Create and Distribute a Torrent File in a Peer-to-Peer Environment

-- (2023115075)

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1. Introduction

- **Project Title:** Creation and Distribution of a Torrent File in a P2P Environment.
- **Abstract:** A brief summary of what the project does (e.g., "This project demonstrates the decentralized distribution of files using the BitTorrent protocol...").
- **Background:** Briefly explain the shift from Client-Server to Peer-to-Peer (P2P) models.
- **Objectives:** What were you trying to achieve? (e.g., efficient file sharing, reducing server load, ensuring data integrity).

2. Distributed Systems Concepts

Explain the theory behind your project to show your academic understanding:

- **P2P Architecture:** Define unstructured vs. structured P2P networks.
- **Decentralization:** How the system functions without a central file server.
- **Scalability:** Why P2P systems handle high traffic better than traditional servers.
- **Data Integrity:** Mention how **SHA-1/SHA-256 hashing** is used to verify file pieces.

3. Project Objectives

The objectives of this project are listed below:

- To study the working of Peer-to-Peer architectures
- To create torrent metadata files for data sharing
- To implement decentralized file transfer mechanisms
- To improve download performance through parallel sharing
- To understand practical distributed system concepts

4.Background and Motivation

Modern distributed applications require efficient mechanisms to transfer large volumes of data across networks. Centralized file distribution systems often suffer from limitations such as high server load, low scalability, and single points of failure. These challenges have led to the adoption of decentralized communication models.

This project focuses on implementing a torrent-based file sharing system that operates in a peer-to-peer distributed environment. By allowing users to exchange file fragments directly, the system ensures improved performance, robustness, and efficient resource utilization.

5. Challenges & Solutions

- **Peer Churn:** What happens when a seeder goes offline?
- **Network Issues:** Handling NAT traversal or firewall blocks.
- **Synchronization:** Ensuring pieces are requested in a way that doesn't cause bottlenecks.

6. Project Workflow

Provide a step-by-step walkthrough:

1. **Creation:** Generating the `.torrent` file from the source data.
2. **Seeding:** The initial peer making the file available.
3. **Discovery:** How a new peer finds the initial seeder via the tracker.
4. **Distribution:** The exchange of pieces between multiple peers.

7. Operational Workflow

The workflow begins when a user generates a torrent metadata file for the selected content. This metadata is shared through the tracker, enabling other peers to identify available data sources.

Peers request and exchange file fragments based on availability. Once a peer receives all fragments, it reconstructs the original file and continues sharing it with others, contributing to the network's sustainability.

8.System Architecture

The system architecture follows a decentralized Peer-to-Peer model with minimal reliance on centralized components. The primary elements of the system include torrent creator, tracker, seeders, and leechers.

The tracker acts as a coordination service, while actual file data transfer occurs directly between peers. Each peer functions both as a client and a server, allowing efficient sharing of resources. This architecture enhances scalability and ensures high availability even when some nodes fail.

