



Softlink Analytics

P&ID Digital Platform

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Agenda

Introduction Need for P&ID Digitization	3
Enterprise Knowledge Intelligence Hub (EKIH)	4
Demo	12
Key Takeaways	14
Success Stories	15
Appendix: Solution Architecture	16
Q/A	18

Need For Digitization of Engineering Diagrams



P&ID Data is static

Process and instrumentation diagrams along with their documentation are commonly stored in static environments



Instrumentation information not available within the same view

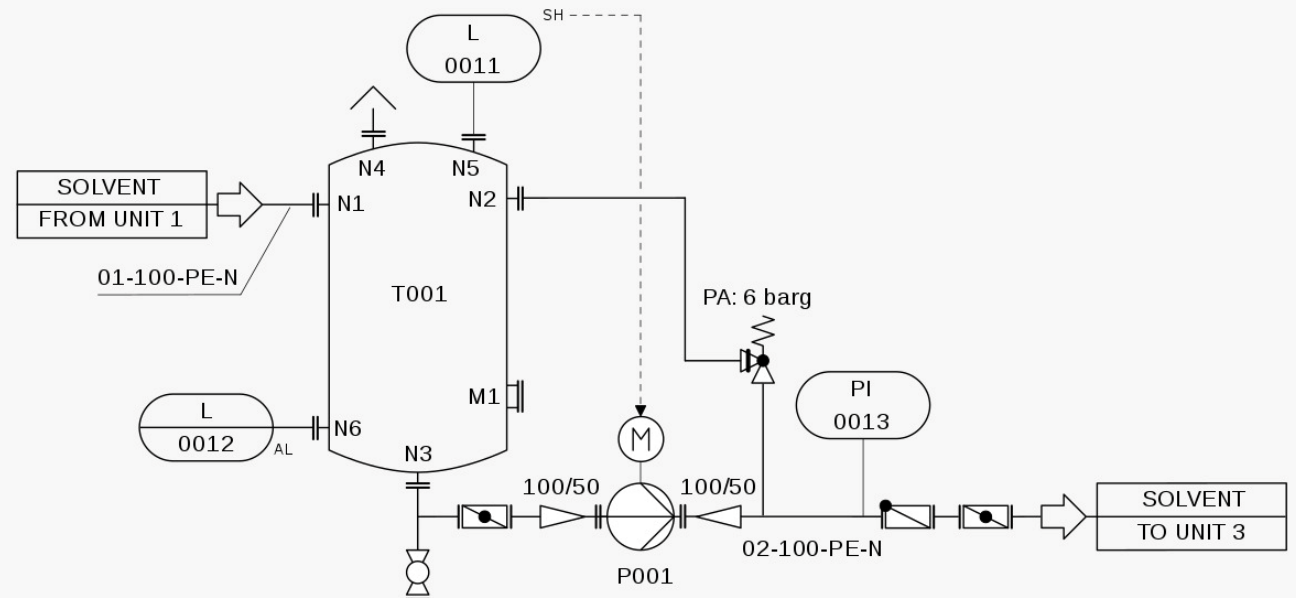
Data Tables of Instruments and components are not available in the same view as the flow diagrams



Field reports are often unstructured

Inspection reports are often written in free hand and hence cannot be ingested into the database

	T001	P001
SERVICE	STORAGE TANK	FEED PUMP
DATA	DIAMETER: 1000 mm HEIGHT: 3000 mm CAPACITY: 2.4 m ³	FLOW RATE: 5 m ³ /h DIFF. PRESSURE: 2.5 bar
DESIGN PRESSURE	10 barg	10 barg
DESIGN TEMP.	50 °C	50 °C



Solution Overview

Extract entities using Deep Learning

- Identify objects in P&ID diagrams using deep learning.
- Establish connectivity with pixel-based algorithms.
- Generate network graphs representing process flows.

Deliver advanced analytics through powerful visualizations

- Analyze data in real-time through intuitive visualizations.
- Accelerate knowledge transfer, aiding new users in quickly.



