| Basic Information	
Company Name: Groundbreaker Solutions LLC	
Proposal Title: Fog Computing & DDIL	
TRL: 3	Location: Thiensville, WI
Number of Employees: 2	Previous DOD Business: Yes
Capital Raised Total: $10,000	Website: https://groundbreaker.solutions
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Part 1: Introduction/Abstract (5%)

Our proposal introduces a Generative AI-enabled tactical network specifically designed to support the U.S. Army's Next Generation Command and Control (NGC2) architecture, effectively addressing operational challenges posed by Disconnected, Disrupted, Intermittent, and Limited (DDIL) environments. Central to this solution is the integration of advanced Generative AI technologies—including GPT-based architectures, diffusion models, and generative adversarial networks (GANs)—with realistic military datasets to dynamically generate authentic, detailed tactical scenarios. This ensures that the modeling and simulation environment accurately represents realistic terrain-based movements, operational patterns, and responsive tactical behaviors.

The technological backbone of our system relies on a robust Fog Computing architecture paired with Microsoft's Azure IoT Edge. By strategically distributing computational resources closer to the edge—between cloud infrastructure and frontline devices—our system significantly reduces latency and enhances the resilience of command and control operations. This localized computing capability supports complex AI inference tasks, data validation, and federated learning, allowing continued functionality and reliable analytics even in severely disrupted network conditions. Portable, ruggedized Fog nodes facilitate local processing and scenario generation, enabling critical decisions without continuous cloud connectivity.

Furthermore, our solution includes intuitive interfaces enabling users to dynamically manipulate parameters such as data throughput, latency, and simulated network disruptions to closely replicate DDIL scenarios. Edge devices feature peer-to-peer communication capabilities independent of centralized Fog nodes, enhancing resilience and ensuring continuous operational effectiveness even when network connectivity is compromised. Collectively, these innovations offer the Army a comprehensive, realistic, and agile Command and Control environment, providing commanders with decisive operational advantages in complex and contested battlefield scenarios.

Graphics and Captions
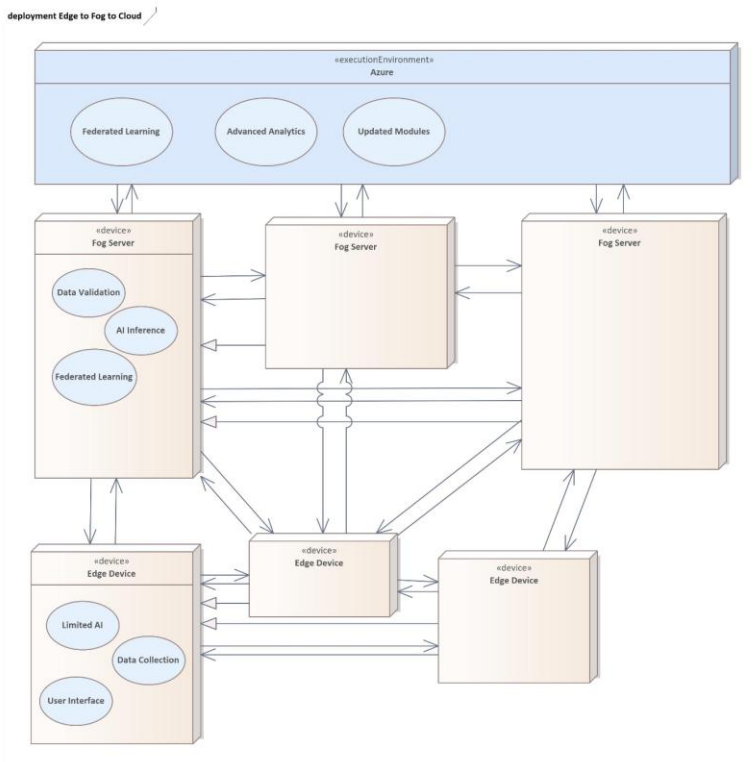
Part 2: Army Benefits (25%)

This proposal addresses the Army's need for enhanced situational awareness and agile decision-making by integrating advanced Generative AI capabilities with a robust Fog Computing framework. By using GPT architectures, diffusion models, and GANs, the system automatically produces complex, realistic scenarios tailored to Army-specific operational contexts. This allows commanders to refine training exercises and better anticipate battlefield dynamics, ensuring that units operate with a level of preparedness that closely mirrors actual mission conditions—even in Disconnected, Disrupted, Intermittent, and Limited (DDIL) environments.