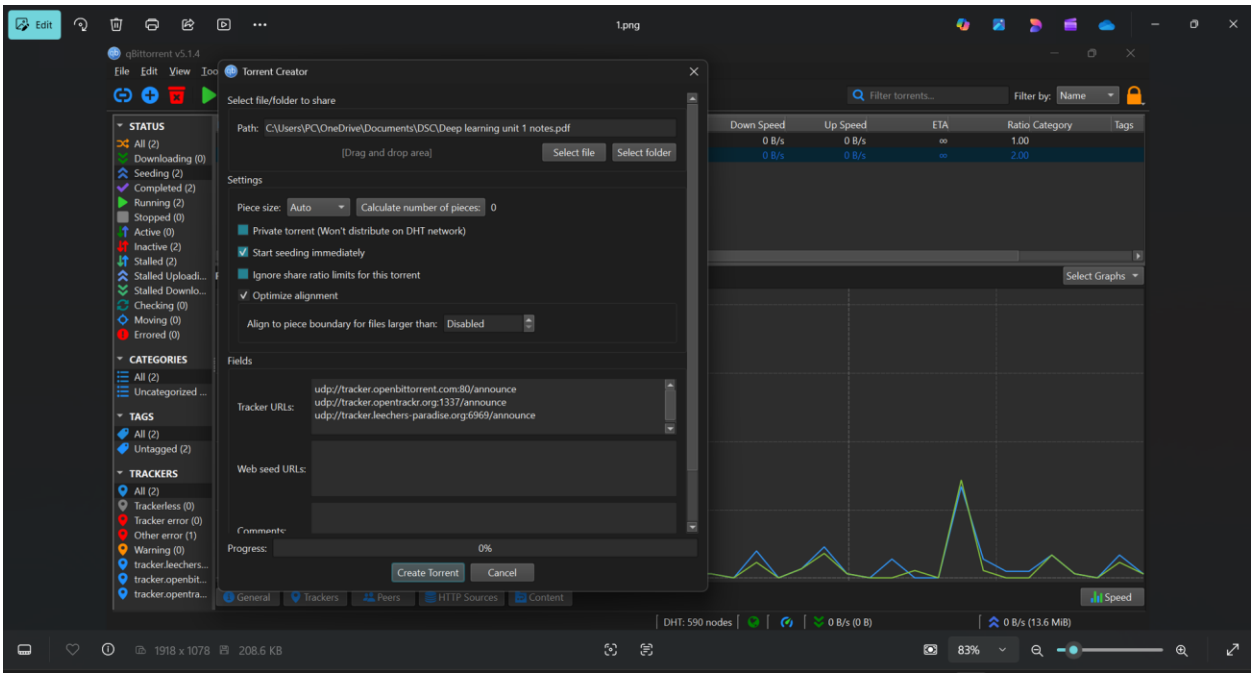
9.Testing and Results

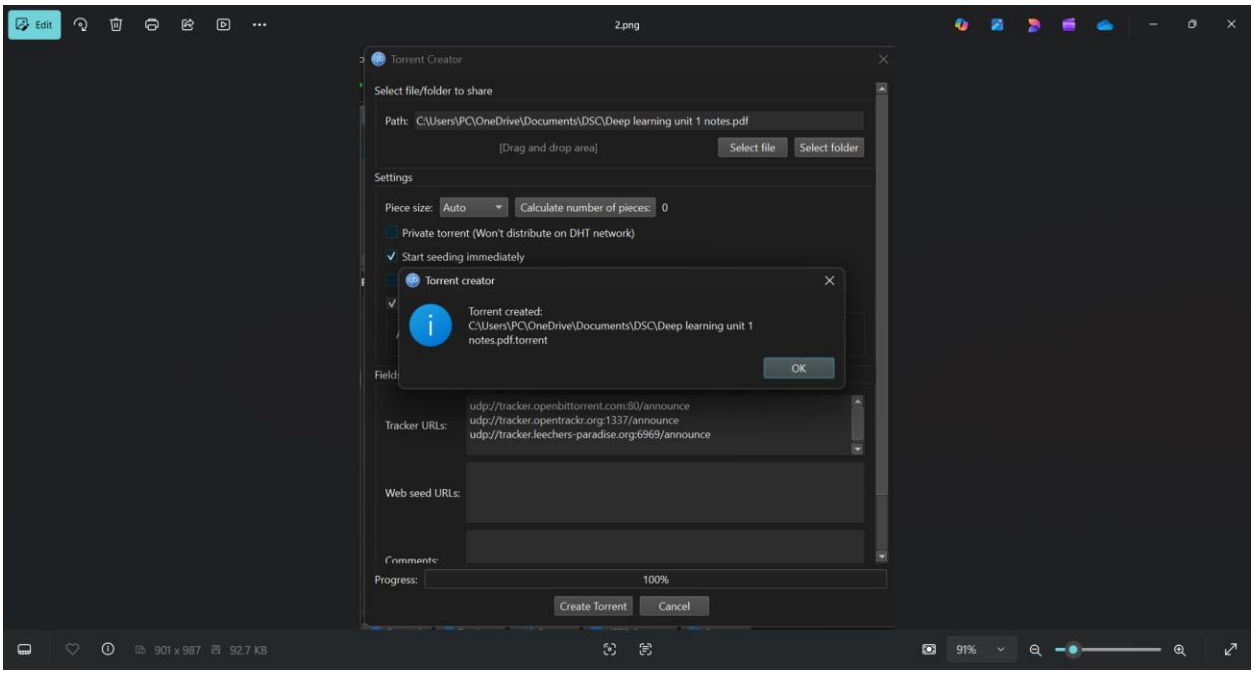
- **Test Cases:** Show what happened when 2 peers joined, then 5, then 10.
- **Performance Metrics:** Download speeds vs. number of seeders.
- **Integrity Check:** Screenshots or logs showing that the file was verified successfully after download.

