



## **A Review of Peer-to-peer Networking on the Internet**

**C.R. RACHANA**

DoS in Computer Science, Pooja Bhagavat Memorial Mahajana PG Centre,  
PG Wing of SBRR Mahajana First Grade College, Mysore - 16, (India).

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### **ABSTRACT**

Peer-to-Peer is a model of communication where every node in the network acts alike. It is as opposed to the Client-Server model, where one node provides services and other nodes use the services. Peer-to-peer computing takes advantage of existing desktop computing power and networking connectivity, allowing economical clients to leverage their collective power to benefit the entire enterprise. Peer-to-peer computing has been envisaged to solve computing scenarios which require spatial distribution of computation, spatial distribution of content, real-time collaboration, scalability or fault-tolerance at reduced costs. All these factors have influenced the emergence of stronger computing-capable peer-to-peer systems.

Peer-to-peer (P2P) systems enable computers to share information and other resources with their networked peers in large-scale distributed computing environments. The resulting overlay networks are inherently decentralized, self-organizing, and self-coordinating. Well-designed P2P systems should be adaptive to peer arrivals and departures, resilient to failures, tolerant to network performance variations, and scalable to huge numbers of peers (tens of thousands to millions). As P2P research becomes more mature, new challenges emerge to support complex and heterogeneous decentralized environments for sharing and managing data, resources, and knowledge with highly dynamic and unpredictable usage patterns.

Peer-to-peer computing has been successful in attracting more peers due to its rich contents, fast response time and trust worthy environment. The enormous applications available on the internet are further strengthened with the application of peer-to-peer computing. This paper intends to review the background, challenges and future of P2P Networking.

**Keywords:** P2P, Online attacks, peer-to-peer computing, software applications, P2P in business.

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### **INTRODUCTION**

P2P systems enjoy the properties of uncoordinated, resilient to attacks, heterogeneous and character to support millions of simultaneous users. The main concept behind P2P is decentralization. Without a centralized server to connect users, they are in turn connected through other users. This allows users

to communicate directly with one another. The Personal Computers in this "interconnected network" are referred to as "peers". Peer-to-Peer computing generally assumes that each peer is acquainted with a small number of other peers with which it can exchange information and services. Acquaintances change constantly, there is no central control, and peers remain autonomous throughout their participation in a P2P network.

Freenet, Gnutella, and Napster were the three most popular Peer-to-Peer file sharing applications. P2P connotes resource sharing between peers (computer on a peer network) over the internet. Each participant contributes portions of their resource such as processing power, disk storage or internet network bandwidth directly to other network participants that are on the P2P network.

In the modern version of peer to peer computing, P2P networks stretch across the entire Internet, not just a home local area network (LAN). Easy-to-use P2P software applications allow both geeks and non-technical people to participate.

There are two broad advantages of the peer to peer file sharing. They are:

First, peer-to-peer computing today, changes the way people share information. Prior to the Internet and even the pervasive use of Personal Computers, information was mostly disseminated through television, radio, or through written (not digital) correspondence. But now information is digitized via e-mail, electronic documents/files, or webpages and can be distributed to many different people in a short period of time irrespective of the distance. The format of information has also greatly changed and ranges from short, sloppy, opinionated text to lengthy, well organized, and thoroughly researched documents. But, people now have to "filter" through a lot of junk data to get to the information they may be seeking. This becomes even a greater challenge when people have access to so many other computer systems. In P2P, rather than expecting the user to understand all the details of the operating system's native share tools, peer-to-peer file sharing systems have the user to download their own software packages. Each type of peer-to-peer file sharing has its own software. This of course is a benefit (you can look for a software package that's easy for you to understand).

Second, peer-to-peer computing changes the way people collaborate. **People no longer have to be in the same room to plan a project, deliver a special talk, conduct a workshop, or learn a computer software program.** Ideas and discussions can be captured electronically and

distributed to groups of people in separate locations for review and input and feedback.

### Peer-to-Peer Software Applications

Peer-to-peer networking enables or enhances the following scenarios:

- **Real Time communications**

- o Server-less Instant Messaging.

Real Time Communications exists today. PC users can chat and have voice or video conversations with their peers today. However, it cannot be denied that many of the existing programs and their communications protocols rely on servers to function.

- o Real-time matchmaking and gameplay  
There are a number of gaming web sites that cater to the gaming community via the Internet. These websites offer the ability to find other gamers with similar interests and play a game together. However, the problem is that these web sites do not allow a gamer to set up an ad-hoc game among friends in a variety of networking environments. But, Peer-to-peer networking can provide this capability.

