

CUSTOMER CASE STUDY

Digitizing Engineering Intelligence with RDF Semantic Modeling

Transforming manual P&ID workflows into automated, compliant knowledge graphs

Solution: RDF-Powered Knowledge Graphs

Industry: Industrial Engineering

Use Case Focus: P&ID Data Digitization

GOALS

- Automate complex P&ID diagram data extraction
- Establish standard-compliant semantic modeling
- Modern engineering facilities rely heavily on Piping and Instrumentation Diagrams to
- However, extracting critical technical data from these diagrams remains a highly manual

CHALLENGES

- Manual extraction from P&ID diagrams is slow and error-prone
- Aligning complex entities with custom industrial ontologies is difficult
- Engineering teams struggle with fragmented workflows that delay safety-critical
- The lack of standardized industrial ontologies makes alignment complex

SOLUTIONS

- Deploy AI-powered QA/QC workflows to automate data extraction
- Utilize RDF and reasoning engines for compliant semantic modeling
- Resolve and map entities dynamically across industrial ontologies
- These persistent data silos ultimately increase operational risks and prevent engineers

RESULTS

- Accelerated system insight access for rapid isolation planning
- Created scalable, interoperable data structures for advanced analysis
- Improved operational safety through standardized semantic context
- To address these operational challenges, the solution combines AI-driven data extraction

EXECUTIVE SUMMARY

Engineering teams routinely struggle with manual, fragmented data extraction from Piping and Instrumentation Diagrams, leading to severe operational bottlenecks and increased safety risks. By combining AI-driven data extraction with RDF-based semantic modeling, this modern solution automates the conversion of complex industrial schematics into standard-compliant knowledge graphs. The resulting digital transformation provides engineers with real-time, context-aware insights, streamlining critical isolation planning and enhancing system-wide decision-making capabilities across the enterprise.

The Bottleneck of Manual Diagram Analysis

Modern engineering facilities rely heavily on Piping and Instrumentation Diagrams to manage complex operations. However, extracting critical technical data from these diagrams remains a highly manual, slow, and error-prone process. Engineering teams struggle with fragmented workflows that delay safety-critical decisions, such as isolation planning and equipment maintenance. The lack of standardized industrial ontologies makes alignment complex, leaving organizations without a cohesive view of their physical assets. These persistent data silos ultimately increase operational risks and prevent engineers from accessing the context-driven insights needed to optimize facility performance.

Semantic Modeling and AI-Driven Extraction

To address these operational challenges, the solution combines AI-driven data extraction with standard-compliant RDF semantic modeling. Automated workflows parse complex engineering diagrams and apply rigorous QA/QC checks to ensure extraction accuracy. By utilizing custom industrial ontologies and reasoning engines, raw data is contextualized and dynamically mapped to a unified structure. This robust entity resolution process bridges the gap between disparate data systems, successfully transforming unstructured diagrams into standard-compliant digital assets. The resulting semantic layer provides a highly scalable and interoperable foundation that supports advanced upstream and downstream analysis.

Unlocking Context-Aware Engineering Decisions

The final layer of the solution visualizes and analyzes this enriched semantic data through intuitive Neo4j knowledge graphs. This configuration enables engineers to execute complex queries and instantly visualize system dependencies, which is critical for planning safe asset isolations and maintenance routines. By converting static diagrams into active digital intelligence, organizations achieve higher operational efficiency and improved safety compliance. The transition from manual data extraction to an automated, RDF-powered knowledge graph represents a significant advancement in digital engineering, allowing teams to make faster, safer, and better-informed decisions.