

Cross layer aspects of P2P overlays for content distribution

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- Content distribution via overlay networks (P2P, CDN)
- Approaches for local data exchange in P2P networks
- Traffic optimization on application and network layer

Transmission paths in CDN and P2P networks

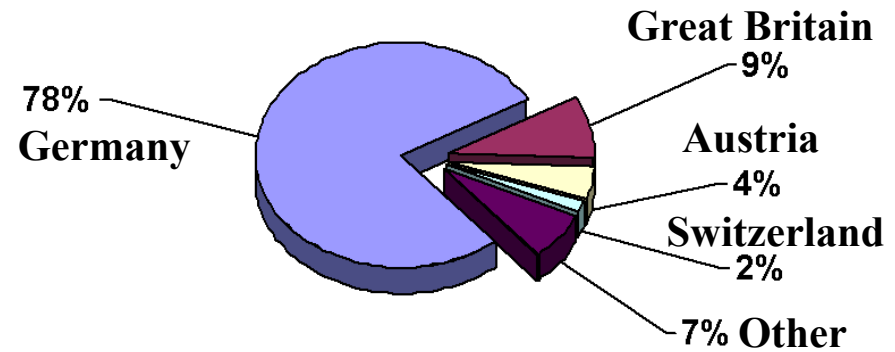


P2P Source Locations

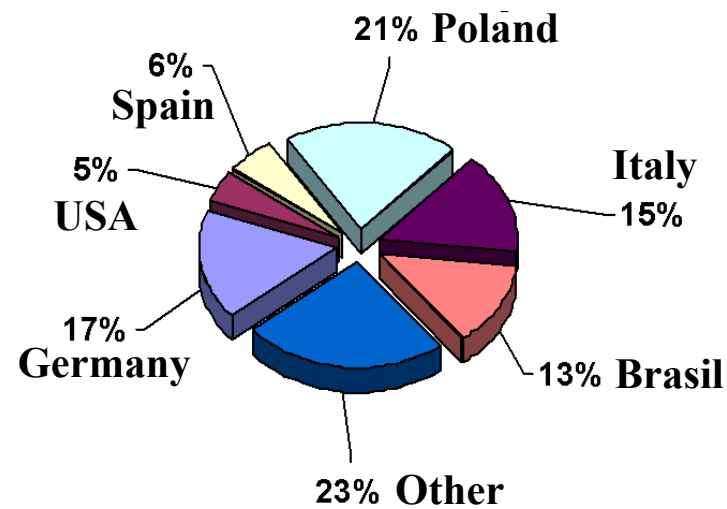
Influence of Social Communities, e.g. due to Language

Distribution of eDonkey Sources:

Downloads of German content in Germany:

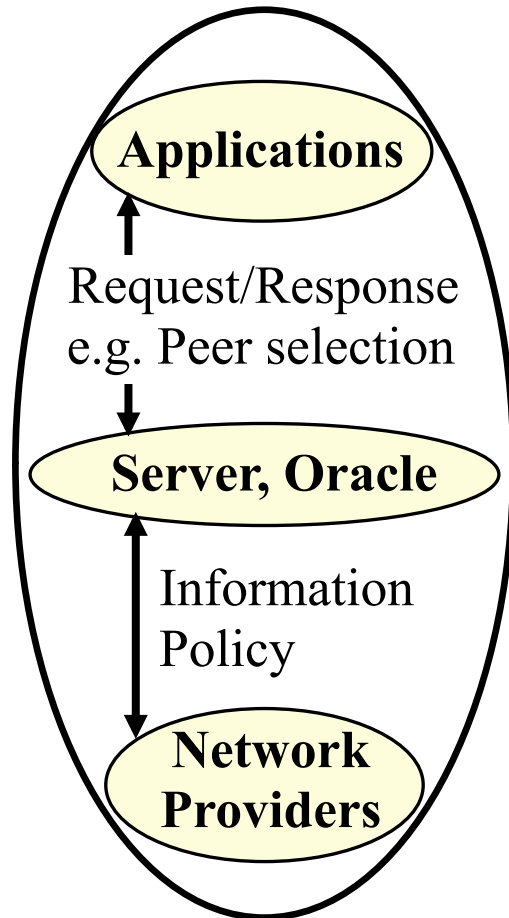


Downloads of English content in Germany: seems to depend on server locations which may change over time

