HELPING THE WORLD MAKE SENSE OF DATA

neo4j

GRAPH DATA SCIENCE USE CASES: SUPPLY CHAIN ANALYTICS

Jaimie Chung

Product Manager,
Graph Data Science

Problem

A global pandemic and ongoing geopolitical conflict have unraveled supply chains for everything from computer chips to vaccine distribution, with 94% of Fortune 1000 companies reporting supply chain disruptions from COVID-19 alone. Furthermore, the globalization of many manufacturing processes, as well as the interconnectedness of distribution and fulfillment presents a convoluted challenge for a supply chain solution. However, the cost of not having an efficient and transparent supply chain is clear: aggravated customers, wasted resources, and lost revenue.

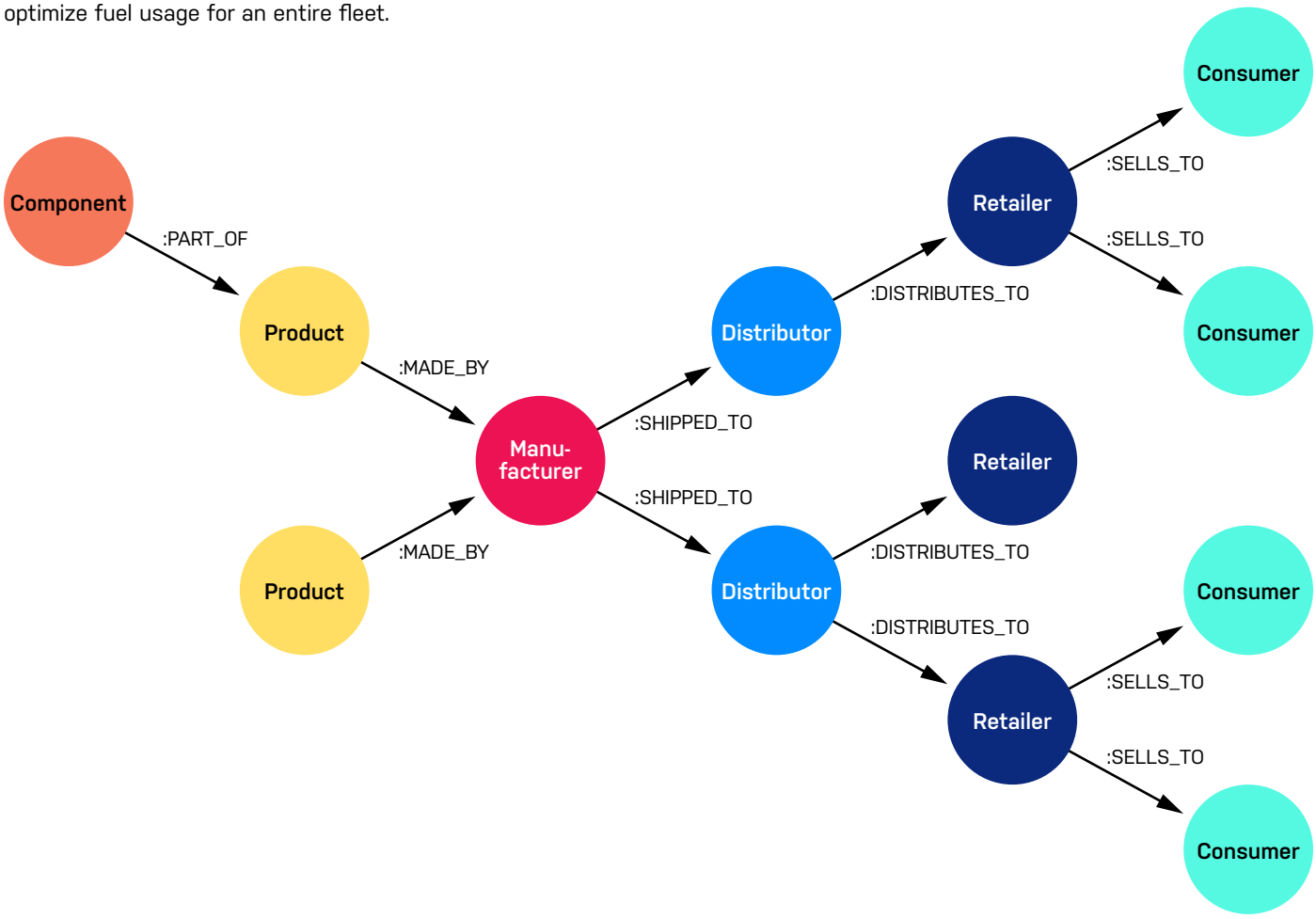
Companies must not only strategize to mitigate disruption but also understand the levers in their supply chains to reduce costs and drive revenue. In addition, supply chain management systems have to solve for a wide range of use cases, from risk management to root cause analysis to real-time routing. It's no wonder that 42% of supply chain leaders are "struggling to balance profitability with sustainability, speed, and innovation."