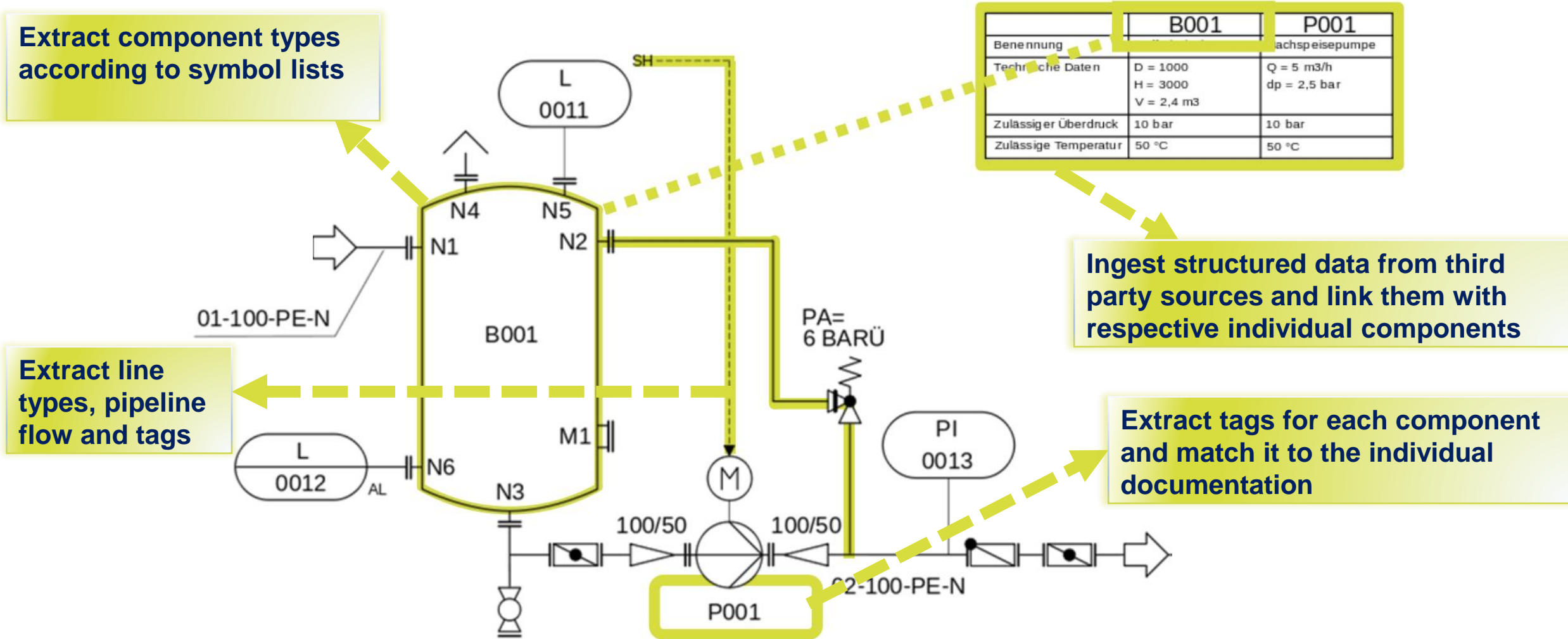
Find context from unstructured data

- Use LLMS to extract valuable context from unstructured field and inspection reports.
- Seamlessly integrate into the existing graph, enriching it with additional context.

Use LLMs to talk to your data

- Query Neo4j graphs through plain English, simplifying data interaction.
- Self Learning System evolves over time to adapt to frequent requests.

P&ID Data Extraction using Deep Learning



Find Context from Unstructured Data



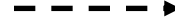
Unstructured Data

Field and Inspection Reports filed by technicians.



