PeerApp White Paper

Comparing P2P Solutions

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Executive Summary

The traffic spawned by file sharing pose a major challenge to ISPs.
The peer-to-peer (P2P) traffic is the dominant type of Internet traffic today, consuming up to 70% of all Internet backbone traffic. P2P applications consume a lion share of ISP network capacity, increase bandwidth cost per subscriber and incur significant support costs. This leads to significant lost revenue and impaired ISP brand perception.

P2P traffic continues to grow unabatedly and is expected to increase even dramatically. Whether it is software companies distributing new releases, enterprise customers using P2P to distribute training materials or corporate information, or music labels and movie studios distributing entertainment, companies have begun using P2P as a scalable solution to reduce the cost of content delivery.

For ISPs, the effect of P2P is more nuanced than it first appears. Surely overall growth in usage affects ISPs networks, but this is further complicated by two facts unique to P2P. First, P2P incurs dramatically more bandwidth per user, which impacts network sizing and oversubscription rates. Second, P2P is a bi-directional by nature, with subscribers requiring large upstream bandwidth, which also impacts network configuration.

Most ISPs now realize that P2P must be addressed, and most are in the process of evaluating usage policies and technology solutions to handle this challenge. On the technology side, ISPs have a variety of choices to address P2P – from acquiring more bandwidth to traffic shaping to completely blocking P2P traffic.

Today, there are four available solutions to address P2P network traffic growth – each of which is evaluated in detail below:

- **ISP Pricing and Policies –** modifying subscription plans from unlimited to usage-based pricing
- **Purchasing Additional Bandwidth –** buying transit bandwidth to accommodate network growth from increased P2P usage
- **Traffic Shaping –** utilizing deep packet inspection devices to throttle or completely block P2P traffic
- **P2P Caching –** utilizing P2P caches to cache and serve P2P content

ISPs: Fight or Embrace P2P?

ISPs face a fundamental question: should they work to limit P2P traffic on their networks, or embrace P2P, manage it effectively, and learn to benefit from it.

As with most Internet traffic trends, there is inevitability to P2P traffic. It is doubtful that ISPs can effectively prevent P2P traffic from infiltrating their networks through protocol blocking, or that they can afford to continually purchase more bandwidth to handle increased traffic.

When you add in the benefits from P2P for legal file sharing and content delivery, embracing P2P and accommodating for P2P network traffic seems to be an ISP's best solution.

However, today many ISPs continue to fight P2P on their networks, and they face constantly changing technical hurdles, and customer dissatisfaction.

Whether an ISP chooses to fight or embrace P2P is a major factor in choosing a P2P management solution.

Options for Handling P2P

ISP Pricing and Policies

Some ISPs choose to modify flat rate subscription plans to usage-aware plans to roll part of the P2P incurred costs to the subscribers. One of the reasons for increasing P2P traffic is flat-rated pricing schemes. Subscribers can download as much content as they want while paying the same monthly fee amount for broadband access. Some ISPs believe that usage-aware subscription plans will help them to either reduce P2P traffic or collect payments from the users for downloaded content. Both options will partly help Service Providers to reduce or postpone expenses for additional transit bandwidth capacity and upgrading the infrastructure.

While this approach does pass ISP's bandwidth costs onto P2P users, and would likely limit heavy P2P use, it seems doubtful that subscribers used to unlimited plans will tolerate new pricing.

ISP Pricing and Policies

Pros	Cons
Pay-for-use model passes costs to heavy users	Impacts all subscribers – not just heavy P2P users
No technology investment required	Competitive disadvantage compared to ISPs offering flat-rate pricing

Purchasing Additional Bandwidth

For many ISPs who see their bandwidth demands increasing from P2P traffic, the solution is simple – purchase more bandwidth to keep pace with subscriber demand. Bandwidth is inexpensive, and subscribers have come to expect unlimited, on-demand, high speed access. Purchasing additional bandwidth to handle P2P network growth does not require complex technology solutions or any changes to underlying business policies.

However, this approach has some clear downsides. Internet transit bandwidth pricing is stabilizing and is clearly not going down significantly beyond its current level. Adding bandwidth also comes with upgrade of expensive routing/switching/ transmission networks which cannot be overlooked. After years of unbridled subscriber and revenue growth, limited growth in the overall business means ISPs can no longer consider bandwidth to be free but a significant cost to factor into overall per-subscriber costs. Nevertheless ISPs business is to monetize the bits to increase average revenue per user (ARPU) rather than subsidizing it for flatter or decreasing ARPUs.

