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Supply Chain and Logistics Management with Graph & AI

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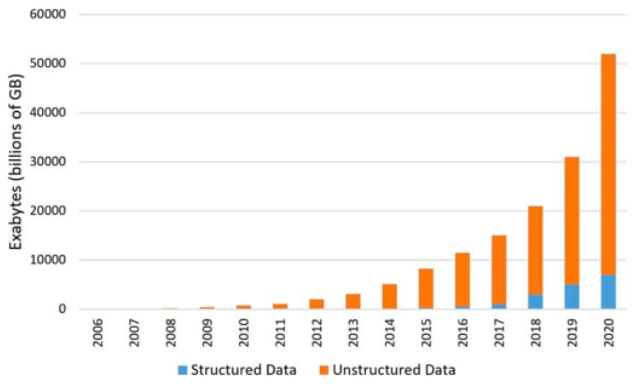
Agenda

- Intro
- Industry Applications
- Data
- Graph Examples
- Approach
- PS Kaas (incl. reference)

Graphs add business value

Data Accessibility

Estimates:
- 90% of the world's data generated in the last 2 years
- 2.5 quintillion bytes of data created daily, accelerating

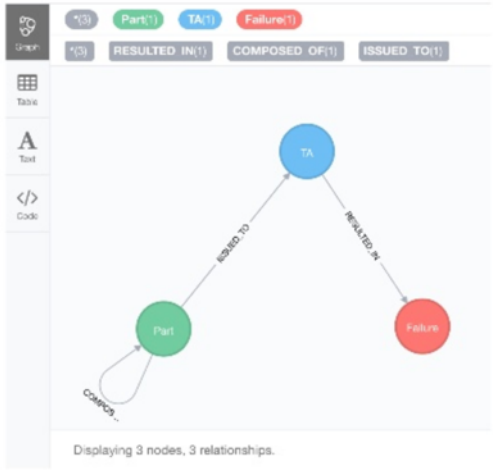


Source: Patrick Cheesman, AI Multiple

Adresses: Lots of unstructured data

Effectiveness & Usability

Largest value added in non-functional areas:
- Simplicity
- Explainability
- Performance
- Data accessability
- Compliance



Lots of overarching questions

Performance

- Extremely fast(er) queries
- Streamlines the process
- Enhances overall efficiency

Lots of delays

Applications

Landscape of supply chain analytics opportunities

Product design

Supply chain design

A. Sales, inventory, and operations planning

- Supplier risk management and incoming goods projection
- Inventory projection and scenario planning
- Forecasting accuracy evaluation and optimization

B. Sourcing	C. Production	D. Warehousing	E. Transportation	F. Point-of-sale	G. Consumer
• Cost modeling to identify cost drivers • Quantification of benefits from spend pooling • Automatic analysis of contract compliance • Aggregate demand/supply balancing	• Scheduling of energy-intensive production • Statistical quality control and tolerance optimization capabilities • Lot sizing and scheduling considering cost, inventories, and capacities	• Picking zone/ warehouse space allocation • Worker to picking zone allocation based on efficiency • Automatic stock relocation in high bay storage areas • Cleansheet cost modeling • Workload optimization	• Real-time routing and ramp allocation at warehouses • Delivery scheduling in line with consumer patterns • Cleansheet cost modeling • Dynamic routing	• Out-of-stock detection and prevention • Shelf space optimization • Channel/store allocation of goods maximizing service • Retail employee scheduling	• Credit rating to define payment terms offered • Return projection to calculate outstanding inventory • Product recommendations based on purchase history • Fraud detection

Source: McKinsey Report "Supply Chain Analytics – Gaining value from data-based decision making"

Select Graph Applications

Supply Chain Management

Challenge
- Traceability
  - High volume of parts
  - different lots
  - Various assembly & mixing levels
  - indeterminate number of stages
- Failure/changes/quality mgt

Solution
- Supply chain graph
  - Sources
  - Components
  - Sub-assemblies
  - Assemblies
  - Products
  - Etc.

Impact
- Improve Parts supply mgt
- Manufacturing efficiency
- Mitigate supplier risk & manage impact
- Manage costs, optimize procurement
- Better compare suppliers and their products

Warranty & Recall

Challenge
- Vertically integrated
- Batch processing
- Nonstandard analysis methods
- Lots of spreadsheets & meeting across many teams
- Highly distributed data / diff. tiers

Solution
- Warranty graph
  - Claim
  - Machine/Vehicle
  - Product
  - Part
  - Supplier
  - Etc.