Extract text using LLMs

Use Large Language Models to extract relevant text from Unstructured reports



Prompt Engineering

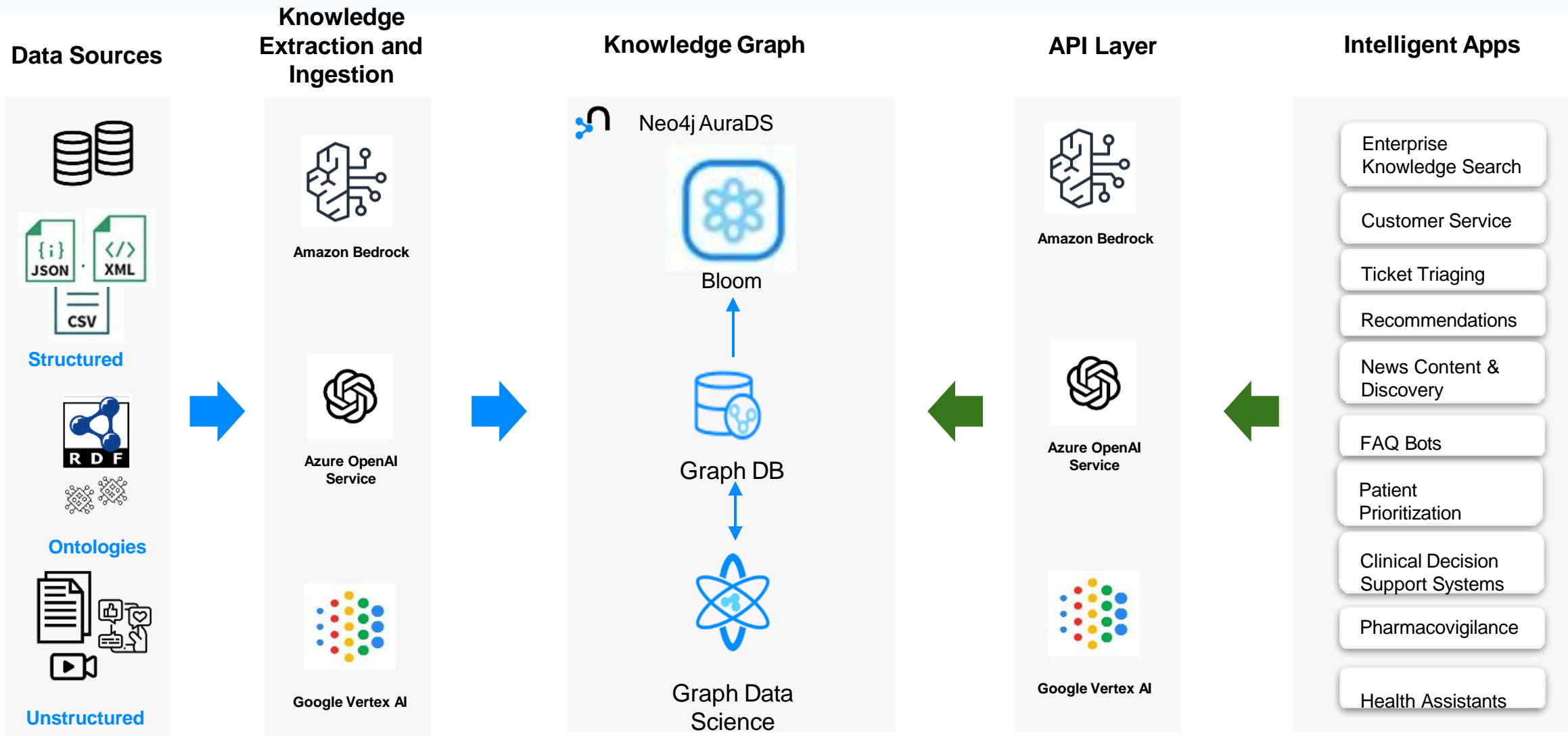
Generate Entities, Enhance context and create new relationships based on text from reports



Graph Integration

Automatically generate cypher to add the extracted information to the graph.

Knowledge Graph and Gen-AI Reference Architecture



Knowledge Graph Creation From Unstructured Data

What Works Well?



