# Peer-to-Peer Networks

Status 2008
13th Week

Albert-Ludwigs-Universität Freiburg
Department of Computer Science
Computer Networks and Telematics
Christian Schindelhauer
Summer 2008

Peer to Peer Networks

Situation 2008

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Internet Traffic 1993-2004

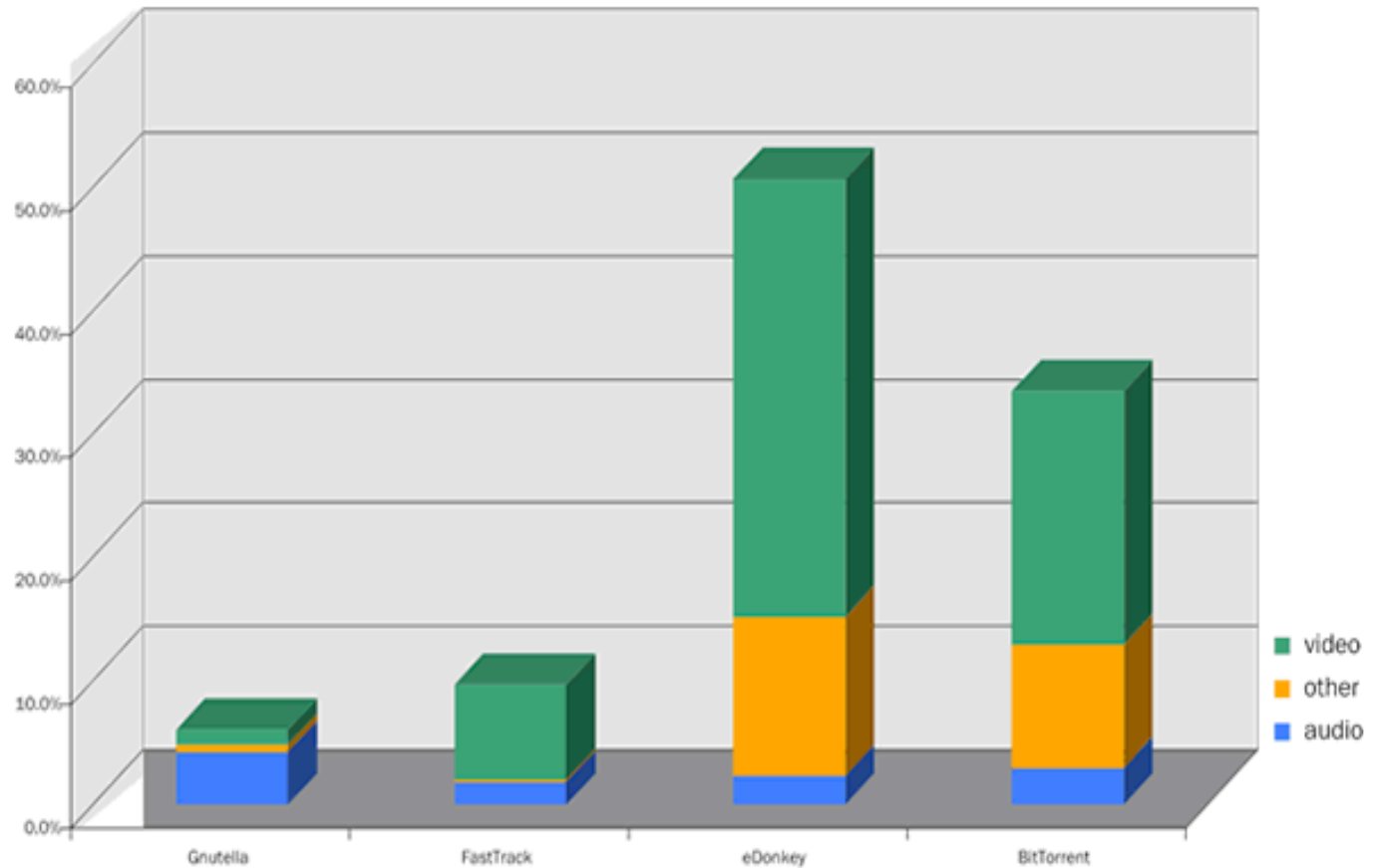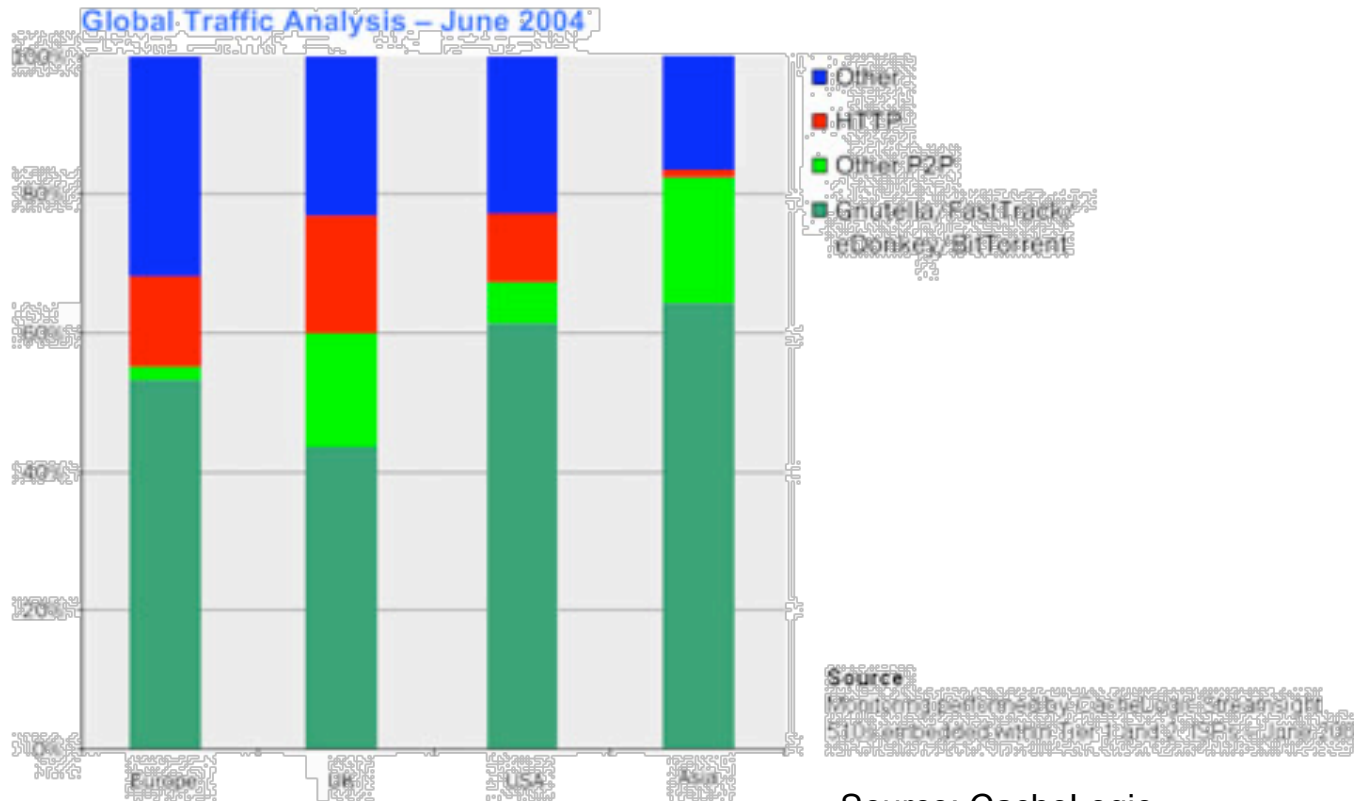CacheLogic Research | Internet Protocol Trends 1993 - 2004

