



Laying a Solid, Extensible Foundation for Driving the Peer-to-Peer Internet Revolution

Solutions for Enabling Person-to-Person Communications

From
FirstPeer

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Overview

Over the past decade, the explosive growth and sweeping reach of the Internet has fundamentally and dramatically altered the ways that both individuals and organizations communicate, interact and transact business. However, in many respects the Internet revolution has only just begun. For the most part, first and second waves of Internet applications have focused on enabling individuals to connect with Web sites and to carry out interactive transactions, with the underlying structure primarily revolving around a centralized server-based paradigm. The newest rising wave of Internet applications are now breaking beyond server-based concepts and using the Internet's inherent flexibility to enable "server-less" interaction directly between individual computers connected to the net. Known generally as Peer-to-Peer or Person-to-Person, these P2P applications hold the promise once again to fundamentally shift the ways that individuals and organizations communicate, share information and conduct business.

Although some high-profile pioneering P2P applications, such as Napster, Freenet and Gnutella, have already made a significant splash, the underlying mechanisms for handling P2P applications are still in their infancy. Discussed in this overview white paper will be the key P2P challenges involved in creating universal standards-based mechanisms for finding and linking between targeted individuals and groups as well as establishing an underlying infrastructure with the reliability, security and scalability needed to support widespread adoption of P2P.

As a prime mover in the P2P arena, FirstPeer is playing a leadership role in identifying and resolving these enabling technology issues to empower the creation of robust new Person-to-Person applications that will fuel the next stage of the Internet revolution. Simultaneously, FirstPeer's innovative new Person-to-Person software tools and standards-based communications mechanisms are laying a solid foundation for the proliferation of a powerful new generation of commercially viable P2P applications.

The Rising Wave of P2P Market Opportunities

The first wave of P2P applications have ventured into new conceptual ground by effectively bypassing the Internet's conventional reliance on central servers to connect users with centralized resources. In essence, by eliminating arbitrary server-based overlay structures, P2P has opened the door for the formation of true user-driven communities with direct peer-to-peer interaction between the users' personal computing systems. Although some attention has been given to peer-to-peer sharing of computer resources in order to aggregate computational capacity, by far the most exciting possibilities lie in the potential for creating person-to-person applications, which empower individuals to connect with each other and unite around specific areas of personal or business interest.

Expanding Grassroots P2P Environments

To date, most of the mainstream media coverage of P2P has been focused on the excitement and the controversial intellectual property issues surrounding applications

such as Napster and Gnutella, however the potential community-building opportunities go well beyond these first forays into the P2P concept.

As P2P technology matures and becomes more widely accepted, the potential for creating very robust communications, exchange and transaction environments is limitless. For example, grassroots-driven trading and information-sharing environments will form and grow around virtually any area of interest, from music collections to sports cards, quilts, antiques, videos, academic subjects, health issues, etc. In addition to empowering individuals, these new grassroots driven P2P forums will also provide rich opportunities for entrepreneurs and small businesses serving the specific interest areas. As discussed below, key factors enabling this proliferation of person-to-person online environments will be new P2P tools that empower mainstream users of varying technical sophistication to participate by making it easy to find each other online and to create targeted groups around common areas of interest.

Enabling Commercial P2P Applications

Another fertile area for the growth of P2P will be as a cost-effective mechanism for enabling commercial applications that currently are either completely impractical to implement or that require the use of high-cost, custom-tailored B2B software. For instance, Covisint, the automotive B2B marketplace formed by the Big Three automakers has been widely acknowledged as one of the most advanced ISMs to date, however its creation and implementation has entailed a huge investment in the multi-million dollar range. Because of the mix of high opportunity and high cost, the prospect of creating such industry-sponsored marketplaces (ISMs) has thus far been simultaneously one of the most encouraging and most frustrating arenas on the business-to-business landscape.

In a Federal Trade Commission report issued in October 2000, FTC Chairman Robert Pitofsky indicated that *“business-to-business marketplaces offer ‘great promise’ in terms of cutting costs, better organizing business processes, and improving competition.”* Similar observations have also been reported in a recent (December 2000) study conducted by Jupiter Research in which the analyst indicated *“ISMs are on track to become the fastest growing of all Net Markets . . . However, the real test will be for these businesses to create real value and functionality for marketplace users.”*

Perhaps most telling are recent comments by Harvard Business School professor Andrew McAfee, who wrote, *“large centralized B-to-B exchanges like Covisint’s might open the door for more nimble Internet firms to adopt open-ended Napster-like, file-sharing technologies to better link up buyers and sellers. . . . P-to-P features, and perhaps ‘peering portals’ might allow suppliers and buyers to share and manage highly complex product databases entirely on their own.”*

Here again, the key to unlocking the full potential of these huge commercial opportunities lies in the development of more robust P2P technologies that are able to fully support the demanding requirements for implementing business-class peer-to-peer marketplaces.