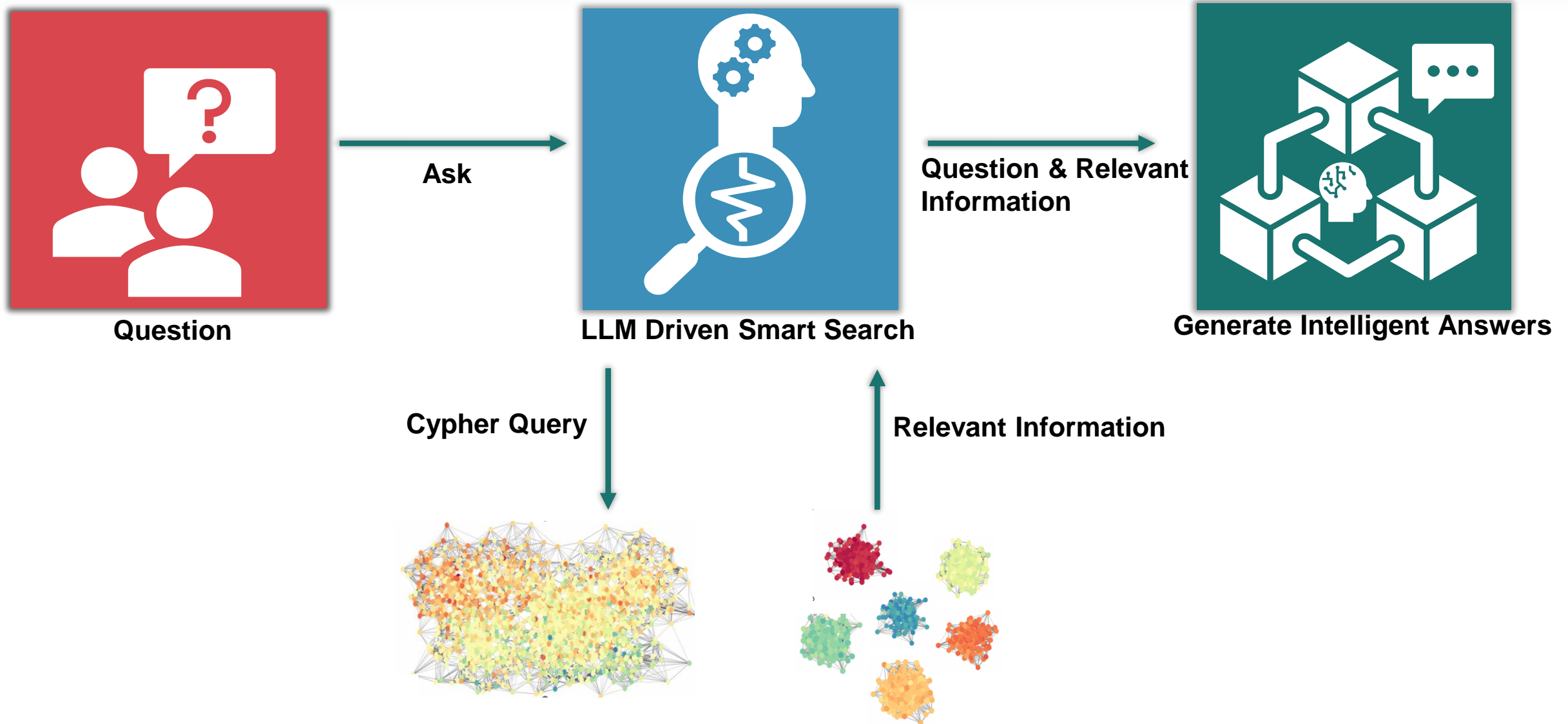
- Extract entities **with a provided graph schema**
- **Disambiguate Entities**
- **Generating structured data** for Cypher insert templates
- Using **few-shot learning** examples

What Doesn't Work Well



- Extract all entities **without providing a schema**
- **Solely relying on LLMs to automatically create & maintain** enterprise Knowledge Graph
- **Zero-shot learning** for Cypher generation

Use LLMs To Talk to Your Data



Retrieval Augmented Generation

What Works Well?



- Gather context from graph via **embedding**, Cypher, or full-text search
- **Context improving LLM answers**
- **LLM returning IDs of context** used for tracking provenance
- Integration with **LangChain** and **LlamaIndex**
- **Returning human understandable answer**
- **Vector search** with embeddings