Impact
- Improved Risk & Impact Analysis
- Identify inappropriate claims or warranty fraud
- Predict future claims
- Better manage warranty and recall risk
- Quickly uncover supplier issues (faults)

Logistics

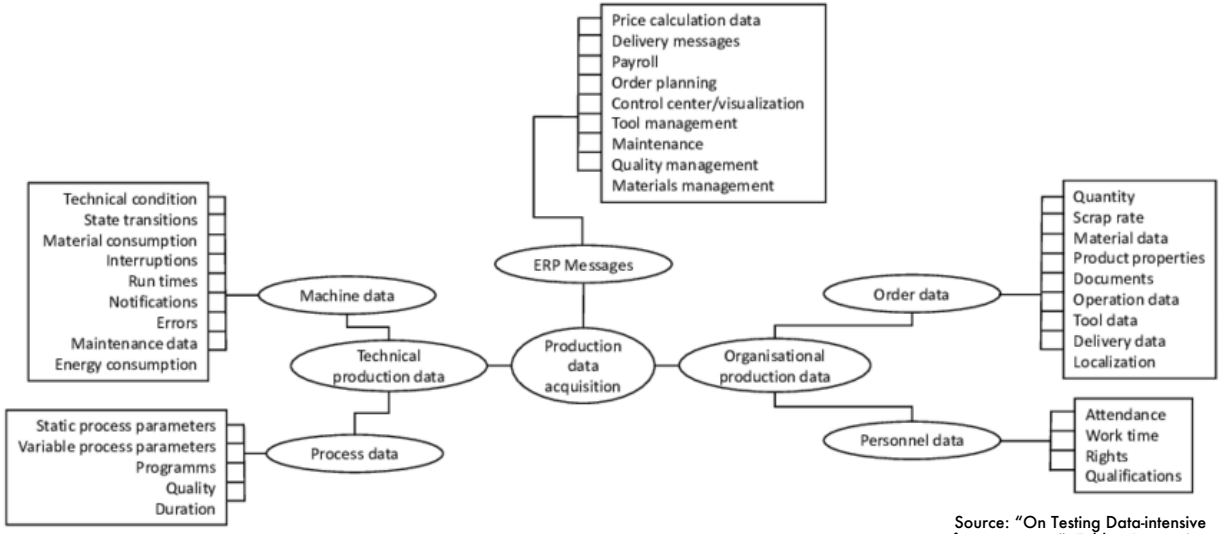
Challenge
- Various stages
- Various partners
- Scheduling
- External influences
- Physical constraints

Solution
- Logistics graph
  - Factory
  - Junctions
  - Warehouse
  - Delivery Center
  - Recipient
  - Etc.

Impact
- Improve transportation logistics
- Real-time Shipping Forecasting
- “Smarter” inventory mgt
- Improved resource & capacity planning
- Quickly onboard new partners