Furthermore, the proposal meets the Army's operational requirements by placing computing power directly in the field via ruggedized Fog nodes running Microsoft's Azure IoT Edge. This decentralization significantly lowers decision latency and maintains critical functionality when network connectivity is compromised. Edge devices, such as ruggedized tablets with peer-to-peer communication, sustain ongoing data exchange and mission execution without relying solely on centralized infrastructure. As a result, Army personnel can swiftly adapt to emerging threats, achieve continuous operational effectiveness, and gain the decisive advantage in complex, contested environments.

Part 3: Technical Approach (40%)

Fog Computing forms the backbone of our solution by positioning computational resources closer to data collection points, reducing latency and enhancing resilience. This decentralized approach is particularly vital for tactical scenarios where connectivity may be intermittent or compromised. Our ruggedized Fog servers, deployed in the field, handle tasks like data validation, local AI inference, and federated learning, allowing critical functions to continue even without continuous cloud access.

Generative AI further amplifies this Fog Computing architecture. Leveraging GPT-based models, diffusion techniques, and GANs trained on military operational datasets, our system rapidly generates realistic tactical scenarios, including

threats, friendly maneuvers, and terrain considerations. These predictive insights enable commanders to anticipate and proactively address challenges, accelerating the Observe-Orient-Decide-Act (OODA) loop and maintaining a strategic edge.

At the edge layer, ruggedized tactical tablets serve as frontline data collection tools, offering rapid analytics and peer-to-peer communication independent of Fog nodes. This ensures operational continuity when higher-level nodes are disrupted. By enabling on-the-spot scenario adjustments, edge devices significantly shorten decision cycles, supporting field operators with intuitive interfaces that bolster situational awareness in dynamic, high-stakes environments.

To prepare for Disconnected, Disrupted, Intermittent, and Limited (DDIL) conditions, we integrate custom IoT Edge modules simulating bandwidth constraints, latency, packet loss, and intermittent connectivity. Operators can adjust these parameters in real time, gaining hands-on experience and confidence in handling network disruptions. This training capability ensures personnel remain agile and maintain robust situational awareness even under adverse conditions.

At the cloud level, we employ Azure infrastructure to aggregate insights from Fog nodes, perform advanced analytics, store extensive datasets, and continually update Generative AI models. Through federated learning, distributed node outputs are combined to refine and adapt models. This centralized coordination ensures continuous improvement based on real-world data, supporting evolving mission requirements and strengthening predictive accuracy.

Azure IoT Edge extends these capabilities by enabling localized computation and data management on edge devices, synchronizing with the cloud only when connectivity permits. Edge nodes can autonomously execute data validation, local AI inference, and federated learning, mitigating reliance on potentially vulnerable centralized resources. Peer-to-peer communication among edge devices further enhances resilience, allowing uninterrupted data sharing and decision support in DDIL environments.

In conclusion, our integrated approach—combining Fog Computing, Generative AI, and Azure IoT Edge—meets the Army's SBIR requirements by delivering a resilient, responsive tactical network. It excels under challenging conditions, accelerates tactical decision-making, and enhances operational agility, ensuring commanders can maintain a decisive advantage in complex and rapidly evolving battlefield scenarios.

Part 4: Commercial Potential (25%)

Our commercialization strategy focuses on dual-use applications, leveraging our Generative AI-enabled tactical network solution initially developed for the U.S. Army's Next Generation Command and Control (NGC2). Beyond military contexts, this approach addresses critical commercial needs for real-time decision-making under constrained networks—benefiting industries such as disaster response, emergency management, and public safety. By partnering with technology companies and integrators specializing in IoT and edge computing, and by capitalizing on Microsoft's Azure IoT Edge platform and our Fog Computing framework, we can quickly adapt these robust, military-grade resilience capabilities for diverse commercial use cases like remote infrastructure management, energy sector monitoring, and disaster recovery operations.

To reach a broad market, we will offer both SaaS and on-premises deployments, with flexible subscription models, licensing agreements, and comprehensive support services for enterprises of all sizes. Our go-to-market plan includes active engagement in industry events, collaboration with research institutions for ongoing innovation, and alignment with industry consortia to extend our network and credibility. This strategic, scalable commercialization approach ensures sustained growth and positions our Generative AI and Fog Computing solutions at the forefront of both military and commercial markets, enhancing operational effectiveness, reducing latency, and bolstering resilience in complex real-world scenarios.