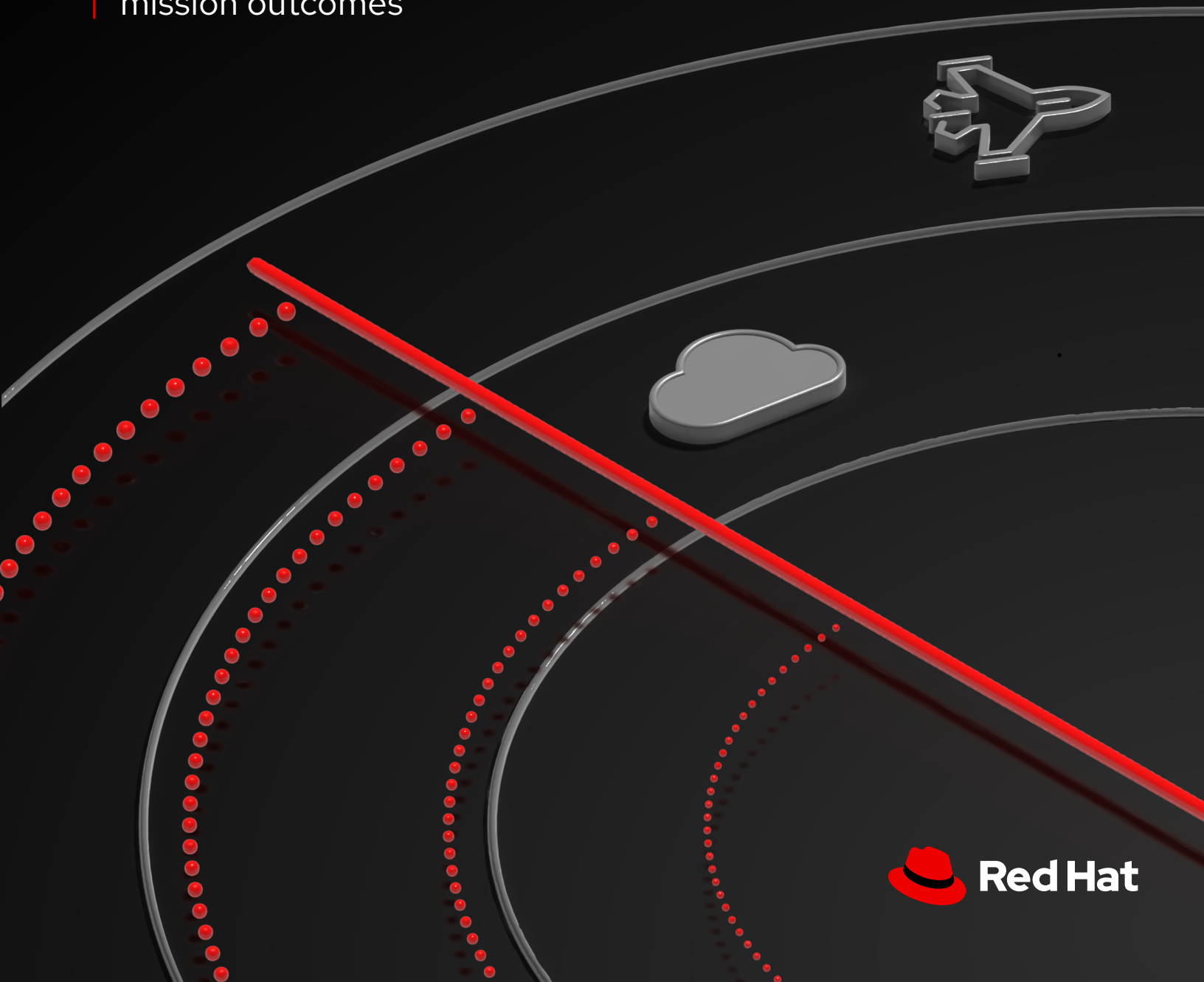
Mission edge

How Red Hat can help the DoD accelerate mission outcomes



Red Hat

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Introduction

A fundamental shift in IT approach

Across the United States Department of Defense (DoD), branches and agencies are using operational and user-generated data to make critical decisions, solve challenges, and maintain dominance in the battlefield. But the way data is collected, shared, and used is changing for the modern warfighter.

To integrate and coordinate command and control simultaneously across land, air, maritime, space, and cyber, digital capabilities need to extend beyond the traditional datacenter or cloud environments to the people, machinery, and technology that need them–at the edge of the network.