Legend: email, FTP, P2P, Web

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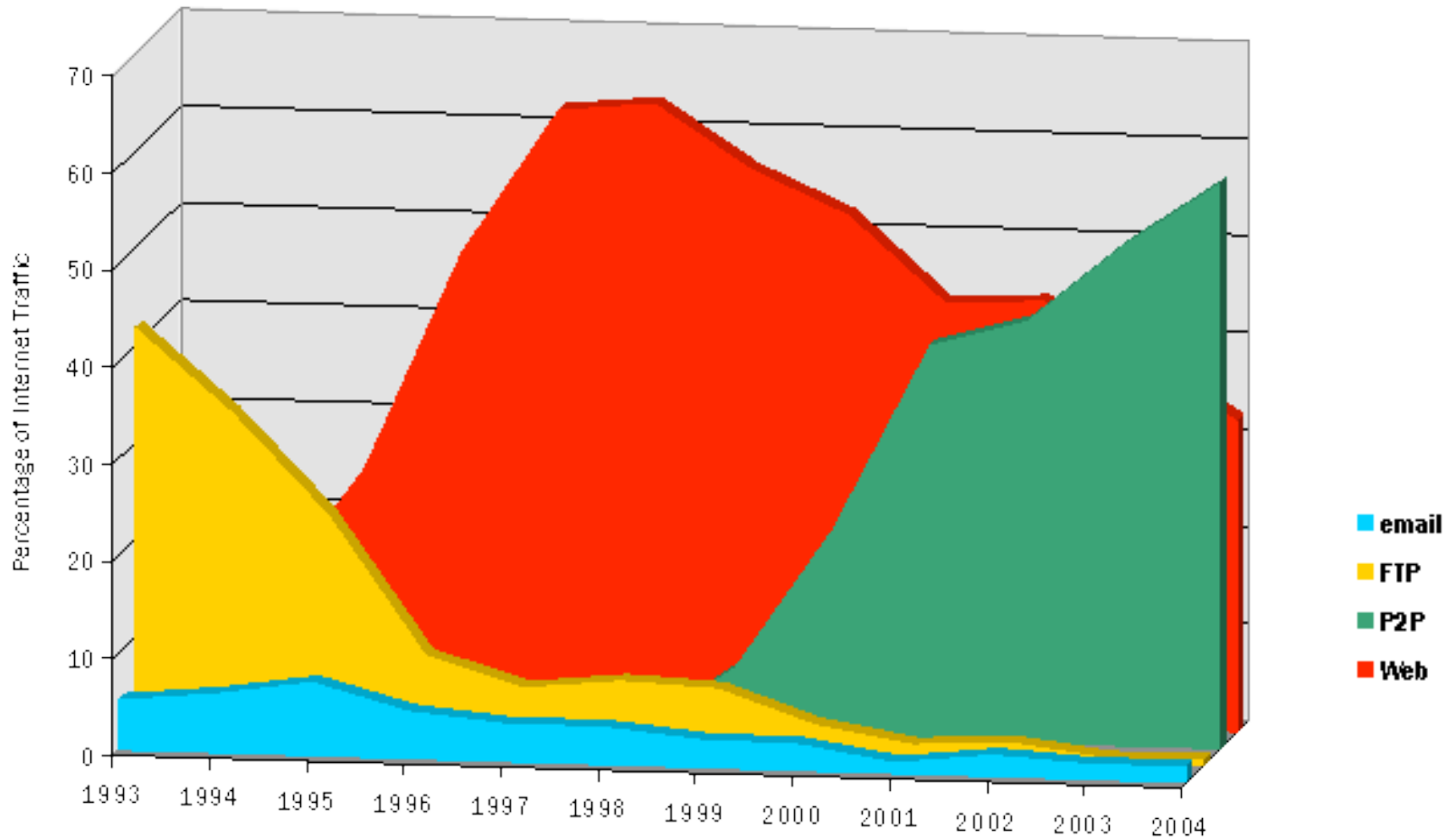
Main Protocols
2004

‣ **Main protocols**
- eDonkey
- BitTorrent
- FastTrack
- Gnutella

CacheLogic Research | **Mix of P2P Traffic Volume by Region**

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P2P Share
June 2004

Source: CacheLogic

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P2P Share Germany 2007

HTTP, 10.71%

Streaming, 8.26%

DDL, 4.57%

VoIP/Skype, 0.98%

FTP, 0.53%

Mail, 0.39%

IM, 0.34%

Tunnel/Encryption, 0.34%

NNTP, 0.09%

P2P, 73.79%

Source: Ipoque 2007

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P2P Systems Germany 2007 by Volume

