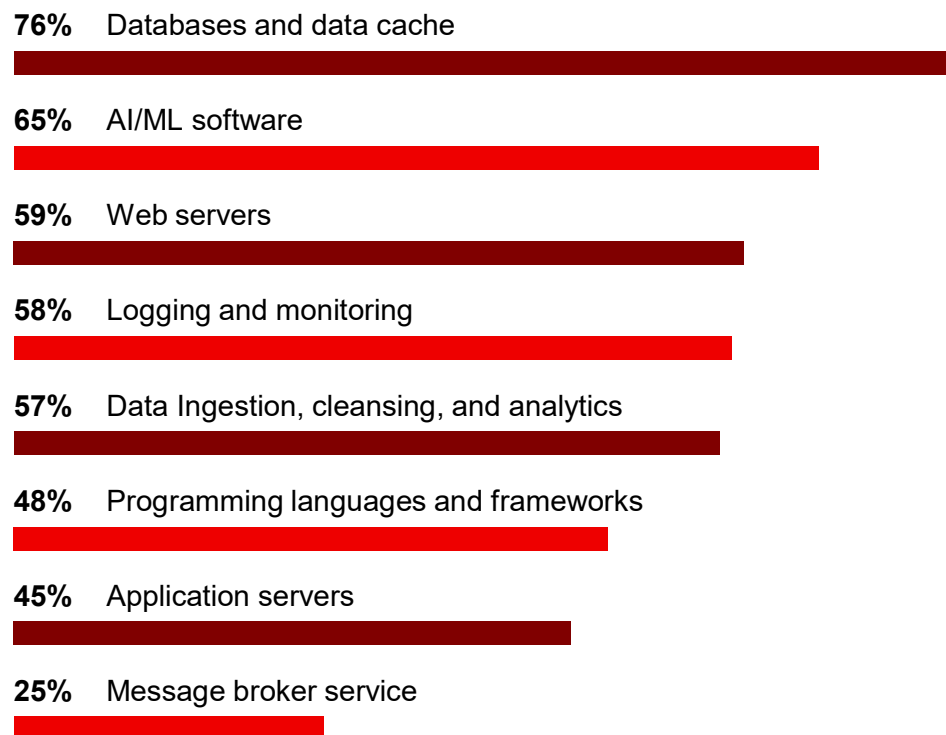


Consistent data  
management



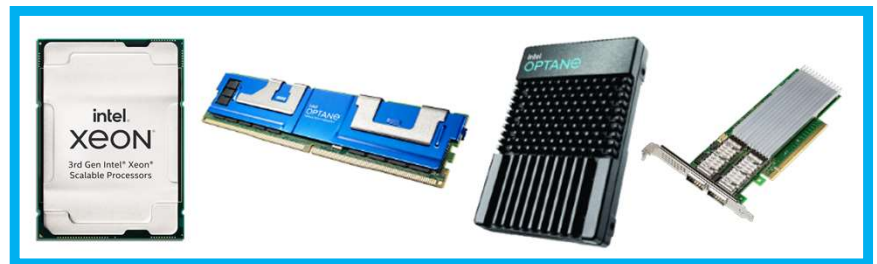
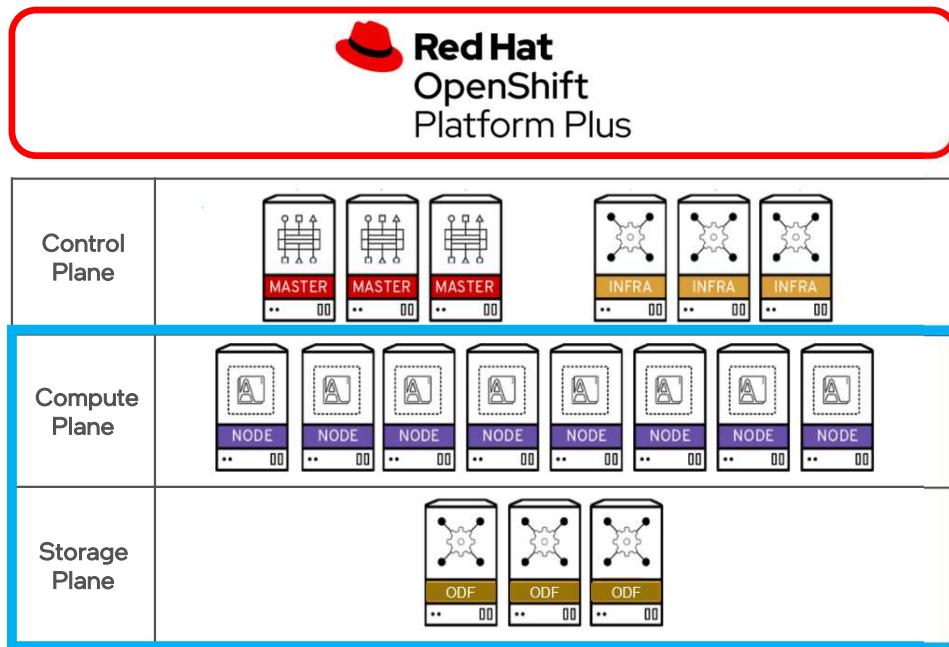
Vulnerability scanning  
and secure image  
management