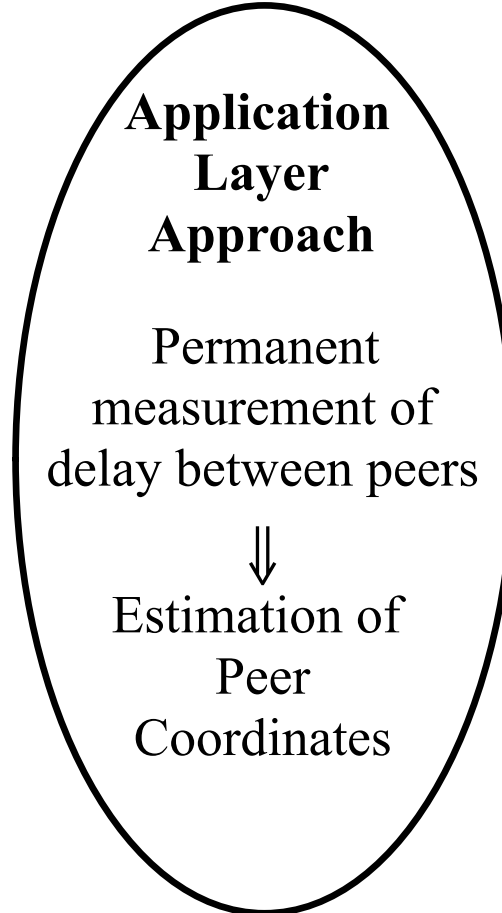


Approaches for local P2P data exchange

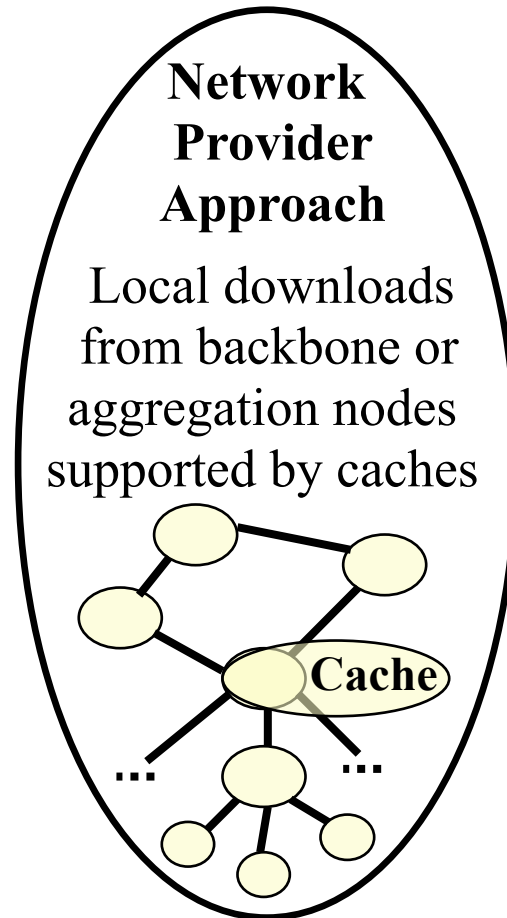
Information server/oracle



Coordinate systems



Caching



Server/oracle support for locality information

- ALTO BoF at the IETF: Application layer traffic optimization
<www.ietf.org/proceedings/08jul/minutes/alto.txt> and <alto.tilab.com>
- P4P: Provider portal for applications
<codex.cs.yale.edu/avi/home-page/p4p-dir/p4p.html>
- Oracle approach, paper by Agrawal, Feldmann, Schneideler
- Problems: Standardization process at the IETF is complex
- How to build a unique interface to application?
- Who provides information and at which level of precision?
A service for IP → AS is available: <www.pwhois.org>

