The contemporary landscape of digital content distribution has led to the emergence of ingenious peer-to-peer (P2P) systems, offering users a seamless platform to share movies, songs, and various file types. This project delves into the development of a P2P application comprising an index server and multiple peers. Through this application, peers can exchange content among themselves with the support of the index server acting as a facilitator. Each peer operates as both a content server and a content client, enabling the registration of available content with the index server for subsequent retrieval by other peers. The communication architecture between the index server and peers is predominantly based on UDP (User Datagram Protocol) for general interactions, while content download operations are conducted over TCP (Transmission Control Protocol).

Project Overview

The crux of this project lies in its architecture that emphasizes a peer-driven content sharing system. Peers register their respective content with the index server, empowering fellow peers to locate and download desired content seamlessly. The communication between peers and the index server is orchestrated through Protocol Data Units (PDUs) that encapsulate diverse functions such as content registration, download requests, content search, acknowledgment, error handling, among others. Each PDU type is intricately designed to encapsulate relevant data, accounting for potential segmentation in cases where content size demands it.

P2P Mechanism Illustration

The project elucidates the operational flow of the P2P mechanism through a sequential portrayal of events involving peer interactions with the index server. These events encompass content registration, content search, download requests, and subsequent registration by peers downloading the content. This orchestrated sequence ensures an organized and efficient distribution network among peers, fostering a decentralized content-sharing ecosystem.

Protocol Data Unit Format

The PDUs serve as the fundamental building blocks of communication within this system, adhering to a specific format that defines their type and associated function or direction. Eight distinct PDU types encompass various functionalities like content registration, download requests, content data transmission, acknowledgment, error handling, and more. Strict size constraints for data within each PDU type ensure optimal communication across the network.

Protocol Description

The communication model between peers and the index server revolves around UDP, providing pivotal services such as content registration, deregistration, content search, and content listing. A comprehensive breakdown elucidates the content registration process, download initiation, content listing, content deregistration, and peer quitting procedures.

Programming Information

To implement this project, pivotal system calls serve as the linchpin for socket programming and managing multiple socket connections simultaneously. System calls such as `getsocketname` assist in retrieving socket address information, while the use of `select` enables efficient monitoring of multiple sockets, an essential aspect for managing diverse events within the P2P network.

This project amalgamates sophisticated socket programming concepts to design a robust P2P application, enabling efficient content sharing among peers. Further sections will delve into detailed protocol descriptions, socket handling intricacies, and programming strategies necessary for realizing this peer-driven content distribution system.