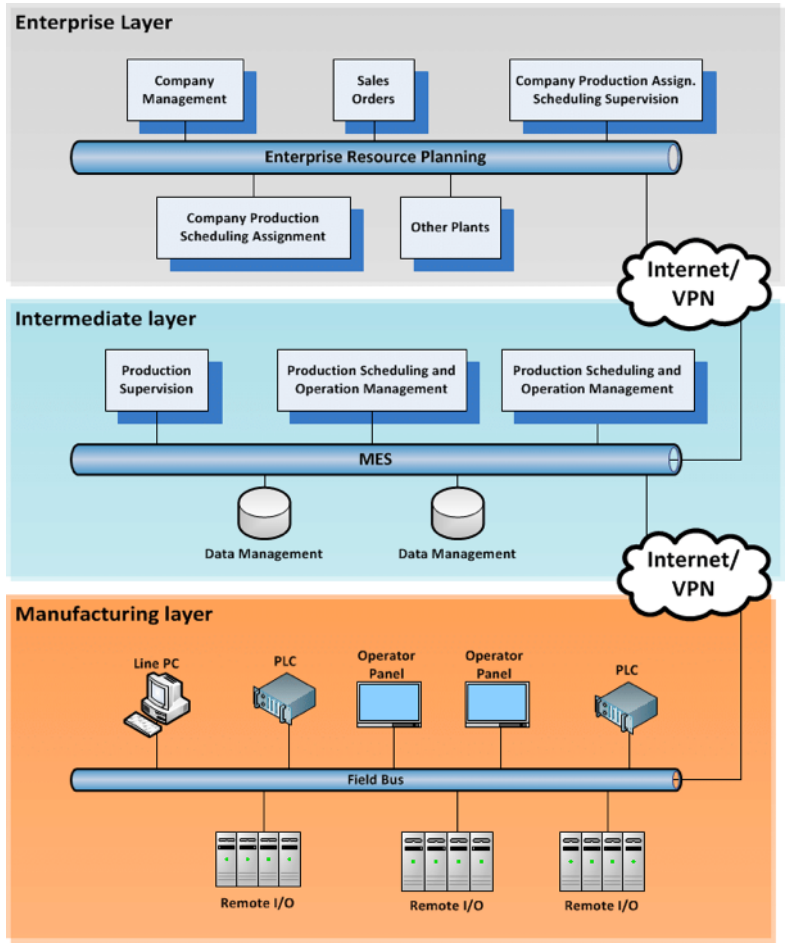
Data

Production data types & systems



Source: "On Testing Data-intensive software systems", Felder, Russo, Auers

Overview of data sources in the context of production systems



Source: "Adapter module for Self-Learning Production Systems", Di Orio

Typical Manufacturing enterprise software organization

Data pool examples

Product

- Documentation
- Processes
- Details
- Hierarchy
- Configurator

Supply Chain

- Supplier
- Parts
- Logistics
- Inventory
- Materials

Customer

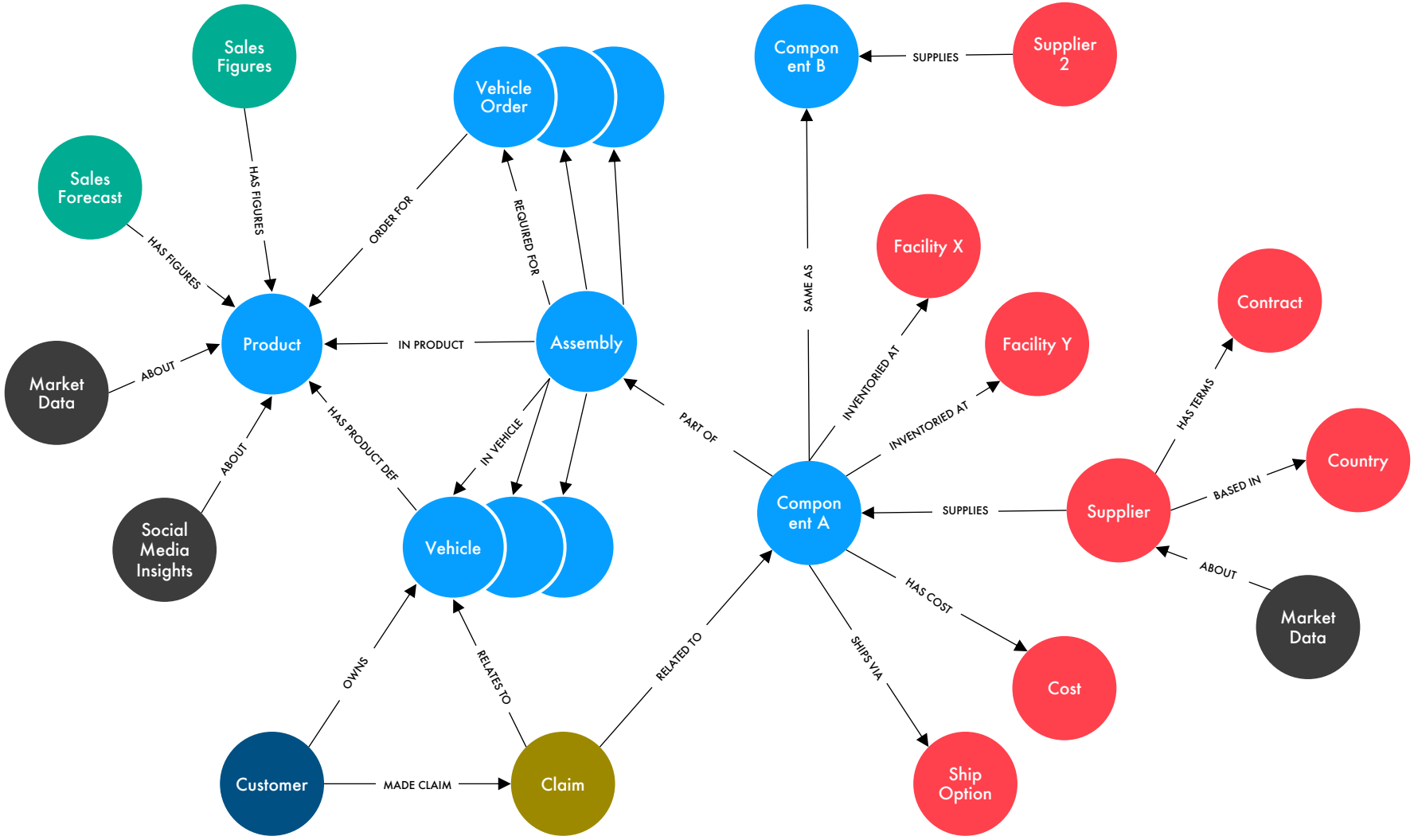
- Master data
- Machine/Vehicle
- Service history
- Interactions
- Social Media