- **Collaboration**

- o Sharing files with others.

The feature already available with windows can be enhanced through peer-to-peer networking to make file content available in an easy and friendly way.

- o Sharing experiences.

With wireless connectivity becoming more prevalent, peer-to-peer networking allows the user to be online in a group of peers and to be able to share their experiences while they are occurring.

- **Content distribution**

- o Text messages

Peer-to-peer computing can allow for the dissemination of text-based information in the form of files or messages to a large group of users.

- o Audio and video

Peer-to-peer networking can also allow for the dissemination of audio or video information to a large group of users. With peer-to-peer computing, only a handful of peers would actually

get their content from the centralized servers. These peers would flood this information out to a few more people who send it to others, and so on.

- **Distributed processing**

- o Division and distribution of a task  
A large computing task can be divided into separate smaller computing tasks well suited to the computing resources of a peer. A peer could do the dividing of a large computing task. Then, peer-to-peer networking can distribute the individual tasks to the separate peers in the group they have joined. Each peer performs his/her computing task and reports their respective result back to a centralized accumulation point.

- o **Aggregation of computer resources**

Peer-to-peer networking can prove its great use for distributed processing by running programs on each peer that run during idle processor times and are part of a larger computing task that is coordinated by a central server. By aggregating the processors of multiple computers, peer-to-peer networking can turn a group of peer computers into a large parallel processor for large computing tasks.

### Peer-to-peer in Business

The power of Peer-to-Peer computing was demonstrated in 1999 when a 19-year-old university student, Shawn Fanning created Napster. Napster opened up a new arena of computing where users across the world could share MP3 music files. An instant success, Napster, in just 18 months, attracted nearly 40 million users (Laudon & Laudon 2002). But Napster was much more than a free source of popular music; it was an exploration of the unknown that widened cultural horizons (Oram 2001). Peer to Peer business solutions include: File Sharing Distributed computing, Collaboration, Messaging, and C2C e-commerce. Specific business applications of P2P include Health Care, Law Firms, Pharmaceutical Industry, Chip Manufacturing and investment Banking.

The most important factors motivating the use of peer-to-peer architectures in supporting business transactions include:

- The absence of cost and risk of ownership and maintenance of a centralized server.

- Improved scalability and ability to deal with transient population of users.
- Dynamic, ad-hoc communication, network organization, failure recovery and enhanced reliability.
- Democratic participation (especially regarding SMEs) and censorship resistance.
- Direct, un-mediated and potentially synchronous peer-to-peer transactions.
- Improved access to resources.
- The explicit exposure of trust relationships that are typically, implicitly handled in centralized systems.

### Current Scenario of P2P

The new P2P system extending beyond file sharing is the SKYPE. SKYPE is a P2P telephone system. It is similar to VoIP services but fully based on individual peers.

From Android outselling Apple's iPhone to the success of Linux and Wikipedia, all are examples of peer-to-peer (P2P) production. According to Belgian theorist Michel Bauwens, these new internet-enabled models will transform society, leading to what is a "P2P political economy".

Peer-to-peer and file sharing services are widely available on fixed line and mobile networks, says the research group who carried out a study on "Peer-to-Peer and File Sharing Market to be a \$100 Billion Industry by 2012". What is more, carriers' revenues from the use of peer-to-peer and file sharing services in Asia are almost twice that of what they're bringing in from North America, indicating a truly global trend and leaving plenty of room for expansion in the West and North America.

There is a global push by carriers to create new and innovative IP-enabled services for consumers as well as business uses. The study notes that buyers of mobile and fixed line telecommunications services are intertwining peer-to-peer and file sharing services along with other IP-enabled services like video telephone abilities, fixed-mobile convergence, presence, streaming, and location-based services.

“Peer-to-peer and file sharing services have moved into the main stream and are now well beyond the early days when a few of the early service providers ended up in litigation. Peering and file sharing have now been embraced by fixed line and wireless operators, many of the intellectual property issues that led to legal fights have been resolved, and media and applications such as ring tones, games, music, and large file videos are taking off. We see this market continuing to grow as consumers increasingly rely on the utility of these applications,” reflects Robert Rosenberg, President of Insight Research.

### **Security Risks**

When the user searches for a file using P2P application, it searches through every computer on the internet that is on the P2P mesh network and to a very large extent, such users are not aware that files are being uploaded from their computers. When the users install applications such as Limewire, Bittorrent, emule, Vuze, utorrent, Transmission, skype etc, the user’s computer is automatically enrolled into a peer network.