Other
0.99%

eDonkey
28.59%

Gnutella
3.72%

BitTorrent
66.70%

Source: Ipoque 2007

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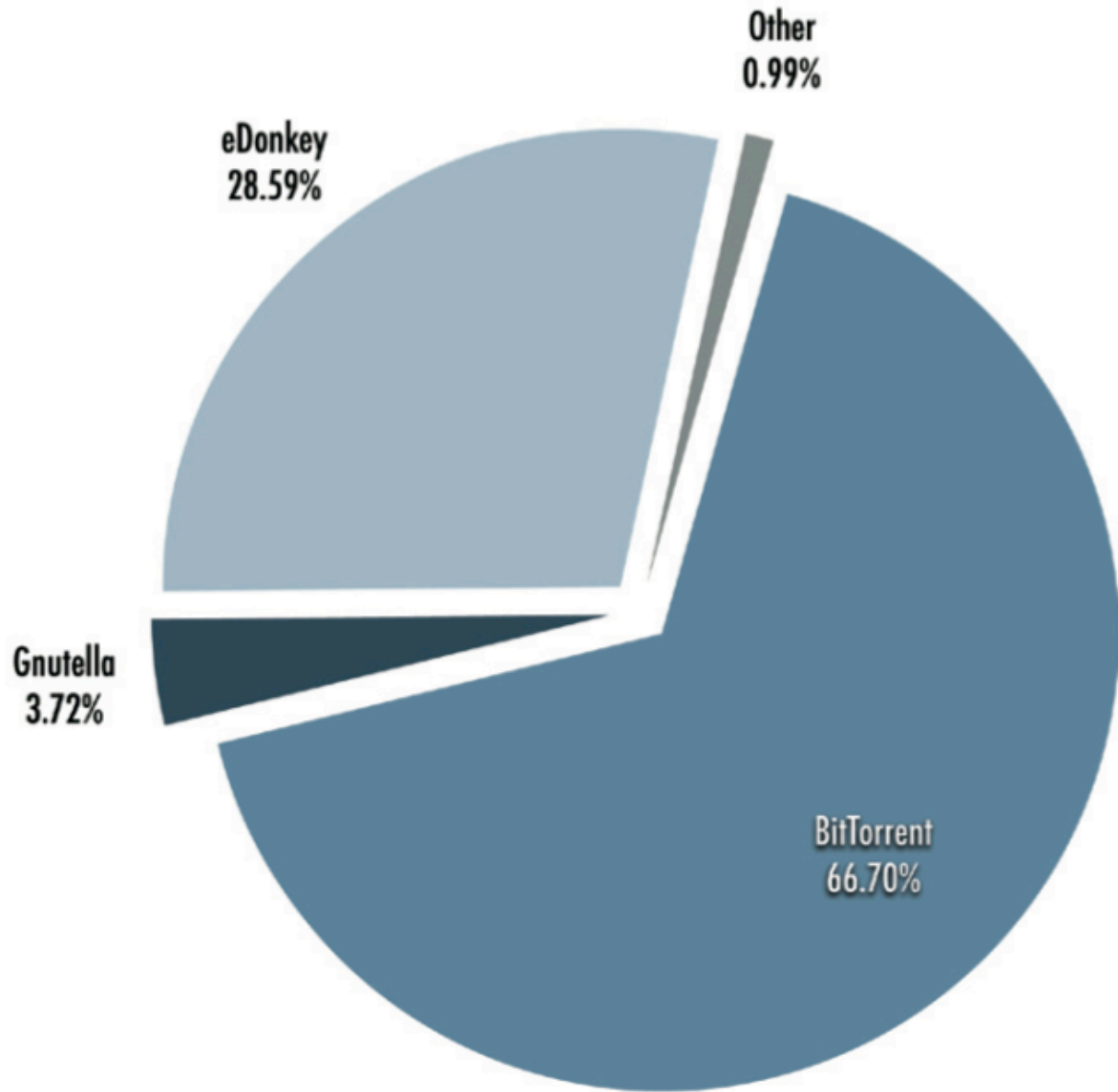
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What Germans Download 2007 by Volume

Traffic Volume per Content Type
Germany, BitTorrent

- TV 21.15%
- Porn 13.05%
- Movie 37.24%
- aBook 1.41%
- Music 7.78%
- eBook 0.81%
- Game 5.77%
- Application 4.97%
- Picture 0.09%
- Anime 7.09%
- Music 0.65%

Legend:
- Video 79.17%
- eBook 0.81%
- Picture 0.09%
- Audio 9.19%
- Software 10.74%