# Broad spectrum of workloads are being deployed in containers and Kubernetes<sup>1</sup>



<sup>1</sup> Pulse, sponsored by Red Hat. "State of workloads adoption on containers and Kubernetes," November 2021.

# Red Hat OpenShift Platform Plus with Intel® Xeon® Scalable Processors & Intel® Optane™ Technology

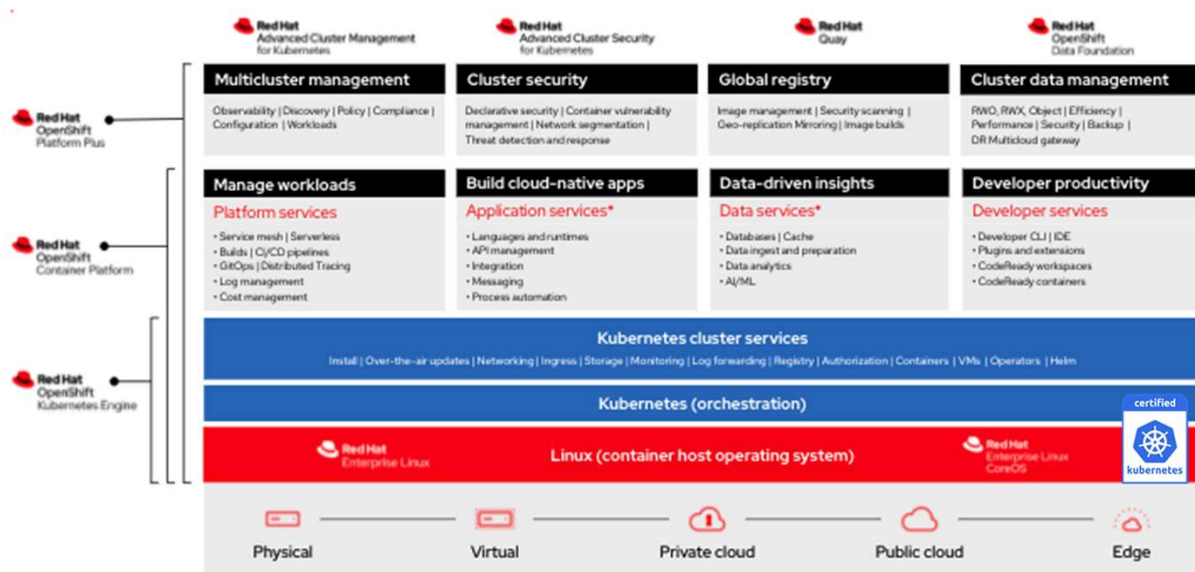


- Dell PowerEdge R750
- Intel® Xeon® Scalable processor 8358
- Intel® Optane™ persistent memory 200 series
- Intel® Optane™ SSD P5800X
- 2x Intel® Ethernet Adapter E810-CQDA2 (100 GbE)

**Red Hat OpenShift Container Platform Clusters**  
Compute (OCP) and Storage (ODF) nodes are combined  
in the Dell PowerEdge R750 server (**Converged**)

# Red Hat OpenShift Platform Plus

Complete hybrid cloud foundation to deploy and manage cloud-native applications



- Consistent user experience, management and security across hybrid infrastructure
- Comprehensive tools for cloud-native application development
- Built-in security across the entire application lifecycle with a global container registry
- Kubernetes-native multicluster security with active threat detection and remediation
- End-to-end management and observability

# Easily Scale Your Apps and Data Services

Intel and Red Hat have co-developed workload-optimized data node configurations for Red Hat® OpenShift® Data Foundation, based on Intel® Xeon® Scalable processors and Intel® Optane™ technology

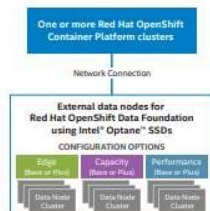


Figure 1. Predefined hardware-plus-software data node configurations eliminate guesswork and let you focus on scaling your apps and data services rather than infrastructure details.