Although Peer to Peer architect has helped to reduce the download time by over 70 per cent, yet serious implications exist. Users of P2P file-sharing systems face many of the same security risks as other Internet users. Users should safeguard their computer from attack when online. File sharing adds an extra dimension to these concerns due to the quantity and frequency of files traded. P2P file-sharing applications are not known to be any less or any more secure than Internet applications on the market in other areas.

### **Viruses**

Peer-to-Peer file sharing allows unsecure access into the user’s computer and in this way virus; Trojans, worms, malware and spyware can easily find their way into the user’s computer. Because peer-to-peer file sharing networks enable files to be transferred among millions of computers, most of which are owned and operated by total strangers, there is always a present risk that files downloaded from a peer-to-peer file sharing network could carry various kinds of malicious software like viruses and “worms.”

It is, of course, always possible to receive a dangerous file in numerous ways, such as over the Web or by e-mail. The best protection against viruses continues to be the use of up-to-date anti-virus software. Though 100% protection can never be achieved, users should be aware that in order to download files without adequate protection opens them up to substantial risks.

### **Online Attacks**

When peer-to-peer networks identify shared files to millions of users, they also identify the location of a user’s computer, and could even target the user computer’s IP address (Internet Protocol address) with attempts to gain access. This is not a risk unique to peer-to-peer file sharing networks; all Internet communications involve an exchange of IP addresses. But because Peer-to-Peer file sharing networks search millions of computers, they can provide access to millions of IP addresses.

### **Copyright Attacks**

A new form of security threat may be growing for peer-to-peer users in the rise of techniques by copyright holders concerned about infringement on file-trading networks. More benign versions flood P2P networks with bogus copies of copyrighted works in order to fool people into downloading or storing them.

### **Future Trends and Challenges**

P2P vision for the future is “No more dedicated servers, everything in internet is served by peers”. The impact on millions of users via the proliferation of peer-to-peer (P2P) file sharing networks such as eDonkey, Kazaa and Gnutella is rapidly increasing and seriously influencing business models (online services, cost control) and user behavior (download profile). An important fraction of the Internet traffic belongs to P2P applications.

P2P applications run in the background of user’s PCs and enable individual users to act as downloaders, uploaders, file servers, etc. Designing and implementing P2P applications raise particular requirements. On the one hand, there are aspects of programming, data handling,

and intensive computing applications; on the other hand, there are problems of special protocol features and networking, fault tolerance, quality of service, and application adaptability.

Additionally, P2P systems require special attention from the security point of view. Trust, reputation, copyrights, and intellectual property are also relevant for P2P applications.

Powerful PCs and the Internet enable people to come together through a common environment. More and more people are taking information sharing into their own hands, and companies are finding themselves in a situation of trying to control people and influence the use of the Internet.

Current commercial uses of Peer-to-Peer technology include the licensed distribution of games, movies, music, and software. P2P has become the largest distributor of authorized content on the Internet, with an average of more than 60 million transactions per month. These aspects of Peer-to-Peer technology definitely hold a promise for novel future applications.

#### **Specific examples of future trends and challenges include**

- Audio Companies: Creating a “copy protected media” format for music files designed to prevent people from sharing illegal copies of music files.
- Business Corporations: Increasing network security levels on corporate networks due to employees granting unauthorized users access to their PC to enable file sharing.
- Educational institutions: Shifting the learning environment from traditional

classrooms to virtual classrooms and developing/implementing effective peer-to-peer learning opportunities.

#### **Summary**

A peer-to-peer network is a class of systems and applications that employ distributed resources to perform a critical function (usually in a de-centralized manner). This can yield savings on maintenance and energy costs related to data retrieval, sharing, and processing.

To summarize, P2P systems exhibit following characteristics:

- Autonomy from central servers.
- Use of edge resources.
- Intermittent connectivity.

P2P also facilitates faster download and exchange of files, which benefits users. This is changing the way people share files and information, collaborate, and how they learn. However, because peer-to-peer computing gives tremendous control to the individual, the outcome is definitely somewhat unpredictable.

#### **P2P is here to stay for the following reasons:**

1. It is Easy to use:
  - P2P software readily available, simple to use.
2. Provide something useful (for free):
  - Until recently, the only alternative to P2P content was “buy a CD”
  - Online music stores may change this?
3. Anyone can contribute:
  - Contributions not tied to geographical location; user in Brazil can provide files for everyone (compare with ad hoc networks!)
  - Enough “altruistic” users are here to make P2P networks useful.

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