Warranty

- Request no.
- Service type
- Work
- Parts
- “External” work

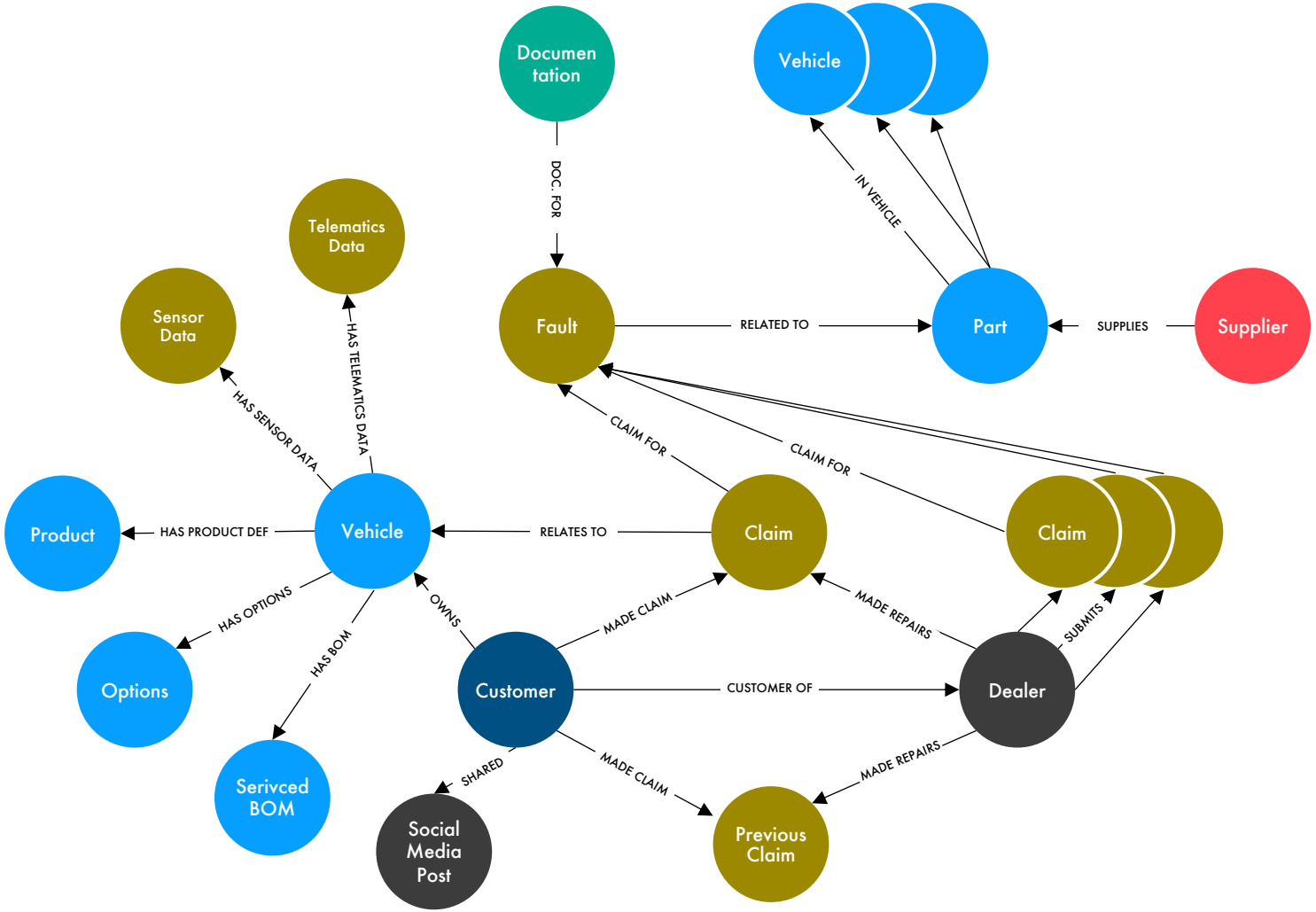
Graph Use Case Examples

Example of a Supply Chain Analytics Graph



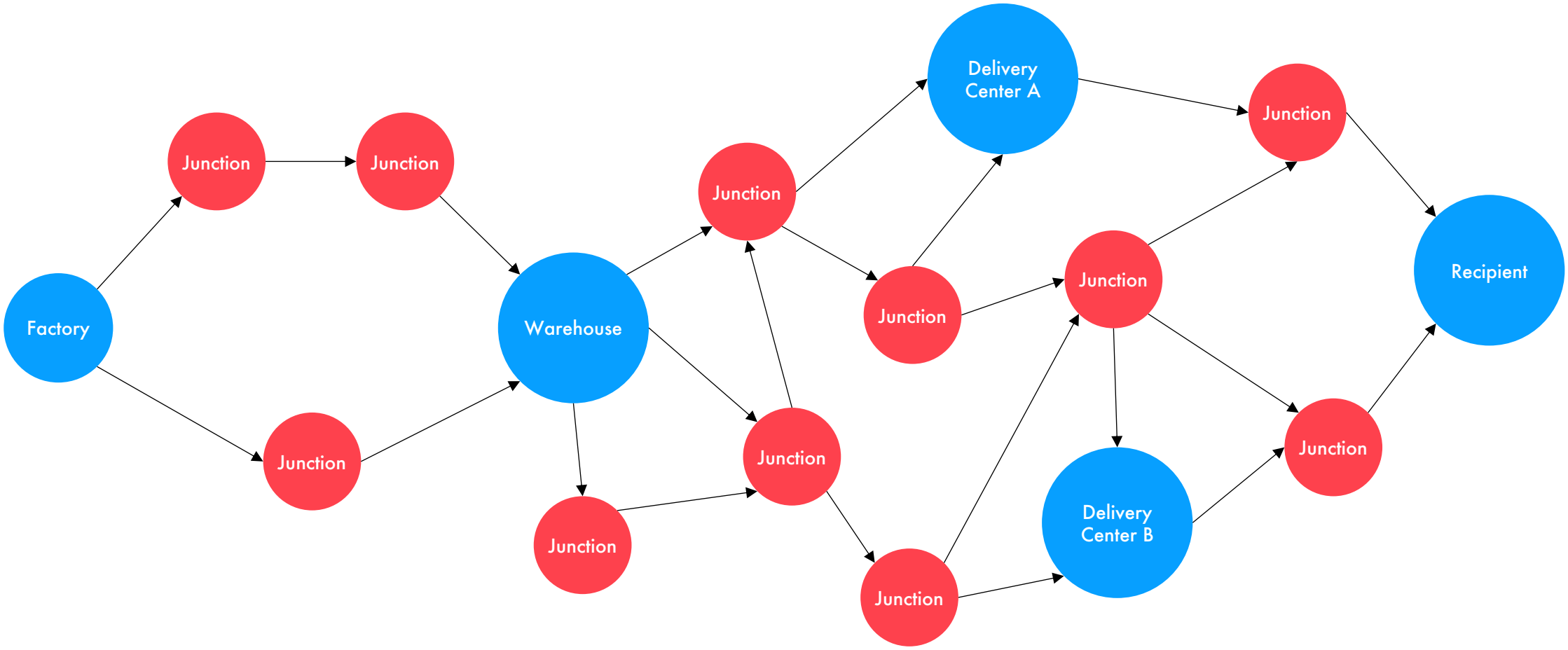
