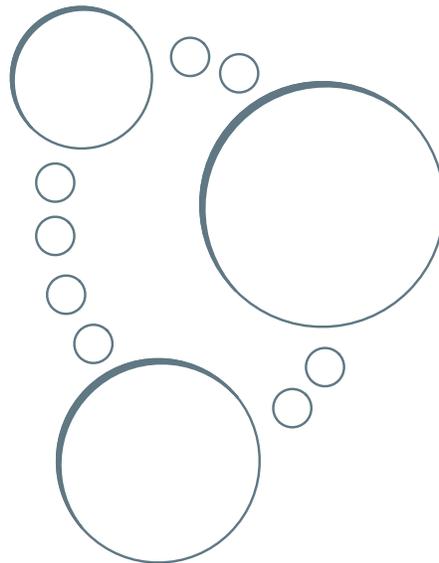


Powering Recommendations with a Graph Database



"YOU MAY ALSO LIKE ..."

Product recommendations help businesses maximize their online revenue. It requires advanced technology, but this is now available off-the-shelf, and is already being used by Wal-Mart and other market leaders.

"You may also like" is a deceptively simple phrase that encapsulates a new era in customer relationship management. In offering the advice, businesses maximize the value they deliver by providing highly targeted, real-time product recommendations to their online consumers.

This ability to make compelling offers requires a new generation of technology. That technology must capture the customer's buying history and also instantly analyze their current choices, before immediately matching them to the most appropriate product recommendations. And all of this analysis must be done in real time before the customer moves to a competitor's website.

The key technology in enabling real-time recommendations is the graph database, a technology that is fast leaving traditional relational databases behind. Graph databases easily outperform relational and other NOSQL data products for connecting masses of buyer and product data (and connected data in general) to gain insight into customer needs and product trends.

Significantly, graph databases are a core technology platform of the Internet giants like Google, Facebook and LinkedIn. But while those pioneers had to build their own in-house data stores from scratch, off-the-shelf graph databases – especially Neo4j – are now available to any business wanting to make the most of real-time recommendations.

The profit and productivity improvements graph databases offer over relational systems are astounding. Volker Pacher, Senior Developer at eBay which uses the Neo4j graph database for sophisticated real-time courier/package routing, said: "We found Neo4j to be literally thousands of times faster than our prior MySQL solution, with queries that require 10-100 times less code. Today, Neo4j provides eBay with functionality that was previously impossible."¹

GRAPH DATABASES: AN UNCONTROVERSIAL CHOICE

eBay is not alone in selecting off-the-shelf graph database Neo4j as a core platform for business critical systems. Neo4j is the world's most popular graph database, according to database monitoring site DB-Engines². Graph databases are growing in popularity faster than any other type of database – by around 250 % last year alone. The DB-Engines authors noted excitedly that "graph databases are grabbing an ever-larger slice of developers' attention. If you haven't used them yet, perhaps it's time to have a closer look."³

The key to understanding graph database systems is they give equal prominence to storing both the data (customers, products) and the relationships between them (who bought what, who 'likes' whom, which purchase happened first). In a graph database, we don't have to live with the semantically poor data model and expensive, unpredictable joins from the relational world. Instead, graph databases support many named, directed relationships between entities or nodes which gives a rich semantic context for the data. Now we can specify both loves and married to a spouse, owns and disliked a game console, or repeatedly visited a store that was amazing (all while being married to a loved spouse and owning a disliked game console at the same time). And queries are super-fast since there is no join penalty.

This makes graph databases especially suited to formulating recommendations, because making the best recommendations – and so maximizing value – involves more than simply offering up products because they are best sellers. Best sellers can be a successful part of a recommendation, but they are one which by their nature are an agg-

BUSINESS BENEFITS OF NEO4J

Across industries, Neo4j offers:

1. Improved competitiveness.

Neo4j enables new types of business functionality that is often not possible with other technologies, allowing you to make real-time decisions based on connected data.