Source: Ipoque 2007

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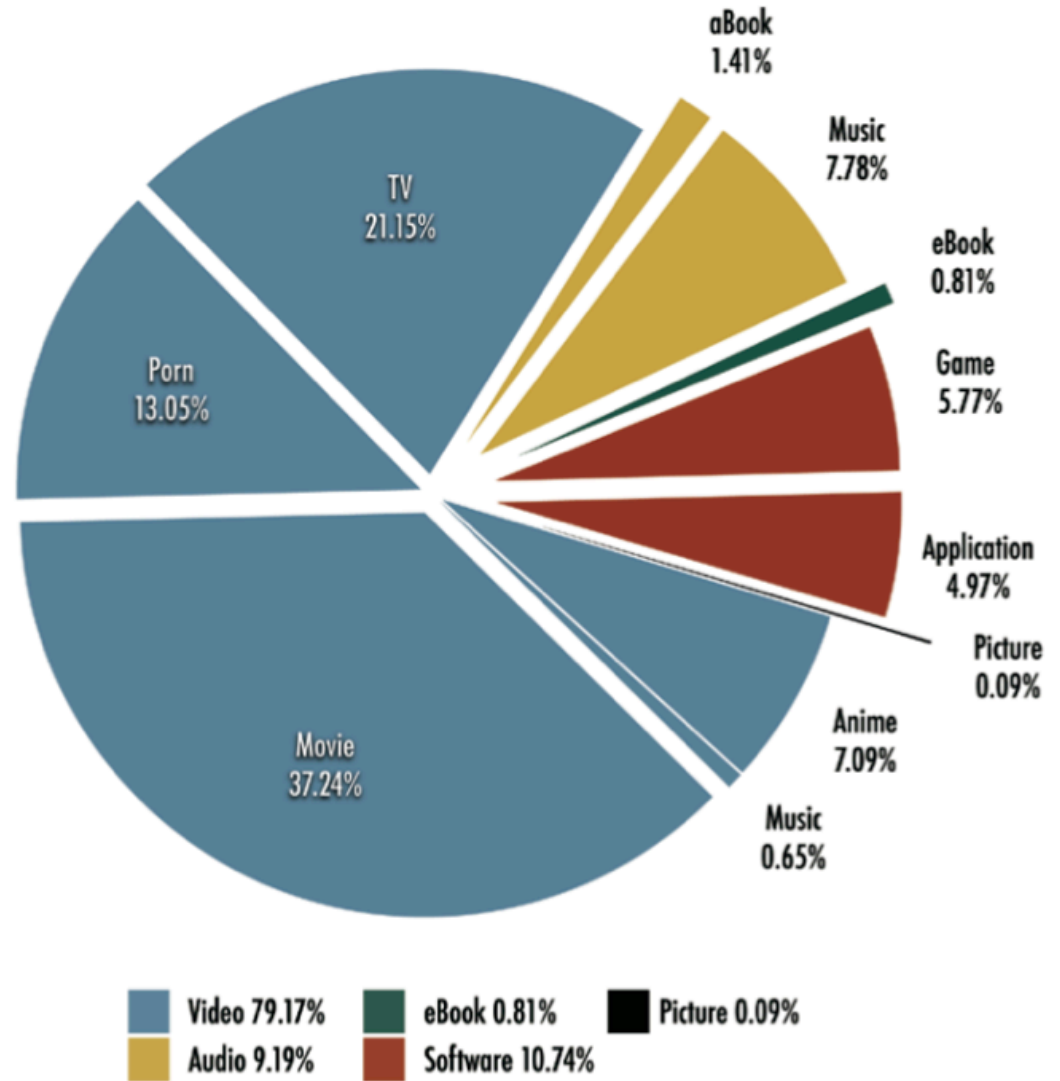
Global Internet Traffic 2007

