# Indexers

## Understanding Blockchain Indexing

Blockchain technology, often likened to a digital ledger, securely records data in encrypted blocks distributed across a decentralized network. Each block in the chain not only contains a record of new transactions but also carries information from the preceding block. However, due to blockchain's sequential structure, the associated data is dispersed across numerous blocks without an inherent system for identifying or extracting specific, higher-level data. Blockchain indexing steps in to address this. It allows users to efficiently search and filter through blockchain data, akin to how one might use Google, Bing, or other search engines to find information on the internet.

## Challenges in Indexing Blockchain Data

Indexing data within a decentralized infrastructure like blockchain presents several obstacles:
1. Absence of a Standard Query Language: Blockchain's immutable nature complicates direct data reading, as it lacks a built-in query language similar to SQL in traditional databases. To access even basic information such as a user's transaction history, one would have to examine each block individually.
2. Complexities in Data Retrieval: The node structure of blockchains, particularly those akin to Ethereum, complicates data retrieval. Historical records are typically spread across various events and stored in separate sections of a node. Limited access to these events in some public nodes can significantly slow down the query process.
3. Limitations of Existing APIs: The APIs currently available are often restricted to basic queries. These include range queries (such as records from a specific timeframe or a certain number of transactions) and top-k queries (which rank different data points relatively). This limitation hinders the ability to conduct more complex data analyses or searches.

## Subgraphs: A Key Solution

One of the most promising solutions to the challenges of indexing blockchain data is the use of subgraphs. Subgraphs are essentially predefined data structures that are designed to efficiently index and query data from a blockchain.

### What are Subgraphs?

Subgraphs are open-source APIs that allow developers to extract data from a blockchain and store it in a structured format. They are designed to be flexible, allowing developers to define the data they want to extract and how they want to store it. This flexibility enables subgraphs to

be used for a wide range of applications, from simple data retrieval to more complex data analysis.

## Advantages of Subgraphs

1. Customized Data Views: Developers can create subgraphs tailored to their specific needs, focusing on the particular data they're interested in.
2. Real-time Data Updates: Subgraphs can update their indexed data in real-time with each new block on the blockchain, ensuring up-to-date information.
3. Decentralized and Open: Like blockchains, subgraphs can be hosted in a decentralized manner, promoting transparency and accessibility.