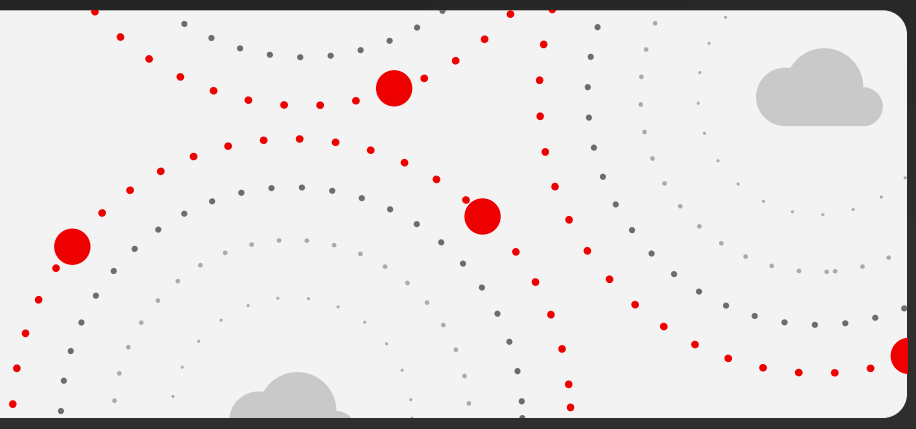
Each of these domains have physical and logistical limitations, and each branch of the DoD must bring its expertise and technology to owning that domain during battle. To overcome these limitations and meet the technology capabilities of near-peer adversaries, defense leaders need solutions that help them:

Innovate with agility.

Standardize interoperability across all branches and agencies.

Maintain a high security posture.

The ultimate goal is to move faster with less risk. Mission edge is an approach that can help achieve this goal to advance mission objectives across the DoD. Mission edge can be defined as a dynamic, decentralized computing architecture consisting of heterogeneous hardware and workloads that connects data producers and data consumers.



A new IT approach for the modern battlefield

The traditional systems used to plan for battle have produced unique monolithic warfighting systems with a history of dominance on the battlefield. However, as technology continues to progress, so have the capabilities and sophistication of the United States' near-peer adversaries. The new challenge is finding ways to achieve the complex integration of the systems needed to coordinate, maintain, and increase operations security across all domains and more specifically, at the edge.

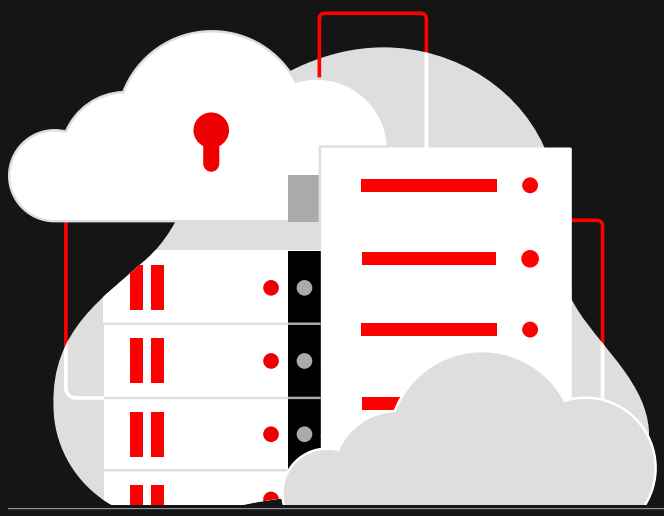
Research from Forrester's workload affinity concept identifies 4 edge computing environments, which include:[1]

Enterprise edge. Any enterprise capabilities delivered to the consumer via modernized networking and application environments that's standardized and secured. For example, cloud-hosted email accessed from a mobile device.

Operations edge. Local networks of smart devices that interact with one another providing key capabilities such as monitoring and control of processes, predictive analytics, and supply chain optimization.

Provider edge. Bringing compute processing closer to the consumer so that extensive back and forth to datacenters is limited or eliminated.

Engagement edge. Globally distributed compute systems that allow consumers to engage with applications. For example, connected vehicles, consumer virtual reality, and gaming.



In the context of the warfighter, these definitions can help identify the edge requirements necessary for achieving mission objectives across the DoD.