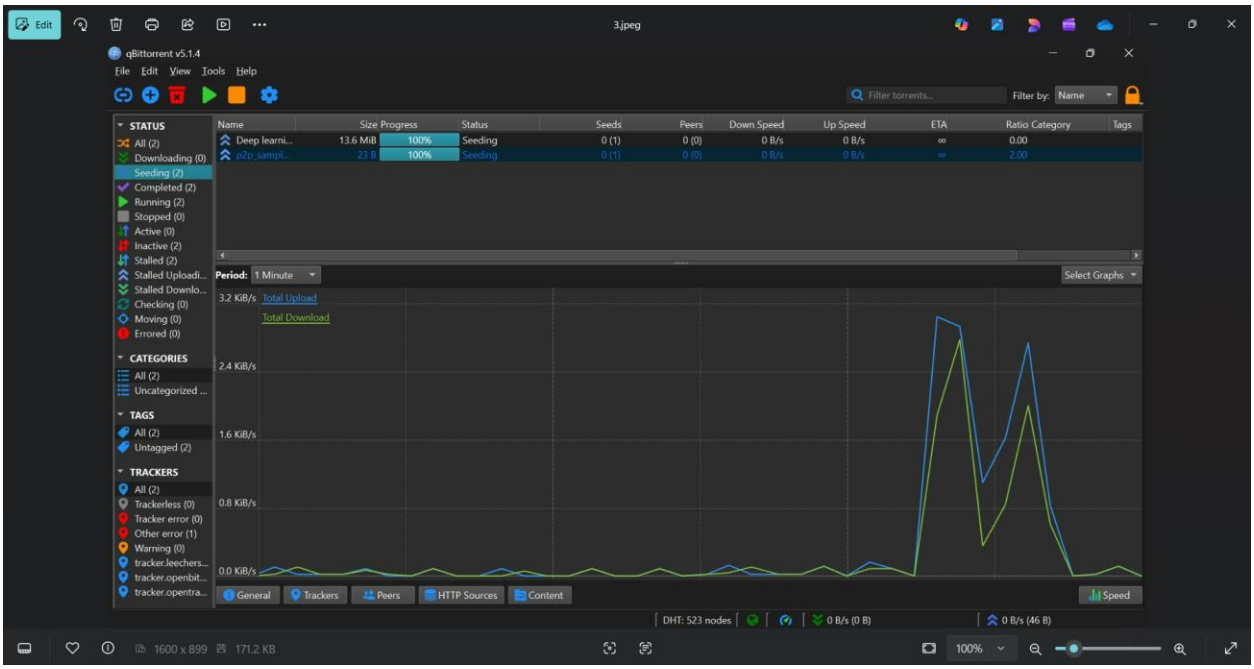
10.Outputs

The implemented system effectively demonstrates torrent-based file sharing in a distributed network. Observations indicate reduced reliance on centralized servers, improved transfer speeds, and efficient utilization of network resources.

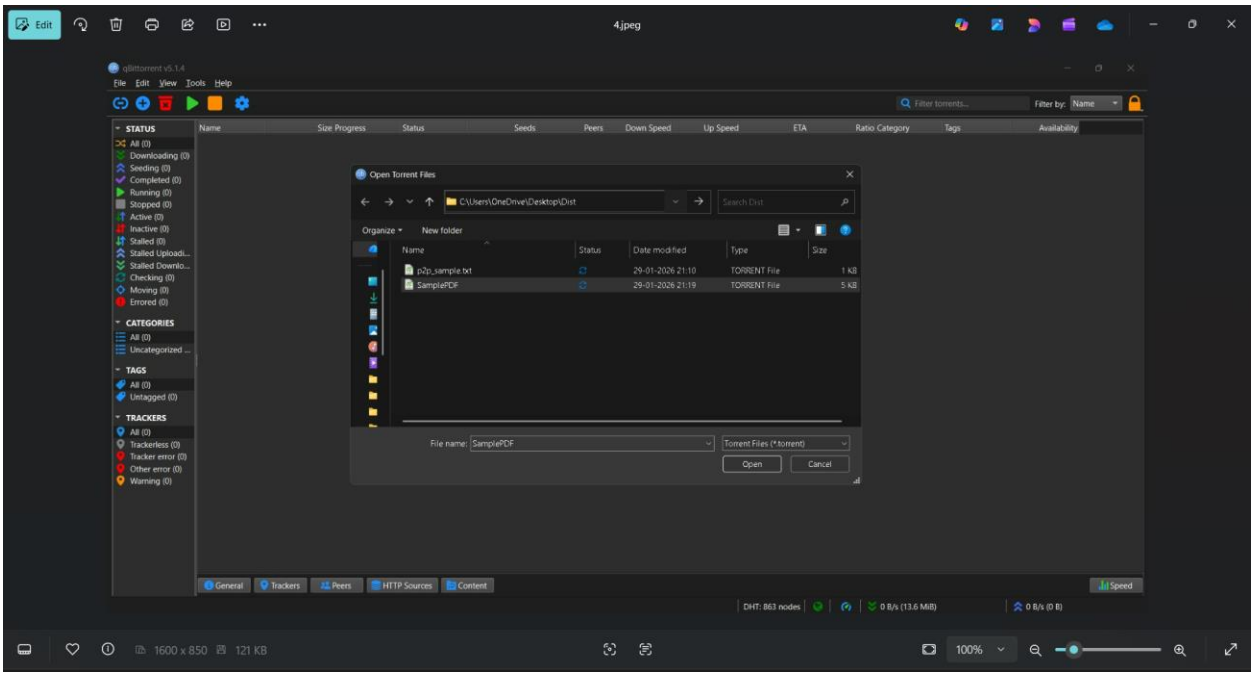
SENDER:

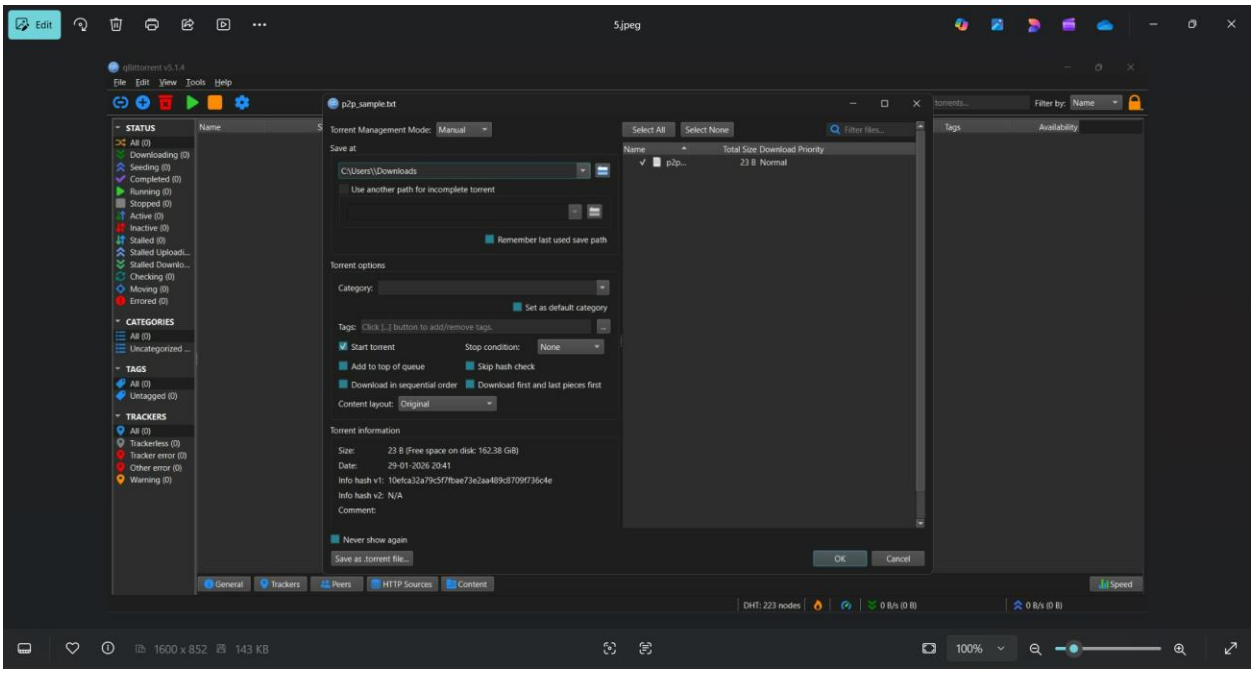

1.png
qBittorrent v5.1.4
File Edit View Tools
Torrent Creator
Select file/folder to share
Path: C:\Users\PC\OneDrive\Documents\DSC\Deep learning unit 1 notes.pdf
[Drag and drop area]
Select file
Select folder
Settings
Piece size: Auto
Calculate number of pieces: 0
Private torrent (Won't distribute on DHT network)
Start seeding immediately
Ignore share ratio limits for this torrent
Optimize alignment
Align to piece boundary for files larger than: Disabled
Fields
Tracker URLs:
udp://tracker.openbittorrent.com:80/announce
udp://tracker.opentrackr.org:1337/announce
udp://tracker.leechers-paradise.org:6969/announce
Web seed URLs:
Comments:
Progress: 0%
Create Torrent
Cancel
STATUS
CATEGORIES
TAGS
TRACKERS
Down Speed
Up Speed
ETA
Ratio Category
Tags
Select Graphs
Speed
DHT: 590 nodes
1918 x 1078
208.6 KB
83%