‣ **Ellacoya report (June 2007)**

  • worldwide HTTP traffic volume overtakes P2P after four years continues record

‣ **Main reason: Youtube.com**

P2P
37%

gaming
2%

non-HTTP video streaming
3%

Newsgroups
9%

VoIP
1%

rest
2%

HTTP
46%

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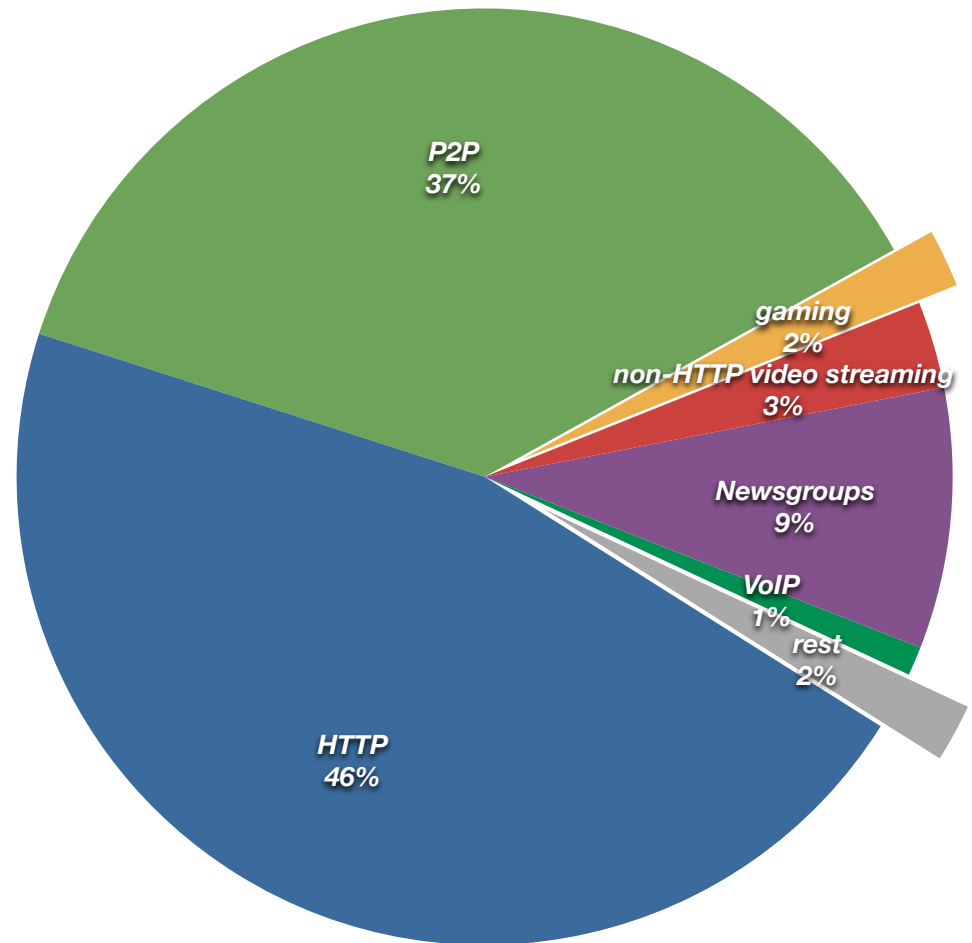
Popular P2P Networks

‣ **Gnutella 1+2**

‣ **Kazaa / Fastrack**

‣ **Mule / eDonkey / Kademlia**

‣ **WinMX**

‣ **DC++ / DirectConnect**

‣ **Azureus / BitTorrent**

‣ **Less popular**

• Ares

• Soulseek

• Mute

  - based on Ant Colony algorithm

• Freenet

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Gnutella 2

‣ **Hybride structure**
  - nodes with high bandwidth become P2P super nodes
  - super nodes provide P2P network like original Gnutella
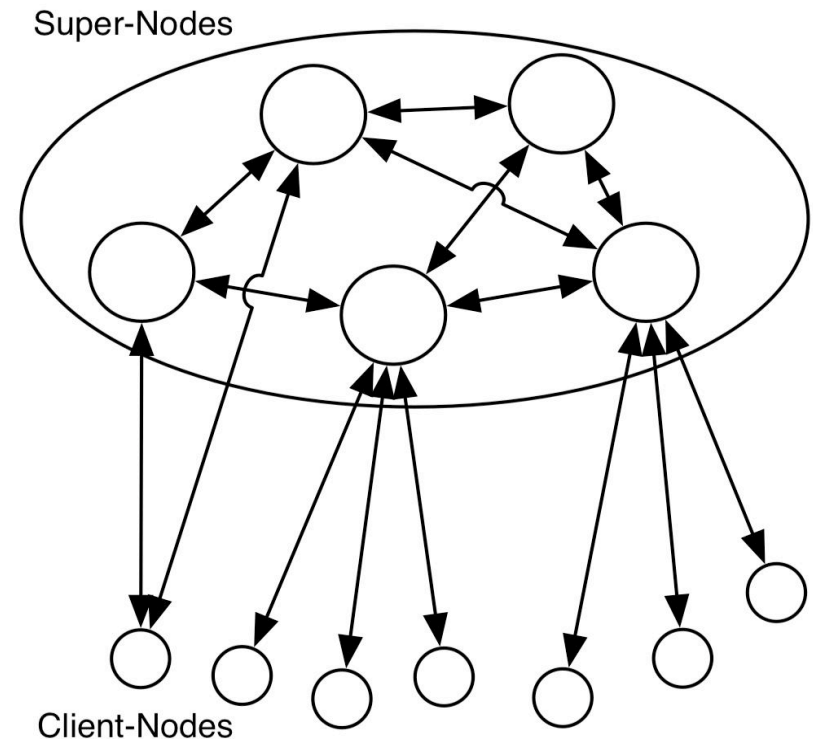 - normal nodes connect to the super nodes as clients