Using a hybrid cloud approach and comprehensive solutions, Red Hat can not only jumpstart Day 1 modernization efforts, but also remain a partner with the DoD throughout the entire process to achieve mission capabilities. More specifically, Red Hat provides expertise and technology solutions to modernize decentralized decision making (DDM), increase operations resilience, extend interconnectedness, and improve data sharing.

1 Forrester. "The Future of Edge Computing," May 11, 2022.

Chapter 1

Decision dominance is the new weapon dominance

Mission success relies on decision-quality data to support the warfighter with trusted access to reliable and timely information. And, while data has been much of the focus across the defense landscape more recently, data is only part of the equation. Accelerating the transformation of data into actionable intelligence is a vital component to compete and win against near-peer adversaries. Decision dominance is supported by 3 foundational capabilities: data availability, distributed decision making, and interconnectedness.

As connected devices become more capable and reliance on them grows, adding complexity to the connected networks, decentralized decision making is the throughline to increase operations resilience, extend interconnectedness, and improve data sharing. But DDM is not without its challenges.

Key challenges of DDM include:

Edge systems are often difficult to access and have limited bandwidth.

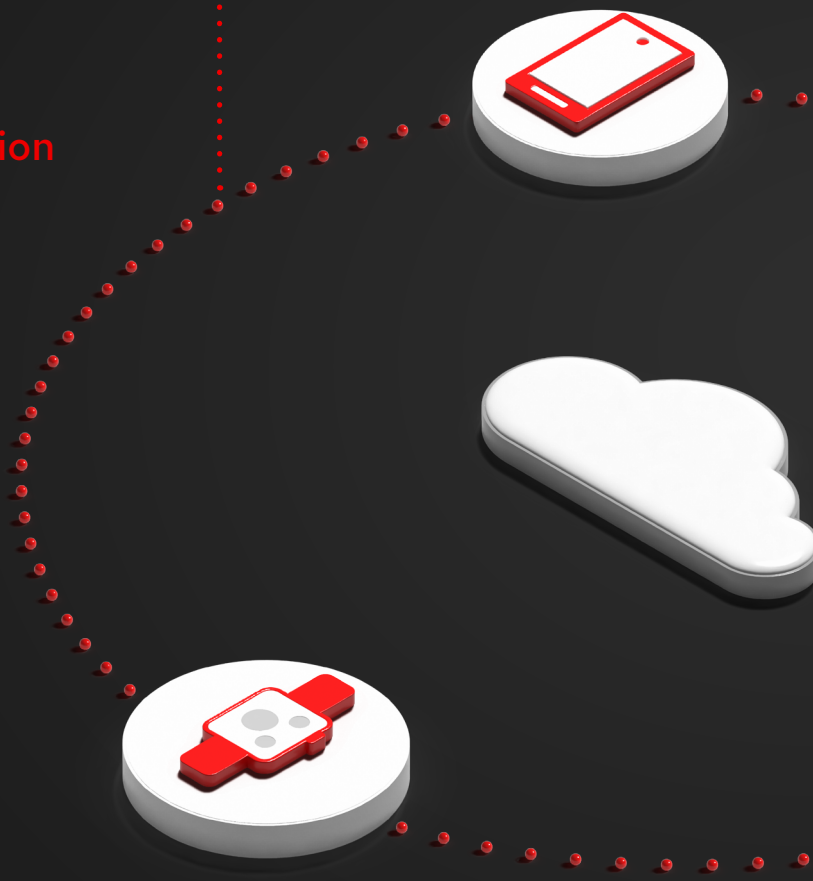
Shifting long-held perspectives toward adopting a software-first approach is not simple.

Adhering to zero-trust requirements because isolation is no longer a suitable security measure for protecting against outside and inside threats.

Improve data availability and integration

Multidomain operations (MDO) and technology initiatives such as Joint All-Domain Command and Control (JADC2) are methods already in use by the DoD to improve data availability and integration among and within service branch and coalition partner systems.

Building MDO capabilities on the foundation of an edge and hybrid cloud architecture offers the ability to effectively distribute and manage the high data volume workloads of a convergence event quickly, resiliently, and dynamically. An edge and hybrid cloud system infrastructure will be necessary to provide the elasticity and resilience needed to support the volume and velocity of data during a convergence event.



Key aspects to edge and hybrid cloud architecture include:

Open standards.
Using open source standards ensures extensibility and interoperability between solutions and pushes collaboration and innovation.

