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Abstract Submission

1. Title

Datastore-Centric Interoperability Framework for Scalable Simulation and AI-Driven Warfighter Readiness

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3. Abstract

Current simulation interoperability architectures rely heavily on network-based protocols such as the Distributed Interactive Simulation (DIS) standard, the High Level Architecture (HLA), and the Test and Training Enabling Architecture (TENA). While effective, these approaches have limited dynamic extensibility and limited support for persistent data capture and intelligent analysis. This presentation proposes a novel datastore-centric interoperability framework that supplants traditional network transport with a structured, dual-database architecture grounded in the DIS data model.

The proposed architecture employs an in-memory database to handle high-rate, time-critical simulation state data, such as entity position, velocity, and orientation updates, while a NoSQL document store manages low-rate, semi-static characteristic data including terrain definitions, entity signatures (radar cross-section, infrared), and environmental parameters. Together, these stores form a unified simulation data fabric with the DIS protocol data model as the canonical schema, ensuring backward compatibility with existing simulation systems.

Beyond interoperability, the architecture is designed to serve as a mission readiness enabler. All simulation activity is automatically captured in a structured, searchable format, creating a rich dataset for after-action review. The Artificial intelligence and machine learning pipelines can process this data to assess warfighter performance, identify training gaps, and generate readiness metrics, which transforms raw simulation output into actionable learning analytics. The use case presented here is the use of 5-Point proficiency/competency models for ab initio training that leverages the aforementioned architecture.

The framework preserves interoperability with legacy systems by exposing DIS, HLA, and TENA network interfaces as optional gateway adapters, allowing existing simulation components to participate without modification. By decoupling data exchange from network transport and anchoring simulation state in a persistent, schema-consistent datastore, this approach enables deeper integration into larger training enterprises, supports scalable AI-driven readiness assessment, and better prepares warfighters for emerging mission demands.

In summary, the proposed datastore-centric interoperability framework replaces traditional network-only transport with a dual-database architecture one for high-frequency, time-critical state updates and a NoSQL datastore for lower-frequency, semi-static attributes, while preserving the DIS data model as a canonical schema for seamless backward compatibility. By automatically capturing all simulation activity in a searchable, persistent store, the system enables sophisticated AI/ML-driven after-action review, performance analytics, and 5-point competency models, thereby transforming raw simulation data into actionable readiness metrics for modern Instructor and Student dashboards; ultimately, creating more lethal warfighters for evolving mission requirements.

4. Projected Track

Primary: Mission Readiness

Secondary: Emerging Capabilities

This submission is classified primarily under Mission Readiness due to its direct application to warfighter assessment and training enterprise integration. It additionally qualifies under Emerging Capabilities for its novel use of hybrid database architectures and AI/ML analytics within the simulation interoperability domain.