‣ **Used in**
  - FastTrack, Gnutella 2, Skype

‣ **Advantage**
  - improved scalability, lower latencies

‣ **Disadvantage**
  - clients can try to disable super node ability
  - scalability limited

Super-Nodes

Client-Nodes

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FastTrack

- **Designed by Niklas Zennström, Janus Friies, Jaan Tallinn 2001**
  - authors of Skype (P2P-Internet-Telefonie)
- **Hybride P2P Network**
  - Super nodes with special tasks
  - Software detects super node ability
    - e.g. no NAT server, more bandwidth, good network connection
  - super node for lookup
  - download by HTTP
    - from client to client (P2P)

- **Software**
  - not open source
  - official client contains malware
  - client super node communication investigated by reverse engineering
    - malware free clients available (Kazaa lite)
    - clients provide no super-node features
  - comunication between super nodes still unknown
- **Ares**
  - by the same developers
  - similar network
    - client: Ares Galaxy

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E-Donkey

‣ **Client server index structure**
- Server
  - special server software
    - ∗ e.g. Lugdunum, satan-edonkey-server
  - provide upload
  - store index information
- Clients
  - several software clients
  - e.g. eMule, Shareaza, MLDonkey, eDonkey2000, Hydranode, Morpheus, ...
  - allow downloads from multiple other clients

- some clients provide mechanisms for fair sharing

‣ **Discussion**
- vulnerable for attacks
  - e.g. law enforcement, denial of service
  - in Feb 2006 Razorback2 server was confiscated by the Belgian police
- Napster like P2P network

‣ **Sucessor Overnet**
- was eliminated 2006
- protocol still in use by a botnet

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Napster Sucessors

‣ **OpenNap**
- Napster clone
  - by reverse engineering of Napster communication
- adds chatting tool
- several clients available
- star topology as in Napster

‣ **WinMX**
- started as OpenNap client
- adds hash code to Napster clone
- in 2001 most successful P2P network in Japan
- 2005 server farm was deactivated
  - and moved to Vanuatu

‣ **Soulseek**
- Napster like system
- adds features like
  - interest groups
  - chatting
  - wishing list
- allows only single server

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Direct Connect

- **Client-server network for indexing**
  - by NeoModus Inc.
  - server provide channels
  - channels can be secured by passwords
    - loophole against copyright laws
  - clients connect to server and transfer data directly from peer to peer
  - very popular in Scandinavia

- **Server is bottleneck**
- **Client software**
  - DC++, MLDonkey, NeoModus Direct Connect, ShakesPeer,...
- **Hub software**
  - Direct Connect Hub link, Hexhub, Open Direct Connect Hub, PtokaX,...

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Skype

- ‣ **Usage**
  - VoIP, video, chat, file transfer, audio and video conferences
  - aims at a legal and free peer-to-peer communication platform
- ‣ **Hybride Peer-to-Peer Network**
  - with super nodes
  - by the creators of Kazaa
- ‣ **Client-sever network**
  - for authentification and registration
- ‣ **Obscurity layers**
  - software encoded
  - communication encoded, possibly readable by Skype

- ‣ **Reverse engineering of Skype failed so far**
- ‣ **Little information by Skype about**
  - internal structure
  - privacy control
  - security
- ‣ **Popularity**
  - wide spread in private use
  - companies and organizations are reluctant to grant the usage of Skype
    - because of security concerns

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Legal Situation

‣ **"IAAL*: What Peer-to-Peer Developers Need to Know about Copyright Law", Fred von Lohmann, 2006**

‣ **Direct Infringement**
- end users share files without authorization of the copyright owner

‣ **Secondary Infringement**
- P2P tool maker
- Inducement
  - if copyright infringement by third party is supported by the tool
  - with intent
- Contributory infringement
  - knowingly contributes to another's infringement
- Vicarious Liability
  - direct infringement by somebody

  - and right and ability to control by tool maker
  - and direct financial benefit

‣ **Defense strategies**
- no direct infringement: „All users are innocent"
- software capable of substantial non infringing uses
- „safe harbors" for online service providers
  - notifies users of a policy to terminate accounts of infringers
  - copyright agent for legal notices
  - must act after notice
  - must not know about infringements
  - must not receive direct benefits from infringements

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Companies using P2P

‣ **Bittorrent, Kazaa**

‣ **Skype**

‣ **Microsoft, Intel, Sun**

‣ **Velocix, StratVantage, Loudcloud, Quiq, NextPage, Consilient, Sharman Networks, BlogAds, Octoshape, Joost, BigChampagne, Collanos, Vudu, ...**

‣ **ISPs and networking companies**

- like Verizon, France Telecom, Pando, Norwegian Telecommunication ...