Tactical networks.
MDO convergence opportunities rely on tactical networks such as sensors, the Internet of Things (IoT), and 5G networks to facilitate the thousands of devices pushing and pulling data across the battlefield.

Automation.
Add and remove assets using automation to gain consistent repeatability to replicate adding and removing capacity and features to an area of service on demand and in a rapid fashion.

Agile integration.
With the variety of data produced and consumed by MDO assets, agile integration allows data veracity and value to be brought to bear as intelligence through event-driven, micro service architectures to feed human and artificial intelligence decision making.

Data management.
Intelligence and insight relies on analysis and inference of data. The assets fielded and available vary from encounter to encounter, so the ability to manage and integrate systems must be flexible enough to adjust to the dynamic nature of available assets from one battle to the next.

For Joint Force C2 functions to achieve decision dominance in all-domain operations, implementation requires planning guidance, industry advancements, and modernized technologies that use and combine existing data and new data while adapting commercial solutions to military-specific requirements.

Chapter 2

A path to resilient operations

Multidomain operations aim to bring together various assets across land, air, maritime, space and cyber domains simultaneously in a window of peak capability known as convergence in order to overwhelm an adversary's ability to respond. The characteristics of these heightened demand for data and workloads across multiple devices and assets can be described using the 5 Vs.

Volume

As more assets enter the battlefield, data volume increases as more producers and consumers of data are introduced.

Variety

These assets belong to the various domains and focus on different information from asset to asset, increasing the variety of data produced and consumed.

Velocity

As convergence is reached, the number of producers and consumers of data will peak, and the amount of data each asset will produce or consume will increase, increasing the velocity of the data flow.

Veracity

The veracity of the data will become more critical as convergence progresses. Data veracity is not just concerned with if the data is authentic, but also if it is timely and actionable.

Value

The value of data is impacted by the veracity, volume, and velocity of the data at the point of decision making.

The MDO battlefield is dynamic. No 2 engagements are the same with different assets being fielded from encounter to encounter. This means that the ability to manage and integrate systems must be flexible enough to adjust to the dynamic nature of available assets from one battle to the next.

A convergence event might see thousands of assets producing and consuming data from in-vehicle sensor systems to satellite systems to offensive and defensive cyber operations. This rich sensor data can be a vital asset but traditional field communication systems are ill equipped to support the volume of data being transmitted in such a scenario.

MDO convergence opportunities will likely need to rely on fielding connected 5G spectrum communications to facilitate the thousands of devices pushing and pulling data across the battlefield.

A comparison can be drawn to major sporting events such as the Superbowl or World Cup that host tens of thousands of fans. Telecommunications companies prepare for these events ahead of time by bringing additional assets to manage increased traffic volume. They are able to scale on demand because they built an infrastructure on an extensible edge and hybrid cloud architecture. However this architecture is only one part of the equation. The ability to quickly and dynamically scale at the edge requires automation.

Automating at the mission edge

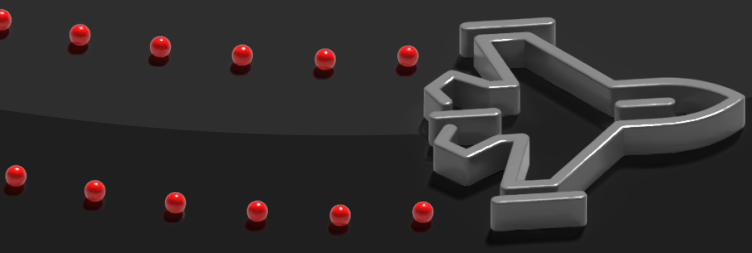
By building automation capabilities to add and remove assets, telecommunications companies in the example above gain consistent repeatability to replicate adding and removing capacity and features on demand and in a rapid fashion. If manual intervention was needed for each of these instances, the capability could not scale fast enough, and the implementation of each intervention would not be uniform.

