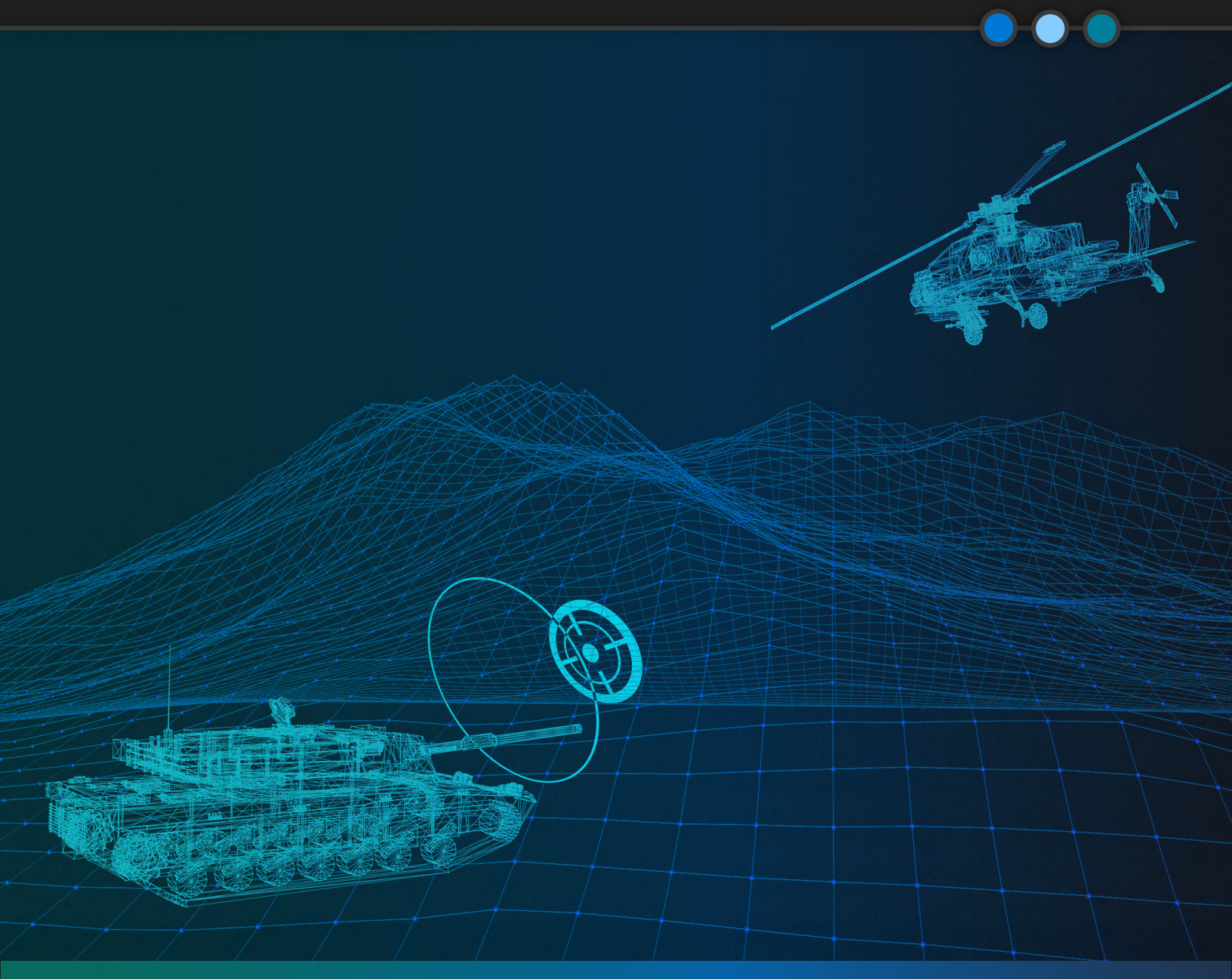
Microsoft

Microsoft Tactical Cloud Platform

Leveraging Hyperscale Cloud Capabilities at the Tactical Edge



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In the ever-evolving landscape of global defense and intelligence, the demand for real-time data processing, analysis, and decision-making has never been more critical. Cloud computing has emerged as a transformative technology, offering unparalleled innovation, scalability, agility, and accessibility for information-driven operations, enhancing decision advantage. Microsoft, as a leading player in the cloud services market, has significantly contributed to this paradigm shift, providing a diverse suite of cloud-based solutions to governments and intelligence agencies worldwide.