What Doesn't Work Well

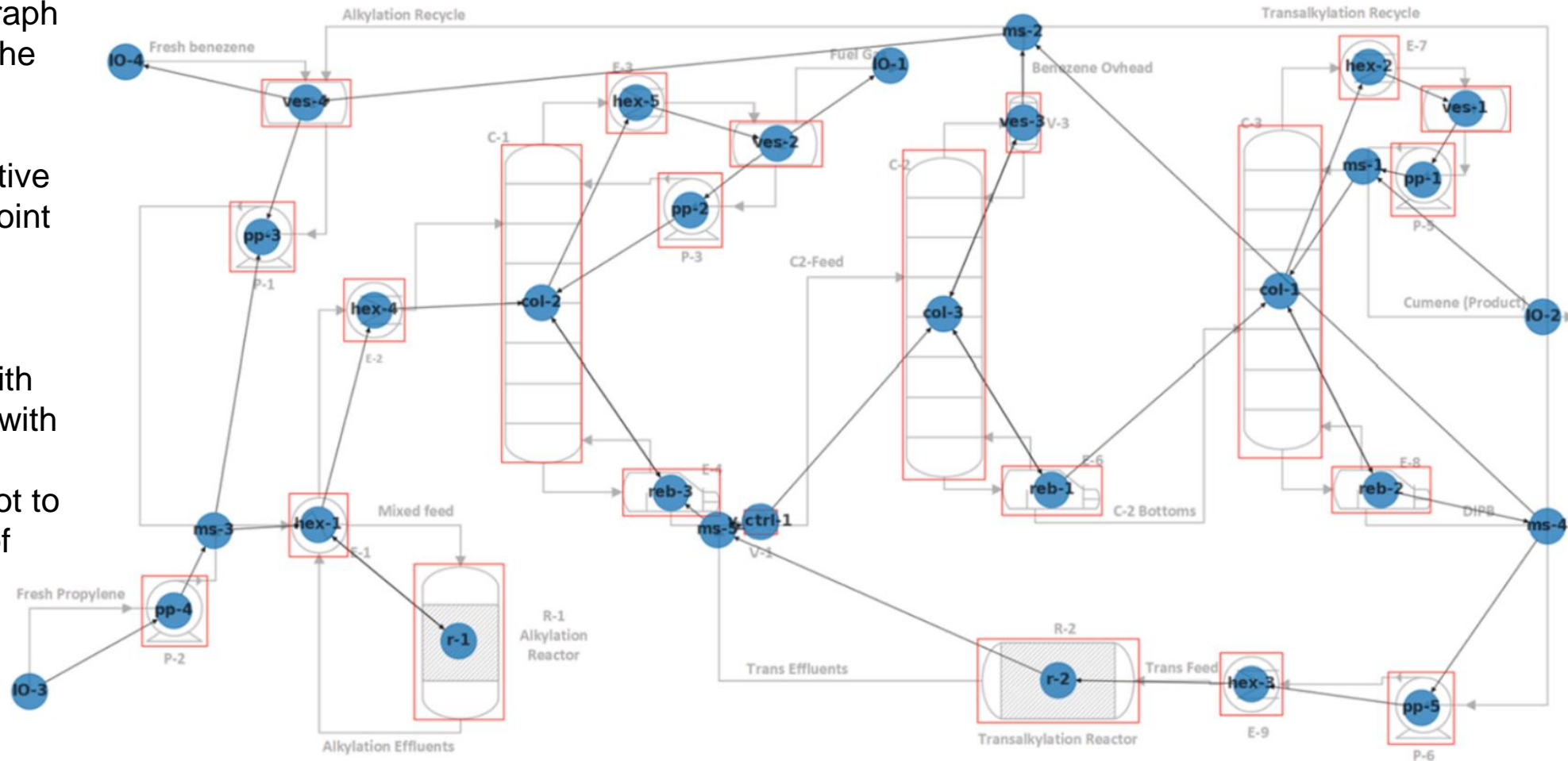


- **Limited context** token-length
- Large contexts can **degrade quality** and add monetary cost
- LLM models still **hallucinate**
- **Lacking metrics on quality / effectiveness**

Enterprise Knowledge Intelligence Hub (EKIH)