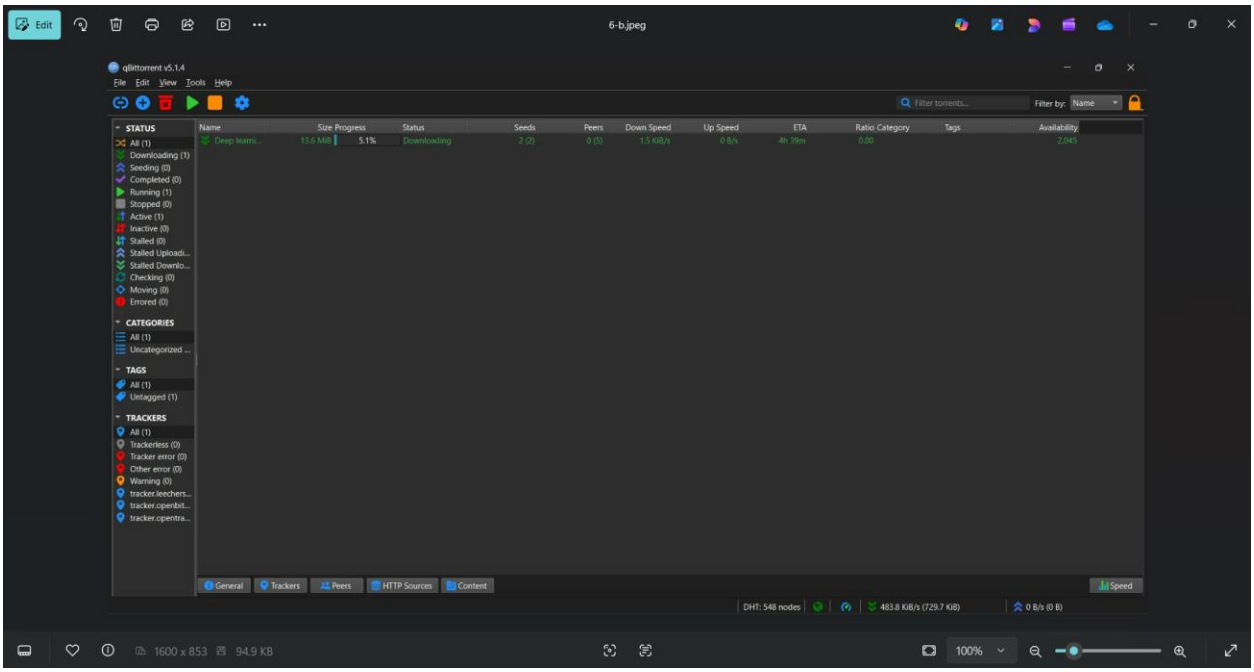

2.png
Torrent Creator
Select file/folder to share
Path: C:\Users\PC\OneDrive\Documents\DSC\Deep learning unit 1 notes.pdf
[Drag and drop area]
Select file
Select folder
Settings
Piece size: Auto
Calculate number of pieces: 0
Private torrent (Won't distribute on DHT network)
Start seeding immediately
Torrent creator
Torrent created:
C:\Users\PC\OneDrive\Documents\DSC\Deep learning unit 1 notes.pdf.torrent
OK
Tracker URLs:
udp://tracker.openbittorrent.com:80/announce
udp://tracker.opentrackr.org:1337/announce
udp://tracker.leechers-paradise.org:6969/announce
Web seed URLs:
Comments:
Progress: 100%
Create Torrent
Cancel
901 x 987
92.7 KB
91%