In this era of digital transformation, data volumes are exploding while performance requirements escalate. Data pipelines and data access are increasingly complex. To keep up, your containerized apps must serve up data more quickly. But you don't have time to evaluate and test various combinations of hardware and software to determine if they meet your data services' needs. You just need your data services to work—on premises, in the cloud, or across multiple clouds.

## Deliver Data Services with Ease

Red Hat delivers an automated, complete cloud-native development and deployment platform with integrated data services through its Red Hat OpenShift and Red Hat OpenShift Data Foundation products. OpenShift Data Foundation delivers persistent storage through a data service and orchestration layer that's fully integrated with and built for Red Hat OpenShift. It natively includes all common storage services, including file, block, and object and also provides deterministic performance at scale to deliver a consistent user experience across any platform where Red Hat OpenShift is deployed. Red Hat and Intel combine cutting-edge software and hardware technologies to deliver a workload-optimized data services solution that uses an external data node featuring Intel® Xeon® Scalable processors and Intel® Optane™ SSDs.

Intel Optane SSDs serve as a cache tier in front of the capacity tier, speeding access to hot data and taking the write pressure off the capacity drives to create a solution that is optimized for both performance and cost. Intel Optane SSDs are fundamentally different from other types of SSDs because they feature a memory-like capability inside an SSD form factor. This provides lower latency, higher IOPS, and greater endurance. Data-centric workloads are I/O-intensive and benefit from Intel Optane SSDs' ability to support up to 100 drive writes per day (DWPD).<sup>2</sup> Intel Optane SSDs provide the performance, endurance, and reliability necessary to accelerate today's most demanding workloads, such as latency-sensitive big data analytics, machine learning/deep learning, and databases.

OpenShift Data Foundation data nodes are easy to deploy and configure, and are portable across clouds. They offer simplicity and flexibility, and streamline the process of going cloud-native using containers.

Appendix A:  
Installation Steps and Scripts ..... 9  
Appendix B:  
Salt-identification Experiment  
Reproduction Instructions ..... 16

3rd Gen Intel® Xeon® Scalable processors  
Intel® Optane™ and Intel® NAND-based SSDs  
Intel® Ethernet Network Adapters



Brief



## Enterprise Platform 4.6 loads

Enterprise platform for enterprise  
for Red Hat OpenShift  
ble processors is the answer

Enterprise data center infrastructure is  
ing, telecommunications, and other  
ions are distributed across private  
nety-two percent of enterprises have a

n, and cloud-native containers are  
ation. The portability and repeatability of  
sources, as well as enable faster time to  
have little overhead, which helps to lower  
sts. They can be implemented quickly and  
containers.

Performance reference architecture  
form 4.6 and 3rd Generation Intel® Xeon®  
enables the deployment of performant and  
onto different footprints, such as bare  
, or a combination of these, in either a

## Workload Solution



Analytics and database workloads

Enterprise digital business practices  
transformation as one of  
can also benefit from modernizing  
databases to SAP  
his migration presents an  
IT digital transformation

Enterprise and modernization

## Red Hat and Intel

Other and SAP, Red Hat  
your SAP landscape.  
itecture throughout your  
nine open source platform,  
ssors, storage, and netwo  
rks. All components  
manageability.

It, agile development with  
rations by connecting  
ilities. Support unique and  
third-party products.

r data. Achieve greater  
ed and optimized together.  
tassets quickly with persis-

Performance results across a

Environment is fortified with integrated tooling  
open-source data science projects and  
proprietary software. Red Hat OpenShift Data Science delivers a more secure, well-  
visioned environment in which to accelerate the development and training of  
/ML models. The ML models built within the environment are highly portable for  
roduction to a diverse range of platforms, ready for container-based deployment  
the hybrid cloud.

For workloads and configurations visit [www.intel.com/PerformanceIndex](http://www.intel.com/PerformanceIndex). Results may vary.



## flows with VINO™ Toolkits

data scientists to develop  
Shift for Data Science,  
ts that amplify capabilities.