Traditional cloud architectures often face limitations in situations where constant connectivity cannot be guaranteed. In remote or hostile environments, hybrid and disconnected cloud services become a necessity to ensure continuous data availability and mission success. The concept of leveraging cloud capabilities at the edge, in proximity to the data source, has emerged as a fundamental solution to overcome these challenges.

Expanding edge horizons

It is evident from the current geopolitical and operational environment that a critical area of competitive advantage moving forward will be digital innovation to support survivability of dispersed C2 nodes. Furthermore, to maximize the efficiency of skilled personnel, human-machine teaming is being considered, leading to an increasing number of autonomous systems being deployed on the battlefield.

As the battlefield digitizes and commanders balance survivability with traditional operational and tactical HQ postures, it becomes crucial to deploy low-latency compute as far forward as possible to support these needs.

However, we are yet to see widespread recognition that the real force multiplier is in intelligence being derived from these autonomous systems. Data that can be stored, processed, and exploited to significantly enhance decision support at the edge, rather than increased compute for real-time consumption of a data feed.

As this potential takes hold we will witness a rapid increase in the number of intelligence data points, and multiples of sensor feeds needing to be fused and processed. Accordingly, the use of deployed Artificial Intelligence (AI) and Machine Learning (ML) will become critical to effective command and control environments.

This increase in volume will undoubtedly be matched by the need for greater velocity to complete the OODA loop. Digitizing orders and automating instructions will be key to enhancing decision support for the human in the 'sensor to effector' loop.

Given these needs, and the advances in technology that we are witnessing, Microsoft and its partners continue to invest in the concept of using low-latency tactical edge compute to enable the use of Azure services for the processing of data in disconnected, disrupted, intermittent and latent environments.

We recognize the power and potential to advance defense missions by leveraging Azure Machine Learning to train complex AI models, which are subsequently optimized and packaged to be deployed, via a Cross Domain Service (if required), to the Azure Stack Edge environment for inferencing.

Decisive Action at the Edge

Provision of AI models and other cognitive services to the Azure Stack Edge, which is deployed within a KLAS Voyager solution, provides defense with a **Tactical Cloud Platform** that offers flexible options for Microsoft and its partners to deliver solutions for enhanced decision support at the edge, such as:

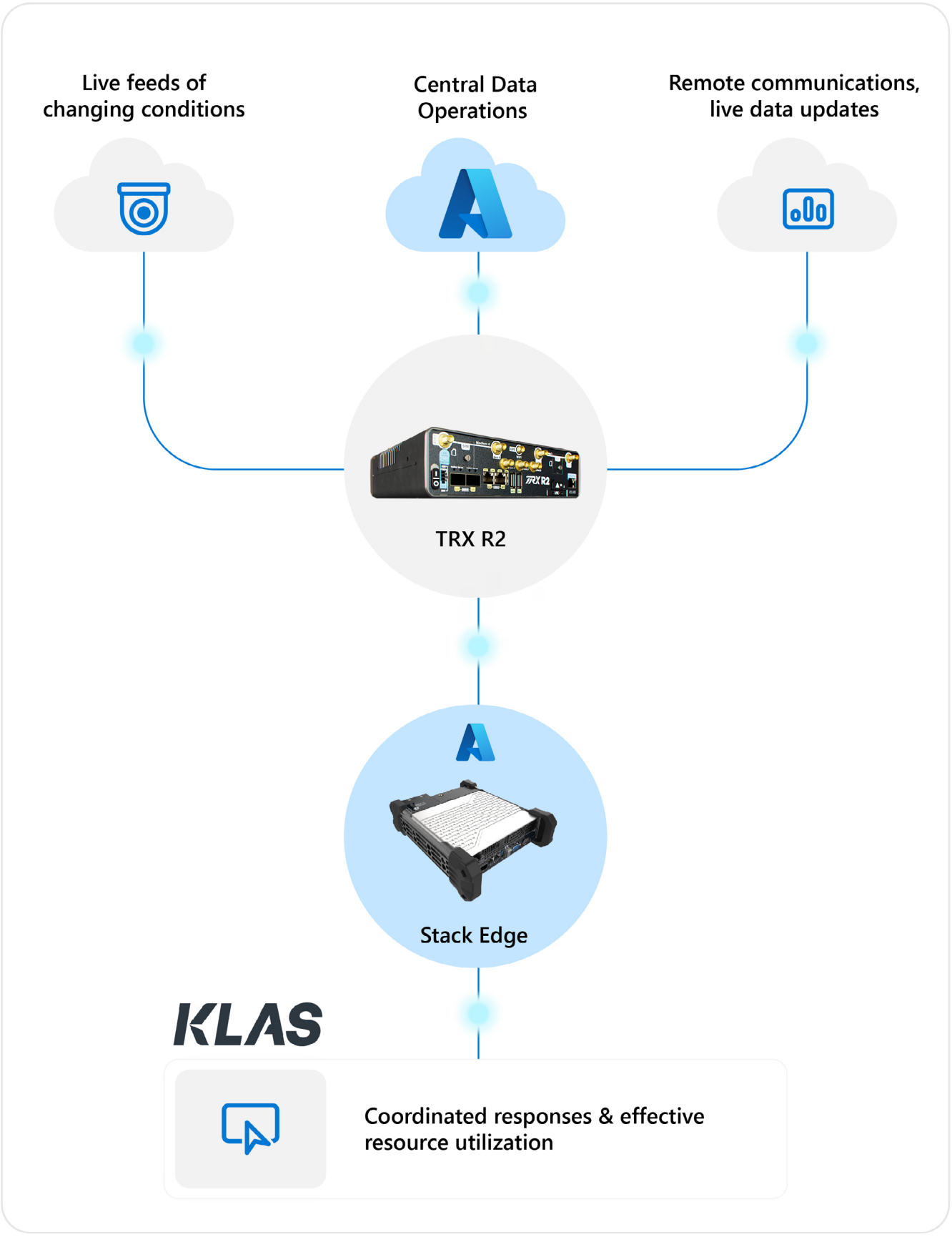
Voice Transcription/Translation – When paired with PTT voice radios, digital audio voice streams can be captured for real-time transcription, translations, and augmentation with other sources of intelligence. Outputs being delivered via synthesized voice, or downstream into other sources of effect.

