

Understanding Data in Healthcare

The Use of Neo4j Graph Database



Can you have too much data? Why dropping the relational databases for graph databases makes sense.

Data aggregation. Healthcare produces a lot of data, and around the beginning of this millennium (early 2000s) we started actively contributing to the rise of importance of data in Healthcare through Population health, precision medicine, etc. The goal was to capture data from all available sources, from providers to payers to people, and ultimately use that data to optimize healthcare. Over the past 10 years we have seen the value of aggregating the data, however we have also seen the issues around it. Security issues with safely managing health information, understanding complex data, or having too many different sources of data that need to be harmonized.

Ultimately, in order to improve the quality of healthcare delivery, the patient experience, decrease medical error, and to timely prevent the spread of diseases, it wasn't enough to just aggregate and compare the data. We also had to incorporate a number of policies on how to implement and use it.

What is a Graph Database?

We use graph databases with the goal to efficiently store, handle, and query highly-connected data in our data models. Having a great data model that is flexible and scalable allows us to represent real-world, variably-structured information without the loss of richness.

What is the Neo4j Graph Platform?

The idea behind Neo4j was to make a universally simple and accessible graph model building platform that will allow business to visualize data faster and with ease. The ultimate goal of Neo4j is to provide a seamless process for integrating with your existing system.

“Capabilities in the Neo4j graph platform include aiding developers to import data to the graph, business analysts to explore the data with ease, and data scientists to make decisions based on analysis results.”(Neo4j official website).

Data visualizations:
When seeing is
~~believing~~
understanding!



Triple aim in Healthcare and how to achieve it one graph at a time.

When thinking about data analytics and using the data for bettering healthcare we will take a look at how understanding the data relates to the three big goals we have:

- **Better Health** - creating better experiences with all participating parties (payers, providers, product companies).
- **Better Care** - being able to deliver care at the highest standard known.
- **Lower Cost** - but not at the expense of better quality of care.

In order to achieve the triple aim we have to better understand the data we currently have and aggregate anywhere between population health, pharma, precision medicine, or even claims management.

Making sense of the connections between the data is one of the ultimate benefits when using graph databases, because most of time we do not see these connection in text base models. Innovative companies in the healthcare space have started implementing this platform for their gains: HealthUnlocked, Doximity, Zephyr Health, Curaspan Health Group, SharePractice, etc.

Better information capture and improved presentation of complex graph databases can have a huge role in transforming electronic health records. One of the more interesting solutions we have stumbled upon is the following:

MEDICUS - a graph-powered solution which offers an improved method of information capture between the patient and provider. The graph incorporates concepts from multiple medical terminology systems (CPT, ICD, SNOMED, NPI, Medical taxonomy) into a composite data store. Instead of free-text definitions, a seed pattern of clinically-relevant relationships defines concepts in a formal way to reflect the semantics of the concept. A common schema supports a uniform user interface and enables efficient documentation by way of semantic navigation: click and discover, rather than search and retrieval.

Currently we are building a platform for a payer that will help identify fraudulent patterns in claims management. The opportunities are vast, so if your organization is considering building a neo4j it is best to act sooner rather than later.

Transforming health information into data driven decisions

Benefits of neo4j from your dev team's perspective 1/2

Drivers for Popular Programming Languages - by using binary “Bolt” protocols Neo4j allows developers to use drivers for the major programming languages of their choice such as: .Net, Java, Spring, JavaScript, and Python. Other drivers are being developed by the ever growing community (http protocol for example).

Graph Visualization - a large part of understanding data is being able to see the connections and Neo4j offers various methods to do so: browser and libraries for developers, or Bloom for analysts - enabling easier embedding of graphs into apps.

Cypher – A Next-Generation Query Language - in order to simplify querying graph data Neo4j created a declarative query language that uses ASCII-Art to represent visual graph patterns for finding or updating data. This language is based on SQL, the syntax is concise and allows users to write CRUD operations in a manageable way.

Graph Data Modeling - even though the quality and richness of graph data will depend solely on how you model it, by using neo4j you will be prompted to focus on understanding what questions the data will answer and then making “hard” decisions whether to store certain pieces of data as properties versus separate nodes.

Data Import - having an active community means that a lot of vendors and partners are developing various tools and apps to approach the data problem. This does not mean your problem will be solved but there are definitely partners like us that can help you build it. Neo4j maximizes value by simplifying the import process making it easier to harmonize various data sources and faster time to visualization.

The ecosystem - in the last few years we are witnessing an exponential growth of startups using data analytics to improve healthcare and more and more investments are coming this way - a lot of them are building on the neo4j platform so do not miss this tidal wave.

Benefits of neo4j from your dev team's perspective 2/2

So, how to start?

If you are a developer starting is “easy”, as neo4j is an open source platform and there are many learning resources available. The community is also active in helping out and advising.

The usual steps would be:

1. [Install Neo4j or Start a Sandbox Online](#)
2. [Learn to Create and Query Data with Cypher](#)
3. [Import Your Data](#)
4. [Build an Application](#)

If you are on the business side and looking to leverage neo4j for your project, feel free to reach out to our Dev team who will take a sneak peek into your data and suggest the right path to better understand and use your data ;)

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