## Enhanced with Intel

range of operations—spanning data  
continuous integration and development/  
nology has matured, data scientists  
aging AI solutions using containers and  
nd scalability, and manage operations and  
ud, and multicloud networks. This can  
ity for data science development teams.

OpenShift Data Science delivers managed  
ommon set of features across multiple  
ata scientists do not have to contend  
ermetes infrastructures and can focus on  
viroment with the latest open-source  
ment.

Data scientists access to common AI toolkits  
I sandbox for the development of data  
lets. Updates and support for core open-  
rb, TensorFlow, PyTorch, and more. The  
is the Red Hat OpenShift cloud service is  
t Data Science provides a core platform  
ing data acquisition and preparation,  
g of ML models, and other tasks.

Environment is offered as an add-on  
d and Red Hat Service on AWS. Within this  
ne-learning engineers can take advantage  
hat are made available from independent  
I. In collaboration with Red Hat, Intel  
and toolkits, tuned to Intel® architecture-  
AI Analytics Toolkit (AI Kit) and OpenVINO™  
its with the latest tools and technologies.



## vides ility

## Private 5G network on Intel® Xeon®

prises understand better how  
ses, as spectrum becomes  
comes more affordable and

hput, connectivity, and low  
es to create separate networks  
a private 5G network can  
well as internet of things (IoT)  
ers of low bandwidth sensors.

gating factor for private 5G, but  
erators (MNOs) increasingly  
as more unlicensed spectrum  
perate their own networks. New  
(CBRS - 3550 MHz to 3700  
frequency C-band (4 to 8 GHz) in  
ross Europe are providing the  
to make private 5G networks

ing with the emergence of edge  
the customer premises to offer  
d data center with much less  
decisions need to be made or  
combination of private 5G and

of cellular technology skill  
lar networks has always been  
technology (IT). In addition,  
eant limited availability of  
llular system. This technology  
is that utilize IP data packets,  
running on Intel® architecture  
networking projects better  
cosystem of vendors to choose  
rices.

ome a cost-effective solution  
it can leverage this technology.



## Edge ents

Connecting branch offices across  
ds solution built around

ing enterprise computing workloads—  
communications technology (CT), and  
er gone a steady evolution in recent years.  
interactions in an environment that stretches  
les hybrid and multicloud services require  
e, and networking resources fluidly to  
vents. Fifty percent of enterprise data is  
at the edge by 2022, and that is expected  
5.<sup>2</sup> This growth in data processing at the  
stive edge computing and distributed

s) are under pressure to monetize 5G  
various opportunities for CSPs to fulfill  
5G capabilities like ultra-reliable  
revenue and customer experience.  
management of these models represents a  
w Enterprise Edge use cases.<sup>3</sup>

ged as an effective means for meeting  
ations are exploring the use of a converged,  
on container technology and microservices  
d establish low-latency, high-bandwidth  
edge.

used virtualized network hardware  
ns (VNFs) to cut expenses and develop  
g heavily on virtual machines to balance  
is achieved some success across the  
puting demands on the network running  
model also deployed on universal customer  
ntage of container technology and open  
ssilient, more manageable solution.

provisioning  
enterprise  
hybrid clouds.  
ture—  
loss an  
ommunication

is ther  
cluster with a  
w-latency or  
cloud-based  
system for  
latest Linux

underlie  
nual  
carry out the  
on in short  
ake mistakes.  
errors

s gain  
provisioning

SMS

viding  
olidation,  
network from  
stallation and



# Red Hat & Intel Resources

- Red Hat & Intel Solution Spotlight
- Red Hat & Intel Reference Architecture
- Visit: [www.Intel.com/Red Hat](http://www.Intel.com/Red Hat)
- Visit: [www.redhat.com/Intel](http://www.redhat.com/Intel)



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Performance varies by use, configuration and other factors. Learn more at [www.Intel.com/PerformanceIndex](http://www.Intel.com/PerformanceIndex).

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

Intel contributes to the development of benchmarks by participating in, sponsoring, and/or contributing technical support to various benchmarking groups, including the BenchmarkXPRT Development Community administered by Principled Technologies.

Your costs and results may vary.

Intel technologies may require enabled hardware, software or service activation.

Some results may have been estimated or simulated.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

All product plans and roadmaps are subject to change without notice.

Statements in this document that refer to future plans or expectations are forward-looking statements. These statements are based on current expectations and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in such statements. For more information on the factors that could cause actual results to differ materially, see our most recent earnings release and SEC filings at [www.intc.com](http://www.intc.com).

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