Intelligence Fusion – Using the KLAS TRIK and SNC's TRAX application it is possible to consume data from tactical radio feeds such as LINK-16, LINK-11, Cursor on Target, etc. This streamlined data platform enables automation of intelligence processes, such as pattern of life analysis, object detection, and multi-intelligence fusion when taking these SIGINT sources and combining them with other data inputs.

ISR feeds for Simulated Mission Planning – Working with Microsoft partners such as SimActive's Correlator3D it is possible to process ISR images from UAS platforms and build complex orthomosaics and photogrammetry to reconstruct 2D image captures in 3D for planning and simulations purposes. Further, LiDAR and NERF scans can provide detailed scene reconstruction.

Robotic Command & Control Orchestration – By leveraging industry standard protocols (e.g., ROS2, MavLink), Microsoft's investment in industrial IoT capabilities allows the creation of complex autonomous or human-assisted workflows for RAS systems. Exploitation of Edge compute allows consumption of sensor outputs from robotic systems in near real-time, helping to inform other systems in the swarm to make intelligent decisions on their next best action.

Vehicle Integration – Using vehicle architecture standards provides significant potential to augment existing data with next-generation AI/ML capability hosted on Edge compute. E.g. by picking up HUMS, weapons, sensor data off the vehicle's integration bus, Microsoft's platform can convert this data – in a low latency, real time fashion – to allow model inferencing, and complex process orchestration, publishing outputs to existing Human Machine Interfaces (HMI).


Live feeds of changing conditions
Central Data Operations
Remote communications, live data updates
TRX R2
Stack Edge
KLAS
Coordinated responses & effective resource utilization

From Hyperscale Cloud to the Edge

Training your ML models

There is significant value in creating focused, task-specific, AI models to support tactical needs. Given the limitations of compute within the form factors - that are constrained by size, weight and power in the operational environment - we can maximize the efficiency of AI models on Edge based hardware using a process called Quantization, which optimizes/compresses a model to ensure it performs well in the target environment. Microsoft accomplishes this through frameworks called Onyx and Olive. You can therefore take advantage of Azure Machine Learning in hyperscale cloud (using unclassified or simulated data) to train, package, and deploy AI models on your edge-based hardware, which can then be used in the mission environment for higher classification workloads.

Exploiting Space

Although AI/ML inference, and data capture will work adequately in isolation, a further consideration for defense is the need to dispatch data back to HQ or rear echelons, as well as having sufficient connectivity to forward-deploy new models and capability specific to the emerging needs of the mission. By leveraging intelligent network capabilities present within the Tactical Cloud Platform (TCP) unit, it is feasible to establish secure cloud connectivity via SatComm such as SES MEO or SpaceX LEO connections, whilst maintaining a local compute presence on your MANET, radio network, or tactical 5G capability.