Given the unpredictability of world events and the complexity of modern supply chains, you need advanced analytics to ensure your supply chain management system is agile enough to respond quickly when disaster strikes. Proactively, you must identify key opportunities for growth. With Neo4j Graph Data Science, you can use the connections in your data to analyze your entire supply chain, gaining otherwise unattainable insights from the relationships hidden in the data you already have.

Data Model

A common data model for supply chain analytics connects raw materials, manufacturers, distributors, retailers, and customers. Mapping this data in a graph instead of in a relational database more accurately represents real-world behavior, and understanding how these entities are connected is key to a more robust view of your supply chain. Graph algorithms and machine learning techniques can be used to identify entities that are crucial to your business, or even fill in connections that might be missing.

This data model demonstrates how a supply chain could be represented to mitigate risk of reliance on one distributor, for example. However, these nodes and relationships could easily be switched out for ports, cargo ships, and routes to mitigate risk of reliance on one port or to optimize fuel usage for an entire fleet.



Solution

Neo4j Graph Data Science offers a variety of analytical approaches to make relevant recommendations based on the relationships within your data, ranging from localized query patterns to machine learning based insights.

Queries

Cypher is a powerful, graph-optimized query language that lets you find patterns you know exist in your data. For example, Cypher queries can quickly reveal a bill of materials, allowing you to trace the components and history of raw materials, intermediates, subassemblies, and parts of a product. Another application is supply chain visibility, where querying a path reveals a distribution route.

Algorithms

Neo4j Graph Data Science offers out-of-the-box graph algorithms for centrality and pathfinding. These algorithms are useful on larger datasets where it's hard to know exactly what you're looking for. These techniques often identify dependencies and vulnerabilities in your supply chain that are not obvious using queries alone. Some examples of useful algorithms include:

- Centrality algorithms, like Betweenness, use network structure to identify important nodes so that you can identify the most crucial parts of your supply chain and ensure there are contingency plans. For example, you may identify a critical component that is central to many downstream products – or a warehouse that represents a potential bottleneck for your whole distribution operation.
- Pathfinding algorithms, like Dijkstra Source-Target, find shortest paths between a source node and a target node so that you can find the optimal path between raw materials to a finished product to maximize efficiency – or the shortest route between distribution centers for shipping.

Together, these techniques yield powerful insights that can bolster your supply chain against tumultuous environments and lead to cost savings.

Supervised Machine Learning

As companies mature their analytics practices, they often want to predict failures and prescribe mitigation approaches, rather than identifying root causes. Graph machine learning lets you learn from the structure of your supply chain to proactively identify future problems.

Node classification is when you use the structure of your graph to predict missing labels on your data – like "high risk" for parts that are likely to stock out or cause failures. Link prediction predicts missing relationships – like better routings between warehouses that you're not currently using or simpler assemblies for parts.

Customer Spotlight

OrbitMI relies on Neo4j Graph Data Science to power their SaaS offering for maritime route optimization. Since OrbitMI offers several products for their customers, they knew they were looking for a graph solution that offered pathfinding algorithms out of the box to accelerate delivery of their vessel management application. The software company chose Neo4j Graph Data Science because of its speed and scalability. Since route optimization involves real-time data analysis and multiple what-if scenarios, OrbitMI knew they needed a reliable and scalable infrastructure partner in order to bring this solution to market quickly.

Built with Neo4j Graph Data Science, OrbitMI's AI routing engine "supports multiple use cases, whether developing new routes, suggesting diversions to existing ones or performing limitless pre-voyage what-if scenarios that minimize CO2 emissions." Their graph includes ports and other locations, and they use pathfinding algorithms to find optimal routes that consider distances, costs, and other business logic. The results of these algorithms are served through a UI for their customers that offers a view of not only where all the ships in their fleet are currently, but also where they will be.

With OrbitMI's Graph Data Science–powered engine, customers have seen a 60% increase in productivity, $12-15 million USD in return on investment, and savings of over 60,000 tons of carbon emissions. In the future, they plan to experiment with Graph Data Science's subgraph filtering feature to reduce route computation time even further.

Conclusion

Neo4j Graph Data Science enables you to make sense of your data – at scale.

Whether you are working to optimize routing or manufacturing, analyzing the impact of an event on your entire supply chain, or identifying key areas of investment, using Neo4j Graph Data Science for supply chain analytics provides fast and accurate results. Supply chain analytics is just one of the many use cases enabled by graph data science.

Learn more about Neo4j Graph Data Science at neo4j.com/graph-data-science or sign up for Neo4j's fully managed cloud offering, Neo4j AuraDS, and get started right away!

Questions about Neo4j? Contact us around the globe:

info@neo4j.com
neo4j.com/contact-us