Additionally, P2P applications are designed to consume as much bandwidth as is available. Adding more bandwidth will almost instantly lead to more consumption. Without managing the P2P traffic, buying additional bandwidth will have little long term effect other than increasing bandwidth costs for the ISP.

Purchasing Additional Bandwidth

Pros	Cons
No negative customer impact	Increasing bandwidth costs difficult to control
No technology investment required	P2P traffic eats up added bandwidth

Traffic Shaping

Protocol-level traffic shaping is a very effective tool for ISPs to reduce bandwidth consumed by P2P traffic and give other traffic a higher priority on their network. Traffic shaping – typically inline network elements that inspect, prioritize, and sometimes redirect traffic – provides a mechanism to control the volume of traffic being sent into a network (Bandwidth Throttling), and the rate at which the traffic is being sent (Rate Limiting). However, since many subscribers use P2P services, limiting or completely blocking P2P traffic will lead to customer dissatisfaction and increase churn.

Recently, many ISPs have begun using Traffic Shaping to curb the usage of P2P file sharing by giving other traffic a higher priority on their network. Many have opted for traffic shaping to manage the usage of this bandwidth, either because they are unable to upgrade their bandwidth fast enough, or as an alternative to upgrading their bandwidth.

Traffic shaping strategy is being used for limiting and suppressing P2P traffic using specialized hardware or leveraging existing infrastructure. Traffic shaping usually manipulates the usage of limited network resources in order to allow Service Providers to control their operational expenses related to transit bandwidth. Shaping works by queuing, dropping or prioritizing the traffic.

Traffic shaping introduces some significant challenges. Traffic shaping dramatically reduces P2P customer's response time of the network, increases network timeouts, and impacts user experience. Alienating a large and growing group of customers can and often does have negative business ramifications for the ISP – dramatically growing customer support costs and churn rates. Plus, P2P users will seek ways to circumvent traffic shaping, through traffic masquerading, encryption etc., triggering a war of attrition with ISPs. In addition, deep packet inspection technology used by traffic shaping is not content-aware – therefore indiscriminate shaping of Bittorrent traffic shall harm both emerging commercial and open uses of the protocol, potentially entangling ISPs in disputes in which they don't want to be entangled. Finally, shaping P2P traffic limits future ISP revenue opportunities from premium P2P services.

Traffic Shaping

Pros	Cons
Controls P2P impact on overall network	Increases customer support and churn for P2P users
Provides better experience for non-P2P subscribers	Damages ISP reputation as unfriendly to subscribers
Provides flexibility to throttle or eliminate P2P traffic	P2P users likely to circumvent traffic shapers (e.g. encrypted P2P traffic)
Implementation familiar to ISPs via inline network devices	Reduces revenue opportunities from P2P

P2P Caching

Content caching is a well-known and established technology used by ISPs primarily for acceleration of Web content delivery. P2P caching, similar to Web caching, temporarily stores popular content flowing into the ISP network. If the content requested by a subscriber is available from a cache, cache satisfies the request from its temporary storage, eliminating data transfer through expensive transit line. With estimates of over 75% of P2P content is requested multiple times, P2P content responds well to caching, manifesting high reuse patterns.

Once a P2P Cache is established, the network transparently redirects all P2P traffic to a cache which either serves the file directly or passes the request onto a remote P2P user and simultaneously caches that file for the next user. Estimates are that P2P caches have seen an amazing 80% byte hit ratio, meaning that 4 of 5 files requested via P2P can be served by the cache. This is significantly much higher than http/web caching.

P2P Caching is the only solution that enables ISPs to fully and affordably embrace P2P on their networks. Instead of growing bandwidth to meet increasing demand, or limiting P2P usage through policies or traffic shaping, P2P Caching lets ISPs simultaneously serve the needs of P2P and non-P2P users without negatively impacting either audience. In fact, P2P Caching provides an improved experience for all subscribers – P2P users whose file sharing is improved through using the cache, and non-P2P users who experience better performance from networks un-congested from P2P traffic.

