

Peer-to-Peer Networks for Business Use – a Real Opportunity?

Kai Fischbach

Department of Information Systems and
Information Management

University of Cologne, Germany

<http://www.wim.uni-koeln.de/>

fischbach@wim.uni-koeln.de

European Broadcasting Union

Union Européenne de Radio-Télévision

16 and 17 June 2004

Agenda

- ▶ Motivation
- ▶ Definition of Peer-to-Peer (P2P) Networking
- ▶ Three Perspectives of P2P: A Conceptual Framework
 - P2P Infrastructure
 - P2P Applications
 - P2P Communities
- ▶ P2P & Business Issues
 - Building P2P systems
 - Understanding P2P Systems
- ▶ Future Work

Is Peer-to-Peer Right for Business-to-Business?

[O]verall, the progress of B2B ecommerce has been hindered by many unanticipated technical, organizational, economic and legal challenges that diminish value."

(Dai & Kauffman, "B2B eCommerce Revisited", EM 2002)

P2P networks allow companies to avoid the fees charged by exchanges and reduce the complexity and expense of networking (...)

(McAfee, "Napsterization of B2B", HBR 2000)

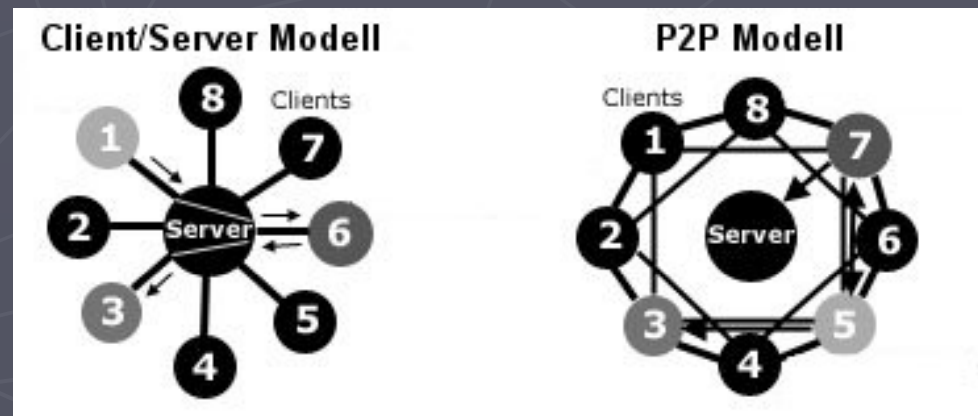
B2B prospects for P2P models are strong (...)

A B2B community based on P2P systems combines the best aspects of the Internet economy.

