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Brain vs Muscle

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Abstract:

"This proposal outlines a ""Brain vs. Muscles"" architecture that leverages edge-native AI to transform tactical network management from reactive processes to proactive, self-healing orchestration. By deploying containerized, quantized models on ruggedized hardware, the system ensures persistent intelligence and secure, automated decision-making even in disconnected or limited network environments.

Artificial intelligence can revolutionize tactical network management by transitioning systems from reactive processes to proactive, self-healing orchestration. Red Hat offers a framework for designing intelligent, real-time decision-making systems within demanding tactical environments. Predictive routing and agentic AI can address critical challenges, such as fragmented networks, quality-of-service optimization, and complex PACE routing, without compromising operational security.

Advanced mechanisms, such as AIOps monitoring live RF spectrum data, can predict and mitigate network disruptions before they impact warfighter communications. Agentic AI can facilitate rapid root-cause analysis during mesh fragmentation, paired with event driven automation, supporting system reliability. A ""Brain vs. Muscles"" design provides a framework for enforcing strict safety guardrails; in this model, AI serves as an analytical brain for anomaly detection, while the platform functions as the deterministic muscle, auditing execution and ensuring automated actions align with established policy-as-code boundaries.

Effective operation within Denied, Disrupted, Intermittent, and Limited (DDIL) constraints is possible using a decentralized, ""offline-first"" architecture. Using edge native software can minimize the hardware compute footprint, allowing AI inference to run on ruggedized edge devices. Technologies such as Modelcar can facilitate air-gapped deployments by

packaging AI models into standard OCI containers, while model quantization optimizes these models to fit within restricted memory parameters without sacrificing tactical accuracy.

Finally, this architecture can ensure continued intelligence even when network links are severed, keeping local AI runtimes fully operational during disruptions. The system can efficiently synchronize telemetry data and configuration updates once connectivity is restored, helping maintain warfighter superiority in challenging conditions."