P2P Caching enables ISPs to generate bandwidth on an as-needed basis to support peak usage without having to oversubscribe networks. P2P Caching effectively manages the peaks and valleys associated with P2P usage. Most importantly, P2P Caching saves ISPs money in bandwidth costs, limits customer support and churn costs, and prepares ISPs to take advantage of new revenue opportunities provided by P2P file sharing and distribution.

P2P Caching

Pros	Cons
Embraces P2P fully	Upfront investment required
Generates bandwidth without additional backbone investments	
Improves experience for P2P and non-P2P subscribers	

Summarizing P2P Options

The table below summarizes P2P options across a variety of financial, technical and customer-impacting criteria.

	ISP Pricing & Policies	Purchasing Additional Bandwidth	Traffic Shaping	P2P Caching
Initial investment	$ Little to no investment	$ No up-front investment	$$$ Requires new equipment purchases	$$$ Requires new equipment purchases
On-going costs	$ No on-going costs	$$$ Large and growing bandwidth costs	$ Low on-going solution costs	$ Low on-going solution costs
Technical feasibility	Easy to implement – only requires billing system updates	Technically ineffective – added bandwidth likely to be consumed by P2P	Effectively minimizes or eliminates P2P traffic	Scales up P2P without adding network bandwidth
Churn / customer support impact	High Subscribers will switch to ISPs offering fixed-price service	Low Subscribers happy as long as bandwidth is available	High P2P subscribers will churn; some non-P2P subscribers will have issues as well	Low P2P and non-P2P users highly satisfied
Revenue Growth from P2P	None	Low	None	High
Overall Assessment	• Inexpensive option • Increases churn / limits growth • **Good solution if subscribers tolerate new pricing**	• Good customer experience • Could lead to expensive, uncontrolled bandwidth spending • **Good solution if bandwidth costs are extremely low**	• Effective in protecting non-P2P users • Drives churn and support costs • **Good solution if P2P subscribers or services are not wanted**	• Improves user experience for all subscribers – P2P and non-P2P • Only solution that enables new P2P revenue opportunities • **Ideal solution for both P2P and non-P2P subscribers**

Sidebar: Economic Impact of P2P Solutions

The economic impact of P2P solutions can be derived from four major areas. Each is listed below. Only P2P caching produces a positive economic impact across all four criteria.

	P2P Caching	ISP Pricing & Policies	Purchasing Additional Bandwidth	Traffic Shaping
Lower Bandwidth Costs	●	◑	○	●
Savings from Fd Subscriber Churn	●	◔	◔	◔
Lower Customer Support Costs	●	◔	●	◑
Increased Subscriber Revenue from new P2P Service Offerings	●	○	◔	○
Overall Economic Impact	●	◔	◑	◑

Note: PeerApp has developed an interactive spreadsheet model that enables ISPs to run own Total Cost of Ownership scenarios, and forecast the expected benefits of UltraBand2000 to their organizations.

Conclusion: Choosing a P2P Solution

For many ISPs, the answer to addressing the challenge and opportunity provided by the growth of P2P is to combine some of the above options. Taken alone, each solution has weaknesses that limit its effectiveness:
Adjusting subscriber policies and pricing can only have a limited impact, as market reality dictates that subscribers will not tolerate higher prices for the same perceived service;
Adding bandwidth is effective to a point where it becomes cost prohibitive, which many ISPs are already experiencing;
Traffic shaping works as a method to block P2P traffic, but the cost of churn and increased support is too great, and the opportunity cost of avoiding P2P as a revenue-generating technology is large.

P2P Caching is especially effective when combined with one or more of the three methods listed above. Many ISPs have already invested in deep packet inspection-capable traffic shaping devices that provide visibility into the different types of network traffic (including P2P) and enforce basic policies to avoid any network overruns and/or to provide service level tiering. Adding P2P Caching to a traffic shaping solution enables ISPs to address the problem of damaged subscriber experience.

Together, Traffic Shaping and P2P Caching provide a solution that ideally balances ISP control over network growth and performance with unfettered subscriber access to advanced services, regardless of network bandwidth impact.

PeerApp

About PeerApp

PeerApp is the leader in providing P2P-Based Bandwidth Solutions. PeerApp develops and services technologies and products to help ISPs enhance network efficiency, reduce bandwidth cost and enhance subscribers' quality of experience and service. PeerApp products and solutions are suitable for all ISPs providing broadband, DSL or cable service. They are designed to allow ISPs to manage their networks in compliance with applicable laws.

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