Source: Joe Depeau

Example of a Warranty Analytics Graph



Source: Joe Depeau

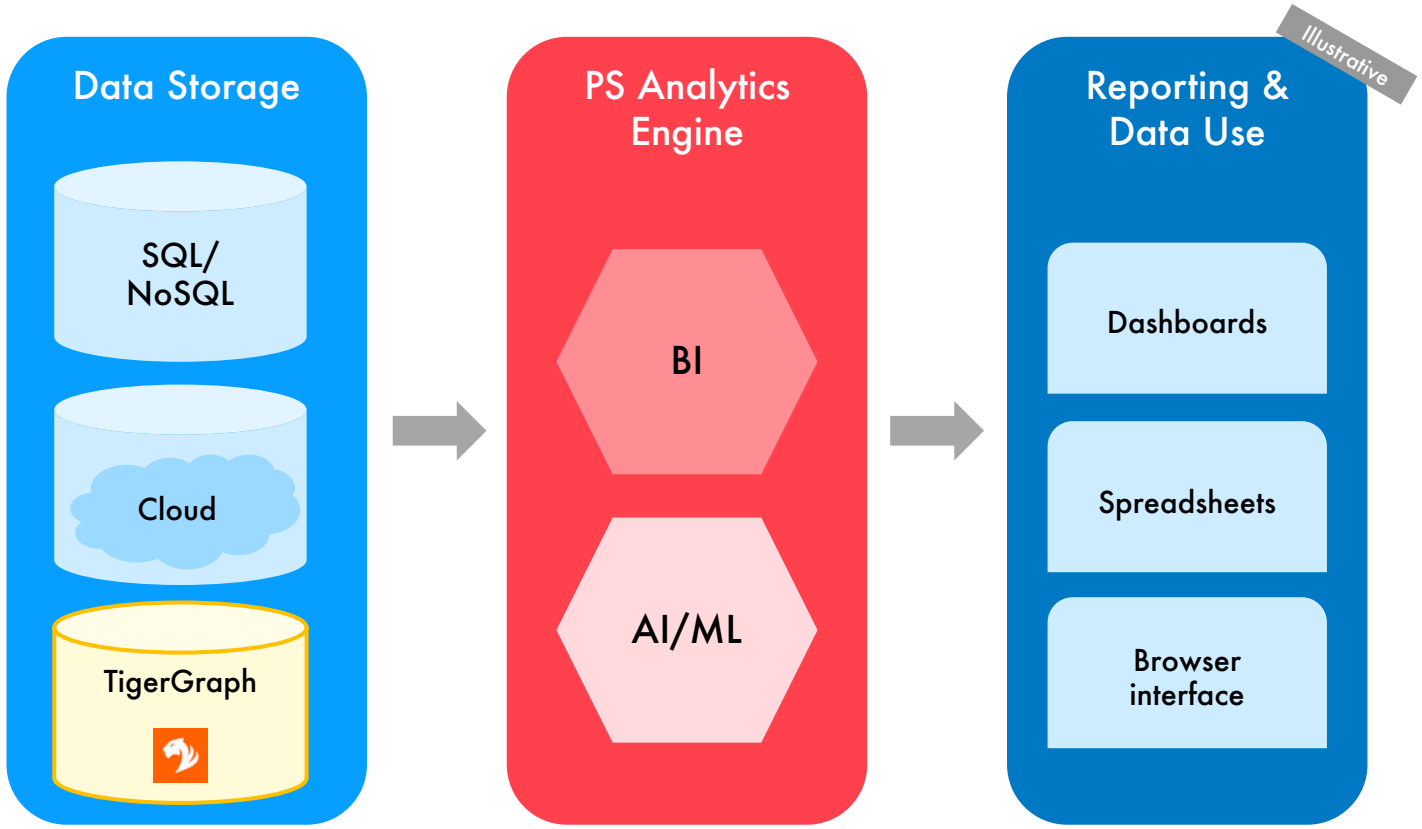
Example of a Logistics Analytics Graph*



Approach

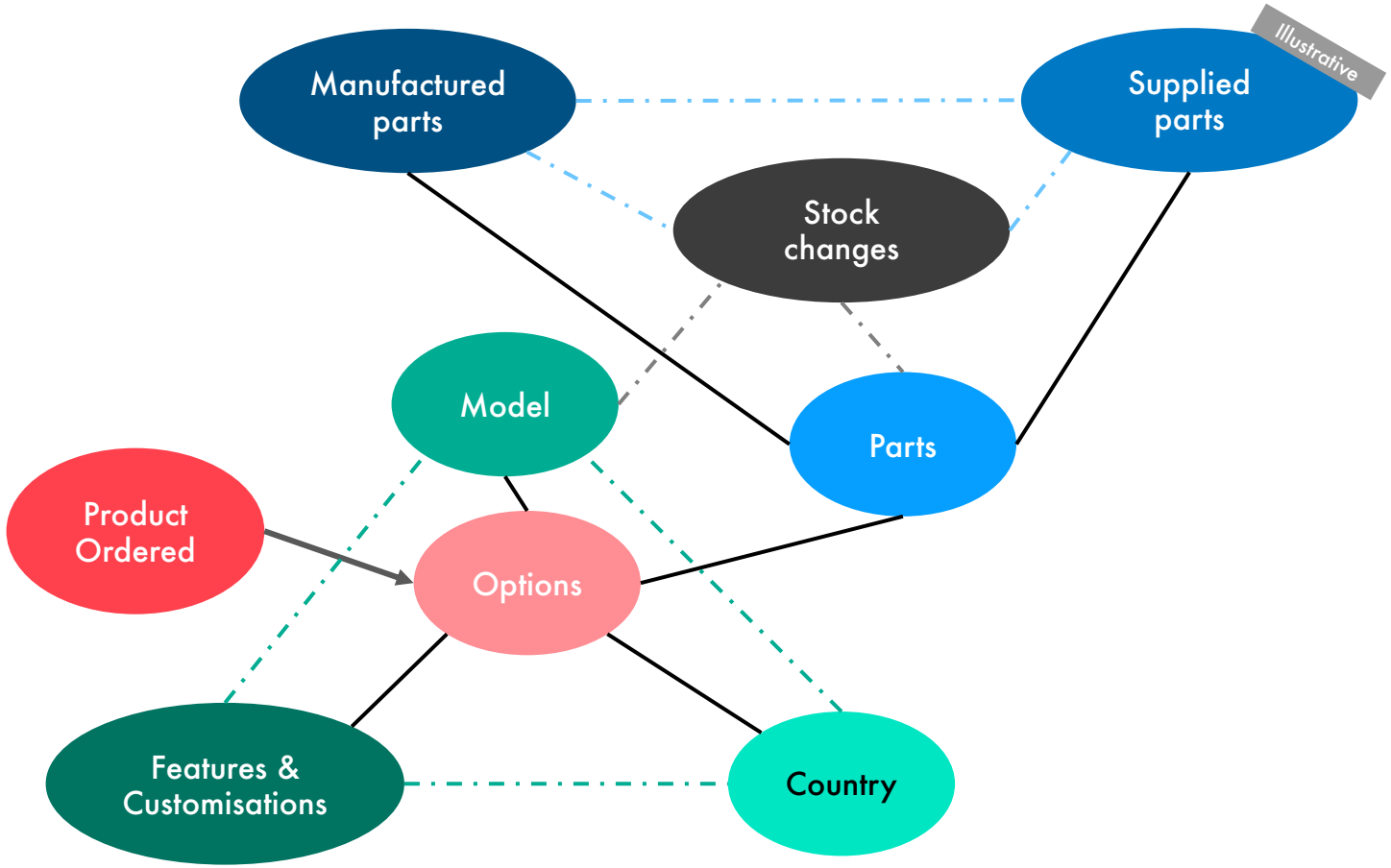