- investigate possible usages of P2P networks

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Companies & Organizations
Fighting P2P Users

‣ **Fighting copyright regulations, e.g.**
- Copyright Solutions
  - Blackwidow
  - P2P monitoring systems
  - monitors several systems
- Evidenzia
  - monitors Bittorrent and eMule index files

‣ **RIAA (Recording Industry Association of America)**

‣ **IFPI (International Federation of Phonographic Industry)**
- Digital File Check
  - program disables P2P Networks

- legal actions against P2P servers and users

‣ **Law Attorneys**
- bulk legal notices („Abmahnwelle")
- search file-sharing networks for specific contents and send legal notices threatening law suits

‣ **Internet Service Providers**
- curb peer-to-peer traffic
- e.g. Comcast & Bell, Canada
- using deep packet inspection (DPI)
- Anagram inc.
  - by Lawrence Roberts
  - P2P traffic detection (without DPI)

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Problems of Copyright Enforcement

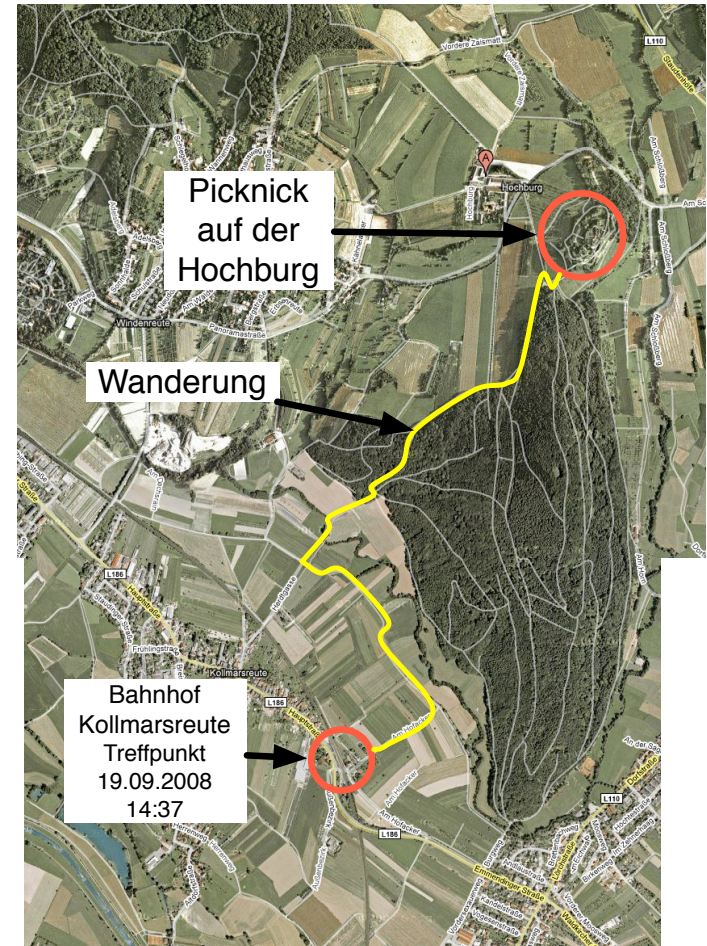▸ **Automated detection and law enforcement**
- Catherine Rampell, How It Does It: The RIAA Explains How It Catches Alleged Music Pirates, 2008
  - Blackwidow from Copyright Solutions
  - Evidenzia
- Log in as fake user and collect IP addresses from other peers

▸ **Problem: False positives**
- Michael Piatek, Tadayoshi Kohno, Arvind Krishnamurthy, Challenges and Directions for Monitoring P2P File Sharing Networks – or – Why My Printer Received a DMCA Takedown Notice
- provoked RIAA accusation by peers blackmailing non-active („innocent") IP addresses

Picknick at the Hochburg

▸ **Friday 19.09.2008, 2 pm**

▸ **Departure 13:56**

- Metro station Freiburg-Messe

▸ **Arrival 14:37**

- Metro station Kollmarsreute

▸ **Hiking trip to Hochburg**

- Arrival approx. 16:00

▸ **Picknick at the Hochburg**

- Order drinks on the forum
- Delivered by car
- Bring your own food

▸ **Later: hiking trip back to Kollmarsreute**

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End of 13th Week

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