

Semantic Layer Strategy for Linked Data Investigations



The Challenge

A government organization sought to more effectively exploit their breadth of data generated by investigation activity of criminal networks for comprehensive case building and threat trend analysis. The agency struggled to meaningfully connect structured and unstructured data from multiple siloed data sources, each with misaligned naming conventions and inconsistent data structures and formats. Users had to have an existing understanding of underlying data models and jump between multiple system views to answer core investigation analysis questions, such as “What other drivers have been associated with this vehicle involved in an inspection at the border?” or “How often has this person in the network traveled to a known suspect storage location in the past 6 months?”

These challenges manifest in data ambiguity across the organization, complex and resource-intensive integration workflows, and underutilized data assets lacking meaningful context, all resulting in significant cognitive load and burdensome manual efforts for users conducting intelligence analyses. The organization recognized the need to define a robust semantic layer solution grounded in data modeling, architecture frameworks, and governance controls to unify, contextualize, and operationalize data assets via a “single pane of intelligence” analysis platform.



The Solution

To address these challenges, EK engaged with the client to develop a strategy and product vision for their semantic solution, paired with foundational semantic data models for meaningful data categorization and linking, architecture designs and tool recommendations for integrating and leveraging graph data, and entitlements designs for adhering to complex security standards. With phased implementation plans for incremental delivery, these components lay the foundations for the client’s solution vision for advanced entity resolution and analytics capabilities. The overall solution will power streamlined consumption experiences and data-driven insights through the “single pane of intelligence.”

The core components of EK’s semantic advisory and solution development included:

Semantic Layer Strategy for Linked Data Investigations

Product Vision and Use Case Backlog:

EK collaborated with the client to shape a product vision anchored around the solution's purpose and long-term value for the organization. Complemented with a strategic backlog of priority use cases, EK's guidance resulted in a compelling narrative to drive stakeholder engagement and organizational buy-in, while also establishing a clear and tangible vision for scalable solution growth.

Solution Architecture Design:

EK's solution architects gathered technical requirements to propose a modular solution architecture consisting of multiple, self-contained technology products that will provision a comprehensive analytic ecosystem to the organization's user base. The native graph architecture involves a graph database, entity resolution services, and a linked data analysis platform to create a unified, interactive model of all of their data assets via the "single pane of intelligence".

Tool Selection Advisory:

EK guided the client on selecting and successfully gaining buy-in for procurement of a graph database and a data analysis and visualization platform with native graph capabilities to plug into the semantic and presentation layers of the recommended architecture design. This selection moves the organization away from a monolithic, document-centric platform to a data-centric solution for dynamic intelligence analysis in alignment with their graph and network analytics use cases. EK's experts in unified entitlements and industry security standards also ensured the selected tooling would comply with the client's database, role, and attribute-based access control requirements.

Taxonomy and Ontology Modeling:

In collaboration with intelligence subject matter experts, EK guided the team from a broad conceptual model to an implementable ontology and starter taxonomy designs to enable a specific use case for prioritized data sources. EK advised on mapping the ontology model to components of the Common Core Ontologies to create a standard, interoperable foundation for consistent and scalable domain expansion.

Phased Implementation Plan:

Through dedicated planning and solutioning sessions with the core client team, EK developed an iterative implementation plan to scale the foundational data model and architecture components and unlock incremental technical capabilities. EK advised on identifying and defining starter pilot activities, outlining definitions of done, necessary roles and skillsets, and required tasks and supporting tooling from the overall architecture to ensure the client could quickly start on solution implementation. EK is directly supporting the team on the short-term implementation tasks while continuing to advise and plan for the longer-term solution needs.

Semantic Layer Strategy for Linked Data Investigations



The EK Difference

Semantic Layer Solution Strategy:

EK guided the client in transforming existing experimental work in the knowledge graph space into an enterprise solution that can scale and bring tangible value to users. From strategic use case development to iterative semantic model and architecture design, EK provided the client with repeatable processes for defining, shaping, and productionalizing components of the organization's semantic layer.

LPG Analytics with RDF Semantics:

To support the client's complex and dynamic analytics needs, EK recommended an LPG-based solution for its flexibility and scalability. At the same time, the client's need for consistent data classification and linkage still pointed to the value of RDF frameworks for taxonomy and ontology development. EK is advising on how to bridge these models for the translation and connectivity of data across RDF and LPG formats, ultimately enabling seamless data integration and interoperability in alignment with semantic standards.

Semantic Layer Tooling:

EK has extensive experience advising on the evaluation, selection, procurement, and scalable implementation of semantic layer technologies. EK's qualitative evaluation for the organization's linked data analysis platforms was supplemented by a proprietary structured matrix measuring down-selected tools against 50+ functional and non-functional factors to provide a quantitative view of each tool's ability to meet the organization's specific needs.

Semantic Modeling and Scalable Graph Development:

Working closely with the organization's domain experts, EK provided expert advisory in industry standards and best practices to create a semantic data model that will maximize graph benefits in the context of the client's use cases and critical data assets. In parallel with model development, EK offered technical expertise to advise on the scalability of the resulting graph and connected data pipelines to support continued maintenance and expansion.

Unified Entitlements Design:

Especially working with a highly regulated government agency, EK understands the critical need for unified entitlements to provide a holistic definition of access rights, enabling consistent and correct privileges across every system and asset type in the organization. EK offered comprehensive entitlements design and development support to ensure access rights would be properly implemented across the client's environment, closely tied to the architecture and data modeling frameworks.

Semantic Layer Strategy for Linked Data Investigations

Organizational Buy-In:

Throughout the engagement, EK worked closely with project sponsors to craft and communicate the solution product vision. EK tailored product communication components to different audiences by detailing granular technical features for tool procurement conversations and formulating business-driven, strategic value statements to engage business users and executives for organizational alignment. Gaining this buy-in early on is critical for maintaining development momentum and minimizing future roadblocks as wider user groups transition to using the productionalized solution.



The Results

The retailer and EK's long-standing partnership allowed them to successfully design, develop, and deploy three major releases for the digital library into the retailer's production environment, resulting in increased time savings and reduced costs related to developing learning content, as well as a workforce with the necessary skills and expertise to do their jobs effectively and adapt to a rapidly changing environment. The retailer was able to gain an improved visibility into each associate's capabilities and an enhanced ability to identify gaps in their learning content, resulting in more targeted learning experiences to upskill employees and guide their professional development. Additionally, the renewed consistency, reuse, and findability of learning materials allowed the retailer to mitigate any repercussions associated with on-site store safety, diversity and inclusion, and employee and customer health and wellbeing.

Enterprise Knowledge (EK) is a services firm that integrates Knowledge Management, Information Management, Information Technology, and Agile Approaches to deliver comprehensive solutions. Our mission is to form true partnerships with our clients, listening and collaborating to create tailored, practical, and results-oriented solutions that enable them to thrive and adapt to changing needs.

Our core services include strategy, design, and development of Knowledge and Information Management systems, with proven approaches for Data and Information Management, Knowledge Graph Implementation in support of NLP, ML, and AI initiatives, Taxonomy Design, Project Strategy and Roadmapping, Brand and Content Strategy, Change Management and Communication, and Agile Transformation and Facilitation. At the heart of these services, we always focus on working alongside our clients to understand their needs, ensuring we can provide practical and achievable solutions on an iterative, ongoing basis.