OVERVEIW OF GRAPH DATABASE

K.B. KAVINDA[1], M.C.WIJEGUNASEKARA[2]

faculty of Computing and Technology, University of Kelaniya, Sri Lanka

Contact: bihan.kavinda1999@gmail.com[1], carmel@kln.ac.lk[2]

Abstract: **People found ways to store data, then they introduce Database. Graph database is one of them. Graph database is very flexible, user-friendly and common database in the industry. In this document, we will discuss about the graph database, advantages and disadvantages ,what kind of a query languages are used and some real-time examples related to graph database.**

Keywords: **Graph database**

1.INTRODUCTION

The basic platform for the graph database was introduced in 1960.It was a simple structure. In 1980, labeled graph was represented in Graph DB as Logical Data Model.

In 2000, Neo4j and Oracle were introduced to market. and also, in 2010 OrientDB, ArangoDB were introduced. Like that, different software was published by different companies.

It was represented as a network model database and also graph databases are a type of NoSQL database. Graph database use Nodes and edges to represent and store data. The edges show the relationship between the nodes it represents by lines. Depends on direct or undirect edges graph divided to direct graph and undirect graph Nodes represent the entities or instances what we want to store and it can hold number of attributes called as properties.

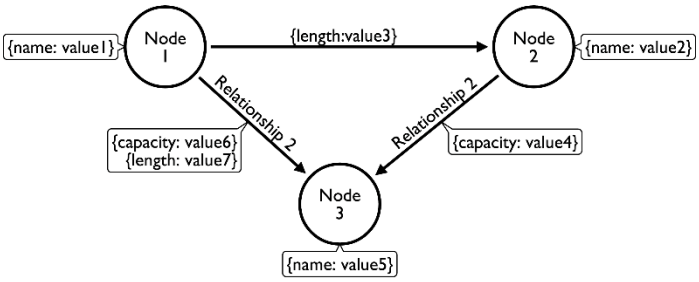

figure 1:Graph database(node, edges)[6]

2.EXAMPLE FOR GRAPH DATABASE

There are number of Graph database platforms in the industry. Before select a better graph DB platform, you have to think it in different ways. What is the main purpose you need to get from the database? Is it user-friendly? What are the supporting programming platforms? etc. let's get some examples,

- Neo4j

  Most common Graph Database in the industry. High performant, scalable, and flexible. Better use for Queries, visualizations and data interaction. Java, Nodejs, PHP, etc are the supported programming platform for this. Graph DB free under GPL v3 license.

- Orient DB

  High speed, scalable and reliable Graph database. it has a recorded level security. Java, Nodejs, PHP are the some supporting programming platforms for Orient DB. Orient DB is Licensed under Apache 2.

- Titan DB

  Titan Db is the best for store billions of vertices and edges distributed across a multi-machine cluster. It also supports for backend stores like HBase, Cassandra. It is licensed under Apache 2.

figure 2: Examples(Neo4j, OrientDB, TitanDB)[7][8][9]

3.ADVANTAGES AND DISADVANTAGES

3.1. ADVANTAGES

Graph database is very common database in the industry. Google, Facebook and so many places were built based on this graph database. Why is this database so common? because it has important advantages,

- Performance
- Flexibility
- Agility
- Search
- Indexing

To get a better performance you have to connect Graph DB with relational DB and NoSQL DB.

With a Flexibility Database, we can add new relationships, new nodes and do changes to the structure without changing the current structure. it is a good advantage for a database.

3.2. DISADVANTAGES

Graph database is not good for operational use cases because it doesn't optimize to store and retrieve business entities for customers or suppliers. And graph DB is not optimized for large analytic queries. To get e better output you need to combine it with relational or NOSQL database.

Graph database simply speed database but it doesn't provide better relationship each other. And also, most commonly it stores all the data on one server or limited to few nodes.

4.TYPES OF GRAPH DATABASE

Mainly we can devide graph database into 3 types

- Property Graph
  Most common Graph type is Property Graph database. its includes basic concept of graph database. Like, nodes, relationships and properties are key components of it.

- Hypergraph
  By this graph, user can connect any number of nodes. It is very useful when you connect large number of many-to-many relationship.
- Triple graph
  For addition of information is represented by separate nodes. This data store format known as triple of subject-predicate-object data structure.

5. GRAPH DATABASE QUERY LANGUAGES

As I described in previous topics, there are number of Graph database software in the world. Neo4j, OrientDB,Titan are some of them. Each graph data base has their own query language to get same output.