KEY FEATURES

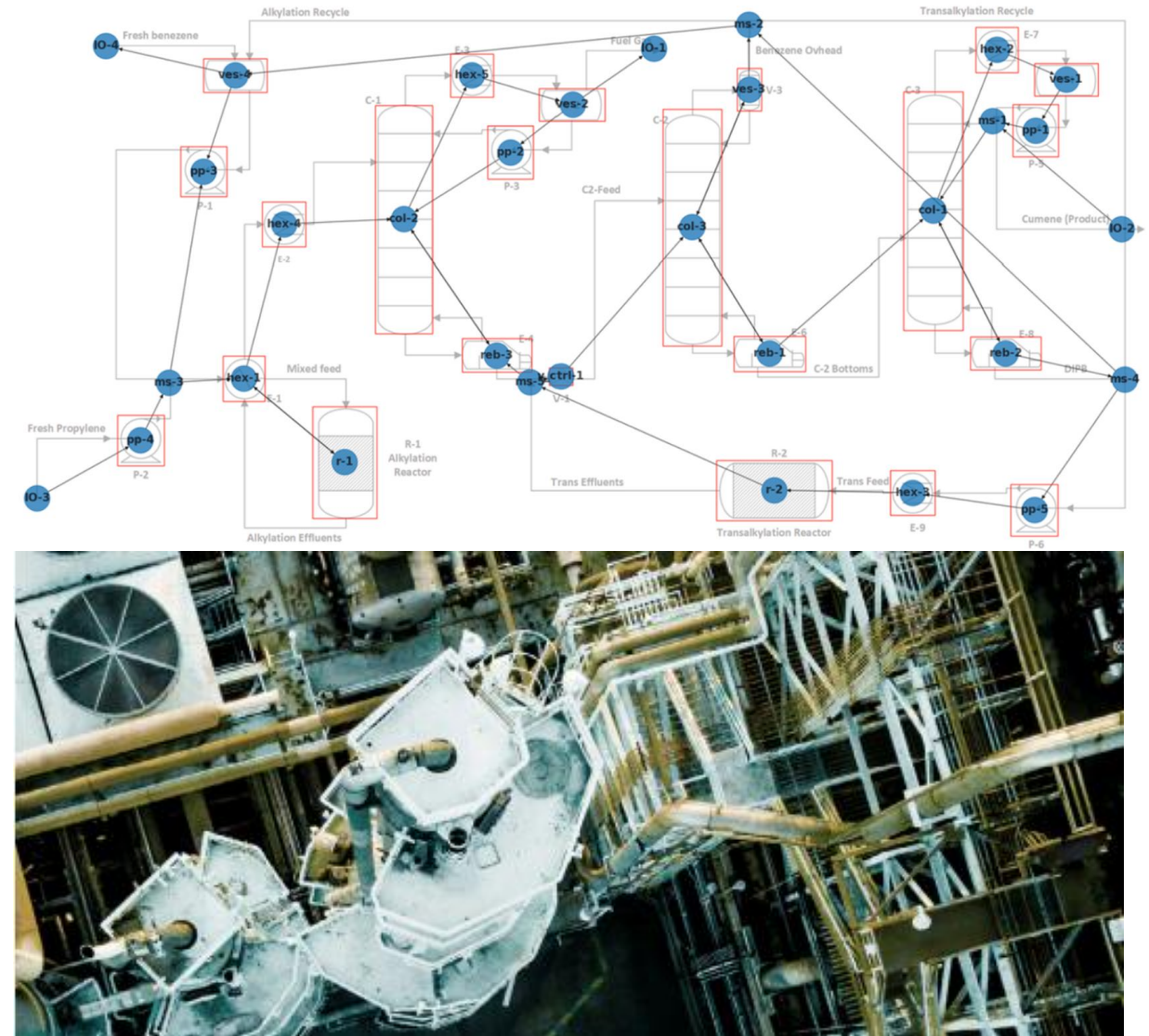
- Visualize the graph data on top of the P&I Diagram
- Highlight Selective areas and pinpoint fault locations
- Have a conversation with our digital twin with integrated AI powered chatbot to identify areas of interest.