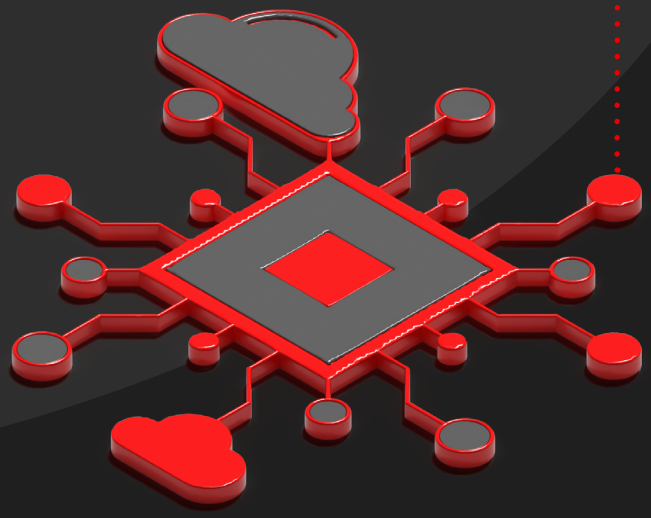
By building MDO capabilities on an edge and hybrid cloud architecture, the DoD can gain the ability to distribute and manage the high data volume workloads of a convergence event quickly, resiliently and dynamically.

Chapter 3

Interconnectedness is mission critical

The edge is not a singular place. It's a dynamic mesh of interconnected systems, data, and devices that produce and consume data—and the flow of that data is crucial for mission success. The communication of this data must travel with the warfighter in real time, adapting to the demands and location of where it's needed. For example, for a naval carrier group, the edge might be a landing craft carrying Marine Corps vehicles to shore. When those vehicles enter the battlespace, the edge moves with the forward line of troops. Beyond that is the electronic warfare edge within adversarial space. Information captured at the edge helps to get inside the enemy's observe-orient-decide-act (OODA) loop to make better decisions, faster.





To achieve the speed, stability, and scale at the edge necessary for success requires:

An information advantage by pushing decision-making to the edge.
Transmitting data from the tactical edge up echelon for processing introduces too much lag. By the time actionable intelligence is sent back to the edge, decisions may be overcome by events. Information advantage requires decision-making at the speed of action—at the edge.

Shortening the OODA loop.
The idea is to move more quickly than the adversary, making better decisions faster. Today, most warfighting platforms cannot share data. This causes delays, confusion, and the opportunity for error. Warfighters can close the OODA loop faster with a Modular Open Systems Approach (MOSA) to edge computing and data science.

Uninterrupted data availability.
Many tactical computers are customized for a single purpose. If one of two computers on a tank is destroyed, for instance, the other cannot take over its functions. To maintain decision advantage, the joint forces need the ability to quickly recompose mission capabilities on any computer.

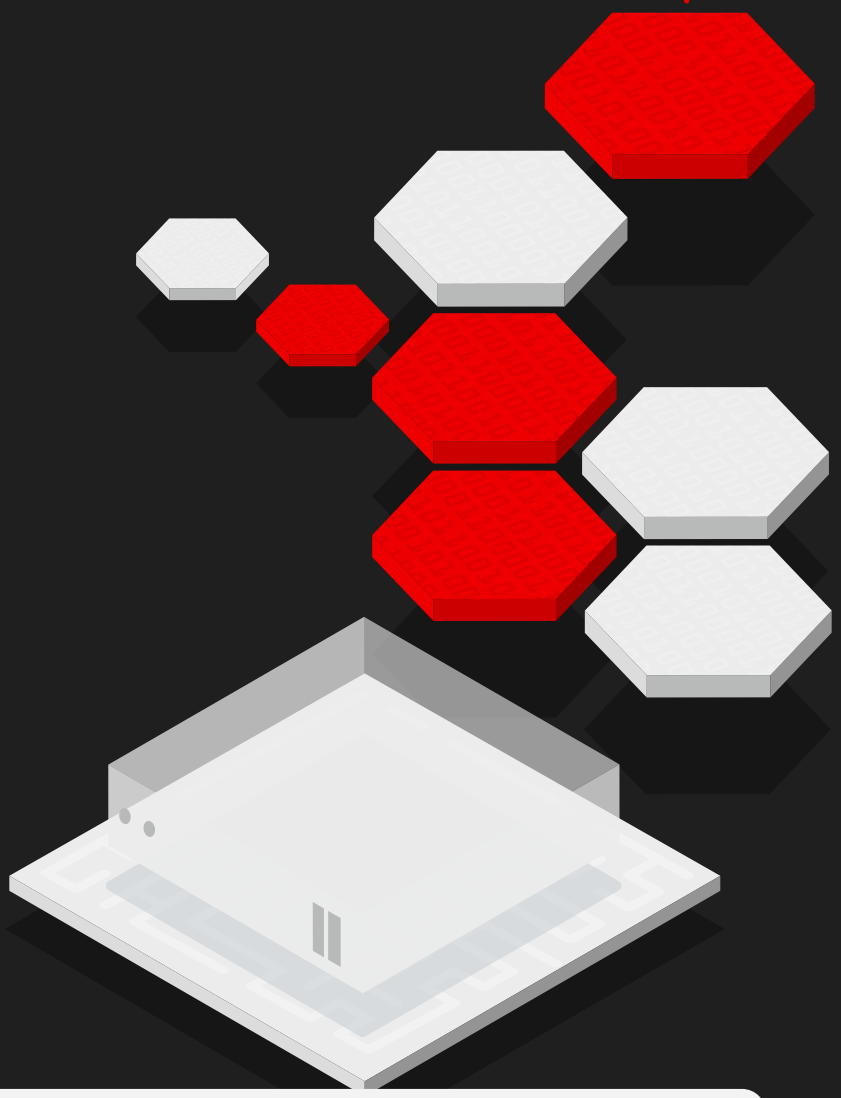
Sharing artificial intelligence and machine learning (AI/ML) capabilities across forces.
Today, each combat system and mission application program office develops bespoke software capabilities, leading to non-interoperable and duplicate applications. An interface for sharing capabilities like ML models and AI algorithms—without disclosing other intellectual property—will help the joint forces achieve decision advantage.