1. Seamless Technical Integration

The Graph DB can be directly implemented in your existing infrastructure



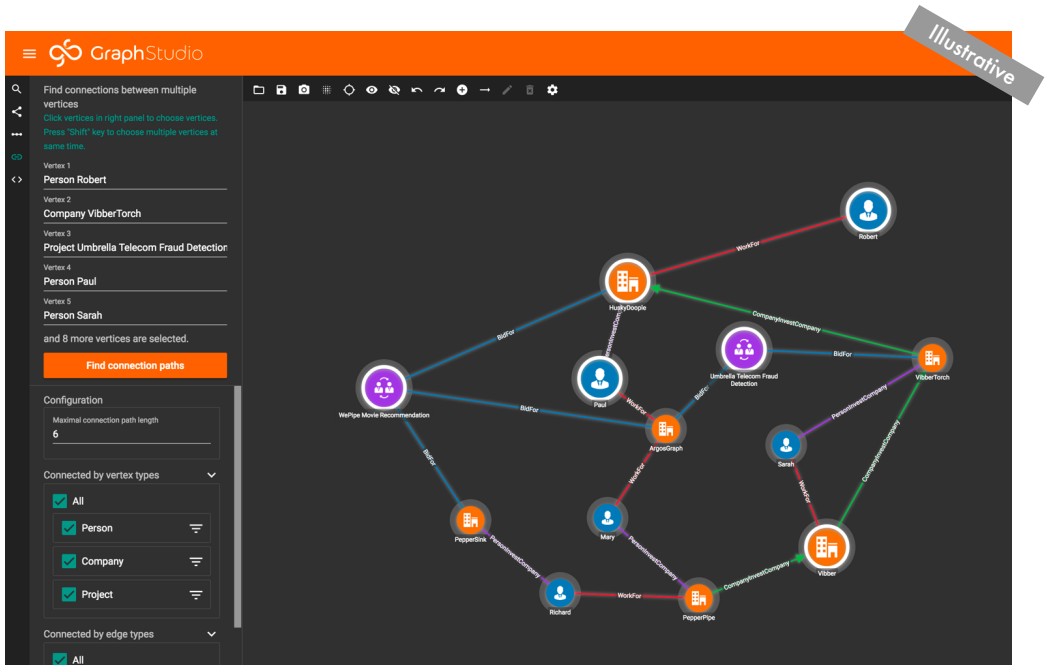
2. Deep Data Access

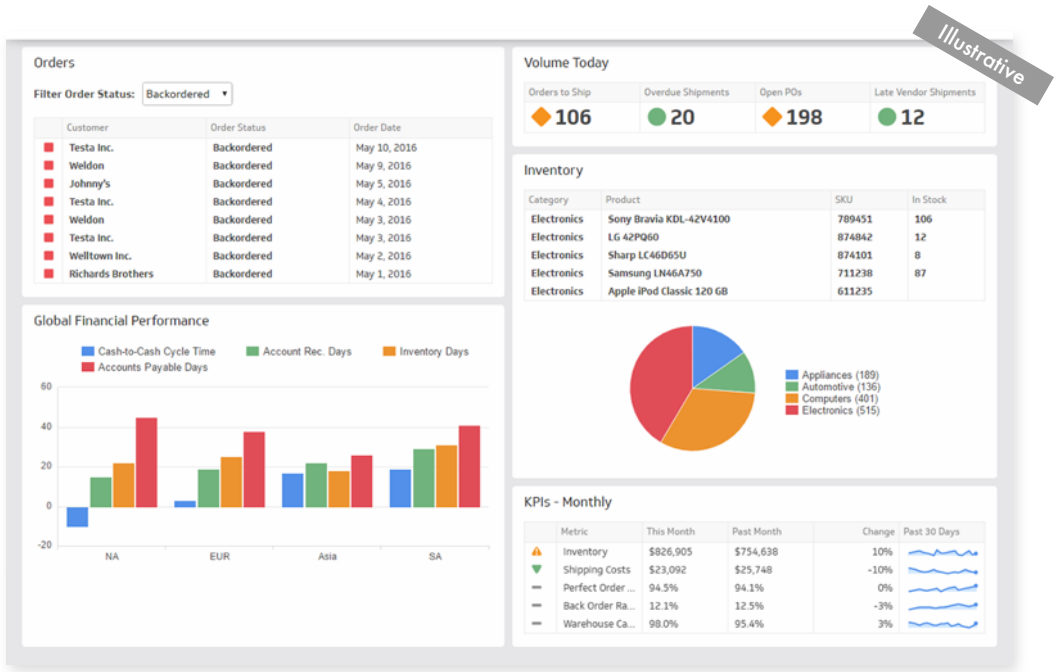