Enterprise Knowledge Intelligence Hub (EKIH)

USE CASES

- **Failure Isolations** in complex process networks
- **Pattern Identification** and assimilation in real time at scale.
- **Process Optimization** using Graph Clustering algorithms
- All Stakeholders of Manufacturing can acquire knowledge seamlessly, reducing overheads and **knowledge transfer** time significantly.
- **Nth Degree impact analysis** through graph traversal in real time.
- **Componentry instrumentation and Process standardization** can be achieved effectively.



Key Takeaways

P&ID Digitization

- **Extract all Elements and flow** from Diagrams
- **Consolidate Disparate data Silos** into a single Source of Truth.
- **Integrate Unstructured Reports** using LLMs
- Operators, executives, SMEs, On-Site Staff, Data Scientists can all access the data net



EKIH*

- **Exponentially Increase data accessibility**
- **Contextual exploration**
- **Combine P&ID layout** with **dynamic graph traversal**
- **Talk to your data** using high accuracy LLMs
- **Drive down operational costs**
- **Exponentially fast knowledge transfer**



1

INCREASE
PRODUCTION
AVAILABILITY



2

SIGNIFICANTLY
REDUCE
OPERATING
COSTS



3

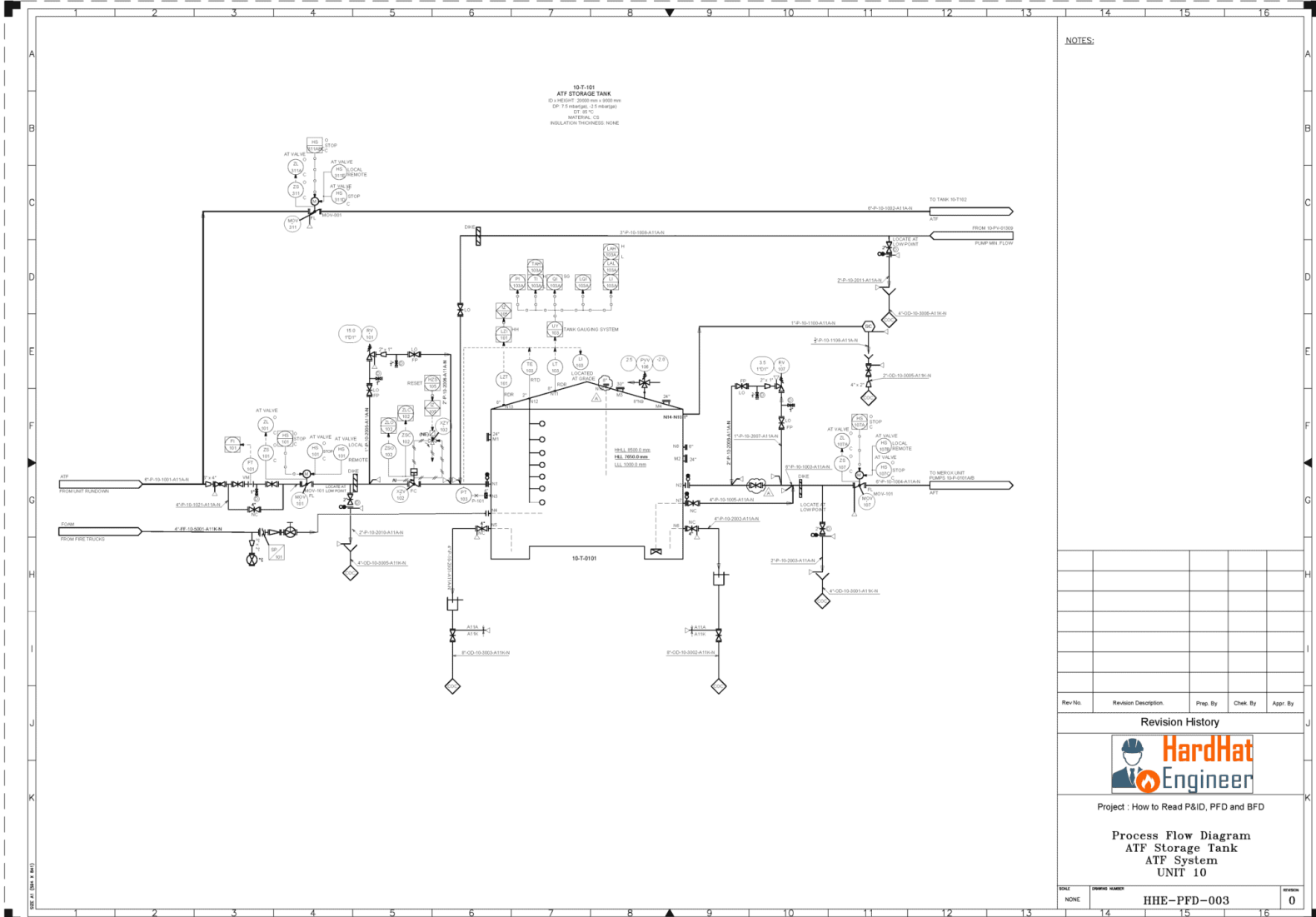
IMPROVE SAFETY
FOR BOTH
PERSONNEL AND
EQUIPMENT



4

MEET NET-
ZERO GOALS

Example P&ID Diagrams



A Few P&ID Symbols



Physical Instrument



Part of a shared display
and shared control in a DCS

	Centrifugal Compressor
	Centrifugal Compressor (Turbine Driven)
	Centrifugal Compressor

BALL VALVES Ball	 Hydraulic	PLUG VALVES Plug	 Motor	BUTTERFLY VALVES Butterfly	 Pneumatic
DIAPHRAGM VALVES Diaphragm	 Motor	SAFETY PSV	RELIEF PRV	QUARTER TURN Quarter Turn Valve Double Acting	 Quarter Turn Valve Spring Acting

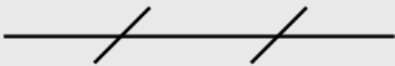
Piping (Major Projcess)



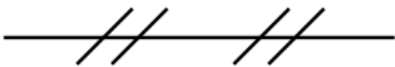
Connection to Process (Minor Process)



Undefined Signal



Pneumatic Signal



Electric Signal



Typical P&ID Component Data Tble

Equipment	Attribute	Reducer Specification	Ball Valve Specification
Tag No.	-	RED-101	BV-102
Type		Concentric Reducer	Floating Ball Valve
Size	Inlet (inch)	4	3
	Outlet (inch)	3	3
Material	Body	Carbon Steel (ASTM A234 WPB)	Carbon Steel (ASTM A216 WCB)
	Trim	-	SS 316
Rating	Pressure Class	300	300
	Temperature (°F)	-20 to 650	-20 to 800
Connection	-	Welded	Flanged
Operator	-		Manual Lever
Model No	-	RD-CR300-4X3	BV-F300-3X3
Manufacturer	-	Example Reducer Co.	Example Valve Inc.
Notes	-	Ensure proper alignment during installation	Suitable for on-off services

