P2P Filesharing Population Tracking Based on Network Flow Data

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Outline

1. Motivation
2. Setting
3. The PeerTracker
4. Validation by Polling
5. Comments on Legal Aspects
6. Conclusion

Contributors

- Philipp Jardas, ”P2P Filesharing Systems: Real World NetFlow Traffic Characterization”, Barchelor Thesis, ETH Zürich, 2004
- Lukas Hämmerle, ”P2P Population Tracking and Traffic Characterization of Current P2P file-sharing Systems”, Master Thesis, ETH Zürich, 2004
- Roger Kaspar, ”P2P File-sharing Traffic Identification Method Validation and Verification”, Semester Thesis, ETH Zürich, 2005

PDFs available from
`http://www.tik.ee.ethz.ch/~ddosvax/sada/`

Motivation

- P2P traffic forms a large and dynamic part of the overall network traffic
- Identification of P2P traffic allows P2P anomaly detection
- Identification of P2P traffic allows better analysis of other traffic

The DDoSVax Project

`http://www.tik.ee.ethz.ch/~ddosvax/`

- Collaboration between SWITCH (www.switch.ch, AS559) and ETH Zurich (www.ethz.ch)
- Aim (long-term): Near real-time analysis and countermeasures for DDoS-Attacks and Internet Worms
- Start: Begin of 2003
- Funded by SWITCH and the Swiss National Science Foundation

DDoSVax Data Source: SWITCH

The Swiss Academic And Research Network

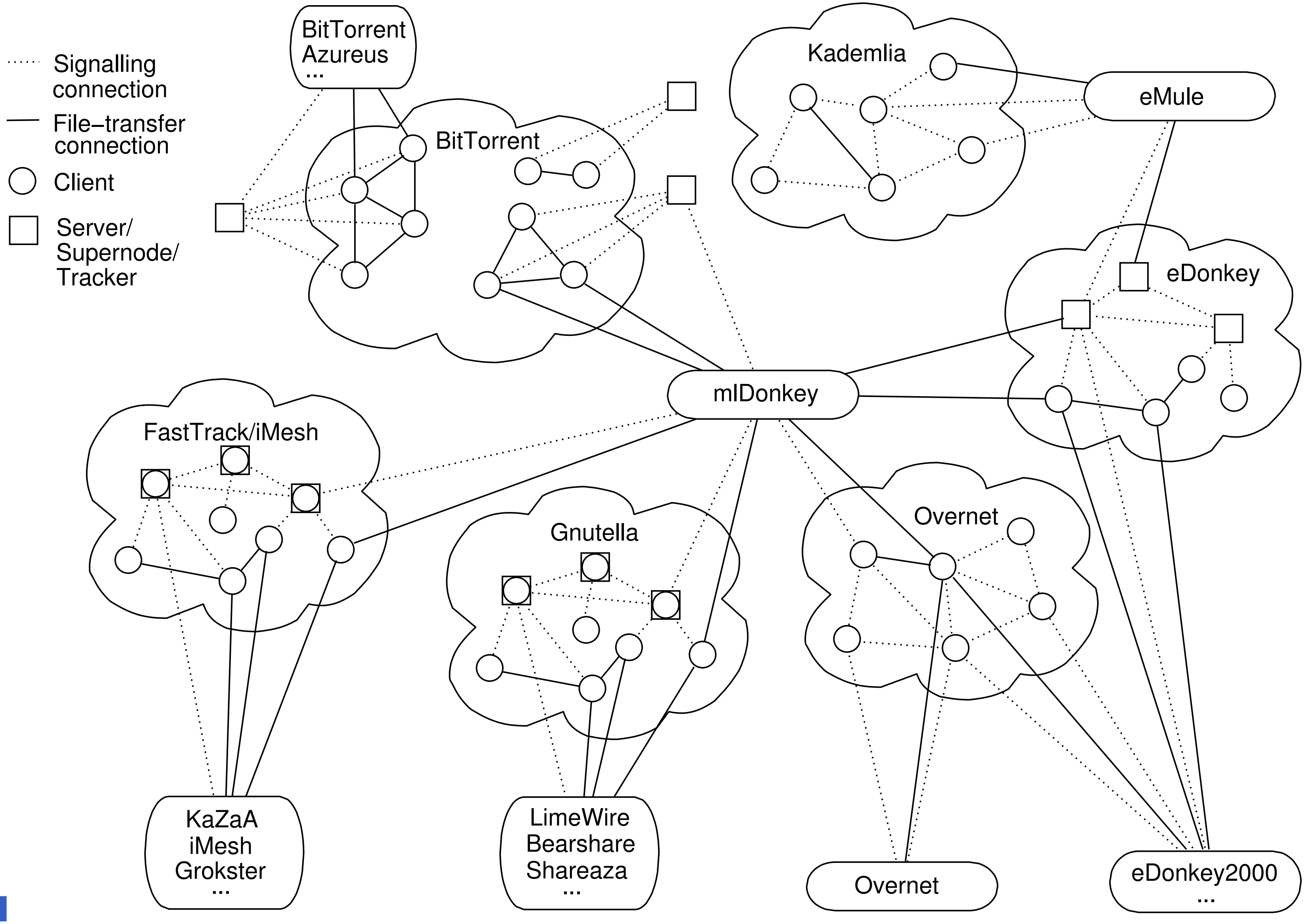
- .ch Registrar
- Links most Swiss Universities and CERN
- Carried around 5% of all Swiss Internet traffic in 2003
- Around 60.000.000 flows/hour
- Around 300GB traffic/hour
- Flow archive (unsampled) since May 2003