Chapter 4

Data sharing: From intelligence to insights

As data continues to shape the modern battlefield, it's important to note that more data and intelligence is not an advantage itself. Data must be processed and analyzed to create value through actionable insights, produced either by humans or AI/ML.

In order to provide the data flow and processing capabilities necessary to deliver the goals of a convergence event while maintaining the flexibility to adapt from one dynamic scenario to another, infrastructure operations, integrations, and data-in-motion processing must be built using open standards.



An open standards approach

Eliminating the barriers between digital infrastructure is essential for mission success. Too often critical data can get trapped in disconnected or isolated departments and agencies. Open standards ensure accessibility and interoperability between solutions to provide the characteristics necessary for actionable intelligence as depicted in Figure 1.

Eliminating barriers between digital infrastructures drives convergence

Collaboration
Battle lab with a multitenant, consistent, and standardized infrastructure.

Speed
Frictionless access to all-domain data, rapid prototyping, experimentation, and iteration.

Agility
Build recomposable capabilities and deploy anywhere with all-domain data integration and DevSecOps.

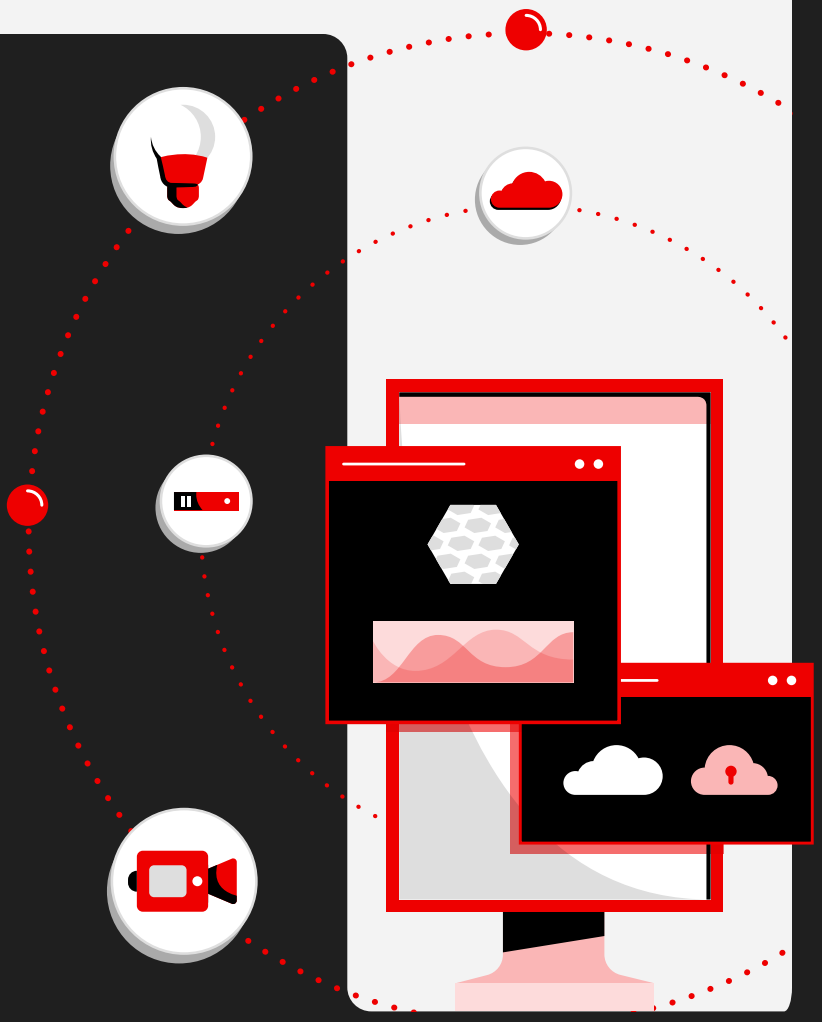
Flexibility
Open standards for data and infrastructure across lab and operational landscapes.