3.jpeg
qBittorrent v5.1.4
File Edit View Tools Help
Filter torrents...
Filter by: Name
STATUS
All (2)
Downloading (0)
Seeding (2)
Completed (2)
Running (2)
Stopped (0)
Active (0)
Inactive (2)
Stalled (2)
Stalled Uploadi...
Stalled Downlo...
Checking (0)
Moving (0)
Errored (0)
CATEGORIES
All (2)
Uncategorized ...
TAGS
All (2)
Untagged (2)
TRACKERS
All (2)
Trackerless (0)
Tracker error (0)
Other error (1)
Warning (0)
tracker.leechers...
tracker.openbit...
tracker.opentra...
Name
Size Progress
Status
Seeds
Peers
Down Speed
Up Speed
ETA
Ratio Category
Tags
Deep learni...
13.6 MiB
100%
Seeding
0 (1)
0 (0)
0 B/s
0 B/s
0.00
p2p_sampl...
23 B
100%
Seeding
0 (1)
0 (0)
0 B/s
0 B/s
2.00
Period: 1 Minute
Select Graphs
3.2 KiB/s
Total Upload
Total Download
2.4 KiB/s
1.6 KiB/s
0.8 KiB/s
0.0 KiB/s
General
Trackers
Peers
HTTP Sources
Content
Speed
DHT: 523 nodes
0 B/s (0 B)
0 B/s (46 B)
1600 x 899
171.2 KB
100%

RECEIVER:


4.jpeg
Open Torrent Files
C:\Users\OneDrive\Desktop\Dist
Search Dist
Organize
New folder
Name
Status
Date modified
Type
Size
p2p_sample.txt
29-01-2026 21:10
TORRENT File
1 KB
SamplePDF
29-01-2026 21:19
TORRENT File
5 KB
File name: SamplePDF
Torrent Files (*.torrent)
Open
Cancel
DHT: 863 nodes
0 B/s (13.6 MiB)
0 B/s (0 B)
1600 x 850
121 KB
100%


5.jpeg
qBittorrent v5.1.4
File Edit View Tools Help
p2p_sample.txt
Torrent Management Mode: Manual
Save at
C:\Users\Downloads
Use another path for incomplete torrent
Remember last used save path
Torrent options
Category:
Set as default category
Tags: Click [...] button to add/remove tags.
Start torrent
Stop condition: None
Add to top of queue
Skip hash check
Download in sequential order
Download first and last pieces first
Content layout: Original
Torrent information
Size: 23 B (Free space on disk: 162.38 GiB)
Date: 29-01-2026 20:41
Info hash v1: 10efca32a79c5f7fbae73e2aa489c8709f736c4e
Info hash v2: N/A
Comment:
Never show again
Save as .torrent file...
OK
Cancel
Select All
Select None
Filter files...
Name
Total Size
Download Priority
p2p...
23 B
Normal
STATUS
All (0)
Downloading (0)
Seeding (0)
Completed (0)
Running (0)
Stopped (0)
Active (0)
Inactive (0)
Stalled (0)
CATEGORIES
All (0)
Uncategorized
TAGS
All (0)
Untagged (0)
TRACKERS
All (0)
Trackerless (0)
Tracker error (0)
Other error (0)
Warning (0)
General
Trackers
Peers
HTTP Sources
Content
Speed
DHT: 223 nodes
0 B/s (0 B)
0 B/s (0 B)
1600 x 852
143 KB
100%


6-b.jpeg
qBittorrent v5.1.4
File Edit View Tools Help
Filter torrents...
Filter by: Name
Name
Size
Progress
Status
Seeds
Peers
Down Speed
Up Speed
ETA
Ratio
Category
Tags
Availability
Deep learni...
13.6 MiB
5.1%
Downloading
2 (2)
0 (5)
1.5 KiB/s
0 B/s
4h 39m
0.00
2.045
STATUS
All (1)
Downloading (1)
Seeding (0)
Completed (0)
Running (1)
Stopped (0)
Active (1)
Inactive (0)
Stalled (0)
CATEGORIES
All (1)
Uncategorized
TAGS
All (1)
Untagged (1)
TRACKERS
All (1)
Trackerless (0)
Tracker error (0)
Other error (0)
Warning (0)
tracker.leechers...
tracker.openbit...
tracker.opentra...
General
Trackers
Peers
HTTP Sources
Content
Speed
DHT: 548 nodes
483.8 KiB/s (729.7 KiB)
0 B/s (0 B)
1600 x 853
94.9 KB
100%

11. Conclusion

In conclusion, torrent-based P2P systems provide a robust and scalable solution for large-scale file sharing. The project effectively applies distributed system principles such as decentralization, concurrency, and reliability, making it a practical implementation for modern data distribution needs.