The Virtual Q-Store in the Cloud

Microsoft and our substantial partner ecosystem continues to innovate around a common goal of enhancing decision making at the edge, based on the provision of a **tactical cloud platform** tailored for mission. Similar to the concept of drawing down mission essential equipment from a unit's physical Quartermaster Store (Q-Store), we have a vision of a 'virtual Q-Store in the cloud' (an extension of the Software Factory for Defense) from which mission essential cognitive services can be selected and rapidly deployed to support a specific mission.

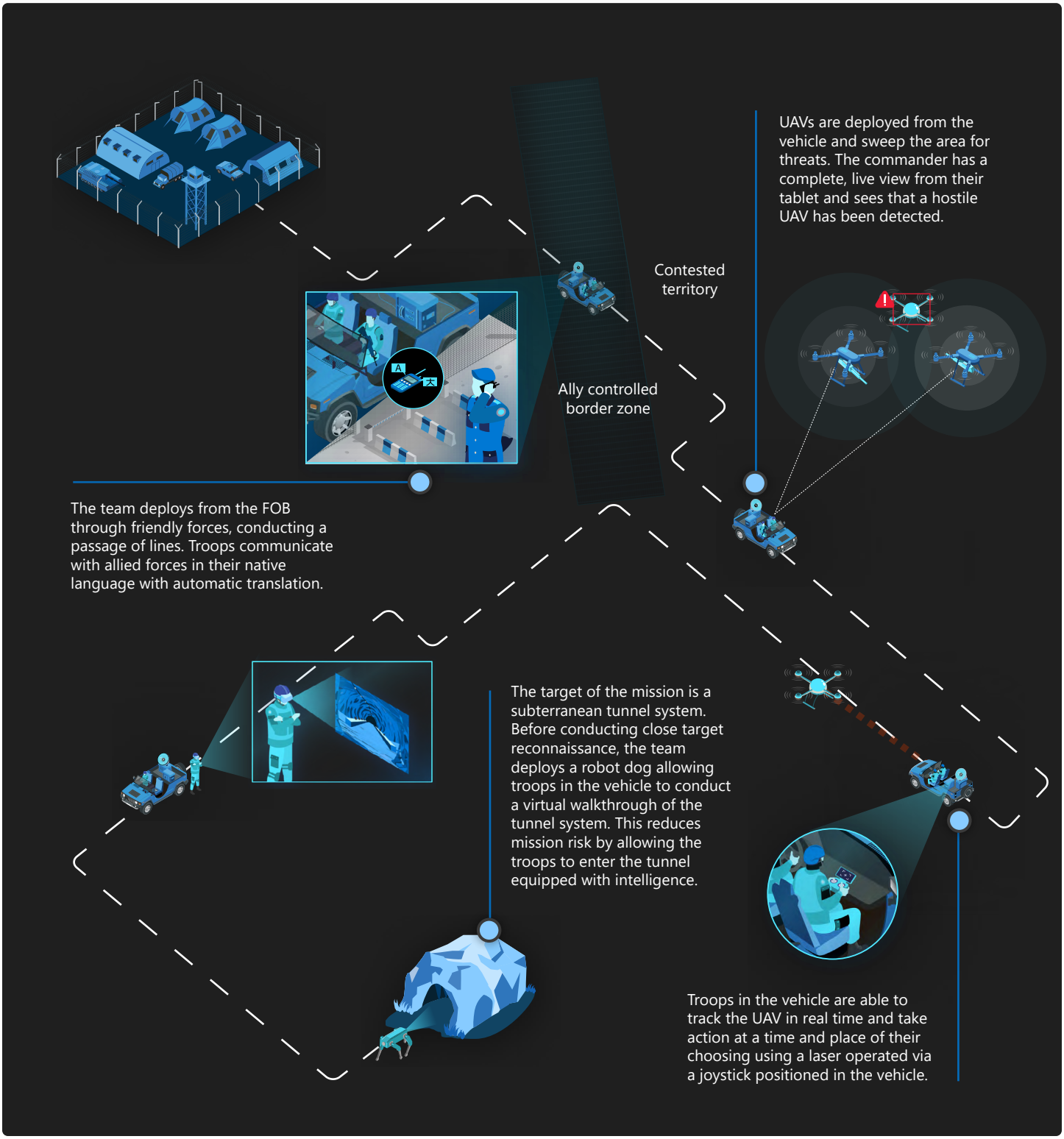
For example, imagine you are part of a team tasked to conduct a close target reconnaissance of a known enemy staging location. Recent intelligence has identified a subterranean cave system that has high potential of being used as a staging area for hostile actions against coalition forces. Your task is to conduct a close target reconnaissance of the known enemy staging area in order confirm or deny its use and further develop the intelligence picture for subsequent operations.