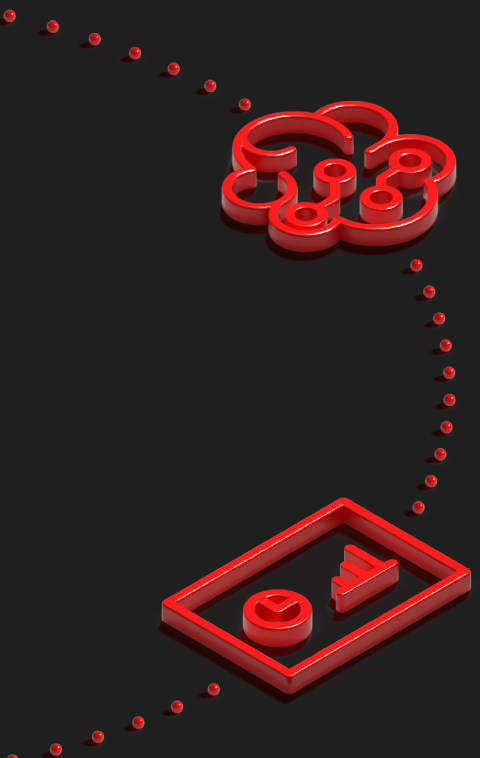
Figure 1. Characteristics necessary for actionable intelligence.

Build on a software-defined foundation

A software-defined network (SDN) architecture provides the backbone for a security-focused and converged joint all-domain digital infrastructure solution. Red Hat provides this foundation which includes data collection, integration, analysis, and syndication. The goal is to provide the warfighters and commanders with a single collaborative environment to access geospatial data combined with the latest analytic models and tools.

This foundation encompasses the key tenants for mission priorities of security, latency, and speed across all topologies, end-to-end. It's an approach that provides a rich transport, communication, and integration layer for mission success. The collaborative environment and analytic tools help the warfighter interact with data at any echelon, in a common relevant operational picture (CROP).





The importance of management

Artificial intelligence and machine learning (AI/ML) are strategic tools, but today's AI/ML systems are far more dynamic and must be regularly updated, modified, and adjusted to maximize the accuracy and value of the insights they deliver. AI/ML tooling should be focused on containerization, data management, and configurable deployments. Red Hat's portfolio provides the flexibility and portability to deploy models with a focus on security to quickly build, scale, reproduce, and share AI/ML results consistently with a joint community of interest (COI).

A key differentiator of Red Hat technology is flexible messaging architectures to achieve near-real-time situational awareness. A robust messaging infrastructure will allow a rich and performant data exchange among all nodes in the JADC2 domains offering capability to process enormous volumes of data at speed. This helps teams bridge data between disparate systems with the ability to transform and enrich data at the edge of the network.

