Distributed Architecture Case Study: BitTorrent
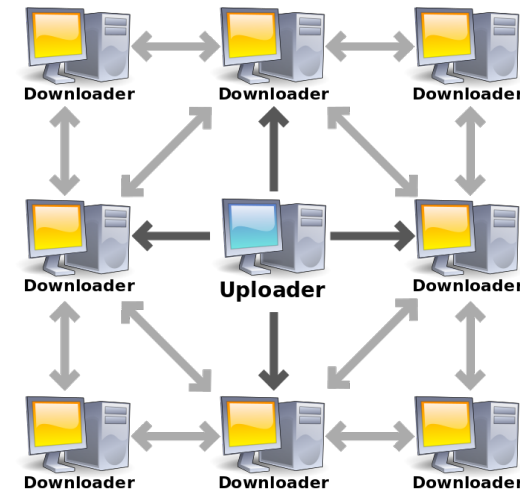
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Introduction

- BitTorrent is a file sharing protocol based on a Peer-to-Peer architecture.
- Its main goal is to speed up files downloads by removing the central server bottleneck
  - All computers downloading the same file, exchange already downloaded parts of the file between each other
    - The set of all the participant of the download is called a *swarm* in the BitTorrent terminology
    - A *swarm* is created for each file download

- The are many implementations:
  - Official client, µTorrent, qBittorrent, Transmission, Vuze, BitComet and many more

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Use-cases

- BitTorrent can basically provide the following services

  - Distribution of larges files on large networks
    - OS, Movies, games distribution
      - Example: *facebook* uses BitTorrent to distribute new releases

  - Robustness and service availability thanks to Data replication
    - This is inherent to the BitTorrent architecture

  - Illegal file-sharing
    - But without strict anonymity
      - private BitTorrent networks

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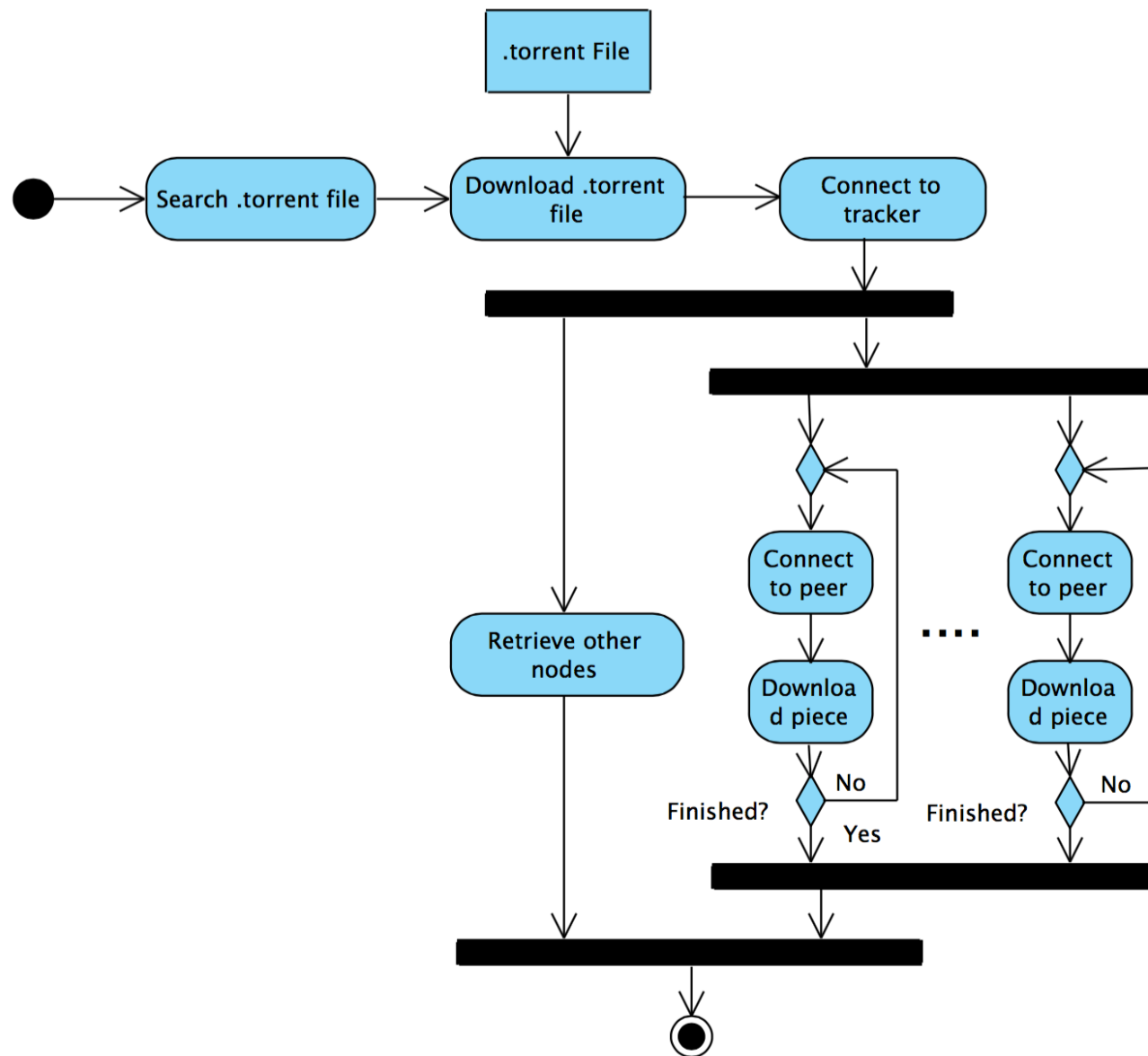
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BitTorrent design idea

- When downloading a file, the BitT client announces to a central BitT server that he is interested in the file

- The BitT server stores the contact information of that BitT client, and sends him not only a list of other BitT clients having the file but also a list of BitT clients which are currently downloading the file already

- The BitT client connects to the other nodes and requests the different parts of the file
  - During downloading the BitT client can be contacted to send parts of the file he already have to other BitT clients

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The `.torrent` files

- A `.torrent` is a file containing the required information to download a specific file
  - Content:
    - Announce : The tracker information, basically the URI
    - Info : Information for
      - Name : File name
      - Piece length : Size in bytes for every download part
      - Length : Total file size
      - Pieces : Hash for every individual piece to be downloaded

```
{
  'announce':'http://bttracker.debian.org:6969/announce',
  'info':{
    'name':'debian-503-amd64-CD-1.iso',
    'piece length':262144,
    'length':678301696,
    'pieces':'841ae846bc5b6d7bd6e9aa3dd9e551559c82abc1...d14f1631d776008f83772ee170c42411618190a4'
  }
}
```

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File download activity diagram

Single point of failure

- The weakness of this architecture is the tracker

    - single point of failure for a swarm

- This why new versions of BitTorrent have introduced the DHT

    - DHT stand for "Distributed sloppy hash table"

    - It is an architecture extension which makes every node part of a distributed tracker

- The DHT is a distributed *hashtable* in which key/value pairs can be stored

    - Basically we can see the DHT as a distributed redondant tracker

    - It does not have an "announce" key. Instead, it has a "nodes" key.

        - This key should be set to the K closest nodes

- By storing the information about the peers in a *swarm* in a distributed hash table, the need for a single tracker is removed

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File download activity diagram with DHT