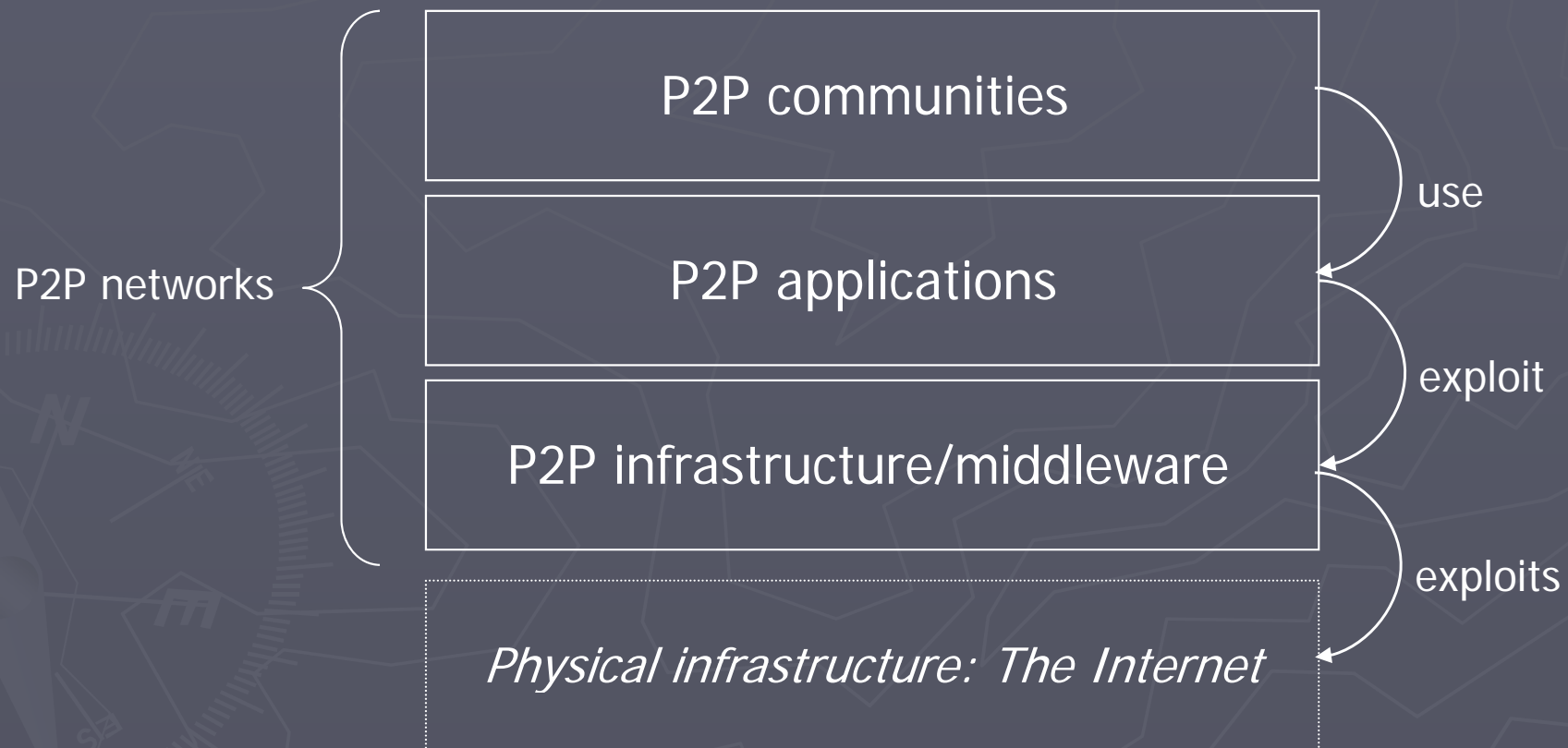
(Choi & Whinston, "Is P2P Right for B2B?", 2001)

Definition of P2P Networking

- ▶ P2P networking is
 - sharing of computer resources and services, e.g.
 - ▶ information
 - ▶ processing cycles
 - ▶ storage for files
 - by direct exchanges between peers
 - without the need of central coordination.
- ▶ Peers can play different roles:
 - Clients, when accessing information
 - Servers, when serving information to other clients
 - Routers, when forwarding information to others
- ▶ P2P is an alternative to client/server
- ▶ P2P is not new



We Developed a Conceptual Framework which Provides a Better Understanding of Different Perspectives of P2P



P2P Infrastructure Provides a Set of Services that are Required by P2P Applications

- ▶ Interoperability and security are major obstacles for commercial usage
- ▶ Important projects: JXTA, Web Services, Jabber, Groove

Location independent services





P2P Applications can be Classified by Means of Shared Resources

Conventional Classification of P2P

- ▶ File Sharing (Napster, Gnutella, Freenet)
- ▶ Grid Computing (SETI@home)
- ▶ Instant Messaging (ICQ, AIM)
- ▶ Collaboration (Groove Workspace)



- ▶ no clear distinction
- ▶ to some cases misleading



Classification by means of shared resources

- ▶ Files
- ▶ Storage
- ▶ Processor cycles
- ▶ Bandwidth
- ▶ Presence information



P2P Communities are of Increasing Practical Importance which is not Reflected in Research up to now

- ▶ Virtual communities (geographically separated members) which make use of P2P applications
- ▶ Characteristics of virtual communities:
 - Common interest
 - Common platform for interaction
 - Common norms and values
 - Self-organizing
 - Reciprocity
- ▶ Socioeconomic challenges:
 - How to build, control and maintain P2P communities?
 - Trust and reputation
 - Free riding and accountability
 - Viable P2P revenue models

P2P Networks Promise Benefits for Business Use

- ▶ Lower cost of ownership and cost sharing
- ▶ Improved scalability
- ▶ New dimension in resource aggregation
- ▶ Enhanced reliability
- ▶ Dynamism – Coping with intermittent connectivity
- ▶ Enabling ad-hoc communication and collaboration
- ▶ New application scenarios
- ▶ ...

