Supporting AI/ML at the tactical edge

The Defense Department has been working for years to realize its vision of tactical edge computing. The goal? To orchestrate multiple commercial and private tactical clouds and deliver battlefield intelligence and data fusion in ways never done before.

One early test, Project Convergence, showed it's possible to reduce the time it takes to move accurate target data from "sensor to shooter" from 20 minutes to 20 seconds. That kind of accelerated decision-making will be crucial to the future of armed conflicts.

The biggest challenge is the environment in which these edge networks must operate. DoD must plan for contested environments, where infrastructure is not always available, connectivity is denied by the adversary, and hardware must be mobile and assumed to be under direct physical threat.

"Our customers' situation is characterized by being frequently disconnected, has low latency and lacks resiliency," said Jim Keenan, vice president for DoD at Red Hat. "Tactical edge reduces and mitigates much of that by bringing compute closer to the edge to better support the warfighter, instead of everything being backhauled from a data center. And whether that tactical edge is on board a ship, the back of a Humvee or out of a small system that's been set up and deployed just to support theater operations, that mission is enabled and reduces those challenges characterized by our warfighters' situation."

Proving what's possible at edge

For example, during an exercise in February 2022, the First Corps based out of Joint Base Lewis–McChord was able to perform mission command functions from a C-17 Globemaster III over the Pacific Ocean en route to Guam and then later from a naval ship. The idea was to distribute command and control functions over a series of nodes, rather than centralize it, so that the technical functionality could remain mobile and present less of a target to adversaries.

The pilot showed that the capability was not only more resilient than existing First Corps

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solutions, but the performance, reliability and latency were superior to anything used previously, said Army Chief Information Officer Raj Iyer. "Technically, we know it can work."

After laying the cloud foundation at the tactical edge, the next step is bringing artificial intelligence and machine learning (AI/ML) to bear to shorten the decision-making cycle. In austere, contested environments, the ability to link back to a centralized data center, upload data and wait for the analysis to come back is a luxury at best — and frequently impossible.

That's why Keenan said he sees the beginnings of exponential growth in the number of AI/ML applications that will be available to warfighters at the tactical edge within the next few years. At the farthest edges, environments become more constrained. The platform must be able to easily deploy, handle and maintain applications, including day two operations, while seamlessly integrating with the data and managing in denied, disrupted, intermittent and limited (DDIL) bandwidth conditions. Doing this right will help streamline and simplify processes and decision-making for warfighters, Keenan said.

To address that need, Red Hat developed Device Edge, which combines Red Hat Enterprise Linux and Kubernetes. It's a flexible platform that combines consistency across all devices and locations with unparalleled AI/ML workload support, he said.

"At the edge, the ability for things to be deployed and automated versus needing large teams of people to come in and to do those deployments is going to be critical. Warfighters are very talented folks, but they may lack the IT talent at the edge to do this. And that's where we think automation can be helpful," Keenan said.

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"Automation makes things repeatable and removes all manual intervention. For the warfighter on the ground, anything that can reduce manual intervention, anything that can simplify operations in contested environments, is going to be important."

Ensuring a common operating picture enterprisewide

That's one reason Red Hat is focusing on ensuring Defense agencies can have a common experience and operating environment across all their automation functions, from the data center to the cloud and then to the edge. To accomplish this, the company is focusing on deploying Ansible across DoD, Keenan said. That can enable and enhance edge deployments by providing a common operating picture across the enterprise.

That approach will also ease training requirements. Not only is the data then interoperable, but warfighters will gain a seamless, consistent experience across any environment within DoD. That makes training easier and requires that warfighters be less specialized to support a specific mission, Keenan said. Instead of having to deploy one of a limited number of specialists to forward positions, DoD teams can train and deploy more highly utilized warfighters.

That has exponential benefits. Specialists require support to help protect them, and that increases the people placed in harm's way. The use of automation to streamline processes means fewer specialists will need to be deployed, which means fewer support personnel will also be needed. That saves not only training and manpower investments, but also human life, he said.

"AI/ML and the Internet of Things create massive amounts of data. We're basically taking that and moving all those capabilities, all those things that are going to be key warfighting enablers, closer to the data set, closer to the warfighter," Keenan said. "That's going to be a competitive advantage for our warfighters."