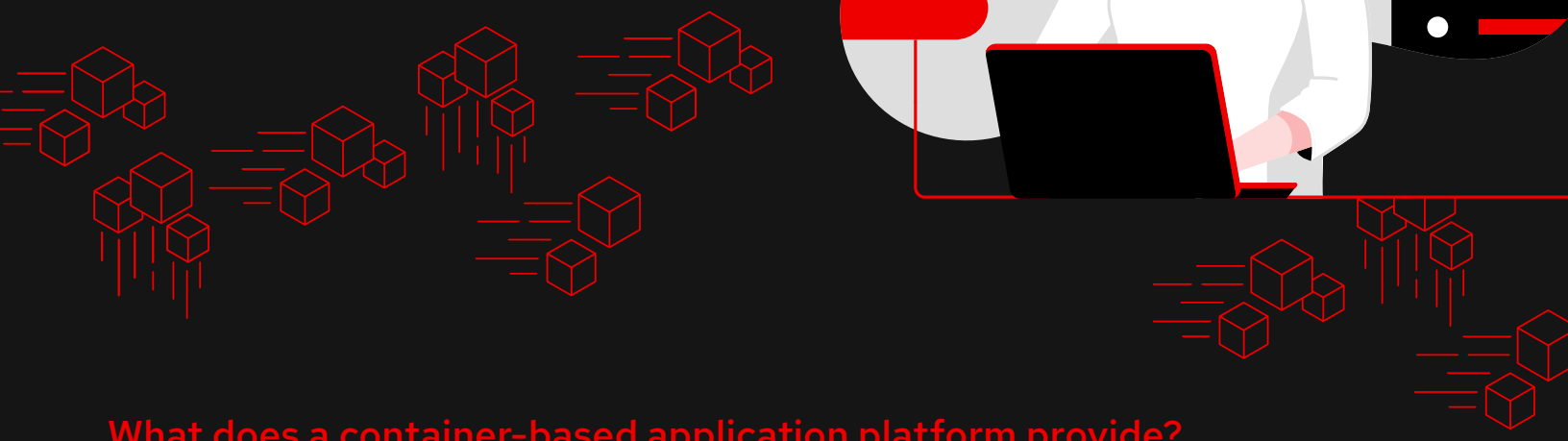
Chapter 5

Red Hat approach to mission edge

Edge computing is a natural extension of Red Hat's open hybrid cloud strategy, which is to support any workload on any environment in any location. But no single vendor can provide it all–not even Red Hat.

Our approach to mission edge includes solutions and expertise supported by a vast hardware and software partner ecosystem to help achieve mission objectives. We provide an extensive catalog of certified hardware, software, and cloud partners that can help modernize widespread resources across the DoD to innovate while maintaining focus on security posture objectives agility, and standardize interoperability across all branches and agencies.

With a modern, container-based application platform, joint forces can build applications once, deploy them at any edge location (forward operating base, vehicle, semiautonomous weapon system, etc.), and freely migrate workloads to other hardware when needed.



What does a container-based application platform provide?

Cost containment
Containers support the MDO and JADC2 objectives to create an integrated warfighting capability by integrating existing systems. Hardware doesn't need to be ripped and replaced. Legacy applications don't need to be rewritten because they can be deployed and managed on the same platform as modern, microservices-based applications.

Mission agility
When AI/ML applications are built from microservices, DoD developers can adapt quickly to change by disintegrating and then recomposing microservices–for example, to ingest data from a new type of sensor.

Data interoperability
Using integration technologies, the DoD can push newly acquired information to other systems at the speed of action, without relying on manual entry. This helps the joint forces to quickly disseminate information up echelon–from battalion to brigade, all the way to the Pentagon–to create a common operational picture.

Mission resiliency and survivability
All computers on an edge asset such as a ship or tank form a microcloud. If one computer fails, the team can quickly recompose the mission capability on another.

Why Red Hat for mission edge?

Adopting edge computing for all-domain decision advantage requires the right technology along with the right techniques and procedures. Red Hat can help with both.

Red Hat® OpenShift® Container Platform helps DoD forces build applications once and deploy them anywhere, for any echelon. Red Hat OpenShift focuses on security at every level of the container stack. Use Red Hat integration technologies to adapt to inevitable changes in data formats and protocols, bringing together data from past, present, and future systems.

Red Hat is also uniquely positioned to guide DoD teams through this digital transformation as they adopt a hybrid cloud platform and new DevSecOps processes. We understand how to bring together ideas from a community that's as complex and diverse as the DoD because that's our business model: distilling the best ideas from upstream communities into focused solutions.

See how Red Hat helps the U.S. Department of Defense move faster, with less risk.

Find out how to accelerate your mission objectives. Contact a Red Hat Department of Defense expert.

About Red Hat
Red Hat is the world's leading provider of enterprise open source software solutions, using a community-powered approach to deliver reliable and high-performing Linux, hybrid cloud, container, and Kubernetes technologies. Red Hat helps customers integrate new and existing IT applications, develop cloud-native applications, standardize on our industry-leading operating system, and automate, secure, and manage complex environments. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500. As a strategic partner to cloud providers, system integrators, application vendors, customers, and open source communities, Red Hat can help organizations prepare for the digital future.