Proposal for OGC Spatial Data Infrastructure Modernization Project (2025–2026)

Submitted by: Voyager Search
Topic Area: Governance
Title: From Fragmented Holdings to Integrated SDIs: Enabling Zero Trust Governance through Dynamic Metadata Standardization

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Overview

Voyager Search proposes an in-kind contribution to deliver a governance-focused demonstrator that showcases a scalable, standards-based approach to SDI implementation. Our COTS platform integrates geospatial content from distributed, heterogeneous sources into a centralized metadata catalog, enriched and standardized to enable discovery, access control, and interoperability. Instead of relying on dynamic federated search, Voyager deploys near-source Agents to harvest, enrich, and standardize metadata — all without moving or modifying the underlying data.

The platform consumes geospatial data in OGC-compliant formats and services (e.g., WMS, WFS, GeoPackage), and also exposes metadata and enriched outputs through OGC-standard interfaces, enabling broader use in SDIs, catalogs, and downstream applications.

Governance Innovation

Our approach operationalizes pragmatic, bottom-up governance by deploying lightweight indexing agents near the data—across data centers, agencies, or jurisdictions. These agents perform in-place metadata extraction, enrichment, and classification, publishing standardized metadata to central catalogs without requiring source data centralization. This allows local custodians to retain control while contributing to national or global SDIs.

Key innovations include:

- **Metadata Standardization**:
  - Converts disparate metadata into ISO 19115, DCAT, and other SDI-aligned schemas.
  - Supports auto-tagging, content-type identification, and schema harmonization across datasets with differing structure and quality levels
- **Zero Trust Classification**: Dynamically labels content by security/access tier, lineage, and provenance.
- **Public/Private Integration**: Fuses government and private datasets with configurable pipelines and content rules.
- **OGC-Aligned Architecture**: Supports ingestion of OGC services (WMS, WFS, CSW) and exposes enriched metadata via OGC-standard APIs and search services.

Deliverables

To meet OGC's technical requirements, Voyager will contribute:

1. **New Public Demonstrator Site:** A web-accessible site showcasing sample datasets before and after Voyager metadata enrichment — illustrating ISO conformance, access control labels, and integration-ready schema. Searchable metadata will be exposed via OGC-compliant APIs.
2. **Best Practice Brief**: A policy and architecture paper outlining our metadata governance model, use of OGC standards, and support for decentralized content aggregation into national SDIs

Alignment with SDI Goals

This contribution supports OGC's SDI vision for the future by:

- Demonstrating real-world tools for integrating local, regional, and private data into national datasets without loss of context or control.
- Providing a standards-compliant, scalable governance framework for SDI modernization.
- Promoting trust, discoverability, and semantic richness in metadata to support automated data pipelines, AI applications, and policy enforcement.

We feel that this work modernizes governance not through policy alone, but through deployable, proven software that automates compliance, trust, and federation across organizational and jurisdictional boundaries.

Voyager Search Proposal for the OGC SDI Modernization Project 2025–2026

Title: Advancing SDI Modernization through COTS Innovation: A Scalable, AI-Augmented Metadata Platform for Distributed and Trusted Discovery

Organization: Voyager Search
Primary Theme: Data & Technology
Supporting Themes: Governance, People
Public Demonstrator: https://voyager.fas.usda.gov/voyager/navigo/search
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Summary
Voyager Search proposes to contribute a production-deployed, commercially available (COTS) software platform as a demonstrator of SDI modernization at scale. Our solution addresses key challenges in today's fragmented geospatial ecosystems: distributed data access, semantic and spatial discovery, metadata standardization, and trustworthiness in automated systems. Our platform is used by federal agencies such as NGA, USDA FAS, and numerous state DOTs, and aligns with the SDI modernization objectives outlined by OGC, FGDC, and UN-GGIM.

By deploying a microservices-based architecture that integrates over 2,000 data formats and sources—including file systems, APIs, and cloud object storage—Voyager enables search across structured and unstructured content. This is coupled with a robust data conditioning and enrichment pipeline powered by AI to generate metadata, extract semantic and spatial attributes, and apply lineage, quality, and zero-trust tagging.

Key Contributions

1. Automated Metadata Generation & AI-Driven Search
    a. Our platform uses machine learning to extract metadata and classify content without human intervention, creating rich, analysis-ready descriptions.
    b. Metadata supports ISO 19115 and other SDI-aligned standards, enabling plug-and-play interoperability across domains.
    c. Integration with LLM-based semantic and spatial search allows natural language queries, improving accessibility and discoverability across government and non-government users.
2. Distributed Indexing and Edge Processing
    a. Our lightweight Agents run close to the data—across data center boundaries or on edge nodes—executing local ingestion, enrichment, and transformation tasks.
    b. This architecture supports national datasets derived from decentralized sources, respecting local nuances while enabling aggregation and conflation.
3. Real-Time Data Integration & Self-Updating Catalogs
    a. Voyager continuously monitors content changes and updates metadata in real time, supporting self-updating portals and data governance frameworks.

    b. Content includes Earth observation, sensor feeds, analytic reports, models, and derived products, harmonized through configurable pipelines.
4. Trust, Lineage, and Zero Trust Integration
    a. Metadata includes provenance, lineage, classification labels, and zero-trust access tiers.
    b. Supports DoD-level compliance and best practices for data reliability and secure access, making the system suitable for sensitive environments.
5. Support for SDI Capacity Building
    a. We collaborate with internship programs (e.g., FGDC GeoPathways) to deliver training on SDI metadata, data governance, and AI.
    b. Our platform is used in live education environments, creating a bridge between operational capability and professional development.

Governance Model & Alignment with SDI Goals

Our approach reflects pragmatic governance: COTS software is delivered directly to agencies and integrated by system integrators, enabling local flexibility while maintaining national interoperability. Our metadata-driven architecture harmonizes local and global schemas, supporting national-level aggregation without requiring rigid centralization. By leveraging open standards such as OGC WFS/WMS, OpenSearch, and ISO metadata, our platform ensures compatibility and longevity.

Conclusion & Request for Participation

Voyager's SDI platform is a proven, forward-looking solution that demonstrates how machine learning, real-time integration, and trusted metadata can operationalize the vision of a modern SDI. We request inclusion in the SDI Modernization Project as a technology demonstrator and best-practice contributor.

We are excited to collaborate with the OGC and global stakeholders to shape a scalable, interoperable, and inclusive future for geospatial data infrastructure.