Current Technology Barriers to Optimizing P2P

Yet, when compared to the evolution of the Internet, peer-to-peer is still in the “pre DNS, pre-browser, pre-Mosaic” stage. There is no persistence or permanence attached to a specific resource or individual. In most cases, when an individual logs onto the Internet they are randomly assigned an IP address. Furthermore, mobile devices such as laptops, IP-based cell phones and palm computers, route among multiple IP addresses, making consistent routing unrealistic. Peer-to-peer evolution is thus faced with a fundamental hurdle - how do these devices find one another? It is like trying to call a phone number that constantly changes. In addition, the need for interactivity between peers, authentication and security are all problems that must be addressed in order to make peer-to-peer robust enough to support next-wave P2P applications.

Unlike centralized server-based data on the Web, all of the information and resources in a P2P environment are dispersed throughout the individual users' computers. To overcome the challenge of managing widely dispersed files residing on disparate platforms, most first-generation P2P programs such as Napster have relied on some sort of central server assistance based around creating unilateral one-way relationships. However, as new P2P applications have evolved, environments such as Gnutella and FreeNet are moving toward truly decentralized, multilateral models in which the entire network of P2P users exists without any centralized facilitation or arbitration. While this greatly increases overall flexibility, widens the breadth of information content and reduces the arbitrariness of centralized control, it also significantly complicates the challenge of managing P2P communications.

Ultimately in order to be successful, these new-generation P2P environments must:

- Provide each user with Persistence and Presence for “finding and being found”
- Support quick and easy formation of targeted user-driven groups
- Enable users to “trust” that each participant is verifiably who they claim to be

Persistence and Presence

Some of the primary challenges with “finding and being found” in decentralized P2P environments include gracefully handling dynamic IP addresses and creating a persistent context, within which users can communicate and share resources. For example, because most users connect to the Internet through the use of dynamically assigned IP addresses, each time they sign-on their Internet Service Provider assigns their computer a different IP address. In addition, the emerging growth of mobile Internet users, whether by remote log-in from laptops or via handheld PDAs and cellphones, are almost always assigned different IP addresses with each new online session. After each log-on, users also need a reliable and persistent mechanism for consistently maintaining their online presence as well as for finding and connecting with other users.

Because a true P2P environment abdicates the use of a central server, there is no easy way to implement server-based mechanisms for sorting out the various dynamic IP addresses assigned to participants within a P2P community or for providing a persistent

context for communication and interaction. Even the Internet's proven Domain Name Service (DNS) structure alone has proven inadequate for handling the server-less world of P2P without some way to match a DNS structure to the users' ever-changing IP addresses. However, as will be described in subsequent sections, FirstPeer's patent-pending architecture brings together new innovative extensions to DNS, in combination with XML, Jabber and other open protocols to provide a standards-based forward path for building tomorrow's next generation of P2P applications.

Supporting Easy Formation of User-driven Groups

Another fundamental issue in fulfilling the promise of next-generation P2P is the need for easy-to-use mechanisms that empower participants to readily set-up, maintain and control their own targeted groups around any issue of interest. Even with today's applications barely scratching the surface of overall P2P market possibilities, it has already become clear that the sheer breath of undifferentiated participation can make it very difficult to focus on specific areas of interest. The bottom line is that today's P2P applications, including most Gnutella clients, are reasonably effective at finding and retrieving generic intellectual property, such as a particular MP3 file, when the user does not care too much about where it comes from.

However, when a narrower more targeted search is required or when the information sources need to be more closely defined, the "shot-gun approach" used by current generation P2P applications falls short of providing the desired results. Rather than wading through mountains of irrelevant contacts and information, new wave person-to-person tools and applications need to enable users to interactively create, select and join subject-specific groups that allow for maximum communications efficiency and a greater degree of intra-group integrity.

Creating "Trusted Community" Environments

The third key challenge in implementing next-generation P2P lies the creation of "trusted communities" in which participants can be verified to have an agreed upon degree of trustworthiness. For example, in the case of both grassroots trading communities and industry-specific marketplaces it can be vital for buyers and sellers to operate in a trustworthy environment that promotes efficiency and ensures transaction integrity.

Here again, the current state of P2P functionality with its inherently anonymous paradigm is inadequate to provide a foundation for supporting trusted communities. Achieving a sufficient level of mutual trust requires built-in mechanisms for maintaining "persistent identities" that automatically maintain each user's verified profile in a consistent fashion from session to session.