- Neo4j
  Neo4j is the most common graph database which are used.it has unique keywords to represent the content.

```
MATCH(Person{name:'B'})-[:FRIEND*2]->(f:Person)

RETURN f.name
```

figure 3: Example query for Neo4j[11]

- OrientDB
  This Graph database Query was written based on SQL language with some different keywords. Some Extensions are added by the creators to give the functionality of a graph.

```
SELECT f.name FROM(

 MATCH

   {class: person, where:(name='B')}

   .out('FRIEND'

   {class:Person, as: f, while: ($depth<=2), where;
(depth>1)}

 RETURN f)
```

figure 4: Example query for OrientDB[11]

Like that, You can get a brief idea about how the queries are written in different Graph Databases. The pattern and words are unique for each Graph Database.

6.SECURITY BACKGROUND

Database means a place where we store some data. So we have to give a better security background for our data. As an example, Neo4j provides data-at-rest encryption with centralized key management and also it has enterprise policies and regulations.

License is very important part in the Database security. Normally there are two types of licenses. Those are Community and Enterprise. Community license available in free but Enterprise license is a paid version.

7.GRAPH DATABASE VS RELATIONAL DATABASE

Graph database and Relational database is common databases in the field. before select a one, you have to think what are the main different of that. Because some outputs unique for each database. now we briefly verify what are the key differences of these databases.

- In the Graph DB its records are stored in the individual record levels, but Relational Database stored those in predefined structures, like tables.
- Graph database main entities represent by nodes and relational DB represent it by rows. RDB use columns as their attributes.
- Graph DB shows each relationship by connecting between entities(nodes). In Relational DB it shows by the foreign keys.

These are the some main differences of Graph DB and Relational DB.

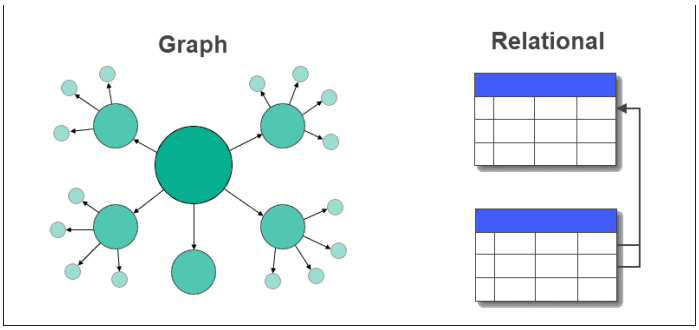

figure 5 :Graph DB vs Relational DB[12]

CONCLUSION

By this report, we discussed some details about Graph Database. What is a graph database? Advantages and disadvantages. We got some example of GDB and get details about each database. we compared Graph database with Relational database. So I think You can get a better idea about graph Database through this document.

RFERENCES

[1] Brian Crawford, “GRANULAR SECURITY IN A GRAPH DATABASE” 2016 march

[2] Wikipidia *Graph Database* [online] https://en.wikipedia.org/wiki/Graph_database

[3] Why Graph Databases [online] https://neo4j.com/why-graph-databases/

[4] Graph database Examples [online] https://www.3pillarglobal.com/insights/a-quick-look-into-the-popular-graph-databases/

[5] Advantages and disadvantages graph database[online] https://www.oreilly.com/library/view/graph-databases/9781449356255/ch01.html

[6] Graph database nodes and edges[online] https://subscription.packtpub.com/book/big_data_and_business_intelligence/9781786466143/1/ch01lvl1sec12/the-property-graph-model-of-graph-databases

[7] Neo4j[online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FNeo4j&psig=AOvVaw0-RCNPlXYqw_lQwyqVsp0d&ust=1633869062391000&source=images&cd=vfe&ved=2ahUKEwisy-3Zqr3zAhW9sksFHSrNAeAQjRx6BAgAEAk

[8] OrientDB[online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FOrientDB&psig=AOvVaw18vyYN2IYKUhASmnTmsJzb&ust=1633869097384000&source=images&cd=vfe&ved=2ahUKEwj9s8Xqqr3zAhVGXCsKHa6_CekQjRx6BAgAEAk

[9] TitanDb[online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fgithub.com%2Fthinkaurelius%2Ftitan&psig=AOvVaw2OYl1gUAGneU8CGQtPm__g&ust=1633869129412000&source=images&cd=vfe&ved=2ahUKEwigmuj5qr3zAhVesksFHR4OAIAQjRx6BAgAEAk

[10] graph database vs relational database[online] https://blog.devgenius.io/graph-database-vs-relational-database-70f6156f7415?gi=82cccdf6cc05

[11] Query languages for existing graph database[online] https://bitnine.net/blog-graph-database/query-languages-of-existing-graph-databases/

[12] graph database vs relational database[online] https://www.google.com/url?sa=i&url=https%3A%2F%2Fphoenixnap.com%2Fkb%2Fgraph-database&psig=AOvVaw3aT2dXBHXPgz-

DAmIM5wse&ust=1633869298727000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCPDK_8-rvfMCFQAAAAAdAAAAABAV

[13] graph database type[online] https://singhnaveen.medium.com/what-are-graph-databases-and-different-types-of-graph-databases-369e5040a9d0