As part of the mission planning conducted in the Forward Operating Base, the team decides a combined vehicle mounted infiltration and foot insertion is required to carry out the mission. The team selects mission essential items of equipment from the physical Q-Store and determine what mission essential cloud-based cognitive services it will need to enhance its decision-making capability once deployed – it does this by selecting services from the **virtual Q-Store** in the cloud and deploying them to mobile **Tactical Cloud Platform** mounted in the patrol vehicle.

Microsoft and partners recently took this scenario and in five weeks developed and deployed a capability into a Supacat vehicle for a live demonstration in the field. The team containerized voice transcription and translation services, computer vision capability, along with the ability to render 3D imagery of robot mounted LiDAR scanning.

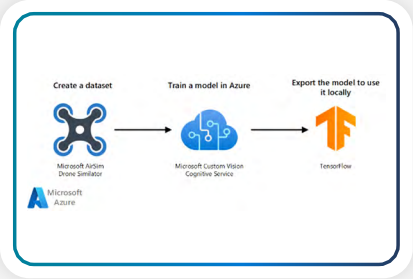
Mobile C2 at the Far Edge

Objective: Conduct a reconnaissance mission deep in a contested operational area.



The Technology that brings this to life

Central to bringing this solution to life in just five weeks was the strong partnership between Microsoft and KLAS, who together made this possible through:

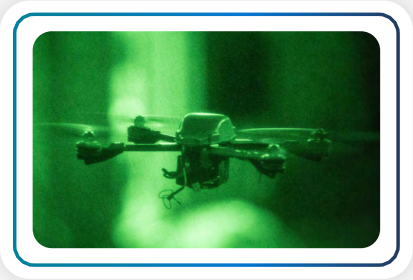


Azure AI Services: Whether you don't have a reliable internet connection, you want to save on bandwidth cost, you have low-latency requirements, or you're dealing with sensitive data that needs to be analyzed on-site, Azure IoT Edge with Azure AI Service Containers gives you consistency with the cloud. Azure AI Services Containers allow developers to use the same intelligent APIs that are available in Azure, but with the benefits of containerization.
Azure AI | Azure AI Services Containers – Learn more

Azure Stack Edge Mini-R: Loaded into the Voyager 6 chassis, the Azure Stack Edge Mini R is an ultra-portable, rugged, edge computing device designed for use in harsh environments. Allows analysis, processing, filtering of data. Supports VMs and containerized workloads. With Azure Stack Edge Mini R, you can run ML models to get quick results that can be acted on before the data is sent to the cloud.
Azure Stack Edge

KLAS Voyager 6 Chassis: Designed to perform up to and beyond the requirements of government and public safety communicators in any operational environment. The Voyager 6 is a six-slot chassis designed for vehicle applications. The chassis is compatible with the Standardized A-Kit Vehicle Envelope (SAVE) specification and the SINCGARS MT-6352.
KLAS Voyager 6

KLAS TRX R2: TRX R2 is a rugged compute gateway that combines both connectivity and local compute so that vehicles and operators have connectivity when they need it, with local processing capabilities when connectivity is unreliable. Mitigated with two 4G/LTE modems or with a single 5G modem. In addition, the TRX R2 integrates GPS, Wi-Fi, and 2 x 10 Gb Ethernet (8-core variant). Combined with KLAS' proven SD-WAN feature embedded in Keel, multiple transports can be used simultaneously in a secure and agile way.
KLAS TRX R2



Military Internet of Things (MIOT): Remote sensing and MIOT devices are linked to the TCP through tactical networks, which allow them to process data locally; this reduces latency and ensures data security - vital for maintaining tactical advantage. The TCP can also exploit Azure cognitive services, using AI to augment raw data streams from sensors, such as Unmanned Vehicles, vehicles' sensors, and military hardware, to perform real-time analysis of the data, enabling instant insight such as threat detection, and decision support. This can all be sent via combat management systems, accessible through wearable devices. The combination of these technologies is a force-multiplier, improving situational awareness, intelligence collection, and heightening the efficiency of defense operations, making them more flexible and adaptable to emerging threats.
IoT Edge | Cloud Intelligence | Microsoft Azure

Microsoft Defense & Intelligence:

Empowering militaries. Improving operations. Protecting national security.