What is a ”Flow”?

In the DDoSVax-Project: CISCO NetFlow v5.
Basically unidirectional aggregated header information:

- Source and destination IP
- Protocol
- Source and destination port (TCP and UDP)
- Packet and byte count
- Start and end time stamp, 1ms accuracy
- Some routing information
- No payload information whatsoever

P2P Networks Considered



⋯ Signalling connection

— File–transfer connection

○ Client

□ Server/ Supernode/ Tracker

BitTorrent
Azureus
...

BitTorrent

Kademlia

eMule

eDonkey

mlDonkey

FastTrack/iMesh

Gnutella

Overnet

KaZaA
iMesh
Grokster
...

LimeWire
Bearshare
Shareaza
...

Overnet

eDonkey2000
...

PeerTracker Algorithm

Idea: ”Traverse” P2P network from seeds

Seeds:

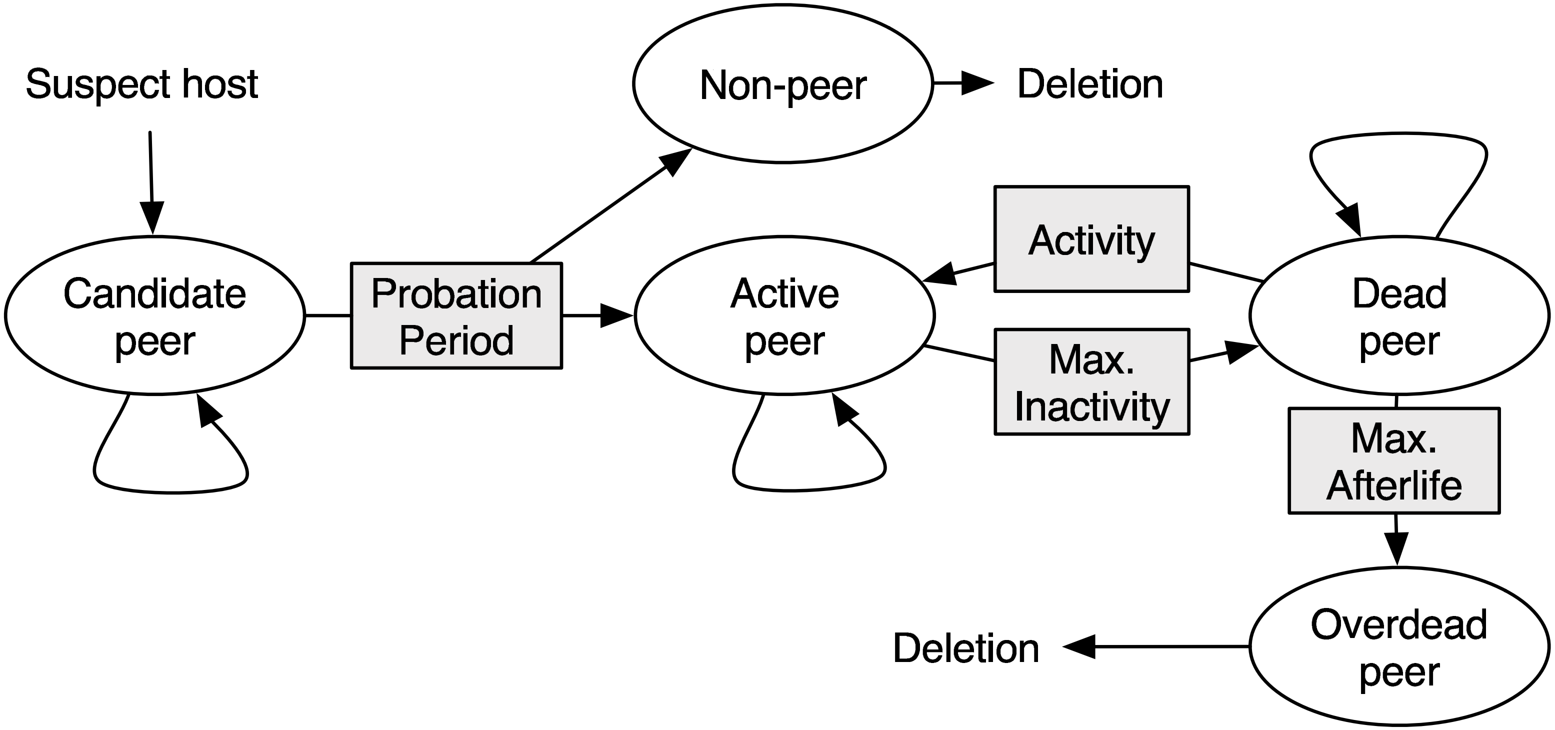
- Seeds are peers using default ports (TCP and UDP)
- Keep a pool of peers for each network
- Add hosts that communicate with the pool
- Remove hosts that are idle