Examples:

- Wal-Mart uses Neo4j to make real-time product recommendations by using information about what users prefer.
- Most of the top dating and online job sites use Neo4j to recommend jobs and/or dates by incorporating a knowledge of the extended network (friend-of-friend) into the recommendation, again in real time, substantially improving the accuracy of the recommendation.

BUSINESS BENEFITS OF NEO4J

Across industries, Neo4j offers:

2. Reduced project time, complexity and cost.

Neo4j cuts the overhead on many types of projects, particularly those involving connected data. Many customers cite the huge acceleration that occurs when a graph model is brought to bear on a connected data problem.

Examples:

- eBay cites that with Neo4j it requires 10-100 times less code than it did with SQL.
- Telenor, one of the world's top telcos, used Neo4j for the authorization system on its business customer portal, improving performance by 1,000 times.

regate picture of all customers. Nowadays we expect finely-tuned recommendations for individuals in the the long-tail⁴ and we react less well to one-size-fits-all suggestions.

Real-time recommendations requires the ability to understand the customer's past purchases, quickly query this data, and match the customer to the people that are the closest match to them both in their social network and in buying patterns. To make real-time recommendations also requires the ability to instantly capture any new interests shown in the customers' current visit. Matching historical and session data is trivial for graph databases like Neo4j.

WAL-MART AND OTHER LEADING ADOPTERS

Neo4j's business benefits have been recognized by Wal-Mart and other market leaders who are using it to serve up real-time recommendations in areas such as general retail, industrial spare parts, jobs, movies, entertainment, restaurants and even online dating:

- Wal-Mart calls Neo4j “a perfect tool for real-time product recommendations”. The retailer has sales of more than \$460 billion and employs 2.2 million associates worldwide, serving more than 245 million customers weekly through its 11,000 stores in 27 countries and e-commerce websites in 10 countries.⁵ Wal-Mart Software Developer Marcos Wada explained: “Neo4j helps us to understand our online shoppers' behavior and the relationship between our customers and products, providing a perfect tool for real-time product recommendations. As the current market leader in graph databases, and with enterprise features for scalability and availability, Neo4j is the right choice to meet our demands.”⁶
- Glassdoor is an online jobs community with more than 20 million members that helps job seekers make more informed job decisions and helps companies attract top talent. Knowing that most jobs are found through personal and professional connections, Glassdoor wanted to be first to market with a product that let users find jobs through their network of Facebook friends Glassdoor's 'InsideConnections' product now serves job recommendations in real time, driven by Neo4j. In the first year after its launch, Glassdoor experienced rapid growth. Its social database grew to include more than 600 million people, more than half of the Facebook graph, and is still growing. Senior Vice President and CTO Ryan Aylward said: “The Neo4j graph database proved the perfect fit for integrating Facebook into the Glassdoor community. As a result we are able to provide a better experience for our members and provide them with real time job recommendations.”⁷
- Viadeo is the world's second-largest professional social network. In order to attract new members and retain existing ones, Viadeo wanted to show members how they are connected to one another and to make real-time recommendations. It found the required real-time 'traversals' of its professional network were not feasible with MySQL databases and so chose Neo4j. At the time it had 8 million members; it now has over 50 million and is adding 1 million new members a month.
- Online dating firm SNAP Interactive, whose site “Are You Interested” has over 68 million users, understood that relationships are more successful if they are forged between people who have friends in common; so to improve its real-time dating recommendations, it wanted to identify its users' common friends and friends-of-friends. SNAP Interactive had no efficient way to gather this data, which amounted to making nearly 10 billion connections across its database of over 1 billion unique users, until it found Neo4j. David Fox, SNAP Interactive Big Data Engineer, said: “Neo4j was the obvious solution for modeling friend-of-friend data. It was an easy choice.”⁸