FirstPeer: Creating a New Comprehensive P2P Architecture

FirstPeer's innovative new P2P technologies address the above challenges by creating a robust and extensible foundation for universal characterization and interaction between any and all P2P participants. As will be described in the following sections, the FirstPeer architecture leverages proven standards, while also maintaining full compatibility with

existing grassroots P2P applications such as Gnutella. The result is a highly reliable and adaptable P2P infrastructure that meets the immediate needs of evolving P2P communities while simultaneously laying the groundwork for delivering the security and scalability needed for implementing powerful new commercial P2P applications.

Extending the Internet

FirstPeer is an open, peer-based, unifying platform engineered to bring together applications, devices and people. FirstPeer ensures universal, trusted interaction for use by individuals and marketplaces in the peer-to-peer paradigm. A fundamental aspect of FirstPeer's next-generation P2P architecture revolves around the adaptation of the Internet's proven DNS and other open protocols such as XML and Jabber to create persistent user profiles and consistent inter-user communications within P2P environments.

In the early days of the Internet, less than 10 years ago, there was no method in place for giving a computer a persistent and unique identity beyond its IP number. With the establishment of DNS, networked computers became readily identifiable by an independent methodology that did not require knowledge of each computer's IP address. To a great extent, DNS brought the World Wide Web into existence by simplifying the navigation and connection challenges as well as by providing a relatively easy-to-use, quasi-natural language method for naming networked resources. Subsequent developments such as XML have enabled a high degree of integration between Internet-based protocols and non-Internet or legacy applications.

FirstPeer is leading the development of next-generation P2P through a combination of patent pending technology and tools that build upon DNS, XML, Jabber, and other open protocols. FirstPeer's software platform manages the interaction among devices on a peer-to-peer basis where no central servers are needed. After enabling FirstPeer, the user can easily define the type of interactions allowed with other individuals or organizations. FirstPeer can authenticate the peers, and provide the tools for secure interaction and commerce. Once the user and second party have been brought together, a market is formed that is completely peer-to-peer.

Finding and Linking Individuals with Personal Servant?

FirstPeer's patent pending Personal Servant? addresses the issues of how to find specific individuals, groups and resources in peer-to-peer networking. The Personal Servant extends and builds upon the basics of traditional DNS, HTTP, XML, XML-RPC and Jabber instant messaging, to address the new peer-to-peer marketplace. With FirstPeer, individuals and groups can be found, connect and interact through a simple, consistent interface across all applications and devices. In addition, all of the Personal Servant's persistent information is stored and accessible through XML for seamless integration with other applications.

From the users' perspective, FirstPeer's Personal Servant? client software provides a free and easy-to-use starting point for empowering new P2P possibilities. By simply creating a unique domain name on the FirstPeer site (e.g. yourname.peername.com) and

downloading the free Personal Servant client, any user can quickly create a reliable and persistent mechanism for “finding others and being found” in any P2P application.

The FirstPeer Personal Servant is a flexible platform-independent software client that empowers the user to take full advantage of FirstPeer’s robust P2P structure and to easily navigate and interact with other participants throughout next-generation decentralized server-less P2P environments.

Personal Servant is available in either Windows-based or Java-based versions and is completely compatible with all current Gnutella software. In addition, because FirstPeer’s Personal Servant takes full advantage of extensible standards such as XML, it provides a highly flexible and readily adaptable platform for implementing virtually any new P2P application.

Key Personal Servant features include:

- A Persistent Online Presence
- FirstPeer Dynamic DNS updates
- FirstPeer Groups and Personal Groups
- Peer-to-Peer Instant Messaging using the Jabber protocol
- Gnutella/0.4 interface to groups
- Peer-to-Peer online notification
- Built-in mini Web server
- XML interface

Forming and Finding Groups or Organizations

FirstPeer’s Personal Servant software also makes it a snap to create, manage and participant in targeted peer-to-peer groups. Any FirstPeer user can create and name new groups focused on their particular areas of interest. Then simply by highlighting a group in the Personal Servant interface, a user can track and join that particular group. The Personal Servant software automatically captures all of the current IP addresses for everyone in the group to support easy transparent interaction. No longer does a user have to “ping” other participants in order to find them online because Personal Servant automatically checks the current status of group members to determine if they’re online and to update to their current IP addresses.

Personal Servant’s built-in Jabber Instant Messaging function also provides for easy and immediate chatting between group members. Any user running the Servant can chat with any other Servant or with other Jabber-compatible clients. Also, because there is no central chat server in the P2P environment, every message is sent directly between users. In addition to eliminating the intrusion of arbitrary centralized control, Personal Servant’s direct communication functions and XML-based extensibility combine to lay a very adaptable foundation for implementing secure and/or encrypted messaging that will be critical in future commercial P2P environments.