Default Port Usage

P2P System	Default port usage (TCP)
BitTorrent	70.0 %
FastTrack	8.3 %
Gnutella	58.6 %
eDonkey	55.6 %
Overnet	83.9 %
Kademlia	66.6 %

From 8 day PeerTracker measurement end of 2004

PeerTracker: Hosts State Diagram



Some PeerTracker Details

- Peers in the SWITCH network form ”core”
- External hosts only identified if they contact core
- Different ageing for core and external hosts
- Dead core peers are still contacted from external peers

Validation

The PeerTracker does not look at Payloads
⇒ Large error possible

Validation Approach:

- Run PeerTracker
- Poll found peers immediately
- Compare polling and tracker results

Peer Polling Methods

P2P System	Polling method
FastTrack	Request: `GET /.files HTTP/1.0` Response: `HTTP 1.0 403 Forbidden` <number 1> <number 2> or `HTTP/1.0 404 Not Found/nX-Kazaa-`<username>
Gnutella	Request: `GNUTELLA CONNECT/`<version> Response: `Gnutella` <status>
eDonkey, Kademlia, Overnet	Request: Binary: 0xE3 <length> 0x01 0x10 <MD4 hash> <ID> <port> Response: Binary: 0xE3 . . .
eMule	Same as eDonkey, but replace initial byte with 0xC5.
BitTorrent	Unsolved. Seems to need knowledge of a shared file on the target peer.

Polling Results

P2P System	TCP Connect	P2P-client found
eDonkey, Kademlia, Overnet	50%	41%
Gnutella	53%	30%
FastTrack	51%	41%
Total	51%	38%

Table 1: Positive polling answers

Polling Remarks

- Delay to polling < 10 Minutes
- About 50% unreachable via TCP and port seen by PeerTracker ⇒ likely behind NAT
- Other errors: Peer variation (esp. Gnutella), classification into wrong network, tracker error
- BitTorrent not really pollable

Legal Aspects

(Warning: I am no legal expert)

- Flow data likely not subject to privacy laws (unless attempts to identify people are made)
- PeerTracker does not identify content shared ⇒ output unproblematic, no action needs to be taken
- Identification of heavy hitters unproblematic, since payloads (shared contents) not identified
- Polling is unproblematic, since similar to running a peer (some users get nervous though...)

PeerTracker for Law Enforcement

Situation for CH!

- Massive private file-sharing is done
- Law enforcement is not really interested in copyright infringement
- Illegal contents (child pornography and the like) can be done far better with modified P2P clients

$\Rightarrow$ Not really suitable

Conclusion, Remarks

- Peer identification feasible with flow data
- Nodes with little traffic problematic
- BitTorrent problematic
- P2P filesharing still evolves
- PeerTracker code is available under GPL
- In productive use at ETH Zurich since 2005

Thank You!