**Abstract**

The GHG Protocol, or Greenhouse Gas Protocol, is a widely used international accounting tool for measuring and managing greenhouse gas emissions. It was developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) in 1998 and has since become the most widely used GHG accounting standard in the world. The GHG Protocol is used by businesses, governments, and other organizations to track their greenhouse gas emissions, set reduction targets, and report their progress. It has helped to standardize GHG accounting and reporting, making it easier to compare emissions across different organizations and sectors.

**GHG-Protocol Taxonomy** (Basic Structure)

Basic taxonomy for the GHG Protocol, organized from the highest level to the lowest:

1. GHG Protocol Standard

* Corporate Accounting and Reporting Standard
* Product Accounting and Reporting Standard

1. GHG Protocol Scope

* Scope 1: Direct GHG emissions
* Scope 2: Indirect GHG emissions from purchased electricity, heat, and steam
* Scope 3: Other indirect GHG emissions, such as from transportation, waste disposal, and supply chain activities

1. GHG Protocol Category

* Category 1: Energy
* Category 2: Industrial Processes
* Category 3: Agriculture, Forestry and Other Land Use (AFOLU)
* Category 4: Waste
* Category 5: Other

1. GHG Protocol Emissions Source

* Emissions from fossil fuel combustion
* Emissions from industrial processes
* Emissions from agriculture and forestry activities
* Emissions from waste disposal
* Emissions from transportation and distribution
* Emissions from upstream and downstream activities in the supply chain

1. GHG Protocol Gas

* Carbon dioxide (CO2)
* Methane (CH4)
* Nitrous oxide (N2O)
* Hydrofluorocarbons (HFCs)
* Perfluorocarbons (PFCs)
* Sulfur hexafluoride (SF6)
* Other greenhouse gases

This taxonomy provides a framework for organizing and categorizing different aspects of the GHG Protocol, including the different standards, scopes, categories, emissions sources, and greenhouse gases. It can be useful for organizations looking to implement the GHG Protocol and track their greenhouse gas emissions.

**Applications GHG-Protocol Taxonomy**

This taxonomy can be used in several ways:

1. GHG Protocol implementation - Organizations can use this taxonomy as a guide for implementing the GHG Protocol and measuring their greenhouse gas emissions. By categorizing emissions sources and greenhouse gases, they can better understand their carbon footprint and identify opportunities for reducing emissions.
2. Reporting and disclosure - Companies can use this taxonomy to report their greenhouse gas emissions to stakeholders, such as investors, customers, and regulatory agencies. By using a standardized taxonomy, they can ensure that their emissions reporting is consistent and transparent.
3. Comparability - This taxonomy can be used to compare greenhouse gas emissions across different organizations, industries, and regions. By using a common language and framework, it is easier to compare emissions data and identify best practices for reducing emissions.
4. Research - Scientists and researchers can use this taxonomy to study different aspects of greenhouse gas emissions, such as the impacts of different emissions sources and greenhouse gases on climate change. By organizing emissions data into different categories and sources, it is easier to analyze and understand the complex relationships between different factors.

Overall, this taxonomy can be a useful tool for organizations, policymakers, and researchers to better understand and manage greenhouse gas emissions. By categorizing emissions sources and greenhouse gases, it provides a structured approach to measuring, reporting, and reducing emissions.

**Workflow**

* Export data from Solidatus (implemented taxonomy tool) in json format
* parse through json file and get the data into dataframe
* Upload converted data into Neo4j to create a graph database using data importer
* Use graph visualizers compatible with neo4j
* Further use it accordingly to implement it on frontend.

**Requirements**

To visualize the GHG Protocol taxonomy, along with the reasons for using various tools and databases. Here's a step-by-step guide:

1. Data Requirements: To construct the GHG Protocol taxonomy visualization, you will need access to emissions data and emissions factor data. Emissions data can be obtained from your organization's internal sources, such as energy and fuel consumption data, or from external sources, such as government agencies and industry associations. Emissions factor data can also be obtained from these sources.
2. Data Cleaning: Once you have obtained the emissions and emissions factor data, you will need to clean and process the data to ensure it is accurate and consistent. This may involve removing duplicates, correcting errors, and standardizing units of measurement.
3. Taxonomy Mapping: The next step is to map the emissions data to the GHG Protocol taxonomy. This involves categorizing emissions data into the appropriate emissions sources and categories within the taxonomy.
4. Data Visualization: Once the emissions data has been mapped to the GHG Protocol taxonomy, you can use a graph database to visualize the taxonomy. A graph database is a database that uses graph structures to represent and store data. In the case of the GHG Protocol taxonomy, a graph database can be used to represent the taxonomy as a network of nodes (representing emissions sources and categories) and edges (representing relationships between sources and categories).
5. Graph Database: Neo4j is a popular graph database that can be used to visualize the GHG Protocol taxonomy. Neo4j provides a flexible and scalable platform for storing and querying graph data. It also includes a variety of visualization tools and plugins for creating custom visualizations of the data.
6. Graph Visualization Tool: There are several tools available for visualizing graph data in Neo4j. One popular tool is the Neo4j Browser, which provides an intuitive interface for querying and visualizing graph data. Other tools include Gephi, a free and open-source graph visualization tool, and Linkurious, a commercial graph visualization platform.

Reasons for using various tools and databases:

1. Graph Database: A graph database is well-suited for representing and querying complex relationships between data points. In the case of the GHG Protocol taxonomy, a graph database can be used to represent the hierarchical relationships between emissions sources and categories.
2. Neo4j: Neo4j is a popular and widely-used graph database that provides a robust and scalable platform for storing and querying graph data. It also includes a variety of visualization tools and plugins for creating custom visualizations of the data.
3. Graph Visualization Tools: Graph visualization tools provide a way to explore and analyze the relationships between data points in a graph database. These tools can help you identify patterns and trends in the data and gain insights into the structure of the graph.

**QnAs**

**What is the need for GHG Protocol taxonomy?**

Greenhouse gas (GHG) emissions are a major contributor to climate change and global warming. It is essential for businesses and organizations to track, measure, and reduce their GHG emissions to minimize their environmental impact and comply with regulatory requirements. The GHG Protocol is a widely used international standard for GHG accounting and reporting that provides a consistent framework for organizations to measure and report their GHG emissions.

The GHG Protocol taxonomy provides a standardized classification system for GHG emissions sources and categories. This taxonomy helps organizations to consistently and accurately measure and report their emissions, which is essential for effective GHG management.

**Why use a graph database to implement the GHG Protocol taxonomy?**

A graph database is a database that uses graph structures to store and represent data. It is particularly well-suited for storing and querying complex, interconnected data sets, making it an ideal choice for implementing the GHG Protocol taxonomy. Here are some advantages of using a graph database to implement the GHG Protocol taxonomy:

1. Flexibility: Graph databases are highly flexible and can adapt to changing data structures and relationships over time. This is particularly useful for the GHG Protocol taxonomy, which may need to be updated as new emissions sources and categories are identified.
2. Scalability: Graph databases can handle large-scale data sets with high levels of complexity and interconnectedness. This is essential for the GHG Protocol taxonomy, which encompasses a wide range of emissions sources and categories.
3. Query performance: Graph databases are optimized for complex queries involving many different relationships and nodes. This is essential for the GHG Protocol taxonomy, which requires complex queries to identify emissions sources and categories and calculate emissions factors.

**What are the Benefits of visualizing the GHG Protocol taxonomy using a graph visualization tool?**

Visualizing the GHG Protocol taxonomy using a graph visualization tool can provide a range of benefits, including:

1. Improved understanding: A graph visualization tool can help users to better understand the relationships between different emissions sources and categories, and how they contribute to overall GHG emissions.
2. Enhanced analysis: By visualizing the GHG Protocol taxonomy using a graph visualization tool, organizations can identify patterns and trends in their emissions data, and identify areas where emissions can be reduced.
3. Improved communication: A graph visualization tool can be used to communicate GHG emissions data and trends to stakeholders in a clear and compelling way, helping to build support for emissions reduction initiatives.

In conclusion, implementing the GHG Protocol taxonomy using a graph database and visualizing it using a graph visualization tool can provide significant benefits for organizations looking to manage their GHG emissions. By using these tools, organizations can gain a better understanding of their emissions data, identify areas where emissions can be reduced, and communicate their emissions data and reduction initiatives to stakeholders.