Join complex tables and query deep interconnections in the supply chain



3. Monitoring & Exploration

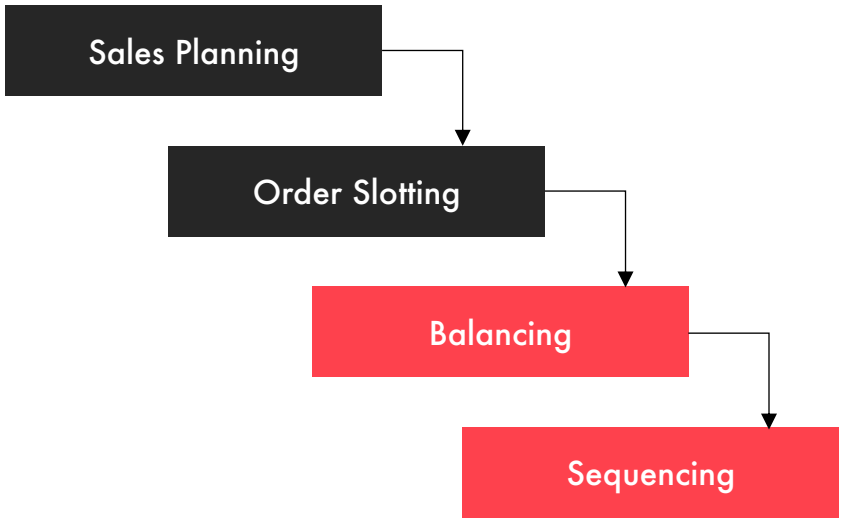
User centric dashboards & custom advanced interactive capabilities