Application layer approach for locality: Coordinate systems

- Project of Azureus & Harvard Univ.
F. Dabek et al., Vivaldi Network Coordinate System, SIGCOMM 2004
J. Ledlie et al., Network Coordinates in the Wild, USENIX 2007
- Permanent latency measurements between nodes
piggy-backed on other P2P data exchange
- 2-dimensional coordinates and a “height” for access link latency
- Advantage: Unique application layer approach
- Problems: Variable delays, updates due to churn or route changes detract from precision; to be implemented per application, seems difficult and only affordable for large P2P networks

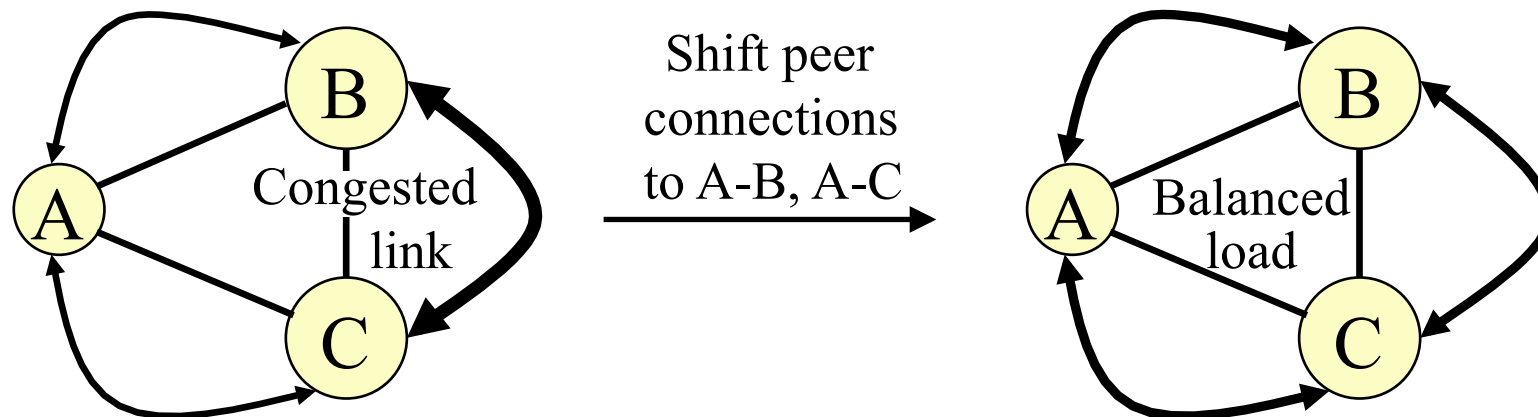
Caches for P2P Traffic

- P2P data is suited for caching, but bypasses web caches for HTTP
High cache hit rate expected for file sharing; no out of date problems
- Transparent P2P caching offered by network analysis systems:
Online detection of P2P downloads for most popular protocols ...
- eDonkey option for transparent caching since October 2004:
In 2006, 20-25% of eDonkey peers had caching option active
7-8% of data loaded from caches in DT's IP platform at high rates
- Caches can open up the upstream bottleneck of P2P networks;
most relevant for limited bandwidth (mobile, asymmetric systems)
- Caching can improve throughput and locality of P2P transfers,
but does not necessarily decrease P2P traffic load (profit for ISPs ?)
- Problem of copyright offending data in the cache, even if not new (?)

Application Layer Traffic Engineering

P4P approach studies overlay traffic engineering with load balancing

Example:



Load balancing can be done on network and application layer
Distributed P2P traffic offers variability to optimize source locations

Load balancing has to integrate

- the link upgrade process on an ISP platform
- failure resilience, at least for single link failures

Conclusion

- P2P networks and server based CDN overlays will compete with regard to content distribution and streaming on the Internet
 - CDN presently achieve shorter transport paths
 - several approaches to improve P2P paths
 - caches of network providers may give additional support
- P2P overlays allow to launch new services without much care about network infrastructure and optimization
- Cooperation with lower layers should be improved over time for popular services to stay competitive