- A leading movie recommendation website is revolutionizing the way the film industry promotes projects by enabling fans to discover the best upcoming releases before they hit the big screen, and make recommendations based on individual taste. In turn, it provides movie studios with insights into the preferences and behavior of film fans, enabling them to more effectively target their marketing campaigns. They considered MySQL databases for its recommendation system, but after seeing the amount of data required, looked at other databases and chose Neo4j. Their CTO stated: “We wanted to quickly connect audiences to the right movies, and Neo4j just fits our philosophical standpoint. We are very happy that we discovered Neo4j. We increased the speed of generating recommendations and users to movies, which is a core part to our business model.”
- Recently launched Cobrain makes personalized shopping recommendations to consumers from the products offered by more than 300 major apparel merchants. Members spend a few moments telling Cobrain what they like. It then uses Neo4j to make billions of calculations in order to find the products loved by their anonymous cohorts and provide real-time recommendations.⁹ Cobrain’s Vice President of Engineering and Technology Andy Rosenbaum said: “The graph database allows us to explore new connections between people, giving a very personalized experience of products we think they’ll love.”

TRYING OUT NEO4J

Neo4j is used by thousands of companies, including more than 50 of the Global 2000 such as eBay, Wal-Mart, Hewlett-Packard, National Geographic and Cisco.

Neo4j and graph databases have also been recognized and acclaimed by a number of leading tech industry watchers. Among them, in January Neo4j was chosen as one of InfoWorld’s 2014 ‘Technology of the Year Award’ winners, alongside products including Microsoft Office 365 and Amazon Web Services.

InfoWorld’s Jonathan Freeman said: “The use cases for Neo4j keep piling up as people realize graph databases are not as niche as they thought.”¹⁰

Over the past year, Neo4j has received consistent analyst recognition, including being named as a ‘Who’s Who in NoSQL DBMSs’ by Gartner, one of ‘10 Companies and Technologies to Watch in 2013’ by Robin Bloor of the Bloor Group, inclusion in the ‘21 NoSQL Innovators to Look for in 2020’ list by Gary MacFadden of Wikibon, “2014 Technology of the Year” from InfoWorld, as well as notable product awards from AlwaysOn, CRN, DTBA and others.

Now Neo Technology has been named by Gartner as a “Cool Vendor” for offering Neo4j as a solution that enables new business opportunities across the “convergence and mutual reinforcement of four interdependent trends: social interaction, mobility, cloud, and information”.

You can start using Neo4j for free. Download an evaluation copy and explore the sample movie graph that comes with it. To move a slice of your key customer or other data across to Neo4j, the website provides import tools for loading data from CSV format into the database.

BUSINESS BENEFITS OF NEO4J

Across industries, Neo4j offers:

3. Faster project time to market and better performance.

Neo4j requires developers to produce less code than relational DB alternatives. Less code = higher quality and an increased success rate on projects. Neo4j’s performance is dramatically better for connected data sets – often the difference between something being possible and not possible.

Examples:

- eBay cites that “Neo4j allowed us to add functionality that was previously not possible”.
- Many customers experience improvements on a similar scale...so much so that one of Neo4j’s standard value statements is “minutes to milliseconds”, in reference to the speed of top connected queries.

Visit

<http://www.neo4j.com/download>
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REFERENCES

- ¹ <http://neo4j.com/users/ebay/>
- ² <http://db-engines.com/en/ranking/graph+dbms>
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- ¹⁰ <http://www.infoworld.com/article/2606402/data-center/135876-InfoWorlds-2014-Technology-of-the-Year-Award-winners.html#slide31>

ABOUT NEO TECHNOLOGY

Graphs are everywhere. From websites adding social capabilities to Telco's providing personalized customer services, to innovative bioinformatics research, organizations are adopting graph databases as the best way to model and query connected data. Neo Technology researchers have pioneered graph databases since 2000, and have been instrumental in bringing the power of the graph to numerous organizations worldwide, including 50 Global 2000 customers, such as Cisco, Accenture, Telenor, eBay and Walmart. Serving customers in production for over a decade, Neo4j is the world's leading graph database with the largest ecosystem of partners and tens of thousands of successful deployments.

Neo Technology is a privately held company funded by Fidelity Growth Partners Europe, Sunstone Capital and Conor Venture Partners, and is headquartered in San Mateo, CA, with offices in Sweden, UK, Germany, France, and Malaysia. For more information, please visit www.neo4j.com.