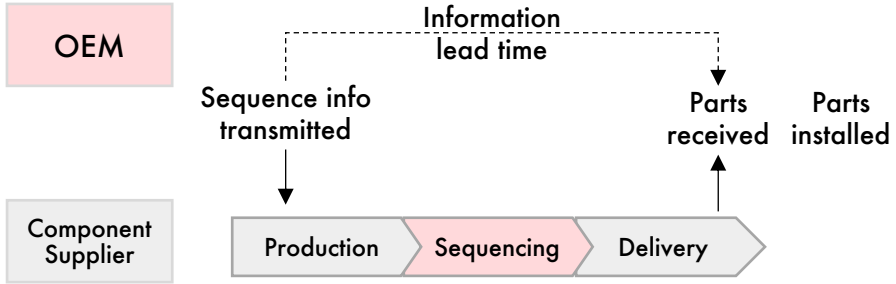




4. Scenario modelling

Leveraging real-time data access & advanced modelling to optimize sequencing and model various planning scenarios





KaaS – Knowledge as a Service

Services

Service	Description
Raw Text Extraction	Extracts raw text from the PDF, HTML, Document files.
Section Extraction	Transforms HTML, PDF, and Doc files into sets of smaller logical units.
Relations Extraction	Extracts structured relations/triples from plain text.
Semantic Ranking	Ranks the given list of sections according to how best they match semantically to a given piece of text.
Natural Language to Structured Query Language Conversion	Transform natural language questions to queries in structured query languages such as SQL.
Co-Reference Resolution	Find expressions that refer to the same entity in a text.
Machine Comprehension	Answers natural language questions by selecting an answer span within an evidence text.
Question Suggestions	Suggest additional related questions for a given question.
Question Understanding	Identify the real ask of the question.
Paraphrase Detection	Identify the text with same or similar meaning
Propriety Embeddings	Custom embeddings trained on huge datasets
Answers Validation	Validate candidate answers based on the real ask of the question
Entity Resolution	Resolves an entity name to a given list of entities. Provides a confidence score to help the system make a decision to accept/reject the resolution.
Structured Data Extraction	Extract and classify piece of structured data elements from unstructured text.
Slot Tagger	Identify entities and their types

A Variety of Real-World Applications

	Cognitive Search	Knowledge Graph	Semantic Ranking	Chatbots	Slot Tagging
Application	*"What are alternative components for this part?"*	*"Tell me all vendors involved in motor production?"*	*"What is our company's policy on suppliers?"*	*"What is the vendor onboarding policy?"*	*"How durable is (Part: cam shaft)?"*
KaaS Services	• Section Extraction • Semantic Ranking • Answer Type Identification • Machine Comprehension • Answers Validation • Paraphrase Detection • Questions Suggestion	• Relations Extraction • Entity Linking • Co-reference Resolution	• Section Extraction • Semantic Ranking • Answers Validation	• Section Extraction • Semantic Ranking • Answer Type Identification • Machine Comprehension • Answers Validation • Paraphrase Detection • Questions Suggestion	• Proprietary Embeddings • Slot Tagger • Co-reference Resolution • Ontology Support
Description	• Human-like understanding of the context of the question • Provides precise answer as compared to results in traditional search platforms	• Identify the facts from the text • Disambiguate the entities	• Uses both semantic and lexical approaches to prune & rank information • Ideal for scenarios including ambiguous documents and multiple answers to a question	• Support for dialogue management • Support for FAQs using paraphrase detection • Uses Cognitive Search as Q&A engine	• Ability to create a slot tagger using minimal data & expand the classes of existing slot tagger • Ideal for domain specific solutions ex: quality reports

CASE STUDY

Digital Research Assistant for Energy Client

OBJECTIVE

- The Strategic Planning Group finds it difficult to analyse, extract and aggregate market intelligence from varied data sources in timely manner.
- The group needs a platform that provides a platform for collaboration.
- The platform should provide advanced visualization and search capabilities.

SOLUTION

- A knowledge discovery application that acts as an expert assistant with advanced search and question-answering capability to assist researchers within their domain will significantly improve results on accuracy and cost.
- Improved research analyst productivity by 27%

MARKET INTELLIGENCE AND RESEARCH

Strategy & Planning

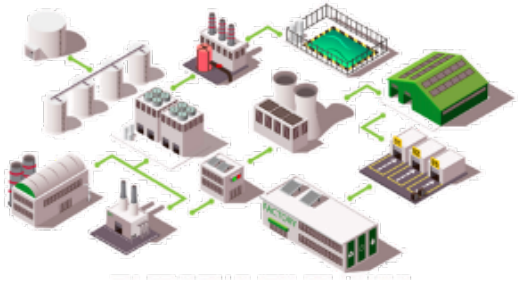
Competitive Intelligence

- Competition Analysis & Research
- Sector and Thematic Search
- Tracking & Analyzing News and Events
- Macro Economics & Analysis

Wrap up

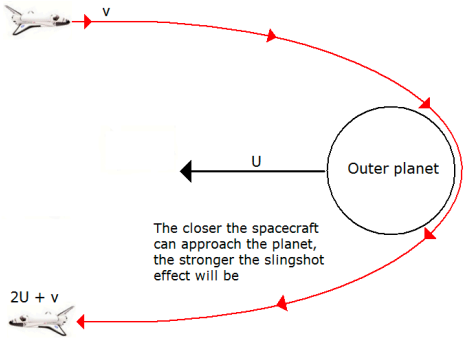
Takeaways

1. Graphs are particularly useful in manufacturing



2. You can quickly unlock exponential value pools

3. You can support and even accelerate your AI efforts



Thank you!

I look forward to hearing from you!

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