Besides, providing unprecedented access and flexibility for individuals and P2P groups, Personal Servant’s incorporation of a built-in mini Web server even enables users to

easily serve their own Web pages on a direct peer-to-peer basis. This feature supports the creation of targeted content to enhance users' P2P community participation, such as allowing for a Web page showing files available on the local peer or identifying offerings for sale in a P2P trading community.

Key Characteristics of the FirstPeer Architecture

In summary, the FirstPeer P2P architecture and Personal Servant software focus on bringing together all of the following key characteristics in order to help drive P2P computing possibilities into a leadership role in the next phase of Internet evolution.

Ease-of-Use

Provides a single consistent interface for today's applications stepping into the P2P paradigm, and tomorrow's applications that will be driven by widening acceptance of P2P. Personal Servant and the FirstPeer structure are designed to provide significantly enhanced capabilities for today's P2P early-adopters and power-users while also creating an extremely easy-to-use facility for attracting millions of new mainstream and less sophisticated users into active participation in P2P environments.

Global Reach and Interoperability

Designed for complete compatibility with today's leading P2P paradigms such as Gnutella, XMP, HTTP, XML-RPC, Jabber open-messaging protocols and proven Internet DNS structures, FirstPeer's architecture provides seamless interoperability with existing systems and applications across the entire global reach of the Internet.

Robustness and Scalability

Because there is no central server, there is no single point of failure or bottleneck in scalability. The FirstPeer P2P architecture and patent-pending Dynamic DNS infrastructure are tailored to take maximum leverage from the proven and highly scalable Internet DNS mechanisms while adapting these technologies for optimal robustness and scalability in the many-to-many world of next-generation P2P applications.

Security

Looking ahead to the needs of commercial P2P application requirements, FirstPeer's entire architecture has been designed as a solid platform for incorporating a wide range of security features and trusted transaction environments. Possibilities such as direct peer-to-peer encrypted email and third-party verification of persistent user profiles are readily implementable within the FirstPeer P2P infrastructure.

Extensibility

As an embodiment of the fundamental P2P philosophy, all of FirstPeer's next-generation P2P solutions are grounded in highly extensible, adaptable, standards-based technologies, such as XML, Java, etc. that will enable third-party developers and online community builders to leverage FirstPeer into their specific application requirements. Whether the need is to quickly build a gateway into P2P for promulgating new software capabilities or

to use the FirstPeer infrastructure for building a global Industry Specific Marketplace, the underlying architecture is designed to accommodate virtually any set of objectives.

Immediate Impacts of the New P2P Paradigm

The immediate impacts of FirstPeer's new P2P architecture will be to enhance functionality for existing users and early adopters of P2P technologies by enabling them to leverage their existing knowledge and interests. Other near-term impacts will be a significant broadening of the use of P2P by more mainstream users as a result of lowering technology barriers and making it much easier for them to get into the P2P world, communicate with other participants and to find useful resources.

On-going Benefits and Emerging Possibilities

Follow-on benefits in the relatively near future will be the rapid development of new commercially attractive P2P applications by providing the extensible "building blocks" for implementing robust and reliable peer-to-peer trading communities and Industry Specific Marketplaces. By eliminating the need for costly centralized servers and complex transaction control structures, the commercialization of P2P as enabled by FirstPeer will fundamentally shift the economics of online markets into a whole new realm of possibilities.

FirstPeer Corporate Overview

FirstPeer is a privately held development-stage company with physical headquarters in San Diego, CA and with a global technology reach spanning the worlds of both the traditional Internet and the on-going P2P revolution.

Founded by pioneering online business entrepreneurs and skilled software developers with in-depth Internet and P2P experience, FirstPeer brings together the optimal skill set for helping transition peer-to-peer computing to the next level.

The bottom line is that FirstPeer directly answers the peer-to-peer paradigm's core technology challenges by providing an enhanced method for connectivity between peers and a stable extensible infrastructure for forward development. To enable interactions, transactions, and exchanges, the marketplace needs more than what is currently available. Individuals need to find and be found by others, groups need to interact, and businesses need to communicate what they have available. FirstPeer provides this through the intelligent Personal Servant based system that extends the existing Internet infrastructure to match the demands of future P2P requirements.

FirstPeer is also dedicated to working closely with developers and builders to contribute to the evolution and expansion of the P2P paradigm. In this role, FirstPeer has rapidly become a prime mover in the P2P space and is playing a key role in leading the next wave of the Internet revolution.