Customer Success Stories

USE CASE BRIEF

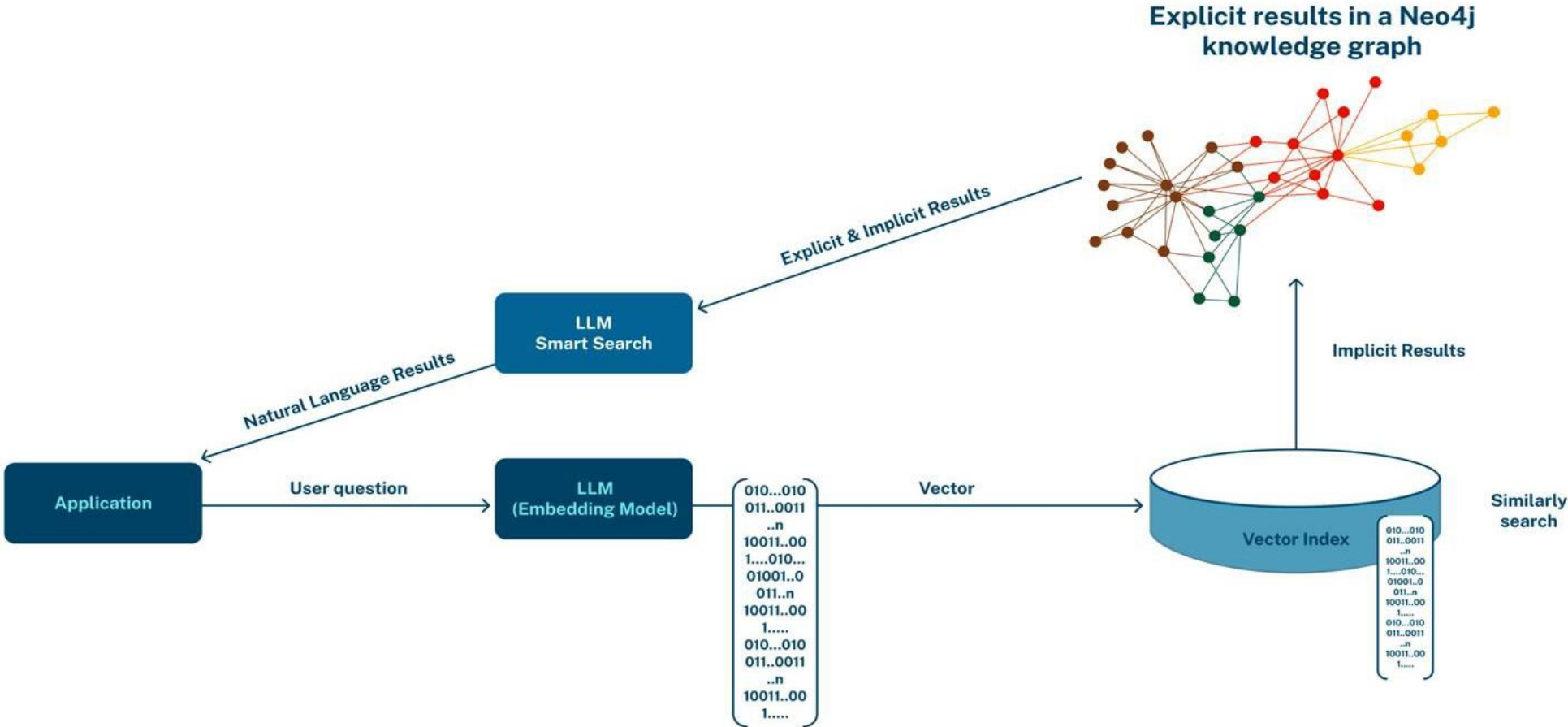
- A **global energy company in Malaysia** is leveraging Neo4j to power their intelligent search capabilities, combining Neo4j with LLMs to provide the best experience to their users. This solution helps them **digitise their maintenance records** and makes it searchable with higher accuracy and deeper context.
- This firm's repair and maintenance staff (Engineering department) are tasked to keep expensive machinery at rigs and refineries working with minimal downtime and no room for mistakes.



THE SOLUTION

- Development of the analytics data platform **Enterprise Data Hub (EDH)** and a centralized **Enterprise Knowledge Intelligence Hub (EKIH)**, allowing them to use analytics with artificial intelligence (AI) and machine learning (ML) throughout the enterprise value chain, to support innovation and amplify bottom-line performance.
- This solution brings intelligence by providing deeper context and powerful insights to the organisation's diverse and disparate data sources. It is driven by Knowledge Graph (KG) running on Neo4j graph database cluster. The **Enterprise Knowledge Intelligence Hub (EKIH)** is built upon the business' asset ontology and taxonomy, which enables more flexible and automated knowledge ingestion, reduces project life cycle, and derives meaningful contextual results from multiple data sources.

Reduce Hallucinations by Grounding LLM Responses



Grounding LLM Responses with Implicit and Explicit Search Through Neo4j's Knowledge Graph

Any questions?

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