But: Can we really achieve guarantees in the chaotic P2P environment!?

Today's P2P networks are not ready yet for reliable business transactions

▶ Security – The Big Concern

- Resources are made available to unknown entities
- Peers need to protect resources not intended to be shared
- Owners have no prior experience in managing a server or a service
- Firewalls are often circumvented

▶ What about

- Availability,
- Durability,
- Network control,
- Authenticity and
- Interoperability?

Requirements for P2P Business Transactions: “A Shopping List”

- ▶ Identification, Addressing, Naming
- ▶ Description, Brokering & Discovery
- ▶ Quality of Service, Service-Level Agreements
- ▶ (Formal) Contract-Based Service Specification
- ▶ Availability
- ▶ Combined Reliability & Performance of Complex Services
- ▶ Fault Resilience
- ▶ Negotiation
- ▶ Pricing Strategies & (Micro-)Payments
- ▶ Fairness & Transparency of mutual/reciprocal resource provision
- ▶ Anonymity (in competitive/cooperative Settings), Security & Trust
- ▶ Mechanisms to enforce Contracts and Commitments, DRM
- ▶ Social Institutions
- ▶ Incentives and Reputation, Norms & Values aiding cooperative Behavior
- ▶ Accountability, Administration, Monitoring
- ▶ Interoperability (on several levels)
- ▶ Value Web Composition

We need a better Understanding of P2P Networks (Structure, Dynamics, Functionality, Economics)

- ▶ How do P2P networks evolve endogenously over time?
- ▶ How robust are they? How might they fail?
- ▶ How to build, control and maintain P2P communities?
- ▶ Which network structures are stable and efficient under various conditions?
- ▶ How to achieve such conditions, i.e. what are the elements and institutions required for P2P business infrastructures?
- ▶ How can organizations and strategies be designed to take advantage of the opportunities provided by P2P?
- ▶ How can we compare the quality of P2P based systems with other architectural approaches?

Proposed Solutions and Future Work

- Develop reference scenarios: which design options and fields of application do P2P networks offer in a business context?
- Derive key elements and business requirements
- Develop metrics and quality indicators for analyzing and evaluating alternative approaches
- Analyze/simulate the structure and dynamics of P2P networks

References

- ▶ *Barkai, D.:* Peer-to-Peer Computing. Technologies for Sharing and Collaboration on the Net. Hillsboro 2001
- ▶ *Dai, Qizhi; Kauffman, Robert:* B2B E-Commerce Revisited: Leading Perspectives on the Key Issues and Research Directions. In: Electronic Markets 12 (2002) 2, p. 67-83.
- ▶ *McAfee, Andrew:* The Napsterization of B2B. In: Harvard Business Review 78 (2000) 6, p. 18-19
- ▶ *Milojicic, Dejan S.; Kalogeraki, Vana; Lukose, Rajan; Nagaraja, Kiran; Pruyne, Jim; Richard, Bruno; Rollins, Sami; Xu, Zhichen:* Peer-to-Peer Computing, 2002-03-08, <http://www.hpl.hp.com/techreports/2002/HPL-2002-57.pdf>, 2002-03-08
- ▶ *Schoder, D.; Fischbach, K.:* Driving Resource Management with Peer-to-Peer Networks. In: WIRTSCHAFTSINFORMATIK, 45 (2003) 3, p. 313-323
- ▶ *Schoder, D.; Fischbach, K.:* Peer-to-Peer Prospects. In: Communications of the ACM, Vol. 46 (2003) 2, p. 27-29.
- ▶ *Whinston, A.B., and S.-Y. Choi:* Is P2P right for B2B? http://business.cisco.com/app/tree.taf?asset_id=49569&public_view=true, 2001-03.