

OGC Spatial Data Infrastructure (SDI) Modernization Project 2025

Exploring How to Empower the Next Generation of SDIs with GeoAI Knowledge Networks

TerraFrame seeks to contribute to the OGC Spatial Data Infrastructure (SDI) Modernization Project by sharing insights from its ongoing work with government agencies in various countries. This aims to aid the transition beyond traditional SDIs to intelligent, interoperable, and sustainable systems, as recommended by the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), thereby making the development of GeoAI solutions more accessible in lower-resourced settings.

At the core of this contribution is the Spatial Knowledge Mesh (SKM)—a decentralized architecture inspired by the Data Mesh paradigm developed by TerraFrame in collaboration with the U.S. Army Corps of Engineers (USACE) and published at FOSS4G 2023. SKM enables organizations to expose semantically rich, machine-readable spatial data products that automatically align by geography and time. The SKM architecture pattern can be utilized to create a federated GeoAI Knowledge Network, where structured knowledge graphs can be composed on-demand to support Graph-augmented Retrieval-Augmented Generation (GraphRAG) for geospatially aware AI systems.

By integrating data across silos and domains—including Earth observation, sensor networks, and application-specific datasets—this approach not only leverages existing SDI investments but also modernizes SDIs into dynamic, knowledge-driven ecosystems. The goal of TerraFrame is to develop the SKM approach for building and maintaining these ecosystems sustainably, empowering government agencies, public institutions, and private sector innovators—especially those with limited resources—to create their own fit-for-purpose GeoAI solutions.

TerraFrame would be happy to showcase its open-source projects that contribute toward a path toward automated knowledge interoperability, enabling location-aware LLMs and intelligent agents to generate real-time insights for pressing challenges across defense, public health, disaster resilience, and economic development.

Continued Collaboration with OGC

TerraFrame was a participant in the OGC Climate and Disaster Resilience 2024 Pilots. In Version 1, it contributed insights based on real-world engagements with customers, focusing on methodologies for constructing Geospatial Knowledge Infrastructures (GKIs) that bring geospatial awareness into Large Language Models (LLMs). In Version 2, TerraFrame developed an AI-powered virtual assistant capable of answering complex, cross-domain questions related to the cumulative impact of disaster events on U.S. civil water infrastructure managed by USACE.

Looking ahead, TerraFrame plans to collaborate with USACE in exploring how gaps in current OGC standards might be addressed to automate interoperability within a Spatial Knowledge Mesh (SKM). This would enable the sustainable creation of spatial knowledge graphs designed for use in GraphRAG systems. TerraFrame looks forward to deepening its engagement with OGC through active participation in the GeoSemantics DWG, GeoAI DWG, and Geo-Reporting SWG, and welcomes collaboration and feedback as it continues contributing to the future of geospatial intelligence.

Contributing to the National Spatial Data Infrastructure (NSDI) Hub

TerraFrame is built around an open-source business model, with a strong focus on developing and contributing foundational technologies to the broader geospatial community. Core innovations—including the Spatial Knowledge Mesh (SKM) architecture, prompt engineering for GeoAI, and tools for enabling semantic interoperability across geospatial and classification systems—are designed to support scalable, standards-aligned solutions. TerraFrame is also advancing the integration of earth observation data into GraphRAG pipelines to power location-aware LLM applications. These developments are well-positioned for contribution to the OGC NSDI Hub, supporting its mission to modernize spatial data infrastructure. Current collaborations include the U.S. Department of Agriculture, U.S. Department of the Interior, and USACE, with a potential additional project in development with a European SDI agency that is also an active OGC member.

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